
TruSpec CHN/CHNS Carbon/Hydrogen/Nitrogen/Sulfur Determinators

(this manual includes both the macro and micro kit versions)

Instruction Manual

Version 2.5x
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Quality at LECO Corporation means understanding our customer's requirements and establishing specifications that clearly define those requirements. The essence of our quality philosophy is the commitment to quality objectives, aimed at never-ending improvement and complete customer satisfaction.

Safety Symbols

These symbols may be found on LECO equipment or their components. These symbols indicate the use of specific safety guidelines. Important safety information is highlighted in this manual by one of the following symbols as well as WARNING and CAUTION statements. Operator and service personnel must follow these instructions for personal safety and to prevent damage to the equipment.

The instrument should be operated only by technically qualified individuals who have fully read and understand these instructions. The instrument should be operated only in accordance with these instructions.

The operator should follow all of the warnings and cautions set forth in the manual and the operator should follow and employ all applicable standard laboratory safety procedures.



This symbol indicates a risk of injury from electrical shock.



This symbol indicates a risk of injury from a high temperature surface.



This symbol indicates a caution.



This symbol indicates a risk of injury from explosion.



This symbol indicates possible electrostatic discharge (ESD) instrument damage.



This symbol indicates a risk of personal injury or instrument damage.

Operating Precautions

The instrument should be operated only by technically qualified individuals who have fully read and understand these instructions. The instrument should be operated only in accordance with these instructions. The operator should follow all of the warnings and cautions set forth in the manual and the operator should follow and employ all applicable standard laboratory safety procedures.



Sensitive Electrical Components. LECO recommends disconnecting instrument power before performing service on any electrical components.



During installation and operation of this instrument, the ON/OFF switch must be easily accessible.

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1 Introduction

The Introduction chapter contains general information about the TruSpec Determinators. This includes safety guidelines and warranty terms. Reference this chapter for replacement parts, operating supplies and optional accessories. To place an order by phone, call our customer service department toll-free in the United States at 1-800-292-6141 or 269-985-5496. Orders may also be sent by fax to 269-982-8977.

1 Introduction

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WEEE

Disposal of WEEE and the Wheeled Bin Symbol

In 2002, the European Union introduced the Directive on Waste Electrical and Electronic Equipment (WEEE). The main aim of the Directive is to ensure that WEEE is collected and treated separately. WEEE may contain hazardous substances that should not end up in the (human) environment because it can have adverse effects on it.

Furthermore, WEEE is a vast source of raw materials. With the ever rising worldwide demand for new equipment and the ever decreasing volume of raw materials in nature, letting this potential source of such materials go to waste is unacceptable.

If equipment is collected separately, the equipment can be recycled and up to 85% to 90% of the equipment can be reused as new material, saving the use of virgin raw materials and energy of producing these. Separate collection and treatment of WEEE will thus decrease CO₂ emissions as well.

For the above reasons, LECO expects end users to dispose of the material in an environmentally friendly way, being separate collection and treatment.

Electrical and Electronic Equipment is labeled with the following "crossed-out wheeled bin" symbol, indicating that the equipment should be disposed of by the end user separate from other types of waste.




End users should contact their dealer/distributor or our company on disposal, collection, and recycling options in their country.

WEEE Statements


English

Correct Disposal of This Product (Waste Electrical & Electronic Equipment)

 (Applicable in the European Union and other European countries with separate collection systems)
This marking shown on the product or its literature, indicates that it should not be disposed with other household wastes at the end of its working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate this from other types of wastes and recycle it responsibly to promote the sustainable reuse of material resources.
Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take this item for environmentally safe recycling.
Business users should contact their supplier and check the terms and conditions of the purchase contract. This product should not be mixed with other commercial wastes for disposal.


Deutsch

Korrekte Entsorgung dieses Produkts (Elektronikmüll)

 (Anzuwenden in den Ländern der Europäischen Union und anderen europäischen Ländern mit einem separaten Sammelsystem)
Die Kennzeichnung auf dem Produkt bzw. auf der dazugehörigen Literatur gibt an, dass es nach seiner Lebensdauer nicht zusammen mit dem normalen Haushaltsmüll entsorgt werden darf. Entsorgen Sie dieses Gerät bitte getrennt von anderen Abfällen, um der Umwelt bzw. der menschlichen Gesundheit nicht durch unkontrollierte Müllbeseitigung zu schaden. Recyceln Sie das Gerät, um die nachhaltige Wiederverwertung von stofflichen Ressourcen zu fördern.
Private Nutzer sollten den Händler, bei dem das Produkt gekauft wurde, oder die zuständigen Behörden kontaktieren, um in Erfahrung zu bringen, wie sie das Gerät auf umweltfreundliche Weise recyceln können.
Gewerbliche Nutzer sollten sich an ihren Lieferanten wenden und die Bedingungen des Kaufvertrags konsultieren. Dieses Produkt darf nicht zusammen mit anderem Gewerbemüll entsorgt werden.


Czech Republic

Správná likvidace tohoto produktu (Zničení elektrického a elektronického zařízení)

 Tato značka zobrazená na produktu nebo v dokumentaci znamená, že by neměl být používán s jinými domácími zařízeními po skončení svého funkčního období. Aby se zabránilo možnému znečištění životního prostředí nebo zranění člověka díky nekontrolovanému zničení, oddělte je prosíme od dalších typů odpadů a recyklujte je zodpovědně k podpoře opatrného využití hmotných zdrojů.
Členové domácnosti by měli kontaktovat jak prodejce, u něhož produkt zakoupili, tak místní vládní kancelář, ohledně podrobností, kde a jak můžete tento výrobek bezpečně vzhledem k životnímu prostředí recyklovat.
Obchodníci by měli kontaktovat své dodavatele a zkontrolovat všechny podmínky koupě. Tento výrobek by se neměl míchat s jinými komerčními produkty, určenými k likvidaci.


Slovenia

Ustrezno odstranjevanje tega izdelka (odpadna električna in elektronska oprema)

 Oznaka na izdelku ali spremljevalni dokumentaciji pomeni, da ga na koncu uporabne dobe ne smemo odstranjevati skupaj z drugimi gospodinjstskimi odpadki. Da bi preprečili morebitno tveganje za okolje ali zdravje človeka zaradi nenadzorovanega odstranjevanja odpadkov, izdelke ločite od drugih vrst odpadkov in ga odgovorno reciklirajte ter tako spodbudite trajnostno ponovno uporabo materialnih virov.
Uporabniki v gospodinjstvih naj za podrobnosti o tem, kam in kako lahko odnesejo ta izdelek na okolju varno recikliranje, pokličejo trgovino, kjer so izdelek kupili, ali lokalni vlađni urad. Podjetja naj pokličejo dobavitelja in preverijo pogoje nabavne pogodbe. Tega izdelka pri odstranjevanju ne smete mešati s drugimi gospodarskimi odpadki.

Français

Comment éliminer ce produit (déchets d'équipements électriques et électroniques)

 (Applicable dans les pays de l'Union Européenne et aux autres pays européens disposant de systèmes de collecte sélective)
Ce symbole sur le produit ou sa documentation indique qu'il ne doit pas être éliminé en fin de vie avec les autres déchets ménagers. L'élimination incontrôlée des déchets pouvant porter préjudice à l'environnement ou à la santé humaine, veuillez le séparer des autres types de déchets et le recycler de façon responsable. Vous favoriserez ainsi la réutilisation durable des ressources matérielles.
Les particuliers sont invités à contacter le distributeur leur ayant vendu le produit ou à se renseigner auprès de leur mairie pour savoir où et comment ils peuvent se débarrasser de ce produit afin qu'il soit recyclé en respectant l'environnement.
Les entreprises sont invitées à contacter leurs fournisseurs et à consulter les conditions de leur contrat de vente. Ce produit ne doit pas être éliminé avec les autres déchets commerciaux.


Italiano

Corretto smaltimento del prodotto (rifiuti elettrici ed elettronici)

 (Applicable in i paesi dell'Unione Europea e in quelli con sistema di raccolta differenziata)
Il marchio riportato sul prodotto o sulla sua documentazione indica che il prodotto non deve essere smaltito con altri rifiuti domestici al termine del ciclo di vita. Per evitare eventuali danni all'ambiente o alla salute causati dall'inopportuno smaltimento dei rifiuti, si invita l'utente a separare questo prodotto da altri tipi di rifiuti e di riciclarlo in maniera responsabile per favorire il riutilizzo sostenibile delle risorse materiali.
Gli utenti domestici sono invitati a contattare il rivenditore presso il quale è stato acquistato il prodotto o l'ufficio locale preposto per tutte le informazioni relative alla raccolta differenziata e al riciclaggio per questo tipo di prodotto.
Gli utenti aziendali sono invitati a contattare il proprio fornitore e verificare i termini e le condizioni del contratto di acquisto. Questo prodotto non deve essere smaltito unitamente ad altri rifiuti commerciali.


Estonia

Õige viis toote kasutusest kõrvaldamiseks (elektriliste ja elektroniliste seadmete jäätmed)

 Selline tähistus tootel või selle dokumentidel näitab, et toodet ei tohi kasutaja lõppemisel kõrvaldada koos muude olmejäätmetega. Selleks, et vältida jäätmete kontrollimatu kõrvaldamisega seotud võimaliku kahju tekitamist keskkonnale või inimeste tervisele ning edendada materilaasete vahendite säästvat taaskasutust, eraldage toode muudest jäätmetest ja suunake taasinglusele.
Kodukasutajad saavad teavet keskkonnaohutu ringlusevõtu kohta kas toote müüjal või keskkonnaametist.
Firmad peaksid võtma ühendust tarnijaga ning kontrollima ostulepingu tingimusi ja sätteid. Toodet ei tohi panna muude hävitamiseks mõeldud kaubandusjäätmete hulka.


Sweden

Korrekt avfallshantering av produkten (elektriska och elektroniska produkter)

 Denna markering på produkten och i manualen anger att den inte bör sorteras tillsammans med annat hushållsavfall när dess livstid är över. Till förebyggande av skada på miljön och hälsa bör produkten hanteras separat för ändamålsenlig återvinning av dess beståndsdelar.
Hushållsanvändare bör kontakta den återförsäljare som sålt produkten eller sin kommun för vidare information om var och hur produkten kan återvinnas på ett miljösäkert sätt.
Företagsanvändare bör kontakta leverantören samt verifiera angivna villkor i köpekontraktet. Produkten bör inte hanteras tillsammans med annat kommersiellt avfall.

Español

Eliminación correcta de este producto (material eléctrico y electrónico de descarte)

 (Aplicable en la Unión Europea y en países europeos con sistemas de recogida selectiva de residuos)
La presencia de esta marca en el producto o en el material informativo que lo acompaña, indica que al finalizar su vida útil no deberá eliminarse junto con otros residuos domésticos. Para evitar los posibles daños al medio ambiente o a la salud humana que representa la eliminación incontrolada de residuos, separe este producto de otros tipos de residuos y recíclolo correctamente para promover la reutilización sostenible de recursos materiales.
Los usuarios particulares pueden contactar con el establecimiento donde adquirieron el producto, o con las autoridades locales pertinentes, para informarse sobre cómo y dónde pueden llevarlo para que sea sometido a un reciclaje ecológico y seguro.
Los usuarios comerciales pueden contactar con su proveedor o consultar las condiciones del contrato de compra. Este producto no debe eliminarse mezclado con otros residuos comerciales.


Netherlands

Correcte verwijdering van dit product (elektrische & elektronische afvalapparatuur)

 Dit merkteken op het product of het bijbehorende informatie-materiaal duidt erop dat het niet met ander huishoudelijk afval verwijderd moet worden aan het einde van zijn gebruiksduur. Om mogelijke schade aan het milieu of de menselijke gezondheid door ongecontroleerde afvalverwijdering te voorkomen, moet u dit product van andere soorten afval scheiden en op een verantwoorde manier recycleren, zodat het duurzame hergebruik van materiaalbronnen wordt bevordert.
Huishoudelijke gebruikers moeten contact opnemen met de winkel waar ze dit product hebben gekocht of met de gemeente waar ze wonen om te vernemen waar en hoe ze dit product milieuvriendelijk kunnen laten recycleren.
Zakelijke gebruikers moeten contact opnemen met hun leverancier en de algemene voorwaarden van de koopovereenkomsten nalezen. Dit product moet niet worden gemengd met ander bedrijfsafval voor verwijdering.


Finland

Tämän tuotteen turvallinen hävittäminen (elektronikka ja sähkölaitteet)

 Ohjeinen merkintä tuotteesta tai tuotteen ohjeismateriaalissa merkitsee, että tätä tuotetta ei tule hävittää kotitalousjätteen mukana sen elinkaaren päätyttyä. Hallitsemattomasta jätteenkäsittelystä ympäristölle ja kanssaihminen terveydelle aiheutuvien vahinkojen välttämiseksi tuote tulee käsitellä musta jätteistä erillään. Jäte on hyvä kierrättää raaka-aineksi kestävä ympäristökehityksen takia.
Kotitalouskäyttäjien tulisi ottaa yhteyttä tuotteen myynteeseen jälleenmyyjään tai paikalliseen ympäristöviranomaiseen, jotka antavat lisätietoja tuotteen turvallista kierrätyksmahdollisuuksista.
Yrityskäyttäjien tulisi ottaa yhteyttä tavaramoittajaan ja selvittää hankintasuojituksen ehdot. Tätä tuotetta ei tule hävittää muun kaupallisen jätteen seassa.

Latvia

Izstrādājuma pareiza likvidēšana (nolietots elektriskās un elektroniskās ierīces)

 Uz izstrādājuma vai tam pievienotajās instrukcijās dotais marķējums norāda, ka to nedrīkst likvidēt kopā ar citiem sadzīves atkritumiem pēc tā ekspluatācijas laika. Lai novērstu vides un cilvēku veselības iespējamo kaitējumu, kas ir saistīts ar nekontrolējamu atkritumu likvidēšanu, šis jānosūta uz citiem atkritumiem un jāpārstrādā, lai sekmētu materiālo resursu atbilstīgu atkārtotu lietošanu.
Mājsaimniecības lietotājiem jāsazinās vai nu ar veikalu, kurā šis izstrādājums ir pirktas, vai ar pašvaldību, lai iegūtu informāciju par to, kā un kur var nodot šo izstrādājumu, lai garantētu ekoloģiski drošu reciklāciju.
Rūpnieciskajiem lietotājiem jāsazinās ar piegādātāju un jāpārbauda pirkuma līguma nosacījumi. Šo izstrādājumu nedrīkst sajaukt ar citiem likvidējamajiem rūpnieciskajiem atkritumiem.

Greece

Σωστή Διάθεση αυτού του Προϊόντος

(Απορρίματα Ηλεκτρικού & Ηλεκτρονικού Εξοπλισμού)



Τα σήματα που εμφανίζονται επάνω στο προϊόν ή στα εγχειρίδια που το συνοδεύουν, υποδεικνύουν ότι δεν θα πρέπει να ρίπτεται μαζί με τα υπόλοιπα οικιακά απορρίμματα μετά το τέλος του κύκλου ζωής του. Προκειμένου να αποφευχθούν ενδεχόμενες βλαβερές συνέπειες στο περιβάλλον ή την υγεία εξαιτίας της ανεξέλεγκτης διάθεσης απορριμμάτων, σας παρακαλούμε να το διαχωρίσετε από άλλους τύπους απορριμμάτων και να το ανακυκλώσετε, ώστε να βοηθήσετε στην βιώσιμη επαναχρησιμοποίηση των υλικών πόρων. Οι οικιακοί χρήστες θα πρέπει να έλθουν σε επικοινωνία είτε με τον πωλητή ή απ' όπου αγοράσαν αυτό το προϊόν, είτε τις κατά τόπους υπηρεσίες, προκειμένου να πληροφορηθούν τις λεπτομέρειες σχετικά με τον τόπο και τον τρόπο με τον οποίο μπορούν να δώσουν αυτό το προϊόν για ασφαλή προς το περιβάλλον ανακύκλωση. Οι επιχειρήσεις-χρήστες θα πρέπει να έλθουν σε επαφή με τον προμηθευτή τους και να ελέγξουν τους όρους και τις προϋποθέσεις του συμβολαίου πώλησης. Το προϊόν αυτό δεν θα πρέπει να αναμνηύεται με άλλα αναμνηύεμένα απορρίμματα προς διάθεση.

Norway

Korrekt avhending av dette produkt

(Avfall elektrisk og elektronisk utstyr)



Denne merkingen som vises på produktet eller dens dokumentasjon, indikerer at den ikke skal kastes sammen med annet husholdningsavfall ved slutten av sin levetid. For å hindre mulig skade på miljøet eller menneskelig helse fra ukontrollert avfallsavhending, vennligst atskil dette fra andre typer avfall og resirkuler det separat for å fremme bærekraftig gjenbruk av materielle ressurser. Husholdningsbrukere bør kontakte enten forhandleren de kjøpte produktet av, eller lokale myndigheter, for detaljer om hvor og hvordan de kan frakte denne artikkelen for miljømessig trygg resirkulering. Forretningsbrukere bør kontakte sin leverandør og undersøke vilkårene i kjøpekontrakten. Dette produktet skal ikke blandes med annet kommersielt avfall som skal kastes.

