



Electron Capture Detectors (ECD)

Information for General Licensees

Notices

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Safety Notices

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

What can we do to assist you?

Please call:

Radiation Safety Officer 302-636-8262

Technical Support 1-800-227-9770

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Important Information For General License Holders. Please Read

Reference: ECD control

Dear Agilent Customer,

We wish to bring an issue to your attention that a number of our customers and regulatory agencies have shared with us relative to the Nuclear Regulatory Commission's requirements for controlling Electron Capture Detectors (ECDs). As you are probably aware, the ownership and locations of ECDs frequently change as a result of internal equipment, lab personnel, and company transfers. As a result of these changes, the awareness of the responsibilities associated with ECD control and monitoring is sometimes lost, and an RSO or lab manager may potentially be faced with being unable to provide ownership records when confronted by regulatory inspectors.

The Nuclear Regulatory Commission (NRC), your individual state agency, and Agilent Technologies have a great interest in your being able to prevent any possible conflict and embarrassment to you or your company. Because of this concern, we strongly urge you and your company's Radiation Safety Officer (RSO) to consider incorporating the suggestions on the following page into your radiation safety program. These suggestions may greatly assist you in building a good relationship with your state regulatory agency and the NRC. Please feel free to contact the Agilent Radiation Safety Officer via (302) 636-8262 if you have any questions.

Sincerely yours,

Agilent Technologies

Radiation Safety Program Suggestions

- 1 Develop and document a Radiation Safety Program that will be passed on to successive RSOs. Customers purchasing Specific License ECDs are required to comply with the conditions of their license. Contact your regional NRC office for specifics of a safety program.

Customers purchasing General License ECDs should use the information provided in the following sections of this manual to prepare a safety program. These sections include:

- Descriptions of specific and general licenses
- General License requirements
- General License restrictions
- Converting licenses
- Properties of an ECD
- Regulatory requirements
- Safety precautions
- ECD warnings
- Capping the ECD
- Temperature limitations
- Transferring an ECD*
- ECD maintenance
- Thermal cleaning the ECD
- Installation, venting, storing and removing the ECD
- Packaging and shipping instructions
- Radioactive wipe tests
- Wipe test conversion formulas
- Incidents, reporting and recording*

- 2 Educate lab managers and ECD users to notify you, as their RSO, of all changes of ownership or transfers to other locations or companies. You must then notify your state nuclear regulatory agency and regional NRC office (listed by state in the Information for General Licensees manual) of those changes.

* Indicates extremely important information

Agilent Electron Capture Detectors

Introduction

This publication describes proper installation, operation and maintenance of Agilent electron capture detectors (ECDs). It also discusses the regulations that govern their use and the safety precautions that must be observed to help avoid radiological hazards.

NOTE

The material contained in this booklet concerning “regulations” is accurate as of the date of writing. However, regulations may change. It is the user’s responsibility to maintain compliance according to the latest regulations.

For customers located outside of the United States—The information contained in this booklet relates to the regulations in the U.S. Though following the safety precautions and many of the requirements in this booklet is a good practice, it is your responsibility to comply with your local regulations.

Definitions

Agency—This applies to your local organization that regulates the use of radioactive materials in your country, state, etc. As used in this booklet, the “Agency” requirements refer to the Nuclear Regulatory Commission (NRC) or, if your state is an Agreement State, the responsible state agency. Refer to **Appendix D** to determine if you are located in an Agreement State or an NRC State. Customers located outside of the U.S. should contact their local “Agency” to determine the applicable regulations.

Agreement States—The Nuclear Regulatory Commission (NRC) is the “Agency” in the U.S. that regulates radioactive materials. However, in certain states, these regulations, by agreement with the NRC, are enforced by a State “Agency.” Refer to **Appendix D** to determine if you are located in an Agreement State or an NRC State.

ECD—Electron capture detector.

General License ECD—This is an ECD that customers in the U.S. can purchase without having their own radioactive materials license. General License ECDs are covered under Agilent Technologies’ distribution license. General License customers are required to complete and sign the General License Registration Card provided at the time of sale and to comply with the requirements of this booklet.

Specific License ECD—This is an ECD that requires customers to possess their own radioactive materials license, issued by their local nuclear agency, which is valid for the applicable material and quantities. A Specific License ECD is physically identical to a General License ECD except for the model number and the detector labeling. The General License ECD label contains additional warnings not required for Specific License ECDs.

GC—Gas chromatograph.

NRC (Nuclear Regulatory Commission)—The “Agency” that regulates radioactive materials in the U.S. Refer to **Appendix E** to locate your local NRC office.

Radioactive Wipe Test—This is also known as wipe test or leak test, a test that is required on all Agilent ECDs at least every 6 months. The wipe test is performed by wiping the outside of the ECD with either filter paper or a cotton swab. The wipe is then analyzed by a liquid scintillation counter to determine the activity of the wipe. Refer to **“Radioactive Wipe Tests”** on page 60 for additional information.

Regulations—As used in this booklet, this refers to the regulations of the NRC in the U.S. as published in Title 10 of the Code of Federal Regulations (abbreviated as 10 CFR). Customers located outside of the U.S. should contact their local “Agency” to determine the local “Regulations.”

What is a Specific License?

Customers in the U.S. can purchase either a General License or a Specific License ECD.

Specific and General Licenses

ECDs are sold as either specific or general license. The two types of ECD are physically identical, except the model number and the detector label. The General License ECD label contains additional warnings not required for the Specific License ECDs.

Specific License ECDs require the end user to have a Materials License from the NRC or their local State Agency which permits them to possess the applicable type and quantities of radioactive material. Customers with a Specific License have more flexibility with their ECD. They can typically ship, sell, or transfer their ECD to any other company or location with a valid Specific License (depending on actual license conditions). They also have more responsibilities. These will be defined in the customer's License and other Regulatory Guidelines.

Owners of Specific License ECDs are required to comply with the conditions of their license. If you would like to obtain a Specific License, contact your local "Agency."

What is a General License?

General License ECDs do not require end users to have a Materials License. Agilent Technologies has a Distribution License with the NRC that allows us to distribute Generally Licensed materials. Before customers can order a General License ECD, they must complete and return a General License Registration Form. By completing and signing the form, customers certify that they will adhere to the instructions, safety warnings and regulatory requirements for Agilent ECDs as specified in the NRC regulations identified at the time of sale.

General License customers may only operate the ECD at the location specified on the General License Registration Form. They cannot open or clean the detector internally. They can only ship the ECD back to Agilent Technologies or another organization licensed to receive radioactive by-product material. If customers with a General Licensed ECD wish to sell or transfer their ECD to another location that does not possess a radioactive materials license, the ECD may only be shipped to the new location via Agilent Technologies.

Agilent Technologies files reports of ECDs sold to U.S. and U.S. district customers to the NRC and applicable "Agreement States" every 3 months. These quarterly reports contain end user's names, company names, addresses, serial numbers, model numbers and ECD shipment dates during the previous quarter.

General License requirements

You become a General Licensee automatically when you purchase a General License ECD, whether it is mounted in a GC or purchased as an add-on accessory. You do not have to apply for a General License from the NRC or State Agency. However, if you reside in an "Agreement State" you may be required to register your ECD within that state and you may be expected to pay a state tax or fee to support your state's nuclear regulatory program. To determine if your state is an "Agreement State" or to obtain the addresses, contact persons and telephone numbers of the agreement states, refer to **Appendix D** at the end of this booklet.

General License restrictions

Certain restrictions apply to General Licenses. They are:

- 1 Owners shall not open the ECD cell.
- 2 Owners shall not modify the cell in any manner.
- 3 Owners shall not use any solvent, including water, to internally clean the cell. See "**Thermal cleaning**" on page 17.
- 4 Owners shall not interfere with or attempt to defeat the overheat circuitry that may be supplied with the ECD.
- 5 Owners shall not transfer the ECD to another person or another location except as described in the applicable Regulations. See "**Who can transfer an ECD?**" on page 16 for additional information.
- 6 Owners must perform a radioactive leak test at least every 6 months.
- 7 Owners must maintain records as required by your local "Agency." See **Appendix D** and **Appendix E**.
- 8 Owners must notify the "Agency" in case of incidents or failures that might lead to a hazardous condition.

Description of the ECD

The ECD can be purchased as an option with the instrument, in which case it is installed in your GC at the factory, or as an add-on accessory to be installed by you or by Agilent Technologies.

The ECD consists of the detector cell, the thermal insulation that surrounds it, mounting hardware, the ECD cover and associated overheat protection circuitry, if appropriate. The two halves of the ECD body are joined by tamper-proof screws that require a special tool for removal. This tool is not provided with the ECD. It is only supplied to Specific License customers who have a license that permits them to work with open sources.

Properties of an ECD

The radiation source used in the ECD is ^{63}Ni . This material is plated onto the inner surface of the cell body. It is a solid at temperatures used in chromatography. Some of its properties are listed here.

- Half life: 101.1 years
- Emission: 65.87 keV maximum, beta radiation
- Melting point: 1453 °C
- Activity: Refer to the Characteristics of the Sealed Source for the individual model number maximum activity.

Regulatory Requirements

The full text of the pertinent sections of the NRC Regulations is posted on the World Wide Web. See **Appendix B** for more information. In general, the following are the regulatory requirements relating to the possession and use of General License ECDs. However, it is your responsibility to ensure compliance with the current NRC requirements or your local nuclear "Agency" requirements.

For the state of Tennessee General Licensees, see **Appendix C** for your state's General License regulation.

- 1 You must not remove the metal tag attached by wire to the ECD.
- 2 You must comply with the instructions provided in this booklet and any other manuals or instructions provided that pertain to ECDs.
- 3 If an ECD has been lost or stolen, you must notify your local "Agency" per the guidelines established in 10 CFR 20.2201 Reports of theft or loss of licensed material.
- 4 If there is any evidence of damage to the ECD, you must stop using it immediately and notify your local "Agency."
- 5 You must perform, or have performed, a radioactive leak test at least every 6 months.
- 6 If the results of the radioactive leak test indicate radioactivity leakage of 0.005 microcuries or greater, you must stop using the ECD immediately and notify your local "Agency."
- 7 You must maintain records containing the date the ECD was received, dates it was transferred to some other person (including return to the factory for transfer or disposal) and the results of the radioactivity leak tests. These records are subject to inspection by your local "Agency."
- 8 You may not transfer the ECD except in accordance with 10 CFR Part 31. See **Appendix B** for additional information.
- 9 You may not modify the ECD cell by cutting, drilling, welding or any other destructive or damaging operation under any circumstances.
- 10 Corrosive chemicals must not be introduced to the ECD.
- 11 Disassembly of the ECD is a violation of your General License and is prohibited. Only customers who have a Specific License which allows them to do so are permitted to open their ECD.

Safety precautions to follow when handling ECDs

- 1 Never eat, drink or smoke when handling ECDs.
- 2 When handling ECDs, wear protective clothing such as laboratory jackets, safety glasses and gloves, and follow good laboratory practices. In addition, wash hands thoroughly with a mild non-abrasive cleaner after handling ECDs.
- 3 Cap the inlet and outlet fittings when the ECD is not in use. See **"Storing your ECD"** on page 18 for further storage instructions.
- 4 Connect the ECD exhaust vent to a fume hood or vent to the outside in some other acceptable manner whenever the ECD is in use.

ECD warnings

Although beta particles at this energy level have little penetrating power (the surface layer of the skin or a few sheets of paper will stop most of them), they may be hazardous if the isotope is ingested or inhaled. For this reason, the cell must be handled with care, radioactive leak tests must be performed at regular intervals, the inlet and outlet fittings must be capped when the ECD is not in use, corrosive chemicals must not be introduced into the ECD and the effluent from the ECD must be vented outside the laboratory environment.

WARNING

Materials that may react with the ^{63}Ni source, either to form volatile products or to cause physical degradation of the plated film, must be avoided. These materials include oxidizing compounds, acids, wet halogens, wet nitric acid, ammonium hydroxide, hydrogen sulfide, PCPs and carbon monoxide. This list is not exhaustive but indicates the kinds of compounds that may cause damage to ^{63}Ni detectors.

WARNING

In the extremely unlikely event that both the oven and the ECD heated zone should go into thermal runaway (maximum, uncontrolled heating in excess of 400 °C) at the same time and that the ECD remains exposed to this condition for more than 12 hours, the following must be done:

- After turning off the main power and allowing the instrument to cool, cap ECD inlet and exhaust vent openings. Wear disposable plastic gloves and observe normal safety precautions.
- Call the Technical Support number identified at the front of this booklet.

It is unlikely, even in this very unusual situation, that radioactive material will escape from the cell. However, permanent damage to the ^{63}Ni plating within the cell is possible and, therefore, the cell must be returned to Agilent.

WARNING

Do not use solvents to clean the ECD.

WARNING

You may not open the ECD cell unless authorized to do so by your local nuclear regulatory agency. Do not disturb the four socket-head bolts. These hold the cell halves together. Removing or disturbing them is a violation of the terms of the General License and could create a safety hazard.

Capping your ECD

WARNING

Overheating or chemical damage could cause radioactive particles to drop from the inlet fitting.

The ECD inlet fitting must be capped whenever a column is not attached. In addition, the metal vent tube exiting from the side of the ECD must be capped whenever the vent line is disconnected. If the ECD is not going to be used or will be stored, see **“Storing your ECD”** on page 18.

Temperature limitations

The maximum detector temperature limit is 400 °C (350 °C for 5790 and 5880 GCs), and the ECD must not be heated above these limits. This limit is built into the 5890, 6890, 7890, 7820A, Intuvo 9000, 8890, and 8860 GCs' temperature control systems. If a malfunction should occur and the temperature of the ECD should rise to 425 °C, the instrument's main thermal control system will turn off all the thermal zones.

For the 5790 and the 5880 GCs, if the temperature should rise above 350 °C, whether due to an incorrect setpoint entry or because of an instrument malfunction, a safety circuit will turn the heater power off at 370 ± 10 °C.

WARNING

If the ECD heater(s) should be deactivated, a hardware problem may exist in the instrument. Consult the instrument manual for information on diagnosing and correcting the problem.

Who can transfer an ECD?

Specific License ECDs—Customers who own a Specific License ECD can sell, lend or transfer their ECD to another company or site, depending on the provisions of that site's license. Specific License customers are required to maintain records of transfers and report such transfers as required to the appropriate authorities.

General License ECDs—Customers cannot transfer their General License ECDs to another company or site within the same company, except through Agilent Technologies or a company licensed to redistribute generally licensed materials. The receiving entity assumes responsibility for local licensing requirements. Contact the Radiation Safety Office as identified on **page 3** for further clarification or assistance.

Maintenance

Customer maintenance of the ECD is limited to installation, radioactivity leak testing, thermal cleaning and removal of the ECD.

We recommend that the ECD be returned to the factory for thorough inspection on a periodic basis (suggested 5-year intervals).

One of the easiest ways to monitor the proper operation of the ECD is to monitor the signal baseline. See your Operators Manual for specific information.

Leaks can adversely affect the performance of your ECD. It is important to locate and fix any gas leaks. Complete instructions for performing leak tests can be found in the Maintenance and Troubleshooting Manual provided with your instrument.

Instructions for removal of the ECD can be found in this manual.

Thermal cleaning

WARNING

Thermal cleaning is the only cleaning procedure permitted for General License ECDs. Do not introduce any liquid solvent into the ECD cell.

The ECD effluent must be vented properly during the thermal cleaning process.

Remove any existing column between the injection port and the ECD. Install an empty (unpacked), clean glass/metal column to maintain gas flow into and through the ECD. Set the oven temperature to 250 °C and the carrier flow to 30 to 90 mL/min. Raise the ECD temperature above your normal operating temperature but less than the maximum operating temperature allowed for your ECD. (For the 5880A GC, the maximum ECD temperature is 370 °C; for 5890, 6890, 7890, 7820A, Intuvo 9000, 8890, and 8860 GC instruments, the maximum ECD temperature is 400 °C). Maintain this bakeout condition for several (3 to 24) hours or until the ECD baseline has stabilized. The total time necessary will depend on the type and degree of contamination as well as the normal operating temperature versus the bakeout temperature. Baking the ECD at higher temperatures (above the normal operating temperature) and at higher purge flow rates will shorten the time necessary. It is good practice to monitor the ECD signal/baseline during the bakeout to help determine the time necessary. A typical baseline trace might look similar to **Figure 1**.

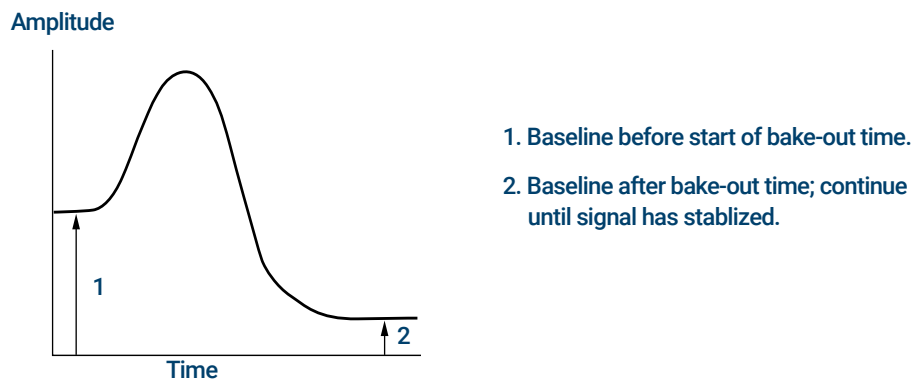


Figure 1. Typical baseline trace

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Who can open their ECD for cleaning?

Cleaning the ECD thermally will most likely change its response characteristics, so you will probably be required to recalibrate your ECD depending on the actual method.

Who can open their ECD for cleaning?

- Customers must have a current Specific License issued by either the NRC or the applicable Agreement State, and
- The license must specify that they are qualified to clean ECDs.

Installation

ECDs ordered as an option to an Agilent GC are installed at the factory. If the ECD is purchased as an add-on accessory, the ECD will be shipped with detailed installation instructions.

WARNING

5880 GCs Only: To prevent possible creation of a hazardous situation, the instructions must be followed exactly. Pay special attention to those sections concerning the overheat protection board and the thermal measurement board.

The instructions include a procedure for verifying correct operation of the overheat protection circuitry. If this circuitry does not function correctly, turn the instrument off, notify your local Agilent service organization immediately and do not attempt to use the instrument.

When installing an ECD, always remember to vent the detector in accordance with the procedure specified in **“Venting your ECD”** on page 18 and remember to install all labels as instructed.

Venting your ECD

The instrument in which the ECD is mounted must be placed where the ECD effluent can be vented. The ECD shall not be vented into the laboratory environment. A vent line to a fume hood is a convenient way to accomplish this. This precaution is taken to avoid radioactive contamination of the laboratory if an abnormal condition should occur.

Agilent Technologies recommends a vent line running to a fume hood. The inside diameter should be 6 mm (1/4-inch) or greater to prevent back pressure which might cause noise in the ECD signal. With a line of this diameter, the length of the tubing is not critical.

Storing your ECD

Depending on the needs of the laboratory, it may be good practice to have an extra ECD on site to provide rapid turnaround for a contaminated ECD. This would be particularly true in laboratories with a very high workload or sample throughput where instrument operation must be maintained. This “spare ECD cell” operation is quite possible with the Agilent design, but some precautions may be necessary for trouble-free operation when the spare ECD is put into service.

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Storing your ECD

Due to the extremely chemically active atmosphere inside the ECD, it is advisable to keep air and moisture out of the cell. The carrier gas flow does this when the detector is in use, but storage for an extended period will result in an ECD that does not perform as desired when restored to service. This may be due to the formation of corrosive compounds (such as nitric acid) from the ionized components of air inside the cell. To our knowledge this has not been proven, but such components would likely be quite detrimental to the ECD if they were present. To prevent this occurrence, we suggest providing a slow purge gas through an ECD in storage or purging the ECD well and sealing an inert gas inside to prevent air (oxygen and water) from diffusing into the active area of the cell. Nitrogen by itself is not a problem but, in combination with oxygen, very corrosive components could be formed. An inert gas, such as argon or helium, would probably be best for this purge gas.

NOTE

The 6-month wipe tests for leakage of radioactive material (see “Radioactive Wipe Tests” on page 60) must continue during periods of inactivity or storage.

Removing your ECD

You will need to remove the ECD if you wish to reposition it on the GC or return it to Agilent Technologies. The ECD consists of two parts: the ECD cell and the heated block. **Under no condition is the ECD cell to be disassembled.**

Begin by turning the heated zone off and allowing the instrument to cool to room temperature. When the ECD has cooled, turn all gas flows off, remove the column to which the detector is connected and turn the main instrument power off. Disconnect the main power cord from the wall receptacle.

The instructions for removing the ECD from your chromatograph vary with the GC model. Determine which model ECD you have and follow the appropriate instructions. When removing the ECD, wear disposable gloves and wash your hands thoroughly with mild soap and water after handling the ECD. If you are returning the ECD to Agilent Technologies, refer to the shipping instructions in **"How to Package and Ship ECDs"** on page 59. If you should encounter any problems or complications when removing your ECD, call your local Agilent customer engineer or the Agilent Response Center at 1-800-424-9759.

Instructions for removing G4597A (Intuvo 9000 GC) ECDs

The G4597A ECD module may be installed in the Intuvo 9000 GC mainframe or in the D2 accessory.

WARNING

All versions of ECD cells contain radioactive material. Exposure to radioactive material is hazardous to human health. Under no circumstances should an ECD cell be disassembled as this is in violation of the General License agreement. ECDs must be returned to a licensed facility. Agilent will accept only ECDs manufactured by either Hewlett-Packard or Agilent Technologies, Inc.

CAUTION

Always allow time for the column heater and other heated zones to cool before turning off the gas supplies. Failure to allow cooling may damage the ECD.

WARNING

Before proceeding, turn off the column heater and other heated zones and let them cool down. When they have cooled, turn off any detector gases at their supply, then 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 On the touch screen, navigate to **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance.**
- 2 Turn off the GC.

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Instructions for removing G4597A (Intuvo 9000 GC) ECDs

- 3 Remove the GC power cord from the wall outlet.
- 4 If present, remove the injector from the GC.
- 5 If present, remove the tray assembly from the GC.
- 6 For an ECD detector module installed in the Intuvo 9000 GC, do the following:
 - a Open the GC front door. See **Figure 2**.

