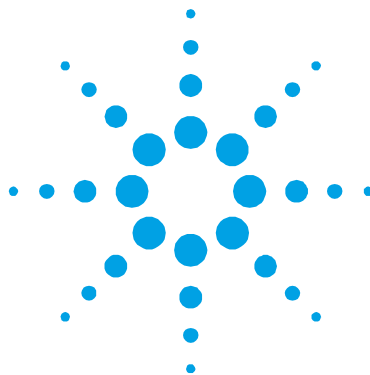




Ion CombiNEG 40-400

Models

X3606-64000, X3606-64001, X3606-64040, X3606-64041

Manuale di Istruzioni Bedienungshandbuch Notice de Mode D'Emploi Instruction Manual

87-900-154-01(A)

05/2019



Agilent Technologies

Notices

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CAUTION

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WARNING

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

Ion CombiNEG 40-400



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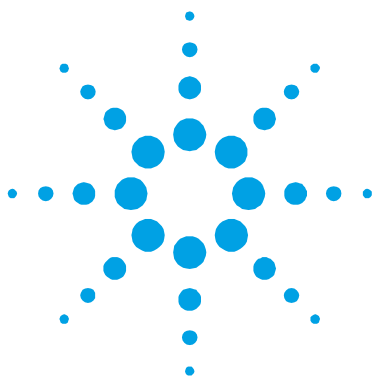
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1 Procedura per l'installazione

Informazioni Generali



1

Procedura per l'installazione

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Traduzione delle istruzioni originali



Informazioni Generali

Questa apparecchiatura è destinata ad uso professionale. L'utilizzatore deve leggere attentamente il presente manuale di istruzioni ed ogni altra informazione addizionale fornita da Agilent prima dell'utilizzo dell'apparecchiatura. Agilent si ritiene sollevata da eventuali responsabilità dovute all'inosservanza totale o parziale delle istruzioni, ad uso improprio da parte di personale non addestrato, ad interventi non autorizzati o ad uso contrario alle normative nazionali specifiche.

Le pompe della serie Ion CombiNEG sono pompe ioniche utilizzate comunemente per applicazioni di ultra alto vuoto, grazie alla loro pulizia, capacità di pompare qualsiasi tipo di gas, e del loro funzionamento senza vibrazioni e necessità di manutenzione.

Nei paragrafi seguenti sono riportate tutte le informazioni necessarie a garantire la sicurezza dell'operatore durante l'utilizzo dell'apparecchiatura. Informazioni dettagliate sono fornite nell'appendice "Technical information".

Questo manuale utilizza le seguenti convenzioni:

AVVERTENZA!



I messaggi di avvertenza attirano l'attenzione dell'operatore su una procedura o una pratica specifica che, se non eseguita in modo corretto, potrebbe provocare gravi lesioni personali.

ATTENZIONE!

I messaggi di attenzione sono visualizzati prima di procedure che, se non osservate, potrebbero causare danni all'apparecchiatura.

NOTA

Le note contengono informazioni importanti estrapolate dal testo.

Simboli di sicurezza

SIMBOLO	DESCRIZIONE DEI SIMBOLI
	Vietato l'accesso ai portatori di stimolatori cardiaci attivi. L'apparato è contrassegnato da questo simbolo per segnalare che i portatori di stimolatori cardiaci attivi non devono entrare in contatto con l'apparato stesso.
	Pericolo elettricità. L'apparato è contrassegnato da questo simbolo quando l'operatore, in presenza di alta tensione, deve fare riferimento al manuale di istruzioni al fine di proteggersi dai rischi di folgorazione.
	Pericolo campo magnetico. L'apparato è contrassegnato da questo simbolo per segnalare all'operatore la presenza di un campo magnetico.
	Pericolo superficie calda. L'apparato è contrassegnato da questo simbolo quando l'operatore deve evitare il contatto con superfici potenzialmente calde che potrebbero causare ustioni.

Immagazzinamento

Per trasportare ed immagazzinare la pompa ionica occorre osservare le seguenti condizioni ambientali:

- Temperatura: da -20 °C a +70 °C;
- Umidità relativa: da 5 a 95% (senza condensa).

Preparazione per l'installazione

La pompa viene fornita in un imballo protettivo speciale; se si presentano segni di danni, che potrebbero essersi verificati durante il trasporto, contattare l'ufficio vendite locale. Durante l'operazione di disimballaggio, prestare particolare attenzione a non lasciar cadere la pompa e a non sottoporla ad urti o vibrazioni. Non disperdere l'imballo nell'ambiente. Il materiale è completamente riciclabile e risponde alla direttiva CEE 85/399 per la tutela dell'ambiente.

ATTENZIONE!

Onde evitare problemi di contaminazione e conseguente degasamento, non toccare con le mani nude i componenti destinati ad essere esposti al vuoto. Utilizzare sempre guanti da alto vuoto o altra protezione adeguata.

NOTA

La pompa non può essere danneggiata rimanendo semplicemente esposta all'atmosfera. Si consiglia comunque di mantenerla chiusa fino al momento dell'installazione sul sistema onde evitare eventuale inquinamento da polvere.

1 Procedura per l'installazione

Preparazione per l'installazione



Figura 1 Imballaggio della pompa Ion CombiNEG 40-400.

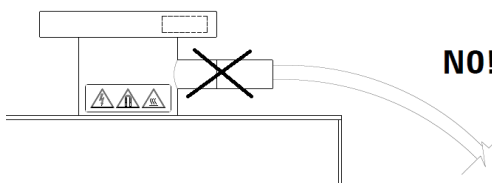
Installazione

Non installare e/o utilizzare la pompa in ambienti esposti ad agenti atmosferici (pioggia, gelo, neve), polveri, gas aggressivi, in ambienti esplosivi o con elevato rischio di incendio. Durante il funzionamento, per ottenere le specifiche tecniche dichiarate, la temperatura ambiente deve essere compresa tra 0 °C e +85 °C e l'umidità tra 0% e 95% (senza condensa).

ATTENZIONE!

La pompa deve essere tenuta sigillata con il suo tubo di ingresso schiacciato ("pinch-off") finché non è pronta per essere collegata al sistema.

AVVERTENZA!



Per evitare lesioni alla persona, non collegare l'alta tensione alla pompa prima che sia installata nel sistema e che tutte le flange di ingresso siano adeguatamente collegate o chiuse.

Il funzionamento delle pompe è ottimizzato solo con l'uso delle apposite unità di controllo Agilent.

ATTENZIONE!

Il rispetto delle normative di sicurezza nell'uso delle pompe è garantito solo con l'uso delle unità di controllo Agilent.

1 Procedura per l'installazione

Installazione

La pompa Ion CombiNEG 40-400 può essere installata in qualsiasi posizione. Per convenienza normalmente viene montata in posizione verticale con la flangia di ingresso in alto o in posizione orizzontale. Le pompe possono essere mantenute sospese in ogni posizione tramite la loro flangia di ingresso.

Per informazioni dettagliate sull'installazione della pompa, vedere l'appendice "Technical Information".

Per l'installazione della pompa getter (cartuccia e flangia di supporto) fare riferimento alle indicazioni disponibili sul manuale di istruzioni operative fornito insieme ad essa.

Uso

Tutte le istruzioni per il corretto funzionamento delle pompe Ion CombiNEG 40-400 sono contenute nel manuale dell'unità di controllo. Leggere attentamente tale manuale prima dell'utilizzo.

Si raccomanda di portare la pompa ad una pressione uguale o minore di 1E-5 Torr (mbar) per la versione Diode SEM - 1E-4 Torr (mbar) per la versione StarCell - in modo da ottenere un avvio più rapido e prolungare la vita della pompa. Tipicamente questo livello di pressione può facilmente essere raggiunto per mezzo di una pompa turbomolecolare, supportata da una pompa primaria, possibilmente non lubrificata con olio, al fine di evitare rischi di contaminazione legati ai vapori di olio.

In linea di principio la pompa ionica può essere avviata anche a pressioni superiori a quella da noi raccomandata, ma questa pratica, se protratta nel tempo, può ridurre il tempo di vita della pompa. In passato la necessità di avviare la pompa ionica ad alta pressione era legata al bisogno di collegarla direttamente alla pompa primaria; con l'avvento delle pompe turbomolecolari tale necessità è venuta meno.

Depositi igroscopici, che sono naturale conseguenza dell'esposizione della pompa all'aria, e l'assorbimento di idrogeno all'interno dei catodi di titanio, fenomeno connesso al principio fisico di funzionamento della pompa, possono nel tempo provocare l'allungamento del tempo di avvio. Infatti il riscaldamento della pompa che si verifica al suo avvio provoca il rilascio del vapore acqueo e di parte dell'idrogeno pompato precedentemente, rendendo la partenza più lunga.

Per il corretto uso della pompa getter (cartuccia e flangia di supporto) fare riferimento alle indicazioni disponibili sul manuale di istruzioni operative fornito insieme ad essa.

Procedure di uso

1. Controllare che la polarità dell'unità di controllo sia corretta per la pompa: polarità positiva per le pompe Diode SEM e negativa per le StarCell. A tale scopo fare riferimento al relativo manuale del controller. Osservare la seguente procedura per l'uso della pompa: tramite una pompa turbomolecolare di pre-vuoto (supportata da una pompa primaria) portare il sistema da vuoto ad una pressione minima di avvio in accordo alla tabella 1. Si raccomanda di installare una valvola a chiusura metallica tra la pompa ionica e la pompa turbomolecolare, in modo da poter successivamente escludere quest'ultima.
2. Collegare l'unità di controllo della pompa ad una apposita fonte di alimentazione ed accendere l'unità. Seguendo le istruzioni sul manuale dell'unità di controllo alimentare la pompa ionica.
3. Osservare la tensione, la corrente e la pressione sul display dell'unità di controllo. Se l'avvio è avvenuto ad una pressione troppo alta, tipicamente la tensione si attesterà su qualche centinaia di Volt. Se la tensione rimane costante intorno a suddetti valori, per evitare il surriscaldamento della pompa si raccomanda di spegnerla, attendere e di avviarla nuovamente ad una pressione inferiore (vedere il paragrafo "Uso"). Si prega di notare che un valore di corrente prossimo alla corrente di corto circuito dell'unità di controllo è indice dell'esistenza di una perdita nella pompa e nel sistema. Inoltre un temporaneo incremento della pressione di pre-vuoto è normale durante la fase di avvio. Se la pompa ionica è stata avviata alla pressione suggerita (vedere la tabella 1), la tensione raggiungerà in breve tempo il valore pre-impostato sull'unità di controllo (3, 5 o 7 kV). Una volta raggiunta la tensione operativa, la corrente inizierà a scendere. Si raccomanda a questo punto di chiudere la valvola di pre-vuoto, in modo da isolare la pompa ionica e il sistema dalla pompa turbomolecolare. Se la tensione della pompa ionica scende dopo la chiusura della valvola, riaprirla quest'ultima per un pre-pompaggio aggiuntivo. Appena la pressione diminuisce, la tensione cresce nuovamente e la valvola di pre-vuoto può essere chiusa.
4. Quando la tensione ha raggiunto il valore operativo pre-impostato, mettere l'unità di controllo nello stato PROTECT, se l'unità di controllo possiede questa predisposizione. Il sistema sarà così autoprotetto dall'incremento della pressione oltre il valore pre-impostato. Nel caso in cui ci fosse un tale incremento, l'unità di controllo viene spenta automaticamente.

5. Se l'unità di controllo consente di impostare il tipo di pompa in utilizzo, sul display comparirà anche il valore di pressione ottenuto dalla conversione della corrente, in accordo con il diagramma pressione-corrente illustrato nel paragrafo "Technical Information" di questo manuale. Se l'unità di controllo non possiede questa predisposizione fare riferimento direttamente a tale diagramma. Ricordiamo che l'indicazione della pressione potrebbe non essere corretta nel caso in cui, durante il suo utilizzo, la pompa ionica sviluppi una corrente di dispersione. In tal caso la pressione risultante dalla conversione sarà maggiore di quella reale.
6. Quando si porta la pompa alla pressione atmosferica, usare azoto secco in modo da evitare l'assorbimento di vapore acqueo da parte delle pareti della pompa. Si raccomanda, una volta spenta la pompa, di attendere il raffreddamento degli elementi al suo interno prima di procedere con l'esposizione alla pressione atmosferica.

Per la procedura di uso della pompa getter (cartuccia e flangia di supporto), fare riferimento alle indicazioni disponibili sul manuale di istruzioni operative fornito insieme ad essa.

AVVERTENZA!



Quando la pompa viene utilizzata per il pompaggio di gas tossici, infiammabili o radioattivi, seguire le appropriate procedure tipiche di ciascun gas. Non usare la pompa in presenza di gas esplosivi.

AVVERTENZA!



Quando è installato il riscaldatore, non toccare la pompa durante le operazioni di riscaldamento e di raffreddamento. L'elevata temperatura può causare lesioni alle persone.

1 Procedura per l'installazione

Procedure di uso

ATTENZIONE! Non avvicinare dispositivi elettronici alla pompa. Il campo magnetico attorno ad essa può provocare dei malfunzionamenti dei dispositivi stessi.

Manutenzione

Le pompe della serie Ion CombiNEG 40-400 non richiedono alcuna manutenzione. Qualsiasi intervento deve essere eseguito da personale autorizzato.

AVVERTENZA!



Prima di effettuare qualsiasi intervento sulla pompa scollegarla dall'alta tensione.

Qualora una pompa dovesse essere rottamata, procedere alla sua eliminazione nel rispetto delle normative nazionali specifiche.

Per la manutenzione della pompa getter (cartuccia e flangia di supporto), fare riferimento al manuale delle istruzioni operative fornito con la pompa getter.

Smaltimento

Significato del logo "WEEE" presente sulle etichette.

Il simbolo qui sotto riportato applicato in ottemperanza alla direttiva CE denominata "WEEE".

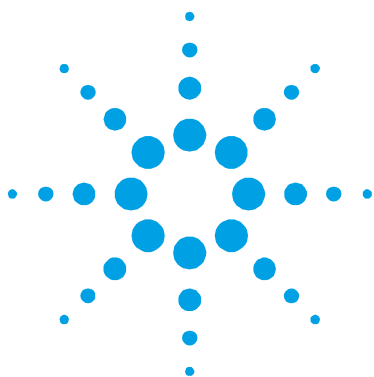
Questo simbolo (**valido solo per i paesi della Comunità Europea**) indica che il prodotto sul quale è applicato, NON deve essere smaltito insieme ai comuni rifiuti domestici o industriali, ma deve essere avviato ad un sistema di raccolta differenziata.

Si invita pertanto l'utente finale a contattare il fornitore del dispositivo, sia esso la casa madre o un rivenditore, per avviare il processo di raccolta e smaltimento, dopo opportuna verifica dei termini e condizioni contrattuali di vendita.



Per maggiori informazioni riferirsi a:

<http://www.agilent.com/environment/product/index.shtml>



2

Anleitung zur Installation

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Übersetzung der Originalanleitungen



Allgemeine Hinweise

Dieses Gerät ist für den professionellen Gebrauch bestimmt. Vor dem Gebrauch soll der Benutzer dieses Handbuch sowie alle weiteren von Agilent mitgelieferten Zusatzdokumentationen genau lesen. Bei vollständiger bzw. teilweiser Nichtbeachtung der enthaltenen Hinweise, unsachgemäßem Gebrauch durch ungeschultes Personal, nicht autorisierten Eingriffen und Mißachtung der nationalen Bestimmungen übernimmt Firma Agilent keinerlei Haftung.

Die Pumpen der Serie Ion CombiNEG 40-400 sind Ionenpumpen, die aufgrund ihrer Reinheit, ihrer Fähigkeit, alle Arten von Gas zu pumpen, und ihres vibrations- und wartungsfreien Betriebes, allgemein für Ultrahochvakuumanwendungen zum Einsatz kommen.

In den folgenden Abschnitten sind alle erforderlichen Informationen für die Sicherheit des Bedieners bei der Anwendung des Geräts aufgeführt. Detaillierte technische Informationen sind im Anhang "Technical Information" enthalten.