Denmark

Korrekt affaldsbortskaffelse af dette produkt

(elektrisk & elektronisk udstyr)



Mærket på dette produkt eller i den medfølgende dokumentation betyder, at produktet ikke må bortskaffes sammen med almindeligt husholdningsaffald efter endt levetid. For at undgå skadelige miljø- eller sundhedspåvirkninger på grund af ukontrolleret affaldsbortskaffelse skal dette produkt bortskaffes særskilt fra andet affald og indleveres behørigt til fremme for bæredygtig materialegenvinding. Hjemmebrugere bedes kontakte forhandleren, hvor de har købt produktet, eller den lokale myndighed for oplysning om, hvor og hvordan de kan indlevere produktet med henblik på miljøforsvarlig genvinding. Erhvervsbrugere bedes kontakte leverandøren og læse betingelserne og vilkårene i købekontrakten. Dette produkt bør ikke bortskaffes sammen med andet erhvervsaffald.

Republic of Ireland (Gaelic)

Díúscairt Cheart an Táirge Seo

(Trealamh Leictreach agus Leictreonach Dramhaíola)



Léiríonn an mharcáil seo atá ar an táirge nó sa litríocht a thagann leis, nár chóir é a dhíúscairt le dramhaíl tí eile ag deireadh a shaol oibre. Chun cosaint i gcoinne dochar don chomhshaol nó do shláinte an duine, a d'fhéadfaid bheith mar thoradh ar an ndíúscairt dramhaíola neamhthéoranta, scar an dramhaíl seo ó chineálacha eile dramhaíola le do thoil agus déan athchúisáil fheargrach air chun athúsáid innmhartha na hachannainí ábhartha a chur chun cinn. Ba chóir dóibh siúd a úsáideann an trealamh seo ba bhaile dul i dteagmháil leis an díoltóir ónár cheannagha siad an táirge seo, nó lena n-óifig áitiúil Rialtais, ar mhaithe le sonraí a fháil faoi cá háit agus cathain is féidir athchúisáil atá slán ó thaobh an chomhshaol de a dhéanamh ar an táirge seo. Ba chóir dóibh siúd a úsáideann an trealamh seo ina ngnó dul i dteagmháil leis an soláthóir agus téarmaí agus coinníollacha an chonartha ceannagha a sheiceáil. Níor chóir an táirge seo a chur le dramhaíl eile trídhlála agus díúscairt a déanamh.

Poland

Prawidłowe usuwanie produktu

(zużyty sprzęt elektryczny i elektroniczny)



Oznaczenie umieszczone na produkcie lub w odnoszących się do niego tekstach wskazuje, że produkt po upływie okresu użytkowania nie należy usuwać z innymi odpadami pochodzącymi z gospodarstw domowych. Aby uniknąć szkodliwego wpływu na środowisko naturalne i zdrowie ludzi wskutek niekontrolowanego usuwania odpadów, prosimy o oddzielenie produktu od innego typu odpadów oraz odpowiedzialny recykling w celu promowania ponownego użycia zasobów materialnych jako stałej praktyki. W celu uzyskania informacji na temat miejsca i sposobu bezpiecznego dla środowiska recyklingu tego produktu użytkownicy w gospodarstwach domowych powinni skontaktować się z punktem sprzedaży detalicznej, w którym dokonali zakupu produktu, lub z organem władz lokalnych. Użytkownicy w firmach powinni skontaktować się ze swoim dostawcą i sprawdzić warunki umowy zakupu. Produktu nie należy usuwać razem z innymi odpadami komercyjnymi.

Romania & Moldova

Evacuarea corectă a acestui produs

(reziduuri provenind din aparatură electrică și electronică)



Marcajele de pe acest produs sau mențiunile în instrucțiunile sale de folosire indică faptul că produsul nu trebuie aruncat împreună cu alte reziduuri din gospodărie atunci când nu mai este în stare de funcționare. Pentru a preveni posibile efecte dăunătoare asupra mediului înconjurător sau a sănătății oamenilor datează evacuării necorecte a reziduurilor, vă rugăm să separați acest produs de alte tipuri de reziduuri și să-l reciclați în mod responsabil pentru a promova refolosirea resurselor materiale. Utilizatorii cșinii sunt rugați să ia legătura fie cu distribuitorul de la care au achiziționat acest produs, fie cu autoritățile locale, pentru a primi informații cu privire la locul și modul în care pot depozita acest produs în vederea reciclării sale ecologice. Companiile sunt rugate să ia legătura cu furnizorul și să verifice condițiile stipulate în contractul de vânzare. Acest produs nu trebuie amestecat cu alte reziduuri de natură comercială.

Slovakia

Správna likvidácia tohoto výrobku

(Elektrotechnický a elektronický odpad)



Toto označenie na výrobku alebo v sprievodnej brožúre hovori, že po skončení jeho životnosti by nemal byť likvidovaný s ostatným odpadom. Prípádntnu poškodeniu životného prostredia alebo ľudského zdravia môže predísť tým, že budete takéto typy výrobkov oddeľovať od ostatného odpadu a vrátiť ich na recykláciu. Používatelia v domácnostiach by pre podrobné informácie, ako ekologicky bezpečne naložiť s týmto výrobkom, mali kontaktovať buď predajcu, ktorý výrobok predal, alebo príslušný úrad v okolí ich bydliska. Priemyselní používatelia by mali kontaktovať svojho dodávateľa a overiť si podmienky kúpnej zmluvy. Tento výrobok by nemal byť likvidovaný spolu s ostatným priemyselným odpadom.

Portugal

Eliminação Correcta Deste Produto

(Resíduo de Equipamentos Eléctricos e Electrónicos)



Esta marca, apresentada no produto ou na sua literatura indica que ele não deverá ser eliminado juntamente com os resíduos domésticos indiferenciados no final do seu período de vida útil. Para impedir danos ao ambiente e à saúde humana causados pela eliminação incontrolada de resíduos deverá separar este equipamento de outros tipos de resíduos e reciclá-lo de forma responsável, para promover uma reutilização sustentável dos recursos materiais. Os utilizadores domésticos deverão contactar o o estabelecimento onde adquiriram este produto ou as entidades oficiais locais para obterem informações sobre onde e de que forma podem levar este produto para permitir efectuar uma reciclagem segura em termos ambientais. Os utilizadores profissionais deverão contactar o seu fornecedor e consultar os termos e condições do contrato de compra. Este produto não deverá ser misturado com outros resíduos comerciais para eliminação.

Macedonia

Правило отстранување на овој производ

(Истрошена електрична и електронска опрема)



Оваа ознака прикажана на производот или во неговата документација покажува дека тој не треба да се фрла со преостанатиот отпад од домаќинствата, кога веќе нема да биде употреблив. За да се избегне можното нарушување на животната средина или на човечкото здравје, како резултат на неконтролираното отстранување на отпадот, ве молиме да го одделите од другите видови отпад и совесно да го рециклирате, за да промовирате одржлива повторна употреба на материјалните ресурси. Корисниците во домаќинствата треба да се обратат до дистрибутерите кај кои го купиле производот или до локалните власти, за да ги дознаат деталите за тоа каде и како можат да го однесат производот заради рециклирање коешто е безбедно за животната средина. Деловните корисници треба да се обратат до нивните набавувачи и да ги проверат условите од договорот за купопродажба. При отстранувањето, овој производ не треба да се меша со другот комерцијален отпад.

Bulgaria

Изхвърляйте правилно този продукт

(отпадно електрическо и електронно оборудване)



Това обозначение на продукта или съпътстващите го материали означава, че той не бива да бъде изхвърлен заедно с другите битови отпадъци след края на ползвания му живот. За да се предотврати възможно увреждане на околната среда или човешки живот от неконтролирано изхвърляне на отпадъци, моли, отделете такова продукти от другите видове отпадъци и го рециклирайте, демонстрирайки отговорно отношение към насърчаването на устойчива многократна употреба на материални ресурси. При употреба за битови нужди трябва да се свържете с продавача на дребно, от когото сте закупили продукта или с местните власти за подробности относно това къде и как можете да предадете продукта за безопасна рециклиране. При употреба за стопански нужди трябва да се свържете с доставчика си и да проверите реда и условията в договора за закупуване. Този продукт не трябва да се смесва с други отпадъци на работното място.

Hungary

A termék megfelelő leadása

(Elektronos és elektronikus készülékek hulladékezelése)



A terméken vagy a hozzá tartozó dokumentáción szereplő jelzés arra utal, hogy hasznos élettartama végén a terméket nem szabad háztartási hulladékkal együtt kidobni. Annak érdekében, hogy megelőzhető legyen a szabálytalan hulladékkezelés által okozott környezet- és egészségkárosodás, különítt ezt el a többi hulladéktól, és felelősségteljesen gondoskodjon a hulladék leadásáról, a hulladékaranyok fenntartható szintű újrafelhasználása céljából. A háztartási felhasználók a termék fogalmazójától vagy a helyi önkormányzati szervektől kérjenek tanácsot arra vonatkozóan, hogy és hogyan vehetik el az elhasznált terméket a környezetvédelmi szempontból biztonságos hulladékkezelés céljából. Az üzleti felhasználók képjének kapcsolatba a forgalmazóval, és vizsgálják meg az adásvételi szerződés feltételeit. A terméket nem szabad leadni kereskedelmi forgalomból származó egyéb hulladékkal együtt.

Lithuania

Tinkamas produkto atliekų tvarkymas

(atitarnavusi elektros ir elektronikos įrangą)



Šis ženklas, pateikiamas ant produkto ar jo dokumentacijos, nurodo, kad pasibaigus produkto tarnavimo laikui, jo negalima išmesti kartu su kitomis buitinėmis atliekomis. Kad būtų išvengta galimos nekontroliuojamo atliekų išmetimo žalos aplinkai arba žmonių sveikatai, ir siekiant išlaikyti aplinką tausojantį antrinių žaliavų panaudojimą, pašam skirti rūšių atliekų ir atiduoti perdirbti. Informacijos, kur ir kaip pristatyti šį produktą saugiai perdirbti, privatiis vartotojai turėtų kreiptis arba į parduotuvę, kurioje šį produktą pirko, arba į vietinės valdžios institucijas. Verslo vartotojai turėtų kreiptis į savo tiekėją ir peržiūrėti pirkimo sutarties sąlygas. Šis produktas tvarkant atliekas negali būti sumaišytas su kitomis atliekomis.

Warranty

Equipment manufactured by LECO Corporation, St. Joseph, Michigan is warranted free from defect in material and workmanship for a period of 1) thirteen months from date of shipment or 2) twelve months from date of installation, whichever occurs first. Equipment not manufactured by LECO is covered to the extent of warranty provided by the original manufacturer and this warranty does not cover any equipment, new or used, purchased from anyone other than LECO Corporation. All replacement parts shall be covered under warranty for a period of thirty days from date of purchase. **LECO makes no other representation or warranty of any other kind, expressed or implied, with respect to the goods sold hereunder, whether as to merchantability, fitness for purpose, or otherwise.**

Expendable items such as crucibles, combustion tubes, chemicals, and items of like nature are not covered by this warranty.

LECO's sole obligation under this warranty shall be to repair or replace any part or parts which, to our satisfaction, prove to be defective upon return prepaid to LECO Corporation, St. Joseph, Michigan. This obligation does not include labor to install replacement parts, nor does it cover any failure due to accident, abuse, neglect, or use in disregard of instructions furnished by LECO. In no event shall damages for defective goods exceed the purchase price of the goods, and **LECO shall not be liable for incidental or consequential damages whatsoever.**

All claims in regard to the parts or equipment must be made within ten (10) days after Purchaser learns of the facts upon which the claim is based. Authorization must be obtained from LECO prior to returning any other parts. This warranty is voided by failure to comply with these notice requirements.

Notice

The warranty on LECO equipment remains valid only when genuine LECO replacement parts are employed. Since LECO has no control over the quality or purity of consumable products not manufactured by LECO, the specifications for accuracy of results using LECO instruments are not guaranteed unless genuine LECO consumables are employed in conjunction with LECO instruments. If purchaser defaults in making payment for any parts or equipment, this warranty shall be void and shall not apply to such parts and equipment. No late payment or cure of default in payment shall extend the warranty period provided herein.

LECO Corporation is not responsible for damage to any associated instruments, equipment, or apparatus nor will LECO be held liable for loss of profit or other special damages resulting from abuse, neglect, or use in disregard of instructions. The Buyer, their employees, agents, and successors in interest assume all risks and liabilities for the operation, use, and/or misuse of the product(s) described herein and agree to indemnify, hold harmless, and defend the seller from any and all claims and actions arising from any cause whatsoever, including seller's negligence for personal injury incurred in connection with the use of said product(s) and any and all damages proximately resulting therefrom.

LECO-Supplied Dell Computers

Dell Support

All LECO supplied Dell PC's include Dell's ProSupport Service, which is designed to provide a base level of customer security. This service option can place a Dell-certified technician at your location the following day, if necessary (after phone-based troubleshooting). In many cases, remote troubleshooting can minimize overall system downtime by getting the issue quickly fixed remotely or helping Dell to dispatch the right part (if necessary).

The inclusion of Dell ProSupport with LECO supplied PC's ensures that any computer related service issues are handled directly by the experts at Dell. This eliminates the unnecessary step of working through the LECO service professionals for a resolution from Dell, and provides PC support 24 hours a day, seven days a week.

Dell ProSupport provides expert assistance when you need rapid problem resolution to help maximize your PC system's uptime and productivity. ProSupport provides the following benefits:

- 24 x 7 Access to advanced-level North American-based phone technicians
- Live Chat tech support
- DellConnect remote diagnosis and resolution
- Next Business Day On-Site Service after Remote Diagnostics

For more information, call 1-800-WWW-DELL (1-800-999-3355) or access Dell's website by copying and pasting the following link into your internet browser:

http://www.dell.com/content/topics/global.aspx/services/prosupport/end_users?c=us&cs=555&l=en&s=biz

Please have your Service Tag and Express Service Code numbers available when contacting Dell to expedite service. These can be found on the back or side of the tower.

Transferring Ownership of a Dell Product

The following section explains the steps to transfer the warranty and ownership of a Dell computer. This transfer is necessary to complete when an equipment package that includes a Dell computer has been purchased from LECO.

- An internet connection is required to complete the transfer. If an internet connection is not available, the transfer can be completed by calling Dell at 800-624-9897.
- To complete the transfer online through Dell's website, complete either the Domestic Customer procedure or the International Customer procedure as explained in the following steps.

For Domestic Customers:

1. Access Dell's website by copying and pasting or entering the following website URL into your internet browser:
http://support.dell.com/support/topics/global.aspx/support/change_order/tag_transfer?c=us&l=en&s=gen&redirect=1

NOTE

It is recommended to complete the transfer of ownership from the computer from which the ownership will be transferred. If this is not possible, follow the instructions provided on Dell's website.

2. Complete the transfer by completing and submitting the form provided on Dell's website.

For International Customers:

1. Access Dell's website by copying and pasting or entering the following website URL into your internet browser:
http://support.dell.com/support/topics/global.aspx/support/change_order/tag_transfer?c=us&l=en&s=gen&redirect=1

NOTE

It is recommended to complete the transfer of ownership from the computer from which the ownership will be transferred. If this is not possible, follow the instructions provided on Dell's website.



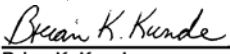
2. Do not enter information into the fields. Instead, click International Transfer Form located below the form fields.
3. On the form, for original owner,
 - A. For First Original Owner, enter "LECO Corp"
 - B. For Original Owner E-mail Address, enter "service@leco.com"
 - C. For Country of Original Purchase, click the arrow and select United States from the list.
4. Complete the transfer by following the remaining instructions provided on the form.

