VARIAN

Varian, Inc.
2700 Mitchell Drive
Walnut Creek, CA 94598-1675/usa

210-MS and 220-MS GC/MS Ion Trap Mass Spectrometer

Hardware Operation Manual

QUALITY SYSTEM ISO 9001 CERTIFIED

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CE

Declaration of Conformity

We hereby Declare that the equipment listed below complies with the requirements of:
The Low Voltage Directive 73/23/EEC (93/68/EEC)
The EMC Directive 2004/108/EC

Applicable Standards

LVD EN 61010-1

EMC EN 61326-1

Type of Equipment: Mass Spectrometer **Model:** 200-MS
210-MS
220-MS

Authorized Representative in the EU

Print Name: G. A. Wassink

Signed: _____

Position: Quality Manager

Date: April 2, 2008

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Manufacturer

Print Name: Anand Shirur

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Date: April 2, 2008

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Quality Systems At Varian, Inc.

The ISO 9000 series standards were created in Geneva in 1987 to cut through a morass of conflicting quality definitions. These standards define a model for quality assurance systems in product design, development, manufacturing, installation, service, and customer support. They are now the worldwide quality assurance benchmark used to gauge the strength of a company's commitment to quality, and the value of its quality systems.

Various organizations around the world, such as the British Standards Institution (BSI), provide certified, objective auditors to scrutinize quality procedures, product development, manufacturing processes, and customer satisfaction programs. No company can claim ISO 9000 series registration unless it receives a stamp of approval from the demanding quality assessors of BSI or similar accredited examining body. ISO 9000 series registration constitutes an objective third-party report to determine the level of a supplier's commitment to quality.

In 1992, Varian, Inc., Analytical Instruments became registered to the most comprehensive of the ISO 9000 series standards — ISO 9001. ISO 9001 registration means that every stage of our quality system, including product development, manufacturing, final test, shipping, and parts and supplies has been rigorously examined against the most exacting set of internationally recognized standards. It means we live up to a standard of quality that you can count on today, and into the future. Our Quality System has received ISO 9001 certification number FM21797.

The quality systems that earned us ISO 9001 registration have direct benefits for our customers:

- We can speed instruments to you faster than ever before. Emergency orders can be processed even faster.
- We fill your orders promptly and completely.
- We have implemented a system of continuous feedback from our customers — we are aware of your needs today and tomorrow.
- We have improved your productivity by cutting systems failure rates in half and speeding service response time.
- We have embedded continuous improvement into the fabric of our organization so that we can achieve even higher levels of quality in the future.
- We are embedding GLP requirements into our products and services to help you meet your regulatory compliance requirements.

ISO 9001 registration is not enough. For us, quality is defined by our customers. We are not satisfied unless you are satisfied. We are striving to understand customer needs, using independent surveys, user groups, customer advisory boards, and our “Hallmark of Quality” response program, in addition to individual face-to-face customer contact. Our products and our processes are configured to meet those needs.

We know that you are seeking more than the most advanced processes and top-notch applications expertise. You want to join forces with a partner committed to delivering world-class quality, reliability, and value — on time, every time.

QUALITY SYSTEM ISO 9001 CERTIFIED

Our overriding aim is to be that partner.

Varian, Inc. Analytical Instrument Warranty

Hardware Products

All analytical instruments sold by Varian, Inc. are warranted to be free from defects in material and workmanship for the periods specified and in accordance with the terms on the face of Varian's quotation or as otherwise agreed upon in writing between Varian and the Customer. The warranty period begins on the date of **shipment** from Varian to the original Customer. However, where installation is paid for by the Customer or included in the purchase price, the warranty period begins upon completion of installation. If the Customer schedules **installation** to start later than 30 days after delivery or if such delay is caused through the Customer's inability to provide adequate facilities or utilities or through failure to comply with Varian's reasonable pre-installation instructions or through other omissions by Customer, then the warranty period starts on the 31st day from date of shipment. Moreover Varian will charge the Customer for labor and other expenses involved in making multiple or follow-up installation service calls.

Software Products

Where software is provided within the frame of a license agreement concluded between the Customer and Varian, any warranty shall be strictly in accordance with the terms of such agreement.

In the absence of a license agreement and unless an alternate warranty period is agreed upon in writing between Varian and the Customer, the warranty period is as specified on the face of Varian's quotation. Varian warrants such software products, if used with and properly installed on Varian hardware or other hardware as specified by Varian to perform as described in the accompanying Operator's Manual and to be substantially free of those defects which cause failure to execute respective programming instructions; however, Varian does not warrant uninterrupted or error-free operation.

Remedies

The sole and exclusive remedy under hardware warranty shall be **repair** of instrument malfunctions which in Varian's opinion are due or traceable to defects in original materials or workmanship or, at Varian's option, **replacement** of the respective defective parts, provided that Varian may as an alternative elect to **refund** an equitable portion of the purchase price of the instrument or accessory.

Repair or replacement under warranty does not extend the original warranty period.

Repair or replacement under warranty claims shall be made in Varian's sole discretion either by sending a Customer Support Representative to the site or by authorizing the Customer to return the defective accessory or instrument to Varian or to send it to a designated service facility. The Customer shall be responsible for loss or damage in transit and shall prepay shipping cost. Varian will return the accessory or instrument to the Customer prepaid and insured. Claims for loss or damage in transit shall be filed by the Customer. To correct software operation anomalies, Varian will issue software revisions where such revisions exist and where, in Varian's opinion, this is the most efficient remedy.

Limitation of Warranty

This **warranty does not cover** software supplied by the Customer, equipment and software warranted by another manufacturer or replacement of expendable items and those of limited life, such as but not limited to: Filters, glassware, instrument status lamps, source lamps, septa, columns, fuses, chart paper and ink, nebulizers, flow cells, pistons, seals, fittings, valves, burners, sample tubes, probe inserts, print heads, glass lined tubing, pipe and tube fittings, variable temperature dewars, transfer lines, flexible discs, magnetic tape cassettes, electron multipliers, filaments, vacuum gaskets, seats and all parts exposed to samples and mobile phases.

This **warranty shall be void** in the event of accident, abuse, alteration, misuse, neglect, breakage, improper operation or maintenance, unauthorized or improper modifications or tampering, use in an unsuitable physical environment, use with a marginal power supply or use with other inadequate facilities or utilities. Reasonable care must be used to avoid hazards.

This warranty is expressly in lieu of and excludes all other express or implied warranties, including but not limited to warranties of merchantability and of fitness for particular purpose, use or application, and all other obligations or liabilities on the part of Varian, unless such other warranties, obligations or liabilities are expressly agreed to in writing by Varian.

Limitation of Remedies and Liability

The remedies provided herein are the sole and exclusive remedies of the Customer. In no case will Varian be liable for incidental or consequential damages, loss of use, loss of production or any other loss incurred.

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Qualitätssysteme bei Varian, Inc.

Die Standards der ISO 9000 Serien wurden 1987 in Genf mit dem Ziel geschaffen, das Durcheinander gegensätzlicher Qualitätsbestimmungen zu entwirren. Diese Standards legen ein Modell für Qualitätssicherungssysteme hinsichtlich Produktdesign, Entwicklung, Herstellung, Installation, Service und Kundenbetreuung fest. Sie sind nun die weltweiten Maßstäbe der Qualitätssicherung, die die Anstrengungen eines Unternehmens bezüglich der Qualität und der Bedeutung seiner Qualitätssysteme messen.

Verschiedene Organisationen in der ganzen Welt, wie die British Standards Institution (BSI), stellen ausgebildete, objektive Prüfer zur Begutachtung von Qualitätsmaßnahmen, Produktentwicklung, Herstellungsprozessen und von Programmen zur Erforschung der Kundenzufriedenheit zur Verfügung. Kein Unternehmen kann die ISO 9000 Registrierung beantragen, ohne die Genehmigung von den beauftragten Qualitätsgutachtern der BSI oder einer ähnlichen akkreditierten Stelle erhalten zu haben. Die ISO 9000 Registrierung bildet einen objektiven Bericht von dritter Seite, um den Grad der Qualitätsanstrengung eines Lieferanten zu bestimmen.

1992 wurden die Varian, Inc., Analytical Instruments nach den umfassendsten Standards der ISO 9000 Serie registriert — ISO 9001. Die ISO 9001 Registrierung bedeutet, daß jedes Stadium unseres Qualitätssystems, einschließlich Produktentwicklung, Herstellung, Endkontrolle, Versand, sowie Teile und Zubehör rigoros gegen die anspruchsvollste Serie international anerkannter Standards geprüft worden ist. Das bedeutet, daß wir einen Qualitätsstandard bieten, auf den Sie heute und in Zukunft rechnen können. Unser Qualitätssystem hat die ISO 9001 Zertifikatnummer FM21797 erhalten.

Die Qualitätssysteme der ISO 9001 Registrierung haben für unsere Kunden direkte Vorteile:

- Wir können Instrumente schneller denn je zu Ihnen schicken. Eilbestellungen werden noch schneller durchgeführt.
- Wir erfüllen Ihre Bestellungen pünktlich und vollständig.
- Wir haben ein System kontinuierlichen Informationsrückflusses von unseren Kunden aufgebaut—wir kennen Ihre Anforderungen von heute und von morgen.
- Wir haben Ihre Produktivität durch Halbierung der Systemfehlerraten und durch Verkürzung unserer Reaktionszeit im Service verbessert.
- Wir haben kontinuierliche Verbesserungen in unserer Organisationsstruktur verankert, so daß wir künftig eine noch höhere Qualität erreichen können.
- Wir haben die GLP Anforderungen in unsere Produkte und Dienstleistungen eingeführt, um Ihnen bei der Erfüllung Ihres behördlichen Abnahmeprotokolls zu helfen.

Die ISO 9001 Registrierung ist nicht genug. Für uns wird Qualität durch unsere Kunden definiert. Wir sind nicht zufrieden, wenn Sie es nicht auch sind. Wir bemühen uns, die Anforderungen unserer Kunden durch unabhängige Untersuchungen, Anwendergruppen, Kundenberatungsgremien und unser Antwortprogramm “Gütesiegel der Qualität” zu verstehen, zusätzlich zu persönlichen Kundenkontakten. Unsere Produkte und unsere Prozesse sind so gestaltet, daß sie diese Anforderungen erfüllen.

Wir wissen, daß Sie mehr als fortschrittliche Prozesse und ausgezeichnetes Anwendungswissen suchen. Sie suchen einen Partner, der Qualität von Weltklasse, Verläßlichkeit und Nutzen für Sie liefert— pünktlich und jederzeit.

Unser oberstes Ziel ist, für Sie dieser Partner zu sein.

QUALITY SYSTEM
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Varian, Inc. Analytical Instrument Garantie

Hardwareprodukte

Es wird garantiert, daß alle von Varian, Inc. verkauften analytischen Instrumente für die angegebene Zeitdauer und in Übereinstimmung mit den „Allgemeinen Lieferbedingungen“ oder anderen schriftlichen Zusagen zwischen Varian und dem Kunden frei von Material- und Herstellungsfehlern sind. Die Garantiezeit beginnt mit dem **Versanddatum** von Varian zum Originalkunden. Wenn die Installation vom Kunden bezahlt oder im Verkaufspreis eingeschlossen ist, beginnt die Garantiezeit nach der abgeschlossenen Installation. Wenn der Kunde den **Installationsbeginn** später als 30 Tage nach erfolgter Lieferung ansetzt, oder wenn die Verzögerung dadurch verursacht wird, daß der Kunde nicht den ausreichenden Platz oder die Versorgungseinrichtungen beschafft oder Varian's berechtigte Anweisungen zur Installationsvorbereitung nicht einhält oder andere Versäumnisse des Kunden vorliegen, dann beginnt die Garantiezeit am 31. Tag nach dem Versanddatum. Darüber hinaus wird Varian dem Kunden den Arbeitsaufwand und andere Unkosten durch mehrfache oder fortgesetzte Installationsanforderungen berechnen.

Softwareprodukte

Wo Software innerhalb des Rahmens eines Lizenzabkommens zwischen dem Kunden und Varian geliefert wird, wird die Garantie genau entsprechend der zeitlichen Abmachung eingehalten.

Besteht kein Lizenzabkommen und ist keine alternative Garantiezeit schriftlich zwischen Varian und dem Kunden festgelegt, gilt die Garantiezeit der „Allgemei-nen Lieferbedingungen“. Varian garantiert für solche Softwareprodukte, die mit Varian’s Hardware benutzt und richtig installiert sind oder zur Ausführung mit anderer von Varian angegebener Hardware, wie sie in der beigefügten Bedienungsanleitung beschrieben ist, daß sie im wesentlichen frei von solchen Defekten sind, die Fehler bei der Ausführung der jeweiligen Programmieranweisungen verursachen; Varian garantiert jedoch keine ununterbrochene oder fehlerfreie Arbeitsweise.

Abhilfen

Die einzige und ausschließliche Abhilfe in der Hardwaregarantie wird die **Reparatur** der Instrumentstörungen sein, die sich nach Varian's Ansicht auf Defekte in den Originalteilen oder bei der Herstellung zurückführen läßt oder, nach Varian's Wahl, der **Austausch** der entsprechenden defekten Teile oder die **Erstattung** eines fairen Teils des Kaufpreises des Instruments oder Zubehörs, vorausgesetzt, daß sich Varian alternativ dafür entscheidet.

Reparatur oder Austausch unter Garantie verlängert nicht die ursprüngliche Garantiezeit.

Reparatur oder Austausch unter Garantieansprüchen soll in Varian's ausschließlichem Ermessen entweder durch einen Serviceingenieur beim Kunden oder durch Ermächtigung des Kunden zum Einschicken des defekten Zubehörs oder Instruments an Varian oder einen Servicestützpunkt erfolgen. Der Kunde übernimmt die Verantwortung für Verlust oder Beschädigung im Transit und hat die Versandkosten im voraus zu bezahlen. Varian wird das Zubehör oder Instrument vorausbezahlt und versichert zum Kunden zurückschicken. Ansprüche für Verlust oder Beschädigung im Transit hat der Kunde zu erheben. Zur Korrektur von Anomalien des Softwarebetriebs wird Varian Software-Neuausgaben ausgeben, sofern Revisionen existieren und dies die beste Abhilfe ist.

Garantieeinschränkungen

Diese **Garantie erfaßt nicht** vom Kunden bereitgestellte Software, Ausrüstungen und Software, die von anderen Herstellern garantiert werden oder den Austausch entbehrlicher Teile und solcher von begrenzter Lebensdauer wie diese, aber nicht darauf beschränkt: Filter, Glaswaren, Instrument Statuslampen, Lampenquellen, Septen, Säulen, Sicherungen, Schreiberpapier und Tinte, Zerstäuber, Flußzellen, Kolben, Dichtungen, Fittings, Ventile, Brenner, Probenröhrchen, Sondeneinsätze, Druckköpfe, glasausgekleidetes Rohr, Leitungs- und Rohrfittings, Dewars für variable Temperaturen, Transferleitungen, flexible Disketten, Magnetbandkassetten, elektronische Vervielfacher, Hitzdrähte, Vakuum Gaskets, Sitzflächen und alle Teile, die den Proben und mobilen Phasen ausgesetzt sind.

Diese **Garantie erlischt** bei eingetretenem Unfall, falscher Benutzung, Umbau, Mißbrauch, Vernachlässigung, Bruch, falscher Benutzung oder falscher Wartung, unbefugten oder falschen Modifikationen oder Basteleien, Benutzung in ungeeigneter physikalischer Umgebung, Benutzung mit marginaler Stromversorgung oder Benutzung mit anderen ungenügenden Einrichtungen oder Versorgungen. Mit vernünftiger Sorgfalt müssen Gefahren vermieden werden.

Diese Garantie steht ausdrücklich anstelle von allen anderen angedeuteten Garantien und schließt sie aus, einschließlich, aber nicht beschränkt auf Garantien der Verkäuflichkeit und Eignung für einen besonderen Zweck, Gebrauch oder Anwendung und allen anderen Verpflichtungen oder Haftungen von Varian’s Seite, wenn nicht solche Garantien, Verpflichtungen oder Haftungen ausdrücklich schriftlich mit Varian vereinbart wurden.

Beschränkung der Hilfen und Haftung

Die hier gegebenen Hilfen sind einzig und allein Sache des Kunden. In keinem Fall wird Varian für versehentliche oder sich ergebende Schäden wie Nutzungsverlust, Produktionsverlust oder jeden anderen Verlust haften.

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Systèmes de qualité chez Varian, Inc.

Les normes ISO série 9000 ont été créées à Genève, en 1987, pour remédier à la confusion dans la définition des normes de qualité. Ces normes définissent un modèle de contrôle de qualité dans le domaine de la conception produit, du développement, de la production, des installations, des services et du support client. Elles constituent à présent la référence mondiale en matière de contrôle de qualité utilisée aux fins d'évaluation du niveau d'engagement d'une entreprise dans ce domaine et la valeur de ses systèmes de qualité.

Plusieurs organisations de par le monde, telle la British Standards Institution (BSI) offrent les services d'auditeurs qualifiés et objectifs, chargés d'examiner les procédures de qualité, le développement de produit, les procédés de fabrication et les programmes de satisfaction du client.

Aucune société ne peut se prévaloir de l'homologation ISO 9000, sans avoir reçu l'approbation des évaluateurs rigoureux de la BSI ou d'un organisme accréditif similaire. L'homologation ISO 9000 constitue une évaluation objective d'un tiers afin de déterminer le niveau d'engagement d'un fournisseur dans le domaine de la qualité.

En 1992, Varian, Analytical Instruments a reçu l'homologation ISO 9001, normes des plus complètes de la série IS0 9000. En d'autres termes, chaque étape du processus de qualité, notamment le développement produit, la fabrication, le test final, l'expédition et les fournitures de pièces a étés oumis à un contrôle rigoureux par rapport à des normes extrêmement strictes, reconnues au niveau international. Nous sommes donc à même de vous garantir et de maintenir un niveau de qualité. Lesdites procédures ont reçu l'homologation ISO 9001 numéro FM21797.

Les systèmes de qualité qui ont reçu l'homologation ISO 9001 présentent des avantages directs pour nos clients :

- Nous sommes en mesure de vous livrer les instruments et de traiter les commandes en urgence dans des délais record.
- Nous répondons pleinement et de manière rapide à vos commandes.
- Nous avons mis en place un système de feedback continu de la part de nos clients et sommes conscients de vos attentes présentes et futures.
- Nous avons amélioré votre productivité en réduisant de moitié les Temps de panne et en accélérant les temps de réponse.
- Nous avons apporté des améliorations constantes au sein de notre structure, afin d'atteindre des niveaux de qualité optima, à l'avenir.
- Nos produits et services reflètent les exigences BPL pour vous permettre de répondre aux impératifs de respect de la règlementation.

Toutefois, nous ne nous contentons pas de l'homologation ISO 9001. Pour nous, la qualité est définie par nos clients. Nous ne sommes satisfaits que lorsque nos clients le sont. Nous nous efforçons de comprendre vos besoins, à l'aide d'évaluations externes, de groupes d'utilisateurs, de comités de conseil clients, et de notre programme “Hallmark of Quality”, outre les contacts directs que nous établissons avec chacun de nos clients. Nos produits et nos procédés sont conçus pour répondre à vos attentes.

Nous n'ignorons pas que vous recherchez plus que des processus évolués et un savoir-faire d'exception dans le domaine des applications. Vous souhaitez conjuguer vos forces avec un partenaire s'étant engagé à offrir une qualité, une fiabilité et une valeur optimales, au moment où il faut et quand il faut.

QUALITY SYSTEM ISO 9001 CERTIFIED

Notre principal objectif : devenir votre partenaire !

Garantie des instruments d'analyse Varian, Inc.

Matériel

Les instruments d'analyse vendus par Varian, Inc. sont garantis exempts de défauts de matière et de fabrication, pour les périodes spécifiées et conformément aux conditions mentionnées sur le recto du devis ou aux termes de tout autre accord écrit intervenu entre Varian et le client. La période de garantie commence à compter de la date de **livraison** de Varian au client d'origine. Cependant, lorsque le client a acquitté les frais d'installation ou que celle-ci est inclue dans le prix d'achat, la période de garantie commence à compter de l'achèvement de l'installation. Si le client prévoit le début de **l'installation** au-delà de 30 jours après la livraison ou si ledit retard est dû à l'inaptitude du client à mettre à disposition les installations ou services ou au non respect des instructions de pré-installation de Varian ou à la suite desdites négligences du client, la période de garantie commence le 31ème jour à compter de la date de livraison. De plus, Varian fera supporter au client tout frais de main d'oeuvre et autres coûts résultant de multiples appels téléphoniques aux fins de suivi de l'installation.

Logiciel

Pour tout logiciel faisant l'objet d'un accord de licence conclu entre le client et Varian, la garantie sera strictement limitée aux termes dudit accord.

En l'absence d'accord de licence et sauf accord écrit sur tout autre période de garantie entre Varian et le client, la période de garantie est telle que spécifiée sur le recto du devis de Varian. Sous réserve de leur installation et de leur utilisation correcte sur le matériel Varian ou tout autre matériel, tel que spécifié, Varian garantie le fonctionnement tel que décrit dans le manuel d'utilisation fourni avec le matériel et l'absence de défauts entraînant l'impossibilité d'exécuter des instructions de programmation respectives. Toutefois, Varian ne garantit pas un fonctionnement sans interruption et sans erreurs.

Recours

Le seul et unique recours relatif à la garantie du matériel se limite à la **réparation** suite à un mauvais fonctionnement de l'instrument, qui, de l'avis de Varian, est dû à des défauts des pièces d'origine ou de la fabrication, ou, à la discrétion de Varian, au **remplacement** des pièces défectueuses en question, sous réserve du choix de Varian de **rembourser** une part raisonnable du prix d'achat de l'instrument ou de l'accessoire.

La répaation ou le remplacement sous garantie n'étend pas la période de garantie originale.

La réparation ou le remplacement, aux termes d'un recours, est laissé à l'entière discrétion de Varian, soit par l'envoi d'un technicien de maintenance sur le site du client, soit en autorisant le client à retourner l'accessoire ou l'instrument défectueux à Varian, voire à l'envoyer à un service de maintenance désigné.

Le client assumera la responsabilité de toute perte ou sinistre lors du transport et règlera à l'avance les frais de transport. Varian renverra l'accessoire ou l'instrument au client en port payé et assuré. Toute réclamation résultant d'une perte ou d'un sinistre intervenu lors du transport devra être faite par le client. Aux fins de correction des anomalies de fonctionnement du logiciel, Varian diffusera des mises à jour des logiciels, le cas échéant, et si de l'avis de Varian, elles constituent la mesure corrective la plus appropriée en la matière.

Limitation de garantie

Cette **garantie ne couvre pas** le logiciel fourni par le Client, les équipements ou logiciels garantis par un autre fabricant ni le remplacement des pièces consommables ou présentant une durée de vie limitée, notamment : filtres, verres, indicateurs d'état de l'instrument, lampes source, septa, colonnes, fusibles, papier graphique et encre, nébuliseurs cellules, pistons, joints, raccords, vannes, brûleurs, tubes d'échantillonnage, inserts de sonde, têtes d'impression, tubes à garniture de verre, dewars, lignes de transfert, disquettes, cassettes magnétiques, multiplicateurs d'électron, filaments, joints hermétiques, isolant et toutes les pièces en contact avec des échantillons et des phases mobiles.

Ladite garantie est nulle en cas d'accident, de mauvaise utilisation,d'altération, de négligence, de bris, d'utilisation, maintenance voire de modifications inappropriées, d'utilisation dans un environnement inadapté, d'utilisation avec une alimentation marginale ou d'autres installations ou services inappropriés. Un certain nombre de précautions doivent être prises pour éviter tout accident.

Ladite garantie se substitue et exclue expressément toute garantie expresse ou tacite, y compris mais ne se limitant pas aux garanties relatives à la qualité marchande du programme et la garantie de son aptitude à une utilisation ou une application particulière, ainsi que toutes les autres obligations ou engagements de la part de Varian, à moins que lesdites garanties,obligations ou engagements aient fait expressément l'objet d'un accord écrit deVarian.

Limitations de garantie et de la responsabilité :

Les recours exclusifs du client sont expressément énoncés aux présentes. En aucun cas, Varian ne sera tenu pour responsable de tout dommage provenant de l'utilisation ou en découlant, de toute impossibilité d'utilisation ou de déficit de production ou de tout autre perte y afférent.

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I sistemi di qualità della Varian, Inc.

La serie degli standard ISO 9000 è stata presentata nel 1987 a Ginevra con lo scopo di mettere ordine in un groviglio di definizioni contrastanti sulla qualità. Tali standard definiscono un modello che assicura la qualità nella progettazione, nello sviluppo, nella fabbricazione, nell'installazione e nella manutenzione dei prodotti nonché nel servizio assistenza clienti. Oggi come oggi essi costituiscono il punto di riferimento, a livello mondiale, ai fini della valutazione dell'impegno delle diverse aziende sul fronte della qualità e della validità dei sistemi di qualità da esse adottati.

Diverse organizzazioni internazionali, come la British Standard Institution (BSI), dispongono d'ispettori certificati e imparziali per la valutazione delle procedure di qualità, dello sviluppo dei prodotti, dei processi di fabbricazione e dei programmi di soddisfazione del cliente. Nessuna azienda può asserire d'essere in possesso della certificazione ISO 9000 finché non dispone del marchio d'approvazione concesso dai rigorosi ispettori di qualità della BSI o di altri enti di controllo riconosciuti. La certificazione di conformità agli standard ISO 9000 costituisce un'attestazione imparziale di terzi del grado d'impegno di una determinata azienda nei confronti della qualità.

Nel 1992 la Varian, Inc., Analytical Instruments ha ottenuto l'omologazione allo standard più completo della serie ISO 9000, l'ISO 9001. L'omologazione ISO 9001 significa che ogni singola fase del nostro sistema di qualità - compresi lo sviluppo del prodotto, la fabbricazione, le prove finali, la spedizione, i componenti e le forniture - è stata rigorosamente esaminata a fronte della serie più esigente di standard riconosciuti a livello mondiale, il che significa che rispondiamo pienamente ad uno standard qualitativo sul quale il cliente può contare oggi come nel futuro. Il nostro Sistema di Qualità ha ottenuto la certificazione ISO 9001 col numero FM21797.

I sistemi di qualità per i quali abbiamo ottenuto l'omologazione ISO 9001 comportano dei vantaggi diretti per i nostri clienti, ovvero:

- Siamo in grado di consegnare gli strumenti più rapidamente rispetto al passato, con la possibilità di evadere le richieste d'emergenza con una rapidità ancora maggiore.
- Gli ordini vengono evasi tempestivamente ed in modo completo.
- Abbiamo messo a punto un sistema di riscontro costante con la clientela, in modo da poter essere sempre perfettamente informati sulle esigenze attuali e future del cliente.
- Abbiamo migliorato la produttività del cliente riducendo della metà il tasso di guasti dei sistemi e velocizzando i tempi d'intervento della manutenzione.
- Abbiamo introdotto un costante miglioramento nella nostra struttura organizzativa in modo da poter conseguire in futuro livelli qualitativi ancor più elevati.
- Stiamo adeguando i nostri prodotti e servizi agli standard GLP per poter aiutare i clienti a soddisfare i requisiti di conformità posti loro dagli enti normativi.

Ma l'omologazione ISO 9001 non è tutto. Per quanto ci riguarda, la qualità viene definita dai nostri clienti: noi siamo soddisfatti solo se lo è il cliente. Ci adoperiamo al massimo per comprendere le esigenze del cliente, ricorrendo ad indagini di società private, gruppi di utenti, associazioni di consumatori e con il nostro programma di risposta Hallmark of Quality - il marchio di garanzia di qualità - oltre che col contatto diretto coi singoli clienti. I nostri prodotti ed i nostri processi sono configurati per rispondere a tali esigenze.

Sappiamo che a Voi i processi più avanzati e l'esperienza delle applicazioni di prim'ordine non bastano. Sappiamo che intendete unire le vostre forze con quelle d'un partner impegnato a fornire livelli qualitativi internazionali, affidabilità e valore, in modo tempestivo e costante.

QUALITY SYSTEM
ISO 9001
CERTIFIED

Quel partner vogliamo essere noi.

Garanzia sugli strumenti analitici Varian, Inc.

Prodotti hardware

Tutti gli strumenti analitici commercializzati dalla Varian, Inc. sono garantiti da eventuali difetti di materiali e di costruzione per i periodi ed alle condizioni indicati sull'offerta Varian o comunque concordati per iscritto tra la Varian ed il Cliente. Il periodo di garanzia decorre dalla data di spedizione dalla Varian al Cliente. Se l'installazione è a carico del Cliente o compresa nel prezzo d'acquisto, il periodo di garanzia decorre dalla fine dell'installazione. Se il Cliente prevede di procedere all'installazione oltre i 30 giorni dalla consegna o se tale ritardo è imputabile alla mancata messa a disposizione, da parte del Cliente, di locali o strumenti idonei o al mancato rispetto delle ragionevoli istruzioni di preinstallazione della Varian o comunque a fatti imputabili al Cliente, il periodo di garanzia decorre dal 31° giorno dalla data di spedizione. Inoltre, la Varian addebiterà al Cliente le spese di manodopera e d'altro tipo sostenute per interventi d'installazione multipli o di verifica.

Prodotti software

Se il software viene fornito nell'ambito d'un contratto di licenza stipulato tra la Varian e il Cliente, trovano applicazione in via esclusiva le garanzie previste dal contratto.

In assenza d'un contratto di licenza e salvo diverso accordo scritto tra la Varian e il Cliente, vale il periodo di garanzia indicato nell'offerta della Varian. La Varian garantisce che i prodotti software, purché regolarmente utilizzati ed installati su hardware Varian o d'altre marche da essa indicate, hanno le prestazioni descritte nel Manuale d'uso fornito a corredo del software e che sono sostanzialmente esenti da difetti che impediscano l'esecuzione delle rispettive istruzioni di programma. La Varian non garantisce alcun funzionamento ininterrotto o senza errori.

Interventi Tecnici

Gli unici interventi previsti dalla garanzia sull'hardware sono o la riparazione dei malfunzionamenti dello strumento che, a giudizio della Varian, siano dovuti o riconducibili a difetti di costruzione dei materiali originali o, a discrezione della Varian, la sostituzione dei componenti difettosi, fermo restando che la Varian potrà, in alternativa, optare per il rimborso di una congrua parte del prezzo d'acquisto dello strumento o dell'accessorio difettosi.

La riparazione o la sostituzione in garanzia non valgono a prorogare in alcun modo il periodo di garanzia originariamente previsto.

Le riparazioni o le sostituzioni in garanzia verranno effettuate, ad esclusiva discrezione della Varian, inviando sul posto un tecnico o autorizzando la resa dello strumento o dell'accessorio difettoso alla Varian o al centro d'assistenza indicato dalla Varian. Il Cliente sarà responsabile di eventuali danni o perdite subiti durante il trasporto dallo strumento o dall'accessorio reso e dovrà pagare le spese di spedizione in via anticipata. La Varian restituirà al Cliente lo strumento o l'accessorio in porto franco con assicurazione a proprio carico. Sono a cura del Cliente gli eventuali reclami per perdite o danni di trasporto. Per eliminare eventuali anomalie di funzionamento del software, la Varian fornirà le eventuali revisioni del software disponibili qualora a suo giudizio siano il rimedio migliore.

Limitazioni della garanzia

La presente garanzia non copre il software fornito dal Cliente, le attrezzature e il software garantiti da altre case né la sostituzione del materiale di consumo o di durata limitata, quali, senza intento limitativo, filtri, provette, spie di stato dello strumento, voltmetri, setti, colonne, fusibili, carta ed inchiosto , nebulizzatori, celle a flusso, pistoni, guarnizioni, pezzi speciali, valvole, bruciatori, tubi di campionamento, inserti per sonde, testine di stampa, tubazioni rivestite in vetro, raccordi per tubi, dewars a temperatura variabile, linee di trasferimento, dischi flessibili, cassette a nastro magnetico, fotomoltiplicatori, filamenti, guarnizioni per vuoto, e tutte le parti esposte all'azione dei campioni o delle fasi mobili.

La presente garanzia decade in caso d'incidente, abuso, modifica, uso improprio, incuria, rottura, funzionamento o manutenzione impropri, modifiche non autorizzate od improprie o manomissioni, impiego in ambiente fisico non idoneo, impiego con alimentazione ai limiti o con altri mezzi o dispositivi inadeguati. Devono inoltre essere adottate tutte le misure ragionevoli atte ad evitare ogni e qualsiasi rischio.

La presente garanzia sostituisce ed esclude espressamente ogni altra garanzia espressa o implicita, comprese - senz'intento limitativo - le garanzie di commerciabilità ed idoneità a scopi, impieghi od applicazioni specifici nonché tutti gli altri obblighi o responsabilità della Varian, a meno che le altre garanzie, obblighi o responsabilità in parola non siano stati accettati per iscritto dalla Varian.

Limitazione degli interventi e delle responsabilità

Quelli qui contemplati sono gli unici ed esclusivi interventi cui ha diritto il Cliente. In nessun caso la Varian sarà responsabile per danni indiretti o consequenziali, mancata disponibilità, perdita di produzione o altre perdite subite.

VARIAN

Sistemas de calidad en Varian, Inc.

Las normas ISO 9000 fueron creadas en Ginebra en 1987 para acabar con una multitud de definiciones de calidad contradictorias. Estas normas constituyen un modelo de sistemas de garantía de calidad en el diseño, desarrollo, fabricación, instalación, mantenimiento y asistencia técnica de productos. Se han convertido en el banco de pruebas de garantía de calidad a nivel mundial y miden el grado de compromiso de una empresa con la calidad, así como el alcance de sus sistemas de calidad.

Diversas organizaciones mundiales, como la British Standards Institution (BSI), proporcionan expertos titulados de probada objetividad para investigar procedimientos de calidad, desarrollo de productos, procesos de fabricación y programas de servicio al cliente.

Varian, Inc., Analytical Instruments fue registrada en 1992 con la norma más exhaustiva de la serie ISO 9000: la ISO 9001. La certificación por la norma ISO 9001 significa que todas las etapas de nuestro sistema de calidad, como el desarrollo del producto, la fabricación, las pruebas finales, la expedición, así como los suministros y recambios, han sido examinados rigurosamente respecto a las normas más exigentes reconocidas internacionalmente. Significa que nos comprometemos a mantener un nivel de calidad con el que podrá siempre contar, hoy y en el futuro. Il nostro Sistema di Qualità ha ottenuto la certificazione ISO 9001 col numero FM21797.

Los sistemas de calidad que nos valieron la certificación ISO 9001 representan beneficios directos para nuestros clientes:

- haremos llegar nuestros aparatos más rápidamente que nunca. Podemos cumplir con pedidos urgentes aún más deprisa.
- Atenderemos sus pedidos de forma rápida y completa.
- Aplicamos un sistema de retorno de información permanente con nuestros clientes: siempre somos conscientes de sus necesidades, actuales o futuras.
- Hemos mejorado la productividad de nuestros clientes, disminuyendo el índice de defectos a la mitad y acortando el tiempo de respuesta del servicio de mantenimiento.
- Hemos integrado sistemas de mejora continuada en nuestra organización, de forma que podremos obtener niveles de calidad aún superiores en un futuro.
- Estamos integrando los requerimientos GLP en nuestros productos y servicios para ayudarle a cumplir con requerimientos de conformidad obligatorios.