In dieser Gebrauchsanleitung werden Sicherheitshinweise folgendermaßen hervorgehoben:

WARNUNG!



Die Warnhinweise lenken die Aufmerksamkeit des Bedieners auf eine spezielle Prozedur oder Praktik, die bei unkorrekter Ausführung schwere Verletzungen hervorrufen könnte.

VORSICHT!

Die Vorsichtshinweise vor bestimmten Prozeduren machen den Bediener darauf aufmerksam, daß bei Nichteinhaltung Schäden am Gerät entstehen können.

HINWEIS

Die Hinweise enthalten wichtige Informationen, die aus dem Text hervorgehoben werden.

Sicherheits-Symbole

SYMBOL	ERKLÄRUNG DER SYMBOLE
	Zutritt für Personen mit Herzschrittmachern verboten. Das Gerät ist mit diesem Symbol versehen, um darauf hinzuweisen, dass Personen mit Herzschrittmachern nicht mit dem Gerät in Kontakt geraten dürfen.
	Gefahr von Stromschlägen Wenn das Gerät mit diesem Symbol versehen ist, muss das Bedienungspersonal im Fall von Hochspannung im Handbuch nachschlagen, um die richtigen Schutzmaßnahmen gegen Stromschläge zu ergreifen.
	Gefahr durch Magnetfelder. Das Gerät ist mit diesem Symbol versehen, um das Bedienungspersonal darauf hinzuweisen, dass ein Magnetfeld vorliegt.
	Gefahr durch heiße Oberflächen. Das Gerät ist mit diesem Symbol versehen, um das Bedienungspersonal vor dem Kontakt mit möglicherweise heißen Oberflächen zu warnen, die Verbrennungen verursachen können.

Lagerung

Für Transport und Lagerung der Ionenpumpe sind die folgenden Umgebungsbedingungen herzustellen:

- Temperatur: -20 °C bis +70 °C;
- Relative Luftfeuchtigkeit: 5 bis 95% (ohne Kondenswasser).

Vor der Installation

Die Pumpe wird in einer speziellen Schutzverpackung geliefert. Eventuelle Transportschäden sind der zuständigen örtlichen Verkaufsstelle zu melden. Beim Auspacken vorsichtig vorgehen, damit die Pumpe nicht fällt oder Stößen oder Vibrationen ausgesetzt wird. Das Verpackungsmaterial ist ordnungsgemäß zu entsorgen. Es ist vollständig recyclebar und entspricht der EG-Richtlinie 85/399 für den Umweltschutz.

VORSICHT!

Um Entgasungsprobleme zu vermeiden, dürfen die Komponenten, die mit dem Vakuum in Kontakt kommen, nicht mit bloßen Händen berührt werden. Verwenden Sie geeignete Sicherheitshandschuhe oder andere Schutzvorrichtungen.

HINWEIS

Die Pumpe kann, wenn sie einfach der Atmosphäre ausgesetzt ist, nicht beschädigt werden. Sie sollte jedoch bis zur Installation an der Anlage geschlossen bleiben, um Verunreinigungen durch Staub zu vermeiden.

2 Anleitung zur Installation

Vor der Installation



Abbildung 1 Verpackung der Pumpe Ion CombiNEG 40-400.

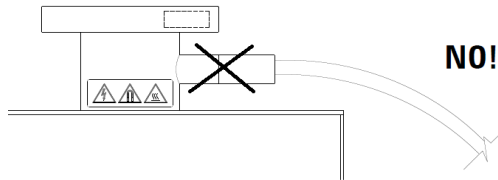
Installation

Die Pumpe darf nicht in Umgebungen installiert und/oder benutzt werden, die ungeschützt vor Witterungsbedingungen (Regen, Frost, Schnee), Staub und aggressiven Gasen sind, und in denen Explosions- und erhöhte Brandgefahr besteht. Während des Betriebes soll die Umgebungstemperatur zwischen 0 °C und +85 °C betragen und die Luftfeuchtigkeit zwischen 0% und 95% liegen (ohne Kondenswasser), um die angegebenen technischen Merkmale zu gewährleisten.

VORSICHT!

Die Pumpe soll versiegelt und mit flachgedrücktem Eintrittsschlauch gehalten werden („pinch-off“), bis sie für den Anschluß an das System bereit ist.

WARNUNG!



Um Personenschäden zu vermeiden, darf die Hochspannungsleitung der Pumpe erst angeschlossen werden, wenn die Pumpe im System installiert ist und alle Eintrittsflansche entsprechend angeschlossen oder geschlossen sind.

Der Pumpenbetrieb wird nur durch den Einsatz speziell dafür vorgesehener Agilent Steuereinheiten optimiert.

2 Anleitung zur Installation

Installation

VORSICHT!

Die Einhaltung der Sicherheitsvorschriften beim Gebrauch der Pumpen ist nur bei Verwendung von Agilent Steuereinheiten gewährleistet.

Die Pumpe Vaclon Plus kann in einer beliebigen Position installiert werden. Aus praktischen Gründen wird sie in der Regel senkrecht mit nach oben gerichtetem Eintrittsflansch oder waagrecht eingebaut.

Die Pumpen können auch in einer beliebigen Position an ihrem Eintrittsflansch hangend eingebaut werden.

Detaillierte Informationen zur Installation der Pumpe sind dem Anhang "Technical Information" zu entnehmen.

Für den korrekten Gebrauch der Getterpumpe (Patrone und Stützflansch) siehe die Angaben in der mitgelieferten Bedienungsanleitung.

Gebrauch

Sämtliche Hinweise für den korrekten Betrieb der Pumpen Ion CombiNEG 40-400 sind im Handbuch der Steuereinheit enthalten. Dieses Handbuch ist vor der Inbetriebnahme genau durchzulesen.

Es wird empfohlen, für das Modell Diode SEM einen Druck von $1\text{E-}5$ Torr (mbar) oder weniger einzustellen und für das Modell StarCell einen Druck von $1\text{E-}4$ Torr (mbar) oder weniger. Auf diese Weise startet die Pumpe schneller und hält auch länger. Üblicherweise kann dieser Druck von einer turbomolekularen Pumpe mit Unterstützung einer Primärpumpe leicht und schnell erreicht werden. Diese sollte am besten eine ölfreie Pumpe sein, um Kontamination durch Öldämpfe zu verhindern.

Grundsätzlich kann eine Ionenpumpe auch mit höheren als den empfohlenen Drücken gestartet werden, allerdings kann sich dabei auf Dauer die Lebensdauer der Pumpe verringern. Früher musste eine Hochdruck-Ionenpumpe direkt an eine Primärpumpe angeschlossen werden. Seit es turbomolekulare Pumpen gibt, ist das nicht mehr unbedingt notwendig.

Hygroskopische Ablagerungen sind eine normale Begleiterscheinung des Betriebs der Pumpe an der Luft und der Absorption von Wasserstoff in den Titankathoden. Das hängt mit dem physikalischen Funktionsprinzip der Pumpe zusammen. Diese Ablagerungen können mit der Zeit dazu führen, dass die Startzeit sich verlängert, weil das Aufheizen der Pumpe beim Start dazu führt, dass Wasserdampf und ein Teil des vorher gepumpten Wasserstoffes freigesetzt wird.

Für den Einbau der Getterpumpe (Patrone und Stützflansch) siehe die Angaben in der mitgelieferten Bedienungsanleitung.

Bedienungsschritte

- 1** Es ist zu kontrollieren, daß die Steuereinheit in bezug auf die Pumpe richtig gepolt ist: positive Polarität für die Pumpenmodelle Diode SEM und negative für das Modell StarCell. Schlagen Sie dazu im Handbuch des Controllers nach. Halten Sie sich beim Betrieb der Pumpe an den folgenden Ablauf: bringen Sie das Vakuumsystem mit einer Turbomolekularpumpe mit Vor-Vakuum (unterstützt von einer Primärpumpe) auf den Mindest-Startdruck gemäß der Tabelle 1. Es wird empfohlen, ein Ventil mit metallischem Verschluss zwischen Ionenpumpe und Turbomolekularpumpe zu setzen, so dass letztere später abgestellt werden kann.
- 2** Schließen Sie die Kontrolleinheit für die Pumpe an eine geeignete Stromquelle an und schalten Sie die Einheit ein. Halten Sie sich an die Instruktionen des Handbuches der Kontrolleinheit für die Stromversorgung der Ionenpumpe.
- 3** Überwachen Sie Spannung, Stromstärke und Druck auf dem Display der Kontrolleinheit. Wenn der Start bei zu hohem Druck erfolgt ist, liegt die Spannung üblicherweise bei einigen Hundert Volt. Wenn die Spannung konstant in der Größenordnung der genannten Werte bleibt, wird empfohlen, die Pumpe abzuschalten, damit sie sich nicht überhitzt. Danach sollte einige Zeit gewartet werden, bevor die Pumpe bei geringerem Druck erneut eingeschaltet wird (siehe Abschnitt "Betrieb"). Beachten Sie bitte, dass eine Stromstärke, die in der Nähe der Kurzschlussstromstärke der Kontrolleinheit liegt, auf eine undichte Stelle in der Pumpe und im System hindeutet. Eine Erhöhung des Drucks für das Vor-Vakuum ist dagegen in der Startphase normal.
Wenn die Ionenpumpe mit dem empfohlenen Druck gestartet wurde (siehe Tabelle 1), erreicht die Spannung in kurzer Zeit den auf der Kontrolleinheit eingestellten Wert (3, 5 oder 7 kV). Wenn die Betriebsspannung erreicht ist, beginnt die Stromstärke zu sinken. Jetzt sollte das Ventil für das Vor-Vakuum geschlossen werden, so dass die Ionenpumpe und das System von der Turbomolekularpumpe getrennt ist. Wenn die Spannung der Ionenpumpe nach dem Schließen des Ventils absinkt, öffnen Sie das Ventil noch einmal für ein zusätzliches Vorpumpen. Sobald der Druck abnimmt, steigt die Spannung erneut und das Ventil für das Vor-Vakuum kann geschlossen werden.
- 4** Wenn die Spannung den voreingestellten Betriebswert erreicht hat, schalten Sie die Kontrolleinheit in den Status PROTECT. Das System schützt sich dann selbst vor einem Druckanstieg über den voreingestellten Wert hinaus. Wenn es zu einem Druckanstieg kommt, wird die Kontrolleinheit automatisch abgeschaltet.

- 5 Wenn der verwendete Pumpentyp auf der Agilent-Kontrolleinheit korrekt eingestellt ist, erscheint auf dem Display auch der Wert für den Druck, der sich aus der Stromumwandlung ergibt. Das Verhältnis ist in dem Diagramm (Druck – Stromstärke) im Absatz “Technical Information” dieses Handbuchs dargestellt. Wir erinnern noch einmal daran, dass die Druckangabe möglicherweise nicht korrekt sein könnte, wenn während des Betriebs an der Ionenpumpe ein Fehlerstrom auftritt. In diesem Fall ist der auf dem Display angezeigte Wert zu groß.
- 6 Wenn die Pumpe auf den atmosphärischen Druck zu bringen ist, verwenden Sie trockenen Stickstoff, um die Absorption von Wasserdampf an den Pumpenwänden zu verhindern. Es wird empfohlen, nach dem Abschalten der Pumpe abzuwarten, bis die innen liegenden Komponenten sich abgekühlt haben, bevor sie dem atmosphärischen Druck ausgesetzt wird.

Für den Vorgang der Verwendung der Getterpumpe (Kartusche und Stützflansch) siehe die Angaben in der mitgelieferten Bedienungsanleitung.

WARNUNG!



Wenn die Pumpe zur Förderung von giftigen, leicht entflammaren oder radioaktiven Gasen benutzt wird, sind die für das jeweilige Gas vorgeschriebenen Vorgänge zu befolgen. Die Pumpe nie bei Vorhandensein von explosivem Gas benutzen.

WARNUNG!



Wenn der Heizer installiert ist, darf die Pumpe während der Aufheizung und Abkühlung nicht berührt werden. Die hohe Temperatur kann zu Personenschäden führen.

VORSICHT!

Keine elektronischen Geräte in die Nähe der Pumpe bringen. Das darum befindliche Magnetfeld kann zu Funktionsstörungen der Geräte führen.

Wartung

Die Pumpen der Serie Ion CombiNEG 40-400 erfordern keine Wartung. Sämtliche Eingriffe dürfen nur von autorisiertem Personal vorgenommen werden.

WARNUNG!



Vor Eingriffen an der Pumpe ist diese von der Hochspannungsquelle zu trennen.

Bei eventueller Verschrottung einer Pumpe ist diese entsprechend der einschlägigen nationalen Vorschriften zu entsorgen.

Für die Wartung der Ionengetterpumpe beachten Sie immer die Bedienungsanleitung.

Für die Wartung der Getterpumpe (Kartusche und Stützflansch) beachten Sie immer die Bedienungsanleitung der Getterpumpe.

Entsorgung

Bedeutung des "WEEE" Logos auf den Etiketten.

Das folgende Symbol ist in Übereinstimmung mit der EU-Richtlinie WEEE (Waste Electrical and Electronic Equipment) angebracht.

Dieses Symbol (**nur in den EU-Ländern gültig**) zeigt an, dass das betreffende Produkt nicht zusammen mit Haushaltsmüll entsorgt werden darf sondern einem speziellen Sammelsystem zugeführt werden muss.

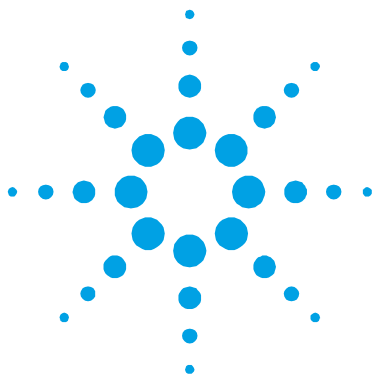
Der Endabnehmer sollte daher den Lieferanten des Geräts - d.h. die Muttergesellschaft oder den Wiederverkäufer - kontaktieren, um den Entsorgungsprozess zu starten, nachdem er die Verkaufsbedingungen geprüft hat.



Für weitere Informationen:

<http://www.agilent.com/environment/product/index.shtml>

2 Anleitung zur Installation Entsorgung



3

Procédure pour l'installation

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Traduction de la mode d'emploi originale



Indications Générales

Cet appareillage a été conçu en vue d'une utilisation professionnelle. Il est conseillé à l'utilisateur de lire attentivement cette notice d'instructions ainsi que toute autre indication supplémentaire fournie par Agilent avant d'utiliser l'appareil. Agilent décline toute responsabilité en cas de non respect total ou partiel des instructions fournies, d'opérations non autorisées, d'utilisation impropre par du personnel non formé ou contraires aux réglementations nationales spécifiques.

Grâce à leur propreté, à leur capacité de pomper tous les types de gaz, à leur fonctionnement sans vibrations et à l'absence d'entretien, les pompes de la série Ion CombiNEG 40-400 sont des pompes ioniques généralement utilisées pour des applications de vide ultra poussé.

Les paragraphes suivants fournissent toutes les indications nécessaires à garantir la sécurité de l'opérateur pendant l'utilisation de l'appareil. Des informations plus détaillées sont disponibles à l'annexe "Technical Information".

Cette notice utilise les signes conventionnels suivants:

AVERTISSEMENT!



Les messages d'avertissement attirent l'attention de l'opérateur sur une procédure ou une manœuvre spéciale dont la mauvaise exécution risque de provoquer de graves lésions.

ATTENTION!

Les messages d'attention apparaissent avant certaines procédures dont le non-respect peut endommager sérieusement l'appareillage.

NOTE

Les notes contiennent des renseignements importants, extrapolés du texte.

Signaux de sécurité

SIGNAL	DESCRIPTION
	Accès interdit aux porteurs de stimulateur cardiaque actif. Ce signal a été apposé sur l'appareil pour aviser les porteurs de stimulateur cardiaque qu'ils ne doivent pas entrer en contact avec l'appareil.
	Danger électrique. Ce signal a été apposé sur l'appareil pour avertir l'opérateur de la présence de haute tension et l'inviter à se référer à la notice d'utilisation pour se protéger contre les risques d'électrocution.
	Danger champ magnétique. Ce signal a été apposé sur l'appareil pour avertir l'opérateur de la présence d'un champ magnétique.
	Danger surface chaude. Ce signal a été apposé sur l'appareil pour empêcher l'opérateur de toucher des surfaces potentiellement chaudes risquant de causer des brûlures.