Interference to Other Devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules and Regulations. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following methods:

- *Reorient or relocate the radio or television receiving antenna.*
- *Increase the separation between the equipment and the radio or television receiver.*
- *Connect the equipment to an outlet on a circuit different from that which the radio or television receiver is currently connected.*
- *Consult the radio or television dealer or an experienced radio/TV technician for help.*

Declaration of Conformity

| | | | | | |
|---|--|--|--|--|--|
|  | | EU DECLARATION OF CONFORMITY according to ISO/IEC 17050 | |  10 | |
| Manufacturer's Name: | | LECO Corporation | | | |
| Manufacturer's Address: | | 3000 Lakeview Avenue, St. Joseph, MI 49085, USA INT 1-269-983-0308 phone • INT 1-269-982-8964 fax | | | |
| <i>Declares that the product:</i> | | | | | |
| Product Name: | | TruSpec, TruSpec Micro Series | | | |
| Description: | | Carbon/Hydrogen/Nitrogen/Sulfur Determinator | | | |
| Product Options: | | This Declaration covers all options of the above product | | | |
| <i>Conforms to the following Product Specifications:</i> | | | | | |
| Low Voltage directive 2006/95/EC (Safety) | | | | | |
| EN/IEC 61010-1:2001 2nd Ed. Pollution Degree 2 | | | | | |
| EN/IEC 61010-2-010:2003 [where applicable] | | | | | |
| UL 61010-1:2004 2nd Ed. (ANSI/NFPA 70 (National Fire Protection Association), National Electrical Code® (NEC)) | | | | | |
| CAN/CSA-C22.2 No. 61010-1-04 (Canadian Electrical Code (CEC), Part I, CSA C22.1 and CSA C22.2 No. 0) | | | | | |
| AS/NZS 61010-1: 2003 | | | | | |
| EMC Directive 2004/108/EC | | | | | |
| EN55011:2007+A2:2007 RF Emissions | | Group 1, Class A | | | |
| EN 61000-3-2:2006+A1:2007 Harmonic Emissions | | Class A | | | |
| EN 61000-3-3:2002 Flicker Emissions | | Per Standard | | | |
| EN 61326-1:2006 Class A for Controlled, Laboratory, Commercial and Industrial Environments (non-residential) | | | | | |
| CISPR11:2003 RF Emissions | | Group 1, Class A | | | |
| IEC 61000-4-2:1995+A1:1998+A2:2000 Electrostatic Discharge | | 8kV Air, 4kV Contact | | | |
| IEC 61000-4-3:2002 Radiated RF Immunity | | 10V/m, 80Mhz-4.2Ghz | | | |
| IEC 61000-4-4:2004 Fast Transient Burst | | 2kV Power lines, 1kV Signal Lines | | | |
| IEC 61000-4-5:1995+A1:2000 Surge Immunity | | 2kV Line-Earth, 1kV Line-Line | | | |
| IEC 61000-4-6:2003 Conducted RF Immunity | | 10V/rms, 150Khz-240Mhz | | | |
| IEC 61000-4-8:1993:A1:2000 Magnetic Immunity | | Not magnetically sensitive equip | | | |
| IEC 61000-4-11:2004 Voltage Dips, Interrupts | | Per EN 61326-1 | | | |
| The product herewith displaying the CE marking complies with the requirements of the Low Voltage directive 2006/95/EC (previously 73/23/EEC) and the EMC Directive 2004/108/EC (previously 89/336/EEC). | | | | | |
| <u>St. Joseph, MI</u> | | <u>12 March, 2010</u> | |  | |
| Location | | Date | | Brian K. Kunde Manager, Compliance Engineering | |
| European contact: | | | | | |
| Your local LECO Sales and Service Office or LECO Europe B.V., Vouersweg 118, 6161 AG Geleen, The Netherlands, +31 46 4747473 tel • +31 46 4747333 fax | | | | | |

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About this Manual

This manual is for the TruSpec CHN Macro, TruSpec CHN Micro, and TruSpec CHNS Micro Determinators. The following references are used throughout the manual.

TruSpec CHN—Refers to the TruSpec CHN Macro determinator. This is the determinator purchased from LECO before the micro kits are installed.

TruSpec Micro—Refers to the TruSpec CHN, CHNS and TruSpec Oxygen Micro determinators.

Screen Examples

The screen examples in this manual are shown with the instrument configured in the CHN mode as purchased from LECO without the micro kits installed. When the CHNS micro kit is installed the sulfur or oxygen element will appear on various screens as necessary.

Equipment Packages

Items listed below are repeated throughout this manual and are subject to revision. Please consult the packing slip received with the instrument.

————→
Note

- *Items listed below are repeated throughout this manual and are subject to revision. Please consult the packing slip received with the instrument.*
- *For a complete listing of kits and packages, see Components and Accessories List, page [1–29](#).*

TRSCHNC Package consisting of: TruSpec CHN Carbon/Hydrogen/Nitrogen Determinator with External Computer

| | | |
|---|---------------|--------------------------|
| 1 | 259-045 | Windows Software |
| 1 | 501-171-HAZ | Anhydron, 1 lb. |
| 1 | 501-609-HAZ | Furnace Reagent, 100gr. |
| 1 | 502-174-HAZ | Lecosorb, 500 gr. |
| 1 | 618-380 | CD Case |
| 1 | 619-097 | Accessory Pack |
| 1 | 630-100-300 | TruSpec CHN Determinator |
| | 1 200-290 | Instruction Manual |
| | 1 630-110-071 | Component Pack |
| 1 | 686-449 | PC Tower Assembly |
| 1 | 704-241 | Copy Protection Key |
| 1 | 710-172 | Flat Color Monitor |

Options

To place an order by phone, please call our customer service department toll-free in the United States at 1-800-292-6141 or 269-985-5496. Orders may also be sent by fax to 269-982-8977.

- **Note**
- *For kit contents, refer to Components and Accessories List, beginning on page [1-29](#).*

Balances

751-300-160 4 Place Balance Kit
751-600-120 6 Place Balance Kit

Carousels

619-180 Stackable Macro Carousel
619-180-110 Stackable Carousel Kit (Macro Sample). This should only be ordered for instruments without a carousel. For instruments with a carousel, order 619-180 for an additional macro carousel.
619-704 Stackable Micro Carousel

Printers

620-630-110 Ink Jet Printer Kit consisting of 203-913 printer paper, 620-630 Ink Jet Printer and 700-689 Printer Cable.
614-459 Black Ink Cartridge for Ink Jet Printer.
620-632 Color Ink Cartridge for Ink Jet Printer.

TruSpec CHN Micro Kit619-675-110

TruSpec CHNS Micro Kit.....619-675-130

- **Note**
- *The TruSpec Micro Kits can only be installed in TruSpec CHN determinator with serial numbers 3280 and above.*

Regulators

| | |
|---------------|---------------------|
| 501-291 | Oxygen Regulator |
| 764-216 | Helium Regulator |
| 766-036 | Pneumatic Regulator |

Vacuum Cleaner

| | |
|---------------|---------------------------------|
| 619-380 | Vacuum Cleaner Assembly, 115 V~ |
| 619-434 | Vacuum Cleaner Assembly, 230 V~ |

Miscellaneous

| | |
|-------------------|--|
| 502-397 | Large Tin Sample Cup, 100/pk |
| 601-490-110 | Foiler Kit |
| 603-340 | Microsample Liquid Kit |
| 604-492 | Quick Sampler Kit |
| 605-980 | Keyboard (This is a replacement keyboard, there is one supplied with the PC Tower Assembly). |
| 615-763 | Smartline™ Service Modem Support |
| 617-605 | Porous Crucible for Liquid Applications |
| 619-496-110 | Tubing Replacement Kit |
| 619-523 | Carousel Mirror |
| 619-611 | Sample Grinder, 115 V~ |
| 619-612 | Sample Grinder, 230 V~ |
| 619-653-110 | 0.9 Liter Ballast |
| 619-680-110 | Liquid Autosampler |
| 619-995 | Bar Code Reader |
| 774-300-000 | CP-100 Capsule Press |

Components and Accessories List

Accessory Pack CHN Macro (619-097)

| | | |
|---|-------------|--|
| 1 | 209-050-078 | Service Video, Operating Concepts |
| 1 | 209-050-079 | Service Video, Maintenance and Troubleshooting |
| 1 | 209-050-080 | Service Video, Routine Maintenance |
| 1 | 501-241 | Vacuum Grease, 5.3 oz. |
| 1 | 501-614 | Sample Spatula |
| 1 | 502-007 | Tube Cleaner (8 mm X 1.22 meters) |
| 1 | 502-023 | Furnace Filter Tube |
| 1 | 502-049 | N Catalyst Reagent (50 grams) |
| 1 | 502-092 | EDTA Setup Standard (50 grams) |
| 1 | 502-186-200 | Tin Foil Sample Cup (100 per bottle) |
| 1 | 502-188 | Alumina Oxide Pellets (200 per bottle) |
| 1 | 502-295 | Copper Turnings |
| 1 | 502-304 | Copper Sticks (100 grams) |
| 1 | 502-359 | Magnesium Oxide Reagent |
| 1 | 502-397-400 | Large Tin Cup (400 per pack) |
| 1 | 502-450 | Heated Particle Filter Disk (package of 50) |
| 2 | 601-442 | O-ring (Lance Assembly) |
| 2 | 601-504 | O-ring (Furnace Assembly) |
| 1 | 601-691-036 | Flexible Tubing Assembly |
| 2 | 602-974 | Captive Screw |
| 1 | 604-378 | Tweezers |
| 1 | 604-398 | Sample Cup Holder, Large |
| 4 | 608-379 | Quartz Wool Strips |
| 1 | 608-898 | Receptacle Cover |
| 1 | 614-961-110 | Porous Crucible |
| 2 | 616-138 | O-ring (Combustion Tube) |
| 1 | 616-146 | Lance Tube |
| 1 | 616-152 | Crucible Extractor Tool |
| 1 | 616-513 | O-ring Removal Tool |
| 1 | 617-441 | Screen Filter |

| | | |
|---|---------|----------------------------------|
| 1 | 619-065 | Furnace Combustion Tube (U-tube) |
| 1 | 619-289 | Reagent Purge Tube |
| 3 | 619-405 | Hose Clamp |
| 1 | 619-425 | Straight Glass Tube |
| 1 | 619-674 | Vent Tube |
| 1 | 702-557 | O-ring (Furnace Exhaust Flange) |
| 1 | 763-265 | Glass Wool (0.5 pound) |
| 1 | 765-978 | 30 Amp Receptacle |
| 1 | 773-942 | Anti-seize Compound |
| 2 | 778-116 | O-ring |
| 2 | 778-120 | Gasket |
| 1 | 778-321 | Lance Extractor Tool |
| 1 | 778-405 | Capsule Storage Block |
| 1 | 789-260 | Quartz/Glass Wool Extractor Tool |

Component Pack (630-110-071)

| | | |
|---|-------------|---|
| 2 | 190-279 | 8-32 x 0.38 Screw |
| 2 | 190-055 | Flat Washer |
| 1 | 537-103 | Flexible Tubing (12 feet) |
| 1 | 601-691-018 | Flexible Tubing (for ballast maintenance) |
| 2 | 604-312 | Flask Clip |
| 1 | 609-110 | Exhaust Flask Assembly |
| 1 | 615-426 | Power Cord |
| 1 | 617-548 | Filter Tube |
| 1 | 619-154 | Catalyst Heater Tube |
| 1 | 619-180 | Carousel Assembly |
| 1 | 619-304 | Carousel Cover Assembly |
| 1 | 619-377 | Bypass Plate (for leak checking) |
| 1 | 620-677 | USB Cable Assembly |
| 1 | 762-458 | Connector Assembly |
| 1 | 775-303 | Helium Connector Assembly |
| 1 | 780-485 | Nitrogen Connector Assembly |
| 1 | 780-844 | Pressure Vessel Hose Assembly |

PC Tower Assembly (686-449)

| | | |
|---|-------------|-------------------------------|
| 1 | 169-001-824 | Voltage Setting Label |
| 1 | 609-787 | Component Pack consisting of: |
| | 1 611-119 | Receptacle Strip |
| | 1 618-980 | Mouse Pad |
| 1 | 686-492 | Computer Tower |
| 1 | 686-449-101 | ID Nameplate |

Specifications

————→ • *Specifications are for both the TruSpec Macro and TruSpec Micro unless otherwise indicated.*

Note

Range (TruSpec CHN Macro)*

Carbon 50 ppm or 0.005% to 50%
Hydrogen..... 200 ppm or 0.02% to 50%
Nitrogen 80 ppm or 0.008% to 100%

Range (TruSpec CHN(S) Micro) (@ 2 mg)*

Carbon 0.002% to 100%
Hydrogen..... 0.02% to 50%
Nitrogen 0.02 to 50%
Sulfur..... 0.04 to 65%
Oxygen..... 0.04 to 100%

Precision (TruSpec CHN Macro)*

Carbon 25 ppm or 0.5% RSD
Hydrogen..... 100 ppm or 1.0% RSD
Nitrogen 40 ppm or 0.5% RSD

Precision (TruSpec CHN(S) Micro) (@ 2 mg)*

Carbon <1% RSD or $\pm 0.001\%$ (whichever is greater)
Hydrogen..... <1% RSD or $\pm 0.01\%$ (whichever is greater)
Nitrogen <1% RSD or $\pm 0.01\%$ (whichever is greater)
Sulfur..... <1% RSD or $\pm 0.02\%$ (whichever is greater)
Oxygen..... <1% RSD or $\pm 0.02\%$ (whichever is greater)

Readability..... 0.0001 ppm

Analysis Time

CHN 4 minutes
CHNS 4 minutes
Oxygen..... 2 minutes

Sample Size (TruSpec Macro)..... up to 1 gram

Sample Size (TruSpec Micro) up to 1 mg**

Instrument Requirement

TruSec Micro Kits TruSpec CHN, model TRSCHN (serial numbers 3280 or above)

Detection Method

Carbon Optimized, Low-Noise, Non-Dispersive Infrared Absorption

Hydrogen..... Optimized, Low-Noise, Non-Dispersive Infrared Absorption

Nitrogen Optimized, Low-Drift, Thermal Conductivity (TC) Cell

Sulfur..... Optimized, Low-Noise, Non-Dispersive Infrared Absorption

Gasses Required

Carrier..... Helium (99.99% pure) @ 35 psi (2.41 bars) ±10%

Combustion..... Oxygen (99.99% pure) @ 35 psi (2.41 bars) ±10%

Pneumatic..... Compressed Air (oil and water free) @40 psi (2.76 bars) ±10%

Furnace Type Resistance, both Primary and Afterburner, maximum temperature 1100°C

Autoloader 30 position, stackable to 120 samples

Dimensions (CHN/CHNS)

Width 27 inches (69 cm)

Height 31 inches (79 cm)

Depth..... 28 inches (71 cm)

Dimensions (Oxygen Add-On)

Width 15 inches (38 cm)

Height 12 inches (30 cm)

Depth 22 inches (56 cm)

Weight (CHN/CHNS)) 250 pounds (113 kilograms)

Power

Determinator 230 V~ ±10% 50/60 Hz, 12 Amps

Computer 115/230 V~ ±10% 50/60 Hz, 5/3 Amps

Monitor 90-264 V~ 50/60 Hz, 1.6 Amps

Oxygen Add-On 230 V~ ±10% 50/60 Hz, 18 Amps max.

*Adjusting sample size may extend instrument range.

**A microbalance (6-place) is required for microanalysis.

2 Installation

This chapter lists step-by-step instructions to install the TruSpec Determinator. For software setup and configuration, refer to System Setup, page 4-1.

| | |
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| Installation | 2-11 |
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Instrument Installation

Notes

- *The following procedure should be used for first time installation of the instrument. This procedure assumes that the instrument has been unpacked and positioned in its permanent location.*
 - *The Balance and Printer are not supplied with the instrument. They must be purchased separately. Refer to Options, page 1-27.*
 - *Refer to the Facility Requirements diagram, page 2-7, during installation of the instrument.*
1. Provide a work surface with convenient electrical power and gas supplies. Refer to the Facility Requirements diagram, page 2-7 for power and gas supply requirements.
 2. Install the Instrument as shown in the Facility Requirements diagram, page 2-8. Provide a minimum space of six inches around the instrument for airflow.



WARNING

HIGH VOLTAGE HAZARD

This equipment operates from a 230V~ source. Contact with this voltage can be fatal. Do NOT connect the instrument to the facility power source until instructed to do so.

3. Connect the AC power cord, supplied with the instrument, to the power connector on the rear of the instrument. DO NOT plug it into facility power. For installation outside the U.S.A. Refer to International Installation, page 2-6.
4. Remove the Incoming Helium Flow Scrubber and Aliquot Dose Flow Scrubber reagent tubes from the gas panel of the instrument and pack them. Refer to Reagent Tube Packing, page 2-11.
5. If you're installing a TruSpec Micro determinator, pack the anhydron tube. Refer to Anhydron Tube Packing, page 3-26. If you're installing a TruSpec Macro, skip to the next step.
6. Install the Computer near the instrument. Refer to Computer Installation, page 2-13.
7. Install the Balance near the computer and instrument. Refer to Balance Installation, page 3-5.



CAUTION

POSSIBLE OPERATOR INJURY

Oxygen is not recommended in the pneumatic systems of LECO instruments. If a spark is present, an explosion may result.

8. Connect the Oxygen Tubing Assembly from the oxygen tank to the oxygen fitting on the rear of the instrument.
9. Slide the fitting back from the edge of the tubing and push the tubing into the oxygen port of the instrument. Then slide the nut toward the instrument and screw it onto the instrument port. Tighten the nut.
10. Turn the oxygen gas on at the tank and set it to 35 psi (2.41 bars).
11. Connect the Helium Tubing Assembly from the helium tank to the helium fitting on the rear of the instrument.
12. Slide the fitting back from the edge of the tubing and push the tubing into the helium port of the instrument. Then slide the nut toward the instrument and screw it onto the instrument port. Tighten the nut.
13. Turn the helium gas on at the tank and set it to 35 psi (2.41 bars).
14. Connect the Pneumatic Tubing Assembly from the pneumatic tank to the pneumatic fitting on the rear of the instrument.
15. Slide the fitting back from the edge of the tubing and push the tubing into the pneumatic port of the instrument. Then slide the nut toward the instrument and screw it onto the instrument port. Tighten the nut.
16. Turn the pneumatic gas on at the tank and set it to 40 psi (2.76 bars).
17. Install a Crucible into the combustion tube. Refer to Crucible Installation, page 2-8.
18. Install the Exhaust Flask onto the rear panel of the instrument. Refer to Exhaust Flask Installation, page 2-10.