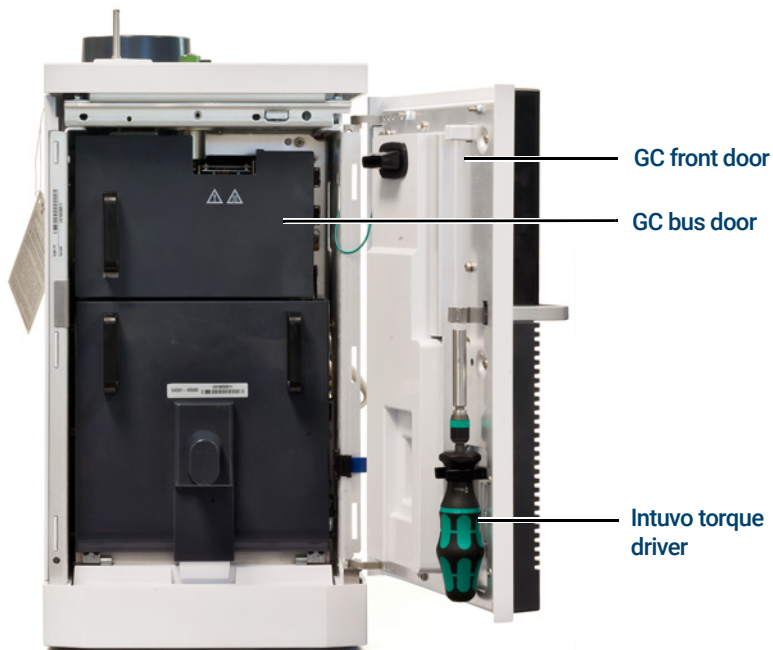


Figure 2. GC front door, bus door, and Intuvo torque driver

- b Open the GC bus door.
 - c Use the Intuvo torque driver to remove the left side compression bolt from the detector fitting module. See **Figure 3**.

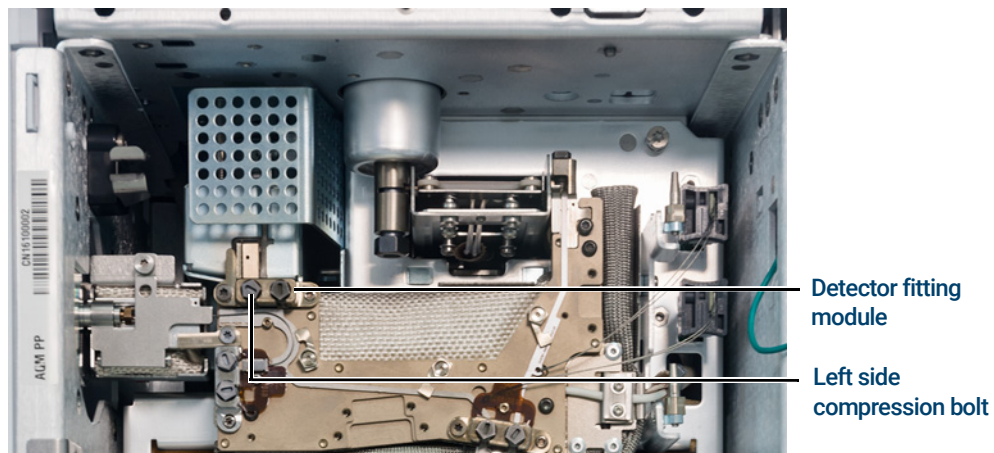


Figure 3. GC detector fitting module and left side compression bolt

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Instructions for removing G4597A (Intuvo 9000 GC) ECDs

- d Using a T20 Torx driver, completely loosen the five captive screws securing the top cover to the GC, and lift the cover off of the GC. See **Figure 4**.

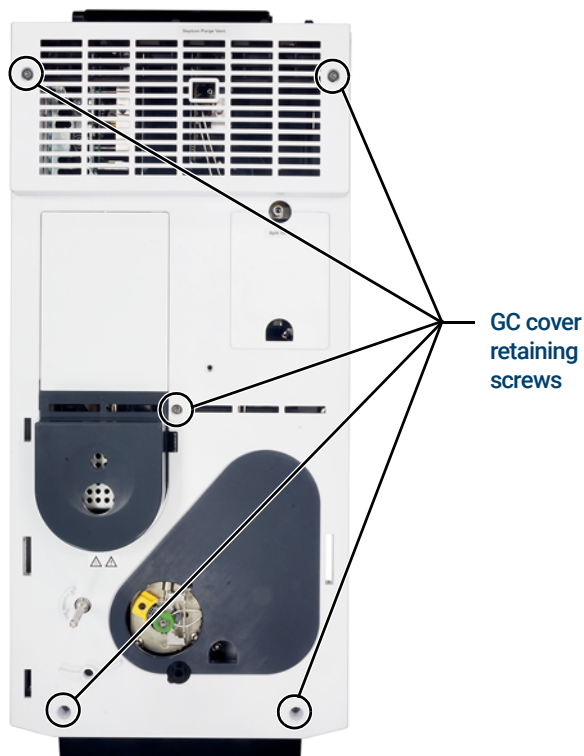


Figure 4. GC top cover removal

- e Completely loosen the three captive screws securing the ALS tower support bracket to the GC, and remove the bracket. See **Figure 5**.

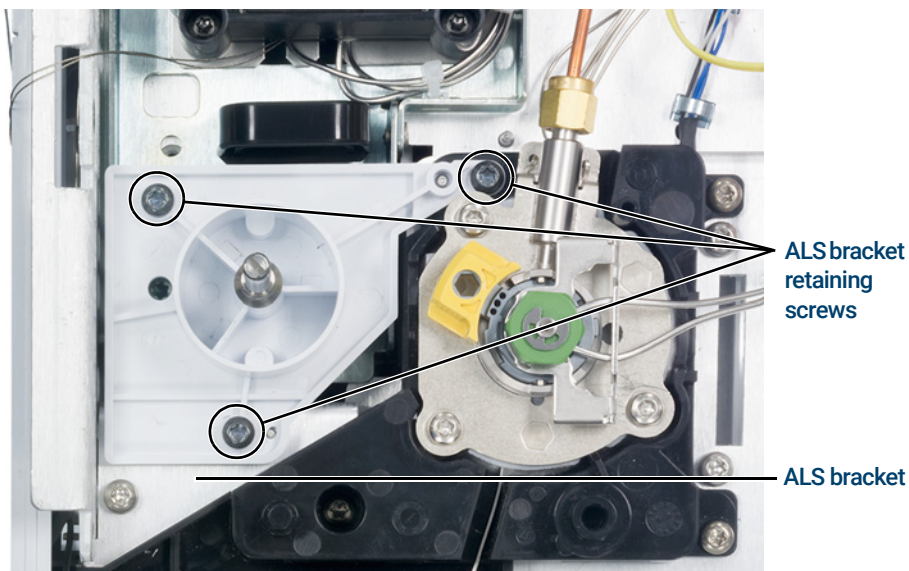


Figure 5. ALS bracket removal

1 Agilent Electron Capture Detectors

Instructions for removing G4597A (Intuvo 9000 GC) ECDs

- f Turn off the detector gas at the source, and remove the gas line connection from the detector EPC module. See **Figure 6**.

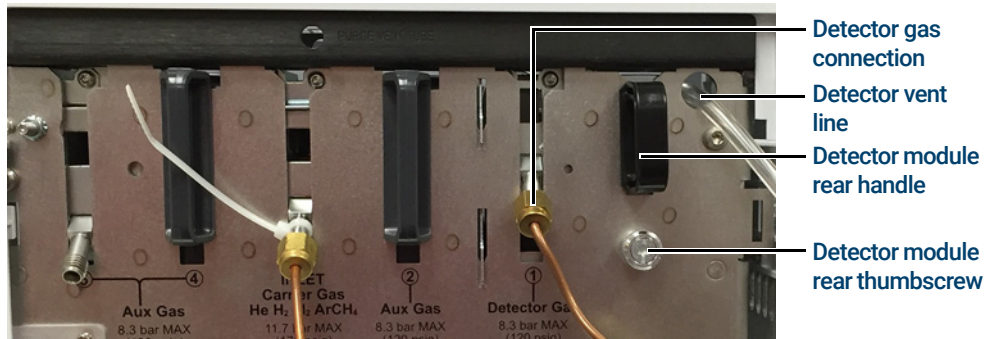


Figure 6. Detector EPC module gas connection, vent line, detector module rear handle and thumbscrew

- g Use a flat-blade screwdriver to completely loosen the two captive screws securing the EPC bracket to the GC, and remove the bracket. See **Figure 7**.

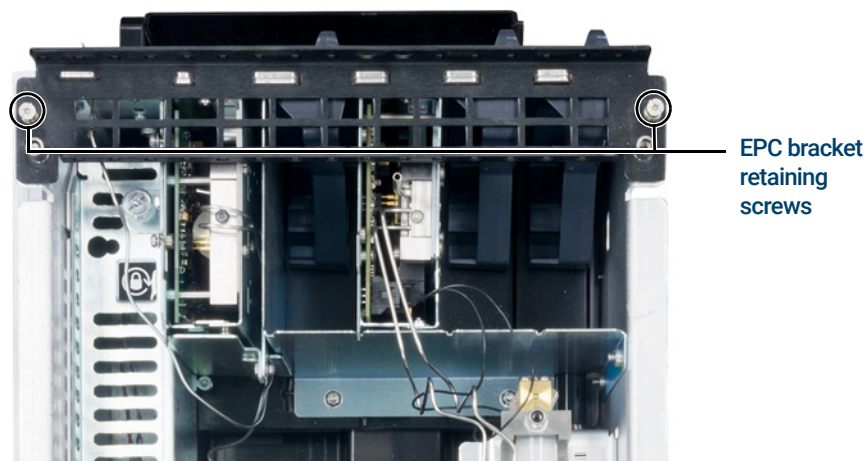


Figure 7. EPC bracket and retaining screws

- 7 For an ECD detector module installed in the D2 accessory, do the following:
 - a Lower the D2 accessory front panel. See **Figure 8**.

1 Agilent Electron Capture Detectors
Instructions for removing G4597A (Intuvo 9000 GC) ECDs

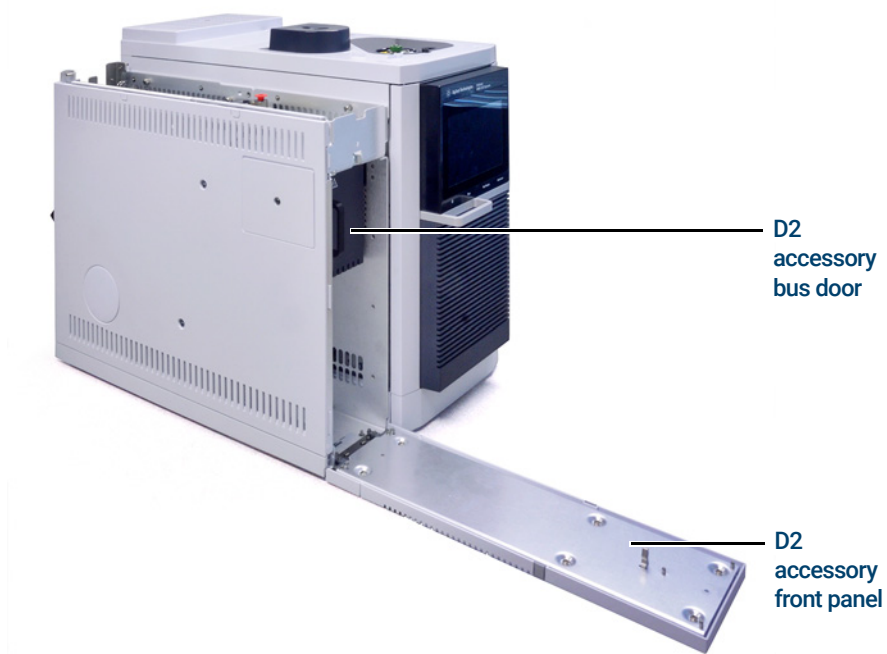


Figure 8. D2 accessory front panel and bus door

- b** Remove the D2 accessory bus door.
- c** Lift the front of the D2 top cover assembly. See [Figure 9](#).

1 Agilent Electron Capture Detectors
Instructions for removing G4597A (Intuvo 9000 GC) ECDs

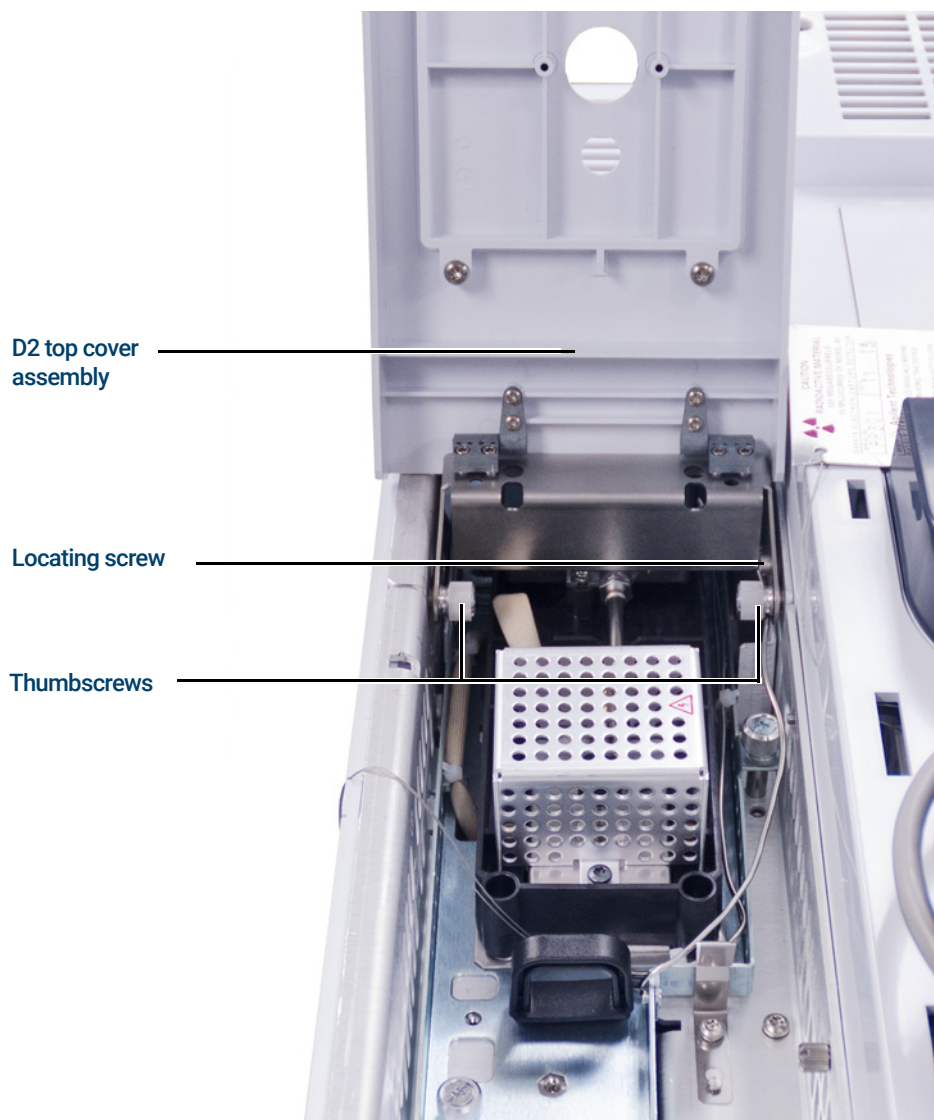


Figure 9. D2 top cover assembly

- d** Remove the locating screw from behind the right side thumbscrew.
- e** Completely loosen the two thumbscrews securing the D2 top cover assembly to the D2 accessory, and then remove the top cover assembly.
- f** Turn off the detector gas at the source, and remove the gas line connection from the detector EPC module. See **Figure 10**.

1 Agilent Electron Capture Detectors
Instructions for removing G4597A (Intuvo 9000 GC) ECDs

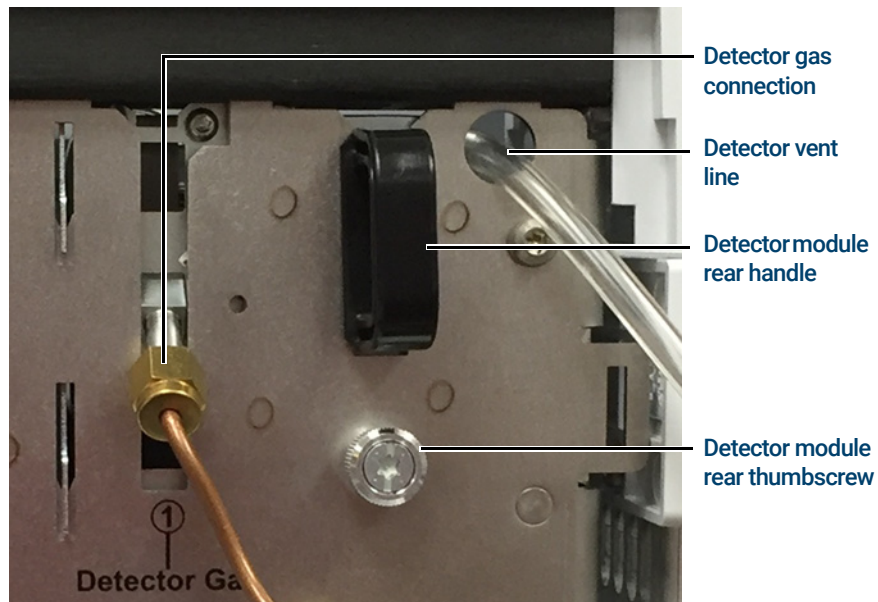


Figure 10. Detector EPC module gas connection, detector module vent line, rear handle and thumbscrew

- 8 Completely loosen the detector module rear thumbscrew.
- 9 Completely loosen the three thumbscrews securing the detector module assembly. See [Figure 11](#).

1 Agilent Electron Capture Detectors
Instructions for removing G4597A (Intuvo 9000 GC) ECDs

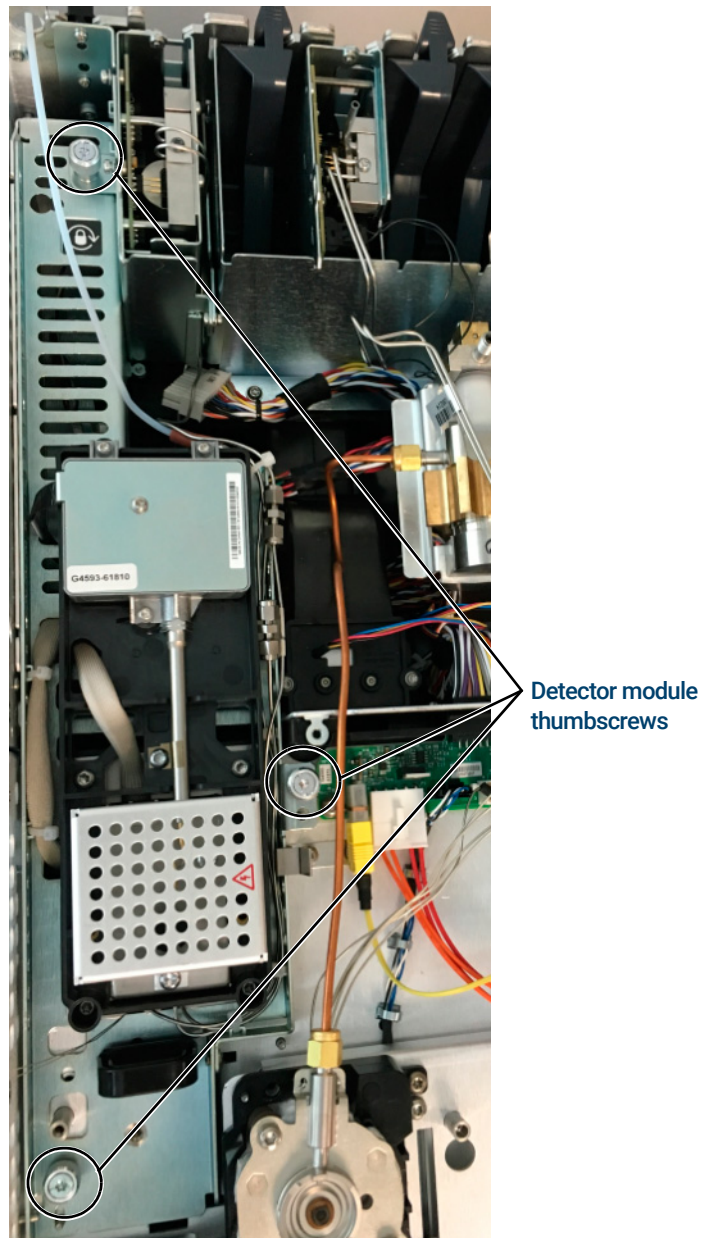


Figure 11. Detector module thumbscrews

- 10** Slide the detector module assembly toward the front of the unit until the detector module dowel pin is in the unlocked position. See **Figure 12**.