Stockage

Pour transporter et garder la pompe ionique il faut respecter les suivantes conditions ambiantes:

- Température: entre -20 °C et +70 °C;
- Humidité relative: entre 5 et 95% (sans condensation).

Préparation pour l'installation

La pompe est fournie dans un emballage de protection spécial; si l'on constate des signes d'endommagement imputables au transport, contacter aussitôt le revendeur local. Pendant l'opération de déballage, veiller tout particulièrement à ne pas laisser tomber la pompe et à ne lui faire subir aucun choc ni aucune vibration. Ne pas abandonner l'emballage dans la nature. Le matériel est entièrement recyclable et il est conforme à la directive CEE 85/399 en matière de protection de l'environnement.

ATTENTION!

En vue d'éviter tout problème de dégazage, ne pas toucher à mains nues les éléments devant être exposés au vide. Portez toujours des gants spéciaux pour le vide ou toute autre protection appropriée.

NOTE

La pompe ne peut être endommagée si elle reste simplement exposée à l'atmosphère. Il est quoi qu'il en soit conseillé de ne pas la retirer de son emballage avant le moment de l'installation, afin d'éviter toute pollution due à la poussière.

3 Procédure pour l'installation

Préparation pour l'installation



Figure 1 Emballage de la pompe Ion CombiNEG 40-400.

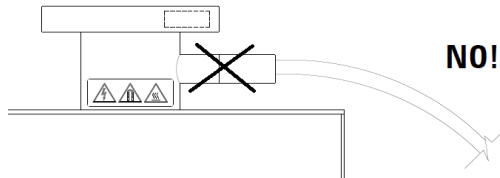
Installation

Ne pas installer et/ou utiliser la pompe dans des milieux exposés à des agents atmosphériques (pluie, gel, neige), à des poussières, à des gaz de combat ainsi que dans des milieux explosifs ou à fort risque d'incendie. Pendant le fonctionnement, pour respecter les spécifications techniques déclarées la température ambiante doit être comprise entre 0 °C et +85 °C et l'humidité entre 0 et 95% (sans condensation).

ATTENTION!

La pompe doit être conservée scellée avec son tuyau d'entrée aplati ("pinch-off") jusqu'à ce qu'elle soit prête à être branchée au système.

AVERTISSEMENT!



Pour éviter toute lésion aux personnes, ne pas brancher la haute tension à la pompe avant que celle-ci soit installée dans le système et avant que toutes les brides d'entrées soient correctement assemblées ou fermées.

Le fonctionnement de la pompe n'est optimisé que si celle-ci est utilisée avec l'une des unités de contrôle Agilent spécifiques.

ATTENTION!

Lors de l'utilisation des pompes, le respect des normes de sécurité est impérativement subordonné à l'emploi des unités de contrôle Agilent.

3 Procédure pour l'installation

Installation

La pompe Ion CombiNEG 40-400 peut être installée dans toutes les positions. Par facilité elle est généralement montée en position verticale, avec la bride d'entrée au sommet, ou en position horizontale.

Les pompes peuvent également être suspendues dans toutes les positions à l'aide de leur bride d'entrée.

Pour plus de détails sur l'installation de la pompe, consulter l'appendice "Technical Information".

Pour l'installation de la pompe getter (cartouche et bride de support), se reporter aux indications disponibles dans le mode d'emploi fourni avec celle-ci.

Utilisation

Toutes les instructions pour le fonctionnement correct de la pompe Ion CombiNEG 40-400 sont fournies dans la notice de l'unité de contrôle. Il est conseillé de lire attentivement cette notice avant d'utiliser la pompe.

La pompe doit être amenée à une pression inférieure ou égale à $1\text{E-}5$ Torr (mbar) pour la version Diode SEM - $1\text{E-}4$ Torr (mbar) pour la version StarCell – pour permettre un démarrage plus rapide et prolonger la durée de vie de la pompe. Ce niveau de pression peut être obtenu facilement au moyen d'une pompe turbomoléculaire assistée par une pompe primaire, si possible non lubrifiée par huile, afin d'éviter les risques de contamination liés aux vapeurs d'huile.

En principe, la pompe ionique peut être démarrée à une pression supérieure à celle préconisée par le fabricant, mais cette pratique risque, à la longue, de réduire la durée de vie de la pompe. Auparavant, la nécessité de démarrer la pompe ionique avec une haute pression était liée au besoin de la raccorder directement à la pompe primaire. Avec l'arrivée des pompes turbomoléculaires, cette nécessité a disparu.

Des dépôts hygroscopiques découlant naturellement de l'exposition de la pompe à l'air et l'absorption d'hydrogène à l'intérieur des cathodes en titane, phénomène lié au principe physique de fonctionnement de la pompe, peuvent, avec le temps, provoquer un allongement du temps de démarrage. En effet, le réchauffement de la pompe qui se produit au moment du démarrage entraîne une émission de vapeur d'eau et d'une partie de l'hydrogène pompé précédemment qui allonge le temps de démarrage.

Pour une correcte utilisation de la pompe getter (cartouche et bride de support), se reporter aux indications disponibles dans le mode d'emploi fourni avec celle-ci.

Procédure d'utilisation

- 1** Contrôler que la polarité de l'unité de contrôle soit correcte pour la pompe: polarité positive pour les pompes Diode SEM et polarité négative pour les StarCell. Pour cette raison, consultez le manuel du contrôleur. Respectez la procédure suivante pour l'utilisation de la pompe: amenez le système de vide à une pression minimum de démarrage en vous référant au tableau 1 à l'aide d'une pompe turbomoléculaire de pré-vide (assistée par une pompe primaire). Il est conseillé d'installer une vanne de fermeture métallique entre la pompe ionique et la pompe turbomoléculaire afin de pouvoir ensuite exclure cette dernière.
- 2** Raccordez l'unité de contrôle de la pompe à une alimentation électrique et mettez-la sous tension. En suivant les instructions du manuel de l'unité de contrôle, alimentez la pompe ionique.
- 3** Surveillez la tension, le courant et la pression affichés sur l'écran de l'unité de contrôle. Si le démarrage a eu lieu à une pression trop élevée, la tension se stabilisera à une valeur de quelques dizaines de volts. Si la tension reste stable autour de cette valeur, arrêtez la pompe pour éviter la surchauffe, attendez quelques instants et redémarrez-la à une pression inférieure (voir le paragraphe "Utilisation". Notez qu'une valeur de courant proche du courant de court-circuit de l'unité de contrôle indique la présence d'une fuite dans la pompe et dans le système. De plus une augmentation temporaire de la pression de pré-vide est normale pendant la phase de démarrage.
Si la pompe ionique a été démarrée à la pression suggérée (voir tableau 1), la tension atteint rapidement la valeur programmée sur l'unité de contrôle (3,5 ou 7 kV). Une fois la tension de fonctionnement atteinte, le courant commence à descendre. Fermez alors la vanne de pré-vide pour isoler la pompe ionique et le système de la pompe turbomoléculaire. Si la tension de la pompe ionique descend après la fermeture de la vanne, rouvrez-la pour un pré-pompage supplémentaire. Dès que la pression descend, la tension remonte et la vanne de pré-vide peut être fermée.
- 4** Quand la tension a atteint la valeur de fonctionnement programmée, placez l'unité de contrôle à l'état PROTECT, si l'unité de contrôle a cette prédisposition. Le système est ainsi auto-protégé contre les hausses de pression supérieures à la valeur programmée. En cas d'élévation excessive de la pression, l'unité de contrôle s'arrête automatiquement.

- 5 Si l'unité de contrôle vous permet de définir le type de pompe en cours d'utilisation, l'écran affiche la valeur de pression résultant de la conversion du courant, selon le diagramme pression-courant décrit dans «Informations techniques» dans ce manuel. Si l'unité de contrôle n'a pas cette prédisposition vous pouvez faire référence directement à ce diagramme. Il est rappelé que l'indication de la pression peut être erronée si la pompe ionique développe un courant de dispersion pendant son utilisation. Dans ce cas, la pression obtenue par la conversion du courant sera supérieure à la pression réelle.
- 6 Lorsque l'on porte la pompe à la pression atmosphérique, utiliser de l'azote sec de façon à éviter que les parois de la pompe n'absorbent de la vapeur d'eau. Après l'arrêt de la pompe, il est conseillé d'attendre le refroidissement des composants internes avant de l'exposer à la pression atmosphérique.

Pour la procédure d'utilisation de la pompe getter (cartouche et bride de support), se reporter aux indications disponibles dans le mode d'emploi fourni avec celle-ci.

AVERTISSEMENT!



Lorsque la pompe est utilisée pour le pompage de gaz toxiques, inflammables ou radioactifs, suivre les procédures appropriées à chaque gaz. Ne pas utiliser la pompe en présence de gaz explosifs.

AVERTISSEMENT!



Lorsque le réchauffeur est installé, éviter de toucher la pompe pendant les opérations de chauffage et de refroidissement. La température élevée peut provoquer des brûlures.

ATTENTION!

Ne pas approcher de dispositifs électroniques de la pompe. Le champ magnétique environnant cette dernière peut entraîner des dysfonctionnements desdits dispositifs.

Maintenance

Les pompes de la série Ion CombiNEG 40-400 ne demandent aucun entretien. Toute intervention doit être exécutée par un personnel agréé.

AVERTISSEMENT!

Avant toute intervention sur la pompe, la débrancher de la haute tension.



En cas de mise au rebut d'une pompe, procéder à son élimination dans le respect des normes nationales en vigueur.

Pour l'entretien de la pompe getter (cartouche et bride de support), se référer toujours au manuel d'utilisation fourni avec la pompe getter.

Mise au rebut

Signification du logo "WEEE" imprimé sur les étiquettes.

Le symbole ci-dessous est appliqué conformément à la directive CE nommée "WEEE".

Ce symbole (**uniquement valide pour les pays de la Communauté européenne**) indique que le produit sur lequel il est appliqué NE doit PAS être mis au rebut avec les ordures ménagères ou les déchets industriels ordinaires, mais passer par un système de collecte sélective.

Après avoir vérifié les termes et conditions du contrat de vente, l'utilisateur final est donc prié de contacter le fournisseur du dispositif, maison mère ou revendeur, pour mettre en œuvre le processus de collecte et mise au rebut.

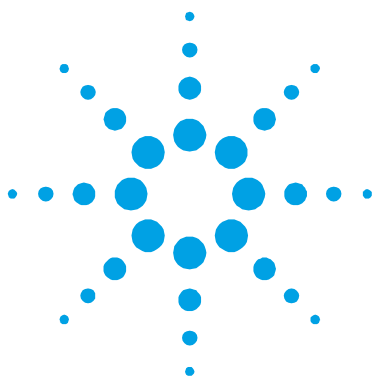


Pour plus d'informations, rendez-vous à l'adresse:

<http://www.agilent.com/environment/product/index.shtml>

3 Procédure pour l'installation

Mise au rebut



4

Installation Procedure

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Original Instructions



General Information

This equipment is destined for use by professionals. The user should read this instruction manual and any other additional information supplied by Agilent before operating the equipment. Agilent will not be held responsible for any events occurring due to non-compliance, even partial, with these instructions, improper use by untrained persons, non-authorized interference with the equipment or any action contrary to that provided for by specific national standards.

The Ion CombiNEG 40-400 series pumps are ion pumps commonly used to create ultra-high vacuum, due to their cleanliness, ability to pump different gases, and maintenance- and vibration-free operation.

The following paragraphs contain all the information necessary to guarantee the safety of the operator when using the equipment. Detailed information is supplied in the appendix "Technical Information".

This manual uses the following standard protocol:

WARNING!



The warning messages are for attracting the attention of the operator to a particular procedure or practice which, if not followed correctly, could lead to serious injury.

CAUTION!

The caution messages are displayed before procedures which, if not followed, could cause damage to the equipment.

NOTE

The notes contain important information taken from the text.

Safety Symbols

SYMBOLS	SYMBOLS DESCRIPTIONS
	Access denied to active pacemaker's holders. The device is marked with this symbol t to indicate that pacemaker holders must not come in contact with the device itself.
	Electric hazard. The device is marked with this symbol when the operator, due to the presence of an high voltage, must refer to the user manual in order to protect himself from electrical shock risks.
	Magnetic field hazard. The device is marked with this symbol to inform the operator about the presence of a magnetic field.
	Hot surface hazard. The device is marked with this symbol when the operator must avoid the contact with potentially hot surfaces which may cause burns.

Storage

During transportation and storage of the ion pump, the following environmental conditions must be respected:

- Temperature: between -20 °C and +70 °C;
- Relative humidity: between 5 and 95% (without condensation).

Preparation for Installation

The pump is supplied in a special protective packing. If this shows signs of damage which may have occurred during transport, contact your local sales office. When unpacking the pump, be sure not to drop it and avoid any kind of sudden impact or shock vibration to it. Do not dispose of the packing materials in an unauthorized manner. The material is 100 % recyclable and complies with EEC Directive 85/399.

CAUTION!

To prevent outgassing problems due to contamination, do not use bare hands to handle components which will be exposed to vacuum. Always use vacuum-compatible gloves or other appropriate protection.

NOTE

Normal exposure to the environment cannot damage the pump. Nevertheless, it is advisable to keep it closed until it is installed in the system, thus preventing any form of pollution by dust.

4 Installation Procedure

Preparation for Installation



Figure 1 Packaging of the Ion CombiNEG 40-400.

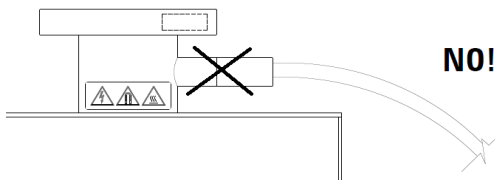
Installation

Do not install or use the pump in an environment exposed to atmospheric agents (rain, snow, ice), dust, aggressive gases, or in explosive environments or those with a high fire risk. During operation, to obtain the declared functioning specification, the ambient temperature must be between 0 °C and +85 °C and the humidity between 0 and 95% (without condensation).

CAUTION!

The pump should be kept sealed with its pinch-off tube until it is ready for attachment to the vacuum system.

WARNING!



To avoid injury, never connect the high voltage to the pump before it is installed into the system and all the inlet flanges are properly connected or blanked off.

The pump operation is optimized using one of the special Agilent controllers only.

CAUTION!

The safety specifications agreement using the pump is guaranteed using the Agilent controller only.

The Ion CombiNEG 40-400 pump can be installed in any position. For convenience it is normally mounted vertically, with the inlet up, or placed horizontally.

Pumps can be supported by the mounting flange in any position.

4 Installation Procedure

Installation

For detailed information about the pump installation, see the appendix “Technical Information”.

For the installation of the getter pump (cartridge and support flange) refer to the indications available in the Operating Instruction Manual supplied with it.

Use

All the instructions for the correct use of the Ion CombiNEG 40-400 pumps are contained in the control unit manual. Read that manual carefully before using the pump.

Rough pumping down to a pressure equal or lower than $1\text{E-}5$ Torr (mbar) for the Diode SEM version - $1\text{E-}4$ Torr for the StarCell version - is recommended for the most rapid starting and in order to preserve pump lifetime. Typically, this pressure level can be easily achieved by means of a turbomolecular pump, supported by a primary pump, preferably oil free.

The ion pump can in principle be started also at pressure higher than the one we recommend, but this prolonged practice can affect the pump lifetime. In the past the need to start the ion pump at high pressure was due to the fact that it was directly connected to the primary pump; thanks to the invention of turbomolecular pumps, this is no longer necessary.

Hygroscopic deposits - that are natural consequence of exposure to air- and hydrogen absorption into the titanium cathodes - phenomenon connected to the physical working principle of the ion pump - may cause starting times to increase with age. In fact the pump heating that takes place at its start-up causes release of the water vapor and some previously pumped hydrogen; thus, the starting time may be lengthened.