La conformidad con ISO 9001 no nos basta. Para nosotros, los criterios de calidad los definen nuestros clientes. No estaremos satisfechos hasta que usted lo esté. Intentamos comprender las necesidades de nuestros clientes, a través de entidades independientes, grupos de usuarios, oficinas de asesoramiento a usuarios y nuestro programa de respuesta “Hallmark of Quality”, además de los contactos directos con nuestros clientes. Nuestros productos y procedimientos están diseñados para poder corresponder a sus necesidades.

Sabemos que nuestros clientes buscan más que experiencia en procesos avanzados y aplicaciones punteras. Se trata de unir fuerzas con un socio que se compromete a entregar calidad reconocida a nivel mundial, fiabilidad y valor, a tiempo, siempre.

QUALITY SYSTEM
ISO 9001
CERTIFIED

Nuestra meta principal es ser ese socio.

Instrumentos analíticos Varian, Inc. Garantía

Productos hardware

Todos los instrumentos analíticos vendidos por Varian, Inc. están garantizados contra defectos de materiales y de fabricación por la duración especificada y de acuerdo con los términos establecidos en las ofertas de Varian, o según lo especificado en el acuerdo escrito entre Varian y el cliente. El plazo de garantía comienza a partir de la fecha de **envío** del material de Varian al cliente original. Sin embargo, si la instalación ha sido pagada por el cliente o incluida en el precio de compra, el plazo de garantía comenzará a partir de la fecha de conclusión de la instalación. Si el cliente especifica que la **instalación** comenzará 30 días después de la entrega, o si este plazo se genera por la imposibilidad por parte del cliente de proveer los medios necesarios o la falta de cumplimiento de las directrices de preinstalación de Varian, o cualquier otra omisión por parte del cliente, el plazo de garantía comenzará el trigésimoprimer día a partir del envío. Además, Varian cobrará al cliente por trabajos y otros gastos relacionados con intervenciones de servicio de instalación múltiples o tardías.

Productos de software

Cuando el software se suministra dentro del marco de una licencia de utilización acordada entre Varian y el cliente, cualquier garantía estará estrictamente limitada a los términos del citado acuerdo. En ausencia de una licencia de utilización y a no ser que exista un acuerdo de período de garantía por escrito entre Varian y el cliente, el período de garantía será el fijado de acuerdo con los términos de Varian que se citan. Varian garantiza estos productos de software si se instalan y usan con hardware Varian, u otro tipo de hardware en el que Varian certifique que funcionan según lo descrito en Manual de instrucciones, y que esté libre de defectos que impidan la ejecución de instrucciones de programación. Sin embargo, Varian no garantiza la utilización ininterrumpida o libre de errores.

Recursos

El único y exclusivo recurso en cuanto a hardware bajo garantía será **reparar** los defectos del aparato, que, en opinión de Varian, sean claramente imputables a defectos de los materiales originales o de fabricación, o **sustituir** los componentes defectuosos, pudiendo Varian optar por **reembolsar** una parte equitativa del precio de compra del aparato o componente.

Las reparaciones o sustituciones en período de garantía no prolongan el período de garantía original.

Las reparaciones o sustituciones en período de garantía se efectuarán, a criterio exclusivo de Varian, enviando un representante de servicio posventa a la instalación, o autorizando al cliente a reexpedir el componente o aparato defectuoso a Varian o a un servicio de reparación designado. El cliente será responsable sobre pérdidas o daños de transporte, y pagará los costes de dicho transporte. Varian reexpedirá el componente o aparato a portes pagados y con seguro de transporte. Las demandas por daños o pérdidas deberán ser gestionadas por el cliente. Para corregir anomalías de funcionamiento de software, Varian editará revisiones de software, siempre y cuando éstas estén disponibles, y cuando, en opinión de Varian, este sea el remedio mas eficaz.

Limitación de garantía

Esta garantía no cubre software provisto por el cliente, equipos y software garantizados por otros fabricantes, consumibles o artículos de duración de vida limitada, como son, entre otros: filtros, elementos de vidrio, pilotos, lámparas, diafragmas, columnas, fusibles, papel y tinta de gráficos, nebulizadores, células de flujo, pistones, cierres, juntas, válvulas, quemadores, tubos de muestras, inserciones de sondas, cabezales de impresión, tubos de vidrio, juntas de tubo, dispositivos de temperatura variable, líneas de transferencia, disquetes, cintas magnéticas, multiplicadores de electrones, filamentos, juntas de vacío, soportes y todos los componentes en contacto con muestras y partes móviles.

Esta garantía no tendrá efecto en los casos de accidente, abuso, alteración, utilización incorrecta, negligencia, rotura, mantenimiento o uso inadecuados, modificaciones inadecuadas o no autorizadas, uso de la fuerza, uso en un entorno inadecuado, funcionamiento con una alimentación defectuosa o el uso con medios inadecuados. Es necesario tomar las precauciones adecuadas para evitar riesgos.

Las garantías de los productos de software de Varian sustituyen y excluyen cualquier otra garantía, implícita o explícita, incluidas pero sin limitación, las garantías de comerciabilidad, adecuación a un fin, uso o aplicación en particular, y todas las demás obligaciones y responsabilidades por parte de Varian, a no ser que estas garantías, obligaciones y responsabilidades sean otorgadas expresamente y por escrito por Varian.

Limitaciones de recursos y responsabilidades

Los recursos provistos en lo citado son única y exclusivamente los del cliente. Varian no podrá ser responsable en ningún caso por daños imprevistos o consecuencias, pérdida de uso, pérdida de producción o cualquier otra pérdida incurrida.

Safety Information

Operating Instructions

This instruction manual is provided to help you establish operating conditions which will permit safe and efficient use of your equipment. Special considerations and precautions are also described in the manual, which appear in the form of **NOTES**, **CAUTIONS**, and **WARNINGS** as described below. It is important that you operate your equipment in accordance with this instruction manual and any additional information which may be provided by Varian. Address any questions regarding the safe and proper use of your equipment to your local Varian office.

NOTE

Information to aid you in obtaining optimal performance from your instrument.

CAUTION

Alerts you to situations that may cause moderate injury and/or equipment damage, and how to avoid these situations.

WARNING

Alerts you to potentially hazardous situations that could result in serious injury, and how to avoid these situations.

Warning Symbol	Warning Description
 **WARNING: SHOCK HAZARD**	Hazardous voltages are present inside instrument. Disconnect from main power before removing screw-attached panels.
 **WARNING: CHEMICAL HAZARD**	Hazardous chemicals may be present. Avoid contact, especially when replenishing reservoirs. Use proper eye and skin protection.
 **WARNING: BURN HAZARD**	Very hot or cryogenically cold surfaces may be exposed. Use proper skin protection.
 **WARNING: EYE HAZARD**	Eye damage could occur either from flying particles, chemicals, or UV radiation. Use proper eye and face protection.
 **WARNING: FIRE HAZARD**	The potential for fire may be present. Follow manual instructions for safe operation.
 **WARNING: EXPLOSION HAZARD**	The potential for explosion may exist because of type of gas or liquid used.
 **WARNING: RADIATION SOURCE**	Ionizing radiation source is present. Follow manual instructions for safe operation.
 **WARNING: MOVING PARTS**	Keep hands and fingers away.

General Safety Precautions

Follow these safety practices to ensure safe equipment operation.

- Perform periodic leak checks on all supply lines and pneumatic plumbing.
- Do not allow gas lines to become kinked or punctured. Place lines away from foot traffic and extreme heat or cold.
- Store organic solvents in fireproof, vented and clearly labeled cabinets so they are easily identified as toxic and/or flammable materials.
- Do not accumulate waste solvents. Dispose of such materials through a regulated disposal program and not through municipal sewage lines.

NOTICE: This instrument has been tested per applicable requirements of EMC Directive as required to carry the European Union CE Mark. As such, this equipment may be susceptible to radiation/interference levels or frequencies which are not within the tested limits.

WARNING This instrument is designed for chromatographic analysis of appropriately prepared samples. It must be operated using appropriate gases and/or solvents and within specified maximum ranges for pressure, flows, and temperatures as described in this manual. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

WARNING It is the responsibility of the Customer to inform Varian Customer Support Representatives if the instrument has been used for the analysis of hazardous biological, radioactive, or toxic samples, prior to any instrument service being performed or when an instrument is being returned to the Service Center for repair.

Electrical Hazards

- Disconnect the instrument from all power sources before removing protective panels to avoid exposure to potentially dangerous voltages.
- When it is necessary to use a non-original power cord plug, make sure the replacement cord adheres to the color coding and polarity described in the manual and all local building safety codes.
- Replace blown fuses with fuses of the size and rating stipulated on the fuse panel or in the manual.
- Replace faulty or frayed power cords immediately with the same type and rating.
- Make sure that voltage sources and line voltage match the value for which the instrument is wired.

Compressed Gas Cylinders

- Store and handle compressed gases carefully and in strict adherence to safety codes.
- Secure cylinders to an immovable structure or wall.
- Store and move cylinders in an upright, vertical position. Before transport, remove regulators and install cylinder cap.
- Store cylinders in a well-ventilated area away from heat, direct sunshine, freezing temperatures, and ignition sources.
- Mark cylinders clearly so there is no doubt as to their contents.
- Use only approved regulators and connections.
- Use only connector tubing that is chromatographically clean (Varian Part Number 03-918326-00) and has a pressure rating significantly greater than the highest outlet pressure from the regulator.

GC Safety Practices

Exhaust System

No special exhaust ducting is necessary for GC detectors installed in a well-ventilated room except when the detectors are used to test hazardous chemicals. If you do install ducting:

- Use only fireproof ducting.
- Install a blower at the duct outlet.
- Locate duct intakes such that their vibration or air movement does not effect detector operation.
- Check periodically for proper operation of the duct.
- Ensure proper ventilation in lab area.

Radioactive Source Detectors

- Read carefully and comply with all NOTES, CAUTIONS, and WARNINGS in the Ni^{63} ECD manual.
- Perform the tests for removable radioactive contamination described in the Ni^{63} ECD manual.
- Comply with leak test schedules and procedures.

Burn Hazard

Heated or cryogenically cooled zones of gas chromatographs can remain hot or cold for a considerable time after instrument power is turned off. To prevent painful burns, ensure that all heated or cooled areas have returned to room temperature or wear adequate hand protection before you touch potentially hot or cold surfaces.

LC Safety Practices

High Pressure Hazard

- If a line ruptures, a relief device opens, or a valve opens accidentally under pressure, potentially hazardous high liquid pressures can be generated by the pump causing a high velocity stream of volatile and/or toxic liquids.

- Wear face protection when you inject samples or perform routine maintenance.
- Never open a solvent line or valve under pressure. Stop the pump first and let the pressure drop to zero.
- Use shatter-proof reservoirs capable of operating at 50-60 psi.
- Keep the reservoir enclosure closed when the reservoir is under pressure.
- Read and adhere to all NOTES, CAUTIONS, and WARNINGS in the manual.

Flash Chromatography

The operator should be familiar with the physico-chemical properties of the components of the mobile phase.

Keep solvents from direct contact with the polyurethane supply tubing as certain solvents will cause weakening and leaks with possible bursting.

All components of the system should be connected to a common power supply and common ground. This ground must be a true ground rather than a floating ground.

Non-polar solvents can develop a static charge when pumped through the system. All vessels that contain mobile phase (including tubing and collection vessels) must be grounded to dissipate static electricity.

Employ static measuring and static discharge devices (e.g., air ionizers) to safeguard against the buildup of static electricity.

Ultraviolet Radiation

Liquid chromatograph detectors that use an ultraviolet light source have shielding to prevent radiation exposure to personnel.

For continued protection:

- Ensure that protective lamp covers of variable and fixed wavelength detectors are in place during operation.
- Do not look directly into detector fluid cells or at the UV light source. When inspecting the light source or fluid cell, always use protective eye covering such as borosilicate glass or polystyrene.

The following is a Federal Communications Commission advisory: This equipment has been tested and found to comply with the limits of a Class A computing device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Spare Parts Availability

It is the policy of Varian to provide operational spare parts for any instrument and major accessory for a period of five (5) years after shipment of the final production run of that instrument. Spare parts will be available after this five (5) year period but on an *as available* basis. Operational spare parts are defined as those individual electrical or mechanical parts that are susceptible to failure during their normal operation. Examples include relays, lamps, temperature probes, detector elements, motors, etc. Sheet metal parts, structural members or assemblies and castings, printed circuit boards, and functional modules are normally capable of being rebuilt to like-new condition throughout their useful life and therefore will be supplied only on an *as available* basis after the final production run of the instrument.

Service Availability

Varian provides a variety of services to support its customers after warranty expiration. Repair service can be provided by attractively priced service contracts or on a time and material basis. Technical support and training can be provided by qualified personnel on both a contractual or as-needed basis.

Varian, Inc. Analytical Instruments Sales Offices

For Sales or Service assistance and to order Parts and Supplies, contact your local Varian office.

Argentina
Buenos Aires
Tel. +54.11.4.783.5306

Australia
Mulgrave, Victoria
Tel. +61.3.9566.1134

Austria
Vösendorf bei Wien
Tel. +43.1.699.9669

Benelux
Bergen Op Zoom
Tel. +31.164.282.800

Brazil and Latin America (S)
São Paulo
Tel. +55.11.820.0444

Canada
Mississauga, Ontario
Tel. 800.387.2216

China
Beijing
Tel. +86.106209.1727

Europe
Middelburg, The Netherlands
Tel. +31.118.671.000

France
Les Ulis Cédex
Tel. +33.1.6986.3838

Germany
Darmstadt
Tel. +49.6151.7030

India
Mumbai
Tel. +91.22.857.0787/88/89

Italy
Torino
Tel. +39.011.997.9111

Japan
Tokyo
Tel. +81.3.5232.1211

Korea
Seoul
Tel. +82.2.345.22452

Mexico and Latin America (N)
Mexico City
Tel. +52.5.523.9465

Russian Federation
Moscow
Tel. +7.095.937.4280

Spain
Madrid
Tel. +34.91.472.7612

Sweden
Solna
Tel. +46.8.445.1620

Switzerland
Varian AG
Tel. +41.848.803.800

Taiwan
Taipei Hsien
Tel. +886.2.698.9555

United Kingdom and Ireland
Walton-on-Thames
Tel. +44.1932.898000

Venezuela
Valencia
Tel. +58.41.257.608

United States
Walnut Creek, California, USA
Tel. +1.800.926.3000
(GC and GC/MS)

Tel. +1.800.367.4752
(LC)

VARIAN

www.varianinc.com

Sicherheitsinformationen

Arbeitsanleitungen

Diese Arbeitsanleitung will Ihnen bei der Aufstellung solcher Arbeitsbedingungen helfen, die einen sicheren und wirkungsvollen Gebrauch Ihrer Geräte ermöglichen. Besondere Überlegungen und Vorsichtsmaßnahmen erscheinen in diesem Handbuch in Form von **HINWEIS**, **ACHTUNG** und **WARNUNG,** wie unten beschrieben. Es ist wichtig, daß Sie Ihr Gerät in Übereinstimmung mit dieser Arbeitsanleitung und allen möglichen zusätzlichen Informationen von Varian betreiben. Alle Fragen bezüglich Sicherheit und Handhabung Ihres Gerätes richten Sie an Ihr Varian Büro.

HINWEIS

Eine Information, um einen optimalen Wirkungsgrad Ihres Instruments zu erzielen.

ACHTUNG

Weist auf Situationen, die zu mäßiger Beeinträchtigung und/oder zu Geräteschäden führen und auf die Vermeidung dieser Situationen hin.

WARNUNG

Weist auf mögliche Gefahrensituationen, die zu ernsthaften Verletzungen führen können und auf die Vermeidung dieser Situationen hin.

Warnungssymbol	Warnungsbeschreibung
WARNUNG ELEKTRISCHER SCHLAG	Gefährliche Spannungen bestehen innerhalb des Instruments. Trennen Sie das Gerät vom Netz, bevor Sie abschraubbare Paneele entfernen.
WARNUNG CHEMISCHE GEFAHR	Gefährliche Chemikalien können vorhanden sein. Vermeiden Sie jeden Kontakt, besonders beim Auffüllen der Reservoirs. Benutzen Sie wirksamen Augen und Hautschutz.
WARNUNG VERBRENNUNGSGEFAHR	Sehr heiße oder tiefstgekühlte Oberflächen können freigelegt sein. Benutzen Sie einen wirksamen Hautschutz.
WARNUNG AUGENVERLETZUNG	Herumfliegende Partikel, Chemikalien oder UV-Strahlung können Augenschäden verursachen. Tragen Sie deshalb einen geeigneten Schutz für Augen und Gesicht.
WARNUNG FEUERGEFAHR	Es besteht eine mögliche Feuergefahr. Beachten Sie die Vorschriften im Handbuch für eine gefahrlose Benutzung.
WARNUNG EXPLOSIONSGEFAHR	Eine mögliche Explosionsgefahr besteht infolge der benutzten Gas- oder Flüssigkeitsart.
WARNUNG STRAHLUNGSQUELLE	Es besteht eine ionisierende Strahlungsquelle. Beachten Sie die Vorschriften im Handbuch für eine gefahrlose Benutzung.
WARNUNG BEWEGTE TEILE	Bleiben Sie mit Ihren Händen und Fingern weg.

Allgemeine Sicherheitsmaßnahmen

Befolgen Sie diese Sicherheitspraktiken für eine gefahrlose Gerätebenutzung.

- Prüfen Sie regelmäßig alle Versorgungs und Pneumatikleitungen auf Lecks.
- Gasleitungen dürfen nicht geknickt oder angestochen werden. Verlegen Sie die Leitungen außerhalb von Laufwegen und abseits von extremer Hitze oder Kälte.
- Lagern Sie organische Lösungsmittel in feuerfesten, belüfteten und eindeutig bezeichneten Schränken, damit sie leicht als toxische und/oder brennbare Materialien erkannt werden.
- Sammeln Sie keine Lösungsmittelabfälle. Entsorgen Sie solche Materialien über ein geregeltes Entsorgungsprogramm und nicht über die öffentlichen Abwasserleitungen.

HINWEIS: Dies Instrument wurde nach den zutreffenden Vorschriften der EMC Direktive getestet, die zum Führen des CE Zeichens der Europäischen Union berechtigen. Dieses Gerät kann an sich auf Strahlungs-/Störpegel oder Frequenzen außerhalb der getesteten Grenzen reagieren.

WARNUNG Dies Instrument ist für chromatographische Analysen entsprechend präparierter Proben gedacht. Es muß mit geeigneten Gasen und/oder Lösungsmitteln und innerhalb der im Handbuch spezifizierten maximalen Werte für Druck, Flüsse und Temperaturen betrieben werden.

WARNUNG Der Kunde ist vor der Durchführung irgendeines Geräteservices verpflichtet den Varian Kundendienstvertreter zu informieren, wenn das Instrument für Analysen gefährlicher biologischer, radioaktiver oder toxischer Proben benutzt worden ist.

Elektrische Gefahren

- Lösen Sie das Instrument von allen Stromquellen, bevor Sie Schutzpaneele entfernen, damit Sie nicht mit potentiell gefährlichen Spannungen in Berührung kommen.
- Wenn ein Nicht-Original Netzkabelstecker benutzt werden muß, muß das Austauschkabel die im Handbuch beschriebene Farbcodierung und Polarität beibehalten und alle örtlichen Sicherheitsvorschriften erfüllen.
- Ersetzen Sie durchgebrannte Sicherungen nur mit Sicherungen der Werte, die am Sicherungspaneel oder im Handbuch angegeben sind.
- Ersetzen Sie fehlerhafte oder durchgescheuerte Netzkabel sofort durch Kabel gleicher Art.
- Sorgen Sie dafür, daß Spannungsquellen und die Netzspannung den gleichen Wert haben, für den das Instrument verdrahtet ist.

Gasdruckflaschen

- Lagern und handhaben Sie komprimierte Gase vorsichtig und in strikter Einhaltung der Sicherheitsvorschriften.
- Befestigen Sie die Gasflaschen an feststehenden Aufbauten oder an Wänden.
- Lagern und transportieren Sie Gasflaschen in aufrechter Stellung. Druckregler zuvor abnehmen.
- Lagern Sie Gasflaschen in gut durchlüfteten Räumen, weit genug weg von Heizungen, direktem Sonnenschein, Frosttemperaturen und Entzündungszonen.
- Kennzeichnen Sie die Flaschen so eindeutig, daß kein Zweifel über deren Inhalt bestehen kann.
- Benutzen Sie nur geprüfte Druckminderer und Verbindungsstücke.
- Benutzen Sie nur chromatographisch reines Verbindungsrohr (Varian Part Number 03-918326-00), das wesentlich höheren Druck als den höchsten Ausgangsdruck des Druckminderers aushält.

GC Sicherheitspraktiken

Abgassystem

Für GC Detektoren, die in einem gut durchlüfteten Raum installiert sind, ist keine spezielle Abgasführung erforderlich, außer wenn die Detektoren zum Testen gefährlicher Chemikalien benutzt werden. Wenn Sie eine Abgasführung installieren:

- Benutzen Sie nur feuerfeste Führungen.
- Installieren Sie ein Gebläse am Ausgang.
- Ordnen Sie die Ansaugöffnung so an, daß ihre Erschütterungen oder Luftströmungen nicht die Detektorfunktion beeinträchtigen.
- Prüfen Sie regelmäßig die einwandfreie Arbeitsweise der Abgasführung.
- Sorgen Sie für gute Entlüftung im Laborbereich.

Radioaktive Detektoren

- Lesen Sie sorgfältig und befolgen Sie alle **HINWEISE**, **ACHTUNGEN** und **WARNUNGEN** im Ni^{63} ECD Handbuch.
- Führen Sie die Tests für zu beseitigende radioaktive Kontamination durch, die im Ni^{63} ECD Handbuch beschrieben sind.
- Erfüllen Sie die Zeitpläne und Verfahren zur Dichtigkeitsprüfung.

Verbrennungsgefahr

Beheizte oder tieftemperaturgekühlte Zonen des Gaschromatographen können beträchtlich lange heiß oder kalt bleiben, nachdem das Instrument bereits abgeschaltet ist. Zur Vermeidung schmerzhafter Verbrennungen müssen Sie darauf achten, daß alle beheizten oder gekühlten Zonen auf Raumtemperatur zurückgegangen sind oder Sie müssen ausreichenden Handschutz benutzen, bevor Sie möglicherweise heiße oder kalte Oberflächen berühren.

LC Sicherheitspraktiken

Gefahr durch hohen Druck

Wenn eine Leitung bricht, eine Entlüftungseinheit sich öffnet oder ein Ventil sich unbeabsichtigt unter Druck öffnet, kann durch die Pumpe möglicherweise ein gefährlich hoher Flüssigkeitsdruck entstehen, der einen Strahl flüchtiger und/oder toxischer Flüssigkeiten von hoher Stömungsgeschwindigkeit verursacht.

- Tragen Sie einen Gesichtsschutz, wenn Sie Proben injizieren oder Routinewartungen durchführen.
- Öffnen Sie niemals eine unter Druck stehende Lösungsmittelleitung oder ein Ventil. Halten Sie zuerst die Pumpe an und lassen Sie den Druck auf Null abfallen.
- Benutzen Sie splittersichere Reservoirs, die für einen Druck von 3,4 bis 4,1 bar ausgelegt sind.
- Halten Sie die Reservoirverkleidung geschlossen, wenn die Reservoirs unter Druck stehen.
- Lesen Sie und befolgen Sie alle **HINWEISE**, **ACHTUNGEN** und **WARNUNGEN** im Handbuch.

Blitzlicht-Chromatographie

Der Bediener sollte mit den physikalisch-chemischen Eigenschaften der Komponenten vertraut sein, aus denen sich die mobile Phase zusammensetzt.

Vermeiden Sie direkten Kontakt der Lösungsmittel mit den Zuführungsleitungen aus Polyurethan, da einige Lösungsmittel das Material der Leitungen schwächen und damit Undichtigkeiten oder Brüche hervorrufen können.

Alle Systemkomponenten sollten an der gleichen Netzstromquelle und einer gemeinsamen Erdung angeschlossen sein. Dabei muss es sich um eine echte, nicht um eine schwebende Erdung handeln.

Nicht-polare Lösungsmittel können sich beim Pumpen durch das System statisch aufladen. Alle Gefäße, die mobile Phase enthalten (einschließlich Leitungen und Sammelgefäße), müssen zur Ableitung elektrostatischer Aufladungen geerdet sein.

Setzen Sie Geräte zur Messung und Ableitung elektrostatischer Aufladungen (z.B. Geräte zur Luftionisierung) als Maßnahmen gegen den Aufbau statischer Elektrizität ein.

Ultraviolette Strahlung

Detektoren in Liquidchromatographen, die eine ultraviolette Lichtquelle benutzen, besitzen eine Abschirmung, die das Bedienungspersonal gegen Abstrahlungen schützt. Zum ständigen Schutz:

- Achten Sie darauf, daß die schützende Lampenabdeckung der Detektoren mit variablen und festen Wellenlängen während des Betriebs an ihrem Platz ist.
- Schauen Sie nicht direkt in die Flüssigkeitszellen im Detektor oder in die UV Lampe. Zum Inspizieren der Lichtquelle oder der Flüssigkeitszelle benutzen Sie immer einen wirksamen Augenschutz, wie er durch Borsilikatglas oder Polystyrol gewährleistet wird.

Verfügbarkeit von Ersatzteilen

Es ist Varian's Grundsatz, Ersatzteile für alle Instrumente und die wichtigsten Zubehöre für einen Zeitraum von fünf (5) Jahren nach dem Fertigungsauslauf dieser Geräteserie verfügbar zu haben. Nach diesem Zeitraum von fünf (5) Jahren können Ersatzteile auf der Basis *solange vorhanden* bezogen werden. Als Ersatzteil werden hier solche elektrischen und mechanischen Einzelteile verstanden, die unter normalen Bedingungen ausfallen können. Beispiele sind Relais, Lampen, Temperaturfühler, Detektorelemente, Motore usw. Metallbleche, Formteile oder Baugruppen und Gußteile, PC Boards und Funktionsmodule können normalerweise neuwertähnlich für eine brauchbare Lebensdauer instandgesetzt werden und werden deshalb nur auf der Basis *solange vorhanden* nach dem Produktionsauslauf des Instruments geliefert werden.

Serviceverfügbarkeit

Varian bietet seinen Kunden auch nach dem Auslaufen der Garantie eine Vielfalt von Serviceleistungen an. Reparaturservice kann zu attraktiven Preisen über eine Wartungsvereinbarung oder nach Zeit- und Materialaufwand zur Verfügung gestellt werden. Technische Unterstützung und Training bieten wir Ihnen durch qualifizierte Chemiker sowohl auf einer Kontraktbasis als auch nach Ihren Erfordernissen an.

Varian Analytical Instruments Verkaufsbüros

Für Verkaufs oder Servicehilfe und zum Bestellen von Teilen und Zubehören setzen Sie sich bitte mit Ihrem Varian Büro in Verbindung.

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Informations et mesures de sécurité

Instructions de fonctionnement

Ce manuel d'instruction est conçu pour aider l'utilisateur à créer des conditions opératoires lui permettant de faire fonctionner le matériel efficacement et en toute sécurité. Il contient entre autres certaines observations spéciales présentées sous forme de **NOTES**, **MISES EN GARDE** et **AVERTISSEMENTS.** Il est important de faire fonctionner ce matériel conformément aux instructions du présent manuel et à toute autre information émanant de Varian. S'adresser au bureau régional Varian pour toute question relative à la sécurité ou à l'utilisation correcte du matériel.

NOTE

Information destinée à tirer le meilleur parti du matériel sur le plan des performances

MISE EN GARDE

Attire l'attention sur une situation pouvant occasionner des dommages corporels légers et/ou des dégâts mineurs à l'appareil et indique comment remédier à cette situation

AVERTISSEMENT

Attire l'attention sur une situation potentiellement dangereuse pouvant occasionner des dommages corporels importants et indique comment remédier à cette situation

Symboles d'avertissement	Description
ATTENTION RISQUE D'ELECTROCUTION	Exposition à des tensions dangereuses. Débrancher le matériel du secteur avant de dévisser les panneaux protecteurs.
ATTENTION SUBSTANCES CHIMIQUES DANGER	Présence éventuelle de substances chimiques dangereuses. Eviter tout contact, en particulier lors du remplissage des réservoirs. Prendre les mesures de protection adéquates pour les yeux et la peau.
ATTENTION RISQUE DE BRÛLURES	Exposition à des surfaces chaudes ou traitées cryogéniquement. Prendre les mesures de protection adéquates pour la peau.
ATTENTION DANGER POUR LES YEUX	Les dommages causées aux yeux sont de deux natures différentes : jet de particules et de produits chimiques ou radiations UV. Utiliser des protections du visage et des yeux appropriées.
ATTENTION RISQUE D'INCENDIE	Risque potentiel d'incendie. Se conformer aux instructions du manuel pour faire fonctionner le matériel en toute sécurité.
ATTENTION RISQUE D'EXPLOSION	Risque potentiel d'explosion en raison du type de gaz ou de liquide utilisé.
ATTENTION SOURCE DE RADIATION	Présence d'une source de radiation ionisante. Se conformer aux instructions du manuel pour faire fonctionner le matériel en toute sécurité.
ATTENTION PIECES EN MOUVEMENT	Garder les mains et les doigts hors de portée.

Précautions générales en matière de sécurité

Les pratiques suivantes garantissent une utilisation sans risques du matériel:

- Effectuer régulièrement des essais d'étanchéité de tous les conduits d'alimentation et de tous les tuyaux du système pneumatique.
- Ne pas travailler avec des conduits de gaz déformés ou percés. Installer les conduits de gaz à l'écart des allées et venues et à l'abri du chaud ou du froid.
- Conserver les solvants organiques dans des récipients à l'épreuve du feu, bien ventilés et portant mention de la nature de leur contenu, en particulier lorsque lesdits solvants sont toxiques et/ou inflammables.
- Ne pas accumuler les solvants de rebut. Les éliminer conformément à un programme agréé d'élimination des déchets et non via les égouts municipaux.

NOTE: Ce matériel a été testé conformément aux dispositions de la directive CME afin de pouvoir porter le sigle CE de l'Union européenne. Il en résulte qu'il peut être sensible à des niveaux de radiation/d'interférence ou à des fréquences se situant hors des limites testées.

ATTENTION Ce matériel est conçu pour effectuer des analyses chromatographiques d'échantillons préparés selon des méthodes appropriées. Il convient de le faire fonctionner avec les gaz et/ou les solvants adéquats et dans les limites des pressions, des débits et des températures maximales spécifiées dans le présent manuel.

ATTENTION Le client est tenu d'informer le service Varian d'assistance à la clientèle que son matériel a été utilisé pour l'analyse d'échantillons biologiques dangereux, radioactifs ou toxiques avant que n'en soit effectué la maintenance.

Risques de chocs électriques

- Déconnecter le matériel de toute source d'alimentation avant d'en démonter les panneaux de protection, sous peine de s'exposer à des tensions dangereuses.
- En cas d'utilisation d'un cordon d'alimentation n'étant pas d'origine, s'assurer que celui-ci soit conforme à la polarité et au codage des couleurs décrits dans le manuel d'utilisation ainsi qu'à toutes les normes régionales de sécurité régissant le secteur de la construction.
- Remplacer les fusibles sautés par des fusibles de même type que ceux stipulés sur le panneau des fusibles ou dans le manuel d'utilisation.
- Remplacer les cordons d'alimentation défectueux ou dénudés par des cordons d'alimentation de même type.
- S'assurer que les sources de tension et la tension de secteur correspondent à la tension de fonctionnement du matériel.

Bouteilles à gaz comprimé

- Ranger et manipuler les bouteilles à gaz comprimé avec précaution et conformément aux normes de sécurité.
- Fixer les bouteilles à gaz comprimé à un mur ou à une structure inamovible.
- Ranger et déplacer les bouteilles à gaz comprimé en position verticale. Avant de transporter les bouteilles à gaz comprimé, retirer leur régulateur.
- Ranger les bouteilles dans un endroit bien ventilé et à l'abri de la chaleur, des rayons directs du soleil, du gel ou des sources d'allumage.
- Marquer les bouteilles de manière à n'avoir aucun doute quant à leur contenu.
- N'utiliser que des connexions et régulateurs agréés.
- N'utiliser que des tuyaux de raccordement propres sur le plan chromatographique (Varian P/N 03-918326-00) et pouvant supporter des pressions sensiblement plus élevées que la plus haute pression de sortie du régulateur.

Mesures de sécurité en CPG

Système d'échappement

Les détecteurs CPG installés dans une pièce bien ventilée ne nécessitent pas de conduits spéciaux d'échappement excepté lorsqu'ils sont destinés à analyser des substances chimiques dangereuses. Lors de l'installation de tels conduits:

- N'utiliser que des conduits à l'épreuve du feu
- Installer un ventilateur à la sortie du conduit.
- Placer les orifices d'aspiration de manière à ce que les vibrations ou les mouvements d'air n'affectent pas le fonctionnement du détecteur.
- Vérifier périodiquement l'état du conduit.
- S'assurer que le laboratoire est correctement ventilé.

Détecteurs à source radioactive

- Se conformer au manuel d'utilisation de l'ECD Ni^{63}, en particulier à ses **NOTES**, **MISES EN GARDE ET AVERTISSEMENTS**.
- Effectuer les tests de décontamination radioactive décrits dans le manuel d'utilisation de l'ECD Ni^{63}.
- Se conformer aux procédures et au calendrier des essais d'étanchéité.

Risque de brûlures

Les zones des chromatographes à gaz chauffées ou traitées cryogéniquement peuvent rester très chaudes ou très froides durant une période plus ou moins longue après la mise hors tension du matériel. Pour éviter les brûlures, s'assurer que ces zones sont revenues à température ambiante ou utiliser un dispositif adéquat de protection des mains avant de les toucher.

Mesures de sécurité en CPL

Risques liés aux hautes pressions

En cas de rupture d'un tuyau ou en cas d'ouverture accidentelle d'une vanne alors que le système est sous pression, la pompe peut occasionner des dommages en expulsant à grande vitesse des jets de liquides volatiles et/ou toxiques.

- Mettre un masque de protection lors de l'injection des échantillons ou en effectuant les opérations de maintenance de routine.
- Ne jamais déconnecter un conduit de solvant ou une vanne sous pression. Arrêter préalablement la pompe et laisser la pression descendre à zéro.
- Utiliser des réservoirs incassables à 50-60 psi.
- Laisser l'enceinte du réservoir fermée lorsque le réservoir est sous pression.
- Se conformer aux **NOTES**, **MISES EN GARDE ET AVERTISSEMENTS** du manuel d'utilisation**.**

Chromatographie Flash

L'utilisateur aura la connaissance des propriétés physico-chimiques des constituants de la phase mobile.