1 Agilent Electron Capture Detectors
Instructions for removing G4597A (Intuvo 9000 GC) ECDs

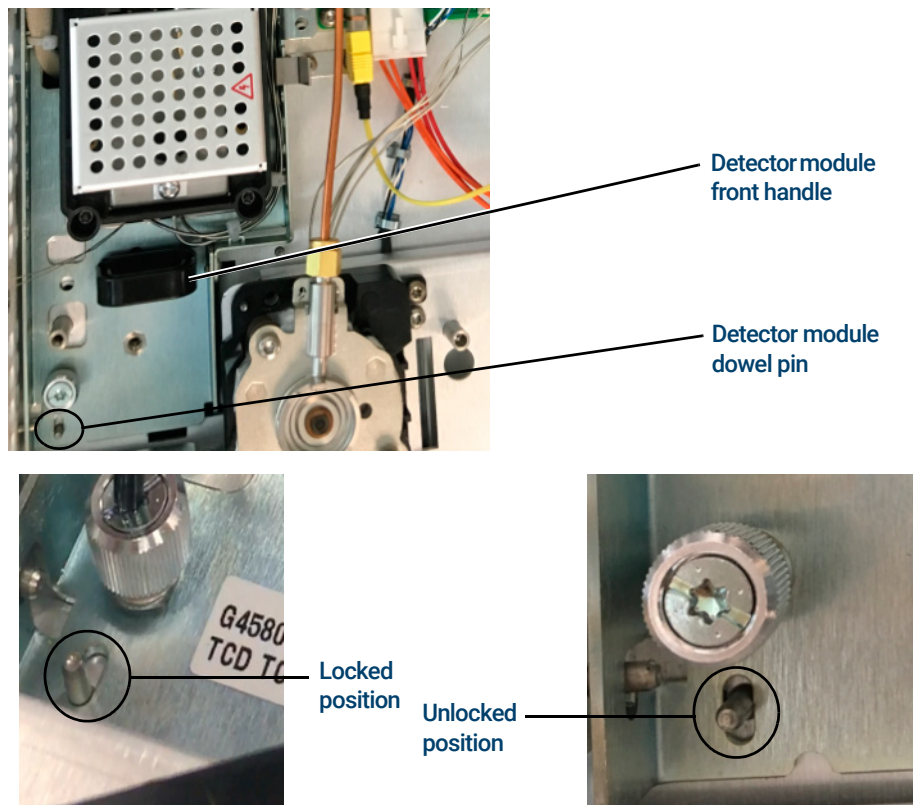


Figure 12. Detector module dowel pin and front handle

- 11** Use the front handle to lift the front of the detector module assembly.
- 12** With the detector module assembly raised, use the detector stand to keep the assembly in the raised position. See **Figure 13**.

1 Agilent Electron Capture Detectors
Instructions for removing G4597A (Intuvo 9000 GC) ECDs

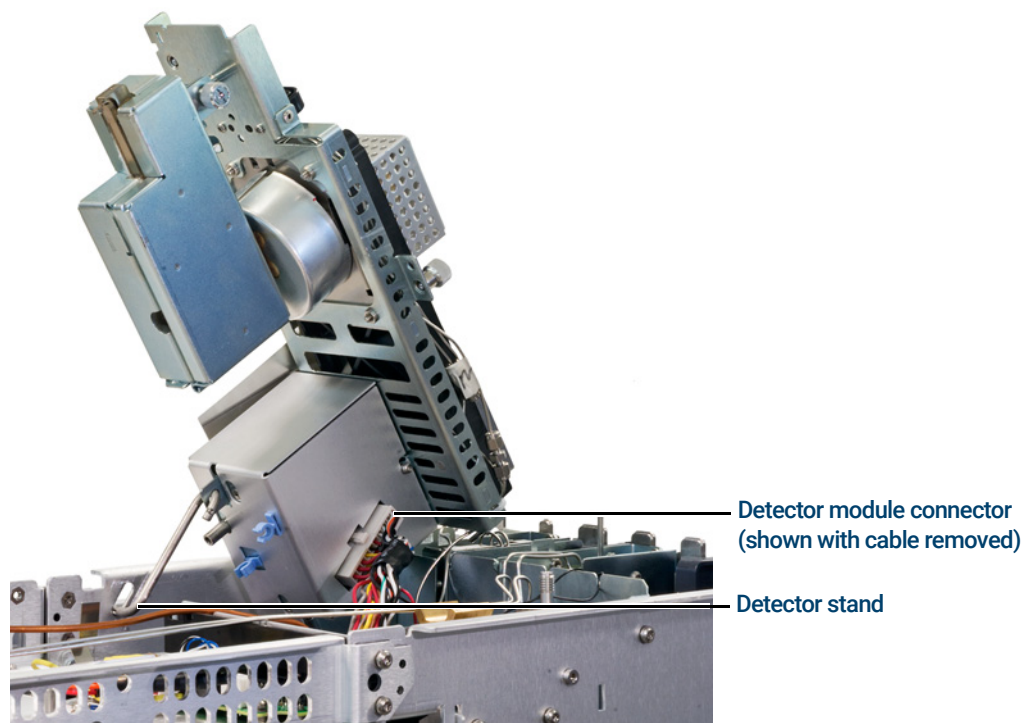


Figure 13. Detector module, raised, with detector stand and connector

- 13** Remove the detector module connector from the detector module assembly by pressing on the connector locking tab and pulling the connector out.
- 14** Disconnect the ECD vent tube at the rubber sleeve. See **Figure 14**.

1 Agilent Electron Capture Detectors
Instructions for removing G4597A (Intuvo 9000 GC) ECDs

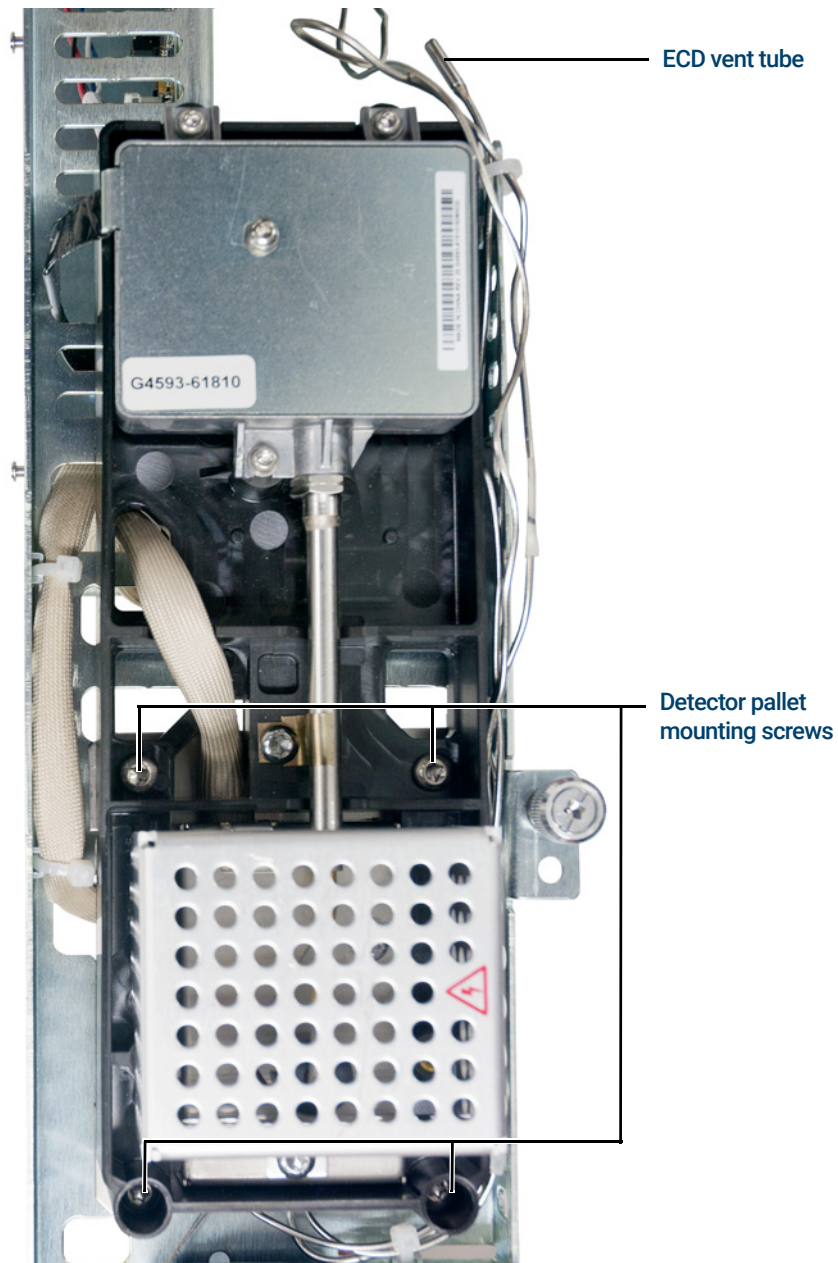


Figure 14. ECD vent tube and detector pallet mounting screws

15 Remove the detector tail as follows:

- a** Completely loosen the detector tail housing thumbscrew. See **Figure 15**.

1 **Agilent Electron Capture Detectors**
Instructions for removing G4597A (Intuvo 9000 GC) ECDs

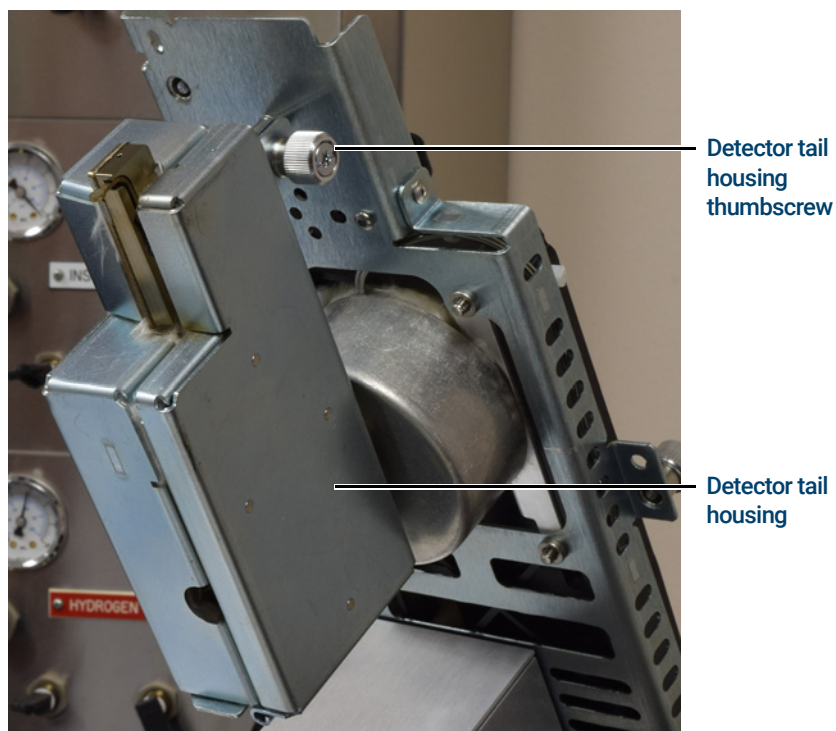


Figure 15. Detector tail housing thumbscrew

- b** Open the detector tail housing.
- c** Use the Intuvo torque driver to remove the detector tail compression bolt. See **Figure 16**.

1 Agilent Electron Capture Detectors

Instructions for removing G4597A (Intuvo 9000 GC) ECDs

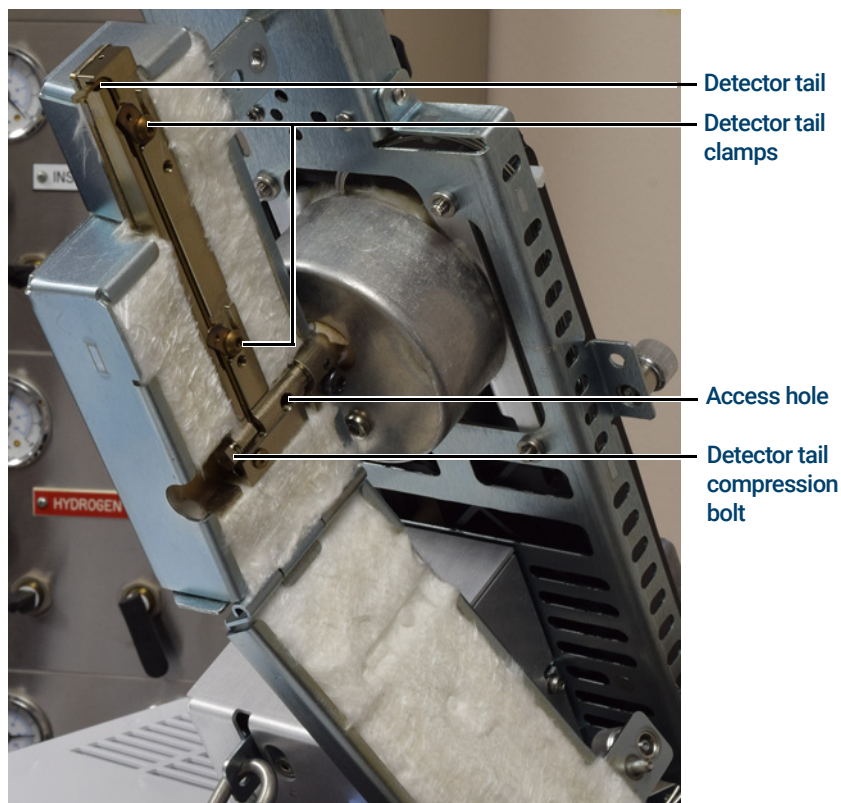


Figure 16. Detector tail housing, opened

- d Free the detector tail ferrule by inserting a T20 Torx driver through the access hole and pressing against the ferrule. This may require some force.
- e Use a T20 Torx driver to loosen and rotate the detector tail clamps.

CAUTION

Rotating the detector tail if the ferrule sticks can damage the tail.

- f Remove the detector tail by rotating it 90 degrees out of the housing. The tail should move freely. If you feel resistance, use a T20 Torx driver to side-load the ferrule. When the tail is fully rotated, slide it out of the detector tail housing.
 - g Close the detector tail housing and secure by hand tightening the thumbscrew.
- 16 While holding the front detector module assembly handle, unhook the detector stand and clip it back onto the bottom of the assembly. See [Figure 13](#) on page 29.
 - 17 Lower the front of the detector module assembly making sure to hold the detector stop clip so that the assembly can be completely lowered.
 - 18 Completely tighten the rear-most thumbscrew on the detector module assembly. This locks the assembly so that the front cannot pivot upward.
 - 19 Use the front and rear handles to lift the detector module assembly out of the GC, and place it on a work bench.

1 Agilent Electron Capture Detectors
Instructions for removing G4597A (Intuvo 9000 GC) ECDs

- 20** Use a T10 Torx driver to disconnect the anode purge and gas inlet lines at the EPC module by completely loosening one captive screw on the gas weldment at the EPC module. See **Figure 17**.

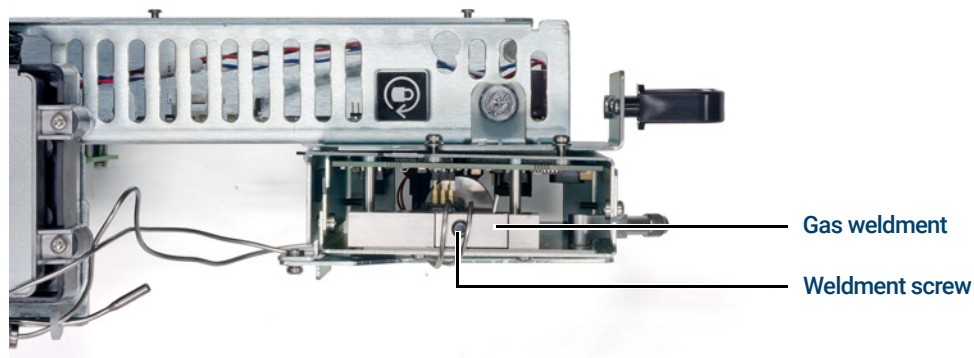


Figure 17. EPC module gas weldment

- 21** Remove the detector stand from the detector module assembly. See **Figure 18**.

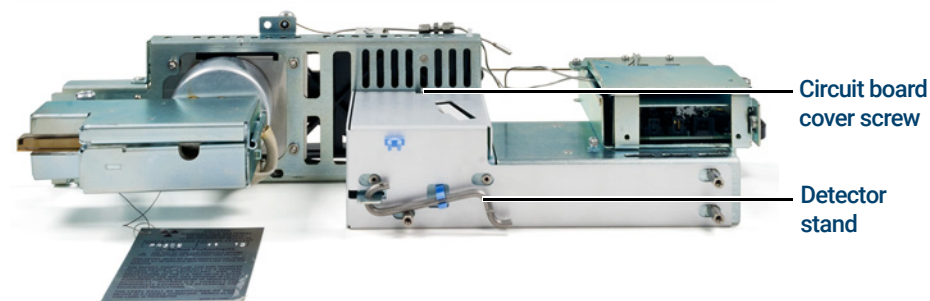


Figure 18. Detector module stand and circuit board cover

- 22** Use a T10 Torx driver to remove the screw securing the detector circuit board cover to the detector module assembly.
- 23** Slide the detector circuit board cover to the rear of the detector module assembly and then remove it.
- 24** Disconnect the TAIL heater connector from the detector circuit board. See **Figure 19**.

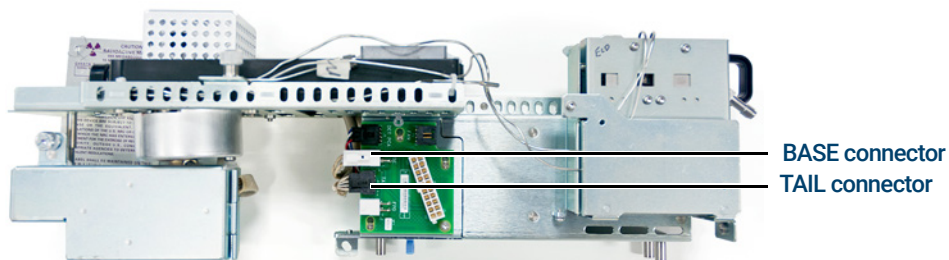


Figure 19. Detector TAIL and BASE heater connectors

1 Agilent Electron Capture Detectors
Instructions for removing G4597A (Intuvo 9000 GC) ECDs

- 25** Disconnect the BASE heater connector from the detector circuit board.
- 26** Cut the two cable ties securing the TAIL heater cable to the detector module assembly. See **Figure 20**.

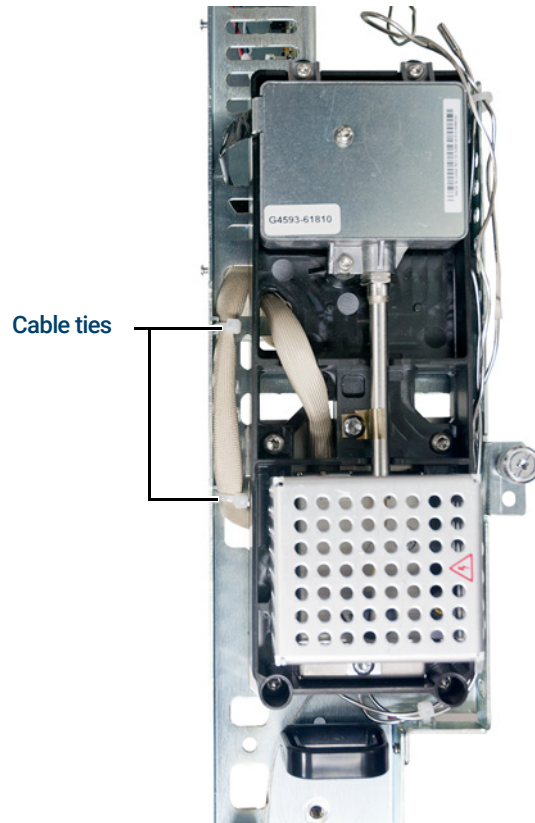


Figure 20. TAIL heater cable ties

- 27** Un-route the TAIL heater cable from the detector module assembly.
- 28** Completely loosen the detector tail housing thumbscrew. See **Figure 15**.
- 29** Open the detector tail housing.
- 30** Use a T20 Torx driver to loosen the detector tail clamping screw. See **Figure 21**.

1 Agilent Electron Capture Detectors

Instructions for removing G4597A (Intuvo 9000 GC) ECDs

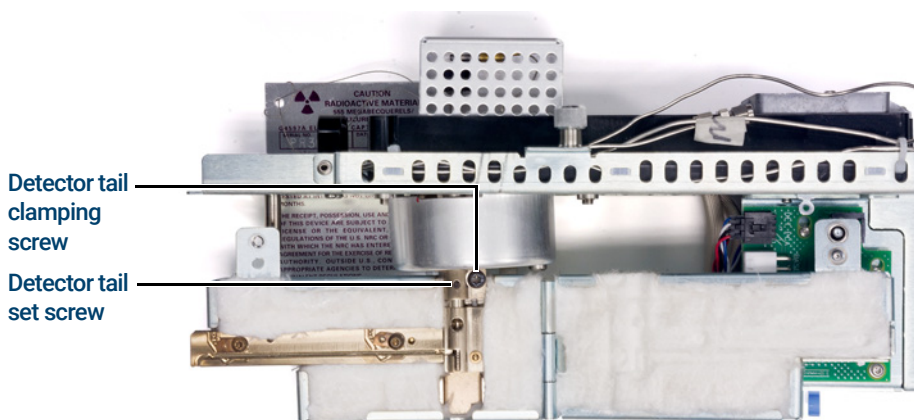


Figure 21. Detector tail clamping screw and set screw

- 31 Use a T6 or T10 Torx driver (as applicable) to loosen the detector tail set screw by no more than two turns. (Depending on when the ECD detector was manufactured, either size set screw may have been used.)
- 32 Slide the detector tail housing off of the detector tail being careful to retain the tail spring which sits between the detector tail housing and the detector module assembly.
- 33 Use a T20 Torx driver to remove the screw securing the insulation cup to the detector module assembly. See [Figure 22](#).

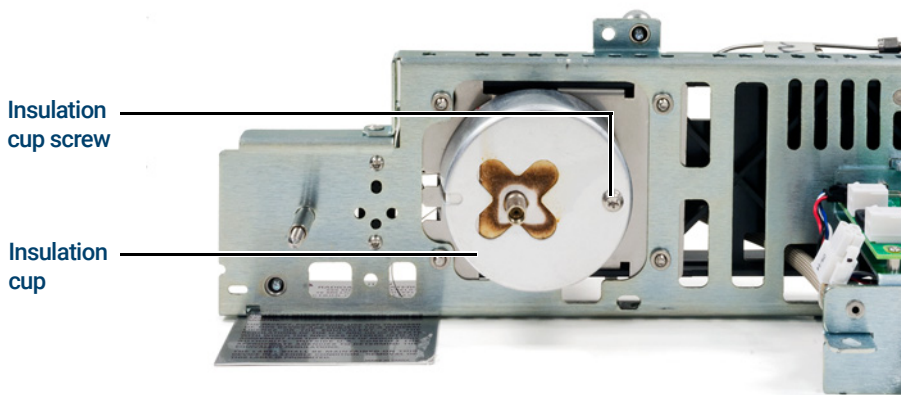


Figure 22. Detector insulation cup

- 34 Remove the insulation cup and insulation from the detector module assembly.
- 35 Use a T20 Torx driver to remove the screw securing the ECD detector top cover to the detector pallet and then remove the cover. See [Figure 23](#).