For the correct use of the getter pump (cartridge and support flange) refer to the indications available in the Operating Instruction Manual supplied with it.

Operating Procedure

1. Check that the controller HV polarity is correct for the pump: positive polarity for Diode SEM pumps and negative for StarCell pumps. Refer to the relevant pump control unit instruction manual and follow the procedure below when operating the pump: establish a minimum starting pressure in the vacuum system per the table 1, by means of a pre-vacuum turbomolecular pump (supported by a primary pump). We recommend to installing an all-metal valve between the ion pump and the turbomolecular pump, in order to be able to insulate it at a later stage.
2. Plug the control unit into a suitable power source and switch the power ON. Follow the instructions in the manual of the control unit to feed the ion pump.
3. Observe the voltage, current and pressure on the display of the control unit. If the ion pump has been started at too high pressure, typically the voltage will be of some hundreds Volts. If the voltage remains constant at these values, in order to avoid pump overheating we suggest turning it off and start it again at a lower pressure (see the paragraph “Use”). A current value near the short-circuit current of the control unit could indicate that an unconfined flow discharge exists in the pump and system. A temporary rise in roughing pressure will usually be noticed during any starting procedure. If the ion pump has been started to the recommended pressure (the table 1), the voltage will quickly reach the pre-set value (3, 5 or 7 kV). Once at the operating voltage, the current will start to decrease. We recommend at this point to close the roughing valve, in order to insulate the ion pump and the system from the turbomolecular pump. If the ion pump voltage drops after closing the roughing valve, reopen the valve for additional rough pumping. As the pressure decreases, the voltage again will rise, and the roughing valve may be closed.
4. When the voltage has reached the pre-set operating value, set the control unit in the PROTECT condition, if the control unit has this feature. The system is now automatically protected against pressure increases above the pre-set limit. If such an increase should occur, the control unit will be turned off automatically.
5. If the control unit allows you to set the pump type in use, the controller display will show the pressure value obtained by the conversion of the current value, as per the pressure versus current graph shown in the paragraph “Technical Information” of this manual. If the controller does not have this feature, please directly refer to this diagram. It is worth noticing that the pressure indication could be not correct if, during its operation, the ion pump starts to be affected by leakage current. In this case the pressure obtained by the current conversion shown on the display will be higher than the real one.

6. When venting the pump, use dry nitrogen. This will avoid water vapor absorption on the pump walls. After the pump has been turned off, we recommend waiting that its internal elements are cooled down before exposing the pump to atmospheric pressure.

For the operating procedure of the getter pump (cartridge and support flange), always refer to the Operating Instructions Manual provided with the getter pump.

WARNING!



When employing the pump for pumping toxic, flammable, or radioactive gases, please follow the required procedures for each gas disposal. Do not use the pump in the presence of explosive gases.

WARNING!



When the heating element is installed, do not touch the pump during the heating and cooling phases. The high temperature may cause a serious damage.

CAUTION!

Do not put any electronic device near the pump since the magnetic field may cause a device malfunction.

Maintenance

The Ion CombiNEG 40-400 pumps does not require any maintenance. Any work performed on the pump must be carried out by authorized personnel.

WARNING!



Before carrying out any work on the pump, disconnect it from the High Voltage supply.

If a pump is to be scrapped, it must be disposed of in accordance with the specific national standards.

For the maintenance of the getter pump (cartridge and support flange), always refer to the Operating Instructions Manual provided with the getter pump.

Disposal

Meaning of the "WEEE" logo found in labels.

The following symbol is applied in accordance with the EC WEEE (Waste Electrical and Electronic Equipment) Directive.

Directive. This symbol (**valid only in countries of the European Community**) indicates that the product it applies to must NOT be disposed of together with ordinary domestic or industrial waste but must be sent to a differentiated waste collection system.

The end user is therefore invited to contact the supplier of the device, whether the Parent Company or a retailer, to initiate the collection and disposal process after checking the contractual terms and conditions of sale.

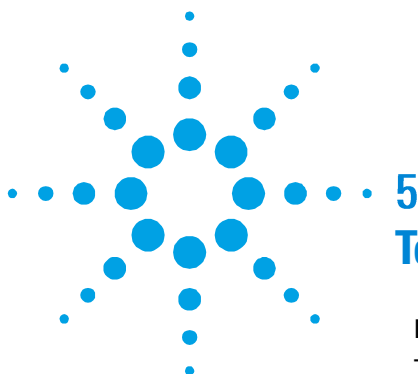


For more information refer to:

<http://www.agilent.com/environment/product/index.shtml>

4 Installation Procedure

Disposal



5

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Description of the Ion CombiNEG 40-400 pump

The Ion CombiNEG 40-400 pumps are ion pumps and are available in four versions:

- X3606-64000: SEM (Diode) version, equipped with 115 V heaters;
- X3606-64001: SEM (Diode) version, equipped with 230 V heaters;
- X3606-64040: StarCell version, equipped with 115 V heaters;
- X3606-64041: StarCell version, equipped with 230 V heaters.

The inlet ConFlat flange is a 4" ½ CFF (DN63CF); the pump also has a 2"¾ CFF (DN40CF) side port, suitable to accommodate a Capacitor-D400-2 getter pump. An optical baffle is mounted inside the ion pump, specifically designed to shield the getter pump against the titanium sputtered by the ion pump during its working. The position of the getter pump once it is mounted inside the pump body has been optimized in order to preserve the conductance around the getter pump and between the getter pump and the inlet flange.

During the pump manufacturing, all the internal surfaces of the Ion CombiNEG 40-400 pump are exposed to a particular thermal treatment, commonly referred to as "vacuum firing", thanks to which the hydrogen content (e.g. in titanium and stainless steel) is strongly reduced. Thanks to the vacuum firing process performed in a dedicated vacuum furnace, the hydrogen outgassing rate can be effectively reduced, thus allowing a faster pumpdown to the ultimate pressure.

The vacuum firing process, associated to the manufacturing bakeout cycle at 450 °C (vacuum inside the pump, nitrogen outside), can produce a non-homogeneous coloring with possible yellow shading, in the external surface of the pump body. This purely aesthetic phenomenon does not affect in any way the cleanliness of the external nor the internal surfaces of the pump exposed to vacuum and should not be perceived as a defect.

5 Technical Information

Description of the Ion CombiNEG 40-400 pump

The magnetic circuit of the Ion CombiNEG 40-400 pump has been optimized in order to get a very uniform distribution, in correspondence of the whole anode length and width, of the component of the magnetic field that is parallel to the axis of the cells composing the anodes. Thanks to this homogeneity, the Ion CombiNEG 40-400 pump exhibit an optimized ratio of pumping speed versus volume.

Ion CombiNEG 40-400 pumps are designed to operate in the pressure range from the recommended maximum starting pressure (1E-5 mbar for SEM Diode or 1E-4 mbar for StarCell) to the ultimate pressure (below 1E-11 mbar). The maximum suggested starting pressure for the StarCell version is one order of magnitude higher with respect to SEM Diode, because thanks to its design the ions are prevented from bombarding the system and the pump walls while starting. This reduces the pressure rise that can be associated with the starting phase and the consequent temperature increase. As pointed out in the paragraph “Use”, the ion pump can in principle also be started at higher pressure, but this prolonged practice can affect the pump lifetime. Moreover, it is worth noticing that there is not in theory a limit to the achievable ultimate pressure, but the measurement of pressures below 1E-11 mbar (in the eXtreme High Vacuum - XHV - range) by means of a gauge is very difficult, due to the intrinsic limitations of the gauge itself. Moreover, the achievement of the ultimate pressure strongly depends on how efficiently the bakeout of the complete system is performed.

Virtually all gases and vapors can be pumped successfully with the ion pump. The pumping speed will vary depending on the system pressure, the gas type, the pump element (SEM Diode/StarCell) and the applied operating voltage. The latter can be optimized using Agilent controllers, in order to always feed the pump at the voltage for which the pumping speed is maximized.

For the pumping of noble (or inert) gases, we recommend the use of StarCell elements.

The StarCell is the best-in-class solution for pumping noble gases. It is the latest variation of a triode configuration. Thanks to its engineered design, StarCell pumps can handle a very high amount of noble gases (better than Noble Diode type pumps – one order of magnitude more) and hydrogen (comparable to the Diode).

Fig. 2 shows the Ion CombiNEG 40-400 pump, Fig. 3 shows the main assemblies of the pump.

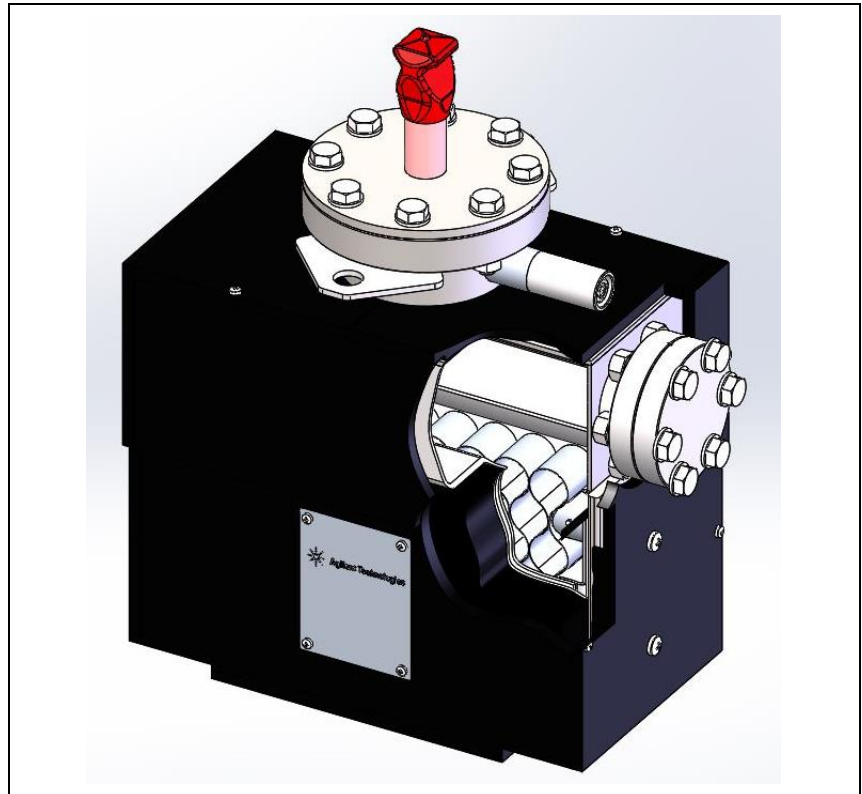


Figure 2 Cut-away showing the main pump assemblies of the Ion CombiNEG 40-400 pump (SEM version), with no getter pump mounted.

5 Technical Information

Description of the Ion CombiNEG 40-400 pump

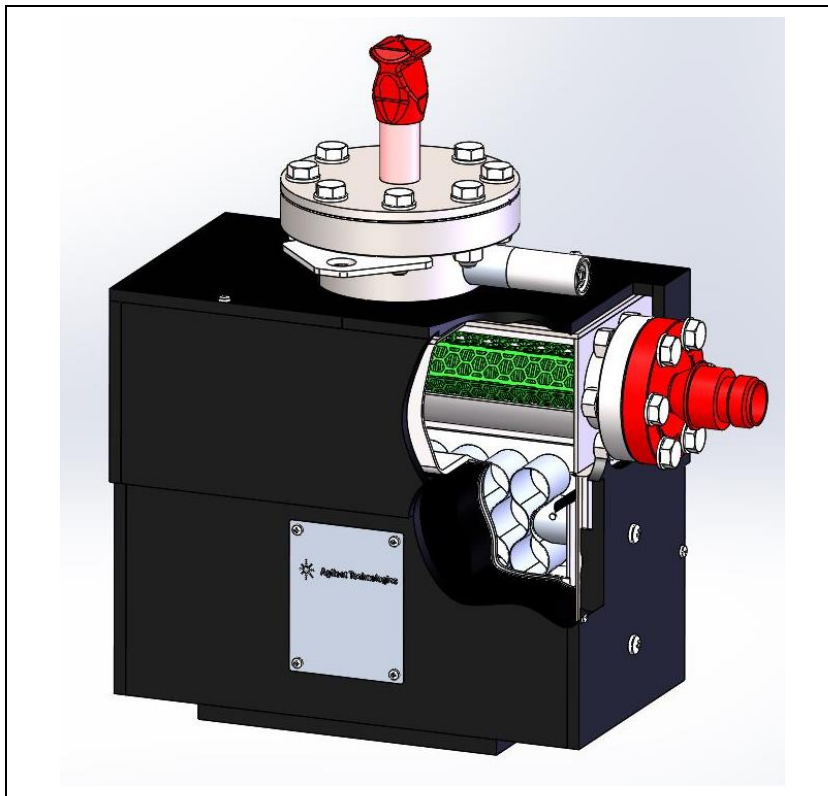


Figure 3 Cut-away showing the main pump assemblies of the Ion CombiNEG 40-400 pump (SEM version), with the getter pump mounted (colored in red and green to be more in evidence).

Technical Specification

The following table details the main technical specifications of the Ion CombiNEG 40-400 pumps.

Tab. 1

Specification	Model	
	SEM (Diode)	StarCell
Nominal saturated pumping speed for Nitrogen (*) (l/s) with shield (without shield)	35 (39)	38 (43)
Nominal saturated pumping speed for Argon (*) (l/s) with shield (without shield)	--	20 (22)
Operating life at 1E-6 mbar of Nitrogen (hours)	50000	80000
Suggested maximum baking pressure with ion pump on (mbar)	5E-6	
Protect current	30 mA	
Operating voltage (max)	+7000 Vdc +/- 10 %	-7000 Vdc +/- 10 %
Suggested starting pressure (mbar)	≤ 1E-5	≤ 1E-4
Ultimate pressure (mbar)	Below 1E-11	
Inlet flange	4"1/2 CFF (DN63CF) AISI 304L ESR	
Internal volume (litres)	3.0	
Temperature limits (°C):		
Pump without magnets	450	
Pump with magnets	350	
HV cable	220	
Getter pump	(**)	
Material:	Body	AISI 304L
	Cathodes	Titanium Titanium
	Anodes	AISI 304L
	Magnets	Ferrite (Ceramic 8)
	Pole piece	Iron
Weight, lbs (kg)	49.6 (22.5)	

(*) Tested according to ISO/DIS 3556-1-1992.

(**) Refer to the Operating Instructions Manual provided with the getter pump.

For the technical specifications of the getter pump, please refer to the Operating Instructions Manual provided with the getter pump.

Figures 4 to 8 show the typical pumping speed vs. pressure diagrams for saturated and unsaturated pumps and the pressure vs. current diagrams. The diagrams are for pumps controlled by means of a 4UHV Agilent controller. Unsaturated curves are given as reference, since the measurement of the pumping speed in the unsaturated state is not described in the norms and may be strongly influenced by the testing conditions. The pumping speed of a new or newly regenerated (i.e. baked) sputter ion pump is typically higher (for nitrogen about 180-190%, depending on the pressure range) than its nominal pumping speed; it decreases during operation until it reaches a stabilized level known as "saturation" (corresponding to the nominal pumping speed). Saturation does not correspond to the end of the pump life. For further explanation on the physics of this phenomenon, please refer to the section "VacIon Plus Pumping Speed" of the ion pump general catalogue. It is worth noticing that to saturate the Ion CombiNEG 40-400 pumps, it normally requires an amount of gas of about 1.6 mbar-liters (in the case of nitrogen). Consequently, pumps can operate for extended periods of time at low pressures in the non-saturated state, if they are properly conditioned. Moreover, we point out that for the unsaturated curves only the first part of the curve is shown, since during the measurement (carried out from low pressure towards high pressure) the pump starts to move from the unsaturated to the saturated condition, so that in the transient phase it cannot be clearly be classified as unsaturated or saturated. It is also worth noticing that the shown current versus pressure curves are typical and may appear different in the presence of a leakage current. A small deviation from the reported curve may also be due to the intrinsic uncertainty of the gauge reading.