Note

- *DO NOT couple the TC cell and ballast exhaust together. Attach them to separate exhaust systems.*
19. Connect the Ballast Exhaust, on the rear of the instrument, to the facility exhaust.



CAUTION

POSSIBLE OPERATOR INJURY

Ballast exhaust must be exhausted away from the work area and should not be vented into the lab. Connect the exhaust ports to the lab exhaust system or a fume hood.

20. Install the USB cable from the computer to the instrument. Refer to Data Transmit Installation, page [2-14](#).
21. Plug the instrument into facility AC power DO NOT turn the instrument on until instructed to do so.
22. This completes instrument installation. Before continuing with operation, refer to Setup, page [4-1](#).

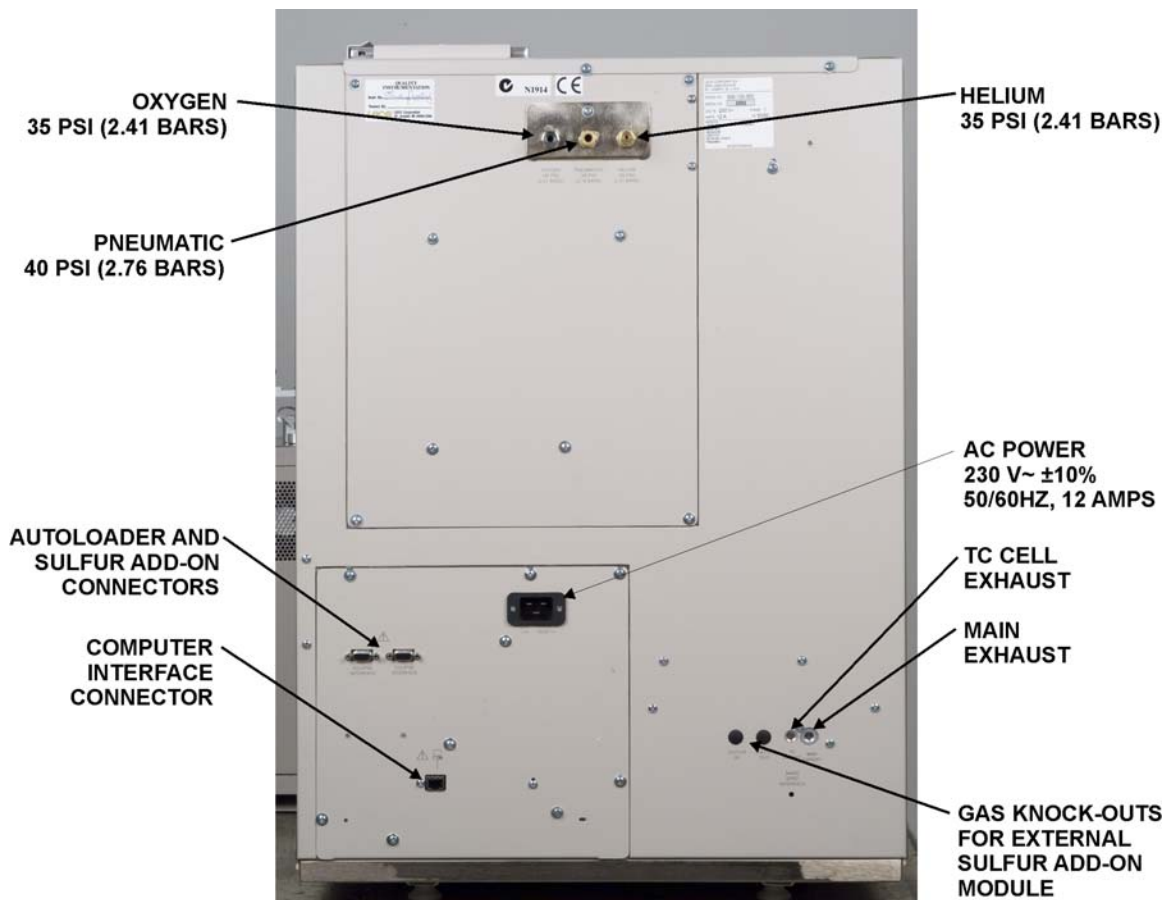
International Installation

For international installation, a HAR approved line cord for use in the end country must be obtained. This product requires a disconnect device that may either be the plug of the power cord or a disconnect device installed at the installation site if the equipment is permanently wired.

When the plug on the power supply cord is intended to serve as the disconnect device, the socket/outlet must be installed near the equipment and shall be easily accessible. When the wiring is permanently connected, a disconnect device (such as a circuit breaker or switch) must be lockable, installed near the equipment, and be easily accessible.

Combustion Tube

The combustion tube supplied in instruments purchased for domestic use is packed before shipment from the factory. Instruments purchased for international use may not have the combustion tube packed. If the combustion tube is not packed, refer to Combustion Tube Packing, page [6-28](#) and pack the combustion tube.



Electrical Requirements

| | |
|-----------------|--------------------------------------|
| Instrument..... | 230V~ (±10%), 50/60 Hz, 12 Amps |
| Computer | 115/230 V~ (±10%) 50/60 Hz, 5/3 Amps |
| Monitor..... | 90 to 264 V~, 50/60 Hz, 1.6 A (max) |
| Balance | 120 V~ (±10%), 60 Hz, 0.5 A (max) |

Gas Required

| | |
|---------------------|--|
| Carrier Gas | 99.99% Helium 35 psi (2.41 bars) ±10% |
| Combustion Gas..... | 99.99% Oxygen 35 psi (2.41 bars) ±10% |
| Pneumatic Gas..... | Compressed Air, source must be oil and water free, 40 psi (2.76 bars) ±10% |

Regulators

| | |
|--------------|---|
| Helium | 0 to 125 psi, CGA 580, 5/8-14 Female RH |
| Oxygen..... | 0 to 125 psi, CGA 540, 9/16-14 Male RH |
| Air | 0 to 125 psi, CGA 346, 9/16-14 Male RH |

**Figure 2-1
Facility Requirements**

Crucible Installation

1. Remove the loading head and set it to the side. Refer to Crucible Replacement, page [6-31](#).
2. Screw the lance extractor tool, located in the inside front door, into one of the threaded holes in the lance assembly and remove the lance assembly.
3. Insert the crucible extractor tool into a crucible and lower it into the combustion tube, Figure 2-3, page [2-9](#). Rest the crucible on the quartz wool packing. Release the crucible and remove the extractor tool.
4. Hold the lance by the removal tool and carefully lower it in place. Unscrew the lance extractor tool. The bottom of the lance should be positioned $\frac{1}{4}$ " inside the top of the crucible. Check alignment and position before the combustion tube is installed. Refer to [Figure 2-2](#) below.
5. Reinstall the loading head.
6. The lance extractor tool should be stored in the inside of the front door.

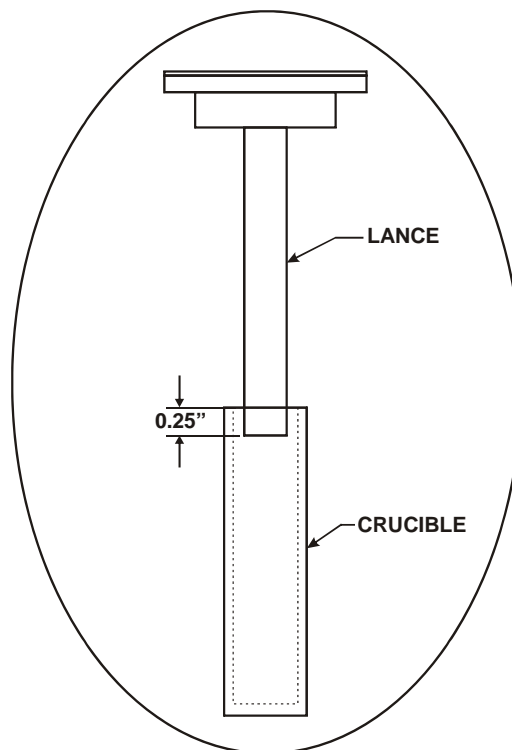


Figure 2-2
Lance Installation

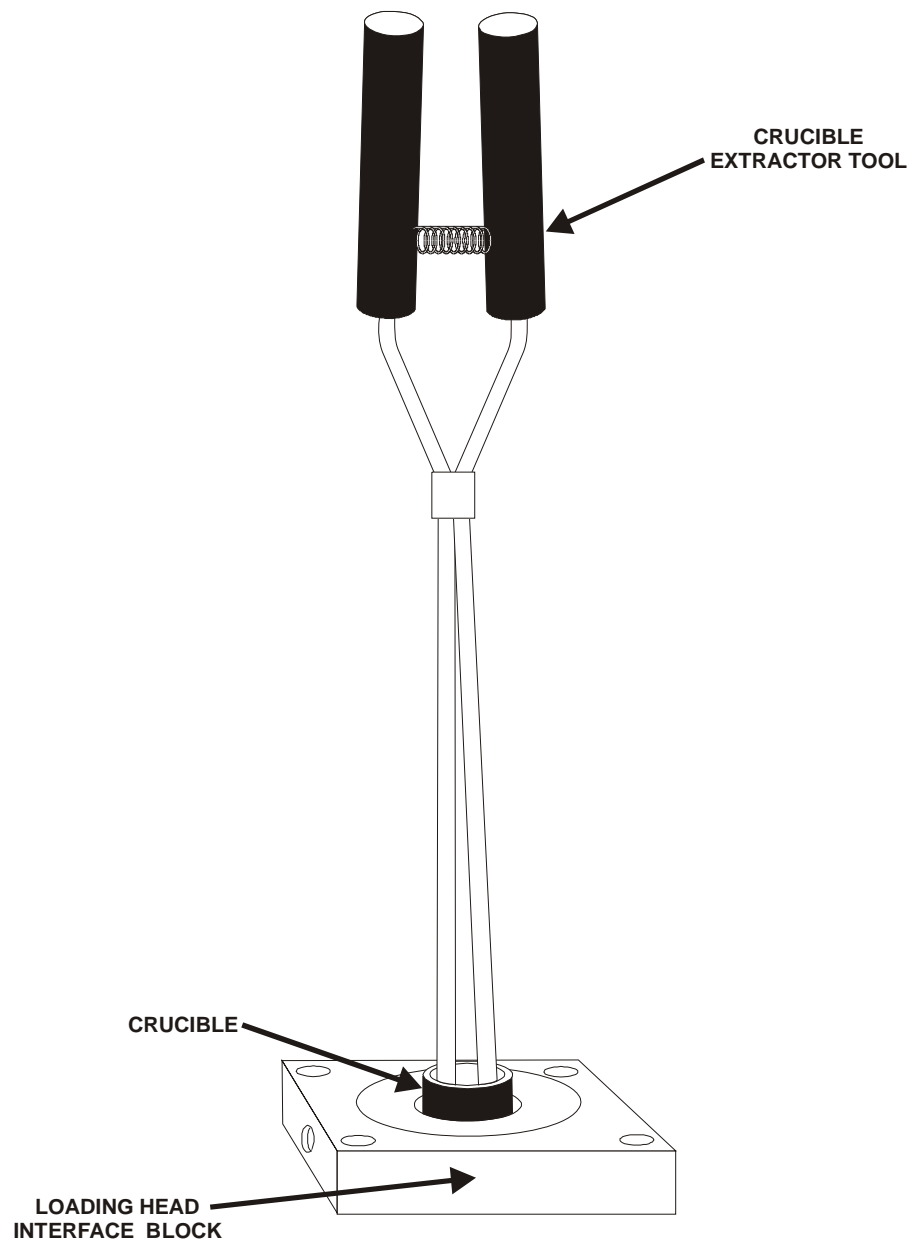


Figure 2-3
Crucible Installation

Exhaust Flask Installation

1. Attach the exhaust flask holder to the rear of the instrument using the screws supplied, Figure 2-4, below.
2. Attach the flexible tubing from the bottom of the instrument to the long open metal tube in the top of the stopper.
3. Connect the short open metal tube, in the top of the stopper, to the lab exhaust using a short piece of flexible tubing.

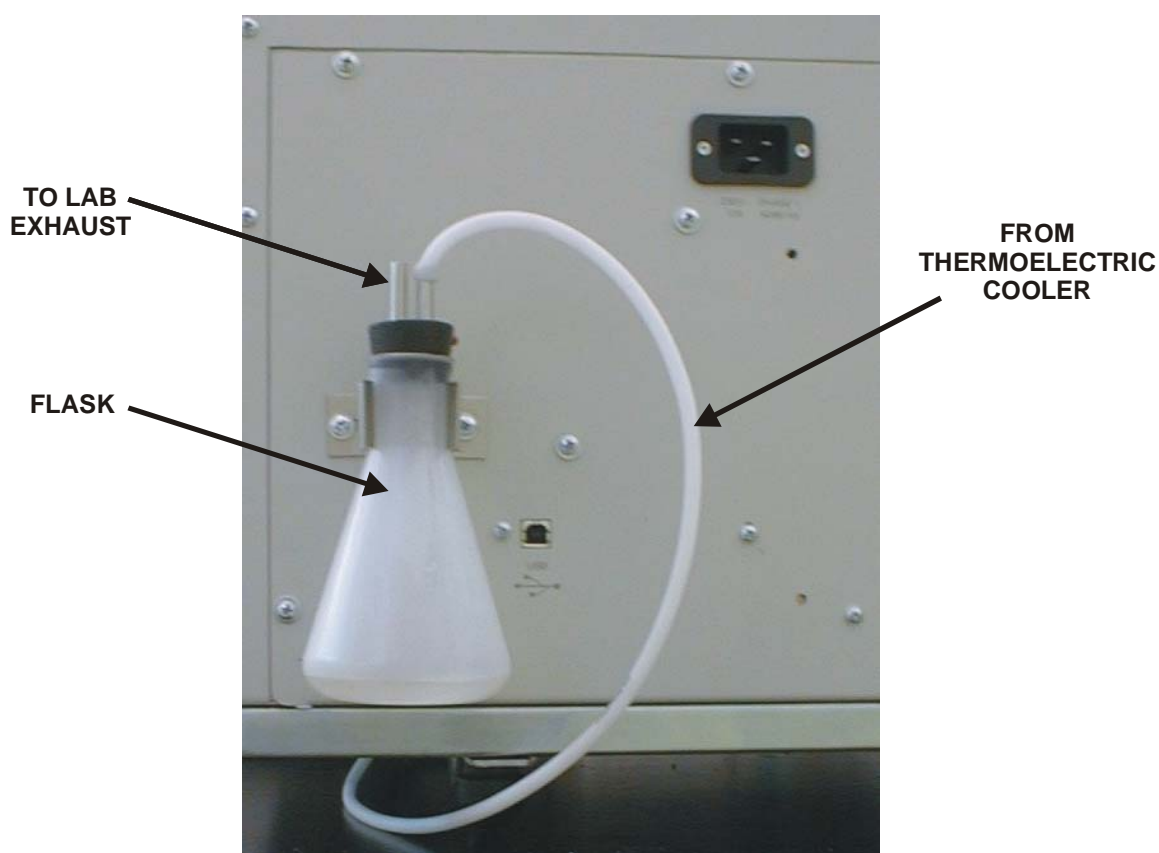


Figure 2-4
Exhaust Flask Installation

Reagent Tube Packing



Anhydron is a strong dehydrating agent and potentially strong oxidant (over 150°C). Don not heat with organic matter, flammables or combustibles. Avoid contact with strong acids. Refer to material safety data sheet for safe handling and storage procedures.

Removal

1. Slide reagent tube upward until the bottom end can swing free.
2. Tilt out the free reagent tube end.
3. Pull the reagent tube downward off the top port.

Packing

1. Insert a screen filter into the bottom of reagent tube. Position the o-ring towards the bottom and push the screen filter up into the tube $\frac{1}{4}$ -inch, Figure 2-5, page [2-12](#).
2. Pack $\frac{3}{4}$ -inch of glass wool into the bottom of reagent tube.
3. Fill the bottom $\frac{1}{3}$ of reagent tube with Anhydron.
4. Fill the top $\frac{2}{3}$ of reagent tube with Lecosorb.
5. Firmly pack $\frac{1}{2}$ to $\frac{2}{3}$ -inch of glass wool into the top of reagent tube.
6. Reinstall the reagent tube.
7. Clean excessive reagent from work area.

Installation

1. Push the top end of the reagent tube over the top port.
2. Tilt the reagent tube inward and pull it down, pushing it over the bottom port.