1 Agilent Electron Capture Detectors
Instructions for removing G4597A (Intuvo 9000 GC) ECDs

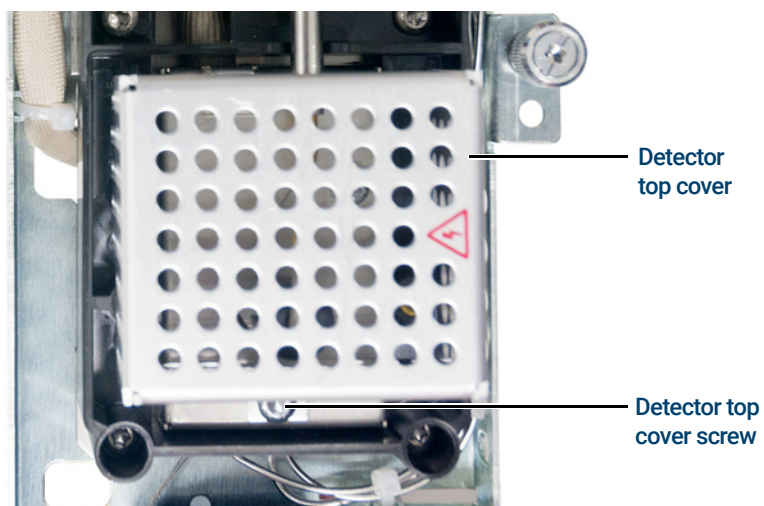


Figure 23. Detector top cover

36 Disconnect the anode signal wire from the detector. See **Figure 24**.

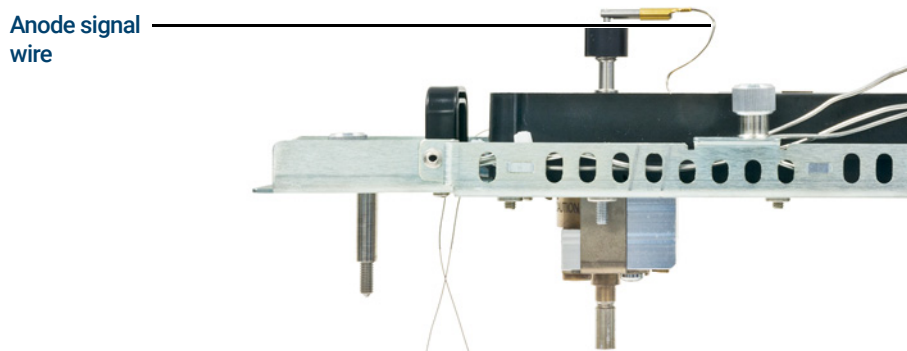


Figure 24. Detector anode signal wire

37 Disconnect the detector cell cable from the detector circuit board by separating the two locking clips which secure the connector to the circuit board. See **Figure 25**.

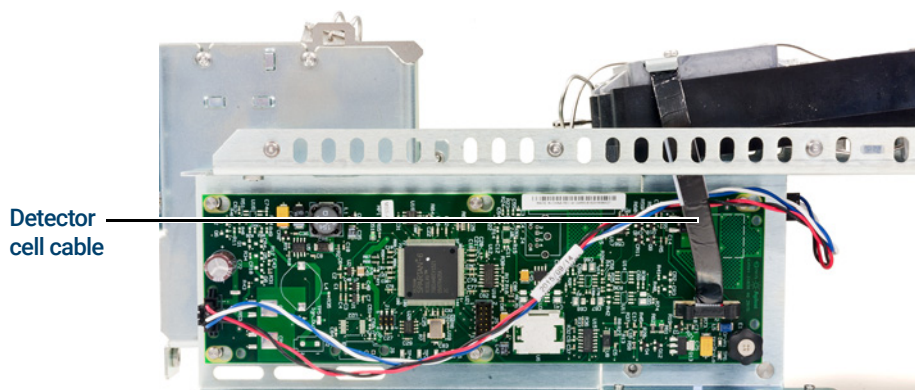


Figure 25. Detector cell cable

1 Agilent Electron Capture Detectors

Instructions for removing G4597A (Intuvo 9000 GC) ECDs

- 38 Use a T20 Torx driver to completely loosen the four screws securing the detector pallet to the detector module assembly. See **Figure 14** on page 30.
- 39 Un-route the BASE heater cable from the detector module assembly.
- 40 Remove the detector pallet from the detector module assembly.
- 41 Cut the three tie-wraps securing the gas lines to the detector module assembly. See **Figure 26**.

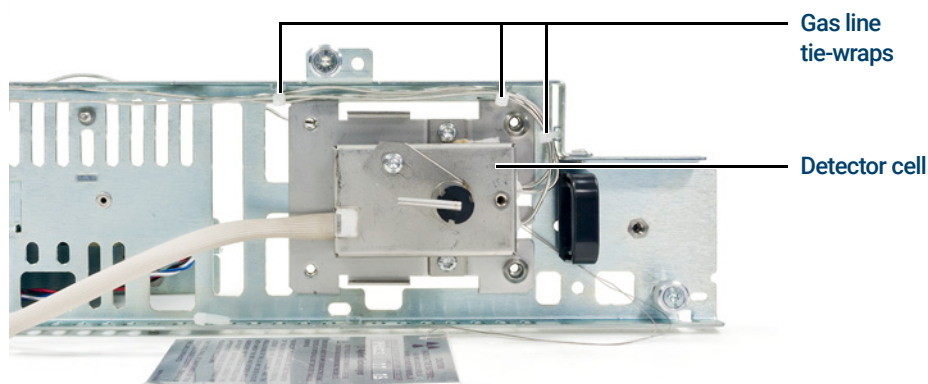


Figure 26. Gas line tie-wraps

- 42 Cut any additional tie-wraps securing the gas line(s) to the detector module assembly.
- 43 Remove the detector cell from the detector module assembly.
- 44 Cap the inlet, anode purge and exhaust vent connections for shipping purposes.
- 45 The ECD detector is now properly disassembled for return of the detector cell to Agilent. Call the Technical Support number identified at the front of the booklet for further directions.

1 Agilent Electron Capture Detectors

Instructions for removing G1533A (6890 GC), and G2397A (8890, 8860, 7890, 7820A, and 6890 GCs) ECDs

Instructions for removing G1533A (6890 GC), and G2397A (8890, 8860, 7890, 7820A, and 6890 GCs) ECDs

Safety

WARNING

All versions of ECD cells contain radioactive material. Exposure to radioactive material is hazardous to human health. Under no circumstances should an ECD cell be disassembled as this is in violation of the General License agreement. ECDs must be returned to a licensed facility. Agilent will accept only ECDs manufactured by either Hewlett-Packard or Agilent Technologies, Inc.

CAUTION

Always allow time for the oven and heated zones to cool before turning off the gas supplies. Failure to allow cooling may damage the ECD.

WARNING

Before proceeding, turn off the oven and any heated zones and let them cool down. When they have cooled, turn off any detector gases at their supply, then turn off the main power switch and unplug the power cord.

CAUTION

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

Removing a left side-mounted ECD from a 7890, 8890, and 8860

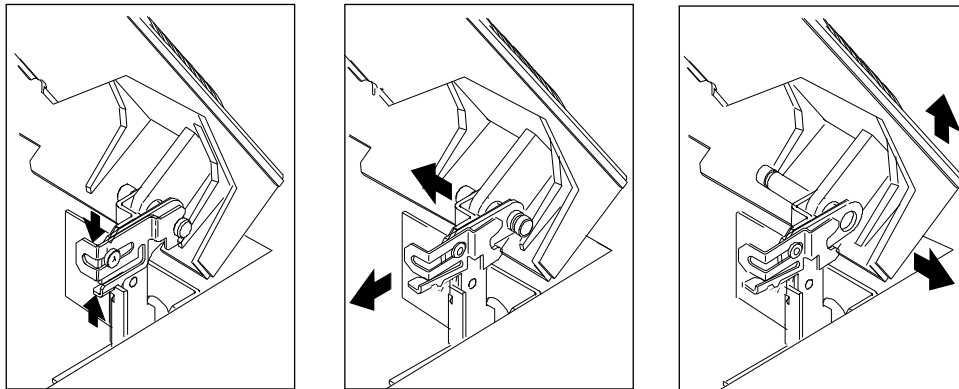
See [“Instructions for removing an ECD from a side-mounted detector box”](#) on page 44.

Removing the detector cover (6890, 7890, 7820A, 8890, and 8860)

Raise the GC's detector cover to the vertical position and lift off of instrument.

1 Agilent Electron Capture Detectors
Removing the old style detector cover (6890)

Removing the old style detector cover (6890)



The top cover protects the detectors, valve box and valve assembly.

- 1 Tilt the front cover up.
- 2 Squeeze the clip on the right hinge, pull the clip toward you and pivot it up.
- 3 Push the metal pin behind the clip to the left.
- 4 Slide the detector cover to the right and lift it off.

1 Agilent Electron Capture Detectors

Removing the right side cover

- 5 To replace the top cover:
 - a Slide the plastic post on the left side of the cover into the hole on the injection port fan cover.
 - b Line up the hole in the tab on the right side of the cover with the metal pin and push the pin to the right through the hole.
 - c Pivot the clip back down and snap it back over the metal pin.

Removing the right side cover

WARNING

The electronics cover shields the high voltage components on the main board. Turn off the main power switch and unplug the power cord before removing this cover.

CAUTION

Be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

- 1 Fully loosen the two captive screws (Torx T-20) in the top of the cover for the 6890, 7890, 8890, and 8860 GCs and on the right side of the cover for the 7820A GC.
- 2 Slide the side cover slightly to the rear of the GC and lift the cover out of the slot in the bottom of the chassis.

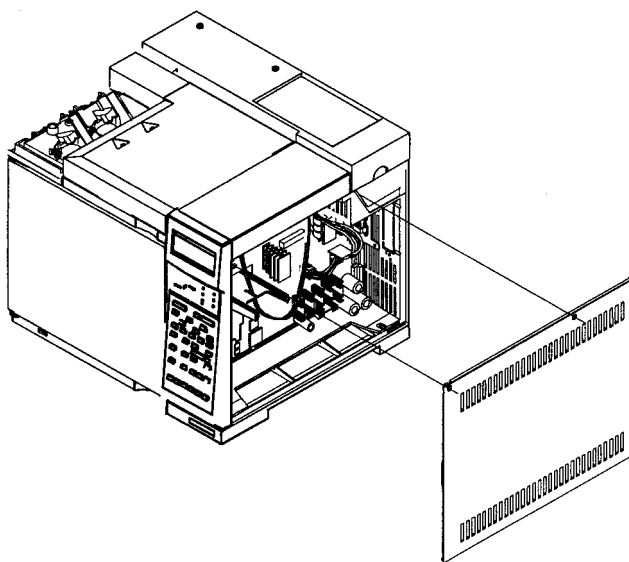
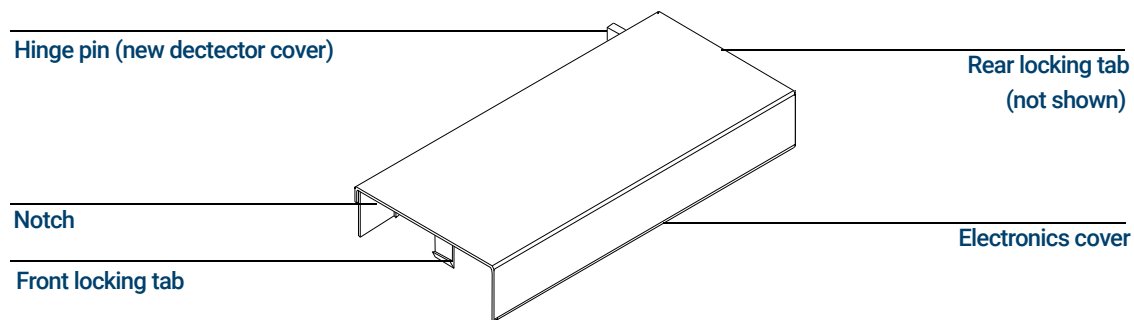


Figure 27. Right side cover removal (6890 GC shown, 7890, 8890, and 8860 GCs similar)

1 Agilent Electron Capture Detectors

Disconnecting the cables

6890 GC cover removal



- 1 Remove the GC right side cover.
- 2 Reach under the electronics cover and press the rear locking tab toward the front of the instrument.
- 3 While pressing the tab, lift up the back of the electronics cover and slide the cover back, up and out of the instrument.
- 4 To reinstall the cover, make sure that the notched edge of the cover faces the front left side of the instrument and snap it back into place.

7890, 8890, and 8860 GC cover removal

- 1 Remove the screws from the left side and the rear of the top electronics cover.
- 2 Lift the electronics top cover up and away from the right side of the GC.

Disconnecting the cables

- 1 Disconnect the heater/sensor cable from the connector on the right side of the GC.
- 2 Disconnect the ribbon cable from the detector board.

1 Agilent Electron Capture Detectors

Removing the makeup gas adapter

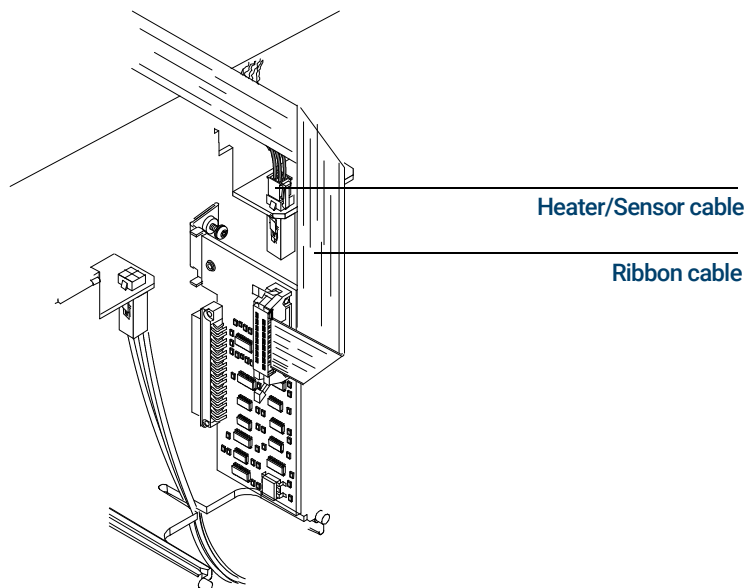


Figure 28. Disconnect the cables (6890 GC shown, 7890, 7820A, 8890, and 8860 GCs similar)

Removing the makeup gas adapter

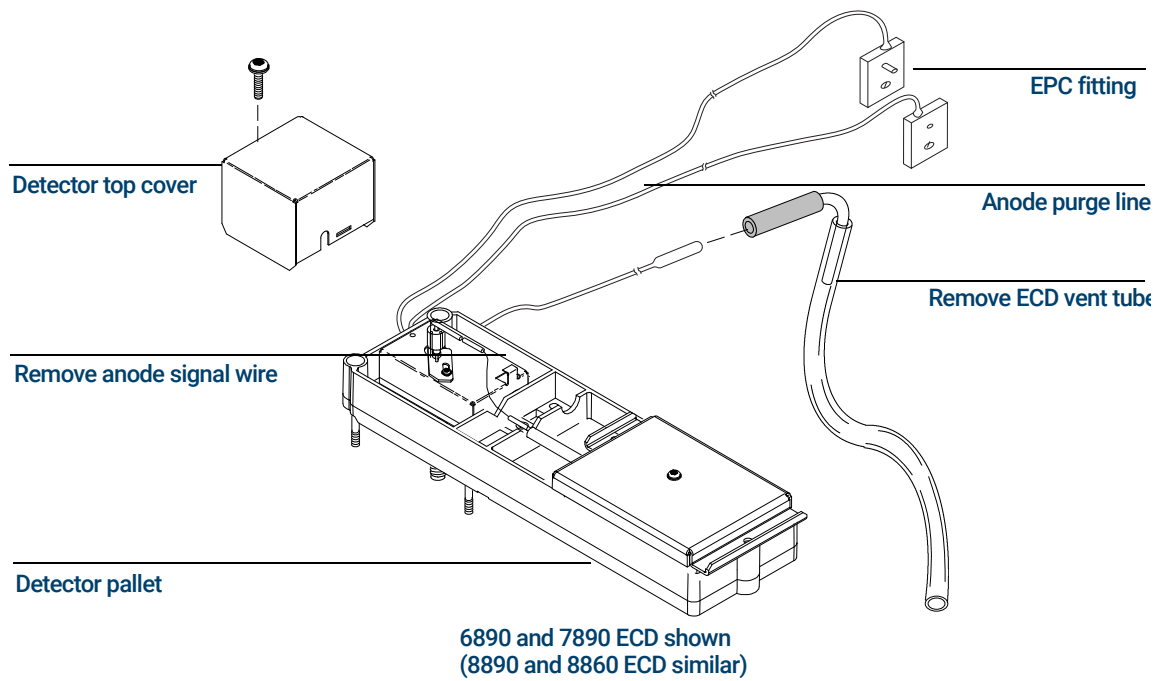
- 1 Inside the oven, remove the insulation cup and disconnect the column from the makeup gas adapter.
- 2 Use a 9/16-inch wrench to loosen the 1/4-inch Swagelok nut on the makeup gas adapter from the bottom of the detector. Slide the makeup gas adapter out of the bottom of the detector.

Removing the ECD

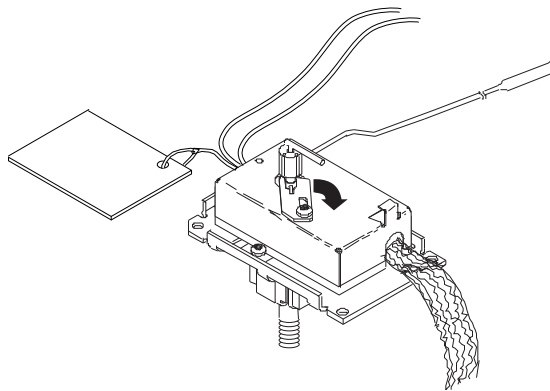
- 1 Disconnect the ECD vent tube at the rubber sleeve.
- 2 Disconnect the anode purge line at the pneumatics manifold.
- 3 Remove the one Torx T-20 screw securing the ECD detector top cover to the detector pallet and remove the cover.
- 4 Disconnect the anode signal wire from the detector.
- 5 Fully loosen the four Torx T-20 screws (five screws for the 7820A GC) on the detector pallet, lift the pallet and turn on its right side.
- 6 Thread the heater/sensor leads out of the detector pallet and remove the rest of the detector from the pallet.
- 7 For shipping or storage purposes, cap the inlet, anode purge and exhaust vent tubing.

1 Agilent Electron Capture Detectors

Removing the ECD



- 8 The ECD detector is now properly disassembled for return to Agilent. Call the Technical Support number identified at the front of the booklet for further directions.



1 Agilent Electron Capture Detectors

Instructions for removing an ECD from a side-mounted detector box

Instructions for removing an ECD from a side-mounted detector box

NOTE

The 8860 and 8890 GCs are similar to the 7890 GC shown in this section.

Remove the detector box cover

- 1 Remove the detector box cover from the side of the GC. Remove the two T-20 Torx screws from the bottom of the cover panel.



Figure 29. Detector box cover removal

- 2 Lift the cover straight up and remove it.

1 Agilent Electron Capture Detectors

Instructions for removing an ECD from a side-mounted detector box

Disconnect the wires and plumbing

- 1 Unplug the heater sensor cable.

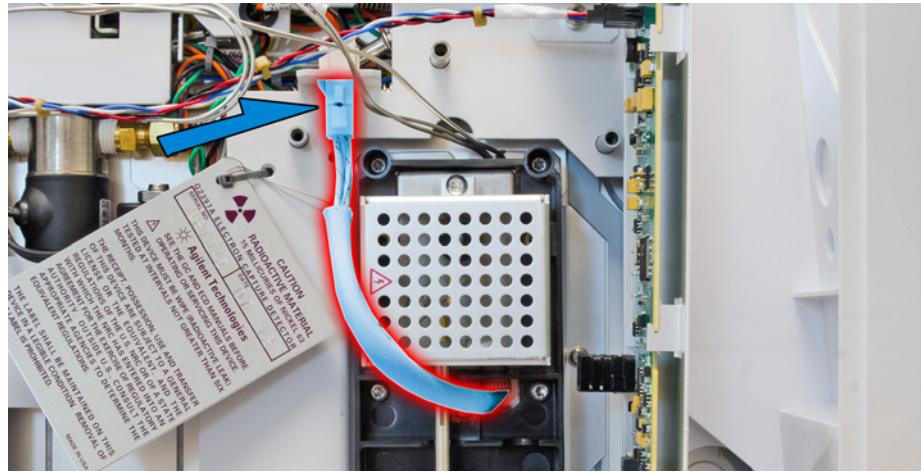


Figure 30. The heater sensor cable

- 2 Unplug the electrometer ribbon cable.

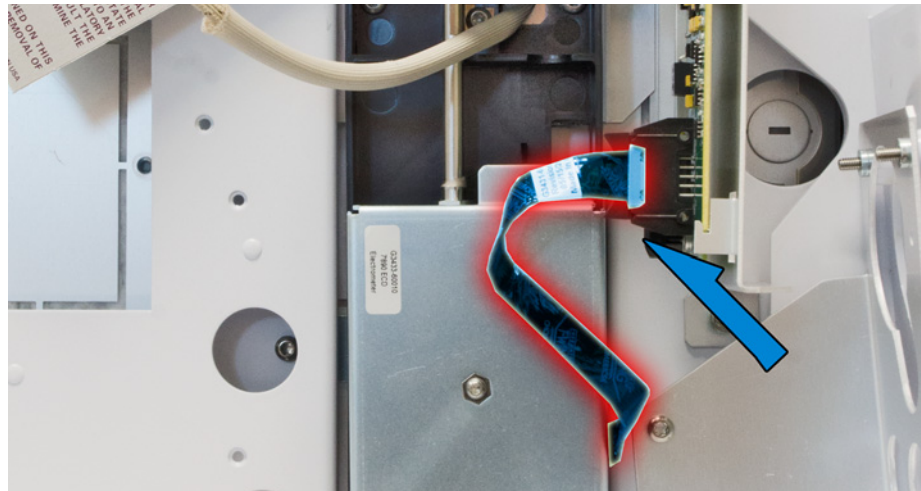


Figure 31. The electrometer ribbon cable

Removing the makeup gas adapter

- 1 Open the oven door.
- 2 Inside the oven, remove the insulation cup and disconnect the column from the makeup gas adapter.
- 3 Use a 9/16-inch wrench to loosen the 1/4-inch Swagelok nut on the makeup gas adapter from the bottom of the detector. Slide the makeup gas adapter out of the bottom of the detector.