Eviter le contact direct des solvants avec les tuyaux en polyuréthane : certains solvants sont susceptibles de provoquer des faiblesses et des fuites avec risques d'explosion.

Tous les constituants du système devront être connectés à une source de courant commune et à une prise de terre commune. Cette prise de terre devra être fixe et non mobile.

Les solvants non-polaires peuvent produire de l'électricité statique lorsqu'ils passent au travers du système. Les bouteilles qui contiennent la phase mobile (incluant les tuyaux et les flacons de collecte de fractions) doivent être mises à la terre pour éliminer l'électricité statique.

Utiliser des appareils de mesure et de décharge d'électricité statique (par exemple des ionisateurs d'air) pour combattre la formation d'électricité statique.

Radiations ultraviolettes

Les détecteurs CPL utilisant une source lumineuse ultraviolette comportent un écran destiné à se prémunir contre les expositions aux rayonnements.

Pour s'assurer une protection permanente:

- Vérifier que le couvercle de protection de la lampe des détecteurs opérant à des longueurs d'onde variables et fixes soit bien en place durant le fonctionnement du matériel.
- Ne pas regarder directement les cellules du détecteur ou la source d'UV. Se protéger systématiquement les yeux lors du contrôle de la source lumineuse ou des cellules, par exemple au moyen de verres borosilicatés ou en polystyrène.

Disponibilité des pièces de rechange

La politique de Varian consiste à fournir des pièces de rechange pour tous les appareils et accessoires majeurs durant une période de cinq (5) ans après livraison de leur production finale. Les pièces de rechange ne sont fournies au terme de cette période de cinq (5) ans que suivant les disponibilités. Il faut entendre par pièces de rechange les pièces individuelles électriques ou mécaniques susceptibles de défaillance au cours de leur utilisation normale. Par exemple, les relais, les lampes, les sondes thermiques, les éléments de détecteur, les moteurs, etc. Les parties en tôles, les éléments ou assemblages structurels et les pièces de fonderie, les cartes à circuits imprimés et les modules fonctionnels sont normalement susceptibles d'être remis à l'état neuf pendant toute la durée de leur vie utile et ne sont dès lors fournies, au terme de la production finale des appareils, que suivant les disponibilités.

Service d'assistance à la clientèle

Varian fournit divers services destinés à aider sa clientèle après expiration de la garantie: service de réparation sur base de contrats de maintenance à prix attractifs ou sur base d'accords à durée limitée portant sur du matériel spécifique; support technique et service de formation assurés par des chimistes qualifiés sur base contractuelle ou en fonction des besoins spécifiques.

Points de vente des instruments analytiques Varian

Contactez votre point de vente régional Varian pour toute question commerciale ou de service d'assistance à la clientèle ou pour passer commande de pièces et de fournitures.

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Informazioni sulla Sicurezza

Instruzioni per l'Uso

Questo manuale ha lo scopo di aiutare l'operatore ad utilizzare lo strumento in modo sicuro ed efficiente. Le considerazioni e le precauzioni speciali vengono presentate in questo manuale sotto forma di avvisi di **NOTA**, **CAUTELA** e **ATTENZIONE**. E' importante che lo strumento venga utilizzato rispettando le istruzioni fornite in questo manuale o che verranno fornite successivamente dalla Varian. Per ogni eventuale chiarimento sull'uso o sulla sicurezza, si prega di contattare la Varian di Leinì (TO).

NOTA

Sono informazioni utili ad ottenere le prestazioni migliori da parte dello strumento.

ATTENZIONE

Allerta l'operatore su situazioni che potrebbero causare ferite leggere e danni limitati allo strumento ed il modo di evitarle.

ATTENZIONE

Allerta l'operatore su situazioni potenzialmente pericolose che possono causare danni molto seri ed il modo di evitarle.

Segnali di ATTENZIONE	Descrizione del Pericolo
 **ATTENZIONE** **Pericolo di folgorazioni**	Nello strumento sono presenti tensioni pericolose. Scollegare il cavo di alimentazione prima di togliere il pannello fissato con le viti.
 **ATTENZIONE** **ESPOSIZIONE A SOSTANZA CHIMICHE**	Possono essere presenti composti chimici pericolosi. Evitare il contatto, specialmente quando si riempiono i contenitori. Usare protezioni opportune per la pelle e per gli occhi.
 **ATTENZIONE** **Pericolo di scottature**	Pericolo di esposizione a superfici molto calde o raffreddate criogenicamente. Usare protezioni opportune per la pelle.
 **ATTENZIONE** **PERICOLO PER GLI OCCHI**	Particelle volanti, agenti chimici o radiazioni UV possono danneggiare gli occhi. Vanno quindi utilizzate le opportune protezioni per gli occhi e per il volto.
 **ATTENZIONE** **Pericolo di incendio**	Pericolo potenziale di incendio. Seguire le istruzioni del manuale per lavorare con una maggiore sicurezza.
 **ATTENZIONE** **Pericolo di esplosioni**	C'è pericolo di esplosioni a causa del tipo di gas o liquido utilizzato.
 **ATTENZIONE** **Pericolo di radiazioni**	E' presente una radiazione ionizzante. Seguire le istruzioni del manuale per lavorare con una maggiore sicurezza.
 **ATTENZIONE** **Parti in movimento**	Non tenere le mani o le dita vicino.

Norme di Sicurezza

Per lavorare in modo sicuro sullo strumento, Vi consigliamo si adottare le seguenti procedure.

- Verificare periodicamente che non ci siano perdite sulle linee e sui raccordi pneumatici.
- Evitare che le linee dei gas vengano piegate o forate. Le linee vanno posizionate in modo tale da non essere calpestate e lontane da sorgenti o troppo calde o troppo fredde.
- I solventi organici vanno conservati in armadi speciali antiincendio, ventilati e con indicazioni chiare sul contenuto di materiali tossici e/o infiammabili.
- Non accumulare i solventi utilizzati. Adottare un programma regolare di smaltimento, ma mai nelle acque di scarico.

AVVERTENZA: Questo strumento è stato testato secondo le Direttive EMC allo scopo di poter utilizzare il Marchio CE della Comunità Europea. Questo strumento può essere suscettibile a radiazioni/interferenze o frequenze che non sono entro i limiti collaudati.

ATTENZIONE Questo strumento è progettato per l'analisi cromatografica di campioni opportunamente preparati. Deve essere utilizzato usando gas e solventi adatti a questo scopo ed entro i limiti massimi di pressione, flusso e temperatura riportati in questo manuale. Se lo strumento non viene utilizzato secondo le modalità specificate dal costruttore, le condizioni di sicurezza previste potranno non essere sufficienti.

ATTENZIONE E' responsabilità del Cliente informare il Servizio Tecnico Varian, prima di qualsiasi intervento di riparazione, se lo strumento è stato utilizzato per l'analisi di campioni biologicamente pericolosi, radioattivi o tossici.

Pericoli Elettrici

- Prima di togliere i pannelli di protezione, scollegare lo strumento da tutte le alimentazioni elettriche in modo da evitare l'esposizione a voltaggi potenzialmente pericolosi.
- Quando si rende necessario sostituire il cavo di alimentazione, assicurarsi che il nuovo cavo rispetti sia le codifiche di colore e di polarità riportate nel manuale di istruzioni che quelle stabilite dalle norme di sicurezza del laboratorio.
- Sostituire i fusibili bruciati solo con fusibili che abbiano le stesse caratteristiche; queste ultime sono riportate sul pannello dei fusibili e/o nel manuale di istruzioni.
- Sostituire immediatamente i cavi di alimentazione difettosi o consumati con cavi dello stesso tipo e con le stesse caratteristiche.
- Assicurarsi che il voltaggio del pannello di alimentazione corrisponda a quello dello strumento da collegare.

Bombole dei Gas

- Occorre prestare molta attenzione quando si spostano bombole di gas compressi. Rispettare tutte le norme di sicurezza.
- Assicurare le bombole ad una parete o ad una struttura fissa.
- Spostare e conservare le bombole sempre in posizione verticale. Togliere i manometri prima di spostare le bombole.
- Conservare le bombole in un'area ben ventilata, non infiammabile, lontana da sorgenti di calore, non esposta a temperature troppo fredde o alla luce diretta del sole.
- Evidenziare in modo chiaro e che non lasci dubbi il contenuto di ogni bombola.
- Usare solo manometri e raccordi di qualità.
- Usare solo tubazioni cromatograficamente pulite (Numero di Parte Varian 03-918326-00) e calibrate per pressioni superiori a quella massima di uscita dal manometro.

Procedure di Sicurezza in GC

Scarico dei Gas

Per i rivelatori GC non è richiesto alcun sistema particolare di scarico dei gas, se lo strumento è installato in una stanza ben ventilata e se non viene utilizzato per l'analisi di sostanze chimiche pericolose. Se si deve installare un sistema di scarico dei gas:

- Usare condutture non infiammabili
- Installare un aspiratore in uscita
- Posizionare la presa d'aria in modo che le vibrazioni e il movimento dell'aria non disturbino il rivelatore.
- Eseguire verifiche periodiche per garantire un funzionamento corretto.
- Garantire una buona ventilazione nel laboratorio.

Rivelatori a Sorgente Radioattiva

- Leggere e rispettare tutte gli avvisi di **NOTA**, **CAUTELA** e **ATTENZIONE** riportati nel manuale del rivelatore ECD al Ni^{63}.
- Eseguire tutti i test di contaminazione radioattiva rimovibile descritti nel manuale dell'ECD al Ni^{63}.
- Rispettare tutte le procedure e le scadenze di verifica per eventuali perdite.

Pericolo di Scottature

Le zone calde o raffreddate criogenicamente del gascromatografo possono mantenere la loro temperatura per parecchio tempo, dopo aver spento lo strumento. Per evitare scottature, assicurarsi che le zone riscaldate o raffreddate siano a temperatura ambiente oppure indossare delle protezioni adeguate prima di toccare tali superfici.

Procedure di Sicurezza in LC

Pericolo di Alte Pressioni

In caso di rottura di una linea o di apertura accidentale di una valvola, quando il sistema è sotto pressione, la pompa può liberare liquidi tossici e/o volatili molto pericolosi.

- E' opportuno adottare un sistema di protezione del viso quando si inietta il campione o si esegue una manutenzione routinaria del sistema.
- Non smontare mai una linea del solvente od una valvola quando il sistema è sotto pressione. Fermare prima la pompa ed aspettare che la pressione scenda a zero.
- Usare dei contenitori per solventi infrangibili ed in grado di lavorare a 50-60 psi.
- Quando i contenitori sono sotto pressione, usare una protezione esterna.
- Leggere e rispettare tutti gli avvisi di **NOTA**, **CAUTELA** e **ATTENZIONE**.

Cromatografia Flash

L'operatore deve conoscere le proprietà fisico-chimiche delle componenti della fase mobile.

I solventi non vanno messi in contatto diretto con il tubo di erogazione in poliuretano, dal momento che alcuni solventi possono causare indebolimento e perdite con possibili scoppi.

Tutte le componenti del sistema vanno collegate ad una fonte di alimentazione e ad una messa a terra comuni. E' meglio che per quest'ultima venga utilizzata una spina con polo di terra.

I solventi non-polari possono sviluppare una carica statica quando vengono pompati attraverso il sistema. Tutti i recipienti che contengono la fase mobile (inclusi i tubi e i recipienti di raccolta) devono avere una messa a terra per disperdere l'elettricità statica.

Vanno utilizzati dispositivi di misurazione e scarico (ad esempio ionizzatori d'aria) per evitare l'aumento di elettricità statica.

Radiazioni Ultraviolette

I rivelatori di cromatografia liquida che usano sorgenti a luce ultravioletta montano degli schermi di protezione per evitare che gli operatori siano esposti a radiazioni pericolose.

Per una protezione sicura:

- Assicurarsi che i coperchi delle lampade dei rivelatori a lunghezza fissa e variabile siano sempre al loro posto, quando si lavora.
- Non guardare mai direttamente dentro le celle o alla sorgente di luce UV. Quando si vuole ispezionare la lampada o le celle, usare sempre delle protezioni adatte per gli occhi, quali vetro in borosilicato e polistirolo.

Disponibilità delle Parti di Ricambio

E' politica della Varian il fornire le parti di ricambio per lo strumento ed i suoi accessori per un periodo di cinque (5) anni a partire dalla data di produzione dell'ultima unità della serie. Le parti di ricambio saranno disponibili anche dopo questo periodo di cinque (5) anni ma solo in base alla disponibilità delle stesse. Per parti di ricambio si intendono i componenti elettrici e meccanici soggetti ad usura durante l'uso, in condizioni normali, dello strumento. Come esempio, citiamo i relay, le lampade, i probe di temperatura , i componenti del rivelatore, i motorini, ecc. Le parti strutturali o da fusione, le schede elettroniche ed i moduli funzionali possono essere ricostruiti e rimessi a nuovo durante tutto il loro periodo di vita e perciò sarà possibile acquistarli, dopo la produzione dell'ultima unità delle serie, solo in base alla loro disponibilità.

Servizi Tecnico

La Varian, alla scadenza del periodo di garanzia, è in grado di fornire ai suoi clienti un'ampia scelta di opzioni. Le riparazioni possono essere effettuate sulla base di contratti di manutenzione particolarmente vantaggiosi od in base ad una tariffa oraria piu' il costo delle parti. A richiesta, si possono avere corsi per operatori sia sotto forma di contratto che a tariffe da concordare.

Uffici Vendite della Divisione Strumenti Analitici della Varian

Per informazioni relative alla Vendita, al Servizio Tecnico o all'acquisto di Parti di ricambio, si prega di contattare l'ufficio Varian piu' vicino.

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Italy
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United Kingdom and Ireland
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Venezuela
Valencia
Tel. +58.41.257.608

United States
Walnut Creek, California, USA
Tel. +1.800.926.3000
(GC and GC/MS)

Tel. +1.800.367.4752
(LC)

VARIAN

www.varianinc.com

Instrucciones de Seguridad

Instrucciones de Operación

Este Manual de Instrucciones está diseñado para ayudarle a establecer las condiciones de operación que le permitan operar su instrumento de forma segura y eficaz. Así mismo, se describen consideraciones especiales ó precauciones, que aparecen en forma de **NOTA**, **PRECAUCION**, y **ATENCION** como se indica más abajo.Es importante que utilice el instrumento de acuerdo con este Manual de Operación y cualquier otra información que le proporcione Varian. Remita a la Oficina Local de Varian cualquier cuestión que tenga respecto al correcto uso de su equipo.

NOTA

Información para ayudarle a obtener unas prestaciones óptimas de su instrumento.

¡PRECAUCION!

Le alerta de situaciónes que pueden causar daños moderados a la salud ó al equipo, y cóm evitar esas situaciones.

ATENCIÓN

Le alerta de potenciales situaciones peligrosas que pueden causar serios daños, y cómo evitar esas situaciones.

Símbolo	Descripción
 **ATENCIÓN PELIGRO DE DESCARGA ELÉCTRICA**	El instrumento utiliza voltages peligrosos. Desconecte el interruptor general antes de retirar los paneles atornillados.
 **ATENCIÓN PELIGRO QUÍMICO**	Peligro de productos químicos. Evite el contacto, especialmente cuando rellene los depósitos. utilice protección de ojos y piel.
 **ATENCIÓN PELIGRO DE QUEMADURAS**	Superficies posiblemente calientes ó frías (criogénico). Utilice protección para la piel.
 **ATENCIÓN PELIGRO PARA LOS OJOS**	Las partículas volátiles, productos químicos o radiación UV pueden causar daños en los ojos. Usar las debidas protecciones para la cara y los ojos.
 **ATENCIÓN PELIGRO DE FUEGO**	Peligro potencial de fuego. Siga las instrucciones del Manual de Operación para su seguro funcionamiento.
 **ATENCIÓN PELIGRO DE EXPLOSIÓN**	Peligro potencial de explosión debido al tipo de gas ó líquido empleado.
 **ATENCIÓN PELIGRO DE RADIACIÓN**	Peligro por Fuente de radiación. Siga las instrucciones del Manual de Operación para su seguro funcionamiento.
 **ATENCIÓN PARTES EN MOVIMIENTO**	Mantenga alejados los dedos y las manos.

Precauciones Generales de Seguridad

Siga estas indicaciones de seguridad para una correcta operación del equipo.

- Realice verificaciones periódicas de fugas en todas las líneas de suministro y tuberías.
- No permita que las líneas de gas se doblen ó pinchen. Manténgalas alejadas de zonas de paso y del calor ó frío excesivo.
- Guarde los disolventes orgánicos en cabinas ventiladas, a prueba de fuego, y etiquetadas para que puedan ser fácilmente identificadas como material tóxico y/ó inflamable.
- No acumule disolventes inservibles. Deseche todo el material inservible a través de un programa especial de desechos y no a través del sistema convencional.

NOTA: Este instrumento ha sido testado bajo las normas de la Directiva EMC según requerimientos de la Marca CE de la Unión Europea. Por lo tanto, este equipo puede ser sensible a niveles de radiaciones / interferencias ó frecuencias que no estén incluidas dentro de los límites testados.

ATENCIÓN Este instrumento está diseñado para análisis cromatográfico de muestras preparadas apropiadamente. Debe ser operado usando gases y/ó disolventes apropiados y con unos niveles máximos de presión, flujos y temperaturas, según se describe en este manual.

ATENCIÓN El Usuario tiene la obligación de informar al Servicio Técnico de Varian cuando el instrumento vaya a ser empleado para análisis de muestras peligrosas de origen biológico, radioactivo ó tóxico, antes de comenzar a realizar cualquier análisis.

Peligros Eléctricos

- Desconecte el instrumento de todos las conexiones eléctricas a la red antes de retirar los paneles para evitar la posible exposición a peligrosos voltages.
- Cuando sea necesario emplear una clavija eléctrica no original, asegurese de colocar los cables de acuerdo con el código de colores y polaridades descritos en el manual y los códigos de seguridad de la red eléctrica.
- Sustituya los fusibles fundidos con fusibles del tipo y tamaño estipulados en el panel de fusibles ó en el manual.
- Sustituya los cables deteriorados inmediatamente con cables del mismo tipo y graduación.
- Asegureses de que los valores de las líneas de electricidad se ajustan a los valores para los que el Instrumento ha sido preparado.

Botellas de Gas Comprimido

- Guarde y maneje las botellas de gas con cuidado y de acuerdo con las normas de seguridad.
- Asegure las botellas a una estructura inmovil ó a la pared.
- Guarde y mueva las botellas en posición vertical. Retire los reguladores antes de transportarlas.
- Guarde las botellas en un área ventilada, lejos de fuentes de calor, de luz solar directa y de temperaturas extremadamente bajas.
- Identifique las botellas claramente para evitar cualquier duda sobre su contenido.
- Utilice sólamente reguladores y conexiones aprobadas.
- Utilice sólo tubos de conexión cromatográficamente límpios (Varian p/n 03-918326-00) y que tengan una graduación de presión significativamente mayor que la mayor presión del regulador.

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Siga estas indicaciones de seguridad para una correcta operación del equipo.

- Realice verificaciones periódicas de fugas en todas las líneas de suministro y tuberías.
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- Guarde las botellas en un área ventilada, lejos de fuentes de calor, de luz solar directa y de temperaturas extremadamente bajas.
- Identifique las botellas claramente para evitar cualquier duda sobre su contenido.
- Utilice sólamente reguladores y conexiones aprobadas.
- Utilice sólo tubos de conexión cromatográficamente límpios (Varian p/n 03-918326-00) y que tengan una graduación de presión significativamente mayor que la mayor presión del regulador.

GC Prácticas de Seguridad

Sistema de Extracción

No se necesita un sistema de extracción para los detectores GC instalados en un laboratorio bien ventilado, excepto cuando se analicen muestras químicas peligrosas. Si instala un sistema de extracción:

- Utilice conductos a prueba de fuego.
- Instale un ventilador al final del sistema.
- Instale entradas de aire cuya vibración no afecte al trabajo del detector.
- Compruebe periódicamente el correcto funcionamiento del sistema.
- Asegurese de una correcta ventilación del laboratorio.

Detectores con fuentes radioctivas

- Lea con cuidado y cumpla todas las **NOTAS**, **PRECAUCION**, y **ATENCION** del Manual del Detector Ni^{63} ECD.
- Realice los test de contaminación radioactiva descritos en el Manual del Detector Ni^{63} ECD.
- Cumpla con los plazos y procedimientos de test de fugas.

Peligro de Quemaduras

Las zonas de calor ó frío (criogénicas) del Cromatógrafo de Gases pueden permanecer calientes ó frías durante bastante tiempo después de apagar el instrumento. Para evitar quemaduras asegureses de que todas las áreas que se calienten ó enfríen han vuelto a la temperatura ambiente, ó protejase adecuadamente las manos, antes de tocar las superficies potencialmente calientes ó frías.

LC Prácticas de Seguridad

Peligro de Alta Presión

Si se rompe una línea de presión, ó se abre una válvula de seguridad accidentalmente bajo presión, la bomba puede generar líquidos a alta presión potencialmente peligrosos, produciendo un chorro a alta velocidad de líquidos volátiles y/ó tóxicos.

- Lleve protección facial cuando inyecte muestras ó realice mantenimiento de rutina.
- Nunca abra una línea ó una válvula bajo presión. Apague la bomba antes y deje que la presión baje a cero.
- Utilice depósitos irrompibles que sean capaces de operar a 50-60 psi.
- Mantenga cerrada la junta del depósito cuando se haye bajo presión.
- Lea y cumpla todas las **NOTA**, **PRECAUCION**, y **ATENCION** del manual.

Cromatografía Flash

El operador debe familiarizarse con las propiedades físico-químicas de los componentes de la fase móvil.

Alejar los disolventes del contacto directo con los tubos de poliuretano ya que ciertos disolventes pueden causar reblandecimiento de los tubos o posibles fugas con riesgo de explosión.

Todos los componentes del sistema deben estar conectados a un enchufe común con toma de tierra común. Esta toma de tierra debe ser una toma de tierra verdadera en lugar de flotante.

Los disolventes no-polares pueden originar carga estática cuando son bombeados por el sistema. Todos los recipientes que contienen fase móvil (incluyendo los tubos y los recipientes de recogida) deben estar conectados a tierra para disipar la electricidad estática.

Utilizar medidores de carga estática y los debidos dispositivos de descarga (por Ej., ionizadores de aire) para salvaguardarse contra la creación de electricidad estática.

Radiación Ultravioleta

Los detectores del Cromatógrafo de Líquidos que utilizan una fuente de luz ultravioleta disponen de protección para prevenir exposiciones radioactivas al personal.

Para una correcta protección:

- Asegurese de que las cubiertas de protección de la lámpara de los detectores está correctamente situada durante su funcionamiento.
- No mire directamente a las celdas del detector ó a la fuente de luz UV. Cuando inspeccione la fuente de luz ó la celda, utilice siempre una protección para los ojos como gafas de borosilicato ó poliestireno.

Disponibilidad de Recambios

Es Política de Varian disponer de Recambios para cualquier instrumento y la mayoría de los accesorios por un periodo de cinco (5) años después del último instrumento fabricado. Los recambios durante esos cinco años estarán disponibles, pero siempre bajo el sistema *"Según disponibilidad"*. Los Recambios están definidos como todas aquellas partes individuales mecánicas ó eléctricas que son susceptibles de fallo durante su normal proceso de operación. Por ejemplo, relés, lámparas, sondas de temperatura, elementos del detector, motores, etc. Las planchas de metal, partes de la estructura, placas de circuitos integrados, y otros módulos funcionales son normalmente susceptibles de reparación y por lo tanto sólo estarán disponibles bajos el sistema *"Según disponibilidad"* después del último instrumento fabricado.

Disponibilidad de Servicio

Varian ofrece una gran variedad de sistemas de Servicio para mantener el soporte a sus usuarios tras el periodo de garantía. El Soporte de Servicio se ofrece a través de atractivos Contratos de Servicio ó bajo un sistema de facturación de mano de obra y materiales. El mantenimiento y el entrenamiento se realiza por ingenieros cualificados bajo Contrato ó petición.

Oficinas de Instrumentación Analítica Varian

Para cualquier consulta sobre Instrumentación Analítica, Servicio Técnico ó Recambios y Accesorios, contacte con su oficina local:

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(GC and GC/MS)

Tel. +1.800.367.4752
(LC)

VARIAN

www.varianinc.com

Contents

Introduction

This manual contains hardware information for the Varian 210-MS and 220-MS Ion Trap Mass Spectrometers. This hardware manual has five chapters. The first chapter provides a functional description of the mass spectrometer (MS) and details of the instrument subsystems. The next chapter describes the installation and operation of the chemical ionization source. The third chapter contains mass spectrometer maintenance procedures. The fourth chapter describes troubleshooting procedures. The final section provides information about related documents, instrument parts, and contacting Varian.

Functional Description

Introduction

The 210-MS and the 220-MS GC/MS systems have four principal components:

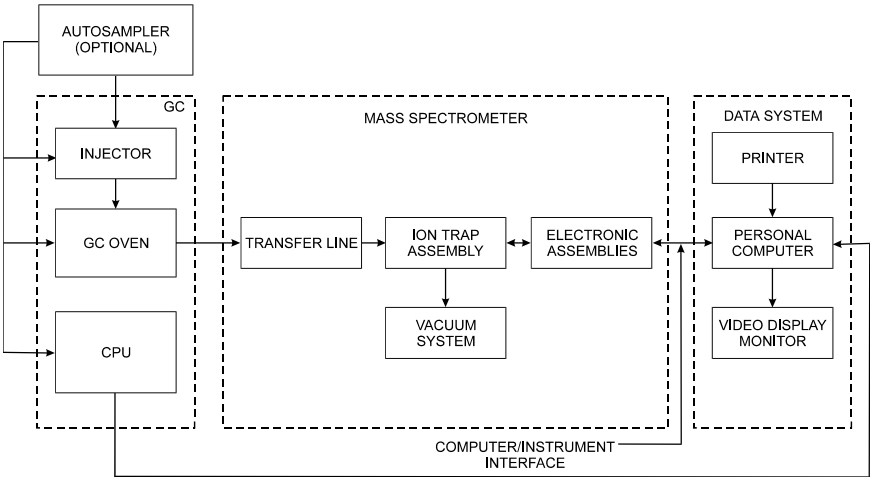
- Gas chromatograph (GC)
- Mass spectrometer (MS)
- Data system (DS)
- Autosampler (optional)

The following figure is a functional block diagram of the 210-MS and the 220-MS. A short, transfer line connects the GC and mass spectrometer. The autosampler sits on top of the GC.

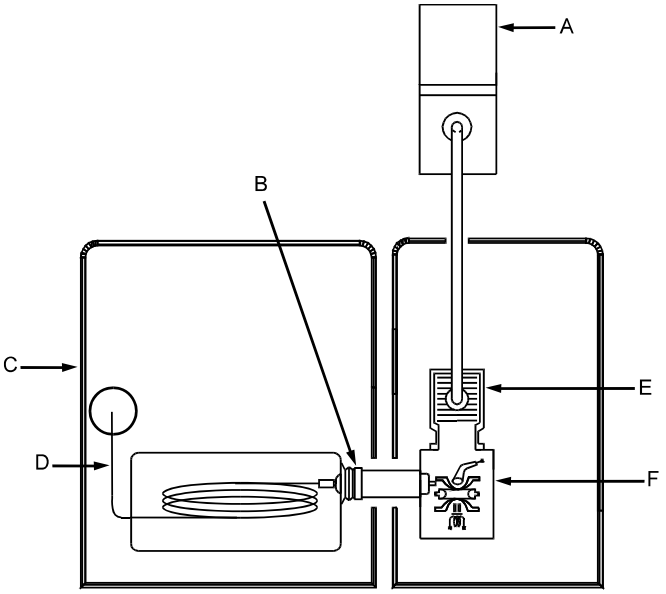
A fused silica capillary column in the GC passes through the transfer line directly into the ion trap assembly (see “Principal Components of 210-MS and 220-MS” on page 8). Samples are injected either manually or using the autosampler onto the capillary column through the GC injection port.

The gas chromatograph then separates the sample molecules. Effluent from the GC passes through the transfer line and into the ion trap. The sample molecules next undergo electron or chemical ionization before being analyzed according to their mass-to-charge ratios.

The ions are detected by an electron multiplier, which produces a signal proportional to the number of ions detected. The electron multiplier passes the ion current signal to the system electronics, which in turn amplify the signal, digitize the result, and pass it on to the data system for further processing and display. Refer to the following functional block diagram of the 210-MS and the 220-MS.



Functional Block Diagram of the 210-MS and the 220-MS



A	Foreline Pump	D	Capillary Column
B	Transfer Line	E	Turbomolecular Pump
C	GC Oven	F	Ion Trap Assembly

Principal Components of 210-MS and 220-MS (Top View)

Gas Chromatograph (GC)

The 210-MS and the 220-MS include high performance Varian Model Gas Chromatographs. The 210-MS includes the 431-GC, and the 220-MS includes the 450-GC. The gas chromatographs come with the 1177 or 1079 Universal Capillary Injector that provides five modes of injection: isothermal split, isothermal splitless, temperature-ramped splitless, on-column, and large volume. For more details about the GC, see the Varian 450-GC User Manual (CP501411) or the Varian 430-GC and 431-GC User Manual (CP501406).

Mass Spectrometer (MS)

The 210-MS and the 220-MS are ion trap mass spectrometers. The mass spectrometer consists of mechanical and electronic assemblies. The following sections describe these assemblies.

The instrument is separated into the electronics and analyzer compartments. The electronics compartment includes the following:

- Controller board
- Power board

The analyzer compartment includes the following:

- Transfer line
- Vacuum manifold (including the ion trap)
- Vacuum pump and controller
- RF coil and generator
- Pneumatics manifold
- Manifold Board

Mechanical Assemblies

The 210-MS and the 220-MS mechanical assemblies include the following:

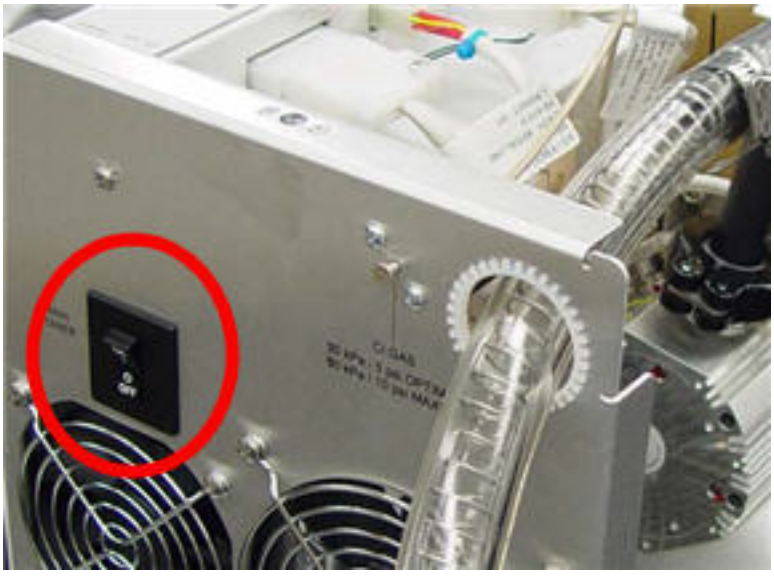
- Controls and indicators
- Cooling fans
- Vacuum system
- Transfer line
- Ion trap assembly

Controls and Indicators

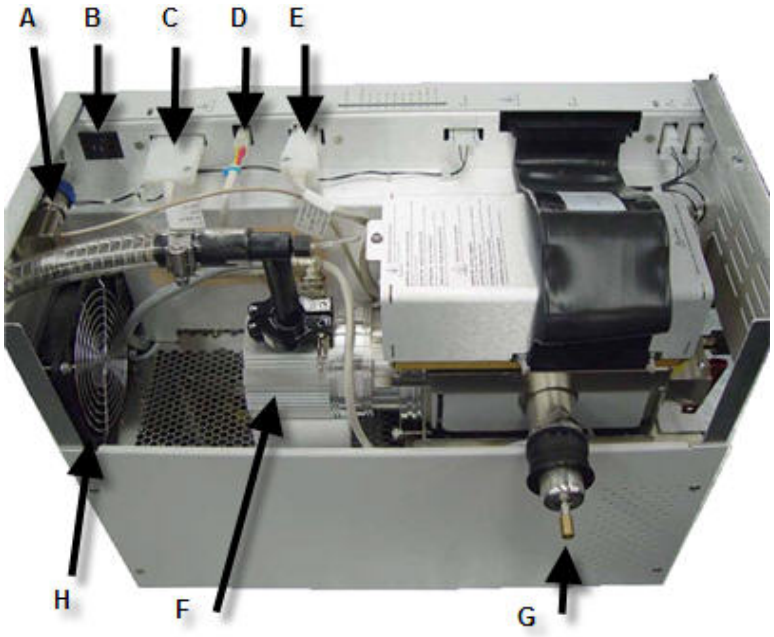
Located on the rear panel, the main power switch for the 210-MS and the 220-MS controls the power to the vacuum system and to the electronics. As the main power switch is turned on, it illuminates the light-emitting diode (LED) on the MS front panel.

WARNING

In the event of an emergency, shut off all power to the 210-MS or 220-MS by putting the main power switch in the OFF position and unplugging the instruments.

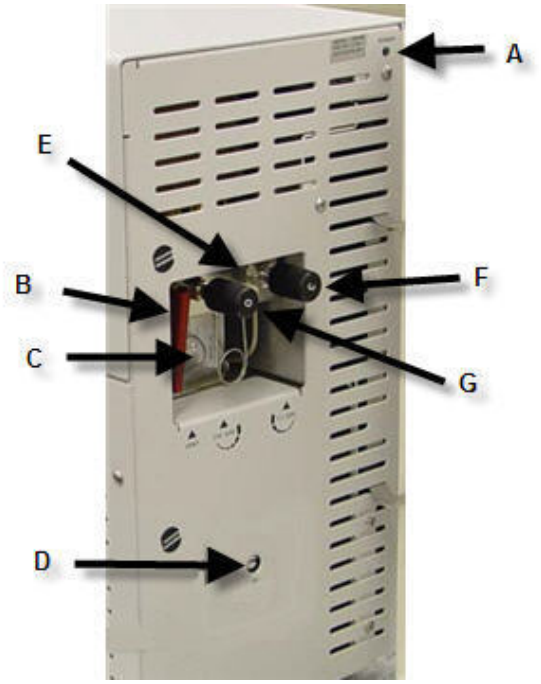


Main Power Switch (Rear Panel)



A	Chemical Ionization (CI) Shutoff Valve	E	Manifold Heater
B	Service Switch	F	Turbomolecular Pump
C	Transfer Line Heater	G	Transfer Line
D	Trap Heater	H	Cooling Fan (1 of 2)

Mass Spectrometer (Top View)



A	LED	E	Pneumatics Manifold
B	Vent Valve	F	CI Cal Gas Adjust
C	Cal Gas Vial	G	Cal Gas Adjust
D	RF Coil Adjustment Screw		

Mass Spectrometer (Front Panel)

Cooling Fans

Two fans mounted on the rear panel of the spectrometer cool the unit. The analyzer compartment fan draws air from the back, blowing it directly on the bearing end of the turbomolecular pump in the analyzer compartment. The air then flows past the manifold electronics and out the front of the instrument. The turbomolecular pump controller supplies power to the analyzer compartment fan.