Ion CombiNEG 40-400 SEM Diode

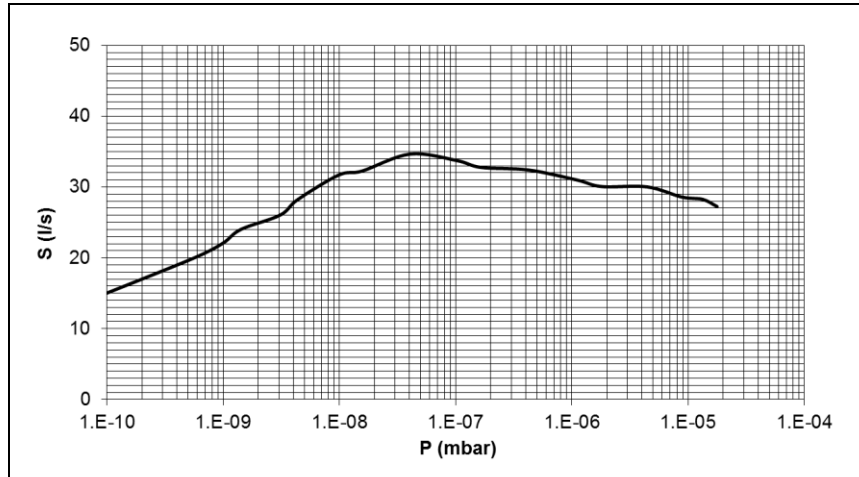


Figure 4 Typical pumping speed vs pressure diagram for Nitrogen (SEM Diode), saturated, equipped with shield).

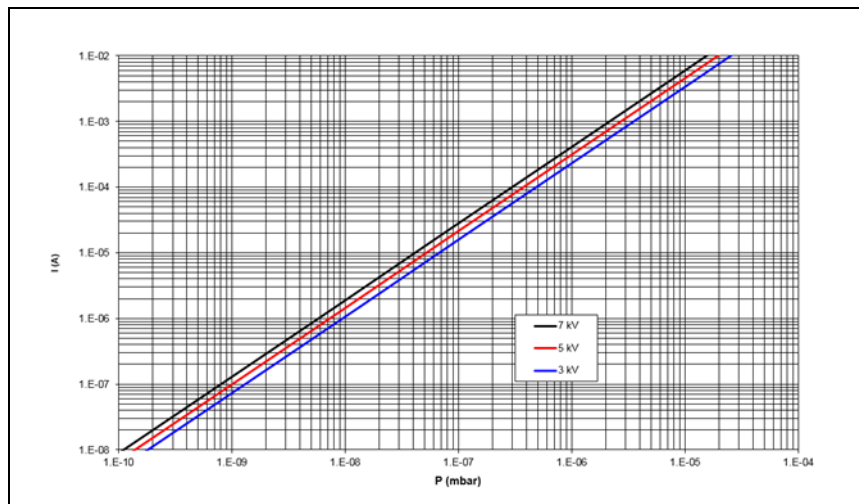


Figure 5 Typical pressure vs current diagram (SEM Diode).

Ion CombiNEG 40-400 StarCell

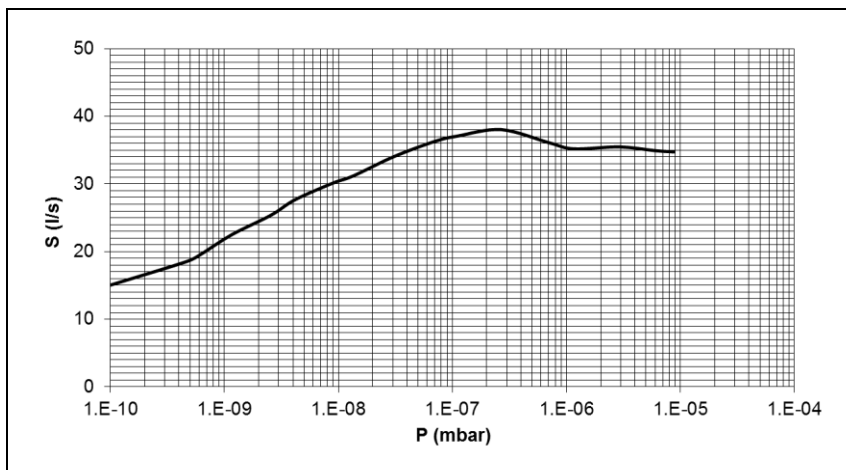


Figure 6 Typical pumping speed vs pressure diagram for Nitrogen (StarCell, saturated, equipped with shield).

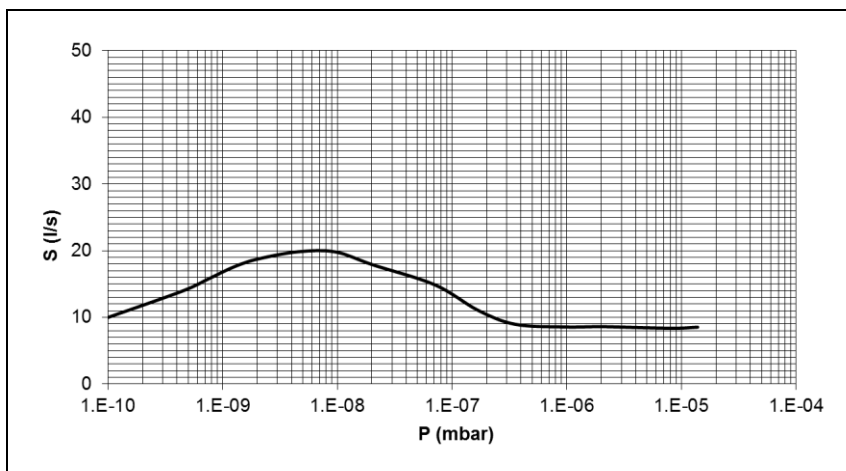


Figure 7 Typical pumping speed vs pressure diagram for Argon (StarCell, saturated, equipped with shield).

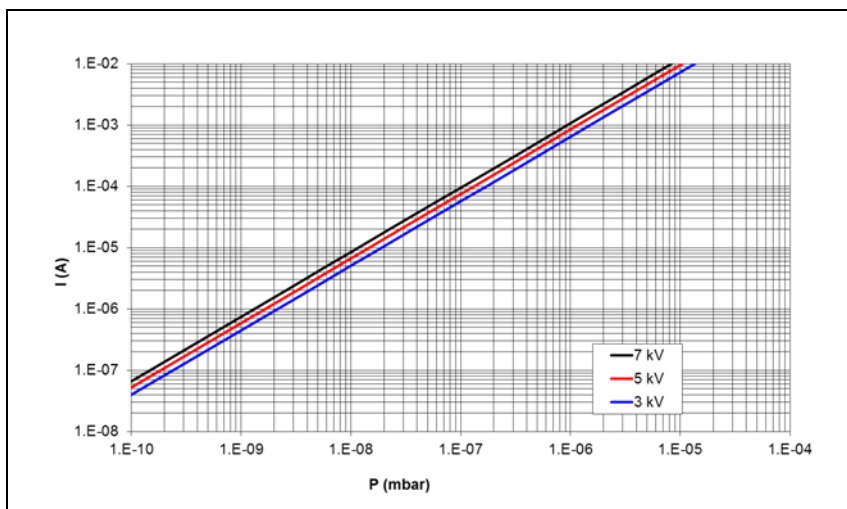


Figure 8 Typical pressure vs current diagram (StarCell).

Outline Drawing

The following figures show the outline drawing for Ion CombiNEG 40-400 pump.

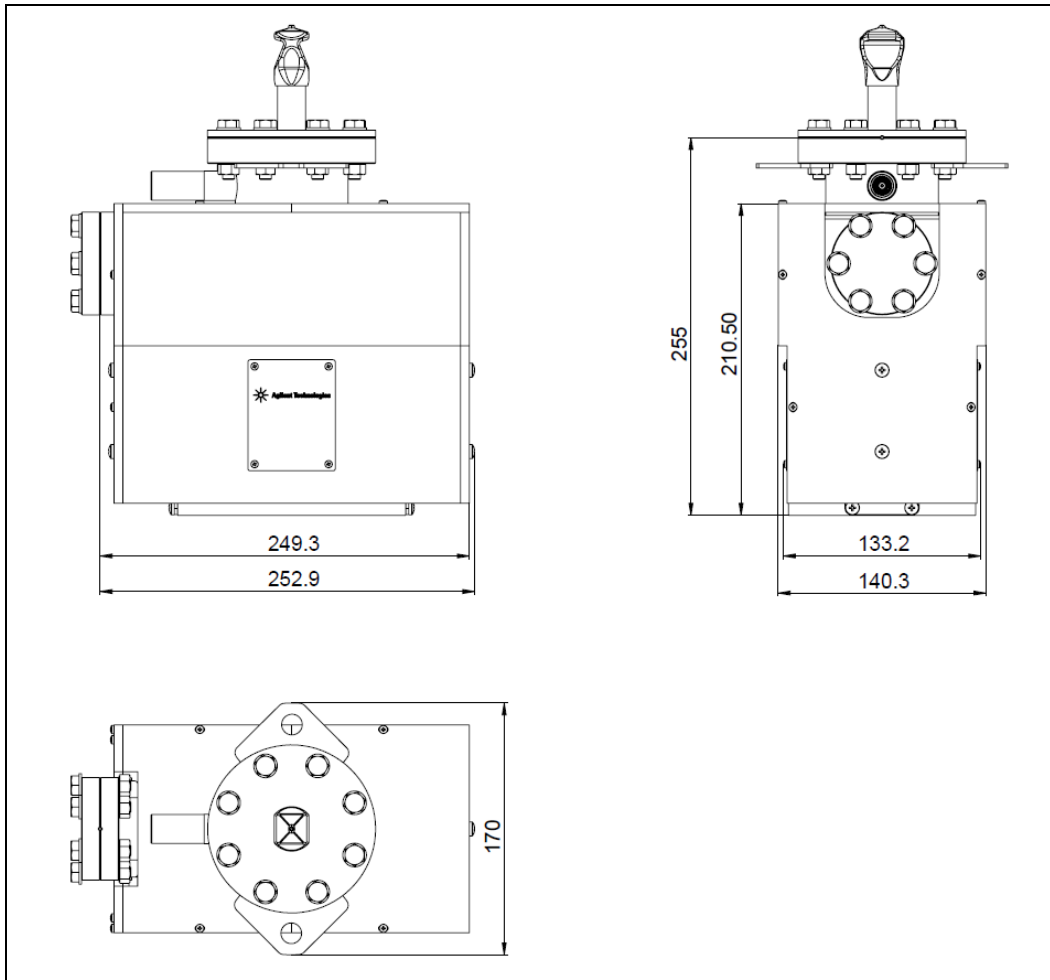


Figure 9 Ion CombiNEG 40-400 outline drawing, showing pump overall dimensions (in mm).

Stray Magnetic Field

The stray magnetic field of the pump was measured by means of a probe along several paths. Fig. 10 shows the pump axis identification to which we refer in this paragraph. It is worth noticing that the background contribution due to the Earth magnetic field was subtracted from the measured values.

Curves of stray magnetic field strength along the centre line of the pump and in the plane of the flange as a function of distance from the pump are shown in Figs. 11, 12, 13, 14 and 15, where B_x is the magnetic field along X axis, B_y is along Y axis and B_z is along Z axis.

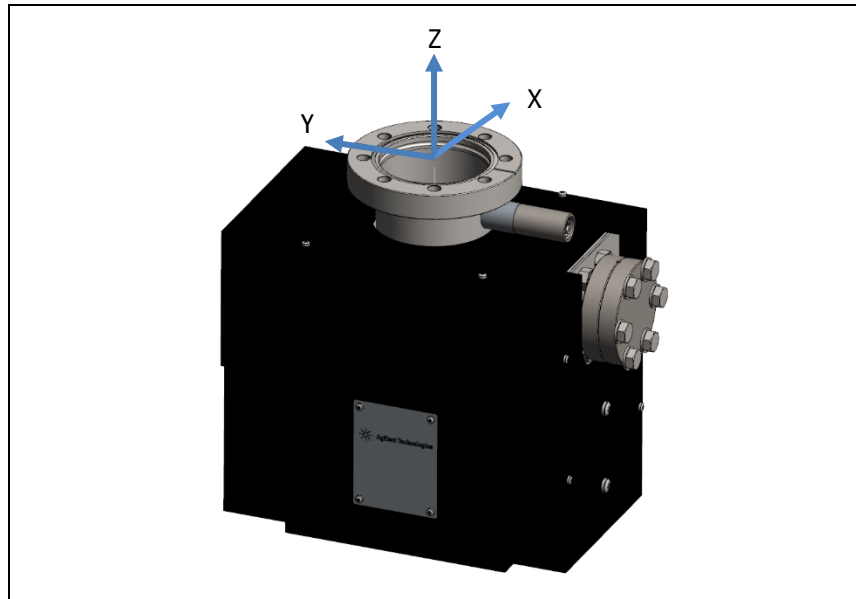


Figure 10 Pump axis identification.

5 Technical Information

Stray Magnetic Field

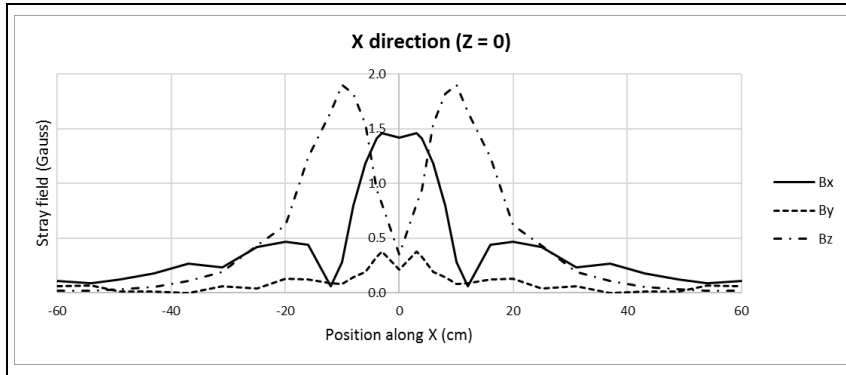


Figure 11 Typical stray magnetic field from the center of the flange along X axis ($Z = 0$ mm).

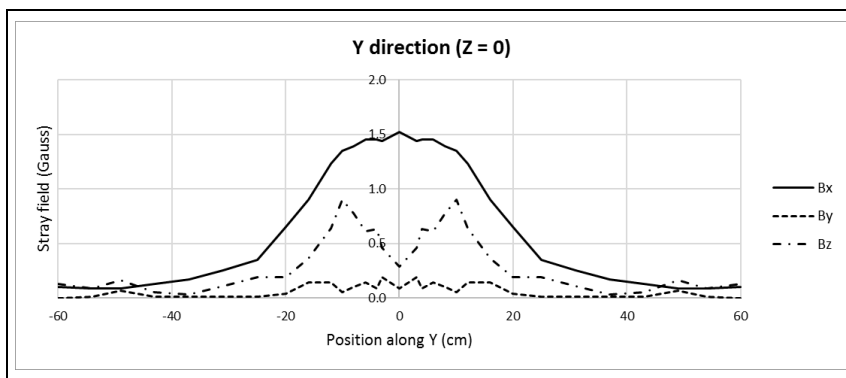


Figure 12 Typical stray magnetic field from the center of the flange along Y axis ($Z = 0$ mm).

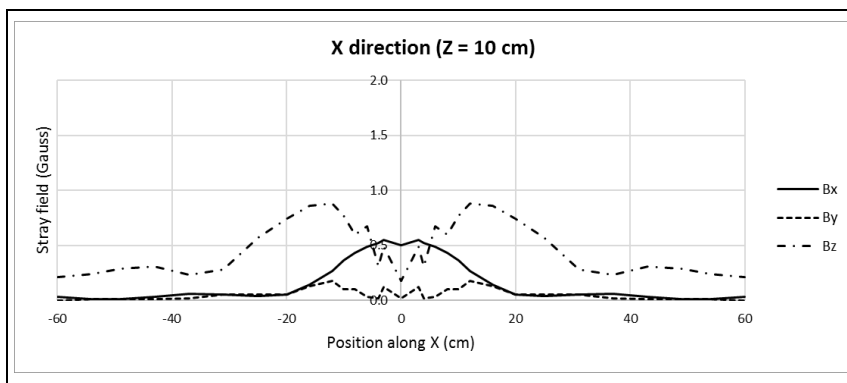


Figure 13 Typical stray magnetic field from the center of the flange along X axis (Z = 10 cm).