1 Agilent Electron Capture Detectors

Instructions for removing an ECD from a side-mounted detector box

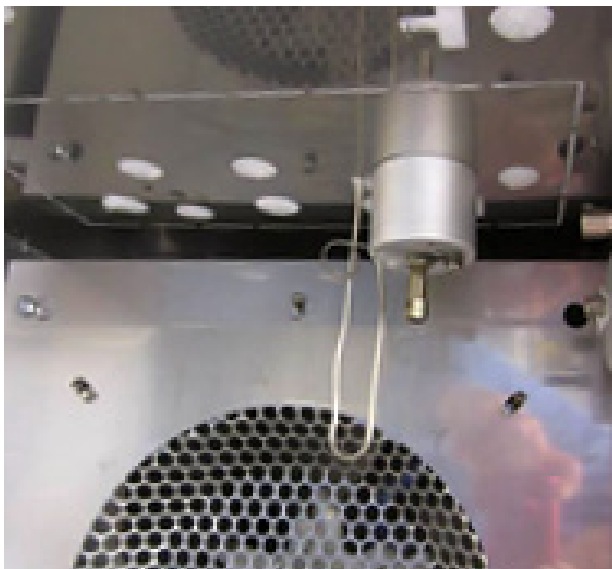


Figure 32. The nut warmer cup and insulation

- 4 Close the oven door.

Removing the ECD

- 1 Disconnect the ECD vent tube at the rubber sleeve.

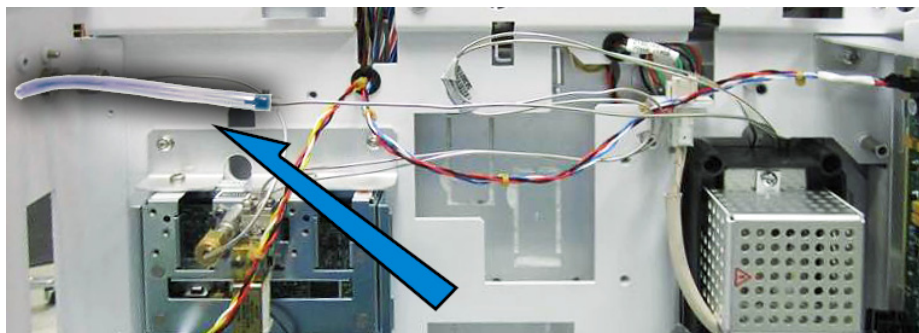


Figure 33. Remove the tube shown here

- 2 Disconnect the anode purge line at the pneumatics manifold (7890 GC) or at the extension connection (8860 and 8890 GCs).

1 **Agilent Electron Capture Detectors**
Instructions for removing an ECD from a side-mounted detector box

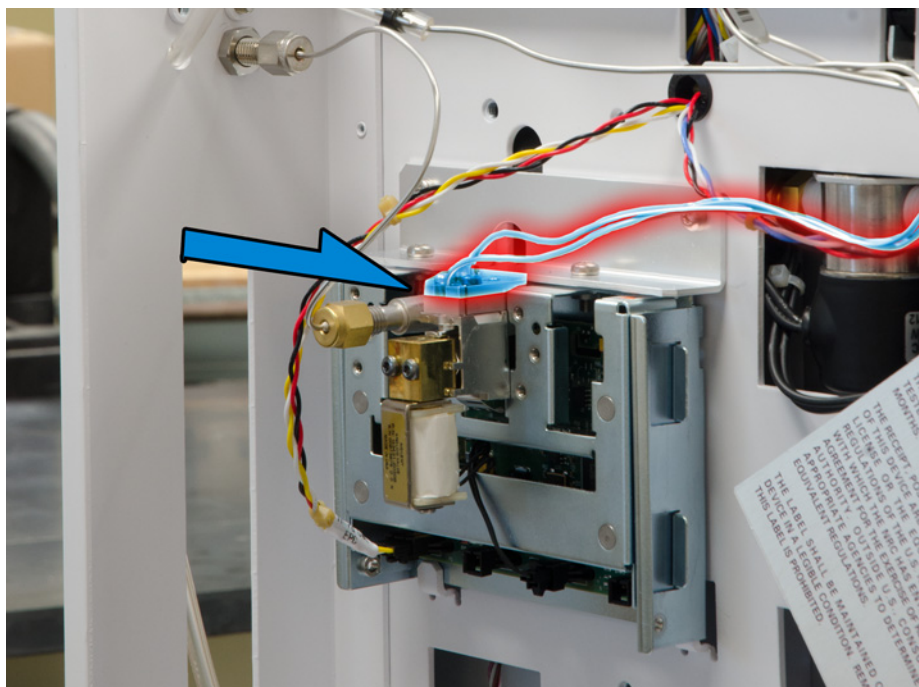


Figure 34. The anode purge line (7890 GC shown)

3 Fully loosen the four Torx T-20 screws on the detector pallet.

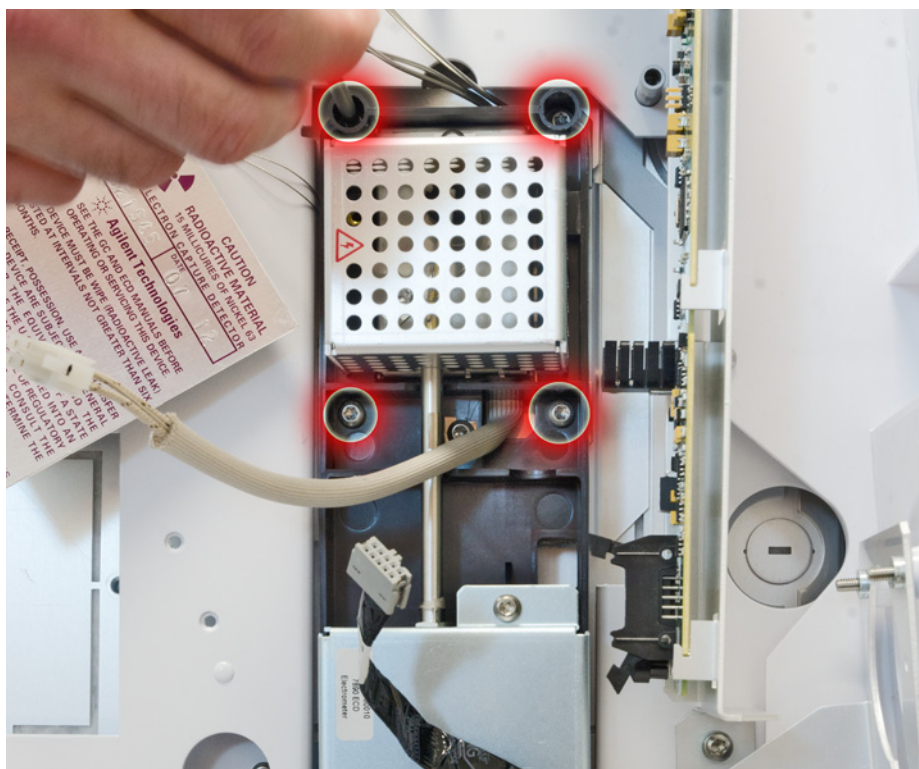
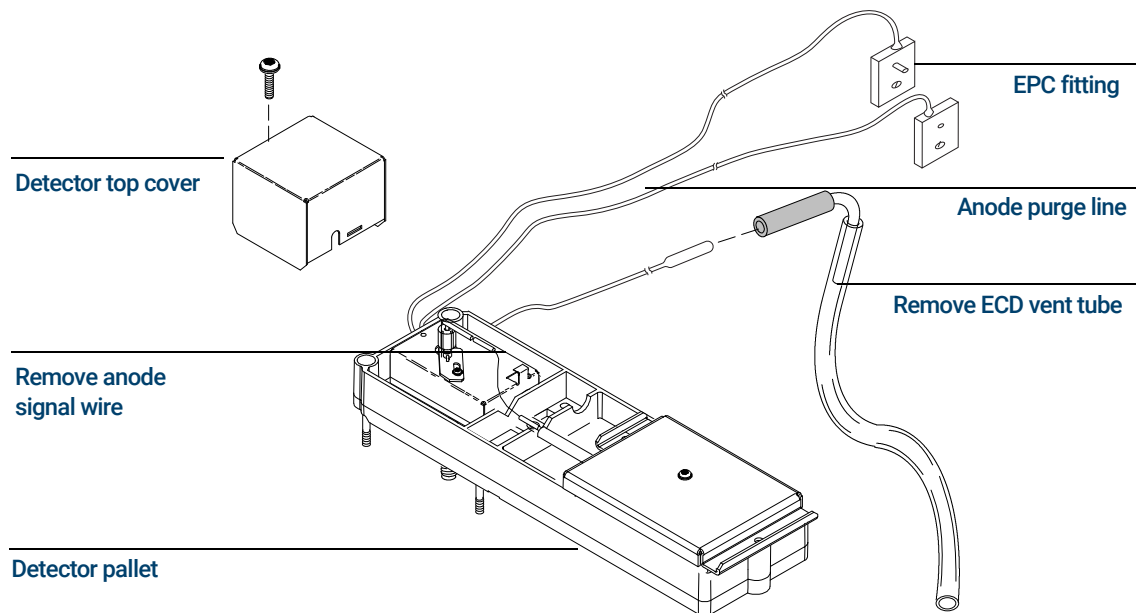


Figure 35. Screws securing the detector pallet

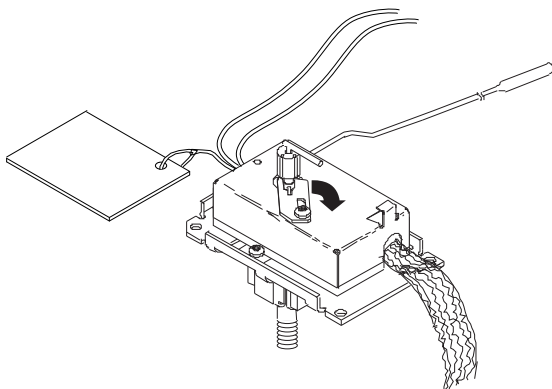
1 Agilent Electron Capture Detectors

Instructions for removing an ECD from a side-mounted detector box

- 4 Pull straight out on the detector pallet to remove it from the GC.
- 5 Remove the one Torx T-20 screw securing the ECD detector top cover to the detector pallet and remove the cover.
- 6 Disconnect the anode signal wire from the detector.
- 7 Thread the heater/sensor leads out of the detector pallet and remove the rest of the detector from the pallet.
- 8 For shipping or storage purposes, cap the inlet, anode purge and exhaust vent tubing.



- 9 The ECD detector is now properly disassembled for return to Agilent. Call the Technical Support number identified at the front of the booklet for further directions.

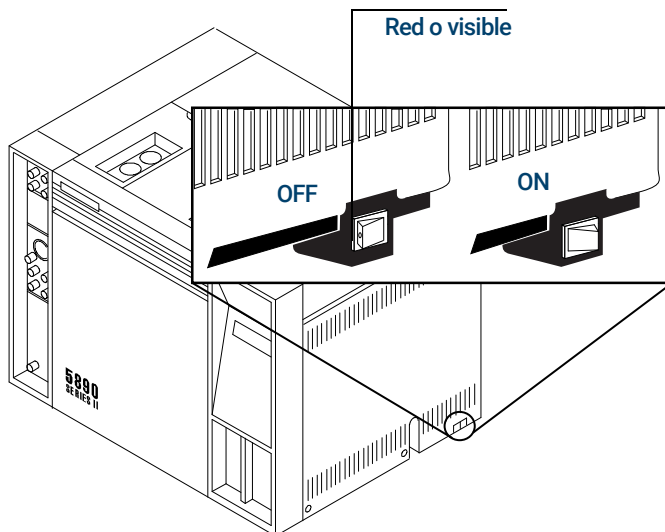


Instructions for removing G1223A and G1224A ECDs (5890 GC)

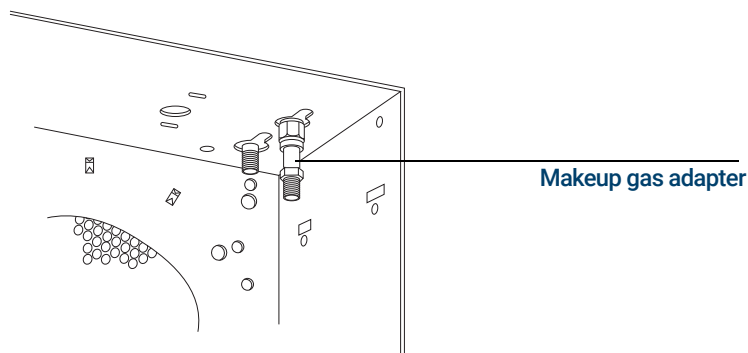
WARNING

Hazardous voltages are present in the instrument when the power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before working on the instrument.

- 1 Set the main power line switch to the off position.



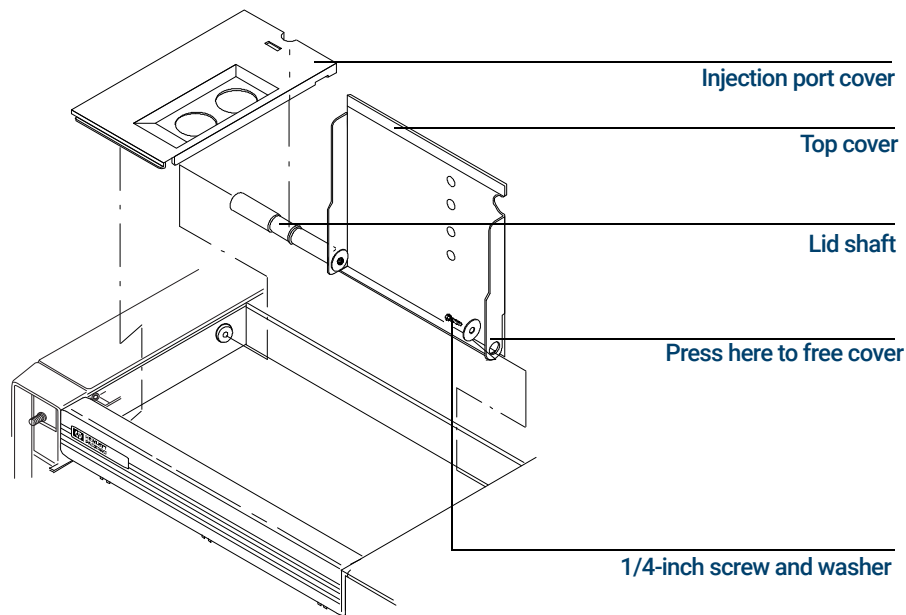
- 2 Disconnect the power cable from its receptacle.
- 3 Allow time for the oven and heated zones to cool.
- 4 When the heated zones are cool, turn off all gas supplies.
- 5 Inside the column oven, at the bottom of the detector to be removed, remove the column and hardware associated with the detector (liner, column/liner nuts, ferrules, makeup gas adapter, etc.).



1 Agilent Electron Capture Detectors

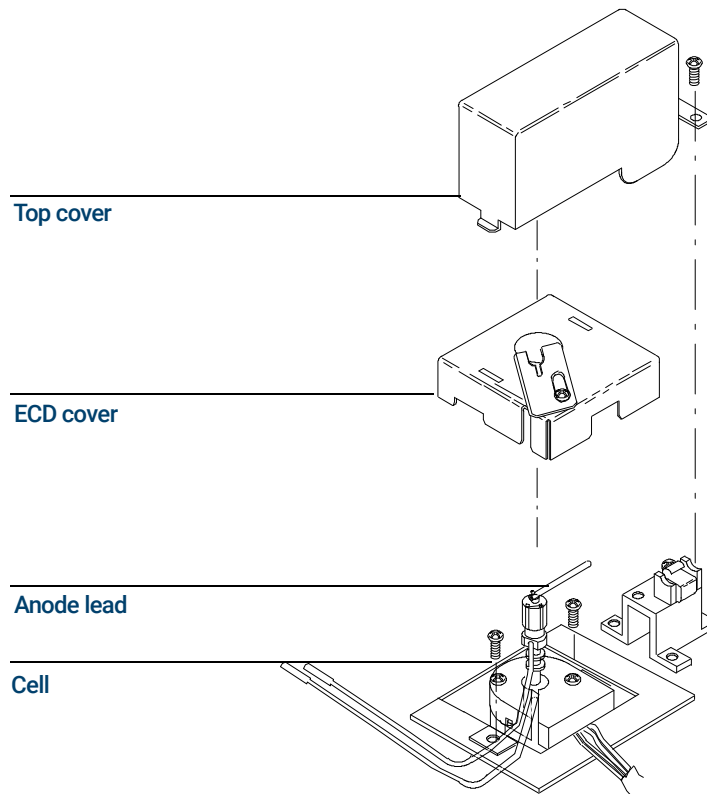
Instructions for removing G1223A and G1224A ECDs (5890 GC)

- 6 Remove the injection port cover by grasping its back edge and lifting it upward.
- 7 Lift the hinged top cover at its front edge, exposing the detector area.
- 8 Remove the 1/4-inch screw and washer securing the cover at its right side hinge point.
- 9 Remove the screw securing the ground strap to the hinged top cover.



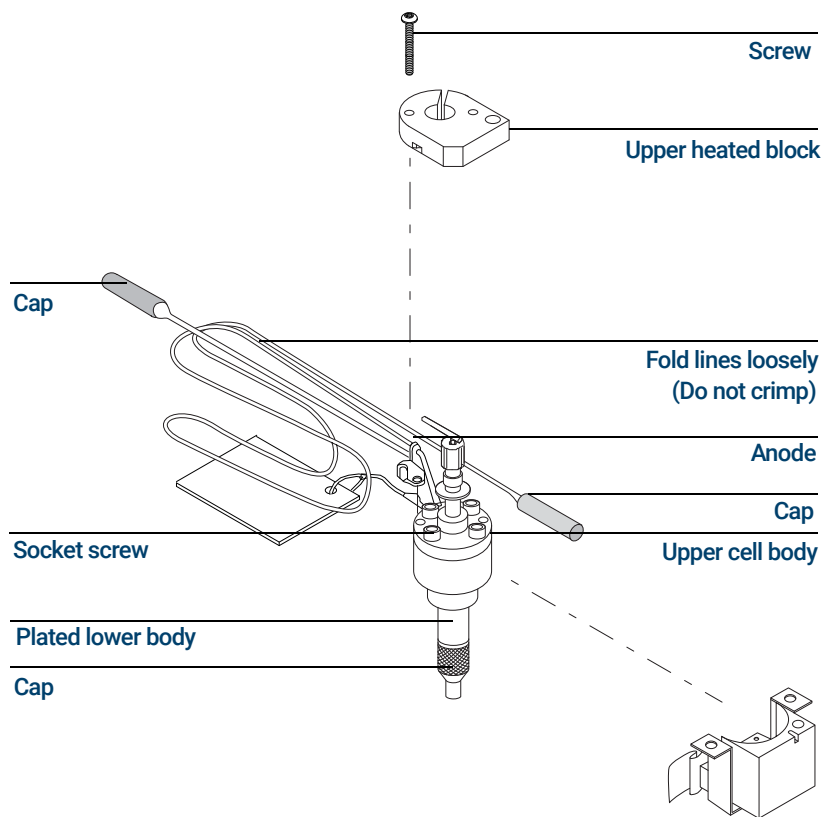
- 10 With the lower right side of the cover pushed in, lift the right side of the cover and slide it to the right to remove the top cover and lid shaft as a unit.
- 11 Using a Pozidriv screwdriver, remove the screw securing the detector top cover to the thermal strap.
- 12 Remove the ECD top cover.
- 13 Disconnect any tubing attached to the ECD purge and vent tubes.
- 14 Disconnect the cell anode lead from the PCB interconnect.
- 15 Loosen the locking screw on the ECD cover.
- 16 Slide the locking tab on the ECD cover back, freeing the cover from the anode shaft of the cell.

1 Agilent Electron Capture Detectors
Instructions for removing G1223A and G1224A ECDs (5890 GC)



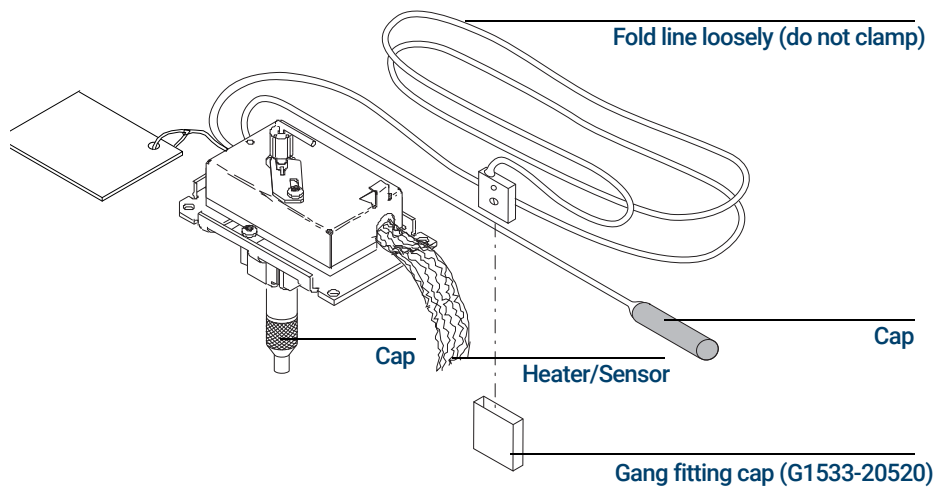
- 17** Carefully slide the ECD cover over the anode shaft and anode and remove it from the ECD.
- 18** Cap the base of the ECD (inside the column oven) to avoid damage or contamination of the ECD.
- 19** Remove the two Pozidriv screws securing the upper and lower heated blocks to the cell.
- 20** Remove the upper heated block from the cell.
- 21** Disengage the cell from the lower block.

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 Instructions for removing G1223A and G1224A ECDs (5890 GC)



22 For shipping or storage purposes, cap the inlet, purge and exhaust vent tubing.

23 The ECD detector is now properly disassembled for return to Agilent. Call the Technical Support number identified at the front of the booklet for further directions.