The electronics section fan draws air from the back and blows it across the controller and power boards in the electronics compartment. Hot air from the GC oven does not affect the MS as long as the system is at least six inches from a wall. The power board supplies power to the electronics compartment fan.

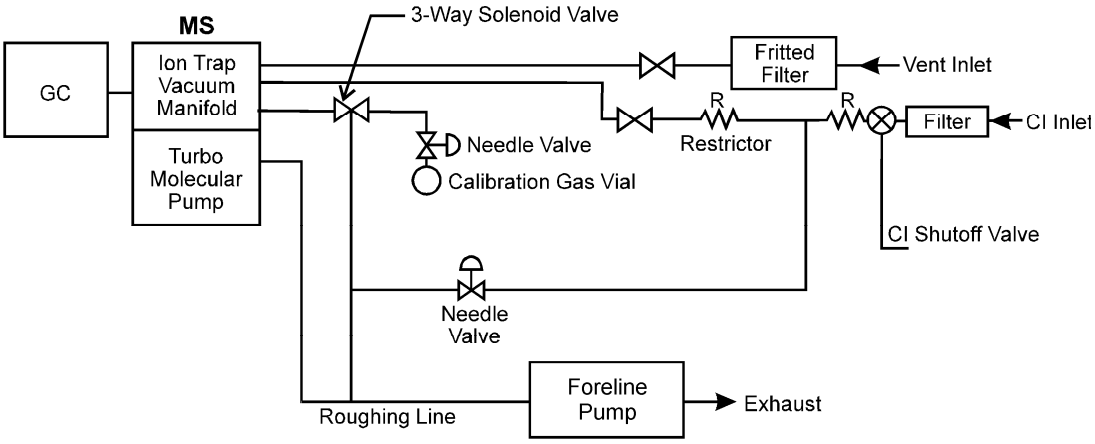
CAUTION

To prevent overheating, do not block cooling fans air intakes.

Vacuum System

The vacuum system evacuates water vapor, air, and carrier gas from the mass spectrometer ion trap assembly. Principal vacuum system components include

- Vacuum manifold
- Turbomolecular pump
- Foreline pump
- Vent valve
- Cal gas valve
- Chemical Ionization (CI) reagent gas valves



The 210-MS and the 220-MS Vacuum System Diagram

Vacuum Manifold

The vacuum manifold, which can be heated for bakeout, encloses the ion trap assembly. The vacuum manifold is a stainless-steel tube, which houses the analyzer. The turbomolecular vacuum pump, which evacuates the manifold, discharges into a foreline pump.

The vacuum manifold sits on top of the RF coil housing. The turbomolecular pump makes an airtight seal with the manifold, to which it is mounted horizontally with a Viton® O-ring. The ion trap assembly suspends from the analyzer flange, and extends into the body of the manifold. The manifold makes an airtight seal with the analyzer flange, also using a Viton® O-ring. Quick release tabs permit easy removal of the trap in the absence of vacuum.

Eight electrical feed-throughs pass through the analyzer flange:

- One for the electron gate
- Three for the filament assembly
- Two for the axial modulation voltages applied to the filament and multiplier end cap electrodes of the ion trap assembly
- One for the high voltage to the electron multiplier cathode

- One for the ion current signal from the electron multiplier anode

Another feed-through passes through the underside of the manifold to provide radio frequency (RF) voltage to the ring electrode.

An ion gauge monitors the pressure inside the manifold by generating and collecting ions from any gas present. The ion gauge also passes through the analyzer flange.

Four additional inlets introduce material into the vacuum manifold, including one inlet each for

- Transfer line
- CI reagent gas
- Introduction of the cal gas
- Venting

Turbomolecular Vacuum Pump

A turbomolecular vacuum pump provides the high vacuum for the 210-MS and the 220-MS. Under normal operating conditions, this pump provides a vacuum of approximately 10^{-5} Torr (1.33×10^{-3} Pa) in the manifold region outside the ion trap assembly. The pump is rated at 80 liters/second and operates at 60 liters/second; it is air cooled and thermostatically protected. If the temperature of the pump housing near the bearing exceeds 60 °C, the pump speed automatically shuts down.

A turbomolecular-pump controller regulates and supplies power to the pump. The controller sits below the pump in the analyzer compartment of the spectrometer. Turning off the main power switch on the rear panel of the mass spectrometer shuts off power to the turbomolecular-pump controller and foreline pump.

NOTE: The electronic Service switch does not control the vacuum pumps.

The turbomolecular-pump controller monitors the pump's rotational speed. The controller sends a signal proportional to the pump speed to the MS controller board through the power board. You can monitor the turbomolecular pump speed from the Diagnostics view in the System Control module window.

If the speed of the turbomolecular pump is equal to or greater than 92% of the maximum operating speed, the signal from the controller prompts the power control board to send a TURBOMOLECULAR SPEED OK signal to the controller board. The controller board uses the signal to enable or disable the filament, electron multiplier voltage, RF generator, Chemical Ionization (CI) reagent gas valve, and cal gas valve by means of an electronic interlock.

If the pump speed falls below 92% of its maximum operating speed, the TURBOMOLECULAR SPEED OK signal to the controller board turns off. The filament, electron multiplier, RF generator, CI reagent gas valve, and cal gas valve turns off automatically. This condition probably indicates a major air leak in the system or that the pump is too warm. If that happens, locate and fix the leak.

Pneumatics Manifold

The pneumatics manifold is an aluminum block mounted to the front of the vacuum manifold. It is equipped with two solenoid and two needle valves for the cal gas and CI cal gas, the cal gas vial, and vent valve.

The vent valve is a manually operated valve that connects to the atmosphere through the pneumatics manifold. You open and close the vent valve using a toggle arm, which is accessible from the front of the instrument.

The calibration-gas-valve assembly consists of a metering needle valve, an ON/OFF solenoid-operated valve, and a glass vial containing the calibration liquid. The assembly sits directly behind the instrument's door. The needle valve controls cal gas flow into the vacuum manifold through the solenoid valve.

The calibration compound is perfluorotributylamine (PFTBA) or $C_{12}F_{27}N$, also known as fluorocarbon-43 (FC-43). A small glass vial attached to the valve assembly holds the compound. You set the flow of cal gas into the manifold manually using a needle valve. The data system controls the opening and closing of the solenoid-operated valve.

Two solenoid valves control the flow of CI reagent gas into the manifold. First, the shutoff valve near the rear panel opens to permit reagent gas flow into the instrument through a fitting. When this valve is open, the foreline pump removes a portion of the CI gas to prevent CI gas surges (pressure pulses) in the ion trap. The gas then flows through the shutoff valve through metering and solenoid-operated valves before entering the vacuum manifold. With the CI gas solenoid open, the CI needle valve determines the split ratio of the reagent flow between the manifold and foreline pump.

You turn the CI reagent gas valve on and off using the data system from System Control or Acquisition. You adjust the flow rate of the reagent gas into the manifold by means of a metering valve.

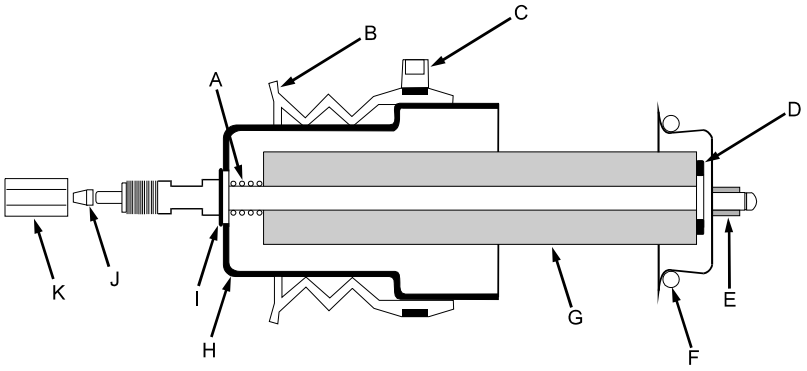
Transfer Line

A stainless-steel-tube transfer line directly couples the GC to the mass spectrometer. The transfer line keeps the GC column warm as the column enters the mass spectrometer. The transfer line is 12 cm (5 in.) long, and has a diameter of 4.1 cm (1.6 in.). One end enters a hole in the right side of the GC before passing into the GC oven. The other end enters the vacuum manifold with the transfer-line tip inserted into the ion trap.

WARNING:
BURN HAZARD

The body of the transfer line is hot. Ensure it is cool before touching or use protective gloves.

The body of the transfer line consists of a stainless-steel weldment fitted with a center tube, a heat exchanger, and a boot. The heat exchanger is an aluminum cylinder that contains a cartridge heater and a thermocouple as the temperature sensor. The temperature sensor measures the temperature of the tube. The cartridge heater heats the cylinder, which in turn distributes heat evenly throughout the length of the transfer line tube. The boot of the transfer line, which attaches to the GC, prevents hot air leakage from the GC Oven.



A	Spring	G	Heat Exchanger
B	Boot	H	Nose
C	Tie Wrap	I	E-Ring
D	Washer	J	Ferrule
E	Transfer Line Tip	K	Nut
F	O-Ring		

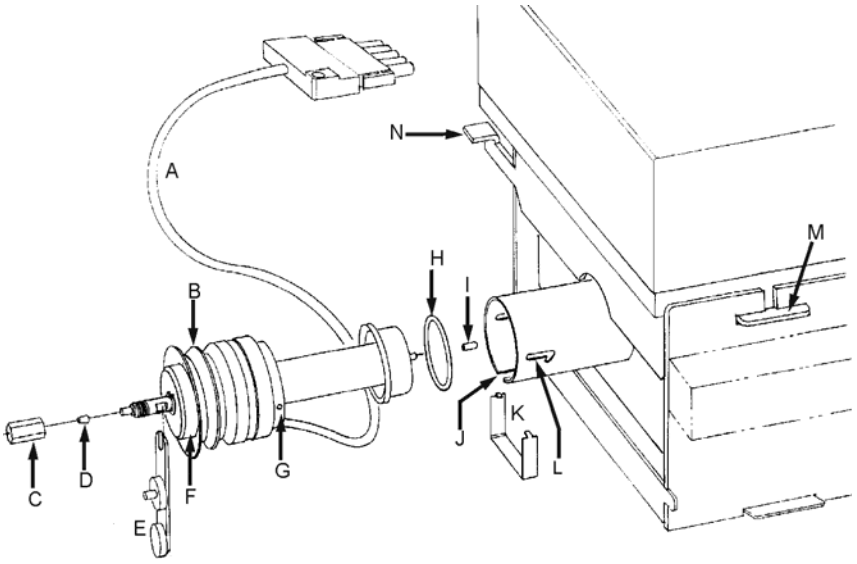
Transfer Line

A bayonet mount feature secures the transfer line. Before you remove the trap, push gently on the bayonet mount as you twist it counterclockwise and pull out the mount. Make sure the transfer line extends out from the trap.

NOTE: Failing to remove the transfer line before removing the trap may damage the trap heater post.

The power board supplies power to the cartridge heater through a transfer line heater cable. The heater cable projects out from one end of the transfer line. It then plugs into a soft-shell connector on the top of the power board panel.

Set the transfer line temperature from the Temperature view in System Control. The maximum temperature that the transfer line can sustain is 350 °C; the minimum temperature depends on the GC oven and trap temperatures. In general, you can set the transfer line temperature as much as 30 °C below the maximum column operating temperature and not observe adverse chromatographic effects (e.g., retention time shifts or peak broadening).



A	Heating Cable	H	O-ring
B	Boot	I	Transfer Line Tip
C	Nut	J	Heating Cable Slot
D	Ferrule	K	Nose Clip
E	Transfer Line/Alignment Tool	L	Bayonet Mount
F	Nose	M	Analyzer Assembly Tongue
G	Nose Hole	N	Analyzer Assembly Lock-Down Tabs

Transfer Line Assembly

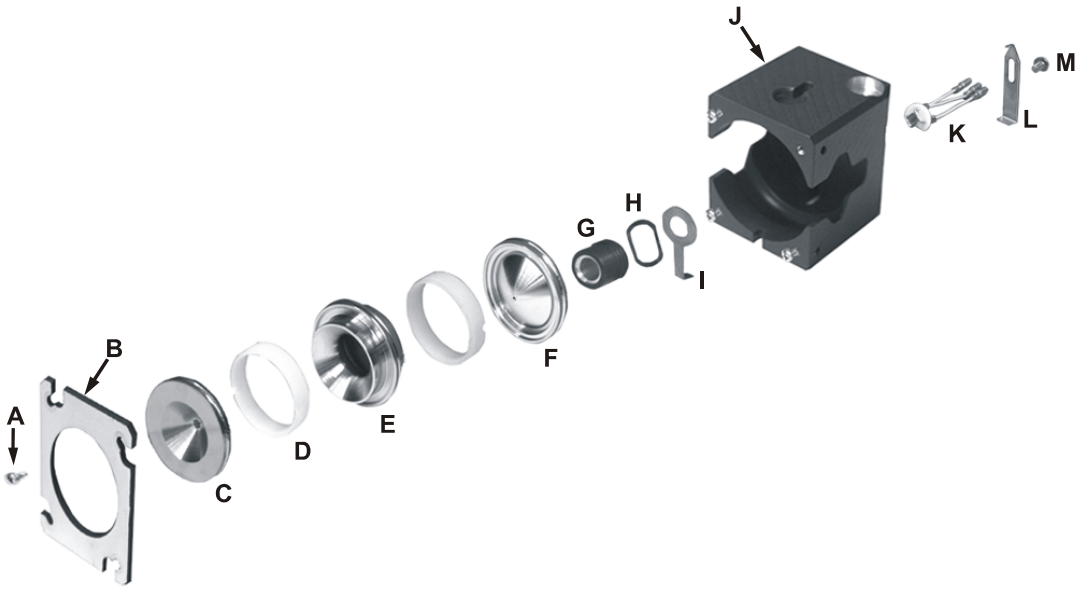
Ion Trap Assembly

The ion trap assembly consists of the following:

- Trap oven
- Filament assembly
- Electron gate
- Ion trap electrodes (3)
- Quartz rings (2)
- Electron multiplier assembly

The figure below shows the ion trap assembly along with its three electrodes, electron gate, and filament lens.

NOTE: The Silica-Coated Spacers have a shiny, mirror like finish on the inside surface.



A	Screw, 6/32, 4 places	H	Wave Washer
B	Clamping Plate	I	Gate Conductor
C	Exit-End Cap	J	Trap Oven, “T” is located this side.
D	Quartz or Silica-Coated Spacer, 2 places	K	Filament Assembly
E	RF Ring Electrode	L	Filament Clip
F	Filament (entrance) End Cap	M	Screw
G	Electron Gate		

Ion Trap Assembly

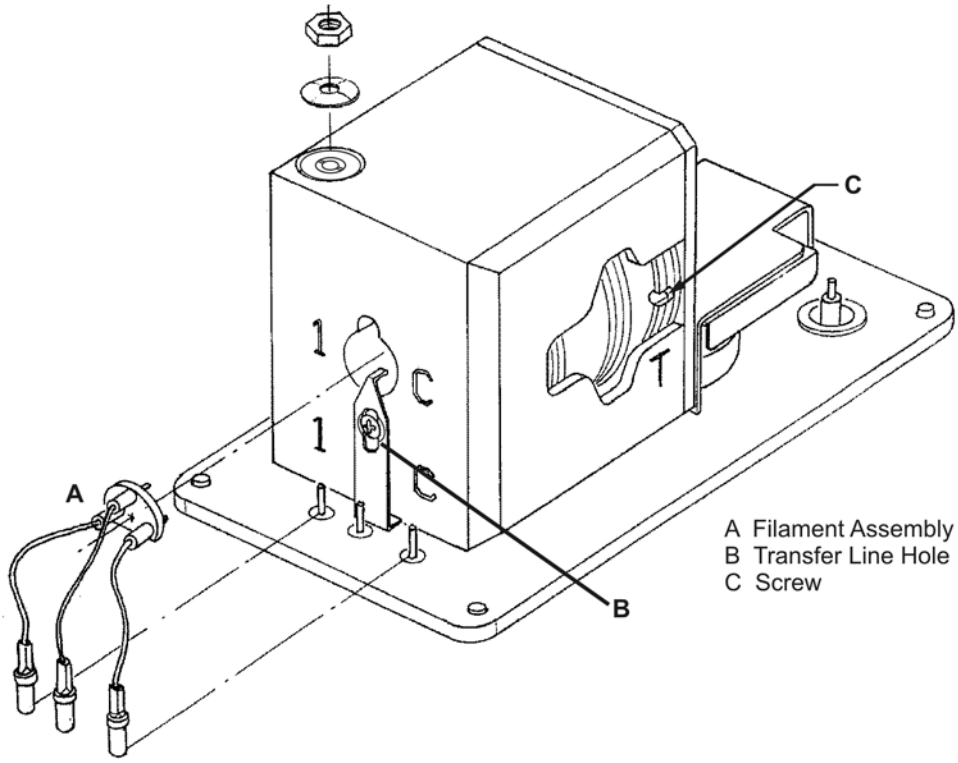
Trap Oven

The trap oven is a heated anodized aluminum block that maintains a uniform temperature for the trap electrodes. A heater post on the manifold flange generates the heat. A thermal well measures the oven temperature. In addition, the oven holds the ionization filaments and acts as a lens for focusing the ionizing electrons before they enter the trap.

Filament Assembly

The filament assembly sits in the trap oven. It is connected to three feed-throughs on the manifold flange.

The filament assembly consists of two filaments and a repeller plate. The two filaments are mounted side-by-side, with each filament approximately equidistant from the entrance hole of the oven’s electron focusing lens. Note that the 210-MS and the 220-MS only use one filament at any given time; the extra filament is provided as a back up in case the first one burns out.



Filament Assembly Shown with Ion Trap

Each filament is a rhenium wire. When sufficiently heated by electric current, the filament produces electrons by thermionic emission. The filament emission current refers to the flow of emitted electrons from the filament. The magnitude of the filament emission current is set in the Instrument Control Page. Emission current settings range from 5 to 100 μA.

NOTE: It is unlikely that two filaments will have the same net flow of electrons into the ion trap. Thus, the signal amplitudes from two different filaments will probably not be the same. A typical difference is 2:1, but it may be as high as 5:1.

Electron Gate

The electron gate is a cylindrical electrode that controls the entry of electrons into the ion trap cavity. When electrons emitted from the heated filament are not required for ionization, the electron gate is held at a -150V dc potential. The electron gate sits inside the trap oven, in front of the lens and behind the entrance-end cap electrode. An anodization layer insulates it from the filament-end (entrance) cap.

When the ion trap requires electrons, the electron gate potential changes from -150 to +150V dc. The gate potential remains positive for a variable length of time, e.g., from 10 μsec to 65 ms. During this interval, the electrons are focused into the ion trap cavity with sufficient energy, usually, 50 to 80 eV, to achieve electron ionization of the sample molecules (or of the reagent gas molecules in the case of chemical ionization).

Ion Trap Electrodes

The ion trap assembly contains three stainless steel electrodes:

- Filament (entrance) end cap electrode
- Exit-end cap electrode
- RF ring electrode

The filament-end cap, exit-end cap, and RF-ring electrodes have hyperbolic inner surfaces. Together, these electrodes form a cavity in which ionization, fragmentation, storage, and mass analysis take place.

Energetic electrons enter the ion trap cavity through the filament-end cap using the electron gate.

There are seven holes in the center of the exit-end cap electrode. Sample ions produced in the ion trap are ejected through these holes into the electron multiplier.

Two identical quartz or silica-coated spacers separate the central ring electrode from the filament and exit-end cap. The trap oven and its clamping plate hold the electrodes and spacers in place. A cutout is provided in the quartz spacers and in the exit-end cap to allow the transfer line to enter the ion trap.

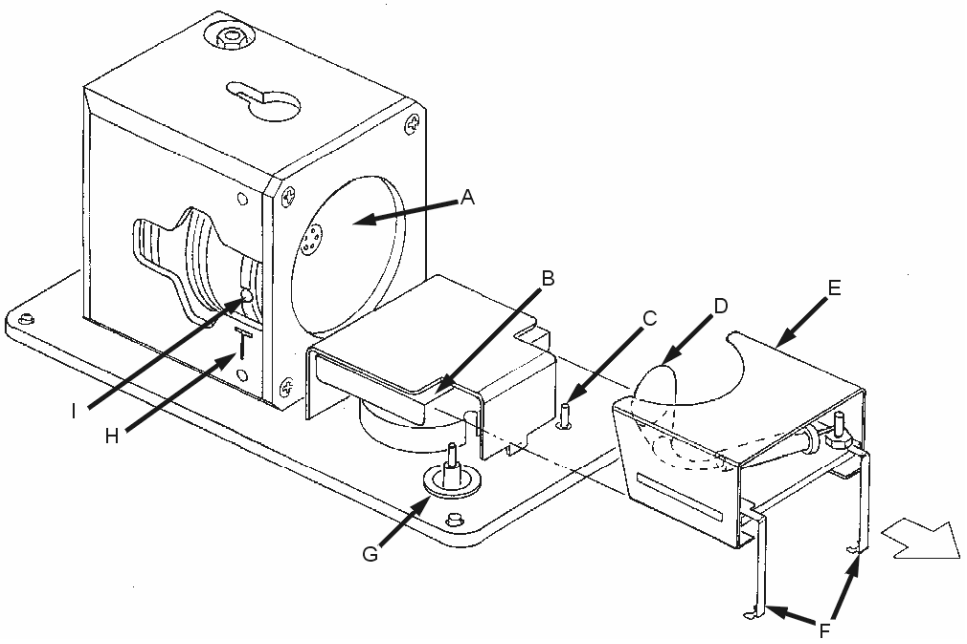
The RF generator assembly provides high voltage RF that is applied to the RF ring electrode.

Under the proper RF voltage, the ion trap electrodes create a three-dimensional, hyperbolic electric field. This field is capable of trapping the ions in stable, aperiodic orbits. As the RF voltage increases, however, the ion trajectories become unstable in increasing order of mass per charge. The ion trap ejects the ions and sends them to an electron multiplier for detection.

During mass analysis, a supplementary RF voltage of 485 kHz is applied to the filament- and exit-end caps. This voltage, termed the axial modulation voltage, improves spectral mass resolution and analytical sensitivity. Other voltages may be applied between the end caps to implement such options as CI and MS/MS.

Electron Multiplier

The electron multiplier is positioned at the exit-end cap electrode. It mounts in a pre-aligned position on a protective metal clip that you can easily remove to replace the multiplier. The multiplier detects positive ions as the ion trap ejects them through the holes in the exit-end cap electrode. The continuous-dynode electron multiplier consists of a lead-oxide/glass, funnel-like resistor. A negative voltage of between -800 and -3000V is applied to the front end of the electron multiplier, referred to as the cathode. The back end of the cathode is held at ground potential, and is referred to as the anode.



A	Exit-End Cap	F	Multiplier Contacts
B	Electron Multiplier Track	G	Multiplier High Voltage Pin
C	Multiplier Signal Pin	H	Transfer Line Alignment
D	EM Grid	I	Transfer Line Entrance Hole
E	Electron Multiplier Mount		

Position of the Electron Multiplier Relative to the Ion Trap

The negative voltage applied to the cathode attracts the positive ions ejected from the ion trap cavity. These ions strike the cathode with sufficient velocity to dislodge electrons from the inner curving surface of the cathode. The increasingly positive potential gradient draws the ejected electrons into the electron multiplier, further accelerating them in the process. Because the electron multiplier is curved, the ejected electrons do not travel far before they again strike the inner surface of the multiplier, resulting in the emission of more electrons. This configuration produces a cascade of electrons that is accelerated toward ground potential at the exit-end of the cathode.

The anode collects the electrons, and passes the resulting ion current signal on to the integrator circuit on the lower manifold board. The ion current signal is proportional to the total number of electrons that the ion trap ejects. Typically, you will adjust the voltage applied to the electron multiplier until the gain is about 10^5, for example, until each ion that enters the electron multiplier generates approximately 10^5 electrons.

Ion Gauge

The design of the optional ion gauge for the 210-MS and the 220-MS is based on the Bayard-Alpert gauge tube. The specifications for the gauge are similar to those of commercially available gauges. Fixed pressure readings with nominally identical gauges may exhibit variations of ±15%. An accuracy of ±25% in mid-range for any one gauge is considered typical.

In general, the ion gauge exhibits good repeatability. However, the ion gauge response depends on gas composition. A certain pressure of air and water will give a different reading than that of Helium. The ion gauge is meant to be a rough indicator of vacuum conditions. It is not a precise quantitative tool.

The gauge uses thoria-coated iridium (ThO-Ir) filaments. These filaments are burnout resistant, and therefore exhibit high tolerance to air and water in the vacuum manifold. There is a time delay associated with heating the filament. This delay translates to a delay in determining whether a filament is open. To obtain a stable reading, you usually need between 15 to 20 seconds after the filament is turned.

The ion gauge will measure pressures between 10^{-6} and 10^{-2} Torr. A logarithmic amplifier amplifies the collector current, and the data system interprets this current as measured vacuum.

Foreline Pump

A foreline pump has two purposes. The first is reducing the vacuum system pressure to a level that will allow the operation of the high vacuum turbomolecular pumps. The second is maintaining the vacuum system pressure by removing the exhaust gases of the high vacuum pump.

The foreline pump is connected to the high vacuum pump by a 2.1m (84 in.) length of 1.9 cm (0.75 in.) ID vacuum tubing. The pump plugs into the rear panel outlet labeled “J2 - LINE VOLTAGE - PUMP ONLY” on the rear of the MS. Power is supplied through this outlet and is controlled by the power switch on the rear panel.

The foreline pumps used with the 210-MS or 220-MS are two-stage rotary vane pumps with pumping speeds of 45 L/min.

WARNING:
CHEMICAL HAZARD

If you use the 210-MS or the 220-MS to analyze hazardous materials, be sure to affix the foreline pump exhaust to an exhaust system that complies with applicable safety and environmental regulations.

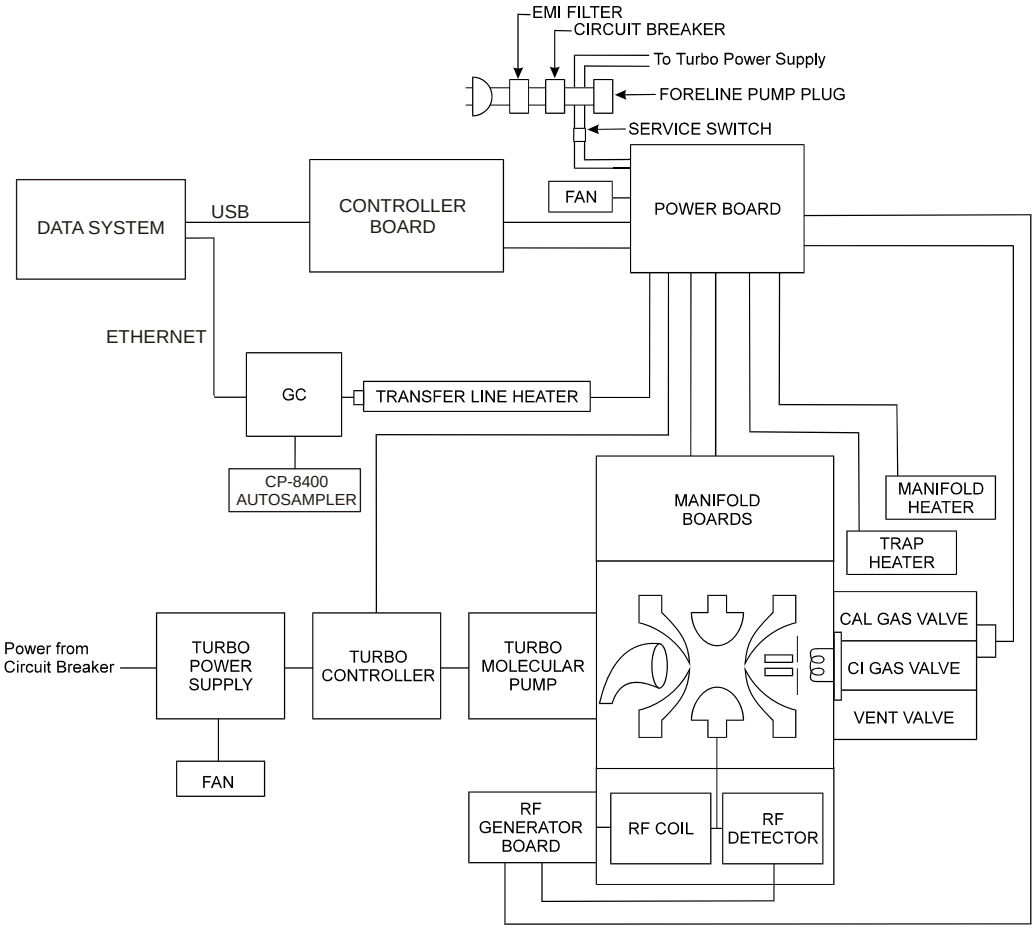
Electronic Assemblies

The electronic assemblies consist of the following:

- Power input subsystem and turbomolecular pump controller
- Power board
- MS Controller board
- Manifold electronics assembly
- RF generator board

The electronics functions are distributed throughout the spectrometer to minimize cable lengths between critical components. The MS controller and power boards reside in an electronics enclosure that is separated from the analyzer section by a sheet metal bulkhead. The manifold electronics are enclosed directly above the analyzer. The RF generator attaches to the rear of the RF coil assembly.

The following is a diagram of the electronic assemblies:



The 210-MS and the 220-MS Pump Electronic Assemblies

Power Input Subsystem and Turbomolecular Pump Controller

The power input subsystem contains the following circuits and switches:

- MAIN POWER switch
- Service switch
- Line voltage selector switches

Main Power Circuit

Line power of 120 ± 10%V ac, 60 Hz ± 3 Hz (or 230 ± 10%V ac, 50 Hz ± 3 Hz) first enters the rear panel of the mass spectrometer through J1, and then passes through the line filter and the circuit breaker. After the circuit breaker, power is split in two directions. One path supplies the turbomolecular pump controller and foreline pump through J2. The second path goes to the electronics service switch, which controls power going to the power board and the rest of the electronics. The electronics service switch allows the vacuum to be maintained in the event that the electronics need to be serviced.

The line voltage selector switches are located on the power board and the turbomolecular controller. These switches are set at the factory.

NOTE: The 210-MS and the 220-MS cannot be switched from 115V to 220V without also changing all the heaters.

The turbo controller regulates the speed of the turbo pump. The controller provides turbo speed and startup power to the power board.

WARNING:
SHOCK HAZARD

In the event of an emergency, shut off all power to the 210-MS or the 220-MS by moving the main power switch to the OFF position.

Power Board

The power control board supplies power to all electronics components except the turbomolecular controller. It controls the heaters, ion trap and ion gauge filaments, and solenoid valves.

NOTE: The switching power supply is protected by a 5A, non-time-delay fuse.

The following switching power supplies reside on the board:

- The +5V dc power supply, which supplies voltage to all digital circuits.
- The -15V and +15V dc power supplies, which supply the voltages to the analog circuits on the power board and the manifold electronics assembly.
- The +20V and -20V dc power supplies, which supply the voltages to the controller and RF generator board's analog circuitry.
- The +24V dc power supply supplies power for the solenoid valves, electronics compartment fan, and the electron multiplier power supply.

- The +60V dc power supply, which supplies unregulated +60V dc voltage to the RF generator board and trap heater.
- The +180V and -180V dc power supply that supplies voltage to the ion trap electron gate circuit and the ion gauge.

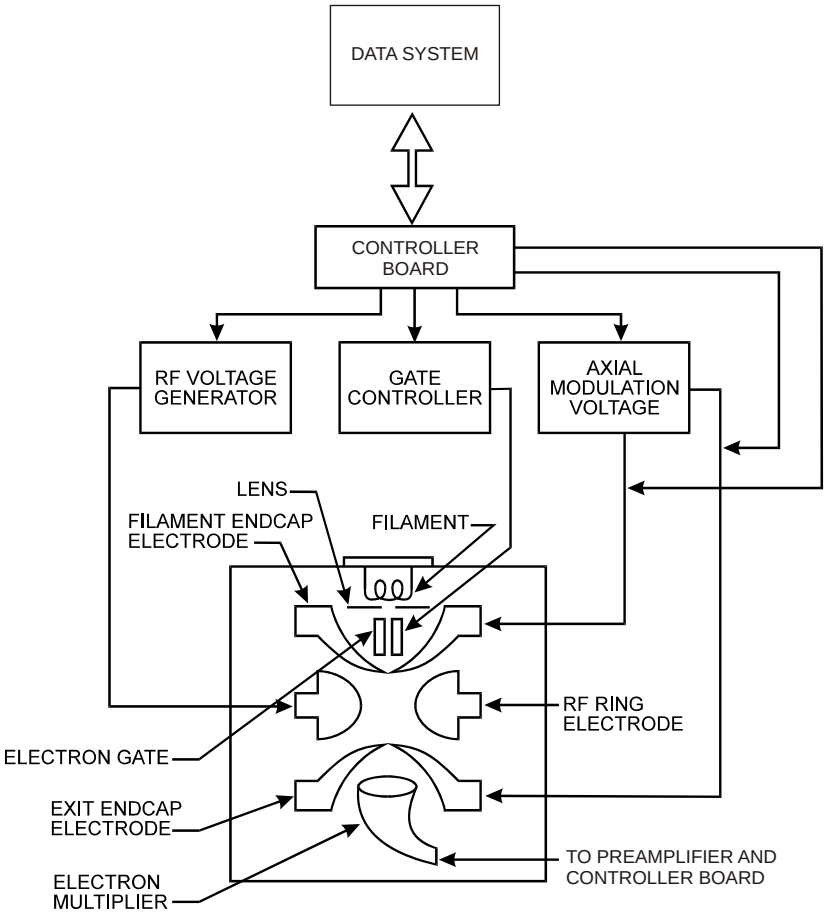
The following circuits are also on the board:

- The trap and ion gauge filament control circuits, which provide current to heat the filament and regulate the emission current from the filament. The trap-filament emission current is set between 5 and 100 μA using the data system.
- Three heater control circuits that provide feedback control for the manifold, trap, and transfer-line heaters. The trap heater uses a proportional integral (PI) control circuit.
- Three solenoid control circuits, which turn the cal gas, CI reagent gas, and CI shutoff valve solenoids on and off.
- The electron energy control circuits, which controls the dc bias on both the ion trap and ion gauge filaments.
- The diagnostic multiplexer circuit, which routes the voltage output of various components, and circuits on the power control board to the controller board. You can access these voltage outputs through the diagnostic pages.
- Mounted on the top edge of the power board are 12 monitor LEDs. When illuminated, these lights indicate that the voltages of the various circuits on the power board are at the correct levels, and that there are no faults. During normal operation, all LEDs, except the +180V and -180V, should be on. The LEDs for +180V and -180V only turn on when the filaments are on.