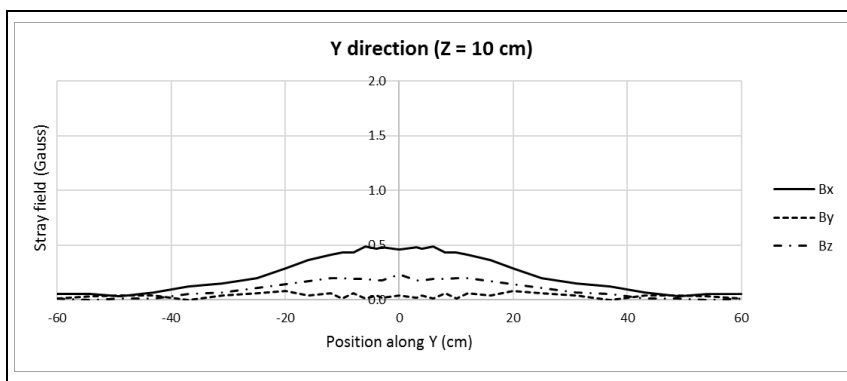


Figure 14 Typical stray magnetic field from flange along Y axis (Z = 10 cm).

5 Technical Information

Stray Magnetic Field

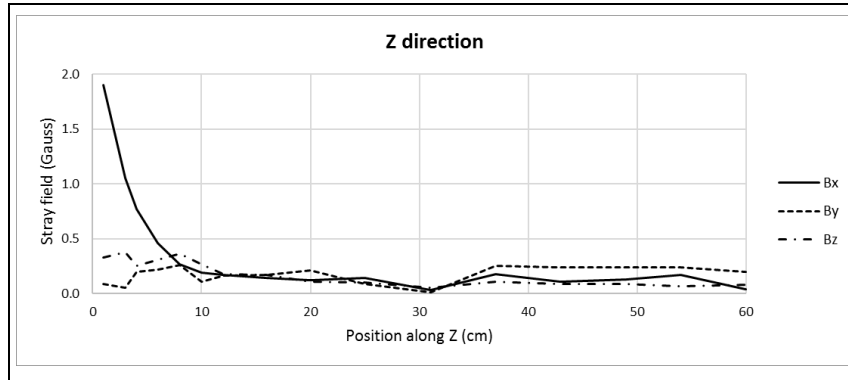


Figure 15 Typical stray magnetic field from flange along Z axis.

Ion CombiNEG 40-400 Pump Installation

Inspection Procedure

Ion CombiNEG 40-400 pumps are evacuated, baked out, sealed and leak-checked at below $1\text{E-}10$ mbar prior to shipping. The following information and procedures can be used to evaluate the vacuum integrity of a Ion CombiNEG 40-400 pump before installation.

Visual Inspection

Inspect the pump and magnet for physical damage which may have occurred during shipment. Inspect the pinch-off seal (that is covered by a rubber cap). If it is open, the pump is at atmospheric pressure.

WARNING!

The pinch-off seal is extremely sharp. Be careful when opening. Watch your fingers.

An Ion CombiNEG 40-400 pump that has been exposed to atmosphere during shipment, or while in storage, will operate properly if it has not been damaged.

The pump is not harmed by such exposure, although it is good practice to keep it under vacuum when not in use, in order to avoid the dust contamination and the accumulation of water vapor from the environment.

Vacuum Evaluation

The ion pump is shipped in an evacuated condition. Before removing the shipping flange for installation on a vacuum system, it is recommended to briefly start the pump in order to verify vacuum integrity and proper operation.

To verify the vacuum integrity of the new pump before venting:

- 1 Connect the ion pump to the control unit as described in the instruction manual of the control unit.

WARNING!



The high voltage which is applied to the ion pump by the control unit can cause severe injury or death. Be sure that the high voltage cable is properly connected to the ion pump and its power unit. Make sure that the pump is well grounded.

-
- 2 With the main power switch in the OFF position, plug the control unit into a suitable power source.
 - 3 Turn the power to ON.
 - 4 Turn the ion pump on by following the instructions on the control unit manual. Observe the reading on the unit display for an indication of one of the following conditions:
 - a If the pump is free of leaks and is at a low pressure, the pressure indication shall quickly fall to or below the 1E-8 mbar range as the volume of gas is pumped.
 - b If the pressure inside the pump is at or near atmospheric level, an arc may strike inside the high voltage feedthrough giving a popping sound and the pump current will fluctuate. If this occurs, turn the power OFF immediately.
 - 5 If the vacuum integrity has been lost, the pump should be leak-checked with a mass spectrometer leak detector before installation on the system.

Short Circuits

If there is a short circuit between the anode and the cathode or, in the case of the StarCell, between the cathode and the pump body, the short-circuit current of the control unit will be drawn and low voltage will be indicated. If a short circuit exists in the control unit or high voltage cable and connector, low voltage will also be observed when the high voltage connector is disconnected from the pump (refer to the control unit manual).

An ohm meter reading on the pump feedthrough may not be effective in finding a short.

Short circuits may be caused by mechanical shock to the pump. If the pump is shorted, contact Agilent.

Typical Installation

A typical installation is shown in the following figure and consists of:

- 1** Ion CombiNEG 40-400 pump.
- 2** Ion pump control unit.
- 3** Clean roughing pump (typically a turbomolecular pump).
- 4** Thermocouple gauge, able to indicate the pressure from atmosphere to 1E-3 mbar range.
- 5** Metallic valve to seal off the roughing pump from the vacuum chamber. Roughing lines are usually made of stainless steel or copper tubing or other low vapor pressure material.
- 6** High voltage cable.
- 7** Primary backing pump (e.g. a scroll pump).
- 8** High vacuum gauge (e.g. Agilent UHV24 or UHV24P).
- 9** Vacuum chamber.
- 10** Getter pump.
- 11** Power supply for the getter pump.

A metallic valve to seal off the ion pump from the rest of the system may also be installed if required.

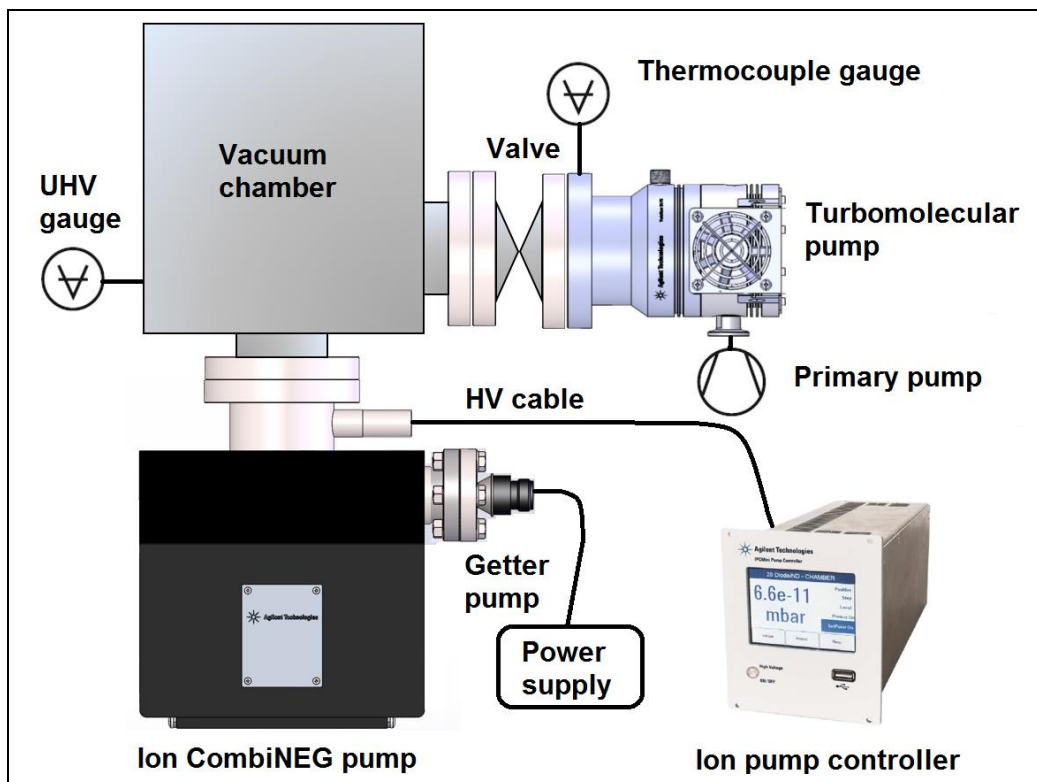


Figure 16 Typical installation.

Inlet Flange Connection

The pump should be mounted allowing a sufficient clearance for installation and removal of the high voltage connector.

The pump should be kept sealed with its pinch-off tubulation until it is ready for the connection to the vacuum system. This avoids the accumulation of dust and other undesirable materials. Before breaking the pinch-off seal, consult the inspection procedure (see the previous paragraph).

Vent the ion pump by opening the pinch-off tubulation in a clean area free from smog, dust, pollen, etc. Venting with dry nitrogen gas is strongly recommended. This can be done by placing a clean polyethylene bag over the ion pump flange. Small pumps can be completely placed inside of the bag. Put a pair of pliers inside the bag, too, and purge the bag with clean, dry nitrogen for several minutes; then handle the pliers from outside the bag in order to break the internal pump vacuum, by opening a small leak in the copper tube pinch-off.

CAUTION!

Do not open the pinch off-seal with a saw or grinder. These methods will cause metal particles to be drawn into the pump by the in-rushing air as the pump is opened.

WARNING!



The pinch-off seal is extremely sharp. Be careful when opening. Watch your fingers.

Use appropriate procedures to maintain the clean condition of the pump and vacuum system.

Unscrew the main flange bolts and lift the blank flange. Remove the copper gasket plate, that must not be reused. Some particles of copper oxide may adhere to the outer edge of the flange gasket. Be careful not to allow them or any other foreign materials to fall into the pump.

CAUTION!

While removing the copper gasket, pay attention in order to not scratch the knife edge of the flange. Do not use a screwdriver or a similar tool in the attempt of lifting the gasket, since you risk hitting the knife edge during this operation.

Connect the ion pump to the vacuum chamber with a short length and large diameter pipe in order to retain as much pumping speed as possible. Proceed as follows:

- 1** Inspect the mating flanges for cleanliness and absence of scratches on the knife edge.
- 2** Place a new copper gasket between pump flange and vacuum chamber flange.
- 3** Bolt mating flanges of the pump to the chamber with new screws. For flanges over NW 35 (2.75" o.d.) also mount washers below the nuts and the screw heads.
- 4** Use silver-plated screws or apply high temperature lubricant to the screw threads. Lubrication simplifies sealing and disassembly. A recommended lubricant is Fel-Pro C-100. Take care in order to not contaminate the internal surface of the pump or the vacuum system with the lubricant.

NOTE

If the screws are not silver-plated, lubrication is essential to prevent galling of the nut and screw after bakeout. Take care in order to not contaminate with lubricant the surfaces exposed to vacuum.

- 5** Attach the nuts and tighten each one to 6 – 11 Nm (4.5 - 8 ft.-lbs) of torque. After tightening a nut, always tighten the opposite nut with respect to the center of the flange. This will partially close the gap between the flange faces.
- 6** Repeat the sequential tightening for two more cycles.
- 7** Continue tightening the bolts until the flange faces meet and a pronounced increase in torque is felt.

Note that it is not possible to install the screws from the lower side of the inlet flange. If for any reason screws cannot be installed neither from the upper side, studs must be used (see Fig. 20).

5 Technical Information
Inlet Flange Connection

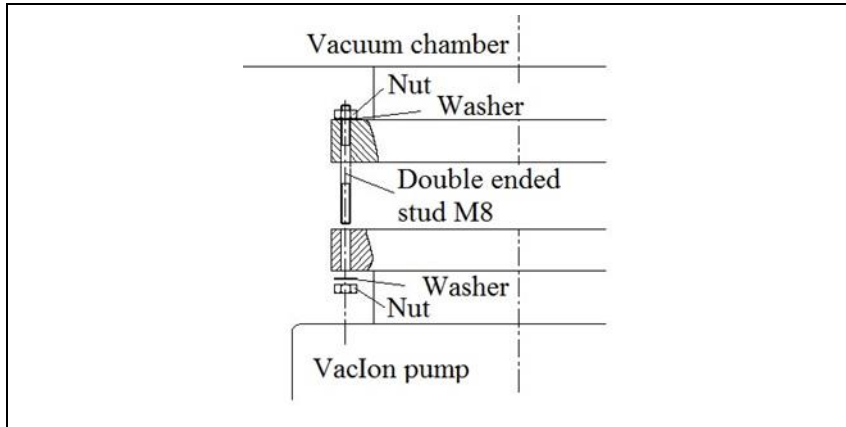


Figure 17 Stud mounting.

Getter Pump Installation

The Ion CombiNEG 40-400 pump has a side port CFF 2"3/4 that is suitable to accommodate a Capacitorr-D400-2 getter pump.

To install the getter pump proceed as follows:

- 1 Be sure that the ion pump is at atmospheric pressure. Venting with dry nitrogen gas is strongly recommended.
- 2 Be sure the HV cable is disconnected.
- 3 Remove the lateral plate of the black pole piece (identified by letter B in Fig. 20) by unscrewing the four M3 screws.
- 4 Unscrew the side port bolts and lift the blank flange. Remove the copper gasket plate, that must not be reused. Some particles of copper oxide may adhere to the outer edge of the flange gasket. Be careful not to allow them or any other foreign materials to fall into the pump.

CAUTION!

While removing the copper gasket, pay attention in order to not scratch the knife edge of the flange. Do not use a screwdriver or a similar tool in the attempt of lifting the gasket, since you risk hitting the knife edge during this operation.

- 5 Inspect the mating flanges for cleanliness and absence of scratches on the knife edge.
- 6 Place a new copper gasket on the side port flange.
- 7 Insert the getter pump (including cartridge plus support flange) in the side port; refer to the instructions that you can find on the Operating Instructions Manual provided with the getter pump.

CAUTION!

While handling the getter pump, do not use bare hands. Always use vacuum-compatible gloves or other appropriate protection. Always refer to the Operating Instructions Manual provided with the getter pump.

- 8 Bolt mating flanges of the pump to the chamber with new screws. For flanges over NW 35 (2.75" o.d.) also mount washers below the nuts and the screw heads.

5 Technical Information

Getter Pump Installation

- 9 Use silver-plated screws or apply high temperature lubricant to the screw threads. Lubrication simplifies sealing and disassembly. A recommended lubricant is Fel-Pro C-100. Take care in order to not contaminate the internal surface of the pump or the vacuum system with the lubricant.

NOTE

If the screws are not silver-plated, lubrication is essential to prevent galling of the nut and screw after bakeout. Take care in order to not contaminate with lubricant the surfaces exposed to vacuum.

-
- 10 Attach the nuts and tighten each one to 6 – 11 Nm (4.5 - 8 ft.-lbs) of torque. After tightening a nut, always tighten the opposite nut with respect to the center of the flange. This will partially close the gap between the flange faces.
 - 11 Repeat the sequential tightening for two more cycles.
 - 12 Continue tightening the bolts until the flange faces meet and a pronounced increase in torque is felt.
 - 13 Put again the lateral plate of the black pole piece (identified by letter B in Fig.20) in its original position.

Control Unit Connection

WARNING!



The high voltage in the high voltage cable which connects the control unit to the ion pump, can cause severe injury or death. Before connecting the high voltage connector of the cable on the pump high voltage feedthrough, or before removing it, be sure that the main power is removed from the control unit.

WARNING!