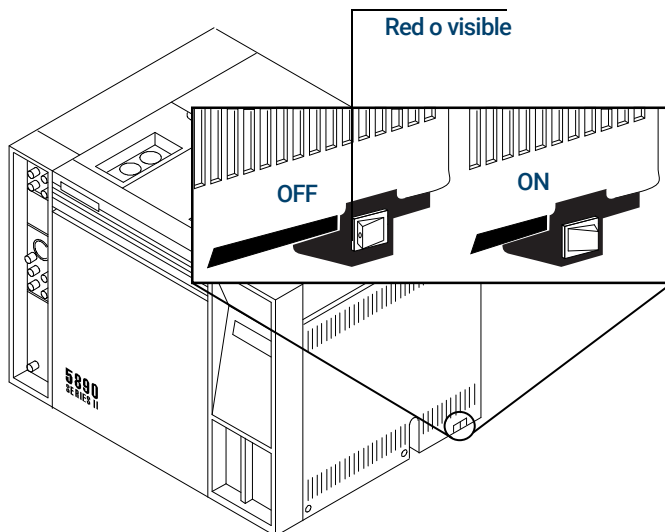


Instructions for removing 19233 and 19235 ECDs (5890 GC)

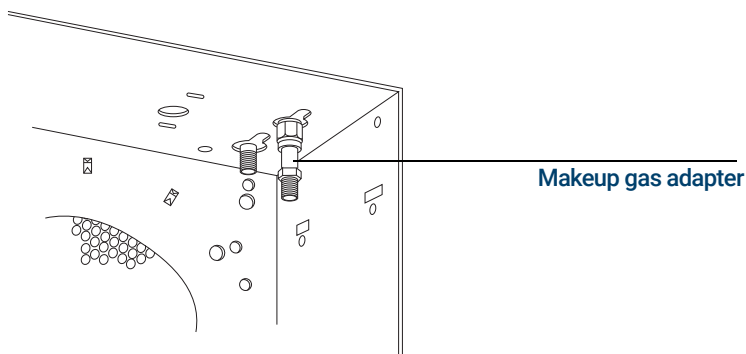
WARNING

Hazardous voltages are present in the instrument when the power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before working on the instrument.

- 1 Set the main power line switch to the off position.



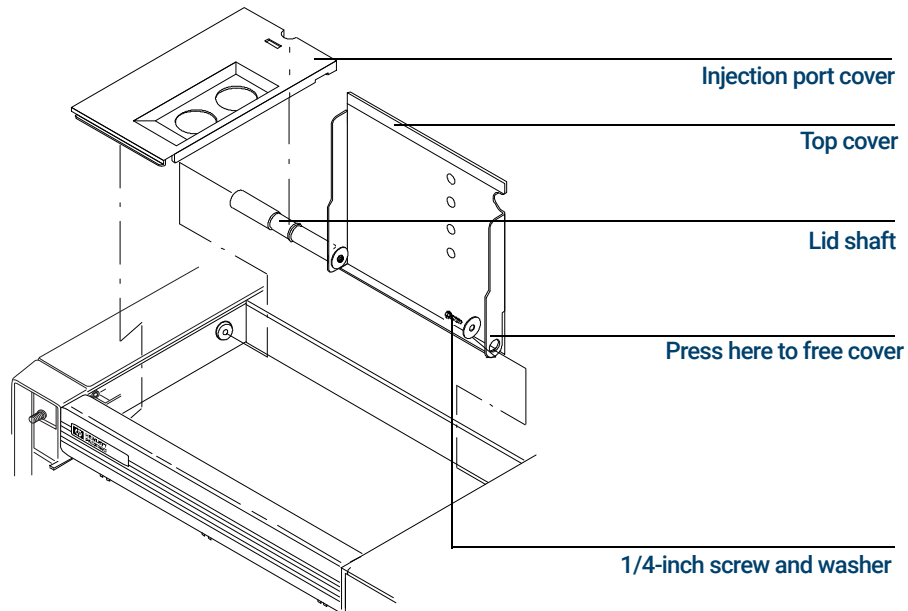
- 2 Disconnect the power cable from its receptacle.
- 3 Allow time for the oven and heated zones to cool.
- 4 When the heated zones are cool, turn off all gas supplies.



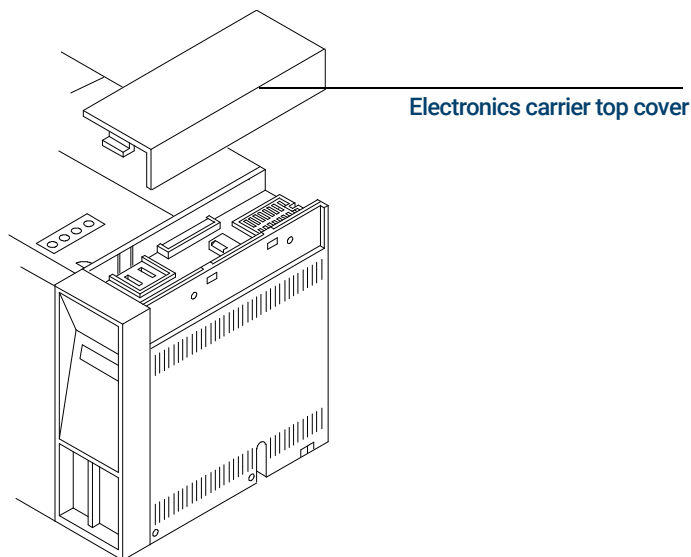
- 5 Inside the column oven, at the bottom of the ECD to be removed, remove the column and hardware associated with the detector(s) (liner, column/ liner nuts, ferrules, makeup gas adapter, etc.).

1 Agilent Electron Capture Detectors
Instructions for removing 19233 and 19235 ECDs (5890 GC)

- 6 Remove the injection port cover by grasping its back edge and lifting it upward.
- 7 Lift the hinged top cover at its front edge, exposing the detector area.
- 8 Remove the 1/4-inch screw and washer securing the cover at its right-side hinge point.
- 9 Remove the screw securing the ground strap to the hinged top cover.



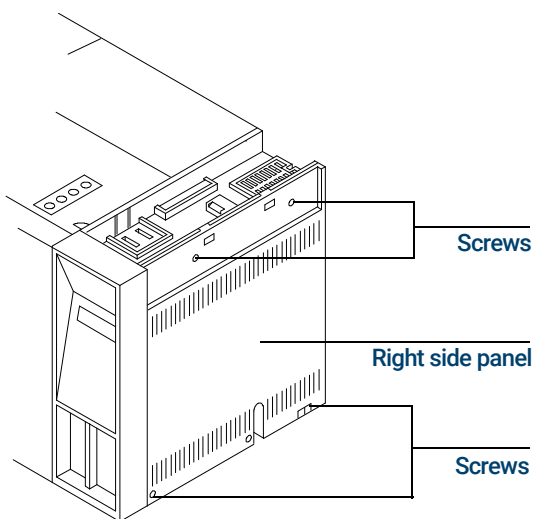
- 10 With the lower right side of the cover pushed in, lift the right side of the cover and slide it to the right to remove the top cover and lid shaft as a unit.



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Instructions for removing 19233 and 19235 ECDs (5890 GC)

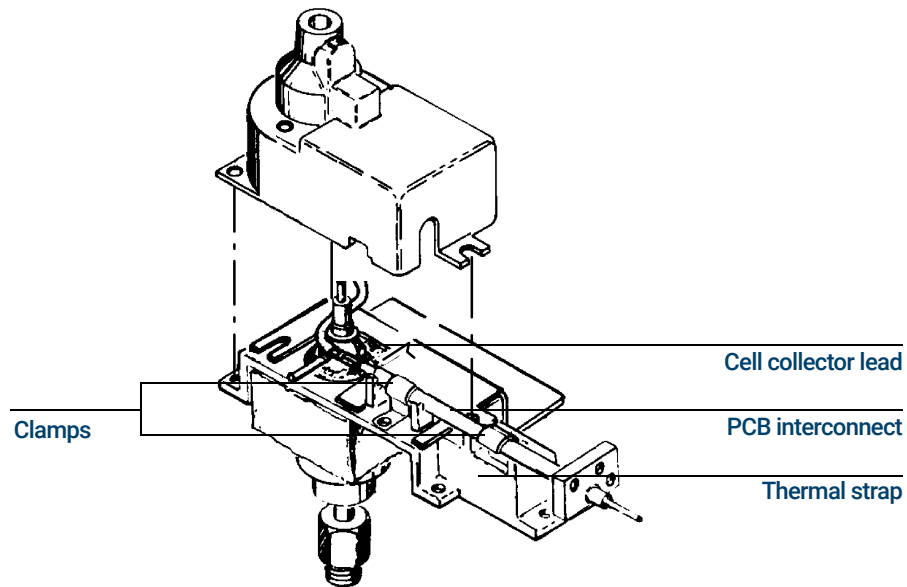
- 11 Remove the electronics carrier top cover by grasping it at the rear and lifting upward until its catch releases, then pulling it toward the rear of the instrument.



- 12 Remove the right side panel by removing four screws, two each along its upper and lower edges.
- 13 Using a Pozidriv screwdriver, remove the three screws securing the ECD cover to the thermal strap.
- 14 Remove the ECD cover.
- 15 Disconnect any tubing attached to the vent exhaust tube.
- 16 Disconnect the cell collector lead from the PCB interconnect.
- 17 Loosen the screws securing the clamps that hold the interconnect in place.

1 Agilent Electron Capture Detectors

Instructions for removing 19233 and 19235 ECDs (5890 GC)



CAUTION

The following steps require protection against ESD (electrostatic discharge). Use a grounded wrist strap (part no. 9300-0969 (large) or 9300-0970 (small)) connected to a suitable ground. Failure to heed this caution may result in damage to the instrument.

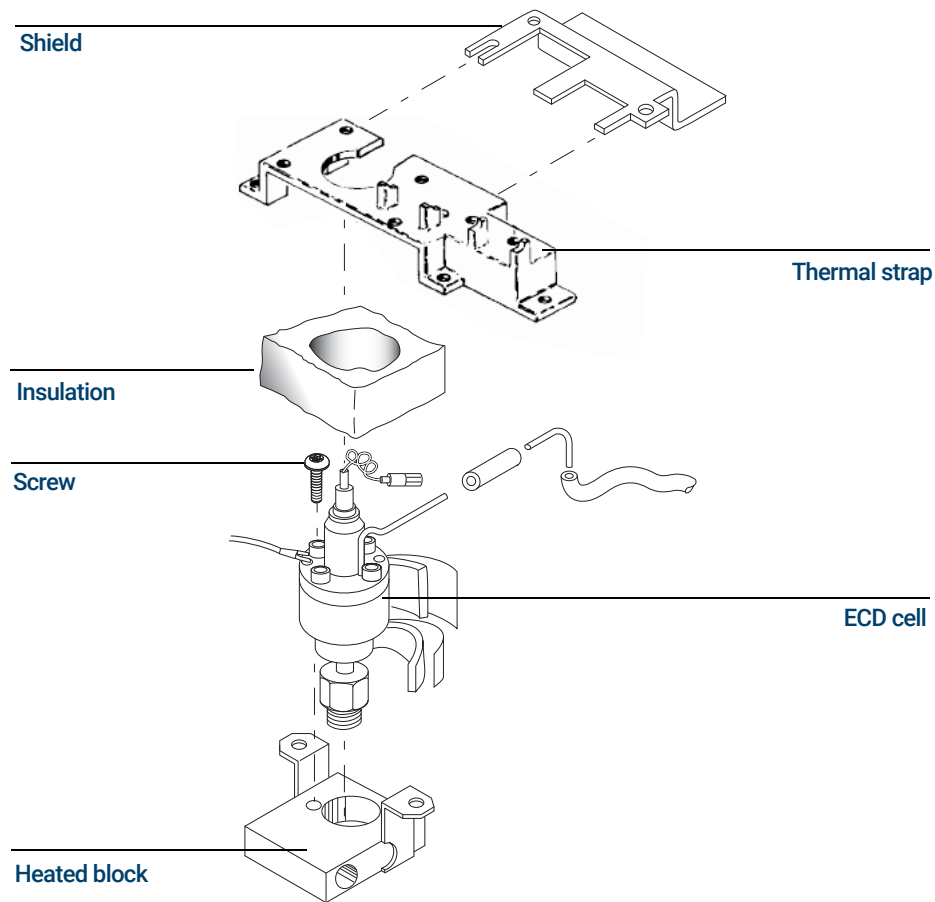
CAUTION

When storing or between handling of PCBs (printed circuit boards), always place them in static-control envelopes or enclosures.

- 18 Remove the ECDs PCB from the right side of the instrument by grasping it in the center area along its outer edge and pulling it straight out. This will draw the interconnect out of the ECD clamps on the thermal strap.

1 Agilent Electron Capture Detectors

Instructions for removing 19233 and 19235 ECDs (5890 GC)



- 19 Remove the five screws securing the thermal strap and shield to the instrument.
- 20 Remove the shield from the thermal strap by working it over the collector lead and exhaust vent tube carefully. Depending on the ECDs location, it may be necessary to bend the shield to remove and install it. Avoid excessive bending as this will fatigue the metal shield, shortening its life.
- 21 Remove the thermal strap, working it carefully over the collector lead and exhaust vent tube.
- 22 Cap the base of the ECD (inside the column oven) to avoid damage or contamination of the ECD.
- 23 Remove the insulation around the ECD cell to expose the two Pozidriv screws that secure the cell to the heated block. Remove the screws.
- 24 Remove the ECD cell from the heated block.
- 25 For shipping or storage purposes, cap the inlet, purge and exhaust vent tubing.

Instructions for removing 19303 and 19312 ECDs (5880 GC)

(For illustrations and more detailed instructions, see your service manual.)

- 1 Remove the top cover of the instrument over the ECD area.
 - a If the instrument has an automatic sampler installed, the top cover is in two parts. Only the left part must be removed. If the sampler is a 7671, remove all sample vials from the tray. If it is a 7672 sampler, remove the sample cassette. Rotate the sampler to the right until it rests on the right top edge of the mainframe. The sampler is heavy, so use care to avoid injury or damage to the sampler. Do not hold it by the door. Remove the two screws at the rear of the left part of the top cover and slide it back and off the instrument.
 - b If there is no sampler, the top cover is in one piece. Remove the two screws at the rear, raise the rear of the cover and slide it back and off the instrument.
- 2 Remove the two screws at the top of the right side instrument cover. Tilt the cover out, and lift it free of the tabs at the bottom.
- 3 Locate the printed circuit board for the detector you are going to remove. These are the small boards at the upper left as you look into the right side of the mainframe. They are in the same order as the detector locations on the top of the oven. ECD boards are labeled NICKEL 63 ELECTRON CAPTURE near the outer edge.
- 4 Use the plastic board puller tabs at the top and bottom to pull the board free of its connector. It is not necessary to remove the board, just pull it out about 25 mm (1-inch).
- 5 Remove the two screws that hold the ECD cover and lift the cover off.
- 6 Note the bare wire that comes out of the top of the ECD cell. It connects to an L-shaped bracket that is held in place by a single screw. Remove the screw and straighten the wire so that the bracket is above the cell. Use care to avoid breaking the wire, particularly at the point where it attaches to the cell.
- 7 Now remove the single screw that holds the insulation cover. Lift the cover up and over the L-shaped bracket until it is free of the ECD. You may have to compress the spring on the L-shaped bracket to allow it to pass through the insulation cover.
- 8 Disconnect the tubing and elbow connect to the ECD vent. This is the tube that extends to the left from the cell body.
- 9 Remove the two Pozidriv screws that hold the cell to the mounting block.
- 10 Remove the threaded plug from the inlet fitting (if present) and check that no column is installed. Grasp the upper part of the cell and pull it straight up. It should come free with only moderate force. If it is "frozen," contact your local Agilent Sales Office. Do not attempt to force the cell loose.
- 11 If the ECD is to be returned to Agilent Technologies, see shipping instructions "[How to Package and Ship ECDs](#)" on page 59.
- 12 Thoroughly wash your hands using a mild nonabrasive soap and water.

WARNING

Do not disturb the four socket-head bolts. These hold the cell halves together; removing or disturbing them is a violation of the terms of the General License and could create a safety hazard.

How to Package and Ship ECDs

Shipping radioactive materials in the U.S. is regulated by the U.S. Department of Transportation (DOT) for surface transport and by the International Air Transport Association (IATA) for air transport.

Appendix A contains:

- "Instructions for Customer Return of ECDs per Compliance with IATA Regulations" for shipping ECDs via Air Transportation.
- "Instructions for Customer Return of ECDs per Compliance with U.S. DOT Regulations" for shipping ECDs via Surface Transportation.

Prior to shipping radioactive materials, you should contact your transportation officer and/ or your carrier to determine which regulations are pertinent to your shipment.

- 1 Using a clean dry cloth, remove any external chemicals or debris that may be on the ECD.
- 2 Insert the threaded plug in the entrance fitting and cap the vent tube. These measures keep foreign materials out of the ECD cavity and keep any loose fragments in.
- 3 Place the ECD in a strong plastic bag and seal the bag.
- 4 Pack the bag in a strong container (corrugated cardboard is satisfactory) with a shock-absorbing packing material (bubble-pack if available) and seal the box carefully. If possible, try to retain the original ECD box for return shipment.
- 5 Determine the carrier's means of transportation to Agilent Technologies; 2850 Centerville Rd., Wilmington, DE 19808-1610. See **Appendix A** for Procedures to package, label, and mark ECDs for return to Agilent Technologies by air or ground transportation (for shipment by Federal Express, use IATA instructions).
- 6 If available, affix the preprinted address label originally provided with the ECD. If you are using our address label, ensure that our current Wilmington, Delaware address is on the label. All ECDs should be sent to:

Agilent Technologies
Attention: ECD Lab
2850 Centerville Road
Wilmington, DE 19808-1610
- 7 All ECDs must be shipped via a licensed common carrier with tracking capabilities; we recommend Federal Express. ECDs should not be shipped via regular mail (because regular mail is not traceable) and ECDs should never be hand-delivered.
- 8 Regulations cited in this manual were valid at the time of this revision. Agilent Technologies accepts no liability for transportation compliance. For additional regulatory information regarding shipping ECDs, refer to the domestic and/or international regulatory requirements in **Appendix A**. Consult with your appropriate transportation officer for changes since the date of this revision.

Radioactive Wipe Tests

In the U.S., your ECD must be tested for leakage of radioactive material at least every 6 months. Customers outside of the U.S. should consult their local nuclear agency to determine the required frequency of wipe tests. Records of all tests and their results must be maintained for possible inspection by the NRC or your local "Agency." Under severe usage conditions, radioactivity leak tests during every column change will provide maximum security.

Although Agilent Technologies performs a wipe test on all ECDs prior to shipment, all further 6-month wipe tests are the responsibility of the end user. In addition, customer wipe tests are not performed by Agilent service engineers, are not included in any service contract, and are not part of any preventative maintenance carried on by Agilent Technologies.

The procedure used is called the wipe test. Wipe test kits are available for sale through Agilent (P/N 18713-60050).

We recommend that disposable gloves be worn when performing this test. If they are not used, wash your hands thoroughly when you are finished.

Radioactive Wipe Test - G4597A Intuvo 9000 GC ECDs

The following are detailed instructions for performing the wipe test on Agilent ECDs. This information is also provided in the service note contained in the wipe test kit.

- 1 Select one information card (item 1), and fill it out completely.
- 2 Select one piece of filter paper (item 2), and label it with a pencil as follows:
Sample 1—Det. Exit
- 3 Disconnect the exit tubing from the ECD vent tube. Wipe the side of the metal ECD exit tube and/or the inside of the exit tubing with the filter paper. Insert it and a completed information card in a plastic bag. If the ECD is installed in a GC, reconnect the tubing to the ECD vent and inspect the vent line to verify that it is attached securely and vented properly.
- 4 After completing wipe tests, wash your hands thoroughly with mild soap and water.
- 5 In the U.S., the "ECD Wipe Sample" must be analyzed by an NRC authorized company offering this service. See **"Wipe test companies"** on page 62 for a list of a few of the companies that provide this service. We suggest that you contact them for cost of testing, turnaround times, and payment arrangements. Please note that the listing of Wipe Test Companies is only provided as a courtesy to our customers and Agilent Technologies is not associated with and does not specifically endorse any one of these companies. You may choose to use any of these companies or any other authorized company. Customers outside of the U.S., please contact your local nuclear regulatory agency for an authorized company.
- 6 You will receive a written report of the results from the wipe test company. It is your responsibility to retain all wipe test results for possible inspection by your local "Agency."

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Radioactive Wipe Test - G2397A (8890, 8860, 7890, 7820A, and 6890 GCs), G1533A (6890 GC), G1223A, G1224A, 19233, 19235 (5890 GC), 19303, and 19312 (5880 GC) ECDs

Radioactive Wipe Test - G2397A (8890, 8860, 7890, 7820A, and 6890 GCs), G1533A (6890 GC), G1223A, G1224A, 19233, 19235 (5890 GC), 19303, and 19312 (5880 GC) ECDs

The following are detailed instructions for performing the wipe test on Agilent ECDs. This information is also provided in the service note contained in the wipe test kit.

- 1 Select three information cards (item 1), and fill them out completely.
- 2 Select three pieces of filter paper (item 2), and label them with a pencil as follows:
Sample 1—Det. Entrance Fitting
Sample 2—Det. Housing
Sample 3—Det. Exit
- 3 Disconnect the column from the ECD.
- 4 Wipe the outside and inside of the ECD entrance fitting (including column and adapter connections) with the piece of filter paper labeled "Sample 1—Det. Entrance Fitting." Immediately insert it and a filled-out information card into one of the plastic bags (item 3), and seal it closed.
- 5 Wipe the ECD housing with the filter paper labeled "Sample 2—Det. Housing," and insert it and a filled-out information card into a second plastic bag.
- 6 Disconnect the exit tubing from the ECD vent tube. Wipe the side of the metal ECD exit tube and/or the inside of the exit tubing with the filter paper labeled "Sample 3—Det. Exit." Insert it and a completed information card in a third plastic bag. If the ECD is installed in a GC, reconnect the tubing to the ECD vent and inspect the vent line to verify that it is attached securely and vented properly.
- 7 After completing wipe tests, wash your hands thoroughly with mild soap and water.
- 8 In the U.S., the "ECD Wipe Samples" must be analyzed by an NRC authorized company offering this service. Below is a list of a few of the companies that provide this service. We suggest that you contact them for cost of testing, turnaround times, and payment arrangements. Please note that the listing of Wipe Test Companies is only provided as a courtesy to our customers and Agilent Technologies is not associated with and does not specifically endorse any one of these companies. You may choose to use any of these companies or any other authorized company. Customers outside of the U.S., please contact your local nuclear regulatory agency for an authorized company.
- 9 You will receive a written report of the results from the wipe test company. It is your responsibility to retain all wipe test results for possible inspection by your local "Agency."