RF Generator Assembly

The RF generator assembly consists of an RF generator circuit board, an RF detector circuit board, and the RF coil. A shielded housing beneath the vacuum manifold encloses the coil and RF detector circuit board. The RF generator circuit board is attached to the back of the shielded housing.

The RF generator circuit board receives an analog signal from the controller board that is proportional to the current mass position in the scan, which is in turn proportional to the RF voltage applied to the ion trap. The RF detector circuit board sends a signal to the RF generator; this signal is proportional to the actual amount of RF voltage applied to the ion trap. The RF generator board compares the desired and actual RF voltages, and based on this feedback, adjusts the gain to modify the applied RF voltage amplifier to equal the desired RF voltage level. Since the high voltage required by the ion trap exceeds the capabilities of conventional electronic amplifiers, a resonant LC circuit consisting of the RF coil and the ion trap capacitance is used. At resonance, the RF voltage at the ion trap-end of the coil is about 100 times that at the RF generator circuit-end of the coil.



The Ion Trap Assembly

Manifold Electronics Assembly

Two boards reside in the enclosure directly atop the analyzer flange. The following circuitry, which is critical to the functioning of the ion trap or must be in close proximity to the trap, resides on these boards.

- The electron multiplier power supply provides high voltage (-800 to -3000V dc) to the cathode of the electron multiplier.
- The integrator circuit, which receives the amplified ion current from the anode of the electron multiplier, converts the current into voltage, for example, 10^{-7}A into 1.0V, and passes the voltage on to the controller.
- The trap filament selection relay.
- The electron gate control controls the gate polarity.
- The axial-modulation low- and high-frequency transformers and amplifiers.
- The ion gauge support circuitry, which includes filament On/Off and selection relays and a log amplifier for gauge read-back signal conditioning.

MS Controller Board

The controller board provides the real-time control and data acquisition function of the mass spectrometer. The controller board communicates with the data system using the USB interface of the data system computer. The MS controller performs the following functions:

- Interprets instrument commands from the data system and produces a sequence of analog and digital signals that control the operation of circuits on other 210-MS or 220-MS boards
- Collects analog and digital diagnostic data from other subsystems and transmits that information to the data system
- Filters, integrates and digitizes the ion current signal, and transmits the spectra to the data system
- Generates axial modulation waveforms, including waveforms used by CI, MS/MS, and SIS options

Upon power-up, the controller's processor runs a ROM resident program that initializes the board. The program permits the processor to receive information through the USB interface. When you start up the 210-MS or the 220-MS data system, operating information is downloaded to the RAM memory of the controller board. The controller board then performs its operations in response to the commands sent through the USB interface.

NOTE: The controller board is accessed through two connectors on the rear panel of the instrument. J42 is a USB connection used for connecting to the Data System. J43 is a D-shell connector labeled, Remote Option, and is used for special research applications and the GC start signal.

When a mass spectrum is acquired, the data system downloads parameters such as electron multiplier voltage, scan range and time, ionization mode, and so on. The controller board uses this information to create a scan over the desired mass range. During the scan, ion current data is accumulated and, at the end of the desired scan time, sent to the data system for further processing and display.

The waveform generator is capable of generating waveforms over a wide range of frequencies and amplitudes. The data system produces a digital version of the desired time-domain waveform, and downloads the resulting binary file to the random access memory (RAM). At the appropriate time, the data is clocked out of the RAM into a waveform reconstruction DAC. The DAC output is then filtered to remove undesirable frequencies. The 210-MS and the 220-MS use the waveform generator in chemical-ionization (CI), MS/MS, or SIS applications; as well as in normal axial modulation.

Components of the waveform generator include the following:

- Dual-port RAM (256 Kbytes) to provide memory for single or multiple digitized waveforms
- A selectable frequency generation clock (625 KHz, 1.25 MHz, or 2.5 MHz and a 15-bit variable-length counter to control timing
- A 12-bit DAC, low-pass filter and amplifier to reconstruct waveforms
- A variable operational frequency range that depends on whether you are using the high frequency transformer (12 to 500 KHz) or low frequency transformer (200 Hz to 1.25 KHz)
- Two transformers located in the manifold electronics assembly, which are used to apply the waveform output to the end cap electrodes of the ion trap

NOTE: Before you can use any of the waveform options, for example, CI, MS/MS, or SIS, the waveform key(s) must be inserted into sockets U5, U6, or U7. The key(s) should be installed by the factory, or by a Varian Customer Support Representative.

Data System

The data system (DS) has both hardware and software components. The hardware includes a computer/instrument interface, personal computer, video display monitor, and optionally, a printer.

The software installed on the system includes programs to control the 210-MS or the 220-MS, to set system parameters automatically, and to oversee scan-control, data-acquisition, and data-processing programs.

For a complete description of 210-MS or 220-MS software, refer to the **MS Workstation Software Reference Manual**.

Computer/Instrument Interface

The computer/instrument interface for the 210-MS and the 220-MS is a universal serial bus (USB) interface. The USB is a standard computer/instrument communications link for all types of computers.

Computer Hardware and Software Requirements

See the Varian Release Notes document, which lists compatible computer hardware and software.

Autosampler

Optional autosamplers available are the Varian 8400, 8410, and CombiPAL AutoSamplers. For complete installation and operating instructions, please refer to the autosampler manual.

Chemical Ionization Options

Introduction

Chemical Ionization provides mass spectral data that complement electron ionization (EI) data for the analysis of complex compounds. In the standard CI mode of operation, a CI reagent gas is introduced into the ion trap analyzer from an external gas supply cylinder. The reagent gas is ionized by EI to form reagent ions. These reagent ions then ionize sample molecules entering the ion trap with the helium carrier gas from the capillary column. The operation and adjustment of reagent gases for the standard CI option are described in the first part of this section.

NOTE: CI mode is an MS option. If your system does not have this option, you cannot perform CI analyses.

Two additional options allow the selection of certain liquids as sources for CI reagents. These are the Liquid CI Inlet (or LCI Inlet) and the Multiple CI module (or MCI module). This chapter describes how to install and operate the LCI inlet. Refer to the documentation included with the MCI module for installing and operating the module.

Installing CI Reagent Gas

Before evacuation, new gas lines contain a significant amount of adsorbed water vapor. The longer the gas line, the more adsorbed water and the longer pumping time required to evacuate water from the line. To minimize this pumping time, the line must be as short as possible. Make sure, however, that the gas line is long enough to reach the rear of the 210-MS or 220-MS and to accommodate the movement of the mass spectrometer 9 inches (23 cm) to the right (for access to the transfer line and turbomolecular pump).

Gas cylinders or lecture bottles should not be stored where they can damage cables or gas lines, and they must be secured in accordance with standard safety practices. Lecture bottles have rounded ends and require a means of support (for example, Matheson Model 505 Non-Tip Stand).

Before installing the CI reagent gas supply, you should complete the following procedures:

- Tune the instrument in EI mode
- Check the entire system for leaks

CI Reagent Gas Requirements

This section gives the requirements for the reagent gases, methane, isobutane, and ammonia. They are used for CI operation with the 210-MS and the 220-MS. The mass spectrometers can also be used with other CI reagent gases.

Use a high-purity reagent gas for maximum sensitivity and good spectral quality. Impurities in the reagent gas may limit the number of sample ions that can be formed, which reduces spectral sensitivity. In addition, impurities may react with sample ions, creating confusing mass spectral data.

The amount of reagent gas consumed during CI operation is very low (typically 1 to 2 mL/minute). Use a K-size gas cylinder of the selected reagent gas.

The recommended gases, methane, isobutane, and ammonia must have a purity of 99.99% or better and use a gas cylinder with a two-stage pressure regulator that has a stainless steel diaphragm and maximum inlet pressure of 15 psi (1 bar). Ammonia must be anhydrous grade.

NOTE: For assistance in selecting and using other reagent gases, please contact your Varian Customer Support Representative.

The CI reagent gas should contain less than 1 ppm of water. Water in the CI reagent gas may interfere with CI operation.

Copper or stainless steel gas lines should be used for methane or isobutane. Stainless steel lines should be used for ammonia. All gas lines should be free of oil (and other contaminants) and preferably flame dried. If possible, use the pre-cleaned copper tubing from the GC Start-Up Kit.

WARNING:
CHEMICAL HAZARD

DO NOT flame dry the reagent gas lines with CI reagent gas present.

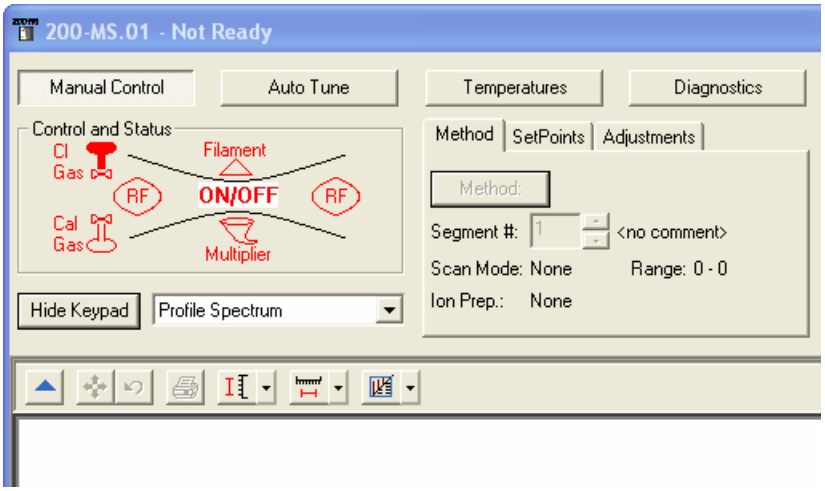
Setting Up the CI Reagent Gas Supply

The following procedure describes how to set up the CI reagent gas supply.

WARNING:
CHEMICAL HAZARD

CI reagent gases may be hazardous. Use proper protection when installing the reagent gas.

1. Open **System Control** and click the **Manual Control** button.



Manual Control View

2. Make sure that the electron multiplier, filament, and RF voltage are all off. The Multiplier, Filament, and RF text should be red or black.

NOTE: Two solenoid-operated valves control the flow of CI reagent gas into the manifold. The valves are opened and closed by clicking on the CI button on the Instrument Control display. A needle valve controls the amount of reagent gas flowing into the manifold. The needle valve is mounted directly behind the door of the mass spectrometer. The needle valve is adjusted manually by using the knob labeled CI GAS. Turning the knob clockwise increases the flow of reagent gas into the manifold. See the Functional Block Diagram of the Vacuum System on page 12.

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3. Verify that the CI gas solenoid valves are closed. When these valves are closed, the CI Gas icon to the left of the ion trap symbol is not green. (If the CI icon is green, click on the icon so that it turns to red or black.)
4. Install a two-stage pressure regulator on the reagent gas cylinder or lecture bottle. Tighten the connection securely.

NOTE: A two-stage pressure regulator typically consists of the following components: Secondary valve, Pressure adjustment valve, Supply pressure gauge, and Delivery pressure gauge

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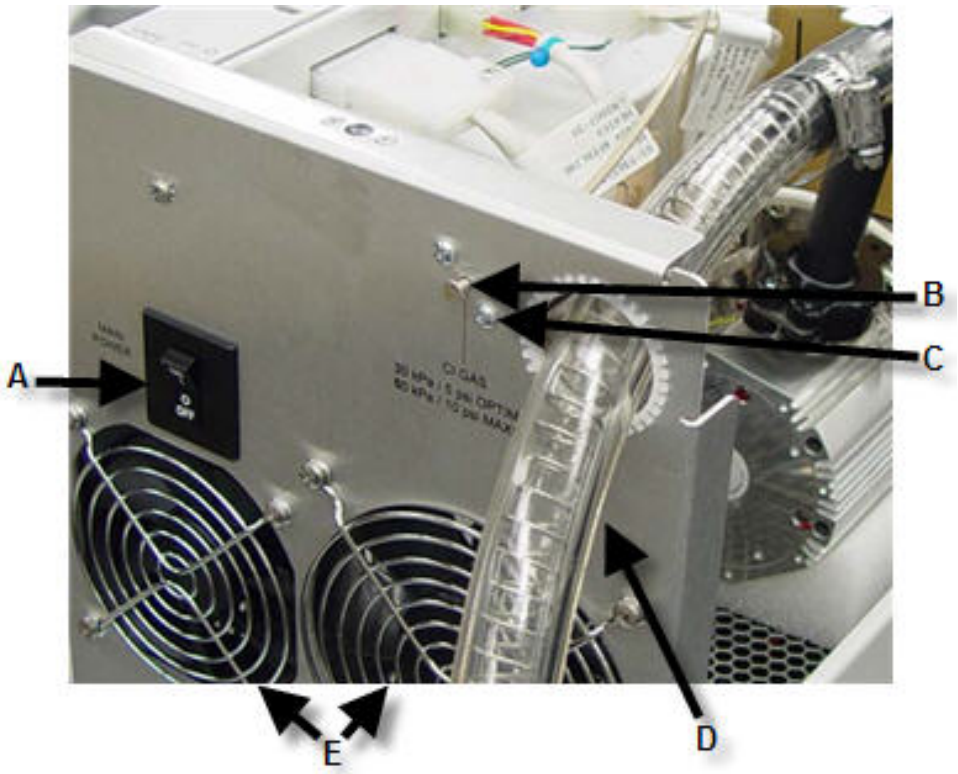
5. Reagent gas is turned on and off with the Main valve on the cylinder or lecture bottle. The secondary valve on the pressure regulator is next in line. This valve is used for coarse control of the flow of gas from the gas cylinder up to the pressure adjustment valve. The supply pressure gauge is used to monitor the gas pressure in the bottle. The pressure adjustment valve is used to set the head pressure of the gas delivered to the mass spectrometer.
6. Connect one end of the 1/8” OD gas supply line to the pressure regulator.
7. On the back of the mass spectrometer, loosen the two screws that hold the plug in the CI Shutoff Manifold 2 to 3 turns. Remove the plug by pulling straight out and twisting.



A	Power Switch	D	Vacuum Hose
B	Plug	E	Fans
C	6/32” Screws (2 each)		

Connecting CI Gas Supply

8. Use 1/8" OD tubing for the supply line between the gas cylinder and the CI shutoff manifold. No ferrule is required on the mass spectrometer end of this tube. The seal is made with an elastomer O-ring. Inspect the end of the tubing and ensure that the surface finish is smooth. If there are scratches, either cut off the damaged part or use 200-600 grit abrasive paper to refinish the sealing end of the tube.
9. Carefully insert the tube into the CI shutoff manifold hole (where the plug came out of) until it is firmly seated. Be careful not to scratch the tube. Tighten the two screws.
10. Ensure that the secondary valve on the regulator on the gas cylinder is closed.
11. Open the main control valve on the lecture bottle. Next, open the secondary valve and adjust the pressure adjustment valve to approximately 5 psi so that reagent gas flows at a moderate rate through the gas line.
12. Open the mass spectrometer door. Verify that the CI GAS needle valve is turned fully counterclockwise.
13. Next, flush the gas line of air and water vapor as follows.

a. Turn the adjustment valve clockwise to reduce the pressure.

b. Open the CI gas solenoid valves by clicking on the CI icon in the Control and Status field of the Manual Control tab dialog in System Control. When the valves are opened, the CI button is green.

c. Evacuate the CI reagent supply line for about 30 minutes.

Checking the Reagent Gas Plumbing for Leaks

To check for air leaks in the reagent gas line connections and the presence of water vapor in the gas line, follow the procedure using a Leak Detection Gas to Troubleshoot for Air Leaks in the Troubleshooting Section. Depending upon the results you obtain, you may need to modify the procedure as follows:

If a large air leak exists, check the CI GAS fitting on the rear of the instrument and the fitting on the pressure regulator for tightness. Then recheck the air/water spectrum. If excess water vapor is indicated by a high 19/18 ratio, there may be water in the gas line or an atmospheric air leak in the reagent gas plumbing. Proceed as follows:

1. Shut off the flow of reagent gas into the manifold by closing the CI solenoid valves. If necessary, click on the CI icon in the Control and Status field of the Manual Control tab dialog in System Control. When the valves are closed, the CI button is black or red—not green.
2. Recheck the air/water spectrum. If the peak at mass 19 (for water) decreases, then water is present in the gas line. In this case, go to step 3. If the peak at mass 19 does not decrease significantly, then little water is present in the gas line. In this case, the MS system probably has an air leak. You will need to fix the leak as described in the Troubleshooting Section. Be sure to check for leaks around
   - The CI GAS port on the rear of the mass spectrometer
   - The fitting that connects the reagent gas line to the pressure regulator
3. To flush excess water from the gas line proceed as follows:
   a. Ensure that the electron multiplier, filament, and RF voltage are off.
   b. Open the main valve on the lecture bottle. (The secondary valve on the pressure regulator is already open.)
   c. Turn the CI needle valve fully counterclockwise.
   d. Open the CI gas solenoid valves and allow the system to pump down for about 1 hour.
   e. Close the main valve on the gas cylinder but keep the CI GAS solenoid valves open. Allow the system to pump down for about 15 minutes.
   f. Recheck the air/water spectrum. If excess water is not present, continue to Setting Flows of CI Reagents.

Setting Flows of CI Reagents

After any leaks have been located and fixed, set the delivery pressure of the CI reagent gas as follows:

1. Ensure that the CI gas solenoid valves are closed. If necessary, click on the CI icon in the Control and Status field of the Manual Control tab dialog in System Control. When the valves are closed, the CI button is black or red—not green.
2. Open the main valve on the lecture bottle. Using the pressure adjustment valve on the regulator, set the head pressure to about 5 psi (34 kPa).

You are now ready to operate the system in the CI mode. If you are a new user, you can perform the introductory example of CI operation in tuning for Chemical Ionization in the *MS Workstation Tutorial Manual*.

Default Parameters for Gaseous CI Reagents

Reagent Gas	Methane	Isobutane	Ammonia
CI Storage Level (m/z)	13	19	13
Ejection Amplitude (v)	9	15	9
Background Mass (m/z)	45	65	45
Target TIC	5000	5000	5000
Maximum Ionization Time (μsec)	2000	2000	2000
Maximum Reaction Time (μsec)	60	60	60
Prescan Ion Time (μsec)	100	100	100

If you have installed the Liquid CI Inlet or the Multiple CI Module, the following parameters may be used for standard liquid CI reagents.

Default Parameters for Liquid CI Reagents

Reagent Liquid	Acetonitrile	d3-Acetonitrile	Methanol
CI Storage Level (m/z)	19	19	19
Ejection Amplitude (v)	15	15	15
Background Mass (m/z)	65	65	55
Target TIC	5000	5000	5000
Maximum Ionization Time (μsec)	2000	2000	2000
Maximum Reaction Time (μsec)	40	20*	40
Prescan Ion Time (μsec)	100	100	100

* Use short reaction times for deuterated reagents. Longer reaction times allow more H/D exchange with background water and the resulting spectrum will show more $[M+H]^+$ and less $[M+D]^+$.

Ion Intensities for Standard CI Reagents

The CI Adjust function gives recommendations of an acceptable level of CI reagent ions for each of the five standard CI reagents. The general principles used in implementing these tests are as follows:

Methane	Adjust the reagent gas pressure so that the peak heights at m/z 17 (CH_5^+) and 29 ($C_2H_5^+$) are about equal. The ratio of the ions at m/z 17 to m/z 16 should be about 10:1. The ion at m/z 41 ($C_3H_5^+$) should be visible.
Isobutane	Adjust the reagent gas pressure so that the peak heights at m/z 57 [$(CH_3)_3C^+$] and m/z 43 [$(CH_3)_2CH^+$] are about equal. There may also be an intense reagent ion at m/z 41 ($C_3H_5^+$).
Ammonia	Adjust the gas pressure so that the ratio of the peak heights at m/z 18 [$(NH_3)H^+$] to m/z 17 (NH_3^+) is about 10:1.
Acetonitrile	Adjust the reagent gas pressure so that the ion at m/z 42 [CH_3CNH^+] is about 10 times higher than at m/z 41. The valley between the 41/42 ions should reach a minimum at less than half the height of the m/z 41 ion. The m/z 54 ion [CH_3CHCNH^+] will be present at 10 - 15% the height of m/z 42. Too much acetonitrile in the trap can cause early filament failures.
d3-Acetonitrile	Adjust the reagent gas pressure so that the ion at m/z 46 [CD_3CND^+] is about 10 times higher than at m/z 44. The m/z 58 ion [CD_3CDCND^+] will be present at 10 - 15% the height of m/z 46.
Methanol	The ion at m/z 33 [$(CH_3OH)H^+$] will dominate the spectrum. No ion is observed at m/z 32, but a small peak is observed at m/z 31 and m/z 47.

In each case, by following these guidelines, the reagent gas pressure in the ion trap will be approximately 1 to 2 x 10^{-5} Torr (about 1.3 to 2.6 x 10^{-3} Pa). The CI reagent molecules comprise about 1% of the gas pressure in the ion trap. Helium atoms from column flow are present at 100 times this pressure.

Liquid CI Reagents

The 210-MS or 220-MS with CI mode has a liquid CI inlet assembly. By installing the assembly, the MS can introduce liquid CI reagents. Use the following instructions to install the liquid CI inlet assembly and, if necessary, to switch back to using gas CI reagents.

Installing the Liquid CI Inlet

1. Before beginning, shut down and vent the MS. If you are not disassembling the trap, it is not necessary to wait for the trap electrodes to cool down before installing the Liquid CI Inlet assembly.
2. Remove the top cover and then attach the Liquid CI Inlet assembly to the back of the instrument using the following instructions. Refer to the drawings below to identify the parts discussed more easily.

g. From the back of the instrument, remove one of the two screws that hold the CI shutoff block intact. Replace it, loosely, with a long screw supplied with the kit (1222200625).

h. Remove the other screw.

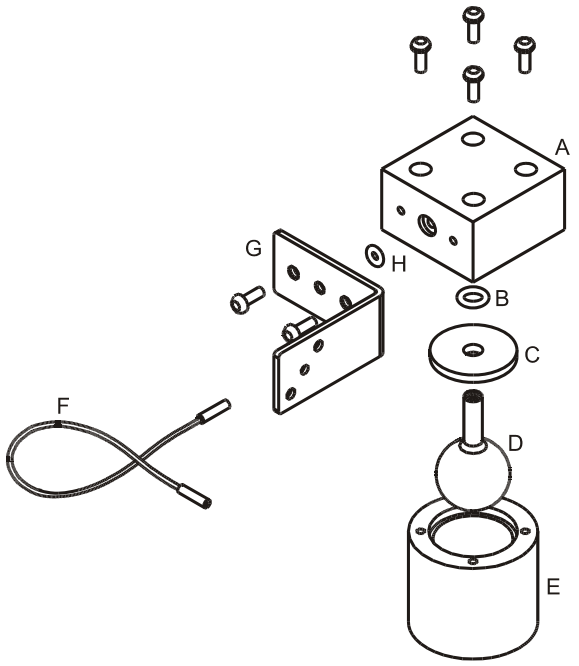
i. Gently pull the free end of the liquid CI restrictor tube (393002401) from the L-bracket where it attaches to the back of the instrument, while leaving the other end of the restrictor tube attached to the Liquid CI Inlet block.

j. Loosely attach the Liquid CI Inlet assembly to the back of the instrument using the L-bracket with the screw that was removed.

k. Rotate the Liquid CI Inlet assembly out of the way to remove the remaining screw.

l. Rotate the Liquid CI Inlet assembly back into position and loosely attach the liquid CI inlet assembly with the remaining long screw (1222200625).

m. Reinsert the liquid CI restrictor tube through the L-bracket into the back of the instrument. The restrictor tube must be inserted far enough to engage the O-ring in the CI shutoff block.



A	Inlet Block (393002301)	E	Reservoir Cover (393002601)
B	Viton O-ring (393010907)	F	Restrictor (393002401)
C	O-ring Retainer (393002501)	G	L-Bracket (393002701)
D	Reservoir Bulb, same as Cal Gas Chamber (392027000)	H	Viton O-Ring (393010904)

Liquid CI Inlet

3. Replace long restrictor (393059701) with 1/8" OD PEEK tubing (393003701).

a. With the liquid CI inlet mounting screws still loose, pull out the long restrictor tube from the CI shutoff block.

b. Loosen the four screws on the top of the pneumatics manifold (at the front of the instrument).

c. Pull out the long restrictor tube from the bottom of the pneumatics manifold. Carefully pull the tube out of the front of the instrument. Save this long restrictor for use with pressurized gases such as methane.

d. Feed the PEEK tube (393003701) into position, starting from the front of the instrument (occupies roughly the same space as the long restrictor tube).

e. Gently install the PEEK tube end into the pneumatics manifold, being careful not to let the retaining plate scratch the tube.

f. Do not retighten the 4 screws on the pneumatics manifold yet.

g. Insert the other end of the PEEK tube into the CI shutoff block and tighten the 2 screws from the rear of the instrument.

4. Replace the front restrictor.

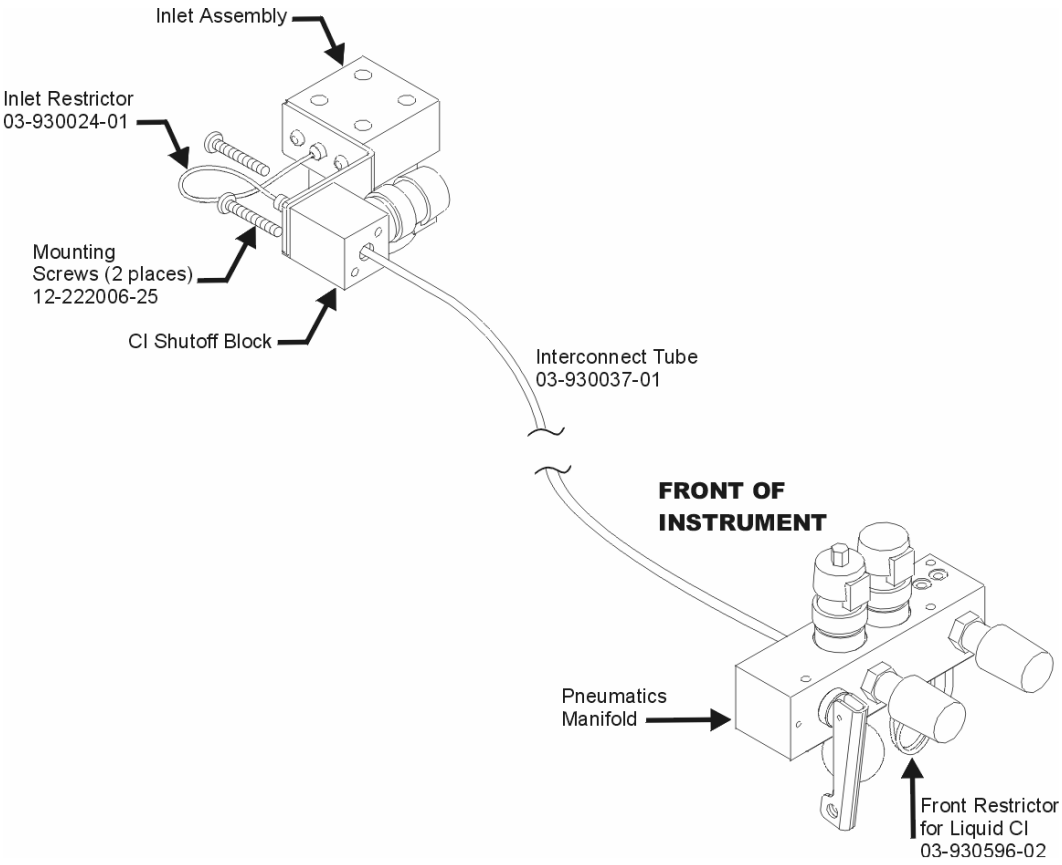
   a. Remove the existing short gas restrictor (393059601) from the bottom of the pneumatics manifold.

   b. Install the front liquid CI restrictor (393059602) into the same location in the pneumatics manifold. Be careful not to let the retaining plate scratch the restrictor tube ends.

   c. Now retighten the 4 screws on the pneumatics manifold.

5. Replace the top cover.

6. Restart the system.



Filling and Refilling the Liquid CI Reservoir Bulb

1. Be sure the CI valves are closed. Disengage the four screws that retain the liquid CI reservoir cover. They may remain in the block.
2. Remove the reservoir cover.
3. Gently pull the bulb down to remove it from the block. The O-ring and O-ring retainer may stay attached to the bulb.

NOTE: No solvent should come in contact with the O-rings.

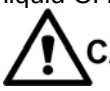
4. Use the reservoir cover as a stand for filling; place the bulb into the reservoir cover. Place the O-ring retainer over the bulb stem. Place the O-ring over the bulb stem.
5. Use a pipette or syringe to fill the bulb halfway with liquid CI reagent. This requires about 3 mL of reagent.
6. Pick up the reservoir cover with the bulb, retainer, and O-ring, and insert the bulb stem into the block.
7. Orient the cover so that the four screws can engage the cover. Tighten the four screws, being careful not to strip the threads in the plastic cover.

After installing liquid CI and each time the reservoir bulb is refilled with liquid, always use care when first opening the CI valves. Do not turn on the filament or multiplier for about 2-3 minutes after opening the CI valves from the Instrument Page.

A convenient way to verify that air and water have been removed sufficiently is to check the ion gauge pressure with the CI valves open. Verify that the pressure has returned to less than 35 x 10^{-6} Torr before turning on the Filament and Multiplier.

Preserving Liquids in Reservoirs

Yellow polypropylene caps have been provided to seal reservoirs containing liquid CI reagents when they are not installed on the instrument.



Never force the cap onto the reservoir stem—it is glass and can break.

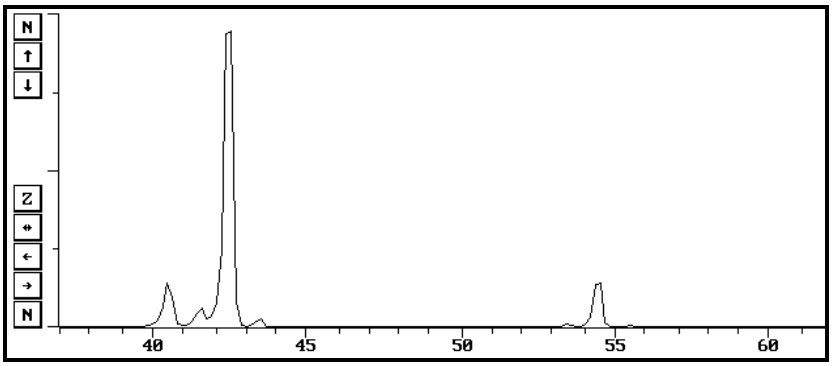
Use safety glasses and protective gloves, especially when attempting to remove a cap from a filled reservoir.

- Use a gentle, twisting/pushing motion to install the plastic cap onto the reservoir stem.
- Use a gentle twisting/pulling motion to remove the plastic cap from reservoir stem.

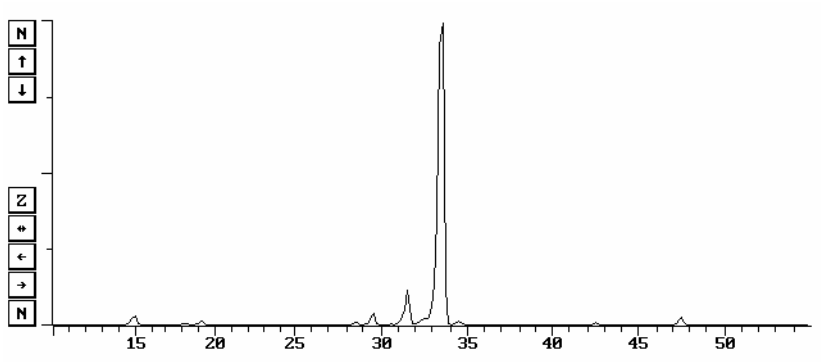
Be careful not to spill any liquid, especially the few drops that may be in the neck of the bulb.

Setting Flows of Vapor from Liquid CI Reagents

1. Connect a liquid reagent reservoir containing the chosen liquid to the liquid reagent inlet block.
2. Open the CI needle valve 6–7 turns counterclockwise.
3. Open the CI solenoids by clicking on the CI button on the Manual Control page and allow the vapor flow from the reservoir to equilibrate. If, after several minutes, there is not enough CI gas entering the trap, increase the flow by turning the needle valve clockwise.
4. While observing the spectrum using Adjust CI Gas, turn the CI needle valve to increase or to decrease the amount of reagent entering the trap until the resolution between M and M+1 just starts to degrade. For best results when using acetonitrile, use a filament emission current of at least 20 μA and maintain at least 50% valley between m/z 41 and m/z 42. To examine the valley in a convenient way, click on the top of the m/z 41 peak and drag it to the top of the display using the cursor. See below for a properly adjusted acetonitrile spectrum and for a properly adjusted methanol spectrum.



Properly Adjusted Acetonitrile Reagent Spectrum



Properly Adjusted Methanol Reagent

Returning to Gaseous CI Reagent Operation

To switch from the Liquid CI Inlet back to a pressurized CI gas (such as methane), the CI gas line may be reinstalled without removing the liquid CI inlet assembly.

1. Loosen the two screws that attach the liquid CI inlet L-bracket to the back of the instrument. Also, loosen the two screws that attach the L-bracket to the liquid CI inlet block.
2. Remove the liquid CI restrictor end that inserts into the back of the instrument; rotate the restrictor out of the way.
3. Install the long CI gas restrictor (393059701) between the gas supply and the CI shutoff block, through the L-bracket.
4. Tighten all screws.
5. It is not necessary to replace the front liquid CI restrictor (393059602) with the short gas restrictor (393059601). Reduce the gas pressure to 5 psi at the supply to return to normal gas CI operating conditions.

MS Maintenance

Periodic Maintenance

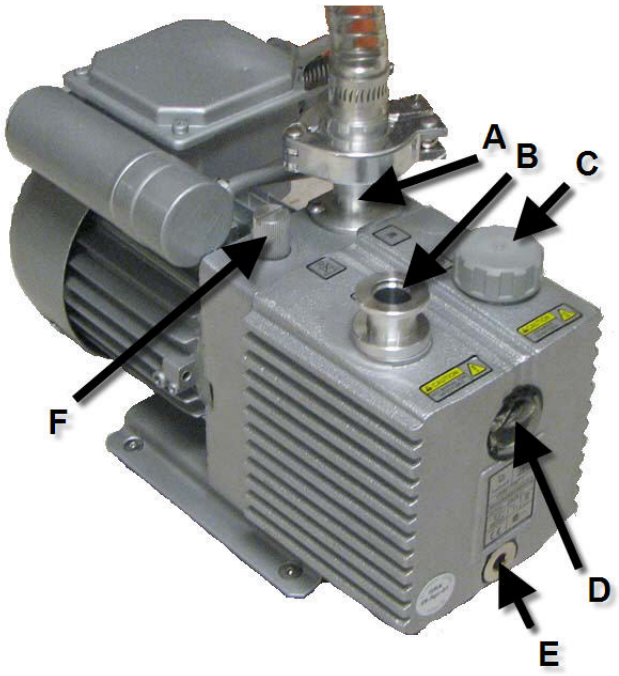
To ensure the GC/MS peak-performance, you must perform periodic maintenance on the vacuum and cooling (fan) systems. The following table identifies relevant maintenance intervals depending on whether or not a rotary vane pump is present.