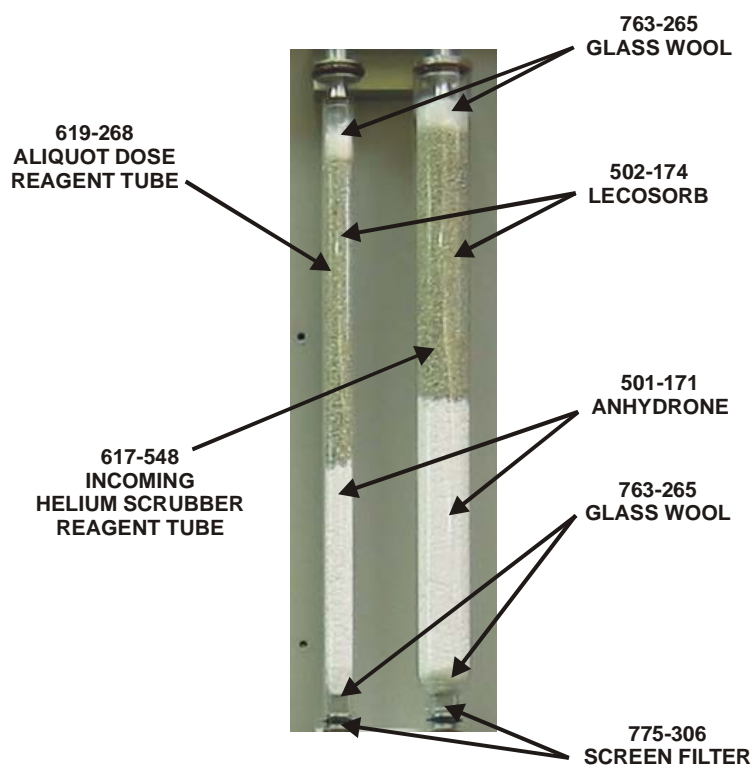


Figure 2-5
Reagent Tube Packing

Computer Installation

1. Unpack the Computer, Monitor and Printer.
2. Set the Computer near the instrument and near the Computer set the Monitor and Printer.
3. Connect the Power Cord, supplied with the monitor, to the power input jack on the rear of the monitor. Refer to the manual supplied with the monitor.
4. Connect the Monitor Cable, supplied with the monitor, to the monitor connector on the rear of the computer.
5. Locate the Instrument Interface Cable and connect it to the Instrument Connector (Ethernet) on the rear of the computer. Connect the other end to the Computer Connector (Ethernet) on the rear of the instrument. Refer to Figure 2-1 on page 2-7.
6. Locate the Keyboard, supplied with the computer, and set it in front of the monitor. Connect the keyboard cable to the keyboard connector on the rear of the computer.
7. Locate the Mouse, supplied with the computer, and set it next to the keyboard. Connect the mouse cable to the mouse connector on the rear of the computer. The Mouse Pad should be positioned under the mouse.
8. Connect the Power Cord, supplied with the printer, to the power input connector on the rear of the printer. Refer to the manual supplied with the printer.
9. Connect the Printer Cable to the connector on the rear of the printer. Connect the other end of the printer cable to the printer connector on the rear of the computer (typically this will be a USB cable).
10. Locate the Copy Protection Key and plug it into one of the USB connectors on the back of the computer.
11. Refer to the manual supplied with the printer and install the ink cartridges in the printer and align them.
12. Turn the Computer ON and wait for the Operating System to load. Click on the TruSpec Icon and follow the registration instructions that appear on the display. Make sure the TruSpec applications program has loaded and the program appears on the display before continuing.
13. Align the ink cartridges after the computer and printer have been turned on. Refer to the manual supplied with the printer for the alignment instructions.

Data Transmit Installation

————→
Notes

- *The data output is RS-232.*
 - *All character generation is coded in ASCII or UNICODE format.*
 - *Special characters (such as expanded print characters) are filtered out.*
-
1. Connect the data transmit connector on the computer to the serial connector on the peripheral device.
 2. Configure the instrument's output to match that of the peripheral device. Refer to Data Transmission Communications Settings, page [5-78](#), for the configuration procedure.
 3. To transmit data automatically, refer to Transmit Data Automation, page [5-77](#).

Apply Power

1. The Power Switch on the left side of the determinator should be in the off position.
2. Turn the Gas Supplies on at the regulators.

————→
Note

- *In the step below the Determinator and Computer must be turned ON.*
3. Turn on AC power to the determinator. Permit the computer to boot-up and run the application program.
 4. Allow the temperature to stabilize for one hour before performing a system check or sample analysis.
 5. Access the Ambient Monitor. Refer to Ambient Chart on page [8-6](#).
 6. Verify that there are no alarms indicated by an exclamation marker in a yellow box to the left of the parameter. All alarms must be cleared before performing a sample analysis. To clear an alarm it may be necessary to perform hardware calibration, system maintenance or wait an appropriate amount of time for the instrument to warm-up. Refer to the Diagnostics and Service Section of this manual for more information.

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3 Option Installation

This chapter lists step-by-step instructions to install optional equipment for the TruSpec Determinator. For software setup and configuration, refer to System Setup, page 4-1.

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Balance Installation

Notes

- The following procedures should be performed to install the balance. Refer to the manual supplied with the balance for more information.
- The Balance is not supplied with the instrument it must be purchased separately. Refer to Options on page 1–27.
- The instrument will only support Sartorius® four or five place analytical balances. Other balances may be used; however, LECO is not responsible for installation or proper operation.

Balance Installation consists of:

Balance Setup—Installing the balance at the location where it will be used and electrically connecting it to the instrument.

Resetting the Balance—Setting the balance output parameter values to match those of the instrument's.

Balance Test Procedure—Making sure the balance operates properly with the instrument.

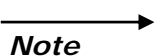
Balance Setup

1. Unpack the Balance and assemble it as shown in the manual supplied with the balance.
2. Plug the AC adapter, supplied with the balance, into facility power. Connect the AC adapter cable to the power-input jack on the rear of the balance.
3. Adjust the balance feet to level the balance. The level bubble should be inside the circle when the balance is level. The level bubble is located on the rear of the balance.
4. Connect one end of the balance interface cable to the serial connector on the computer (**COM 1**). Connect the other end of the cable to the balance connector on the rear of the balance.
5. To properly interface the balance with the analyzer, reset the balance to the factory defaults. Refer to Resetting the Balance on the next page.
6. After the balance is reset, do not change any of the configuration codes. The balance codes can be changed to custom configure the balance, if desired, after this procedure is completed and the balance is operating with the determinator.

Resetting the Balance

1. Turn the AC power ON to the balance by pushing the Power button.
2. As soon as all the segments on the display light, push the TARE button. The display will blank for a few seconds and then the menu code settings will appear.
3. Press CAL to display 9 in the left digit.
4. Press PRINT to skip the center digit.
5. Press CAL to display 1 as the right digit.
6. Press TARE and hold it for 2 seconds or more. The balance will reset to the factory set defaults.
7. Continue with Balance Test Procedure below.

Balance Test Procedure



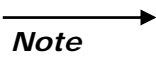
Note

- *Refer to Balance Configuration, page 4–35, and verify the instrument is properly configured before performing this procedure.*
1. Make sure the spreadsheet is displayed on the monitor and press the Print button on the balance. A sample should be logged in and the weight displayed on the balance entered into the spreadsheet under mass.
 2. If desired, the sample logged in during this test procedure can be deleted.



Figure 3-1
Balance Control Panel

Printer Installation



- *A printer is not supplied with the instrument. It must be purchased separately. Refer to Options, page [1-27](#), for more information.*

1. Shut down and turn off the Computer system if necessary.
2. Unpack the Printer and locate the printer interface cable.
3. Refer to the installation instructions supplied with the printer and connect the printer to the computer.
4. Refer to the installation instructions supplied with the printer. Install the printer on the work surface and attach all necessary cables and components.
5. Refer to the installation instructions supplied with the printer and install the printer software. This will require turning on the computer system and printer. It is not necessary to turn on the instrument at this time.
6. After the printer is installed and tested turn the computer and printer OFF.

Liquid Autosampler

Instructions to install and setup the Liquid Autosampler are provided in the 619-680-110 Liquid Autosampler Kit. The Instructions are Leco® part number 619-680-901. For software setup, operation and maintenance refer to the information below.

Note

- *The Liquid Autosampler should only be used with the TruSpec CHN Macro determinators.*

Setup

- System Configuration, page [4-32](#).

Operation

- Liquid Sample Analysis, page [5-36](#).

Maintenance

- Duckbill Replacement, page [6-49](#).

Illustrations

- Liquid Autosampler- Exploded View, page [10-26](#).
- Liquid Loading Head, page [10-37](#).

Stackable Carousels

Stacking carousels increase the number of samples that can be analyzed without operator intervention. Each carousel can hold 29 samples and up to four carousels can be stacked on the loading head.

As samples are analyzed, samples from the upper carousel drop and fill the lower carousel. Only samples from the lower carousel drop into the loading head.

1. Determine the number of carousels that are going to be used and stacked.
2. Prepare and weigh 29 samples for the first or bottom carousel.
3. Looking down into the carousel, turn the bottom plate until hole number 30 is open. Refer to Figure 3-2 below.

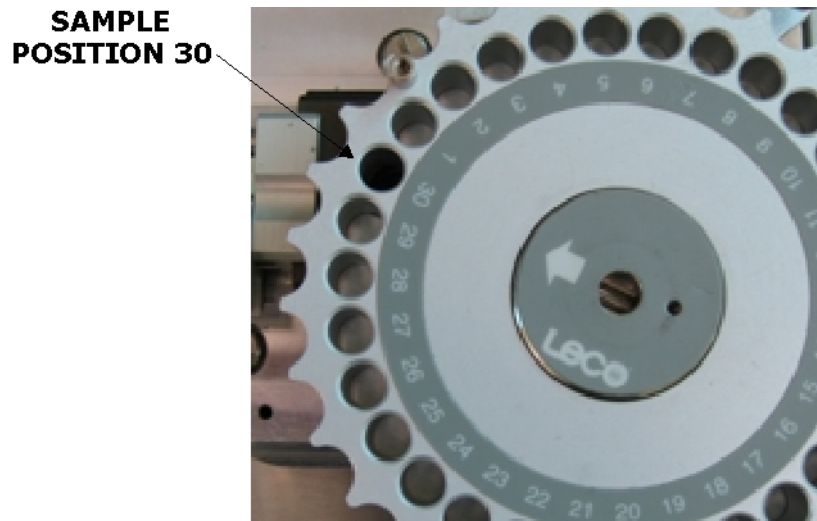


Figure 3-2
Carousel Open Position

4. Insert samples into holes 1 through 29 of the carousel. DO NOT move the bottom plate. Use this carousel for the first or bottom carousel only.

5. Without moving the bottom plate install the carousel onto the loading head. The large and small pins on the bottom plate must align with the holes in the loading head. DO NOT move the bottom plate to align the holes, move the entire carousel. Refer to Figures 3-3 and 3-4 below.

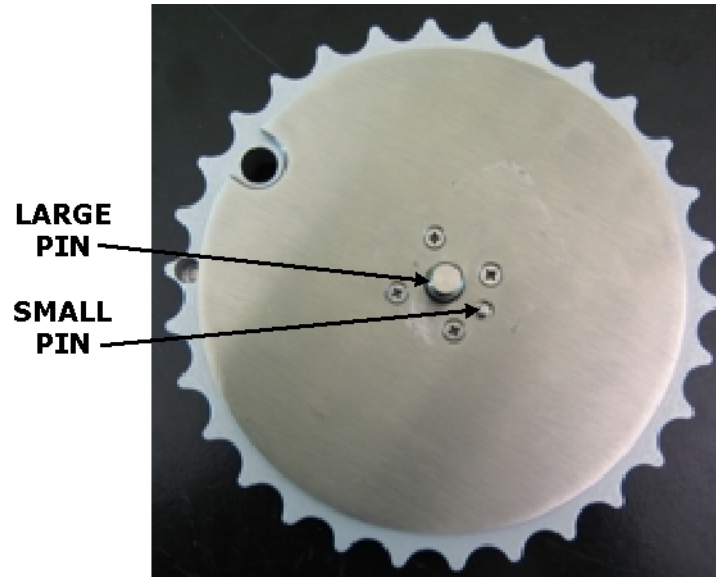


Figure 3-3
Carousel Bottom Plate

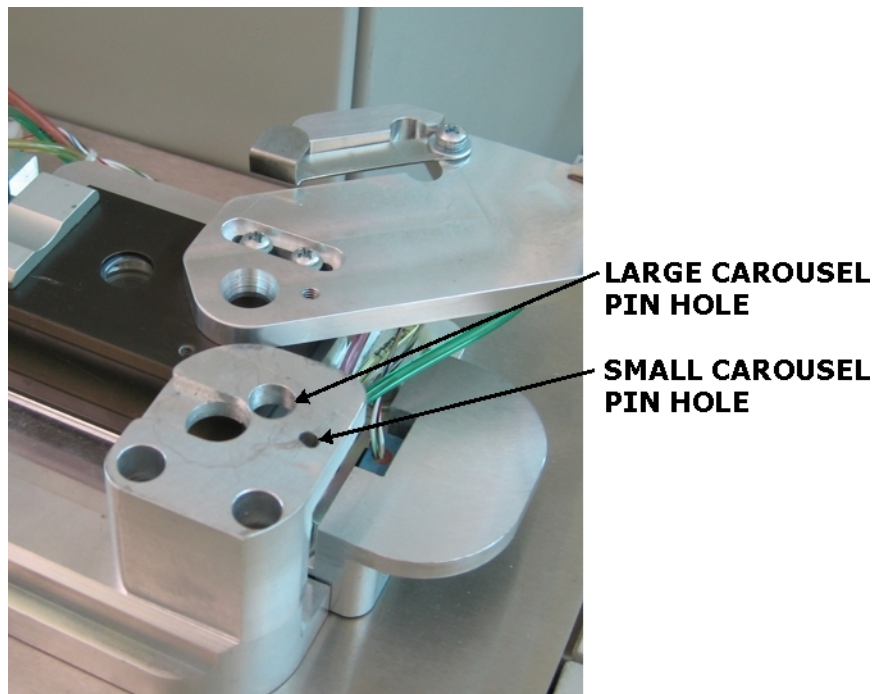


Figure 3-4
Carousel Mounting Position

6. Prepare and weigh up to 29 more samples for the second carousel.
7. Looking down into the carousel, turn the bottom plate until hole number 29 is open.
8. Insert samples into holes 30 through 28 of the carousel. DO NOT move the bottom plate.
9. Without moving the bottom plate, align the standoffs and install the second carousel on top of the first carousel. The standoff on the first carousel should be inserted into the hole in the second carousel directly under the standoff in the second carousel. Refer to Figure 3-5 below.

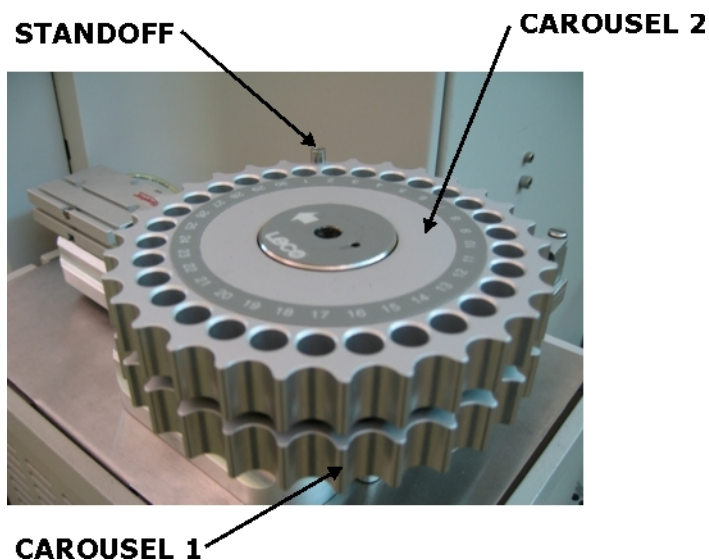


Figure 3-5
Stacked Carousels

10. To stack more carousels, repeat steps 7 through 9. For the third carousel hole 28 should be open and for the fourth carousel hole 27 should be open. As the samples drop into the first carousel they will be in the correct numerical order.
11. Enter the sample information into the spreadsheet. It will be necessary to ignore the sample position numbers on the carousels and number the samples in the spreadsheet from 1 to the highest sample number in consecutive order.

Note

- If operation is intermittent with the weight of 4 carousels, perform the carousel adjustment procedure on page [9-31](#).

Smartline Installation

Smartline provides an on-line support connection between your instrument and LECO's Technical Service department. This section contains detailed instructions for the installation of Smartline to an existing computer system and the necessary steps required to install the software and external modem.