Wipe test companies

Nuclear Radiation Developments Inc.
2937 Alt Boulevard
Grand Island, New York 14072
716-773-7634

National Leak Test Center
P. O. Box 1400
North Tonawanda, New York 14120
716-693-0550

QSA Global Inc.
6765 Langley Drive
Baton Rouge, Louisiana 70809
225-751-5893

Detector Service Center, Inc.
9423 Chapel Hill Road
Cary, North Carolina 27513
919-469-0259

Spencer Scientific
13309 SE 159th Place
Renton, WA 98058-7802
425-204-6167

High wipes

If the radioactive leak test indicates leakage of 0.005 microcuries or greater, you must take the ECD out of service immediately and notify the NRC or the appropriate State agency within 5 days. See **"Incidents"** on page 64 for additional reporting information.

Wipe test conversion formulas

When you receive your wipe test results, they will be defined as CPMs, DPMs, microcuries or Becquerels. For your convenience, some conversion formulas and examples to put these numbers in perspective are found below.

C = Wipe in CPMs (counts per minute)

D = Wipe in DPMs (disintegrations per minute)

E = Efficiency of the liquid scintillation counter (LSC) for that day

F = Wipe in microcuries (μCi)

B = Wipe in Becquerels (Bq)

$D = C/E$

$F = D/(2,220,000)$

$B = (D)/60$

1 Curie (Ci) = 3.7×10^{10} Becquerels (Bq) = 37,000 MBq

1 Curie (Ci) = 1,000 mCi (millicuries)

1 Agilent Electron Capture Detectors

Wipe test conversion formulas

$$1 \text{ Curie (Ci)} = 1,000,000 \text{ } \mu\text{Ci (microcuries)}$$

$$1 \text{ Curie (Ci)} = 1,000,000,000 \text{ nCi (nanocuries)}$$

$$1 \text{ Curie (Ci)} = 1,000,000,000,000 \text{ pCi (picocuries)}$$

For example, if you had a wipe of 9,435 CPM and the efficiency of the count is 85%, you would convert the value to DPMs and microcuries as follows:

$$(9,435 \text{ CPMs}) / (0.85) = 11,100 \text{ DPMs}$$

$$(11,100 \text{ DPMs}) / (2,220,000) = 0.005 \text{ } \mu\text{Ci} = 5 \text{ nCi}$$

$$(11,100) / (60) = 185 \text{ Bq}$$

Incidents

10 CFR Sections 20.2202 31.5(c)(5) and 20.2203 of the NRC Regulations, referred to in **Appendix B**, describe the reporting actions that must be taken if an incident occurs. In this section, an incident is any occurrence involving radioactive material that may have caused, or threatens to cause:

- Exposure to dangerous levels of radiation
- Release of dangerous amounts of radioactive materials

Please refer to the NRC regulations for further details.

WARNING

In the absence of radiation measuring equipment, all incidents or significant failures should be reported and the ECD should be taken out of service immediately.

Because a General Licensee is not required to maintain radiation measurement capability and may not have access to one when needed, the following criteria are offered to aid in recognizing possible incidents and other failures:

- **High wipe**—If the leak (wipe) test results for your ECD exceeds the 0.005 microcuries limit, a notification of failure must be reported, per 10 CFR 31.5.
- **Temperature runaway**—A failure in the temperature control circuits of the instrument, accompanied by failure of the overheat protection circuits, could cause the heating of the detectors to exceed their limits. This must be reported if it causes failure or damage to the ECD.
- **Physical damage**—If the ECD is involved in a fire, flood or any other event that may cause harm to the ECD, it must be reported, per 10 CFR 31.5.
- **Modification of the ECD**—Changes to the ECD, including drilling, welding, soldering, sawing or other operations, are prohibited under a General License. If this occurs, it must be reported per 10 CFR 31.5.
- **Breakage of the ECD**—If the inlet fitting or vent tube of the ECD should break off, take the ECD out of service immediately and report this failure to the appropriate agency.
- **Lost ECD**—If you should lose, misplace, accidentally dispose of an ECD or if an ECD gets lost in shipping, such occurrences must be reported, per 10 CFR 20.2201.

This list is not exhaustive. It is intended to illustrate the range of occurrences that could be considered reportable incidents or failures. In dealing with radioactive isotopes, it is advisable to be overly cautious, particularly if you do not have the equipment to make an accurate assessment of the situation.

Incidents and failures should also be reported to:

Agilent Technologies
Attn: Radiation Safety Officer
2850 Centerville Road
Wilmington, Delaware
19808-1610

Principle of Operation

The radioactive source in this ECD produces high-energy electrons called beta particles. These beta particles collide and interact with the carrier gas molecules causing a multiplication of the number of electrons and a decrease in their energy. Each beta particle produces approximately 100 of these low energy electrons, also known as free electrons.

When a sample molecule comes in contact with the free electrons, a free electron may be captured by a sample molecule to create a negatively charged ion. The voltage across the cell electrodes is pulsed to collect the surviving free electrons, while the heavier ions are relatively unaffected and swept out the vent with the carrier gas flow.

The measured cell current is compared to a reference current. The pulse rate is adjusted to keep the two currents equal. The more free electrons there are, the lower the pulse frequency required to match the reference current. When a component that captures electrons passes through the cell, it causes a decrease in the electron concentration and an increase in the pulse rate. This pulse rate is converted to a voltage and recorded.

What types of samples do ECDs detect?

The ECD is used for low-level detection of electron-capturing substances. These include mono- and poly-halogenated compounds, nitro derivatives and anhydrides. The ECD produces little or no response to hydrocarbons, ethers, and esters or to aliphatic alcohols, ketones and amines. Hydrocarbons, ethers, and esters, in that order, are the preferred solvents for ECD analysis.

Because of the combination of very high sensitivity and selectivity provided by the ECD, it is widely used for trace level analysis of halogenated, particularly chlorinated, components. A major application is the detection and quantitation of pesticide residues, many of which are chlorinated.

Sensitivity

The response of the ECD depends upon the molecular composition of the analyte and its concentration, your ECD, the cell cleanliness, the column, the inlet and the instrument setpoints (temperature, flow rates, and reference current).

It is important to create calibration curves on all compounds and evaluate ECD response on a regular basis. Even with frequent calibration, you can expect the ECD response to change when operating conditions change, for instance, when analyzing dirty samples that contaminate the ECD.

1 **Agilent Electron Capture Detectors**
Sensitivity

A

Instructions for Customer Return of ECDs per Compliance with IATA Regulations (Air Transportation)

Procedures for Packaging, Labeling and Marking ECD Packages for Return to Agilent Technologies by Air

- 1 Plug the entrance fitting and cap the vent tube. Place the ECD in a strong plastic bag, seal it and pack it in a strong container with shock-absorbing packing material (a corrugated cardboard box in good condition and bubble wrap is a satisfactory combination).
- 2 This package must be marked with the appropriate Radioactive Material Excepted Packaging label. Contact your Agilent Field Repair Center for the required label.
- 3 The Air Bill/Air Waybill must list this as "Radioactive material, excepted package-articles, UN2911."
- 4 Refer to [page 69](#) for a further explanation of shipping information and instructions.

IATA Regulations

The following are references and excerpts from the International Air Transport Association (IATA), Dangerous Goods Regulations. This information is provided for your convenience. It is your responsibility to comply with all current regulations including requirements for training, packaging, labeling and documentation procedures. Most primary carriers use the IATA regulations; however, consult with your selected carrier for additional information.

Definition of Excepted Quantities (Excerpted from IATA 2.7)

Excepted Quantity - Certain dangerous goods, when shipped in very small quantities, and when packaged in user-tested packaging configurations, are subject to less stringent regulations. In certain cases the package may be exempt from most marking, packaging and labeling requirements of the hazard class.

In the case of radioactive material, the requirements for radioactive material in excepted packages is found in IATA 10.5.8.

Excepted Package Activity Limits for ECD Returns (Calculated from Table 10.3.C)

The activity of an ECD cell (an item in Table 10.5.A) is below the limit of 800 mCi for ^{63}Ni . ($A_2 = 800 \text{ Ci}$; therefore $800 \text{ Ci} \times 0.01 = 8 \text{ Ci}$ or 8000 mCi). This qualifies all packages containing a single ECD (at 15 mCi) as an excepted quantity.

Table 1 Excepted Package Activity Limits (10.3.11.1.1.1)

Nature of Contents	Instruments and articles		
	Materials Package limits	Item limits	Package limits
Solids:			
Special form	$10^{-3}A_1$	$10^{-2}A_1$	A_1
Other form	$10^{-3}A_2$	$10^{-2}A_2$	A_2
Liquids:			
	$10^{-4}A_2$	$10^{-3}A_2$	$10^{-1}A_2$
Gases:			
Tritium	$2 \times 10^{-2}A_2$	$2 \times 10^{-2}A_2$	$2 \times 10^{-1}A_2$
Special form	$10^{-3}A_1$	$10^{-3}A_1$	$10^{-2}A_1$
Other form	$10^{-3}A_2$	$10^{-3}A_2$	$10^{-2}A_2$

Instructions for Customer Return of ECDs per Compliance with U.S. DOT Regulations (Surface Transportation other than Federal Express)

Procedures for packaging, labeling and marking ECD packages for return to Agilent Technologies by common carrier

- 1 Plug the entrance fitting and cap the vent tube. Place the ECD in a strong plastic bag, seal it, and pack it in a strong container with shock-absorbing packing material (a corrugated cardboard box in good condition and bubble wrap is a satisfactory combination).
- 2 Completely remove or mark out any previous labels if the container chosen has previous shipping labels on it.
- 3 This package must be marked with the appropriate Radioactive Material Excepted Packaging label.

Contact your Agilent Field Repair Center for the required label.
- 4 Refer to [page 59](#) and the regulations provided below for additional shipping information and instructions.

U.S. DOT Regulations

The U.S. Department of Transportation (U.S. DOT) provides requirements for surface transportation of ECDs in 49 CFR Part 173.424 (Excepted packages for radioactive instruments and articles). Contact your qualified carrier or access the regulation on line at www.dot.gov for up-to-date instructions.

B

CODE OF FEDERAL REGULATIONS, TITLE 10—ENERGY, CHAPTER 1 NUCLEAR REGULATORY COMMISSION

Please access the NRC's home page at www.nrc.gov. Open the Reference Library icon and then Title 10 of the Code of Federal Regulations. Topics of interest include:

PART 20—STANDARDS FOR PROTECTION AGAINST RADIATION

Section 20.2201 (Reports of theft or loss of licensed material)

Section 20.2202 (Notification of incidents)

Section 20.2203 (Reports of exposure...exceeding constraints or limits)

PART 30—RULES OF GENERAL APPLICATION TO DOMESTIC LICENSING OF BYPRODUCT MATERIAL

Section 30.34 (Terms and conditions of licenses)

Section 30.51 (Records)

Section 30.52 (Inspections)

Section 30.53 (Tests)

Section 30.61 (Modification and revocation of licenses)

PART 31—GENERAL DOMESTIC LICENSES FOR BY-PRODUCT MATERIAL

Section 31.2 (Terms and conditions)

Section 31.5 (Certain measuring, gauging, or controlling devices)

NOTE

Section 31.5 is the primary regulation governing the ownership of your generally licensed ECD.

C

Rules of Tennessee Department of Environment and Conservation

0400-20-10-.10 General Licenses* - Radioactive Material Other Than Source Material

The following are excerpts from Tennessee State Regulations for Protection Against Radiation. Regulations for Agreement States other than Tennessee, in which ECDs are installed, are similar to Tennessee regulations, or equivalent portions of regulations of the state in which the ECD is installed.

- 1** A general license is hereby issued to receive, acquire, own, possess, use and transfer radioactive material incorporated in a device or equipment manufactured pursuant to a specific license or equivalent licensing document, issued by the Division, the U.S. Nuclear Regulatory Commission, or any Agreement State and authorizing distribution under the general license of this paragraph or its equivalent.
- 2** Certain detecting, measuring, gauging or controlling devices and certain devices for producing light or an ionized atmosphere.[†]
 - a** A general license is hereby issued to commercial and industrial firms and research, educational and medical institutions, individuals in the conduct of their business and State or local government agencies to own, acquire, receive, possess, use or transfer, in accordance with the provisions of subparagraphs (b), (c) and (d) of this paragraph, radioactive material contained in devices designed and manufactured for the purpose of detecting, measuring, gauging or controlling thickness, density, level, interface location, radiation, leakage, or qualitative or quantitative chemical composition, or for producing light or an ionized atmosphere.
 - b**
 1. The general license in subparagraph (a) of this paragraph applies only to radioactive material contained in devices that have been manufactured or initially transferred and labeled in accordance with the specifications contained in:
 - (i) A specific license issued by the Division pursuant to paragraph (5) of Rule 0400-20-10-.13, or
 - (ii) A specific license issued by the U.S. Nuclear Regulatory Commission pursuant to 10 CFR 32.51 or an Agreement State with provisions comparable to paragraph (5) of Rule 0400-20-10-.13.
 2. The devices shall have been received from one of the licensees in part 1 of this subparagraph or through a transfer made under part (c)9 of this paragraph.

* Different general licenses are issued in this rule, each of which has its own specific conditions and requirements.

† Persons possessing radioactive material in devices under the general license in this paragraph before October 2, 1978, may continue to possess, use or transfer that material in accordance with the requirements in the 1972 edition of the regulations.

- c Persons who own, acquire, receive, possess, use or transfer radioactive material in a device pursuant to the general license contained in subparagraph (a) of this paragraph:
1. Shall assure that all labels affixed to the device at the time of receipt and bearing the statement that removal of the label is prohibited are maintained thereon and shall comply with all instructions and precautions provided by such labels;
 2. Shall assure that the device is tested for leakage of radioactive material and proper operation of the on-off mechanism and indicator, if any, at no longer than 6 month intervals or at such other intervals as are specified in the label; however,
 - (i) Devices containing only krypton need not be tested for leakage of radioactive material; and
 - (ii) Devices containing only tritium or not more than 100 microcuries of other beta and/or gamma emitting material or 10 microcuries of alpha emitting material and devices held in storage in the original shipping container prior to initial installation need not be tested for any purpose.
 3. Shall assure that the tests required by part 2 of this subparagraph and other testing, installation, servicing and removal from installation involving the radioactive material, its shielding or containment, are performed:
 - (i) In accordance with the instructions provided by the labels, or
 - (ii) By a person holding an applicable specific license issued by the Division, the U.S. Nuclear Regulatory Commission, an Agreement State or a Licensing State to perform such activities.
 4. Shall maintain records showing compliance with the requirements of parts 2 and 3 of this subparagraph. The records shall show the results of tests. The records also shall show the dates of performance of and the names of persons performing testing, installation, servicing and removal from installation of the radioactive material, its shielding or containment. The licensee shall retain these records as follows:
 - (i) Each record of a test for leakage or radioactive material required by part 2 of this subparagraph shall be retained for 3 years after the next required leak test is performed or until the sealed source is transferred or disposed of;
 - (ii) Each record of a test of the on-off mechanism and indicator required by part 2 of this subparagraph shall be retained for 3 years after the next required test of the on-off mechanism and indicator is performed or until the sealed source is transferred or disposed of; and
 - (iii) Each record that is required by part 3 of this subparagraph shall be retained for 3 years from the date of the recorded event or until the sealed source is transferred or disposed of.

5. Shall immediately suspend operation of the device if there is a failure of or damage to, or any indication of a possible failure of or damage to, the shielding of the radioactive material or the on-off mechanism or indicator, or upon the detection of 0.005 microcurie (185 becquerel) or more removable radioactive material. The device may not be operated until it has been repaired by the manufacturer or other person holding an applicable specific license issued by the Division, the U.S. Nuclear Regulatory Commission, an Agreement State or a Licensing State to repair such devices. The device and any radioactive material from the device may only be disposed of by transfer to a person holding an applicable specific license to receive the radioactive material contained in the device or as otherwise approved by the Division. The licensee shall within 30 days furnish to the Division at the address in Rule 0400-20-04-.07 a report containing a brief description of the event and the remedial action taken. In the case of detection of 0.005 microcurie or more removable radioactive material or failure of or damage to a source likely to result in contamination of the premises or the environs, the licensee shall within 30 days submit to the Division at the address in Rule 0400-20-04-.07, a plan for ensuring that the premises and environs are acceptable for unrestricted use. Under these circumstances, the criteria set out in paragraph (2) of Rule 0400-20-10-.36, "Radiological criteria for unrestricted use," may be applicable, as determined by the Division on a case-by-case basis;
6. Shall not abandon the device containing radioactive material;
7. Shall not export the device containing radioactive material except in accordance with 10 CFR 110;
8. Shall:
 - (i) Transfer or dispose of the device containing radioactive material only by export as provided by part 7 of this subparagraph, by transfer to another general licensee as authorized in part 9 of this subparagraph, or to a person authorized to receive the device by a specific license issued by the Division under this Chapter or an equivalent license issued by the U.S. Nuclear Regulatory Commission or an Agreement State, or as otherwise approved under subpart (iii) of this part.
 - (ii) Shall within 30 days after the transfer of a device to a specific licensee or export furnish a report to the Division. The report shall contain:
 - (I) The identification of the device by manufacturer's (or initial transferor's) name, model number and serial number;
 - (II) The name, address and license number of the person receiving the device (license number not applicable if exported); and
 - (III) The date of the transfer.
 - (iii) Shall obtain written Division approval before transferring the device to any other specific licensee not specifically identified in subpart (i) of this part. However a holder of a specific license may transfer a device for possession and use under its own specific license without prior approval, if, the holder:
 - (I) Verifies that the specific license authorizes the possession and use, or applies for and obtains an amendment to the license authorizing the possession and use;

0400-20-10-.10 General Licenses - Radioactive Material Other Than Source Material

- (II) Removes, alters, covers, or clearly and unambiguously augments the existing label (otherwise required by part 1 of this subparagraph) so that the device is labeled in compliance with Rule 0400-20-05-.113; however the manufacturer, model number, and serial number must be retained;
 - (III) Obtains manufacturer's or initial transferor's information concerning maintenance that would be applicable under the specific license (such as leak testing procedures); and
 - (IV) Reports the transfer under subpart (ii) of this part.
9. Shall transfer the device to another general licensee only if:
- (i) The device remains in use at a particular location. In this case, the transferor shall give the transferee a copy of this paragraph and any safety documents identified in the label of the device. Within 30 days of the transfer, the transferor shall report to the Division:
 - (I) The manufacturer's (or initial transferor's) name;
 - (II) The model number and the serial number of the device transferred;
 - (III) The transferee's name and mailing address for the location of use; and
 - (IV) The name, title and phone number of the responsible individual identified by the transferee in accordance with part 12 of this subparagraph to have knowledge of and authority to take actions to ensure compliance with the appropriate regulations and requirements; or
 - (ii) The device is held in storage by an intermediate person in the original shipping container at its intended location of use prior to initial use by a general licensee.
10. Shall comply with the provisions of Rules 0400-20-05-.140 and 0400-20-05-.141 for reporting radiation incidents, theft or loss of radioactive material;
11. Shall respond to written requests from the Division to provide information relating to the general license within 30 calendar days of the date of the request, or other time specified in the request. If the general licensee cannot provide the requested information within the allotted time, it shall, within that same time period, request a longer period to supply the information by submitting a letter to the Division at the address in Rule 0400-20-04-.07 providing written justification as to why it cannot comply;
12. Shall appoint an individual responsible for having knowledge of the appropriate regulations and requirements and the authority for taking required actions to comply with appropriate regulations and requirements. The general licensee, through this individual, shall ensure the day-to-day compliance with appropriate regulations and requirements. This appointment does not relieve the general licensee of any of its responsibility in this regard;

13. Shall:
- (i) Report these devices to the Division annually. Reporting shall be done by verifying, correcting and/or adding to the information provided in a request for a report received from the Division. The report information shall be submitted to the Division within 30 days of the date of the request or as otherwise indicated in the request.
 - (ii) In reporting devices, furnish the following information and any other information specifically requested by the Division:
 - (I) Name and mailing address of the general licensee;
 - (II) Information about each device: the manufacturer (or initial transferor), model number, serial number, the radioisotope and activity (as indicated on the label);
 - (III) Name, title and telephone number of the responsible person designated as a representative of the general licensee under part 12 of this subparagraph;
 - (IV) Address or location at which the device(s) are used and/or stored. For portable devices, the address of the primary place of storage. Each address for a location of use represents a separate general license;
 - (V) Certification by the responsible representative of the general licensee that the information concerning the device(s) has been verified through a physical inventory and checking of label information; and
 - (VI) Certification by the responsible representative of the general licensee that they are aware of the requirements of the general license.
14. Shall be subject to the bankruptcy notification requirement in paragraph (7) of Rule 0400-20-10-.16 if holding devices containing radioactive material that meet the following criteria, based on the activity indicated on the label:
- (i) At least 10 mCi (370MBq) of cesium-137;
 - (ii) At least 0.1 mCi (3.7 MBq) of strontium-90;
 - (iii) At least 1 mCi (37 MBq) of cobalt-60;
 - (iv) At least 1 mCi (37 MBq) of americium-241 or any other transuranic (i.e., element with atomic number greater than uranium (92)); or
 - (v) At least 0.1 mCi (37 MBq) of radium-226.
15. Persons generally licensed by the U.S. Nuclear Regulatory Commission or an Agreement State with respect to devices meeting the criteria in parts 13 and 14 of this subparagraph are not subject to reporting requirements if the devices are used in areas subject to the Division's jurisdiction for a period less than 180 days in any calendar year. The Division will not request reporting information from such licensees.
16. Shall report changes to the mailing address for the location of use (including change in name of general licensee) to the Division, at the address in Rule 0400-20-04-.07, within 30 days of the effective date of the change. For a portable device, a report of address change is only required for a change in the device's primary place of storage;

17. Shall not hold devices that are not in use for longer than 2 years. If devices with shutters are not being used, the shutter shall be locked in the closed position. The testing required by part 2 of this subparagraph need not be performed during the period of storage only. However, when devices are put back into service or transferred to another person and have not been tested within the required test interval, they shall be tested for leakage before use or transfer and the shutter tested before use. Devices kept in standby for future use are excluded from the 2-year time limit if the general licensee performs quarterly physical inventories of these devices while they are in storage.
- d** The general license provided in this paragraph is subject to the provisions of paragraphs (1), (2) and (3) of Rule 0400-20-10.16, paragraphs (1), (2) and (3) of Rule 0400-20-10-.23, Rules 0400-20-10-.26 through 0400-20-10-.28 and Rule 0400-20-10-.30.
 - e** The general license in subparagraph (a) of this paragraph does not authorize the manufacture or import of devices containing radioactive material.
- 3** Luminous safety devices for aircraft.
- a** A general license is hereby issued to own, receive, acquire, possess and use tritium or promethium-147 contained in luminous safety devices for use in aircraft, provided:
 - 1. Each device contains not more than 10 curies of tritium or 300 millicuries of promethium-147; and
 - 2. Each device has been manufactured, assembled or imported in accordance with a specific license issued by the U.S. Nuclear Regulatory Commission, or each device has been manufactured or assembled in accordance with the specifications contained in a specific license or equivalent licensing document issued by the Division or an Agreement State to the manufacturer or assembler of such device pursuant to licensing requirements equivalent to those in Section 32.53 of 10 CFR Part 32.
 - b** Persons who own, receive, acquire, possess or use luminous safety devices pursuant to the general license in subparagraph (a) of this paragraph are exempt from the requirements of Chapter 0400-20-05, except that they shall comply with the provisions of Rules 0400-20-05-.140 and 0400-20-05-.141.
 - c** This general license does not authorize the manufacture, assembly or repair of luminous safety devices containing tritium or promethium-147.
 - d** This general license does not authorize the ownership, receipt, acquisition, possession or use of promethium-147 contained in instrument dials.
 - e** The general license provided in this paragraph is subject to the provisions of Rules 0400-20-10-.16 through 0400-20-10-.30, as applicable.