Procedure	Interval
Check the foreline pump oil level and condition	Weekly
Purge foreline pump oil	Weekly
Check cooling fans	Weekly
Change foreline pump oil	Once a year
Change scroll pump tip seal	Every 9 months

Checking Foreline Pump Oil Level and Condition

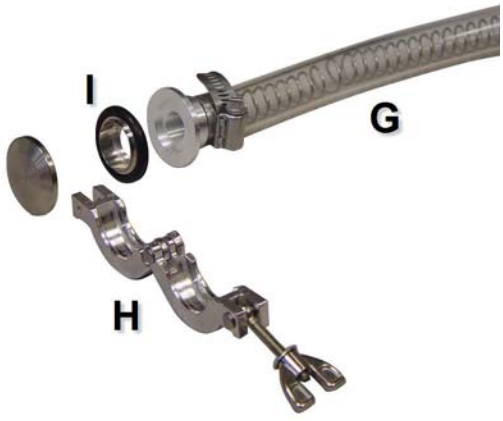
If using a rotary vane pump, check the oil level and condition every 2 to 3 months. The pump should be switched off, but still warm.

1. Ensure the oil level is between the maximum and minimum levels on the sight glass. If the oil level falls below the minimum level, gradually add more oil (8829953800) through the filler port until the oil level is centered between the maximum and minimum levels. Use a funnel if necessary.
2. Ensure the pump oil is clear and light amber in color.
    - If the oil becomes cloudy, purge it as described in “Purging Foreline Pump Oil” on page 45.
    - If the oil becomes thick and dark in color and has a burnt smell, change it as described in “Changing Foreline Pump Oil” on page 45.



A	Inlet	F	Gas Ballast Valve
B	Exhaust	G	Foreline
C	Filler Plug	H	Clamping Ring
D	Oil Level Sight Glass	I	Seal
E	Drain Plug		

DS-42 Foreline Pump



Foreline Hose

Purging Foreline Pump Oil

NOTE: If your system has an oil mist filter, you do not need to purge the oil. The oil mist filter does this function.

The condensation from sample vapors can accumulate in the foreline pump oil during routine operation. This condensation can reduce pump efficiency and shorten the life of the oil. However, the pump oil may be rejuvenated with a weekly purge.

Purging can be completed without interrupting system operation. However, this should not be performed while the MS is acquiring data, when the filament is on, or when the electron multiplier is on.

To purge the foreline pump oil:

1. Place an exhaust vent over the open exhaust port.
2. With the foreline pump running, turn the gas ballast valve counterclockwise to the open position. The pump will become noisy and emit oil vapor.
3. After 10 minutes, turn the gas ballast valve back to the closed position.
4. Remove the exhaust vent.

Changing Foreline Pump Oil

To ensure peak performance and maximum pump lifetime, change the pump oil and the oil mist filter cartridge at least once a year or whenever the oil becomes thick, dark in color, and has a burnt smell. The oil change must be performed while the oil is warm.

To change the pump oil:

1. Turn off and vent the MS.
2. Disconnect the power cord of the pump from the rear of the MS.
3. Disconnect the vacuum hose from the foreline pump by removing the clamping ring.
4. Pull the hose free and then place the seal on a clean lint free surface for later use.
5. Carefully place the foreline pump on a raised surface. The surface should be high enough to allow a 0.5 liter (0.5 US qt) or larger container to be placed under the drain port when the pump is tilted forward. A container with an opening diameter of at least six inches will make this task easier.

Pump weighs 25 kg (55 lb.). To prevent personal injury, use proper moving and lifting techniques.

6. Place an oil pan beneath the drain port to catch any spillage.

WARNING:
CHEMICAL HAZARD

Hazardous chemicals may be present. Avoid contact with skin.
Use proper eye and skin protection.

7. Remove the plastic cover and the filler plug on top of the pump.
8. Put the container where it can catch the oil and then slowly remove the drain plug in the front of the pump.

WARNING

Toxic residues from mass spectrometer samples build up in used pump oil. Dispose of all used pump oil in accordance with applicable regulations. Place a hazards warning label on the container, if appropriate.

9. Tilt the pump forward and hold until oil flow ceases.
10. Return the pump to the horizontal and refit the plug.
11. Run the pump for approximately ten seconds with the intake port open. This will remove any residual oil from the pumping block.

CAUTION

Avoid breathing oil mist coming from the exhaust port during this operation.

12. Remove the plug, tilt the pump, and then drain the oil.
13. Return the pump to the horizontal position.
14. Wipe the oil residue from the drainage port and then refit the drain plug.
15. Fill the pump with fresh oil (part number 8829953800) through the filler port until the oil level reaches the maximum level in the sight glass. A funnel may be helpful.

Flushing

The pump should be flushed if the pump oil is particularly dirty. After draining the pump (previous steps 1-13):

1. Remove the inlet filter by removing the locking screw of the inlet port with a 4 mm Allen wrench; unscrewing the inlet port with a 30 mm open ended wrench; and pulling the filter up with a pair of tweezers or long nose pliers.
2. Clean the filter in warm soapy water. Rinse and blow-dry with air or nitrogen.
3. Refit the filter.
4. Screw the inlet port back into the pump housing and lock in place with the locking screw.
5. Pour 0.33-Liter / (0.35 US qt) of fresh pump oil in through the inlet port then run the pump.

CAUTION

Avoid breathing oil mist coming from the exhaust port during this operation.

6. Stop the pump, drain the flushing oil, and replace as described previously.

Changing the Oil Mist Cartridge

The following explains how to change the cartridges for the DS-42 and the DS-102 Oil Mist Eliminators. When the cartridge is saturated, excessive mist or oil can spray out. The cartridge must then be replaced.

Replace the cartridge of the oil mist eliminator on the exhaust port of the pump when you change the oil.

DS-42 Oil Mist Eliminator

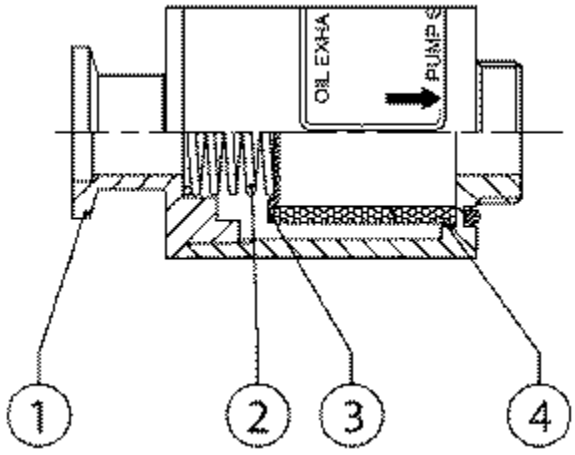
To disassemble the oil mist eliminator:

1. Unscrew and remove Upper housing 1
2. Remove Spring 2
3. Remove Valve 3
4. Remove Cartridge 4
5. Clean the parts with a dry cloth.
6. Degrease with a water soap solution.
7. Rinse with clean water and dry.

To reassemble the oil mist eliminator:

1. Install a new cartridge.
2. Press gently to check that it is firmly seated.
3. Install Valve 3 so that the raised center fits inside the cartridge.
4. Center the Spring 2 over the Valve 3.
5. Cover entire assembly with Upper housing 1, ensuring that the O-ring gasket is flush against the housing.
6. Tighten Upper and Lower housings.

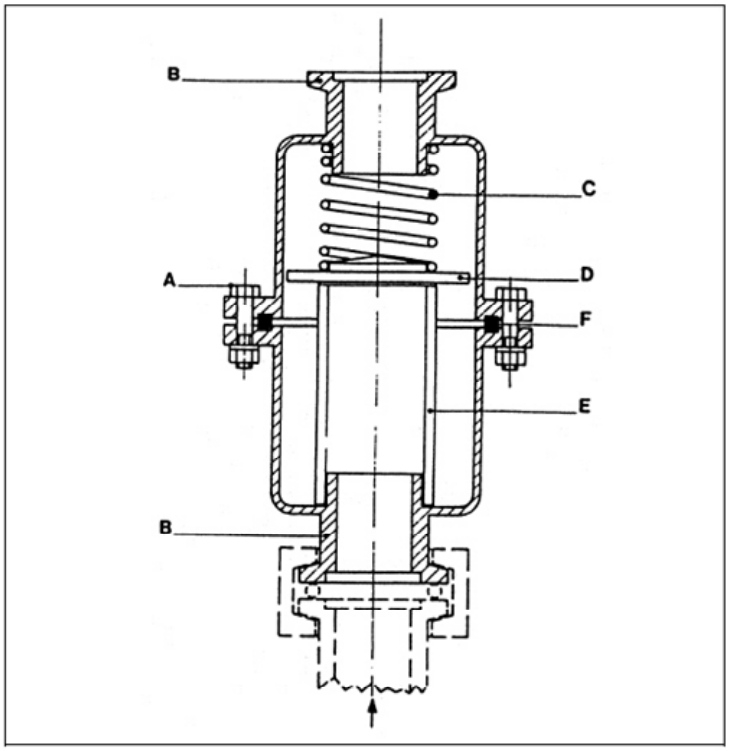
NOTE: After changing the cartridge several times, it may be necessary to replace the O-ring gasket.



DS-102 Oil Mist Eliminator

To disassemble the oil mist eliminator:

1. Remove assembly screws A.
2. Remove Upper housing B
3. Remove Spring C
4. Remove Valve D
5. Remove Cartridge E
6. Remove O-ring F.
7. Clean the parts with a dry cloth.
8. Degrease with a water soap solution.
9. Rinse with clean water and dry.



DS-102 Oil Mist Eliminator

To reassemble the oil mist eliminator:

1. Install a new cartridge in Lower housing B.
2. Press gently to check that it is firmly seated.
3. Install Valve D with polished side toward cartridge.
4. Center Spring C over Valve D, fit gasket, F in the groove.
5. Cover entire assembly with Upper housing B.

6. Tighten Upper and Lower housings B, using screws A.

NOTE: After changing the cartridge several times, it may be necessary to replace the gasket and the centering O-ring gasket.

Checking Cooling Fans

CAUTION

To prevent overheating, do not block air intakes of cooling fans.

The cooling fans maintain an optimal temperature for the turbomolecular pump and the electronics modules. Without the cooling fans, the lifetime of the turbomolecular pump and temperature-sensitive electronic components would be shortened. To ensure proper operation of the cooling system, operate the MS with its covers in place. In addition, be sure to check the fans at least once each week.

The 210-MS or 220-MS is equipped with two fans on its rear panel. The function of these fans is to pull air into the instrument. To check fan operation, proceed as follows:

1. Make sure that the MS MAIN switch and SERVICE switch are turned ON. (See “Mechanical Assemblies” on page 10 for a photo showing the locations of the main and SERVICE switch.)
2. Place a large sheet of paper over one of the fan guards.
   - If the paper is sucked toward the fan guard, the fan is working.
   - If it is not, the fan is broken. Contact your Varian Customer Support Representative to arrange for a replacement.
3. Check the second fan in the same manner.

If the fans are excessively noisy, for example, if they whine or whir, one of the fans may be about to fail and it should be replaced.

To identify which of the two fans is about to fail, proceed as follows:

1. Remove the top cover from the MS.
   - If the noise continues, proceed to step 3.
   - If the noise stops, proceed to step 2.
2. Turn off the electronics compartment fan using the SERVICE switch, and replace the top cover. (See “Mechanical Assemblies” on page 10 for a photo showing the location of the SERVICE switch.)
   - If the noise returns, it is coming from the turbomolecular pump cooling fan. Proceed to step 4.
   - If the noise does not return, remove the cover and proceed to step 3.
3. Turn off the electronics compartment fan using the SERVICE switch. (See “Mechanical Assemblies” on page 10 for a photo showing the location of the SERVICE switch.)
   - If the noise continues, it is coming from the turbomolecular pump-cooling fan.

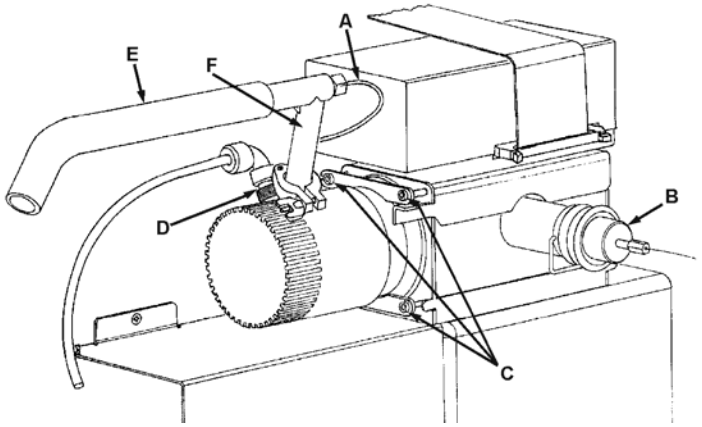
- If the noise stops, it is coming from the electronics compartment fan.

4. Contact a Varian Customer Support Representative to arrange for replacement of the broken fan.

How To Replace the Turbomolecular Pump

To disconnect the turbomolecular pump from other components, proceed as follows:

1. Turn off the MS.
2. Confirm that the main power switch is turned OFF, that the vacuum system has been vented, and that the power cord is unplugged.
3. Taking care not to break the GC column, slide the MS about 12 to 18 inches away from the GC.
4. Remove MS cover by grasping both sides and lifting up.
5. Disconnect the 1/8-in. pneumatics exhaust tube from the vacuum hose elbow.
6. Disconnect the vacuum hose elbow from the turbomolecular pump by removing the clamping ring and pulling the elbow away from the pump.
7. Pull the vacuum hose as far as you can toward the rear of the instrument.
8. Remove the turbomolecular exhaust-port seal and place it on a clean, lint-free surface for later use.
9. Unplug the turbomolecular cable from the turbomolecular pump by rotating the ring on the connector in the counterclockwise direction. Continue rotating until you can pull the connector free.



A	Pneumatics Exhaust Tube	D	Turbomolecular Cable
B	Transfer Line	E	Vacuum Hose
C	Clamping Screws (4 places)	F	Vacuum Hose Elbow

Turbomolecular Pump Connections

To unsecure the turbomolecular pump, proceed as follows:

1. Loosen each of the four clamping screws about 2 turns with a 3/16-in. ball head hex driver.

   Take care not to completely unscrew the two inner clamping screws. (If you should unscrew them, put back the screws after you have removed the turbomolecular pump from the instrument.)

2. Remove the outside bottom clamping screw.
3. Remove the bottom clamp as you hold the turbomolecular pump in place.
4. Remove the outside top clamping screw (closest to the transfer line).
5. Remove the top clamp as you hold the turbomolecular pump in place.

To replace and to secure the turbomolecular pump, proceed as follows:

1. Pull the turbomolecular pump to the rear and lift it clear of the instrument.
2. Remove the large seal from the turbomolecular inlet, and place it on the inlet of the new turbomolecular pump (part number 393076401). The orientation of the seal is not important.
   - On the new turbomolecular pump, leave the red cap over the turbomolecular exhaust port.
3. Carefully slide the new turbomolecular pump and seal into position on the end of the manifold.
   - Make sure the electrical connection (turbomolecular cable) is tilted towards the bulkhead, for example, toward the left as viewed from the rear of the instrument.
   - Take care not to scratch the sealing surface on the manifold in front of the turbomolecular pump.
4. Insert the top clamp and loosely fasten it into place.
5. Insert the bottom clamp and loosely fasten it into place.
6. Tighten all four clamping screws until snug.

To reconnect the turbomolecular pump to other components, proceed as follows:

1. Reconnect the turbomolecular cable. Rotate the retaining ring clockwise with downward pressure to lock the cable into position.
2. Remove the red cap over the turbomolecular exhaust port.
3. Place the seal on the turbomolecular pump exhaust port.
4. Reconnect the vacuum hose elbow and clamp.
5. Reconnect the pneumatics exhaust tube.

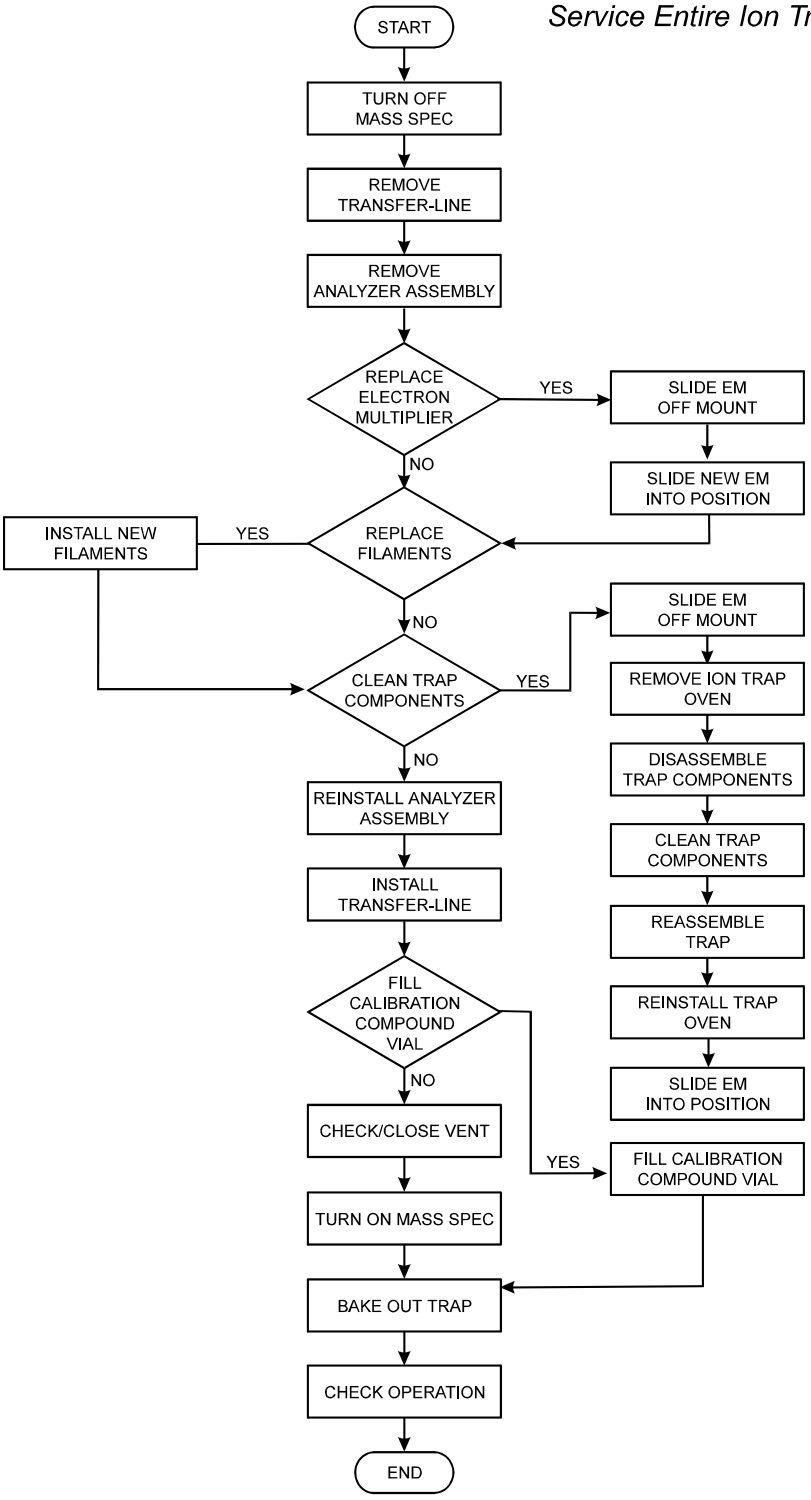
To finish installing the turbomolecular pump replacement, proceed as follows:

1. Make sure that the vent valve is closed.
2. Plug in the power cord.
3. Turn on the rear-panel main power switch.
4. Snug up the top and bottom clamp screws.

5. Monitor the turbomolecular pump speed using Diagnostics under Vacuum System Status.
6. Once the pump is running satisfactorily, replace the top cover and then slide the GC and MS back together.
7. Discard the old turbomolecular pump. Be sure to comply with all applicable health and safety regulations.

How To Service the Ion Trap

You will need to service the ion trap if it requires cleaning or replacement of the filaments or the multiplier. The following flow chart illustrates the general sequence of ion trap maintenance operations. Each step is then described in detail.



Flow Chart for Servicing the Ion Trap

Turning Off the MS

Allow heated zones to cool before disassembly.

To turn off the cooled mass spectrometer, proceed as follows:

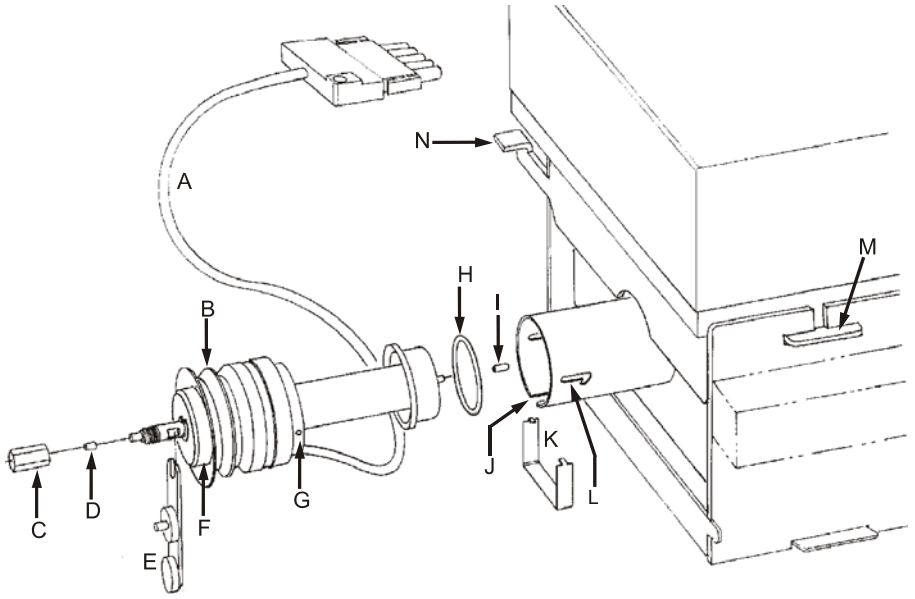
1. Shut off the turbomolecular pump, foreline pump, and all electronics by turning off the main power switch on the back panel.
2. Disconnect the MS power cord.
3. Open the front-panel door and lift the toggle vent valve for 1 second to slow the turbomolecular pump down.
4. Once the pump has finished spinning down, open the vent valve. Leave it open until the system is fully vented, for example, about 5-10 minutes.

Retracting the Transfer Line

NOTE: Fully vent the analyzer assembly before attempting to retract or remove the transfer line. Vacuum makes retraction of the transfer line difficult.

To retract the transfer line, proceed as follows:

1. Simultaneously push and rotate the transfer line nose counterclockwise.
2. Pull the transfer line away from the analyzer.
   - Under most conditions, the transfer line needs only to be retracted in order to remove the analyzer. If it is necessary to remove the transfer line (for example, to inspect or change the O-ring), perform steps 5 and 6.
3. Remove the nose clip by pulling both sides away from the boot.
   - Take care not to apply excessive force.
4. Pull the nose away from the analyzer until the entire assembly is free of the transfer-line shell.
   - Exercise particular care if the column is still connected to the transfer line.



A	Heating Cable	H	O-ring
B	Boot	I	Transfer Line Tip
C	Nut	J	Heating Cable Slot
D	Ferrule	K	Nose Clip
E	Tool	L	Bayonet Mount
F	Nose	M	Analyzer Assembly Tongue
G	Nose Hole	N	Analyzer Assembly Lock-Down Tabs

Transfer Line Assembly

Removing the Analyzer Assembly

CAUTION

Retract transfer line before removing analyzer assembly.

NOTE: Be sure the transfer line is retracted. Otherwise, you will not be able to remove the analyzer assembly without damaging the analyzer.

To remove the analyzer assembly, proceed as follows:

1. Remove the top cover of the MS by grasping both sides and lifting up.
2. Unplug the trap heater harness located near the top of the instrument.
3. On the side of the analyzer assembly (near the transfer line), push out the locking tabs on the power ribbon cable. This releases the cable.
4. Pull the ribbon cable out and move it away from the analyzer.
5. Push down and spread the two analyzer release tabs.

NOTE: Some 210-MS or 220-MS systems have a transfer line removal flap warning that will block the locking tabs. If such a flap is present, tip it out of the way during the procedure and return it to its original position once the analyzer is replaced.

6. Tilt the rear end up carefully to remove the analyzer.
7. Move the analyzer assembly toward the rear to free the front tab.
8. Place the analyzer upside down on a flat surface.

NOTE: To prevent contamination when touching parts of the trap or the electron multiplier, wear latex or nitrile gloves.

Replacing the Electron Multiplier

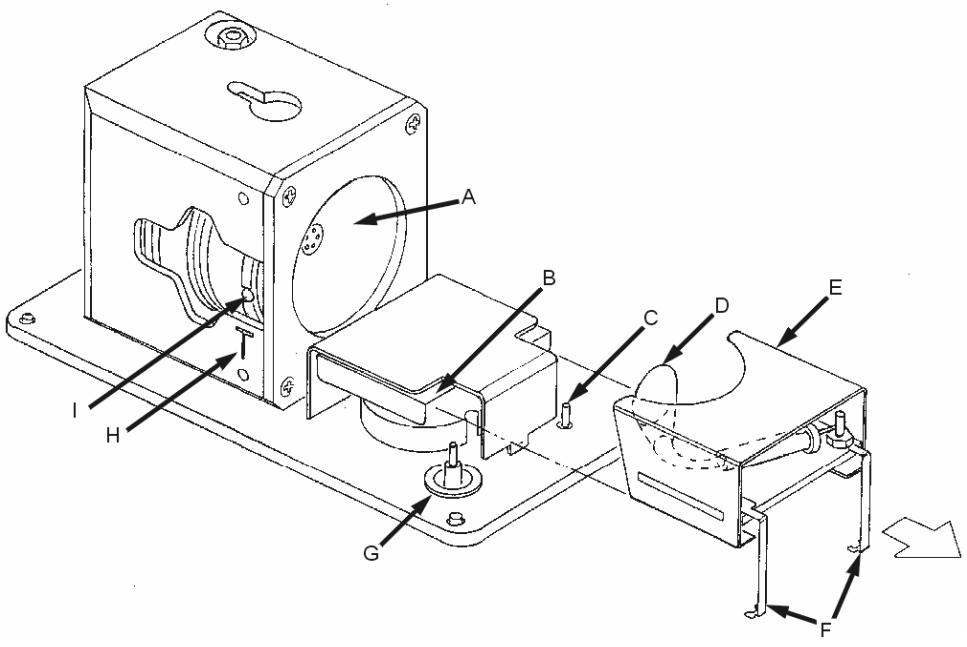
The electron multiplier should sit as close as possible to the ion trap. The electron multiplier grid should never be in contact with the trap.

To remove the electron multiplier, proceed as follows:

1. Slide the electron multiplier back along its track until it clicks into place.
2. Continue sliding the electron multiplier, but with slightly less force, until the multiplier bracket comes free of the track.
3. To protect the electron multiplier, place it with one of its sides facing down on a flat surface. The glass multiplier grid should not be touching anything.

To install the new electron multiplier, proceed as follows:

1. Slide the electron multiplier forward along its track.
2. Push the multiplier bracket forward until it is as close as possible to the ion trap. The assembly should snap into place.
3. Make sure the high voltage and signal contacts are in good contact with the feed-through pins.



A	Exit-End Cap	F	Multiplier Contacts
B	Electron Multiplier Track	G	Multiplier High Voltage Pin
C	Multiplier Signal Pin	H	Transfer Line Alignment
D	EM Grid	I	Transfer Line Entrance Hole
E	Electron Multiplier Mount		

Electron Multiplier

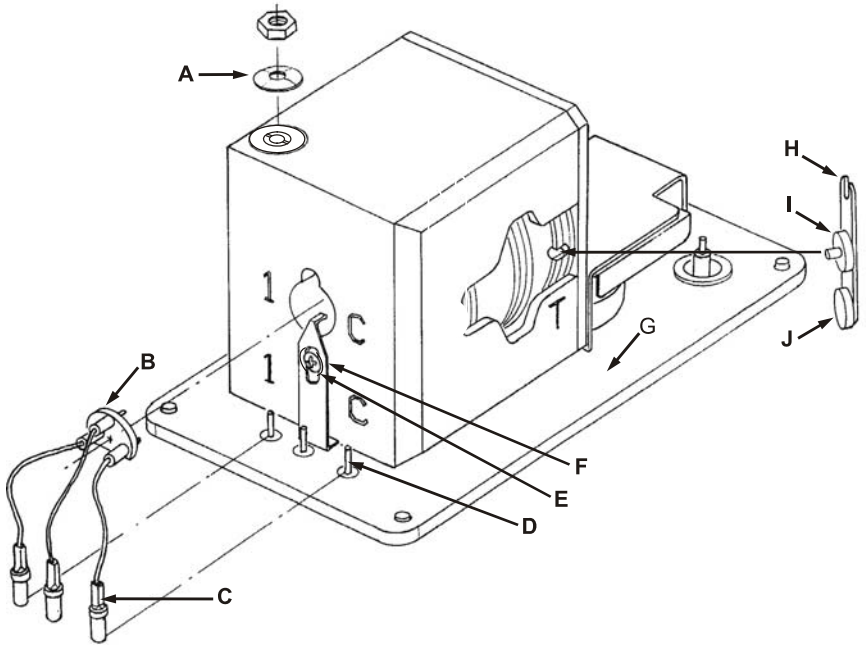
Replacing the Filament(s)

To replace the filament(s), proceed as follows:

1. Orient the trap so the filament assembly is facing you.
2. Disconnect the filament connectors from the flange feed-through pins by gently pulling each pin connector up until the wires are free from the pins.
3. Using a Phillips screwdriver, loosen the screw on the filament retainer.
4. Slide the filament clip down off the ceramic filament disk.
5. Remove the filament assembly.

NOTE: Inspect the area around the filament entrance hole for carbon deposits. Carbon buildup in this area can lead to lower sensitivity and/or shorter filament lifetime. Area should be cleaned before replacing filament assembly.

6. Place the new filament assembly in the trap oven, and align the posts in the 1, 2, and C positions.
7. Slide the filament clip onto the filament disk and tighten the screw. Be sure that the clip is not touching any of the filament connectors.
8. Connect the filament connectors to the flange post connectors.



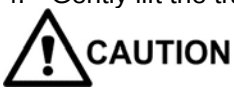
A	Belleville Washer	F	Filament Retainer
B	Ceramic Filament Assembly	G	Analyzer Flange
C	Filament Connectors	H	Transfer Line Alignment Tool
D	Post Connectors for Filament	I	Center Disk
E	Screw	J	Feeler Disk

Filament Assembly

Removing the Ion Trap Oven

Using gloves to remove the ion trap oven, proceed as follows:

1. Remove the electron multiplier and place it on its side.
2. Disconnect the filament wires from the flange feed-through pins (labeled 1, 2, C) by gently pulling each pin connector up until all wires are free of the flange.
3. Remove the nut using the 11/32-in. nut driver (supplied).
4. Gently lift the trap oven assembly off the heater post and thermo well.



Do not rotate the assembly more than 2 degrees. Otherwise, you may damage the contact springs.

- Turn the analyzer assembly over to remove the Belleville washer.

Cleaning the Trap Components

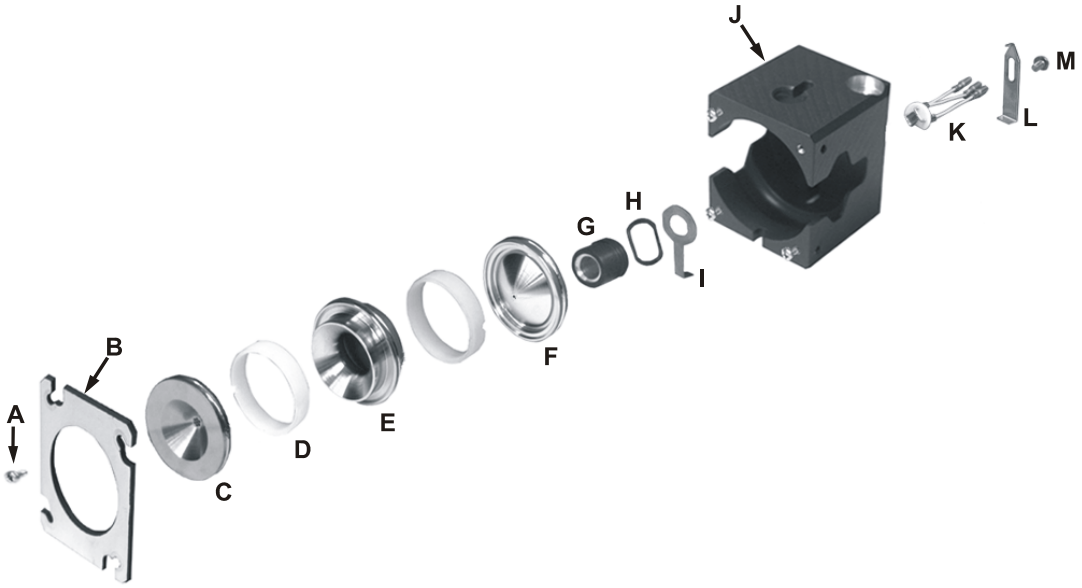
To clean the trap components:

- Disassemble the trap components
- Clean the trap components
- Reassemble the trap

Disassemble the Trap Components

1. Place the oven filament-side-down on its feet. This will protect the filament wires from becoming damaged.
2. Loosen the two screws with slotted holes by 3 to 4 turns. Do not remove the screws.
3. Completely remove the two screws in the non-slotted holes.
4. Slide the clamping plate off of the trap oven.
5. Lift out the entire electrode stack, or remove each piece singly.
   - Be very careful not to damage the quartz spacers.
6. If you only intend to clean the electrodes, leave the gate parts in the oven. Otherwise, remove the gate, wavy spring washer, and gate conductor by turning the oven upside down.

NOTE: The Silica-Coated Spacers have a shiny, mirror like finish on the inside surface.