To avoid injury, never connect the high voltage to the pump before it is installed into the system and all the inlet flanges are properly connected or blanked off. Make sure that the pump is well connected to the grounded vacuum system.

WARNING!



Before removing the high voltage connector of the cable from the control unit, be sure that the main power is removed from the control unit. Wait at least 10 seconds after removing the main power from the control unit, to allow capacitors to discharge completely.

To disconnect the coaxial high voltage cable from the controller, slide the safety locking sleeve (very little sleeve travel is required) from the control unit and at the same time pull on the male end of the cable connector to remove it from the socket on the control unit.

Safety Interlock

The Ion CombiNEG 40-400 pump feedthrough in conjunction with the cable P/N 9290705, 0707, 0708 and 0709, when used with the Agilent control units, allows the operation of the “High Voltage Cable Safety Interlock” feature.

When the high voltage cable connector is disconnected from the Ion CombiNEG 40-400 pump feedthrough, the high voltage is automatically switched off by the control unit.

Heater Replacement

The heating element (Fig. 18) is composed by two plates, placed on the sides of the pump body and kept in contact with the pump body by means of two metal brackets. The pump is shipped with the heating element already mounted.

NOTE

It is suggested to make a 10 – 15 minutes of initial operation of the heater in a ventilated room to allow the evaporation of residual internal alloying elements.

To replace the heating element, proceed as follows (see Figs. 19 and 20):

- 1** Remove four M5 screws identified by letter A (two screws per side).
- 2** Remove the plate B by unscrewing four M3 screws.
- 3** Remove the pole piece top plate C by unscrewing two M3 screws.
- 4** Remove the pole piece top plate D by unscrewing two M3 screws.
- 5** Remove the screws E from the pump body / pole piece (two screws per side).
- 6** Remove the pump from inside the pole piece by lifting it upwards.
- 7** Remove the heater by slightly displacing, if necessary, the side magnets under which the cable is positioned.

CAUTION!

When displacing the magnets, don't detach them from the pole piece, but drag them on the pole piece surface. This will prevent the magnets to be attracted by the magnets placed on the opposite side.

WARNING!



To avoid injury, take particular care while doing this operation. Watch your fingers to avoid the danger of crushing. You can use a rubber or plastic or wood spacer to be placed between the magnets when the pump body is not inside the pole piece.

- 8 Replace the heater with a new one: place the heater plate F1 on the fixed pole piece lateral surface and place the cable under the magnets by slightly moving, if necessary, the side magnets. Be sure that you cannot see the written side of the heating plate.

CAUTION!

When displacing the magnets, don't detach them from the pole piece, but drag them on the pole piece surface. This will prevent the magnets to be attracted by the magnets placed on the opposite side.

WARNING!



To avoid injury, take particular care while doing this operation. Watch your fingers to avoid the danger of crushing. You can use a rubber or plastic or wood spacer to be placed between the magnets when the pump body is not inside the pole piece.

- 9 Reposition the pump inside the pole piece and tighten the screws E (two screws per side).
- 10 Reposition the pole piece top plates C and D and tighten the screws.
- 11 Place the heater plate F2 on the plate B. Be sure that the written side of the heating plate is in contact with the plate B.

5 Technical Information

Heater Replacement

- 12** Reposition the plate B with the heater plate F2 and tighten the screws.
- 13** Tighten the screws A (two screws per side).

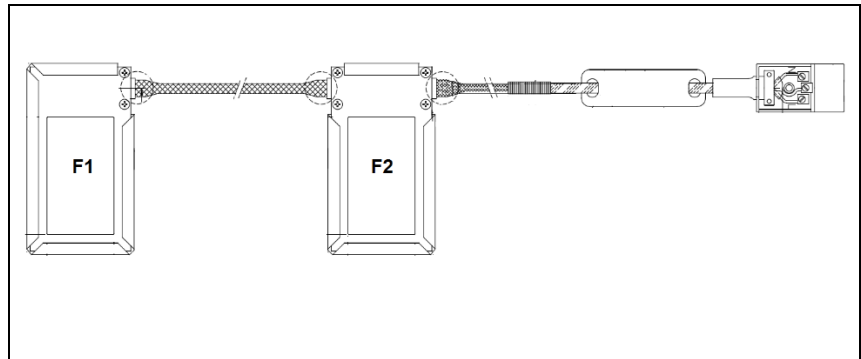


Figure 18 Heating element, composed by two plates (F1 and F2).

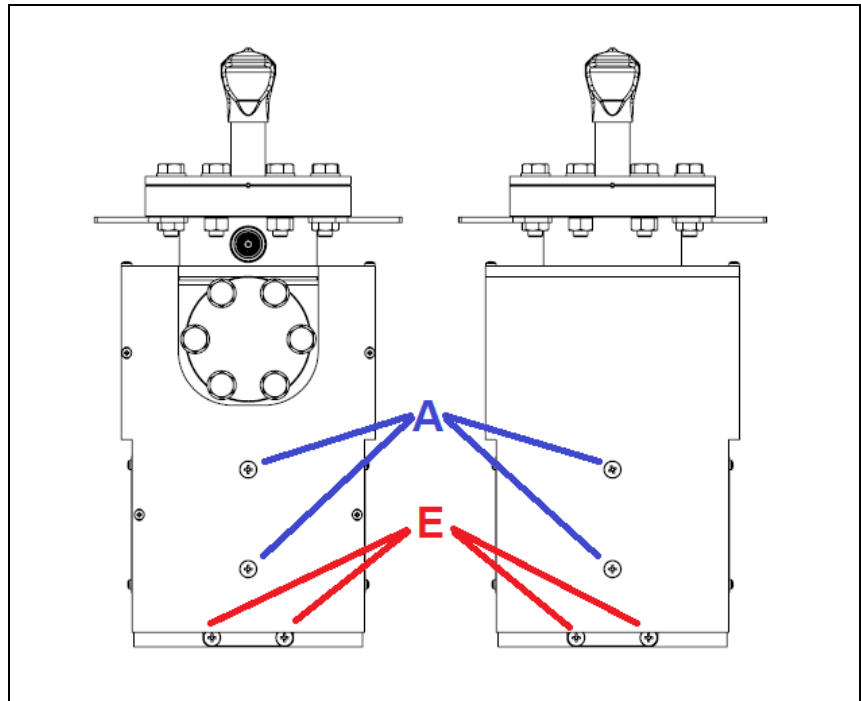


Figure 19 Letters A and E identify the screws to be removed for heater replacement.

5 Technical Information

Heater Replacement

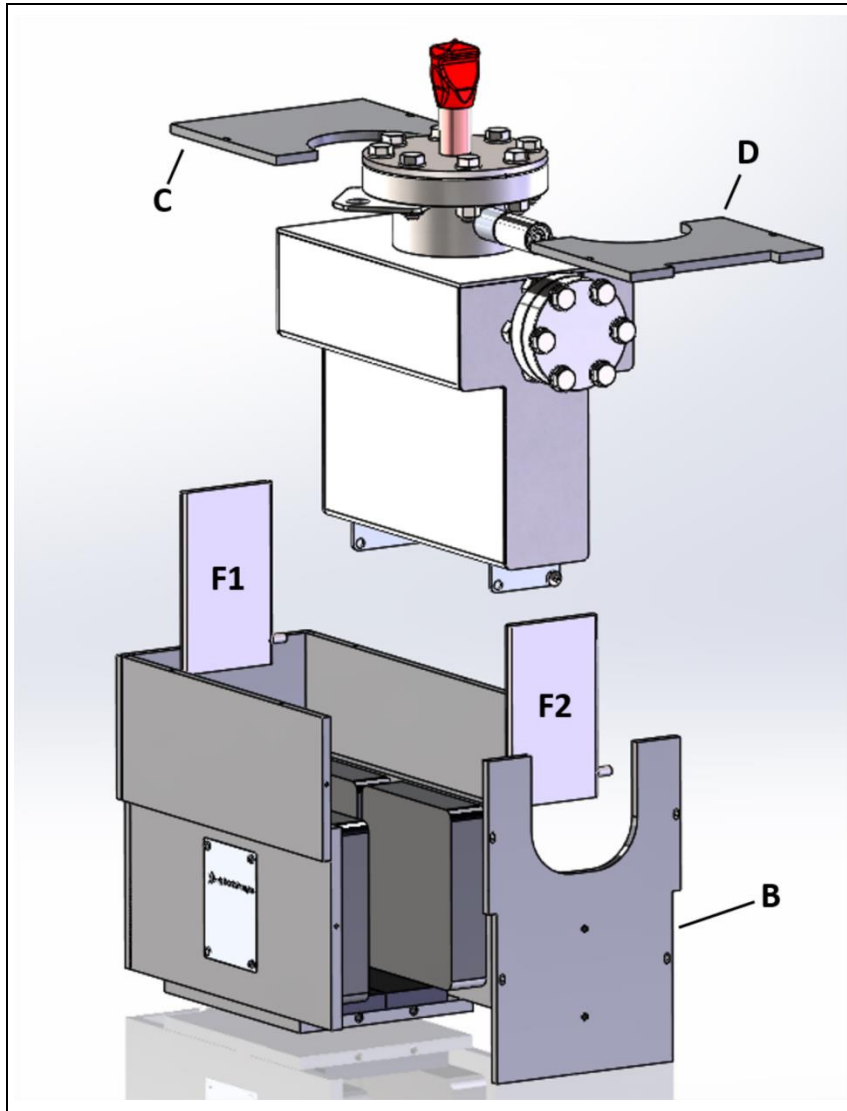


Figure 20 Heating element installation. Letters B, C and D identify the pole piece plates to be removed for heater replacement, F1 and F2 identify the two plates of the heater.

Bakeout Operation and Getter Pump Activation

For every ultra-high vacuum (UHV) application, it is necessary to bake the whole vacuum system in order to reach the ultimate pressure. This is done by heating the pump and all the components in the system, and is generally required to quickly achieve base pressure less than 1E-8 mbar.

CAUTION!

Do not exceed the temperature limits reported in Table 1.

Note that it is possible to perform the bakeout in two ways, that is to say with the ion pump on or off. In the first case (bakeout with the ion pump on):

- 1 Heat the pump body and the vacuum system to temperatures between 150 °C and 220 °C (220 °C is the maximum allowable for most bakeable high voltage cables). This temperature is high enough to degas the pump surfaces of water vapor without damaging the magnet and high voltage connector. Note that the system components must be compatible with the bakeout temperature. The heating must be approximately even on all surfaces or evaporated water will condense on the colder surfaces resulting in an incomplete bakeout and preventing achievement of UHV vacuum pressure.
- 2 Monitor the pump current on the control unit. Agilent recommends that the pressure during the bakeout should not exceed 5E-6 mbar, to reduce the risk of developing leakage currents; if this value is exceeded, turn the bakeout off and then on again when low current is restored. An automatically controlled relay may be used to control the heaters and to monitor the current limit during the bakeout in automatic mode.
- 3 Bake the Ion CombiNEG 40-400 pump for at least 24 hours. Longer bakeout periods are recommended when the pump has been used with heavy gas loads or when UHV pressure (1E-9 mbar or less) is desired.

5 Technical Information

Bakeout Operation and Getter Pump Activation

- 4 As the pump and the system cool down to room temperature, a drop in pressure should be observed.

In the second case (bakeout with the ion pump off), an external turbo pump, connected to the system through a bakeable isolation valve, is necessary. The ion pump should be switched on when the system is still at the bakeout temperature, then the turbo pump should be insulated and the system should be kept at high temperature for the final part of the bakeout process, until the ion current begins to decrease. It is worth noticing that this second method gives the best vacuum performance, since the outgassed species are not sorbed by the ion pump (inside which they will remain), but they are removed from the vacuum system by the turbomolecular pump. This helps to preserve the ion pump lifetime.

NOTE

It is strongly recommended to degas filaments (e.g. in gauges or residual gas analyzers) when the system is at high temperature. If they are outgassed at room temperature, this operation will compromise the effectiveness of the bakeout.

CAUTION!

For the correct management of the getter pump temperature during the bakeout process, always refer to the Operating Instructions Manual provided with the getter pump.

Bakeout of Ion CombiNEG 40-400 with the Integral Heaters

- 1 The integral heaters are to be powered with the appropriate voltage. Please refer to the inscription on the heaters to apply the correct voltage.
- 2 The integral heaters are designed to provide in every point of the ion pump a minimum temperature in the range 150-200°C, if the pump is wrapped in a 3-fold aluminum foil.

NOTE

Keep the high voltage cable out of the aluminum foils in order to not exceed the temperature limits reported in Table 1.

- 3 Bakeout the Ion CombiNEG 40-400 pump for 24 hours. If the pump is used in heavy gas load applications, it is recommended to bakeout the pump for a longer period.
 - 4 Wait until the pump cools down to room temperature and recovers its base pressure before using it in the application.
-

WARNING!



Do not touch the heaters and the ion pump during the heating and cooling phases. The high temperature may cause serious damage.

CAUTION!

For the correct management of the getter pump temperature during the bakeout process, always refer to the Operating Instructions Manual provided with the getter pump.

5 Technical Information

Bakeout Operation and Getter Pump Activation

NOTE

It is worth noticing that the bakeout of the ion pump alone is not sufficient to achieve the ultimate pressure. The complete vacuum system must be baked according to the indications in the paragraph "Bakeout operation".

Getter Pump Activation

For the activation of the getter pump, refer to the Operating Instructions Manual provided with the getter pump.

CAUTION!

During the activation of the getter pump, the pressure inside the system can increase significantly. We therefore suggest performing the activation with the ion pump switched off and with support of a turbo pumping system.

CAUTION!

We suggest to activate the getter pump when the degassing of the filaments (e.g. in gauges or residual gas analyzers) has already been performed.

WARNING!



Do not touch the ion pump during the heating and cooling phases of the getter pump activation. The high temperature may cause a serious damage.

Operating Procedure

- 1 Using a clean roughing pump, evacuate the system to the suggested starting pressure (or lower), as stated in the technical specification. To reach this pressure the use of an oil free turbo-molecular roughing pump is recommended.
- 2 When starting the ion pump, a slight pressure increase is normal, since the internal components are heated and outgassed. Leave the roughing pump connected to the system while starting the ion pump. This will make the startup faster and easier.
- 3 Connect the ion pump control unit to a suitable power source and switch the controller on.
- 4 Switch on the high voltage and observe the current and voltage behaviour on the controller display. The fastest starting is obtained using a high applied voltage (e.g. 7 kV). The applied voltage may be reduced later, when the pressure will be lower, in order to optimize the pumping speed. This operation is done automatically by Agilent controllers when set in "STEP" mode.
- 5 If the ion pump has been started at too high pressure, typically the voltage will be of some hundreds Volts. If the voltage remains constant at these values, in order to avoid pump overheating we suggest to turn it off and start it again at a lower pressure (see the paragraph "Use"). If the ion pump is started at the suggested pressure, the voltage will quickly increase to full voltage as the pump starts operating. The current will start at several milliamps and slowly decrease to microamps or nanoamps as low vacuum pressure is achieved.
- 6 When starting the ion pump for the first time, if the voltage decreases instead of increasing, switch off the ion pump, keep the roughing pump running and start the ion pump again after a while.
- 7 When the pump reaches its full operating voltage, the roughing valve can be closed.
- 8 If the pump does not start after 30 minutes of pumping, see the section PUMP TROUBLESHOOTING.

5 Technical Information

Operating Procedure

- 9** Once the pump reaches its base pressure with stable voltage and current, the ion pump and the system may be baked at high temperature as per the indications in the section titled BAKEOUT OPERATION.
- 10** To stop the ion pump, simply switch off the high voltage. The pump surfaces will continue to pump for a few minutes depending on the system pressure.
- 11** When venting the pump use clean, dry nitrogen. This will avoid water absorption on the pump surfaces and make subsequent pump downs easier. Wait that the ion pump is at room temperature before exposing it at the atmospheric pressure.

For the operating procedure of the getter pump, always refer to the Operating Instructions Manual provided with the getter pump.

Maintenance

WARNING!