- 4** Calibration and reference sources.
- a** A general license is hereby issued to those persons listed below to own, receive, acquire, possess, use and transfer, in accordance with the provisions of subparagraphs (d) and (e) of this paragraph, americium-241 in the form of calibration or reference sources:
1. Any person who holds a specific license issued by the Division that authorizes the receipt, possession, use and transfer of radioactive materials; and
 2. Any person who holds a specific license issued by the U.S. Nuclear Regulatory Commission which authorizes the receipt, possessions, use and transfer of special nuclear material.
- b** A general license is hereby issued to receive, possess, use and transfer plutonium in the form of calibration or reference sources in accordance with the provisions of subparagraph (d) and (e) of this paragraph to any person who holds a specific license issued by the Division which authorizes him to receive, possess, use and transfer radioactive material.
- c** A general license is hereby issued to own, receive, possess, use and transfer radium-226 in the form of calibration or reference sources in accordance with the provisions of subparagraph (d) and (e) of this paragraph to any person who holds a specific license issued by the Division which authorizes him to receive, possess, use, and transfer radioactive material.
- d** The general licenses in subparagraphs (a), (b) and (c) of this paragraph apply only to calibration or reference sources which have been manufactured in accordance with the specifications contained in a specific license issued to the manufacturer or importer of the sources by the U.S. Nuclear Regulatory Commission pursuant to Section 32.57 of 10 CFR, Part 32 or Section 70.39 of 10 CFR, Part 70 or which have been manufactured in accordance with the specifications contained in a specific license issued to the manufacturer by the Division or any Agreement State or Licensing State pursuant to licensing requirements equivalent to those contained in Section 32.57 of 10 CFR, Part 32 or Section 70.39 of 10 CFR, Part 70.
- e** The general licenses provided in subparagraphs (a), (b) and (c) of this paragraph are subject to the provisions of Rules 0400-20-10-.16, 0400-20-10-.22, 0400-20-10-.23, 0400-20-10-.26, 0400-20-10-.27, 0400-20-10-.28, and 0400-20-10-.30, and Chapters 0400-20-04 and 0400-20-05. In addition, persons who own, receive, acquire, possess, use and transfer one or more calibration or reference sources pursuant to these general licenses:
1. Shall not possess at any one time, at any one location of storage or use, more than 5 microcuries of americium-241, 5 microcuries of plutonium or 5 microcuries of radium-226 in such sources;
 2. Shall not receive, possess, use or transfer such source unless the source, or the storage container, bears a label which includes one of the following statements, as appropriate, or a similar statement which contains the information called for in one of the following statements, as appropriate:
 - (i) The receipt, possession, use and transfer of this source, Model_____, Serial No._____, are subject to a general license and the regulations of the U.S. Nuclear Regulatory Commission or of a state with which the Commission has entered into an agreement for the exercise of regulatory authority. Do not remove this label.

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CAUTION - RADIOACTIVE MATERIAL - THIS
SOURCE CONTAINS (AMERICIUM-241) (PLUTONIUM)*.

DO NOT TOUCH RADIOACTIVE
PORTION OF THIS SOURCE

(name of manufacturer or importer)

(ii) The receipt, possession, use and transfer of this source, Model_____, Serial No._____, are subject to a general license and the regulations of a Licensing State. Do not remove this label.

CAUTION - RADIOACTIVE MATERIAL - THIS
SOURCE CONTAINS RADIUM-226.

DO NOT TOUCH RADIOACTIVE
PORTION OF THIS SOURCE

(name of manufacturer or importer)

3. Shall not transfer, abandon or dispose of such source except by transfer to a person authorized by a license from the Division, the U.S. Nuclear Regulatory Commission, an Agreement State or a Licensing State to receive the source;
 4. Shall store such source, except when the source is being used, in a closed container adequately designed and constructed to contain americium-241, plutonium or radium-226 which might otherwise escape during storage; and
 5. Shall not use such source for any purpose other than the calibration of radiation detectors or the standardization of other sources.
- f** These general licenses do not authorize the manufacture of calibration or reference sources containing americium-241, plutonium or radium-226.
- 5** Ownership of radioactive material.
- A general license is hereby issued to own radioactive material without regard to quantity. Notwithstanding any other provisions of this Chapter, this general license does not authorize the manufacture, production, transfer, receipt, possession or use of radioactive material.
- 6** Ice detection devices.
- a** A general license is hereby issued to own, receive, acquire, possess, use and transfer strontium-90 contained in ice detection devices, provided each device contains not more than 50 microcuries of strontium-90 and each device has been manufactured or imported in accordance with a specific license issued by the U.S. Nuclear Regulatory Commission or each device has been manufactured in accordance with the specifications contained in a specific license or equivalent licensing document issued by the Division or any Agreement State to the manufacturer of such device pursuant to licensing requirements equivalent to those in Section 32.61 of 10 CFR, Part 32 of the regulations of the U.S. Nuclear Regulatory Commission.

* Showing only the name of the appropriate material.

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- b** Persons who own, receive, acquire, possess, use or transfer strontium-90 contained in ice detection devices pursuant to the general license in subparagraph (a) of this paragraph:
 1. Shall, upon occurrence of visually observable damage, such as a bend or crack or discoloration from overheating to the device, discontinue use of the device until it has been inspected, tested for leakage and repaired by a person holding a specific license or equivalent licensing document from the U.S. Nuclear Regulatory Commission or an Agreement State to manufacture or service such devices; or shall dispose of the device pursuant to the provisions of these regulations;
 2. Shall assure that all labels affixed to the device at the time of receipt, and which bear a statement which prohibits removal of the labels, are maintained thereon;
 3. Are exempt from the requirements of Chapter 0400-20-05 except that such persons shall comply with the provisions of paragraph (1) of Rule 0400-20-05-.120, Rule 0400-20-05-.140 and Rule 0400-20-05-.141.
 - c** This general license does not authorize the manufacture, assembly, disassembly or repair of strontium-90 sources in ice detection devices.
 - d** The general license provided in this paragraph is subject to the provisions of Rules 0400-20-10-.16, 0400-20-10-.22, 0400-20-10-.23, 0400-20-10-.26, 0400-20-10-.27, 0400-20-10-.28, and 0400-20-10-.30.
- 7** Radioactive material for certain in vitro clinical or laboratory testing.
- a** A general license is hereby issued to any physician, veterinarian in the practice of veterinary medicine, clinical laboratory or hospital to receive, acquire, possess, transfer or use, for any of the following stated tests, in accordance with the provisions of subparagraphs (b), (c), (d), (e) and (f) of this paragraph, the following radioactive materials in prepackaged units for use in "in vitro" clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation therefrom, to human beings or animals:
 1. Iodine-125, in units not exceeding 10 microcuries each.
 2. Iodine-131, in units not exceeding 10 microcuries each.
 3. Carbon-14, in units not exceeding 10 microcuries each.
 4. Hydrogen-3 (tritium), in units not exceeding 50 microcuries each.
 5. Iron-59, in units not exceeding 20 microcuries each.
 6. Cobalt-57, in units not exceeding 10 microcuries each.
 7. Selenium-75, in units not exceeding 10 microcuries each.
 8. Mock iodine-125 reference or calibration sources, in units not exceeding 0.05 microcurie of iodine-129 and 0.005 microcurie of americium-241 each.
 - b** No person shall receive, acquire, possess, use or transfer radioactive material pursuant to the general license established by subparagraph (a) of this paragraph until he has filed an application for and received from the Division a copy of Form RHS 8-51 with number assigned. The general licensee shall furnish on the application the following information and such other information as may be required by that form:

0400-20-10-10 General Licenses - Radioactive Material Other Than Source Material

1. Name and address of the licensee;
 2. The location of use; and
 3. A statement that the licensee has appropriate radiation measuring instruments to carry out "in vitro" clinical or laboratory tests with radioactive materials as authorized under this general license and that such tests will be performed only by personnel competent in the use of such instruments and in the handling of the radioactive materials.
- c** A person who receives, acquires, possesses or uses radioactive material pursuant to this general license shall comply with the following:
1. The general licensee shall not possess at any one time, pursuant to this general license, at any one location of storage or use, a total amount of iodine-125, iodine-131, cobalt-57, selenium-75 and/or iron-59 in excess of 200 microcuries.
 2. The general licensee shall store the radioactive material, until used, in the original shipping container or in a container providing equivalent radiation protection.
 3. The general licensee shall use the radioactive material only for the uses authorized by subparagraph (a) of this paragraph.
 4. The general licensee shall not transfer the radioactive material except by transfer to a person authorized to receive it by a license pursuant to this Chapter, from the U.S. Nuclear Regulatory Commission, or an Agreement State or Licensing State nor transfer the radioactive material in any manner other than in the unopened, labeled shipping container as received from the supplier.
 5. The general licensee shall dispose of the Mock Iodine -125 reference or calibration sources described in subparagraph (a) of this paragraph as required by Rule 0400-20-05-.120.
- d** The general licensee shall not receive, acquire, possess or use radioactive material pursuant to subparagraph (a) of this paragraph:
1. Except as prepackaged units which are labeled in accordance with the provisions of a specific license issued by the Division, the U.S. Nuclear Regulatory Commission, an Agreement State or Licensing State that authorizes manufacture and distribution of iodine-125, iodine-131, carbon-14, hydrogen-3 (tritium), selenium-75, cobalt-57, iron-59, or Mock Iodine-125 to persons generally licensed; and
 2. Unless one of the following statements, as appropriate, or a substantially similar statement which contains the information called for in one of the following statements, appears on a label affixed to each prepackaged unit or appears in a leaflet or brochure which accompanies the package:
 - (i) This radioactive material may be received, acquired, possessed and used only by physicians, veterinarians in the practice of veterinary medicine, clinical laboratories or hospitals and only for "in vitro" clinical or laboratory tests not involving internal or external administration of the material, or the radiation therefrom, to human beings or animals. Its receipt, acquisition, possession, use and transfer are subject to the regulations and a general license of the U.S. Nuclear Regulatory Commission or of a State with which the Commission has entered into an agreement for the exercise of regulatory authority.

(name of manufacturer)

- (ii) This radioactive material may be received, acquired, possessed, and used only by physicians, veterinarians in the practice of veterinary medicine, clinical laboratories or hospitals and only for "in vitro" clinical or laboratory tests not involving internal or external administration of the material, or the radiation therefrom, to human beings or animals. Its receipt, acquisition, possession, use and transfer are subject to the regulations and a general license of a Licensing State.

(name of manufacturer)

- e** Licensees possessing or using radioactive materials under this general license shall report in writing to the Director, Division of Radiological Health, at the address in Rule 0400-20-04-.07, any changes in information furnished in the application submitted under subparagraph (b) of this paragraph. The report shall be furnished within 30 days after the effective date of such change.
- f** Any person using radioactive material pursuant to this general license is exempt from the requirements of Chapter 0400-20-05 with respect to radioactive materials covered by this general license, except that such person using the Mock Iodine-125 described in part (a)8 of this paragraph shall comply with the provisions of Rules 0400-20-05-.120, 0400-20-05-.140, and 0400-20-05-.141.
- 8 Self Luminous Products Containing Radium-226**
- a** A general license is hereby issued to any person to acquire, receive, possess, use, or transfer, in accordance with the provisions of subparagraphs (b) through (d) of this paragraph, radium-226 contained in the following products manufactured prior to December 8, 2011.
1. Antiquities originally intended for use by the general public. For the purposes of this paragraph, antiquities mean products originally intended for use by the general public and distributed in the late 19th and early 20th centuries, such as radium emanator jars, revigators, radium water jars, radon generators, refrigerator cards, radium bath salts, and healing pads.
 2. Intact timepieces containing greater than 0.037 MBq (1 μ Ci), non-intact timepieces, and timepiece hands and dials no longer installed in timepieces.
 3. Luminous items installed in air, marine, or land vehicles.
 4. All other luminous products provided that no more than 100 items are used or stored at the same location at any one time.
 5. Small radium sources containing no more than 0.037 MBq (1 μ Ci) of radium-226. For the purposes of this paragraph, "small radium sources" means discrete survey instrument check sources, sources contained in radiation measuring instruments, sources used in educational demonstrations (such as cloud chambers and spinthariscopes), electron tubes, lightning rods, ionization sources, static eliminators, or as designated by the NRC.
- b** Persons who acquire, receive, possess, use, or transfer byproduct material under the general license issued in subparagraph (a) of this paragraph are exempt from the provisions of Chapters 0400-20-04 and 0400-20-05, and Rule 0400-20-10-.26, to the extent that the receipt, possession, use, or transfer of byproduct material is within the terms of the general license; provided, however, that this exemption shall not be deemed to apply to any such person specifically licensed under this Chapter.

0400-20-10-.10 General Licenses - Radioactive Material Other Than Source Material

- c** Any person who acquires, receives, possesses, uses, or transfers byproduct material in accordance with the general license in subparagraph (a) of this paragraph shall:
1. Notify the Division should there be any indication of possible damage to the product so that it appears it could result in a loss of the radioactive material (a report containing a brief description of the event, and the remedial action taken, must be furnished to the Division at the address listed in Rule 0400-20-04-.07 within 30 days);
 2. Not abandon products containing radium-226 (the product, and any radioactive material from the product, may only be disposed of according to Rule 0400-20-05-.127 or by transfer to a person authorized by a specific license to receive the radium-226 in the product or as otherwise approved by the NRC or an Agreement State;
 3. Not export products containing radium-226 except in accordance with 10 CFR Part 110;
 4. Dispose of products containing radium-226 at a disposal facility authorized to dispose of radioactive material in accordance with any Federal or State solid or hazardous waste law, including the Solid Waste Disposal Act, as authorized under the Energy Policy Act of 2005, by transfer to a person authorized to receive radium-226 by a specific license issued under this Chapter, or equivalent regulations of the NRC or an Agreement State, or as otherwise approved by the NRC or an Agreement State; and
 5. Respond to written requests from the Division to provide information relating to the general license within 30 calendar days of the date of the request, or other time specified in the request. If the general licensee cannot provide the requested information within the allotted time, it shall, within that same time period, request a longer period to supply the information by providing the Division, by an appropriate method listed in 10 CFR 30.6(a), a written justification for the request.
- d** The general license in subparagraph (a) of this paragraph does not authorize the manufacture, assembly, disassembly, repair, or import of products containing radium-226, except that timepieces may be disassembled and repaired.

Authority: T.C.A. §§ 68-202-101 *et seq.*, 68-202-201 *et seq.*, and 4-5-201 *et seq.* Administrative History: Original rule filed February 22, 2012; effective May 22, 2012.

D Agreement States

Refer to: <https://scp.nrc.gov/asdirectory.html>

E

United States Nuclear Regulatory Commission Regional Offices

Office	Address	Telephone (24 hours)
Region I		
Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont,	USNRC Region I 2100 Renaissance Boulevard, Suite 100 King of Prussia, PA 19406-2713	Toll Free: 1-800-432-1156 7:30 am to 4:15 pm ET, Monday through Friday 24 hour emergency event notification #: 301-816-5100
Region II		
Alabama, Florida, Georgia, Kentucky, North Carolina, Puerto Rico, South Carolina, Tennessee, Virginia, Virgin Islands, West Virginia	USNRC Region II Marquis One Tower 45 Peachtree Center Avenue N.E. Suite 1200 Atlanta, GA 30303	Toll Free: 1-800-577-8510 7:30 am to 4:15 pm ET, Monday through Friday 24 hour emergency event notification #: 301-816-5100
Region III		
Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, Wisconsin	USNRC Region III 2443 Warrenville Road, Suite 210 Lisle, IL 60532-4352	Toll Free: 1-800-522-3025 7 am to 4:30 pm CT, Monday through Friday 24 hour emergency event notification #: 301-816-5100
Region IV		
Alaska, Arizona, Arkansas, California, Colorado, Hawaii, Idaho, Kansas, Louisiana, Mississippi, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, Pacific Trust Territories, South Dakota, Texas, Utah, Washington, Wyoming	USNRC Region IV 1600 E. Lamar Boulevard Arlington, TX 76011-4511	Toll Free: 1-800-952-9677 7:30 am to 4:15 pm CT, Monday through Friday 24 hour emergency event notification #: 301-816-5100

F Self Inspection

We strongly advise adding a periodic internal audit of your ECD management program. Such an audit will greatly enhance your ability to maintain staff awareness of the regulatory requirements you face as a General Licensee. Please refer to the next two pages for a suggested format. The items identified in the audit are derived from the NRC's regulation 10 CFR 31.5 c), the entire portion of which may be accessed on the world wide web by following the pathway below:

www.nrc.gov

Reference Library

Title 10 of the Code of Federal Regulations

Part 31

31.5

31.5 (c) "Certain measuring, gauging or controlling devices"

SELF-INSPECTION FORM FOR GENERAL LICENSEES

Please print or type.

Registration No. _____ Company Name _____

Address _____ City _____ State ____ Zip _____

Chief Executive Officer or Plant Manager _____ Person Responsible for Radioactive Devices _____

Job Title of Responsible Person _____ Telephone _____

Fax _____ E-Mail Address _____

Address where Radioactive Devices Are Used:

Address _____ City _____ Zip _____

REVIEW OF DEVICE RECORDS

(Do not include static eliminators containing polonium-210.)

Number of radioactive devices possessed at time of previous report
(Total number of devices shown on Inventory Verification Form.)

Number of radioactive devices received since previous report

Number of radioactive devices transferred since previous report
(Fill out transfer report below for devices transferred.)

Number of radioactive devices possessed now

Explanation of any discrepancies in the above _____

REPORT OF DEVICE TRANSFERS

**Note that a general licensee may transfer a radioactive device
only to a specific licensee. ***

* A general licensee may transfer a device to another general licensee if the device remains in use at the same location.
See 32 Ill. Adm. Code 330.220(b)(3)(H).

(No report is required if a radioactive device is transferred to a specific licensee in order to obtain a replacement device.)

Device Reference Number(s) _____ Transfer Date _____

Name of Specific Licensee _____

Contact Person _____ Telephone _____

Address _____ City _____ State ____ Zip _____

SELF-INSPECTION FORM FOR GENERAL LICENSEES

(Page 2 of 2)

CERTIFICATION OF COMPLIANCE WITH LICENSING REQUIREMENTS

1. Radioactive devices have not been/will not be abandoned. [32 Ill. Adm. Code 330.220(b)(3)(F)]
2. Radioactive devices have been/will be transferred to authorized recipients only. [32 Ill. Adm. Code 330.220(b)(3)(G)]
3. Theft or loss of a radioactive device or transfer, other than for trade-in or replacement, has been/will be reported to the Department of Nuclear Safety. [32 Ill. Adm. Code 340.1210]
4. Installation, removal, and servicing involving radioactive material or its shielding or containment are performed by persons specifically licensed or otherwise authorized to do so. [32 Ill. Adm. Code 330.220(b)(3)(C)]
5. Plant relocations or address changes will be reported to the Department of Nuclear Safety. [32 Ill. Adm. Code 320.10(a)]
6. If applicable to the types of radioactive devices possessed, tests for proper operation of an on-off mechanism and indicator are performed in accordance with the manufacturer's instruction manual. All malfunctions are reported to the Department of Nuclear Safety. [32 Ill. Adm. Code 330.220(b)(3)(B), (C), and (E)]
7. Tests for contamination or leakage of radioactive material are performed at intervals specified on the device label and are analyzed by someone specifically licensed or otherwise authorized to do so. Any leakage above regulatory limits is reported to the Department of Nuclear Safety. [32 Ill. Adm. Code 340.1260 and 330.220(b)(3)(B) and (C)]
8. All radioactive devices are labeled correctly and missing or damaged labels have been replaced. [32 Ill. Adm. Code 330.220(b)(3)(A)]
9. Records are maintained of receipt, transfer, use, storage, and disposal of devices and of the tests described above. [32 Ill. Adm. Code 310.40 and 330.220(b)(3)(D)]

SIGNATURE OF RESPONSIBLE INDIVIDUAL

(Person named above as responsible for radioactive devices.)

I hereby certify, that to the best of my knowledge and belief, compliance with the regulations is being maintained and the above information is complete and correct except as noted.

Name (Print or Type)

Signature

Date

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