A	Screw, 6/32, 4 places	H	Wave Washer
B	Clamping Plate	I	Gate Conductor
C	Exit-End Cap	J	Trap Oven, “T” is located this side.
D	Quartz or Silica-Coated Spacer, 2 pieces	K	Filament Assembly
E	RF Ring Electrode	L	Filament Clip
F	Filament-End Cap	M	Screw
G	Electron Gate		

Ion Trap Assembly

Clean the Trap Components

To clean the ion trap parts:

- Clean the chrome-plated or Silica-coated parts
- Clean the quartz spacers

NOTE: For Silica-coated electrodes, do not use aluminum oxide.

Clean Chrome Plated Parts

To clean the filament-end cap, RF voltage ring electrode, and exit-end cap, proceed as follows:

1. Using a slurry of number 600 aluminum oxide in water (or glycerol) and a cotton-tipped applicator, remove all contaminants from the stainless steel ion trap parts.
    - Use the wooden end of a cotton swab, cut at an angle, to clean the inside corners, for example, the holes in the end caps.

- Contaminants sometimes appear as dark or colored areas, but they may also be invisible. Clean each part thoroughly, even if there is no apparent contamination.
- After you clean a part, hold it under running water and use a clean applicator to remove the last visible traces of aluminum oxide.

2. Immediately place the clean part in a beaker containing a solution of detergent and warm water.

NOTE: Do not let the slurry dry on the metal. Dried aluminum oxide is difficult to remove.

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3. When you have finished cleaning all of the parts, place the beaker in an ultrasonic cleaner, and subject the beaker and its contents to ultrasound for about 1 minute.
4. Rinse each part with fresh water.
5. Using clean tools, place the parts in a beaker containing de-ionized water, then subject the beaker and its contents to ultrasound for about 1 minute.
   - If the water is cloudy afterwards, replace the deionized water and repeat.
6. Rinse the parts with methanol.
7. Place the parts in a beaker of fresh methanol. Subject the beaker and its contents to ultrasound for about 1 minute.

NOTE: Once the ion trap parts are clean, wear clean, lint-free gloves in subsequent handling of the parts to prevent contamination. Do not wear vinyl gloves.

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8. Remove the ion trap parts from the beaker, and place them on a clean, lint-free surface.
   - Allow the parts to dry in air.
9. Inspect each part to make sure that all spots and particles have been removed.
   - If you observe any contamination, clean the part again using the procedure described above.

NOTE: You can clean any small parts, e.g., the electron gate conductor, the gate, and wavy washer spring, by placing them along with the other parts in methanol and subjecting them to ultrasound for 1 minute.

Check the oven trap near the filament entrance hole for carbon deposits. Carbon buildup may result in lower sensitivity and/or shorter filament lifetime. The carbon stains should be removed *only* with a cotton swab and methanol. After cleaning, check filament entrance hole for particles and fibers. Area must be cleaned before reassembly.

Clean Silica-Coated Ion Trap Electrodes

The silica top surface of the Silica-Coated Ion Trap Electrode is a very thin (only about 1 μm), but durable layer which is strongly bonded. However, **abrasives**, such as alumina powder, **must not be used** to clean the trap parts because this will definitely destroy the silica layer! **Strongly acidic or strongly basic laboratory cleaners must not be used** to clean the trap parts because they will also remove the silica layer!

1. For routine cleaning of the Silica-Coated electrodes, ultrasonicate the ion trap electrodes for 10 minutes in methylene chloride or methanol. Use separate beakers for each electrode to avoid scratching trap surfaces. Trap disassembly and reassembly is otherwise identical to the recommendations Maintenance Section.
2. If heavy matrix (dirty) samples are routinely run on the instrument and the electrodes are visibly discolored where the column enters the trap at the multiplier end cap, one may use a toothbrush and liquid hand soap or dish detergent (pH between 6 and 7.5) to gently scrub the trap parts. The trap is rinsed and then sonicated in water followed by two sonications in methylene chloride or methanol.

CAUTION

DO NOT use Aluminum Oxide or other abrasives because this will remove the silica layer on the trap!

DO NOT use harsh laboratory cleaners because this will remove the silica layer on the trap! Use only mild detergent (pH between 6 and 7.5).

NOTE: You will notice that the initial hydrocarbon background is higher than on the standard ion trap. To speed up the bakeout, you may want to bake out the ion trap overnight at 220 °C. In the bakeout mode, the manifold is set to 120 °C.

Clean the Two Quartz or Silica-Coated Spacers

NOTE: The Silica-Coated Spacers have a shiny, mirror like finish on the inside surface.

1. Wipe all surfaces of the quartz spacers with a clean, soft, lint-free cloth that has been dampened with reagent-grade acetone.
2. Subject the quartz spacers to ultrasound in acetone for 5 minutes.
3. Rinse each of the quartz spacers with de-ionized water.
4. Subject the quartz spacers to ultrasound in methanol for 5 minutes.
5. Dry the spacers in air, or in an oven set to approximately 120 °C for 30 minutes.

Reassemble the Trap

To reassemble the trap assembly, proceed as follows, referring to the Ion Trap Assembly figure:

NOTE: The orientation of the trap components is important. Make sure that all parts are free of particles, lint, and so on.

1. Replace the gate conductor, tab-down into position.
2. Replace the wavy washer on the gate conductor. The washer orientation is not important.
3. Replace the gate so that the flat, shiny surface faces the washer.
4. Replace the filament (single-hole) electrode in the oven.
5. Replace one of the quartz spacers so that the notch faces the filament (single-hole) electrode.
6. Replace the RF electrode, followed by a quartz spacer. The notch in the quartz spacer should face up towards the exit (seven-hole) electrode.

NOTE: Make sure that the notch in the quartz spacer and the notch in the exit-end cap are aligned.

7. Replace the exit (seven-hole) electrode so that the notch on this electrode faces the side of the trap labeled with the side-ways T.
8. Slide the clamping plate under the screws on the top of the trap oven assembly.
9. Visually check the transfer line hole, making sure that notches in the quartz spacer and exit-end cap electrode are aligned and centered in the trap oven.
10. Tighten the screws.

Reinstalling the Trap Oven Assembly

To reinstall the trap oven assembly, proceed as follows:

1. Gently slide the trap assembly onto the heater post and thermo well, taking care not to bend the end cap contact springs.

CAUTION

Do not rotate the assembly more than 2 degrees; otherwise, you may damage the contact springs.

2. To set transfer line hole height to the analyzer flange, place the nub of the center disk into the hole created by the notches in the quartz spacer and the exit (seven-hole) electrode.
3. Rotate the alignment tool so that the feeler disk touches or almost touches the analyzer flange. Proper alignment is achieved when the feeler disk touches the analyzer flange and the alignment tool is perpendicular to the flange.

4. Replace the Belleville washer so that the crown side is facing upwards.

NOTE: When reinstalling the trap assembly, make sure that you orient the Belleville washer crown side up. Tighten the nut until the Belleville washer is flat, for example, until the nut bottoms out.

5. Replace and tighten the nut until it is snug.
6. Attach filament wires 1, 2, and C to the flange feed-through pins.

Repositioning the Electron Multiplier

To install the electron multiplier, proceed as follows:

1. Slide the electron multiplier forward along its track.
2. Push the multiplier bracket forward until it is as close as possible to the ion trap. The assembly should snap into place.
3. Make sure the high voltage and signal contacts are in good contact with the feed-through pins.

Reinstalling the Analyzer Assembly

To reinstall the analyzer assembly, proceed as follows:

NOTE: Make sure that the manifold O-ring is clean and free of particles and fibers.

1. Make sure the transfer line is retracted or removed.
   - Align the analyzer with the release tabs toward the rear of the instrument.

NOTE: Take care not to scrape or bang the analyzer parts (e.g., the trap oven assembly, electron multiplier, filament wires, and so on.) against the stainless steel manifold flange.

2. With a slight forward downward tilt, check that all cables and hoses are out of the way. Slowly insert the front tongue into the slot.
3. Lower the rear of the analyzer by spreading the release tabs and pushing down gently.

   You should be able to install the analyzer assembly into the manifold without applying force.
4. Engage the release tabs and make sure that the release tabs are secure in their notches.
5. Connect the trap heater cable.
6. Connect the power ribbon cable and lock it into place. Ensure that the cable is firmly connected and that the locking tabs are fully engaged.

Installing the Transfer Line

If the transfer line has been removed, reinstall the transfer line as follows. If the transfer line has only been retracted, proceed to steps 6 and 7 only.

1. Make sure the O-ring is free of lint, particles, and so on.
2. Insert the assembly into the transfer-line shell.
3. Orient the assembly so that the heating cable fits inside the shell slot.
4. Rotate the nose so that the nose holes line up with the small slots in the shell. These holes are found at the 4:00 and 10:00 positions.
5. Install the nose clip.
6. Push the nose in, rotating it clockwise to lock it in place.
7. Connect the transfer line heater cable.

Closing the Vent

To close the vent, or to check that it is closed, the vent valve lever should be facing down.

Turning On the MS

To turn on the mass spectrometer, proceed as follows:

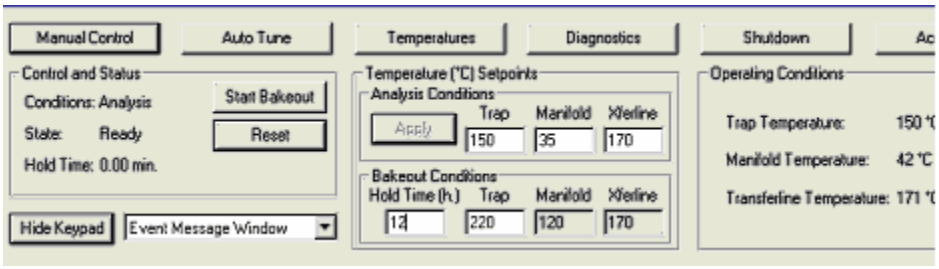
1. Make sure that the power switch on the back of the mass spectrometer is in the OFF position.
2. Check that all heater cables are plugged in.
3. Plug in mass spectrometer power cable.
4. Turn ON the mass spectrometer power switch at the rear of the instrument.
5. Open **System Control** on the computer.
    - The most recently set instrument parameters will be loaded into the mass spectrometer.
    - The software will stay on the shut down page until the mass spectrometer is fully restarted.
6. Briefly press down on the analyzer assembly to ensure a good vacuum seal.
7. Replace the mass spectrometer system cover.

Baking Out the Trap

To bake out the trap, proceed as follows:

1. Open **System Control** and click **Temperatures**.
2. Under **Bakeout Conditions**, enter a bakeout time of 2 to 6 hours at 220 °C or higher.
3. Set manifold temperature to 120 °C.

4. Click **Start Bakeout**.



Checking the Ion Trap Operation

To check the ion trap operation, proceed as follows:

1. Once bake out is finished, re-establish the analysis temperature in the trap for at least 2 hours to achieve thermal equilibrium.

   The manifold temperature should be below 50 °C.

2. Run **Diagnostics**.
3. Run **Auto Tune** or manually tune spectrometer.

Filling the Calibration Compound Vial

The calibration compound used with the 210-MS or 220-MS is perfluorotributylamine (PFTBA; $C_{12}F_{27}N$). This compound is also known as fluorocarbon-43 (FC-43).

NOTE: There is no need to vent the vacuum system before you fill the cal gas vial with calibration compound, provided the cal gas needle valve is closed. To close the cal gas needle valve, turn it clockwise.

To fill the cal gas vial, proceed as follows:

1. Loosen each of the four retaining screws about 3 turns with a Phillips screwdriver. The four screws are located on the top of the pneumatics manifold.
2. Pull the cal gas vial down gently with a slight twisting motion until it clears the pneumatics manifold.
3. Refill the vial using a Pasteur pipette until the vial is filled about 1/3 full with PFTBA compound (392035300).
4. Remove any liquid that remains in the neck of the vial with a lint-free paper tissue.
5. While holding the vial vertically, carefully push the vial into the cal gas port on the manifold with a slight twisting motion.
6. After you have pushed the vial in as far as it will go, tighten the four retaining screws.

7. Open the cal gas needle valve 10 counterclockwise turns. Leave the needle valve open for at least 30 minutes. Any excess cal gas and water vapor will be pumped away.
8. Open **System Control** on the computer and then click **Manual Control** button.
9. Under the **Adjustments** tab, select **Adjust Cal Gas**.
10. Adjust the cal gas pressure according to the instructions on the screen.

Moving the 210-MS or 220-MS

To move the 210-MS or 220-MS, proceed as follows:

1. Shut down the GC and mass spectrometer.
2. Turn off the GC and computer. Then unplug the GC, mass spectrometer, and data system power cords.
3. Open the vent valve lever on the front of the mass spectrometer for ten minutes.
4. Keep an eye on the capillary column inside the GC as you gently slide the mass spectrometer away from the GC. Be sure not to bend or kink the capillary column.
5. Use the alignment tool to prevent the transfer line from turning while you loosen the brass capillary nut connecting the column to the transfer line.
6. Cap the transfer line with a capillary nut and no-hole ferrule.
7. Place the capillary column and nut inside the GC oven. This will protect them from damage.
8. Turn off the carrier gas, then disconnect the helium gas line that is connected to the GC filter.
9. Cap the filters with Swagelok plugs or caps.
10. Move the 210-MS or 220-MS to its new location. Be sure the new location satisfies the power and environmental requirements described in the 210-MS and the 220-MS Pre-installation Instructions.

Troubleshooting

How To Isolate GC or MS Problems

In general, whenever you attempt to isolate an MS problem, you will check the system in the following order:

- Data System
- GC
- MS

Checking the Data System

Refer to the software release notes for relevant software troubleshooting procedures.

Checking the GC

The simplest and most effective way of isolating a GC problem is to run a test sample. Running a sample will allow you to check several operational and performance factors, including the carrier gas supply, chromatographic characteristics, and sample-related problems.

The test sample that is most frequently run is the COLTEST mixture. This multicomponent mixture is very well suited to troubleshooting injector and column problems. Please see “How to Run the COLTEST Sample” on page 87 for a description of the use of this test mixture.

See the GC manuals for information about fixing GC faults. Ensure that you are thoroughly familiar with all safety issues before you attempt to repair any electronics component.

Checking the MS

If your data system and GC are operating normally, the problem could be caused by the mass spectrometer or by the communication channel between it and the data system. Typical problems with the ion trap include lack of response (no spectra), low response, poor resolution, and mass misassignment.

There are two procedures for isolating problems associated with the Mass Spectrometer. Running the Auto Tune routine from System Control will provide

you with information about system performance. Running the diagnostics program will initiate a hardware test. These tests may be used to isolate simple ion trap problems, e.g., air leaks, burned-out filaments, high contamination levels, and so on.

NOTE: If diagnostics fail, once the problem is corrected, the *Reset* button must be clicked before further testing.

In certain cases, you may need to physically separate the GC and MS to isolate an ion trap problem. In these cases, remove the column from the injector, and plug its end with a septum. This will minimize the input of air. Maintain the column and transfer line at ambient temperature to prevent degradation of the stationary phase. You do not need to vent the MS vacuum system to complete this procedure.

If you wish to further isolate the mass spectrometer, you must remove the column from the ion trap by shutting down the system and capping the transfer line with a no-hole ferrule.

How To Troubleshoot Problems with Spectra

The following describes the common problems a user may encounter with an Ion Trap Mass Spectrometer.

What To Do If No Spectrum Appears

If a spectrum fails to appear on the screen when you click on the ion trap icon in the Instrument Control Page, regardless of mass range, you should investigate the following potential causes:

- The method segment is a FIL/MUL Delay and ionization is EI (AUTO or FIXED) mode. During FIL/MUL Delay the trap icon is red.
- The filament is open.
- The turbomolecular pump has stopped.
- An RF adjustment is required.
- The instrument parameters are inappropriate.
- The trap has been incorrectly assembled.
- There is a problem with the electronics.
- The system has not finished baking out.

NOTE: Before you begin troubleshooting, however, be sure that you have baked out 210-MS or 220-MS for at least 2 hours.

Run Diagnostics to determine if any hardware problems are present. If you have done this, and the missing-spectrum problem persists, continue as follows. These steps apply if either air/water or cal gas peaks are missing.

Check for an Open Filament

Diagnostics determines if one or both filaments are open. If only one filament is open, enter System Control. Click on Set Points. Under Filament Selection, select the other filament.

If both filaments are open, shut down the instrument. Then check the filament continuity and wire connections after you have removed the ion trap assembly from the manifold. If necessary, replace the filaments.

Check the Turbomolecular Pump

The Diagnostics Vacuum test will determine if the Turbomolecular pump speed reading is at least 100 ± 2%.

Make sure the pump speed reading is at least 100 ±2%. If it is not, inspect cooling fans for proper operation.

Check the RF Adjustment

Check whether an RF adjustment is needed (particularly after you have changed the ion trap temperature), proceeding as follows:

1. Open **System Control** on the computer and then click the **Manual Control** button.
2. Click on the **Adjustments** tab and then click **Adjust RF Tuning**.
3. Adjust the RF ramp by turning the RF tuning screw.
4. Adjust the RF ramp until the highest value is minimized.
5. Click **Save Results**.

Check the Parameter Settings

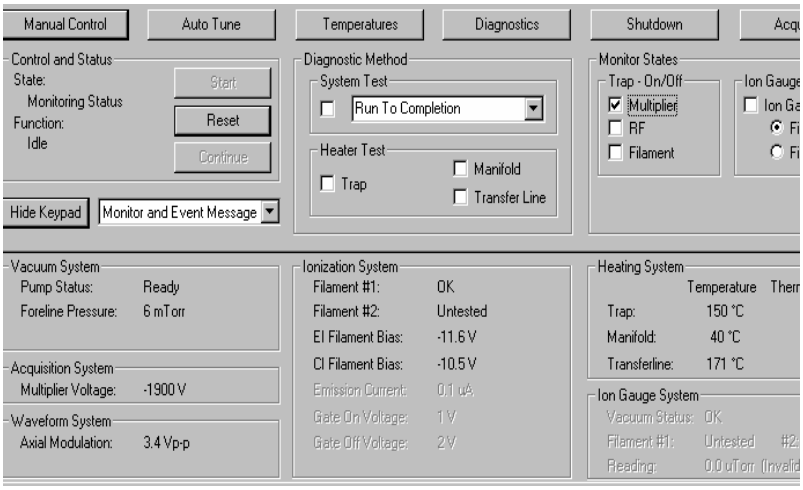
Check whether you have set inappropriate method parameters, proceeding as follows:

1. Open **System Control** and then click the **Auto Tune** button.
2. Select **Electron Multiplier Tune** and then click on **Start Auto Tune**.
3. Select **Air/Water Check** and then click **Start Auto Tune**. If air and/or water levels are out of range, go to section on Air/Water leaks to troubleshoot these problems. If a spectrum is present, enter Method Editor and check if
   - You specified the EI ionization mode.
   - Make sure that the ionization storage level permits storage in the trap of the ions selected in the scan range.
4. If you are unsure of appropriate levels, then reset parameters by clicking on the **Defaults** button in each section.
   a. Save your method file as Default.
   b. Activate Default file, turn on trap and Cal gas. Check for cal gas spectrum.
5. If the spectrum returns, note which parameter(s) were causing the problem. If no spectrum is present, and the trap was recently disassembled, the assembly of the trap must be checked.

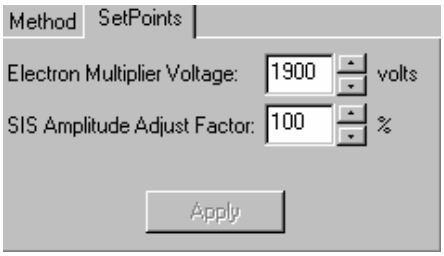
Check the Assembly of the Trap

Check whether you have incorrectly installed the oven components, proceeding as follows:

1. Display the axial modulation readback by selecting **Diagnostics** and checking **Axial Modulation** under the **Waveform System** box.



2. If the axial modulation readback is near zero, there maybe a scratch on the trap oven, which is shorting out one of the end caps. Shut down the system, remove the trap oven, and use an ohm meter to check for continuity between the electrodes and ground. Use the screws holding the clamping plate as ground. If this test is done without removing the trap from the electronics assembly, there will be continuity to ground.
3. Check whether there is a problem with the electron multiplier, proceeding as follows:
    a. Under **Monitor States**, select **Multiplier**.
    b. Under **Acquisition System**, check that the electron multiplier voltage is the same or close to the value displayed under the **SetPoints** tab in the **Auto Tune** section.



    c. If the electron multiplier voltage in the Diagnostics is only a few volts, the multiplier is shorted to ground. Shut down the system, and replace the electron multiplier or call a Varian Customer Support Representative.

Check the Electronics

Check whether there is an electronics problem, proceeding as follows:

1. From **Manual Control**, click on **Diagnostics**.

2. Click on **Run Tests to Completion** to isolate the cause of the problem. Note which of the tests fail.

NOTE: If, after performing these tests, you are still unable to isolate the cause of the problem, contact your Varian Customer Support Representative.

What To Do If You Experience a Loss of High Mass Peaks

The loss of high mass peaks maybe due to:

- RF ramp needs adjustment
- Too many low mass ions (for example, air or water leak)
- Improper Ionization storage levels (for example, settings are too low)
- High Trap temperatures may cause loss of high mass cal gas peaks

NOTE: Before you begin troubleshooting, however, be sure that the 210-MS or 220-MS has baked out for at least 2 hours, and that the manifold temperature is at or below 50 °C. If you have done this, and the problem persists, continue as follows.

1. Check for an air leak in **Auto Tune** section.
2. Check the RF ramp Adjustment.
3. Reduce trap temperature to 150 °C.
4. Enter **Method Builder** and then check that the method contains EI AGC (Automatic Gain Control) ionization mode, and Default values for other parameters.

NOTE: If, after performing these tests, you are still unable to isolate the cause of the problem, contact your Varian Customer Support Representative.

What To Do If Part of the Spectrum is Missing

If you do not observe high- or low-mass ions in System Control but the ions in the mid-range of the spectrum appear normal, you should investigate the following possibilities:

- An RF adjustment may be required, particularly if you have just changed the ion trap temperature.
- The ionization RF level may be incompatible with the scan range.
- The trap temperature may be too high to allow you to observe all of the cal gas ions. Reduce trap oven temperature to 150 °C, and wait 2 hours for thermal equilibration.

NOTE: Before you begin troubleshooting, however, be sure that the 210-MS or 220-MS has baked out for at least 2 hours. If you have done this, and the problem persists, continue as follows.

Check the RF Adjustment

Check whether an RF ramp adjustment is needed, proceeding as follows:

1. Open **System Control** and then click **Manual Control** button.
2. Click the **Adjustments** tab and then click on **Adjust RF Tuning**.
3. Adjust the RF ramp by turning the RF tuning screw on the front panel. Adjust to minimize the highest reading.

Check the RF Storage Level

Check whether the RF storage level is incompatible with the scan range, proceeding as follows:

1. Open the **Method Builder**.
2. Select **EI-AGC** segment, and click on **Ionization Mode**. Note Ionization Storage Level. Confirm values are appropriate for mass range.

Check the Trap Temperature

Check whether the trap temperature is too high to permit you to observe all cal gas ions, proceeding as follows:

If the trap temperature is too high, the height of the mass 614 peak may be reduced, and the mass 502 peak may disappear entirely (above 200 °C). Reduce trap oven temperature to 150 °C and wait 2 hours for thermal equilibration.

NOTE: If, after performing these tests, you are still unable to isolate the cause of the problem, contact your Varian Customer Support Representative.

What To Do If Resolution Is Poor but Air and Water Levels Are Acceptable

If the peaks are broader than you would have expected, you should investigate the following possible causes:

- There are too many ions in the trap (for example, contamination or high column bleed).
- The axial modulation value is too high or too low.
- Axial modulation is not functioning properly.

Before you begin troubleshooting, however, be sure that the 210-MS or 220-MS has baked out for at least 2 hours. If you have done this, and the problem persists, continue as follows.

Check the Ion Content of the Trap

With the trap turned on, note the TIC (total ion current) value. If the TIC value exceeds 20,000 counts in full-scan mode, or a few thousand counts in MS/MS, reduce the number of stored ions.

To reduce the number of ions in the trap, do one or more of the following:

1. Make sure that the electron multiplier is set for a gain of 10^5. In the **Method Builder**, check that the Multiplier Offset is equal to 0 in the Method. Reduce the trap filament current and/or ion time settings (AGC OFF).
2. Reduce the AGC target value to 10,000 (AGC ON).

Check the Axial Modulation Setting

Check whether the axial modulation is set too high or too low, proceeding as follows:

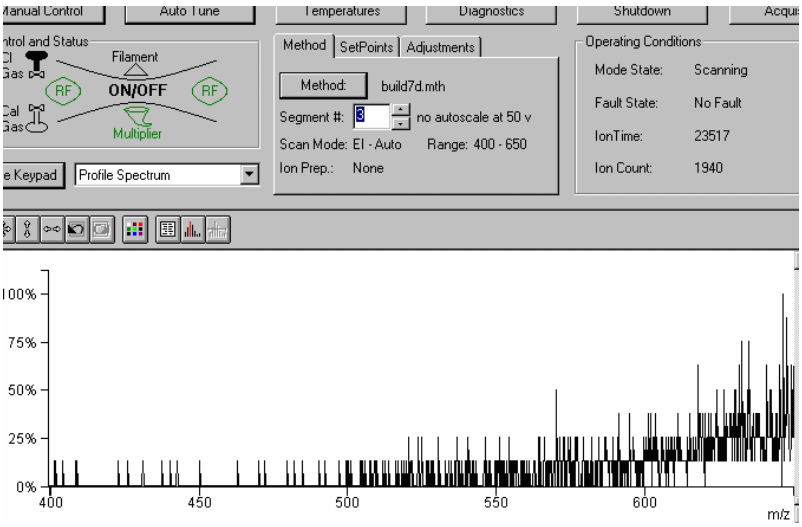
1. Click on **SetPoints** from **Manual Control**. Make sure the axial modulation is set between 2.5 and 5 volts. If you adjust the axial modulation, check several cal gas ions for resolution (e.g., m/z = 131 and 414).
2. Check whether axial modulation is working properly, proceeding as follows:
3. Open **System Control**, turn on trap and cal gas. Click near m/z 131, to expand the mass range $\pm$ 5 about m/z 131.
4. Click on **SetPoints** and then change the **Axial Modulation** by several volts. Click **Apply**. Confirm the shift of mass 131. Return axial modulation to initial value.
5. Click the **Diagnostics** button from **System Control** and then select **Run Tests to Completion**. Confirm the axial modulation is working properly.
6. Make sure that the axial modulation readback is within 20% of the set point. If the axial modulation readback is out of this range, it will usually result from improper installation of the trap oven causing a shorted end cap.
7. If the oven is properly assembled and axial modulation is out of range, contact your Varian Customer Support Representative.

What To Do If There Is High Baseline at High Masses

If the baseline on the instrument page increases sharply between masses 400 and 650, you should investigate whether there are particles on the electrode surface.

Check whether there are particles on the trap electrode surfaces, proceeding as follows:

1. Develop method for EI/AGC ON for mass range 400 to 650. Open **System Control** and activate this method.
2. Turn on RF and the electron multiplier (filament is OFF).
3. Examine the spectrum, and notice whether the baseline increases exponentially at high masses.



If the baseline ramps up, shut down the 210-MS or 220-MS and then carefully clean the electrode surfaces with a lint-free cloth.

What To Do If Trap Function Calibration Fails After Calibration Ions Have Been Correctly Identified

If the trap function calibration fails after the calibration ions have been correctly identified, you should investigate the following possible causes:

- The electron multiplier voltage is too low.
- The cal gas pressure is too low.

Check the Electron Multiplier Voltage

1. Open **System Control**.
2. Select **Auto Tune** and then click on **Electron Multiplier Tune**.
3. Click on **Start Auto Tune**.

Check the Cal Gas Pressure

1. Open System Control.
2. Select **Manual Control** and then click on the **Adjustments** tab.
3. Click **Adjust Cal Gas** and then set the cal gas pressure to a value at the mid to high end of the scale.

How To Check for Leaks

A major problem in mass spectrometry is keeping the system as leak-tight as possible. Air leaks may result in reduced sensitivity, tuning problems, and decreased resolution; in addition, they may reduce the lifetimes of the capillary column, filaments, and the electron multiplier. Check the system each day for air and water leaks before you begin acquisitions.

As you use this guide, pay particular attention to any examples in which air and water backgrounds appear in the spectra. Familiarity with these examples will help you to rapidly troubleshoot the system.

How To Establish the Conditions Required for Checking Leaks

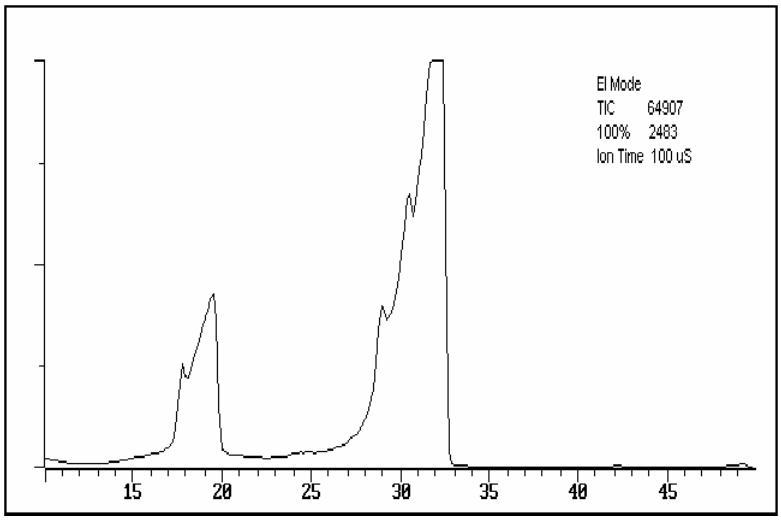
To establish the conditions required for checking leaks, proceed as follows:

1. Verify that the carrier gas pressure on the gauge in the front panel of the GC is set correctly. With a 30m x 0.25 mm, DB-5 fused silica capillary column, the carrier gas pressure should be about 10-12 psi (83 kPa).
2. Set the trap temperatures:
   - Trap heater temperature to 150 °C.
   - Transfer line temperature to 270 °C.
   - Manifold temperature to 35 °C.
3. Set the column-oven and injector temperatures to 100 °C.

CAUTION

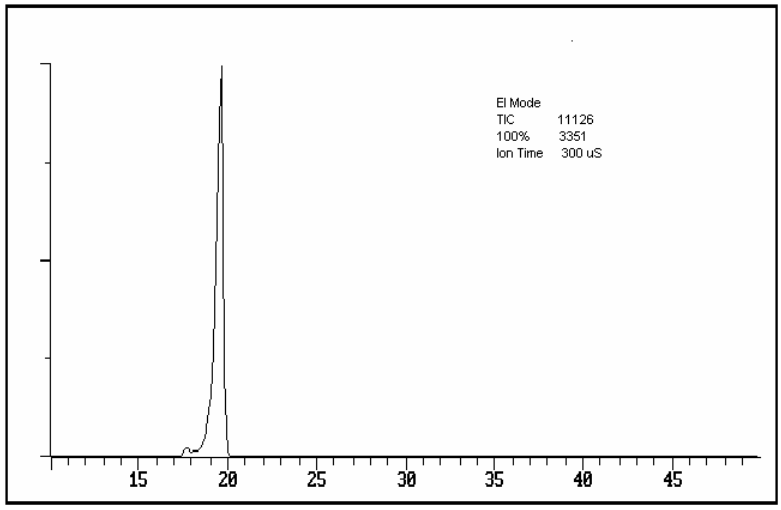
Often, major air leaks are accompanied by a hissing sound. These leaks may be due to extremely loose fittings, improperly seated O-rings, or open valves. If you suspect a major leak, do not turn on the electron multiplier, RF voltage, or filament. Using the Diagnostics section, confirm that the turbomolecular pump is operating at 100% speed. If it is not, you can be sure there is a major air leak.

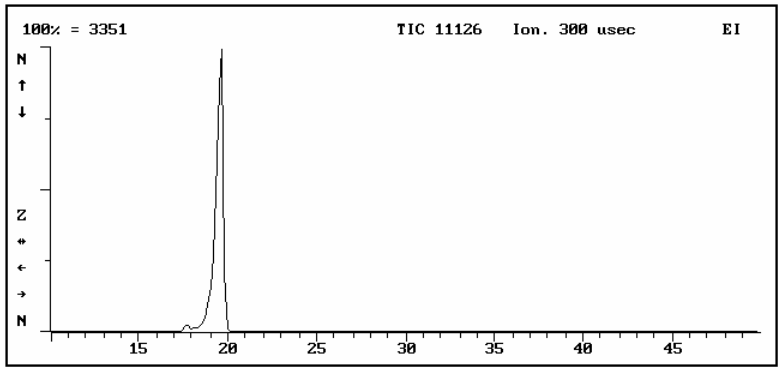
4. Open **System Control** and then click **Auto Tune** button.
5. Select **Air/Water Check**.
6. Click **Start Auto Tune.**
7. Compare your air/water spectra to the following:



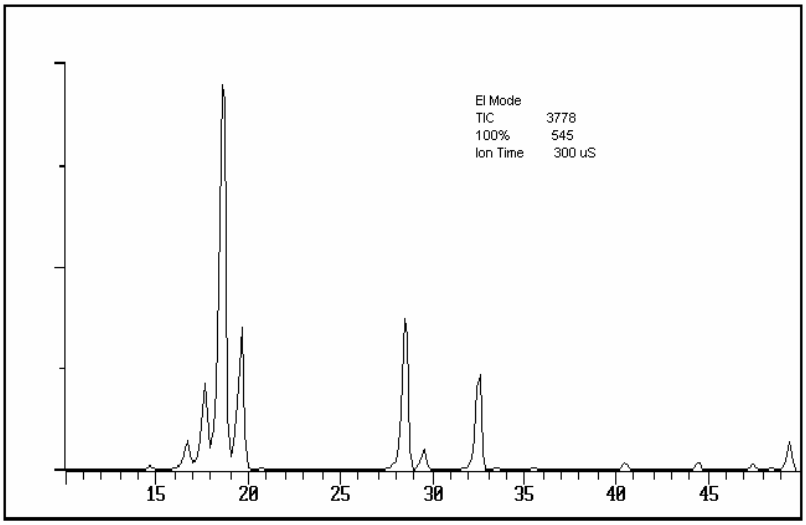
Air/Water spectrum from an instrument with a gross air leak

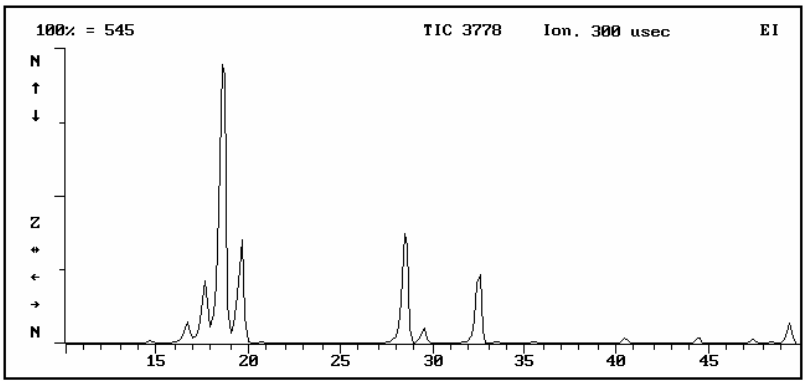
- If the peaks at masses 32 (O_2+), 28 (N_2+), and 18 (H_2O+) are severely broadened or undifferentiated, your system has a large air leak. Immediately turn off Air/Water Check.