The high voltage in the high voltage cable which connects the control unit to the ion pump, can cause severe injury or death. Before mounting the high voltage connector of the cable on the pump high voltage feedthrough, or before removing it, be sure that the main power is removed from the control unit. Before removing the high voltage connector of the cable from the control unit, be sure the main power is removed from the control unit. Wait at least 10 seconds after removing the main power from the control unit, to allow capacitors to discharge completely.

Ion CombiNEG 40-400 pumps are maintenance free. In case of life time expiry or premature failure of the pump, please contact your nearest Agilent sales/service office for assistance.

For the maintenance of the getter pump, always refer to the Operating Instructions Manual provided with the getter pump.

Leakage Current Check

If the pump current reading is used as a pressure measurement, it is worth checking the pump leakage current as follows:

- 1 Turn off the pump control unit.
- 2 Remove the pump pole piece (magnetic circuit). Contact the local Agilent Technologies representative to get indication about how this operation should be carried out.
- 3 Turn on the pump control unit and wait for current stabilization. The current reading should not be higher than 100 nA. Make sure that the control unit and the high voltage cable leakage current is negligible.
- 4 If the reading is higher than 100 nA, this indicates that leakage current comes from the pump; in this case you should perform a "high-potting" per the procedure described in the following section, then recheck the pump and re-install the pole piece.

- 5** If it is not possible to "high-pot" the pump, the pressure reading is biased by the leakage current value. In this case, if a more reliable pressure indication is needed, consider operating the ion pump at a lower voltage (5 kV), to reduce the leakage current without reducing significantly the pumping speed.

If, for any reason, it is not possible to remove the pole piece, the presence of leakage current can be evaluated by changing the high voltage applied to the ion pump from 7 kV to 3 kV. This reduces exponentially the leakage current, thus confirming that the current reading is affected by leakage.

High-potting

A constant high pump current, when no vacuum leak exists, is often caused by field emission currents which prevent the use of the pump current as a UHV pressure indicator. To reduce this field emission current, "high-potting" should be performed. "High-potting" is the term used to describe the application of higher than normal operating voltage (8 kV AC, max. 50 mA) for the purpose of burning off "whiskers" (sharp edges) on the pump cathode.

High-potting should be done under vacuum and preferably without pump magnets installed (to reduce the drawn current).

High-potting must be done carefully and in voltage steps since uncontrolled arcing inside the pump can cause permanent damage. Therefore, slowly increase the applied voltage and watch the current meter for indication of arcing inside the pump as whiskers are burned away. If arcing occurs wait at this voltage until the current is stable again. Then slowly increase voltage again in steps up to a maximum voltage. The maximum voltage may be applied to the pump for a period of about 5 – 10 seconds. This should effectively remove any "whiskers" or sharp edges on the pump cathode.

CAUTION!

Before performing the high-potting disconnect from the system all other electrical devices connected to it.

WARNING!



Voltages developed in the high-potter power supply are potentially lethal. Use caution during operation and ensure the correct grounding.

Ion CombiNEG 40-400 Pump Troubleshooting

Tab. 2

Symptom	Possible cause	Correction procedure
1) – Slow starting	Starting vacuum pressure too high.	Reduce the starting pressure to the value recommended in Table 1.
2) – Slow starting (more than 30 minutes).	Air leaks which limit pressure to above 10^{-6} mbar and cause longer starting time.	Leak check the vacuum system with a helium leak detector.
3) – Slow pump-down due to long exposure of viton parts to air.	Viton releases considerable gas after long exposure to air. (e.g. A bell-jar system which reached 2×10^{-8} mbar in 24 hours after 30 minutes air exposure, will only reach 1×10^{-7} mbar in 24 hours after 20 hours air exposure)	With the system under vacuum, pump for several days, or bake at 100-150 °C (minimum) for up to 15 hours.
4) – Slow pump-down due to absorption of vapours on pump and system walls.	Vapours and gases admitted to a system are absorbed on the walls of the system and pump. Subsequent reduction in pressure depends on the rate of depletion of this vapour. Heavy hydrocarbons are most troublesome because of their relative low vapour pressure and they are very difficult to remove, even by baking.	Bake the system walls, thereby accelerating the desorption process. Baking mobilizes the vapours so they can be cracked and pumped by discharge (see the section “BAKEOUT OPERATION”).
5) – Slow starting or slow pump-down.	High voltage feedthrough is leaking.	Replace the feedthrough.
6) – Current higher than expected at any given pressure.	Ion pump leakage current causing higher pressure reading.	Verify that leakage current (see the dedicated paragraph) occurs and then high-pot the pump.
7) – System fails to achieve desired UHV vacuum pressure.	System not fully baked. Water vapor limits the base pressure.	Bake the system walls, thereby accelerating the desorption process. Baking mobilizes the vapours so they can be cracked and pumped by discharge (see the section “BAKEOUT OPERATION”).
8) – System fails to	System not appropriately cleaned for UHV.	Clean all components for

Symptom	Possible cause	Correction procedure
achieve desired UHV vacuum pressure.	Excessive outgassing from walls limits base pressure.	UHV and bake the system again.
9) – System fails to achieve desired UHV vacuum pressure.	The pressure indication is not given by a gauge, but it comes from the conversion of the ion pump current, that may be affected by leakage.	Verify that leakage current occurs (see the dedicated paragraph) and then high-pot the pump.
10) Sudden and unexplained pressure (current) increases take place with regular frequency.	Instability for noble gases occurs. It is worth noticing that a small quantity of noble gas (argon) is present in the air composition.	Bake the ion pump and the system with the ion pump off and a turbomolecular pump as support. This should partly remove the noble gases inside the ion pump. Choose the most appropriate pumping element for noble gases (StarCell is recommended).

Getter Pump Troubleshooting

Tab. 3

Symptom	Possible cause	Correction procedure
1) – Pressure level does not improve after activation.	Activation was not correctly performed.	Check the correct activation procedure by referring to the Operating Instructions Manual provided with the getter pump.
2) – Getter pump activation does not work.	The getter pump is not correctly powered.	Check the correct pin configuration by referring to the Operating Instructions Manual provided with the getter pump.
3) – Getter pump activation does not work.	The getter pump and/or the insulating elements of the heater have been damaged because of a mechanical shock.	Contact the local sales representative for replacement.
4) – The performances of the getter pump are reduced.	The surface of the getter material is covered by a passivation layer.	Perform a reactivation of the getter.
5) – The performances of the getter pump are reduced.	A vacuum failure has occurred during the activation or regeneration of the getter pump. The pumping characteristics could have been affected, to a greater or lesser extent, depending on temperature and time.	Perform a reactivation of the getter to check if the performance loss is reversible. If not, contact the local representative for support.
6) – The performances of the getter pump are reduced.	The maximum number of allowed reactivations has been reached.	Contact the local sales representative for replacement.

Ion CombiNEG 40-400 Pump Replacement Parts and Accessories

Tab. 4

Description	Part number
Ion CombiNEG 40-400, SEM (Diode), with 115 V heaters	X3606-64000
Ion CombiNEG 40-400, SEM (Diode), with 230 V heaters	X3606-64001
Ion CombiNEG 40-400, StarCell, with 115 V heaters	X3606-64040
Ion CombiNEG 40-400, StarCell, with 230 V heaters	X3606-64041
For part numbers of the getter pump (cartridge plus support flange), please refer to your local Agilent representative.	
Cables and heaters	
HV radiation resistant cable, 4 m (13 ft), with interlock (for Fischer feedthrough)	9290705
HV radiation resistant cable, 7 m (23 ft), with interlock (for Fischer feedthrough)	9290707
HV radiation resistant cable, 10 m (33 ft), with interlock (for Fischer feedthrough)	9290708
HV radiation resistant cable, 20 m (66 ft), with interlock (for Fischer feedthrough)	9290709

For a complete overview of Agilent extensive vacuum product line and for part numbers not included in the above table please refer to the Agilent Vacuum Catalogue.

Ion CombiNEG 40-400 Pump Controllers

The following controller series are available to supply the Ion CombiNEG 40-400 pumps:

- 4UHV Controller
- IPC Mini Controller

If the Ion CombiNEG 40-400 model does not appear in the list of pumps shown on the display of the 4UHV or IPC Mini controllers, you can use the settings of the VacIon Plus 40 pump

Please refer to the Agilent Vacuum Catalogue to choose the correct controller (polarity and power) for each pump.

Getter Pump Power Supply

For the specifications of the power supply to be used for the activation of the getter pump, please refer to the Operating Instructions Manual provided with the getter pump.

5 Technical Information

Getter Pump Power Supply



Vacuum Products Division

Dear Customer,

Thank you for purchasing an Agilent vacuum product. At Agilent Vacuum Products Division we make every effort to ensure that you will be satisfied with the product and/or service you have purchased.

As part of our Continuous Improvement effort, we ask that you report to us any problem you may have had with the purchase or operation of our products. On the back side you find a Corrective Action request form that you may fill out in the first part and return to us.

This form is intended to supplement normal lines of communications and to resolve problems that existing systems are not addressing in an adequate or timely manner.

Upon receipt of your Corrective Action Request we will determine the Root Cause of the problem and take the necessary actions to eliminate it. You will be contacted by one of our employees who will review the problem with you and update you, with the second part of the same form, on our actions.

Your business is very important to us. Please, take the time and let us know how we can improve.

Sincerely,

Giampaolo LEVI

*Vice President and General Manager
Agilent Vacuum Products Division*

Note: Fax or mail the Customer Request for Action (see backside page) to Agilent Vacuum Products Division (Torino) – Quality Assurance or to your nearest Agilent representative for onward transmission to the same address.

CUSTOMER REQUEST FOR CORRECTIVE / PREVENTIVE / IMPROVEMENT ACTION

TO: AGILENT VACUUM PRODUCTS DIVISION TORINO – QUALITY ASSURANCE FAX

N°: XXXX-011-9979350

ADDRESS: AGILENT TECHNOLOGIES ITALIA S.p.A. – Vacuum Products Division –

Via F.Ili Varian, 54 – 10040 Leini (TO) – Italy

E-MAIL: vpd-qualityassurance_pdl-ext@agilent.com

NAME	COMPANY	FUNCTION
ADDRESS:		
TEL. N° : FAX N° :		
E-MAIL:		
PROBLEM / SUGGESTION :		
REFERENCE INFORMATION (model n°, serial n°, ordering information, time to failure after installation, etc.):		
DATE		
CORRECTIVE ACTION PLAN / ACTUATION (by AGILENT VPD)		LOG N°

XXX = Code for dialing Italy from your country (es. 01139 from USA; 00139 from Japan, etc.)



**Vacuum Products Division
Instructions for returning products**

Dear Customer,

Please follow these instructions whenever one of our products needs to be returned.

Complete the attached **Request for Return form** and send it to Agilent Technologies (see below), taking particular care to include the completed **Health and Safety** declaration Section. No work can be started on your unit until we receive a completed copy of this form.

After evaluating the information, Agilent Technologies will provide you with a **Return Authorization (RA) number** via email or fax, as requested. Note: Depending on the type of return, a Purchase Order may be required at the time the Request for Return is submitted. We will quote any necessary services (evaluation, repair, special cleaning, eg).

Product preparation

- Remove all accessories from the core product (e.g. inlet screens, vent valves).
- Prior to shipment and if applicable for your product, drain any oils or other liquids, purge or flush all gasses, and wipe off any excess residue.
- If ordering an Advance Exchange product, please use the packaging from the Advance Exchange to return the defective product.
- Seal the product in a plastic bag, and package product carefully to avoid damage in transit. You are responsible for loss or damage in transit.
- Include a copy of the Health and Safety Declaration in the shipping documentation on the outside of the shipping box of your returning product.
- Clearly label package with RA number. Using the shipping label provided will ensure the proper address and RA number are on the package. Packages shipped to Agilent without a RA clearly written on the outside cannot be accepted and will be returned.
- Return only products for which the RA was issued.

Shipping

- Ship to the location specified on the printable label, which will be sent, along with the RA number, as soon as we have received all of the required information. Customer is responsible for freight charges on returning product.
- Return shipments must comply with all applicable Shipping Regulations (IATA, DOT, ADR, etc.) and carrier requirements.

RETURN THE COMPLETED REQUEST FOR RETURN FORM TO YOUR NEAREST LOCATION:

EUROPE:

Fax: 00 39 011 9979 330

Fax Free: 00 800 345 345 00

Toll Free: 00 800 234 234 00

vpt-customerccare@agilent.com

NORTH AMERICA:

Fax: 1 781 860 9252

Toll Free: 800 882 7426

vpl-ra@agilent.com

PACIFIC RIM:

please visit our website for individual
office information

<http://www.agilent.com>



TERMS AND CONDITIONS

Please read the terms and conditions below as they apply to all returns and are in addition to the Agilent Technologies Vacuum Product Division – Products and Services Terms of Sale.

- Unless otherwise pre-negotiated, customer is responsible for the freight charges for the returning product. Return shipments must comply with all applicable **Shipping Regulations** (IATA, DOT, etc.) and carrier requirements.
- Agilent Technologies is not responsible for returning customer provided packaging or containers.
- Customers receiving an Advance Exchange product agree to return the defective, rebuildable part to Agilent Technologies **within 15 business days**. Failure to do so, or returning a non-rebuildable part (crashed), will result in an invoice for the non-returned/non-rebuildable part.
- Returns for credit toward the purchase of new or refurbished Products are subject to prior Agilent approval and may incur a restocking fee. Please reference the original purchase order number.
- Units returned for evaluation will be evaluated, and a quote for repair will be issued. If you choose to have the unit repaired, the cost of the evaluation will be deducted from the final repair pricing. A Purchase Order for the final repair price should be issued within 3 weeks of quotation date. Units without a Purchase Order for repair will be returned to the customer, and the evaluation fee will be invoiced.
- Products returned that have not been drained from oil will be disposed.
- A Special Cleaning fee will apply to all exposed products
- If requesting a calibration service, units must be functionally capable of being calibrated.

Vacuum Products Division Request for Return Form

Customer information		
Company :	Contact Name:	
Address:	Tel:	Fax:
	Email:	

Equipment			
Product description	Agilent PartNo	Agilent Serial No	Original Purchasing Reference
Failure description		Type of process (for which the equipment was used)	

Type of return	
☐ Non Billable ☐ Billable ➡ New PO # (hard copy must be submitted with this form): _____	
☐ Exchange ☐ Repair ☐ Upgrade ☐ Consignment/Demo ☐ Calibration ☐ Evaluation ☐ Return for Credit	

Health and safety		Substances (please refer to MSDS forms)			
The product has been exposed to the following substances: (by selecting "YES" you MUST complete the table to the right)		* Agilent will not accept delivery of any product that is exposed to radioactive, biological, explosive substances or dioxins, PCB's without written evidence of decontamination.			
		Trade name	Chemical name	Chemical Symbol	CAS Number
Toxic	☐ YES ☐ NO				
Harmful	☐ YES ☐ NO				
Corrosive	☐ YES ☐ NO				
Reactive	☐ YES ☐ NO				
Flammable	☐ YES ☐ NO				
Explosive (*)	☐ YES ☐ NO				
Radioactive (*)	☐ YES ☐ NO				
Biological (*)	☐ YES ☐ NO				
Oxidizing	☐ YES ☐ NO				
Sensitizer	☐ YES ☐ NO				
Other dangerous substances	☐ YES ☐ NO				

Goods preparation	
If you have replied YES to one of the above questions. Has the product been purged?	☐ YES ☐ NO
If yes, which cleaning agent/method:	
Has the product been drained from oil?	☐ YES ☐ NOT APPLICABLE
I confirm to place this declaration on the outside of the shipping box.	☐

I declare that the above information is true and complete to the best of my knowledge and belief. I understand and agree to the terms and conditions on page 2 of this document.	
Name:	Authorized Signature:
Position:	
Date:	
NOTE: If a product is received at Agilent which is contaminated with a toxic or hazardous material that was not disclosed, the customer will be held responsible for all costs incurred to ensure the safe handling of the product, and is liable for any harm or injury to Agilent employees as well as to any third party occurring as a result of exposure to toxic or hazardous materials present in the product.	

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