- **Note**
- *For part number and ordering information refer to Options on page [1-27](#).*

Modem Installation

1. Turn the instrument and computer off.
2. Unpack the Smartline package. Refer to Components and Accessories List, page [1-29](#), for package contents.
3. Connect the modem to the rear of the computer using the modem cable.
4. Connect the power cube, supplied with the modem, to the power input jack on the modem.
5. Connect the modem to the same outlet as the computer.
6. Turn the modem, computer, and instrument on.
7. Insert the Modem Installation CD-ROM in the CD-ROM disk drive (typically D:). The Installation program should start automatically.
8. When the Welcome screen is displayed, click Next.
9. When the Installation screen is displayed, select Software then select US Robotics control center and click Install.
10. When the Setup screen is displayed, click Next then Next again. The program will automatically choose the best location (folder) in which to install the program.
11. Click OK when finished.



POSSIBLE PROGRAM ERROR
Disregard any further software installation beyond this point. Click Cancel to close the pop-up window.

12. Turn the computer off then back on again to reboot the system to activate the modem software.
13. Refer to NetOp[®] Software Installation and install the software, page [3-15](#).

NetOp® Software Installation

————→
Note

- *After Modem Installation, page 3–14, the NetOp® software must be installed. This procedure installs the software.*

1. Insert the NetOp® Installation CD-ROM in the CD-ROM disk drive (typically D:). The Installation program should start automatically.
2. The first screen displayed is the Language Selection screen. Select the appropriate language then click Install.
3. Select Windows then click Yes to accept the license agreement.
4. When the Registration dialog box is displayed, enter the HOST registration numbers.

————→
Note

- *The HOST registration number can be found on the back of the NetOp® Installation CD-ROM jewel case.*

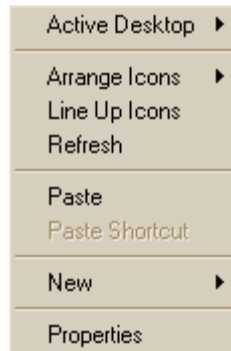
5. Click Next. The program will automatically choose the best location (folder) in which to install the program.
6. Click Next. The files will be copied into this location.
7. Click OK when finished.
8. Continue with Create a Shortcut on the next page.

Create a Shortcut

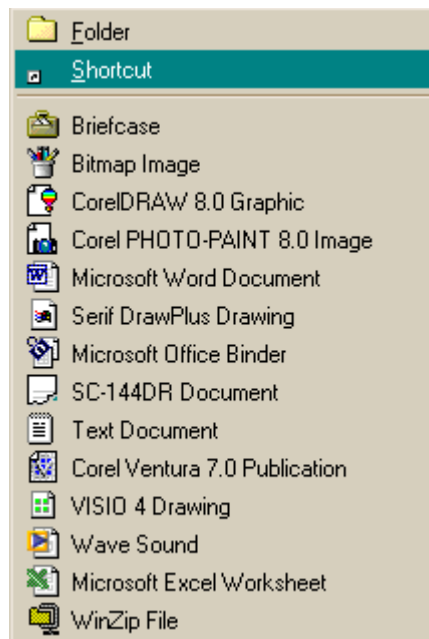
—————→
Note

- *A shortcut should be created on the computer desktop for easy access to LECO.*

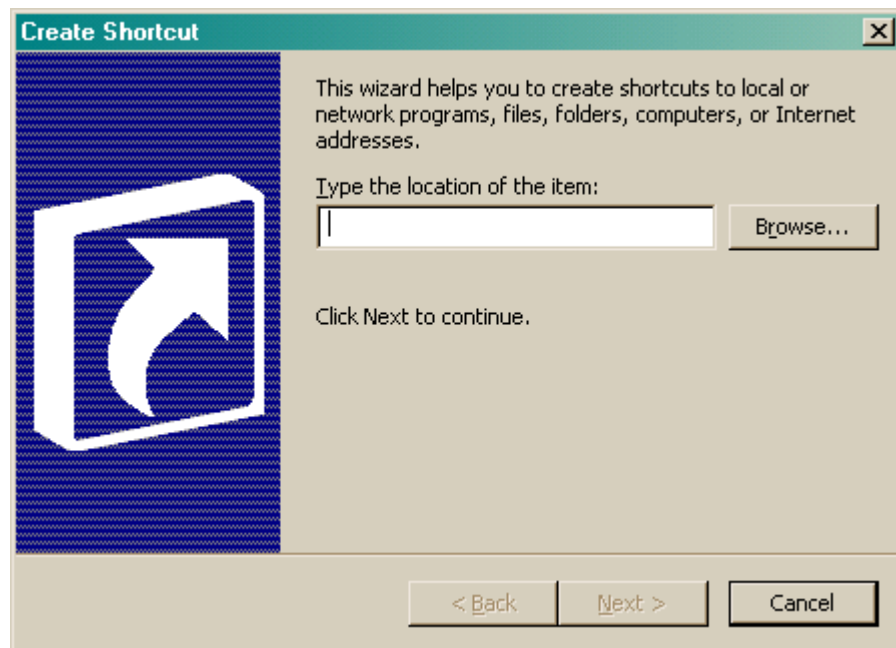
1. Close or minimize all open programs.
2. Right-click on the computer desktop. A drop-down menu is displayed.



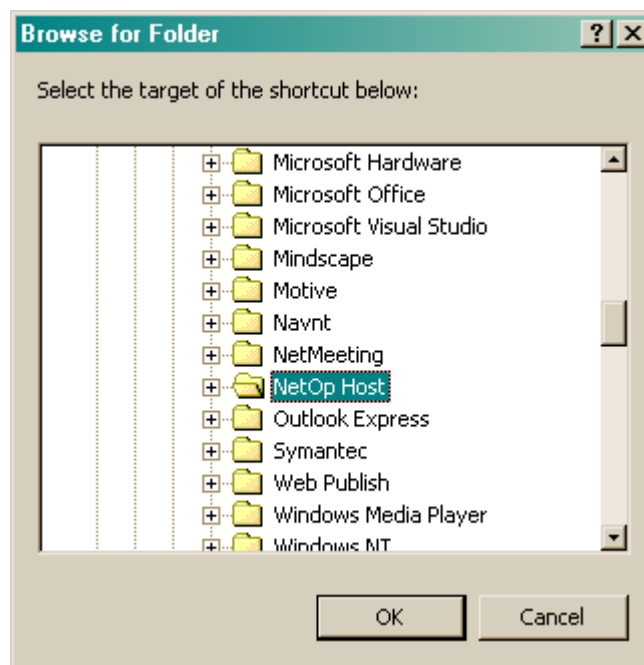
3. Click New. A second drop-down menu is displayed.



4. Click Shortcut. The Create Shortcut wizard is displayed.

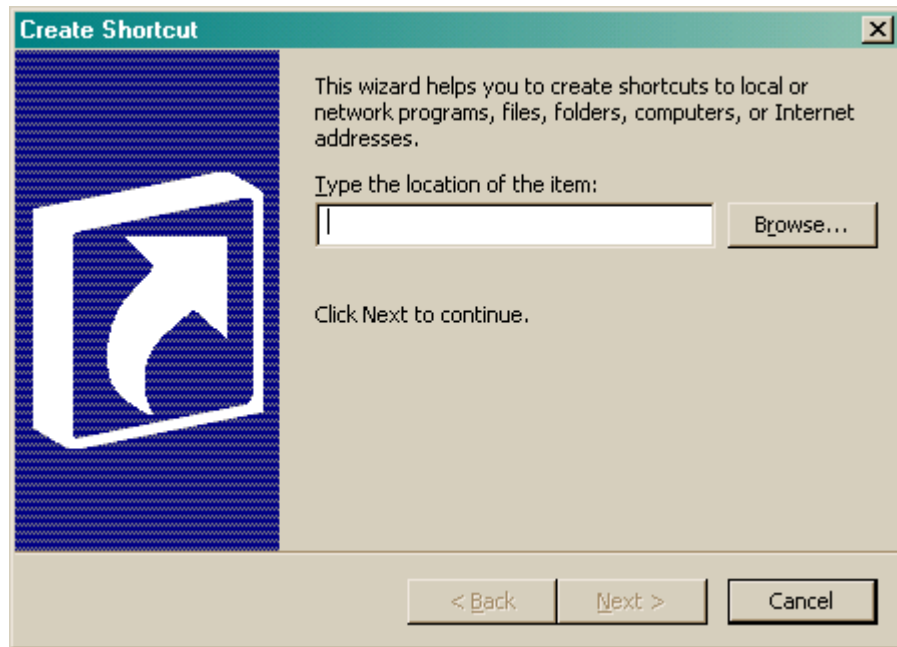


5. Enter the location of the program. If the location is not known, the program can be located using the Browse button.
- A. Click Browse. The Browse For Folder dialog box is displayed.

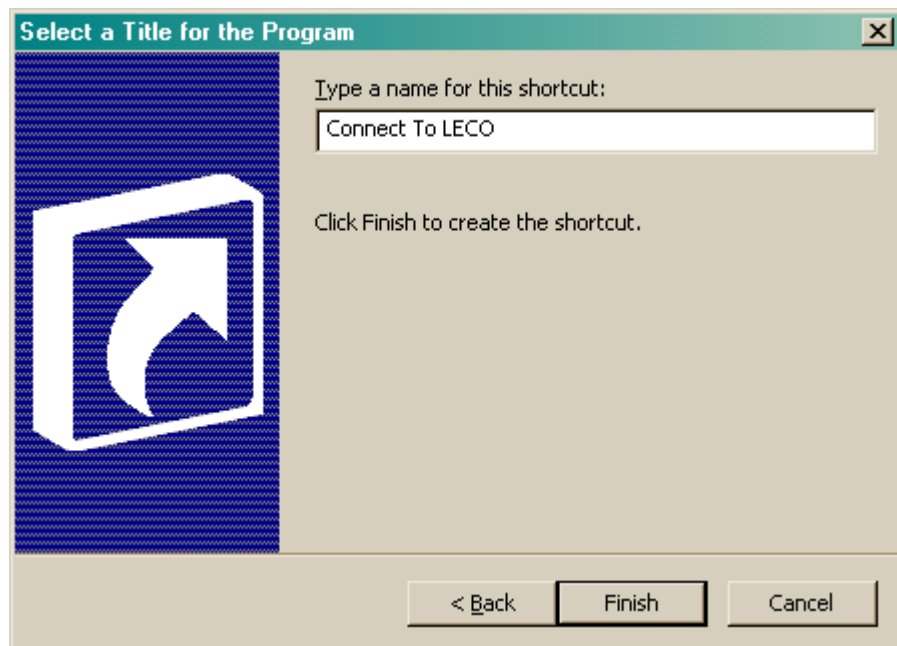


- B. Locate and select the folder.
- C. Click OK.

6. Once the program location has been entered, click Next. The Select a Title for the Program dialog box is displayed.



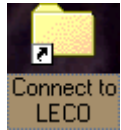
7. Enter the name of the shortcut as Connect to LECO.



8. Click Finished when done. The shortcut is displayed on the computer desktop.

Operation Setup

1. Turn the computer on.
2. Double-click the Connect to LECO icon on the computer desktop. If the icon is not there, refer to Create a Shortcut, page [3-16](#), for additional information.



3. Click in the check box next to U.S. Robotics 56K Fax Ext.
4. Click Wait For Call then contact LECO Service department (269-982-5497) to confirm Smartline is working properly.

TruSpec Micro Kits

There are two Micro kits available for the TruSpec CHN determinator. The 619-675-110 converts the determinator to a TruSpec CHN Micro and the 619-675-130 converts the determinator to a TruSpec CHNS Micro.

Instructions to install the TruSpec Micro Kits are included in the kits. For software setup, operation and maintenance refer to the information that follows.

Theory of Operation for the TruSpec Micro Determinators can be found on pages [7-3](#) and [7-5](#).

Flow diagrams for the TruSpec Micro Determinators can be found on pages [7-6](#) and [7-7](#).

Accessory Packs for the Micro Determinators

Accessory Pack CHN Micro (619-712)

| | | |
|----|---------|--|
| 1 | 502-189 | Copper Sticks (100 grams) |
| 1 | 502-190 | Copper Oxide Wire Pieces (100) |
| 1 | 601-963 | Tin Capsules |
| 1 | 601-964 | Fine Spring Loaded Pliers (used to crimp capsules) |
| 1 | 608-089 | O-ring |
| 1 | 608-379 | Quartz Wool Strip |
| 1 | 619-725 | Micro Spatula |
| 1 | 619-726 | Forceps |
| 1 | 619-736 | Tube Cleaning Brush |
| 10 | 702-557 | O-ring |
| 1 | 773-942 | Anti-seize Compound |

Accessory Pack CHNS Micro (619-770)

| | | |
|---|---------|--------------------------------|
| 1 | 502-189 | Copper Sticks (100 grams) |
| 1 | 502-190 | Copper Oxide Wire Pieces (100) |
| 1 | 502-207 | Cystine Sample |
| 1 | 502-209 | Sulfamethazine Sample |
| 1 | 502-489 | Micro Porous Crucible (10/pk) |

| | | |
|----|---------|-------------------------------|
| 1 | 502-293 | Silver Capsule |
| 1 | 502-489 | Porous Crucible |
| 1 | 601-964 | Pliers |
| 10 | 608-089 | O-ring |
| 1 | 608-379 | Quartz Wool Strip (15 inches) |
| 1 | 619-725 | Micro Spatula |
| 1 | 619-726 | Forceps |
| 1 | 619-736 | Exhaust Tubing Brush |
| 10 | 702-557 | O-ring |
| 1 | 773-942 | Anti-seize Compound |

Software Setup (Micro)

Configure the analysis method for the Micro mode by selecting Micro for the sample size.

1. From the Configuration method click Method.
2. Click Properties to display the analysis parameters.
3. In the Sample Size dialog box click Micro.

The screenshot shows the 'Methods' dialog box with the 'Analysis Parameters' tab selected. The 'Sample Size' section contains two radio buttons: 'Macro (50 mgs - 1.5 grams)' and 'Micro (20 micrograms - 50 mgs)'. The 'Micro' option is selected. Below this is a text box for 'No Sample Drop Detection' with the value '0' and the label 'times N Blank'. The 'Furnace' section contains two text boxes: 'Temperature' with the value '950' and 'Afterburner Temperature' with the value '850'. Both have a range of '0 - 1050 C'. At the bottom are 'OK', 'Cancel', and 'Help' buttons.

Notes

- Refer to *Create a Method*, on page 4–39, for a complete list of method procedures and definitions.
- To login and analyze a sample refer *Login a Sample* and then *Sample Analysis* starting on page 5–17.

Sample Preparation TruSpec Micro

Notes

- To prevent contamination, only handle the capsules with forceps.
 - Crimp capsules on a clean surface such as an inverted beaker.
1. Place the Micro Capsule on the balance using forceps.
 2. Press Tare to tare the balance.
 3. Add Sample to the microcapsule being careful not to spill any on the balance pan.
 4. Remove the Micro Capsule from the balance and crimp as shown below.
 5. Place the crimped Micro Capsule on the balance and record the mass. For the TruSpec CHN use Tin Capsules. For the TruSpec CHNS use Silver Capsules.

Notes

- CHN Tin Capsules, LECO P/N 601-963
- CHNS Silver Capsules, LECO P/N 502-206

Tools

- Pliers, LECO P/N 601-964
- Forceps, LECO P/N 619-726
- Spatula, LECO P/N 619-725

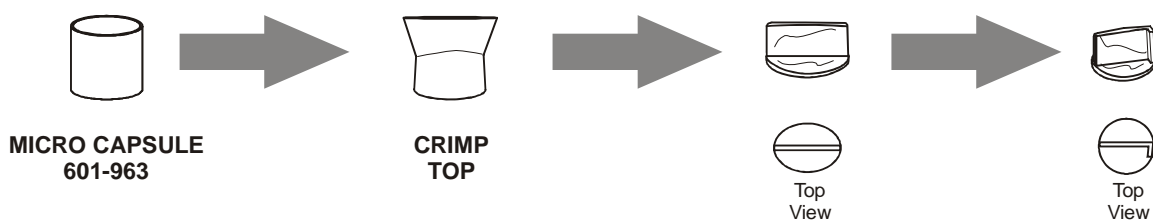


Figure 3-6
Sample Preparation—Microcapsule

Periodic Maintenance Schedule (Micro)

The following schedule is a list of maintenance procedures that should be performed on a regular basis. For more information concerning periodic maintenance and periodic maintenance procedures, refer to the individual topics.



TRUSPEC MICRO

In order to obtain the best possible analysis results periodic maintenance must be performed at the intervals listed below.