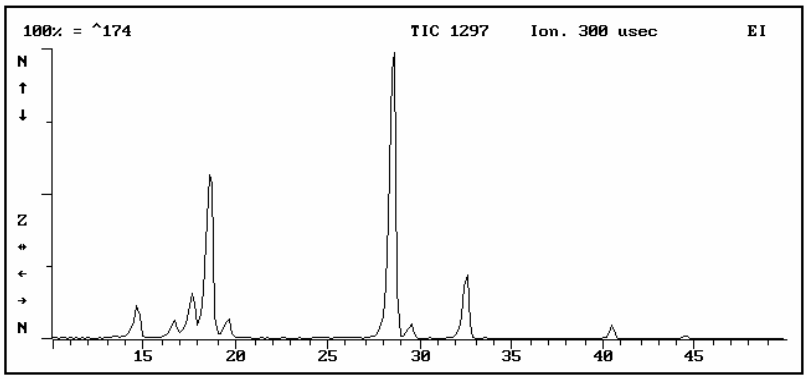
Air/Water Spectrum from a System with a Very High Water Vapor Background





Air/Water Spectrum from a System with Excess Water Vapor and a Relatively Small Air Leak

- If the ratio of the height of the peak of mass 18 (H_2O^+) to mass 19 (H_3O^+) is about 10:1, there is little water vapor in your system.
- If the ratio of peak height of mass 18 to mass 19 is less than 10:1 but greater than 5:1, additional bakeout maybe necessary. Be aware, however, that if you do not eliminate the water vapor, your system's sensitivity and performance may be less than optimal.
- If the ratio of the peak height of mass 18 to mass 19 is much less than 10:1, your system contains excess water vapor.



Air/Water Spectrum Obtained from a System with No Significant Air Leaks and Little Water Vapor

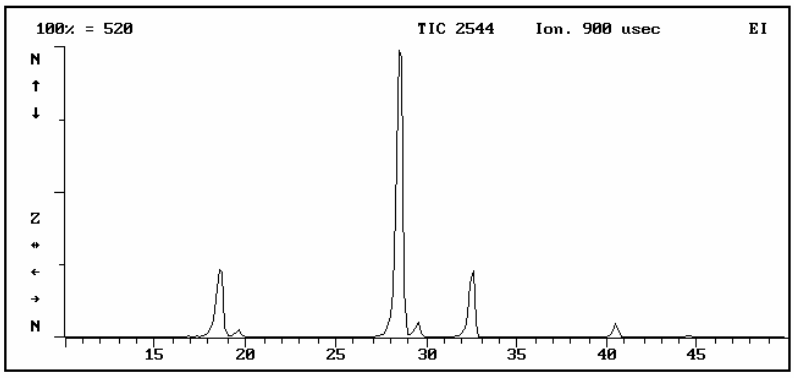
This spectrum is indicated by:

- The peak at mass 18 (H_2O^+) may be the base (highest) peak. This is dependent on the level of water vapor.
- The ratio of the peak height at mass 18 (H_2O^+) to that at mass 19 (H_3O^+) is greater than or equal to 10:1.
- The 100% counts value is significantly lower than 500.
- The ratio of the peak height at mass 28 to that at mass 32 (O_2^+) is about 4:1.

8. If there are no air or water leaks in your system, you should obtain the following approximate values. Please note that these values are only typical, so the actual values may vary from system to system.

100% value	**TIC**	**18:28 ratio**	**19:18 ratio**	**28 width**
<100	<1000	~ 1:1	10 to 15%	< 1 m/z

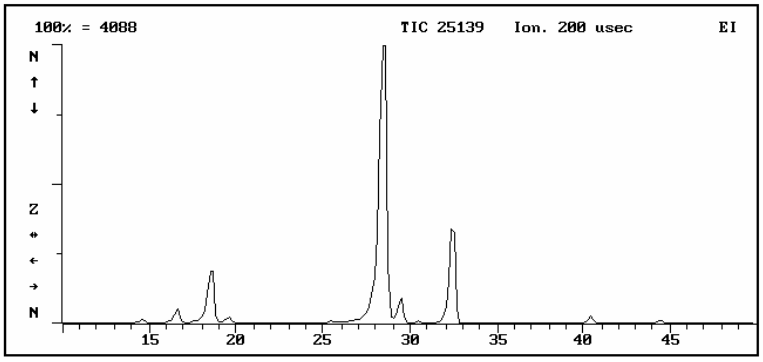
9. Spectra observed if there is an air leak in your system.



Air/Water Spectrum Obtained from a System with a Small Air Leak and Little Water Vapor

This spectrum is indicated by:

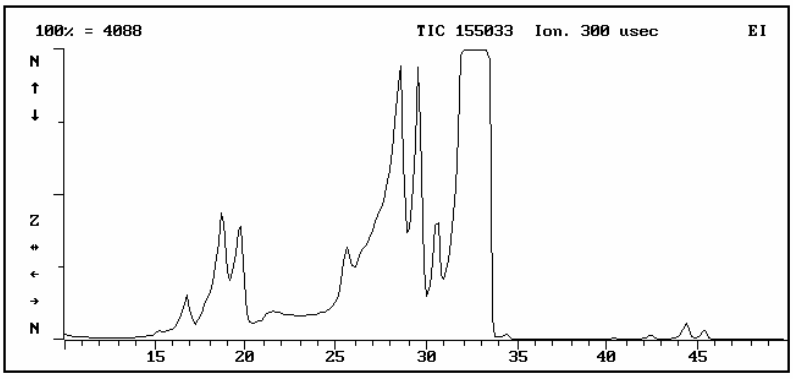
- The peak height at mass 28 is noticeably greater than that at mass 18.
- The ratio of the peak height at mass 28 to that at mass 32 is greater than 4:1.
- The 100% scale counts value has increased to greater than 500.
- The ratio of the peak height at mass 18 to that at mass 19 is greater than or equal to 10:1.



Air/Water Spectrum Obtained from a System with a Moderate Air Leak and Little Water Vapor:

This spectrum is indicated by:

- The peak at 28 starts to overload.
- The 100% counts value may be several thousand counts.
- The peak height at mass 18 is greater than that at mass 19.



Air/Water Spectrum Obtained from a System with a Large Air Leak and Little Water Vapor:

This spectrum is indicated by:

- The peak at mass 32 is the base (highest) peak.
- The peaks at masses 18, 19, and 28 are broadened. As a leak increases, all peaks broaden and eventually become undifferentiated.

How To Fix High Water Levels

The presence of excess water vapor may be due to:

- Failure to pump down for a sufficient length of time (for example, at least two hours, when the system is vented)
- Introduction of water vapor when the ion trap is cleaned
- Introduction of water vapor when the capillary column is replaced
- Water vapor in the carrier gas tank
- An atmospheric air leak in the system
  This problem most often occurs under conditions of high relative humidity.

High water backgrounds after venting the system is often observed, especially after cleaning the trap. Several hours of bakeout may be required for the water vapor to desorb from surfaces in the vacuum system, and for the water level to drop to a stable level. Never operate 210-MS or 220-MS if the mass 18 and 19 peaks are the same height (or if the air/water check shows NO). After the system has baked out sufficiently (for example, overnight) and if water vapor in the system is still detected, it might be because of a contamination in the carrier gas tank or an air leak.

Saturated filters on the GC may produce an increase in the air/water background. Replace the filters at regular intervals, and whenever moisture or other background from the GC becomes a problem.

Using Leak Detection Gas to Troubleshoot for Air Leaks

You may use a leak detection gas such as Freon or argon to locate leaks. A leak at the transfer line (the high vacuum side) should produce an immediate response. If, on the other hand, the leak is coming from the GC injector, it will take about 90 seconds to register a response. (It takes about that length of time for the gas molecules to travel through the capillary column.) If you discover a leak at the injector, you can correct the problem without venting the system; however, be sure to wait until all GC zones are cool before beginning. If the leak is coming from the transfer line connection, you will have to shut down the GC/MS system and vent the system before fixing it.

NOTE: Set the mass range from 35 to 50 if you will be using an argon leak-detection gas, or from 80 to 110 if you will be using a Freon leak-detection gas.

Troubleshoot leaks using argon gas as a leak detecting gas. The mass peak of interest for argon is at mass 40.

To reduce the risk of damaging the filaments or multiplier, develop a method file with the following parameters:

1. Set the electron multiplier 100 V below the 10^5 setting.
2. Turn off AGC and set the ion time to 100 μsec.
3. Set the filament emission current to 10 μA.

4. Set scan range from m/z of 35 to 50 (or 80 to 110).
5. Enter system control, activate the argon method for troubleshooting and turn the trap ON.

NOTE: Do not spray argon indiscriminately around the fittings. Argon diffuses very rapidly from the fitting you are testing toward a true leak. This could lead you to mistakenly identify the fitting that you are testing as the leak source.

Check for leaks:

- Spray a fine stream of argon on the transfer line closest to the analyzer.
- Examine the monitor for a response. If a peak at mass 40 does not appear, there is no leak.
- If a peak appears at mass 40, there is a leak. The transfer line O-ring may have particles on its surface. Shut down the system and check the O-ring.

Check the following gaskets and fittings for leaks, one item at a time and in the following order. Tighten the fittings and/or flanges as needed. Wait a few seconds between subsequent applications of argon.

- Cal gas tube fitting on the pneumatics manifold
- Vent valve fitting on the manifold
- Top vacuum manifold flange

How To Fix Large Air Leaks

Typical sources of large air leaks in 210-MS or 220-MS are:

- Lint or damage on the manifold flange O-ring seal
- Lint or damage on the transfer line O-ring seal
- The transfer line brass nut
- The O-Ring seal between the turbomolecular pump and the manifold
- The release tabs of the analyzer that may not be locked into position

If the brass nut on the transfer line is not tight enough. Ensure the nut is tight enough, but do not over tighten the fittings. Otherwise, you may generate an even larger leak. Then, recheck the system

If you cannot eliminate the leak, vent the system, and check the O-ring on the manifold and transfer line for particles. Wipe off both O-rings with lint-free paper.

The turbomolecular pump will probably fail to achieve its 100% speed if there is a leak or poor seal at the turbo/manifold interface. Never attempt to operate the system under these conditions.

How To Fix Small-to-Moderate Air Leaks

You may have more trouble finding and correcting a small-to-moderate air leak than a large one. Symptoms associated with small-to-moderate air leaks include the following:

- The peak at mass 28 will have increased, becoming significantly larger than the mass 18 peak.
- The air leak will probably increase the water background, particularly in humid environments. An increase in water vapor content will be accompanied by a 20% or greater increase in the 19:18 mass ratio.

Check GC Connections

NOTE: Check the GC Maintenance Section for additional information for trouble shooting leaks.

To identify and correct a leak at the connections between the capillary column and the injector or transfer line, proceed as follows:

- Make sure that you are using ferrules of the correct size, for example, 0.4 mm for 0.25-mm ID columns, and 0.5 mm for 0.32-mm ID columns.
- Make sure that the ferrule on the transfer line is a graphite/Vespel mixture. Most transfer line connection leaks occur on the high vacuum side (e.g., around the transfer line O-ring).

In the case of a graphite/Vespel ferrule, tighten each ferrule one-half turn beyond finger tightness. In the case of a graphite ferrule, tighten each ferrule three-quarters of a turn beyond finger tight.

- Leaks at the septum may arise from loose injector nuts or overuse of the septum. Regularly change the septum as part of your routine GC preventive maintenance program. To reduce the level of air bleeding into the system and any background from the septum material, use good quality, low-bleed septa.
- Air leaks in the GC pneumatics are the most difficult leaks to detect and eliminate, because detection gases are not particularly effective for this purpose. In general, you should tighten all fittings, and then check for such a leak using a solvent such as methanol.
- Saturated filters on the GC may produce an increase in the air/water background. Replace the filters at regular intervals and whenever moisture or other background from the GC becomes a problem.

How To Remove Capillary Column from the System

To remove the capillary from the system, proceed as follows:

1. Turn off the GC column oven and heater. Shut down and vent the mass spectrometer.
2. Open the inside of the GC oven. Make sure that about 30 cm (12 in.) of the mass-spectrometer end of the capillary column is hanging freely, so that you can move the mass spectrometer away from the GC without breaking the column.
3. Keep an eye on the capillary column in the GC oven as you gently slide the mass spectrometer away from the GC.
    - As you slide the mass spectrometer away, take care not to allow the column to bind or kink. When you have fully withdrawn the mass spectrometer from the GC, the distance separating them should be ≥23 cm (9 in.). The transfer line should be fully removed from the GC oven.

NOTE: Avoid contamination of the transfer line, injector, and capillary column by using clean tools and wearing clean lint-free Nylon® gloves. As you remove parts, place them on a clean, lint-free, unpainted surface.

4. Use the alignment tool and a 5/16-in. wrench to loosen the brass nut on the end of the transfer line.
5. Remove the capillary column from the transfer line.
6. Remove the brass nut, along with the ferrule, from the column.
7. Remove the ferrule from the nut. Discard the ferrule.
8. From inside the GC oven, pull the transfer line end of the column back into the hole in the side of the GC.

NOTE: Leave the free end of the column on the floor of the oven.

To withdraw the transfer line from the vacuum manifold, proceed as follows:

1. Unplug the transfer line heating cable.
2. Grasp the nose of the transfer line, then rotate counterclockwise as you press lightly toward the manifold. Gently slide the transfer line away from the manifold.
3. Remove the nose clip, and then pull the transfer line away from the analyzer.
4. Wrap the transfer line in clean aluminum foil and place it on a clean, dry surface.
5. Cover the analyzer opening with aluminum foil.

To remove the capillary column from the GC injector, proceed as follows:

1. Use a 5/16-in. wrench to loosen the capillary column nut that secures the column to the injector.
2. Carefully remove the nut, ferrule, and column from the injector.

3. Slide the column nut, along with the ferrule, off the end of the column.
4. Remove the ferrule from the column nut. Discard the ferrule.
5. Carefully lift the column support cage, along with the column, from the column hanger. Then, remove the support cage and column from the oven.
6. Seal the end of the column or insert the ends of the column into a septum.
7. Store the column and the support cage.

How To Install New Capillary Column in the System

To install a new capillary column in the mass spectrometer, proceed as follows:

1. Unwind about 60 cm (24 in.) of the mass spectrometer end of the column from the support cage.
2. Insert this end of the column through the transfer line hole in the right side of the GC.
3. Insert the column end through the brass nut (to be installed on the GC end of the transfer line). Then slide the nut several inches down the column.

NOTE: The wide, threaded opening of the nut should face the end of the column.

4. Place a new graphite/Vespel ferrule on the column, with the taper facing the nut. Slide the ferrule, along with the nut, about 30 cm (12 in.) down the column.
5. Carefully insert the tip of the column into the nose end of the transfer line.
6. Slide the column all the way through the transfer line until the tip of the column projects a few inches beyond the transfer line tip.
7. Using a sapphire-, or carbide-tipped scribing tool or ceramic scoring wafer, score the column once lightly about 2 cm (1 in.) from its end.
8. Bend the column slightly to break it at the mark. The column should break cleanly.
9. Using a Kimwipe® tissue dipped in methanol, carefully wipe the last 15 cm (6.0 in.) of the column.
10. Be sure to wipe toward the end of the column so that the Kimwipe® tissue fibers do not enter the opening at the column end.

To position the column in the transfer line, proceed as follows:

1. Install the brass nut on the end of the transfer line, but do not tighten the nut completely.
2. Keep an eye on the tip of the column and position it so that about 1 mm (1/32 in.) of the column projects from the transfer line tip.

NOTE: As you tighten the nut, the position of the column in the transfer line may change. If this happens, loosen the nut and readjust the column until about 1 mm (1/32 in.) of the column projects from the transfer line tip.

3. Grasping the transfer line securely with the alignment tool, use a 5/16-in. wrench to tighten the brass nut. Tighten the nut until snug, but do not over tighten.
4. Rotate the transfer line so that the heater cable projects downward.

To install the transfer line in the manifold, proceed as follows referring to the Transfer Line Exploded View on page 17:

1. Position the transfer line in the manifold, and install the clip into the holes and slots.
2. Gently push the transfer line toward the manifold, and rotate the collar in the clockwise direction until the bayonet lock engages.
3. Reconnect the transfer line heating cable to the mass spectrometer.
4. Gently push the mass spectrometer toward the GC, until the transfer line boot fits snugly over the collar on the side of the GC oven.

NOTE: The capillary column nut should be visible inside the GC column oven.

5. The MS is properly engaged when the bumpers on the left side of the spectrometer achieve full contact with the right side of the GC.
6. Replace the cover on the mass spectrometer.

How To Troubleshoot the GC

NOTE: Please refer to the GC Operator's Manual for information about GC troubleshooting and diagnostics procedures not described in this section.

This section describes chromatographic troubleshooting, with particular emphasis on GC/MS applications. You will be able to see most of the problems addressed in this section by running the COLTEST mixture (392027300).

The following procedure describes the chromatographic conditions and the expected results when running the COLTEST sample with a 30-m DB-5 column (0.25 mm ID, 0.25 μm film thickness).

How To Run the COLTEST Sample

The COLTEST method is in this directory, <root>:\VarianWS\Service.

Set Up the Injector Conditions

If you are using a 1079 injector, hold an initial temperature of 40 °C for 0.1 min, then ramp the temperature to 280 °C at a rate of 200 °C/min.

If you are using a 1177 injector, proceed as follows:

1. Use an isothermal temperature of 260 °C.
2. Set up the following external event program conditions:

NOTE: "Gas saver event", if present, must be ON.

Time	Event 1	Injector Mode
0.00	On	Splitless
0.50	Off	Split

3. Set the splitter flow rate to 100 mL/min.

Set Up the Column

Develop programmable column temperature program with:

1. An initial column temperature set to 40 °C.
2. Hold at 40 °C for 2 min.
3. Ramp the temperature, at an initial rate of 10 °C/min to 140 °C, then at a rate of 20 °C/min to 280 °C.

NOTE: Do not hold the temperature at 140 °C.

4. Adjust the total run time to 21 min by adjusting the hold time of the last segment.

Set Up the Transfer Line and Trap-Temperature Conditions

1. Set the transfer line temperature to 260 °C.
2. Set the trap temperature to 150 °C.
3. Set the manifold temperature to 35 °C.

Set Up the Mass Spectrometer Acquisition Method

To set up the mass spectrometer acquisition method:

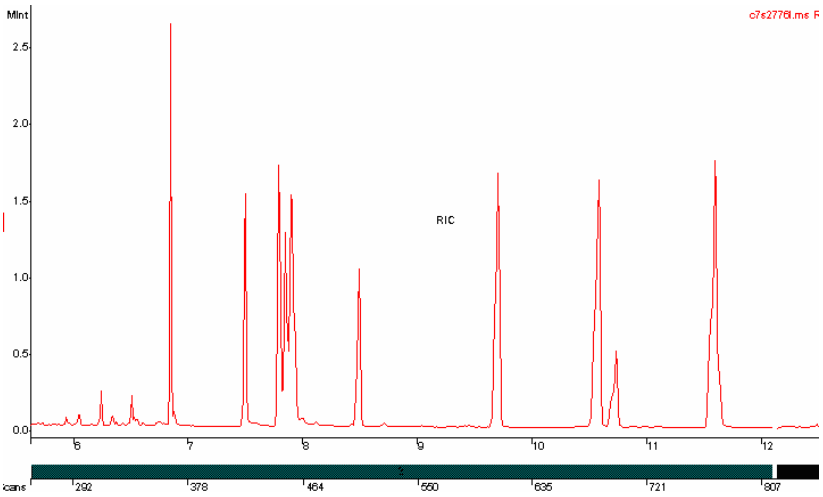
1. Set the mass range to 40 to 350 at a scan rate of 1 scan/sec.
2. Set the background mass to 39.
3. Set a filament/multiplier delay of 180 sec.
4. Set a peak threshold of 1 count.
5. Set a mass defect value of 0.
6. Specify electron ionization (EI Auto).
7. Turn cal gas OFF.

The COLTEST test mixture contains the following compounds at levels of 1 to 5 ng/μL.

No.	Compound	Formula	Integer Weight	Quantitation Mass
1	decane	$C_{10}H_{22}$	142	57
2	1-octanol	$C_8H_{18}O$	130	69
3	undecane	$C_{11}H_{24}$	156	71

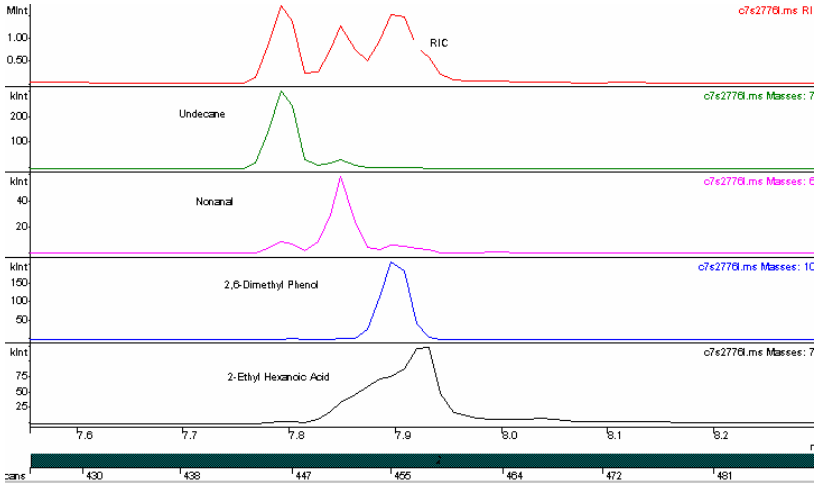
No.	Compound	Formula	Integer Weight	Quantitation Mass
4	nonanal	$C_9H_{18}O$	142	67
5	2,6-dimethylphenol	$C_8H_{10}O$	122	107
6	2-ethylhexanoic acid	$C_8H_{16}O_2$	144	73
7	2,6-dimethylaniline	$C_8H_{11}N$	121	106
8	decanoic acid, methyl ester	$C_{11}H_{22}O_2$	186	74
9	undecanoic acid, methyl ester	$C_{12}H_{24}O_2$	200	87
10	dicyclohexylamine	$C_{12}H_{23}N$	181	138
11	dodecanoic acid, methyl ester	$C_{13}H_{26}O_2$	214	143
12	hexachlorobenzene	C_6Cl_6	282	284

The following is a typical chromatogram for this test mixture. Note that 2,6-dimethylphenol and 2-ethylhexanoic acid coelute normally on a DB-5 column, depending on column and injector.



Typical Chromatogram of COLTEST Text Mixture

The following figure demonstrates the resolving power of the 210-MS and the 220-MS for coeluting compounds.



Resolution of 210-MS or 220-MS for Coeluting Compounds

You can also effectively separate the individual components in the mixture for subsequent data manipulation, e.g., library searches and quantitation. For details about plotting single ion chromatograms for ions specific to a single compound, please refer to the online help or section in the Software Reference manual.

How To Troubleshoot Common Chromatographic Problems

The COLTEST mixture includes polar or active compounds such as 1-octanol, 2,6-dimethylphenol, and 2,6-dimethylaniline. Also present are some nonpolar or inactive compounds, such as decane and dodecane at approximate levels of 1 ppm in hexane. Analysis of the mixture yields information about solvent tailing, column efficiency, dead volume, active sites in the injector/column, and so on. You can use the analysis to troubleshoot common chromatographic problems. The following table identifies many of the problems, and proposes solutions.

Correction of Solvent Tailing or Broadening Problems

Symptom	Solution
Poor column installation resulting in dead volume in the injector	Reinstall the column in the injector. Check the column seal with the insert in the SPI/1079 (on-column). Make sure you have a good cut on the column by examining the column under magnification. Check the 1077/1079 injector for insertion depth.
Solvent flashing in hot injector (usually 1077 or 1079)	Reduce the injection speed for the hot injectors. If possible, reduce the injector temperature. If you are using sandwich injection, reduce the solvent plug to 0.5 μL.
Incorrect temperature control using programmable SPI or 1079 injector	A typical setting for the SPI is 20 °C below the solvent boiling point. The column temperature is set at the solvent boiling point. Hold the column at this temperature until SPI has finished heating (usually about 2 min).
Septum purge line plugged	Check that the septum purge flow is 2 mL/min for a 1177 or 1079. If necessary, adjust the valve setting (depending on your injector configuration).

Symptom	Solution
Injector not purged properly following splitless injection	For a splitless injection, the vent flow should be at least 70 mL/min. The injector should be switched to the split mode 30 to 90 sec after the injection.

Correction of Tailing Sample Peaks for Particularly Active Components

Symptom	Solution
Active sites in the injector insert or liner	Change or clean the injector insert. If necessary, silanize it.
Active sites or degraded phase present in the column	Remove the front 15 cm of the column and reinstall it. If the retention times change, or if cutting the column does not fix the problem, replace the column.

Correction of Low Response and Severe Tailing with High Boiling Point Compounds

Symptom	Solution
Injector not hot enough to vaporize high boilers	Increase the temperature of the injector
High levels of column bleed masking component peaks	Condition the column at 30 °C below its maximum operating temperature (320 °C for DB-5). Switch to a high temperature column, (e.g., the SGE HT5), if conditioning does not help.
High levels of silicone or other contamination coated on the ion trap surfaces	Clean the ion trap as outlined in the Maintenance Section. Check Contamination Table for listing of potential contaminations.
Insufficient vaporization of the higher boiling point components	Lower the injector temperature and the injection speed. Check that the graphite ferrule in the 1079 is free of cracks, and that the septum support is tight.
Trap temperature too low	Increase the trap temperature in increments of 20 °C.

Correction of Leading Sample Peaks (Reverse Tailing)

Symptom	Solution
Column overload due to injection of excessive amounts of a component	Dilute the sample, or perform a split injection.
Degradation of the stationary phase	Change the column.
Carrier gas velocity too low	Increase the carrier flow rate.

Correction of Poor Resolution[1]

Symptom	Solution
Column temperature or program is not optimized	Modify the method (e.g., slow the column ramp rate) to improve the separation
Carrier gas flow is not optimized	Decrease the carrier gas linear velocity to improve the resolution.
Column cannot separate certain species, (e.g., those with similar boiling points)	Use a more polar column.
Column stationary phase is degraded, resulting in poor efficiency	Replace the column.

Lack of Reproducibility of Peak Size

Symptom	Solution
Leaking or partially plugged syringe	Visually check that the syringe is pulling up the sample. Check that the injector nut is tight. Flush the syringe with solvent. Heating the solvent in a hot injector may help if the syringe is plugged; otherwise, replace the syringe.
Leak at the septum	Replace the septum regularly and ensure that the septum nut is tight.
Improper installation of column in the injector, or a leak at the column inlet	Check the installation of the column in the injector. Tighten the capillary column nut.
Sample being absorbed by active surfaces in the injector or column	Change the injector insert. Remove the front 15 cm of the column, or replace the column.
Incomplete vaporization of sample in the injector	Increase the injector temperature. Or, increase the maximum temperature to which the injector (1079) is programmed.
1177 or 1079 splits too soon	Confirm that the switch time is chromatographically optimized.

Correction of Peak Splitting (Particularly for Low Boilers)

Symptom	Solution
Sample is flashing in injector, simulating two injections.	Lower the injection temperature, or use a 1079 programmed injection.
Column temperature programming starts before 1079 has finished programming.	Increase the initial column hold time until 1079 reaches its maximum temperature, (for example, typically at 2 min.).
Column is cracked.	Re-cut and install the column.
A piece of septum is stuck in the injector insert.	Replace the insert and septum.

[1] Peaks are not well separated, e.g., 2,6-dimethylphenol and 2-ethylhexanoic acid in the COLTEST mixture.

Correction of Extra, Unexpected Peaks in the Chromatogram

Symptom	Solution
Septum bleed, particularly during temperature programming	Use high-temperature, low-bleed septa. Make sure that the septum purge flow is set to 2 mL/min for a 1177 or 1079 injector.
Impurities from the sample vials (e.g., plasticizers present)	Confirm that this is indeed the case by running a solvent blank with a new syringe. Use certified sample vials, and keep the samples refrigerated. Check contamination table.
Impurities from the carrier gas present	Install or replace the carrier gas filters.
Injector or GC pneumatics contaminated	Remove the column from the injector and bake it out at elevated temperature, (e.g., 350 °C) using a purge of at least 20 mL/min.
Impurities present in the sample	Confirm that this is indeed the case by running a blank or standard.
Solvents extract impurities from the septum.	Switch to a new septum type, lower the injection temperature, or reduce the injection volume.
Impurities present in syringe wash solvent	Use high purity grade solvents.

Correction of Retention Time Differences Between Runs

Symptom	Solution
Unstable carrier gas flow controller/regulator	Check the pneumatics for leaks. If necessary, replace the flow controller/ regulator.
Column contamination or degradation	Condition or replace the column.
Injector leaks	Replace the septum at regular intervals. Check that the septum nut and capillary column nut are tight.

Documents, Parts, and Supplies

Important Documents

Documents that you may wish to consult regarding 210-MS or 220-MS operation include:

- Software Operation Manual, 395414500
- Software Reference, 391496300
- MS Workstation Tutorial Manual, 391498800
- Pre-Installation Instructions, 395414200
- Release Notes, 391496201

Parts and Supplies

Listed below are part numbers and descriptions for the available 210-MS or 220-MS Field Service Parts. Items are in quantities of one (1) each unless otherwise specified.

Kits, Assemblies, Boards, and Cables

Part Number	Description
393141103	USB Cable
393080001	PWA, POWER BOARD
393085001	PWA, RF GENERATOR
393074401	Cable, Controller to PWR 26 pins (Ribbon)
393074501	Cable, Controller to PWR 64 pins (Ribbon)
393011392	Replacement Spares Kit
393001001	Assembly, Analyzer Flange
393000593 393000592	Assembly, Transfer Line (115V) Assembly, Transfer Line (230V)
393033493 393033492	Cable, Transfer Line heater (115V) Cable, Transfer Line heater (230V)
393000891 393000892	Assembly, Vacuum Manifold (115V) Assembly, Vacuum Manifold (230V)
393076991	Assembly, Ion Gauge
393074101	Cable, Trap Heater (60V)
393081001	PWA, Controller
393083001	PWA, Lower Manifold
393022001	PWA, Upper Manifold

Trap Components

NOTE: The Silica-Coated Spacers have a shiny, mirror like finish on the inside surface.

Part Number	Description
393055201	Gate Conductor
393055101	Gate
1492000900	Wavy Washer
393031501	Assembly, Multiplier
393053501	Spacer, Quartz
393010801	Transfer Line Wrench/Analyzer Alignment Tool
393060191	Assembly, Filament disk with wires
393054901	Filament Clip
393059191	Tip. Transfer Line (Ultra Clean)
393050001	Trap Oven
393052401	Clamping Plate
393053502	Quartz Spacer, Silica-Coated
1312200800	Nut, 8-32 X 11/32"
1499822800	Belleville Washer, Large
393053901	Thermo Well

393010904	Thermo Well O-ring
1222200606	Trap Oven screw 6-32 X 3/8
393010903	O-ring, 1.112 ID Transfer Line
393010914	Quad-ring, Viton® Manifold
393010918	Quad-ring, Viton Transfer Line

Pump Spares, Pumps, Pump Conversion Parts

Part Number	Description
393077001	Assy, pump ,RVP42 (DS-42), 115V
393077002	Assy, pump ,RVP42 (DS-42), 230V
392035800	Screen, Turbo Pump (V-81)
393031601	Cable, Turbo Controller to turbo
2732068100	Turbo Controller
392051800	7’ Length Tygon® Tubing
393076401	Turbo Molecular Pump (V-81)
8829953800	Premium Foreline Pump Oil (DS-42)
393847701	DS-42 Oil Mist Eliminator
8829951700	Foreline Pump Oil (1L) for DS-102
2710100200	Oil Mist Cartridge, 2/pk (DS-102)
2820043800	O-ring, Turbo Pump to Manifold

GC Spares

Part Number	Injector Type	Description
CR213104	1079 or 1177	0.4 mm Graphite / Poly Ferrules
394955100	1079 or 1177	Capillary Injector Nut
200003400	1079 or 1177	Carrier Gas Line Assembly
190015800	1079 or 1177	Ceramic Scoring Wafer
390842300	1079 or 1177	Injector Nut Wrench
7200008400	1079 or 1177	Septa Extraction Tool
8850103100	1079 or 1177	Viton O-rings, 25/pk
CR298777	1079	BTO Septa 11.5 mm, 50/pk
392534201	1079	Ferrule Insert Graphite
CR298713	1177	9 mm Septa
392611927	1177	Inlet Sleeve, Gooseneck 4 mm Open
392611936	1177	Inlet Sleeve, Gooseneck Glass Wool
391866308	1177	Screw Captive Micro Seal

Tools, Test Samples, and Other Supplies

Part Number	Description
392027000	FC-43, Reservoir (Cal Gas Bulb)
392027300	COLTEST sample
393065201	OFN test sample
392027600	Aluminum Oxide, 600 Grit
392035300	GC/MS Calibration Compound, FC-43
5550034600	Fuse, 5 x 20 mm, 0.5A
8899999000	Applicator, Cotton Tipped, pkg. 100
393010702	Solenoid, 3-way, Cal Gas
393010001	Needle Valve, Cal Gas

CI Parts/Spares

Part Number	Description
393010202	Solenoid, 2-way, CI
393059701	Restrictor, long, CI
393059601	Restrictor, short, CI
393010101	Needle Valve, CI Gas
393002291	Liquid CI Inlet Kit
393010601	CI Solenoid, 2-way, Chemrez

Varian Service

If you are unable to resolve a problem with your 210-MS or 220-MS using the procedures described, you may call a Varian Customer Support Representative. When you call, please be prepared to provide the following information:

- 210-MS or 220-MS serial number located inside the front panel.
- Installed options
- Diagnostics test results

If you are having problems with the gas chromatograph, please be prepared to provide the following information:

- GC model
- AutoSampler model, if any
- Type of injector you are using
- Cryogenics (if applicable)
- Information about your GC column, (for example, the manufacturer, bonded phase, film thickness, and ID and length)

If you are having problems with your computer or software, please be prepared to provide the following information:

- Computer manufacturer and model
- Windows version
- Mouse driver version
- Printer manufacturer and model
- Network configuration
- Printouts of your autoexec.bat and config.sys files
- MS Workstation software version

In addition, you should observe the following guidelines when describing the problem to the Customer Support Representative:

- Tell the service representative which part of the software, (for example, System Control, Manual, or Acquisition, you were using when the problem occurred).
- Tell the service representative which troubleshooting routines you have used.