Note

- The following maintenance intervals should be entered into maintenance counters to notify the operator when maintenance should be performed. Refer to *Configure Maintenance Counters* on page [6-46](#).

| Maintenance Item | Location of Maintenance Item | Inspection, Cleaning, and Maintenance Intervals |
|--------------------------------|---|--|
| Air Filter Cleaning | On the top of the instrument cabinet. | Vacuum daily and wash monthly to prevent clogging. Refer to page 6-8 . |
| Anhydrone Tube (TruSpec Micro) | Accessed through door on right side of determinator. | Check daily and repack when anhydrone cakes, about 100 analyses. Refer to page 3-26 . |
| Carousel Cleaning | On top of the loading head assembly. | The carousel should be cleaned weekly. Refer to page 6-16 . |
| Combustion Tube Packing | Inside furnace assembly. WARNING: Disconnect facility power and let furnace cool before removing combustion tube. | Replace the copper sticks in the secondary side every 350 analyses. Replace the copper oxide in the primary side every 1000 to 1500 analyses. Refer to Combustion Tube Packing page 3-28 . |

| | | |
|--|---|--|
| Crucible Replacement | Inside combustion tube. Remove loading head and use tongs to remove crucible. WARNING: Furnace may be hot. | Replace every 200 analyses. Replace the Reticulated Micro Crucible, used in the CHNS micro only, every 75 analyses. Refer to page 6-32 . |
| Loading Head Cleaning | On top of the furnace shelf above the furnace assembly. | Inspect every day and clean ashes and soot if necessary. Refer to page 6-34 . |
| Incoming Helium Scrubber, Repacking the Reagent Tube | Behind the access door on the front panel of instrument. | Replace every 90 days or when anhydron cakes or lecosorb changes colors. Refer to page 6-40 . |
| Aliquot Dose, Repacking the Reagent Tube | Behind the access door on the front panel of instrument. | Replace at counter limit (approximately 800 macro, 200 to 300 micro). Refer to page 3-26 . |
| O-rings | Located in various assemblies, reagent tubes, and loading head. | Replace when repacking or replacing the reagent tubes, cleaning an assembly, or when damaged. Refer to page 6-39 . |
| Reduction Heater Tube Packing | Inside catalyst heater assembly. WARNING: Disconnect facility power and let catalyst heater cool before removing reduction heater tube. | Replace approximately 6000 analyses. Refer to page 6-18 . |
| Screen Filter Cleaning | Inside reagent tubes at the bottom. | Clean when reagent tubes are packed. Refer to page 6-42 . |
| Duckbill Replacement—Liquid Loading Head | On the Liquid Loading Head. Refer to Figure 10-31 on page 10-37 . | Replace the Duckbill periodically or when it leaks. Refer to Check Valve Replacement on page 6-49 . |

Anhydron Tube Packing (Micro)

Removal

1. Open the small door on the right side of the determinator and remove the glass anhydron tube.
2. Slide reagent tube upward until the bottom end can swing free.
3. Tilt out the free reagent tube end.
4. Pull the reagent tube downward off the top port.

Packing

1. Insert a ½ inch wad of Quartz Wool into one end of the tube. Refer to Figure 3-7, page [3-27](#).
2. Fill the tube with 2 ¾ inches of Anhydron.
3. Insert a ½ inch wad of Quartz Wool on top of the anhydron.

Installation



After installation make sure none of the quartz wool strands interfere with the o-ring seal.

1. Push the top end of the reagent tube over the top port.
2. Tilt the reagent tube inward and pull it down, pushing it over the bottom port.
3. Close the door on the side of the determinator.

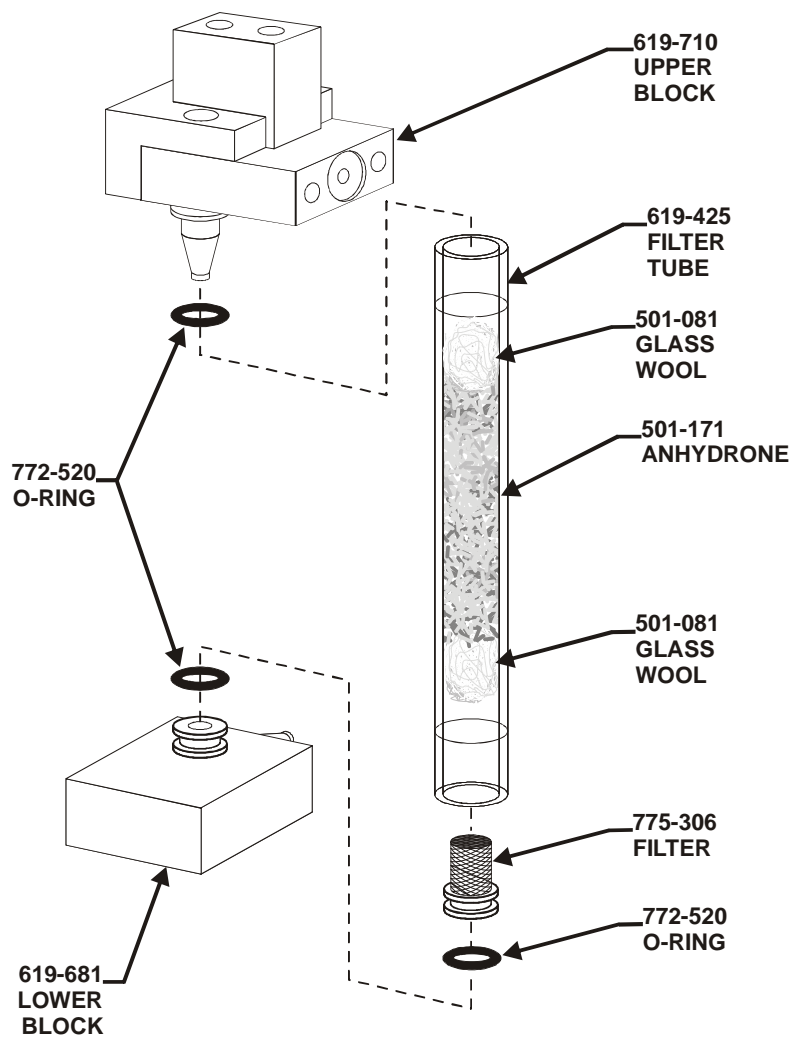


Figure 3-7
Anhydron Tube Packing

Combustion Tube Packing (Micro)

Notes

- Only replace the combustion tube if it becomes cracked or plugged. The combustion tube can be reused even if it looks cloudy.
- If it becomes necessary to remove the combustion tube refer to *Combustion Tube Removal* on page 6-22.



CAUTION

POSSIBLE COMBUSTION TUBE DAMAGE Do not touch the lower portion of the combustion tube without gloves. Body oil can promote devitrification that may cause the combustion tube to crack.

1. Remove 1 quartz wool strip from the package. Separate it lengthwise into 2 sections being careful to match the outside diameter of the roll to the inside diameter of the combustion tube. Each section is $\frac{3}{4}$ -inch wide.
2. Using the crucible extractor, push two rolled quartz wool strips into the primary side of the combustion tube until the rolls are properly positioned in the combustion tube, Figure 3-8, page 3-30.
3. Pour $\frac{3}{4}$ inch of Copper Oxide Wire into the primary side of the combustion tube until it rests on the quartz wool strips.
4. Insert the combustion tube into the furnace, seal it with two high-temperature orange o-rings.
5. In the primary side of the combustion tube, insert the crucible until it rests on the copper oxide wire. If you're packing the combustion tube for the CHNS micro insert the reticulated micro crucible inside the larger crucible.
6. Insert the Lance Assembly into the primary side of the combustion tube. The bottom of the lance tube should be positioned $\frac{1}{4}$ inch inside the crucible. Refer to Figure 3-9 on page 3-31.
7. Add or remove a small amount of copper oxide wire under the crucible to insure that the bottom of the lance is properly positioned inside the crucible.
8. Push 3.5 grams of copper turnings into the top of the secondary reagent tube. Compress the copper turnings until they fill 0.75 inches of the bottom of the tube.
9. Pour Copper Sticks on top of the copper turnings.

10. Insert the secondary reagent tube into the secondary side of the combustion tube.
11. Seal the secondary side of the combustion tube with the afterburner interface block.

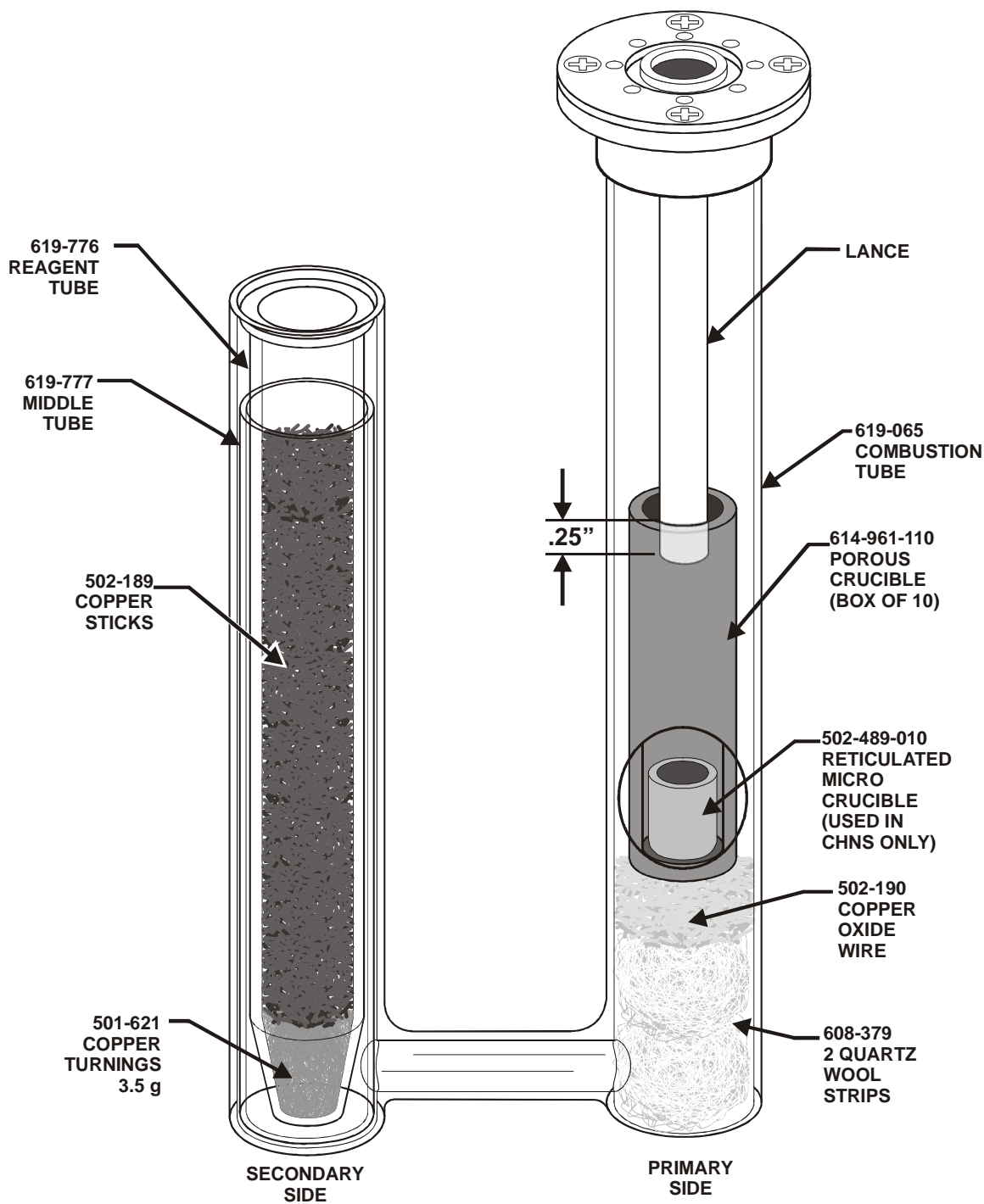
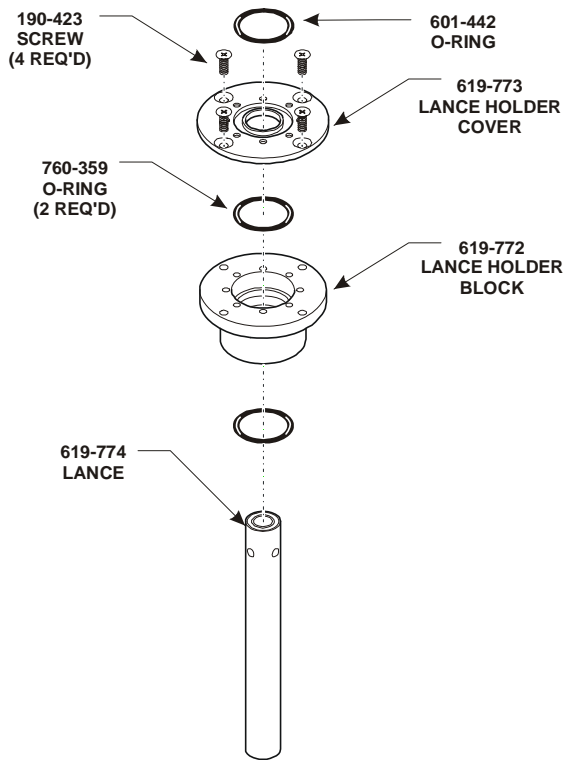


Figure 3-8
Combustion Tube Packing (Micro)

CHNS MICRO



CHN MACRO/MICRO

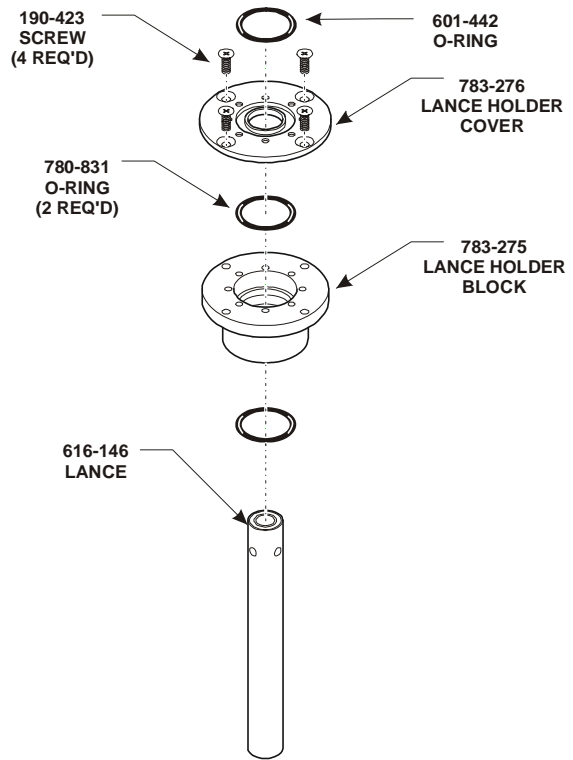
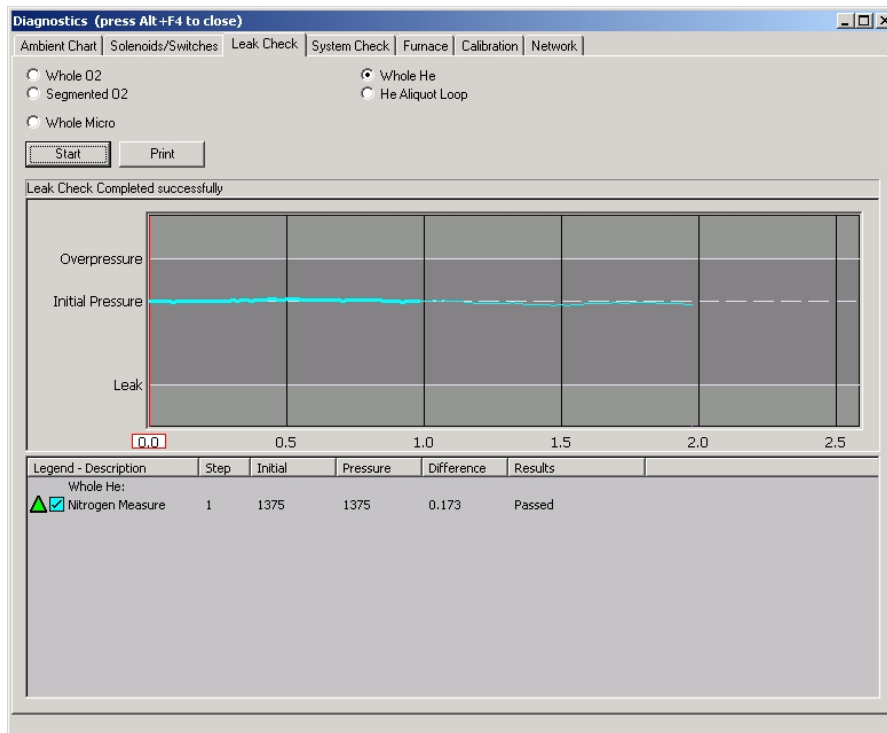


Figure 3-9
Lance Assemblies

Leak Check (Micro)

Note → • Refer to page 8–31 for the TruSpec Micro Leak Check Flow Diagram.

1. Click Diagnostics and select Leak Check. The Leak Check screen will appear.



2. Click the Whole Micro button in the upper left of the screen to select the micro leak check procedure.
3. Click Start to perform a leak check. System pressure is monitored in the chart at the middle of the screen.
4. Click Stop to abort a leak check in progress.
5. Click Print to print the results of a completed leak check on the system printer.

Note → • For a complete explanation of the Leak Check procedure refer to Leak Check on page 8–22.

Leak Check Definitions

Whole Micro—Click this button to pressurize and leak check the entire TruSpec Micro combustion system. The TruSpec Microanalysis Kit must be installed for this selection to appear.

Initial Pressure (graph)—The system pressure before the leak check is started. The system is pressurized to this value.

Overpressure (graph)—Overpressure is approximately 2.5 mmHg above initial pressure. If the pressure rises above this value the leak check will fail.

Leak (graph)—Leak pressure is approximately 5 mmHg below initial pressure. If the pressure falls below this value the leak check will fail.

TruSpec Oxygen Add-On

Equipment Packages

Items listed below are repeated throughout this manual and are subject to revision. Please consult the packing slip received with the instrument.

—————→ • *Items listed below are repeated throughout this manual and are subject to revision. Please consult the packing slip received with the instrument.*

Note

TRSOX Package consisting of: TruSpec Oxygen Add-On

- 1 630-100-900 TruSpec Oxygen Furnace Assembly
 - 1 630-190-071 Component Pack
- 1 660-010-155 TruSpec Micro Pack
- 1 660-010-144 Accessory Pack

TruSpec Add-On Pack (660-010-155) consisting of:

- 1 190-277 8-32 Screw (ground wire catalyst side panel to base)
- 1 193-008 Lock Washer (ground wire catalyst side panel to base)
- 1 200-290 Instruction Manual
- 4 601-691-001 CFLEX Tubing
- 1 606-702-012 PFA Tubing (bottom of side panel catalyst to CO₂ cell)
- 1 615-830-031 PFA Tubing (oxygen manifold B to top of catalyst side panel)
- 8 617-484 Fitting Nut (tubing install)
- 8 617-485 Fitting Ferrule (tubing install)
- 8 617-486 Flangless Nut Removal Tool
- 1 618-044 Eclipse Cable Assembly
- 4 619-405 Hose Clamp
- 1 619-729 Tube (helium regulator to flow controller)
- 1 619-731 Tube (incoming scrubber to helium regulator manifold)
- 1 619-732 Tube (TC manifold #4 to helium regulator manifold IN)
- 1 660-010-142 AC Power Harness
- 1 660-010-143 Right Side Panel with Catalyst Heater

Component Pack (630-190-071) consisting of:

| | | |
|---|-------------|---|
| 3 | 190-744 | Screw (for furnace adapter plate) |
| 3 | 602-803 | O-ring (micro interface block) |
| 1 | 608-052 | Heating Element Assembly |
| 1 | 608-057 | Furnace Adapter Plate (for leak check plate) |
| 2 | 608-065 | Graphite Lance |
| 1 | 608-087 | Flat Washer (heat shield lance assembly) |
| 1 | 608-130 | Inner Furnace Tube |
| 1 | 608-135 | Combustion Tube Extractor Tool |
| 1 | 608-898 | Receptacle Cover |
| 1 | 615-830-040 | Tubing (micro interface block A to oxygen manifold A) |
| 1 | 615-830-110 | Tubing (furnace adapter plate) |
| 2 | 621-018 | Flow Control Valve |
| 1 | 625-401-360 | Outer Furnace Tube |
| 1 | 625-501-568 | Pneumatic Line Assembly |
| 6 | 625-505-643 | Heating Element Insulation |
| 1 | 765-978 | AC Power Receptacle, 30A |
| 1 | 773-661 | Adapter Fitting |
| 1 | 660-010-141 | Micro Interface Block |
| 3 | 779-513 | O-ring (sample drop plate and load head seal) |

Accessory Pack (660-010-144) consisting of:

| | | | |
|---|-------------|--|--------------|
| 1 | 501-053 | Carbon Acetanilide Sample | 10 grams |
| 1 | 501-170 | Rare Earth Copper Oxide | 50 grams |
| 1 | 501-621 | Copper Turnings | 200 grams |
| 1 | 502-184 | Benzoic Acid Standard | |
| 1 | 502-196 | Carbon Black Powder | |
| 1 | 502-227 | Tin Capsule | 500 / Bottle |
| 1 | 502-228 | Graphite Pad | |
| 1 | 601-442 | O-ring (catalyst tube, top) | |
| 1 | 601-963 | Tin Capsule | |
| 1 | 606-026 | Graphite Crucible | 10 / PK |
| 6 | 608-089 | O-ring (inner combustion tube) | |
| 6 | 608-090 | O-ring (outer combustion tube, bottom) | |
| 6 | 611-351-178 | O-ring (outer combustion tube, top) | |

| | | |
|---|---------|--|
| 1 | 619-154 | Catalyst Heater Tube |
| 6 | 772-520 | O-ring (screen filter and reagent tube blocks) |
| 1 | 775-306 | Secondary Filter |
| 1 | 775-601 | Reagent Tube |

Initial Installation

Notes

- Before installing the TruSpec O furnace, perform the Initial Power-Up and System Setup procedures.
 - The lance must be removed from the primary side of the combustion tube, in the determinator, before performing oxygen analyses.
 - Specifications for the TruSpec Oxygen Add-On are listed on page 1–32.
1. Provide a work surface with convenient electrical power supply.
 2. Place the furnace 6 inches to the right side of the determinator.
 3. A male plug and female receptacle, which can be used for the power cord of the furnace, are supplied. If other types of connectors are used, follow the wire color code shown in the Power Cord Wiring Table below. Do not plug the furnace in until instructed to do so.



WARNING

To avoid electrical shock do not plug the furnace into facility power until instructed to do so.

| Power Cord | Connection |
|------------|----------------|
| Black | 230 V~ |
| White | Neutral |
| Green | Ground (earth) |

Figure 3-10
Power Cord Wiring Table

Oxygen Furnace Scrubber

1. Slide the tube toward the quick disconnect block with the tapered port, tilt out the freed tube end, then pull the tube off the tapered port. Refer to figure 3-24 on page [3-55](#).
2. Pack $\frac{3}{4}$ inch (19 mm) of glass wool into the screen filtered bottom of the tube. Refer to Figure 3-11 below.
3. Fill the bottom half of the tube with anhydrous. Refer to Figure 3-12 below. Fill the top half of the tube with Lecosorb.
4. Pack $\frac{1}{2}$ inch to $\frac{3}{4}$ inch (13 to 19 mm) of glass wool into the top of the tube.
5. Reinstall the tube in the blocks.

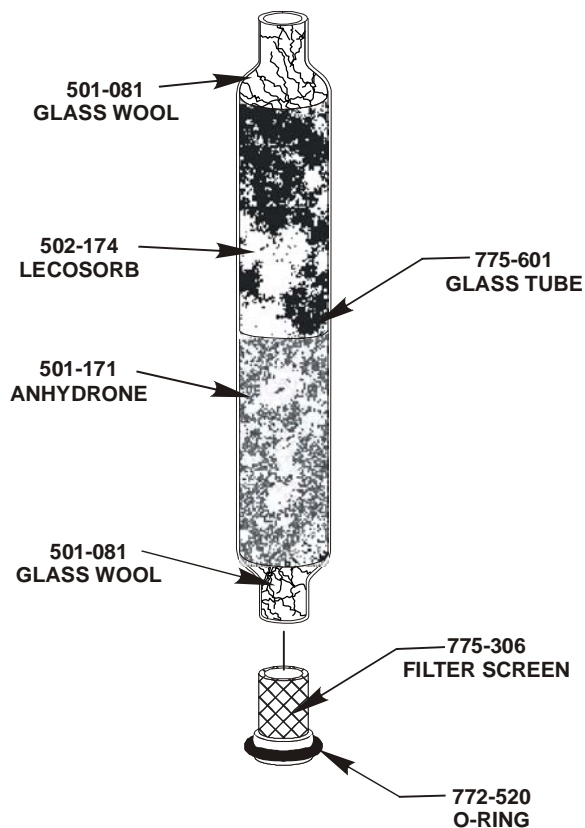


Figure 3-11
Oxygen Furnace Scrubber

Heating Element Installation

1. Remove the four screws and take off the sample drop plate. Refer to Figure 3-8, page [3-40](#).
2. Remove the four screws and take off the top plate.
3. Remove the two screws and take off the heat shield.
4. Remove the furnace right side panel.
5. Loosen the two thumbscrews and take off the fan plate assembly. The wires do not have to be disconnected.
6. Lift the two heating element leads away from the heating element and insert the heating element.
7. Remove the two screws and washers that attach the power supply leads to the terminal block.
8. Line up a heating element lead end over a terminal and then place a power supply lead end over the heating element lead end.
9. Secure the two leads using one of the screws and washers removed in a previous step.
10. Insert two heating element strips around the top of the heating element.
11. Reattach the fan plate assembly.
12. Replace the heat shield, top plate, and sample drop plate.
13. Install the Right Side Panel.

Note

- *If you're installing the furnace at the location it's going to be used skip to Packing and Installing the Furnace Tubes on page [3-41](#).*

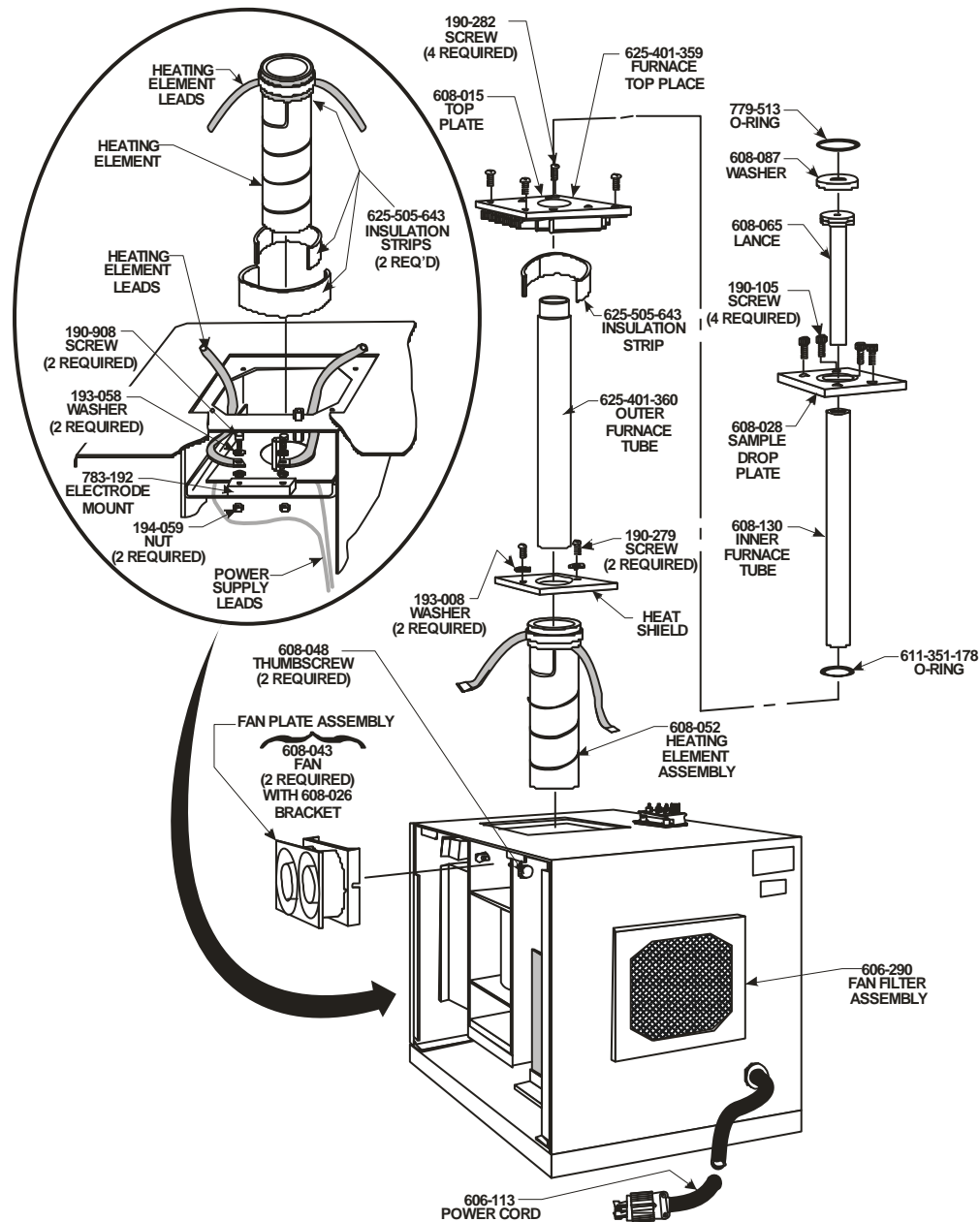


Figure 3-12
Heating Element Installation

Packing and Installing the Furnace Tubes

1. Remove the Right Side Panel of the TruSpec Oxygen Furnace.
2. Remove the Load Head, Sample Drop Plate, Top Plate and Heat Shield.
3. Very lightly lubricate the bottom inside of the outer furnace tube with 616-529 Vacuum Grease.
4. Insert the outer furnace tube into the heating element. The outer furnace tube will meet resistance as it is pushed past the o-ring seal. Before the outer tube is fully in place wrap insulation around the tube near the top (the insulation will be placed between the inner heating element and outside of the outer combustion tube to help keep heat within the furnace area). Refer to Figure 3-14 on page 3-42. Continue to push the outer furnace tube until it is firmly seated.
5. Install the Heat Shield and Top Plate on the furnace.
6. Place the 601-351-178 O-ring around the outer furnace tube.
7. Reinstall the Sample Drop Plate and insert the 779-513 o-ring into the groove on the sample drop plate.
8. Roll the graphite pad and insert it into one end of the inner furnace tube until there is a $\frac{1}{2}$ inch recess between the graphite pad and the end of the inner furnace tube. Refer to Figure 3-14 on page 3-42.
9. Very lightly lubricate the bottom inside of the inner furnace tube with 616-529 Vacuum Grease.
10. Insert the inner furnace tube, graphite pad end down, into the outer furnace tube. The inner furnace tube will meet resistance as it is pushed past the o-ring seal. Continue to push the inner furnace tube until it is firmly seated.
11. Pour 2.25 grams of carbon black powder into the inner furnace tube using the funnel.
12. Insert the crucible extractor tool into a 606-026 Graphite Crucible and lower it into the furnace until it is resting on the carbon black powder.
13. Release the crucible and remove the crucible extractor tool.
14. Lower the graphite lance carefully into place.
15. Install the 608-087 Washer (heat shield) on the lance assembly
16. Reinstall the Load Head and Right Side Panel.

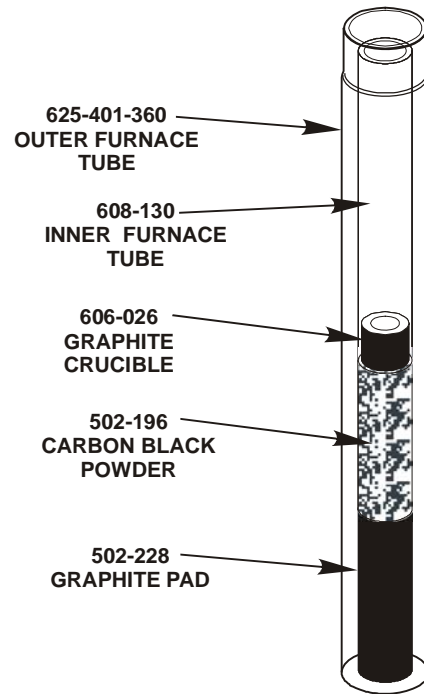


Figure 3-13
Packing the Furnace Tube

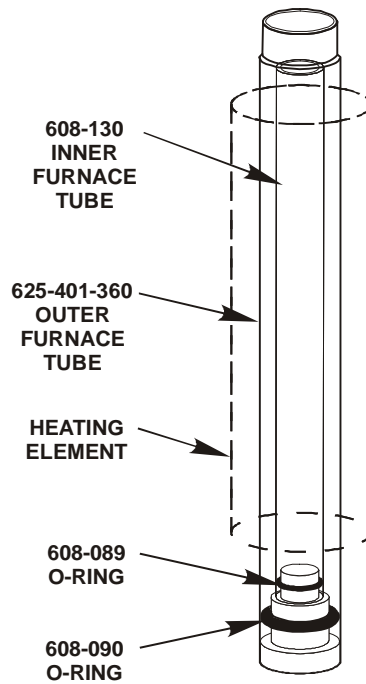


Figure 3-14
Seating the Furnace Tube

Helium Regulator

Notes

- *It will be necessary to perform this procedure unless the instrument was modified for micro analysis.*
 - *If the instrument was modified for micro analysis skip this procedure and continue with Loading Head and Gas Lines on [page 3-46](#).*
1. Place the unit's Power ON/OFF switch in the OFF position and disconnect the unit from facility power.
 2. Turn OFF all gas supplies to the unit.
 3. Remove the unit's right side panel, left side panel and top panel.
 4. Working from the top of the unit, locate the helium regulator figure 3-15 below. Note that the IN port is in an upward position. Remove the two screws that secure the regulator to the Helium regulator manifold block and then remove the regulator. Rotate the regulator 180° and then reinstall the regulator to the Helium regulator manifold block using the screws previously removed.

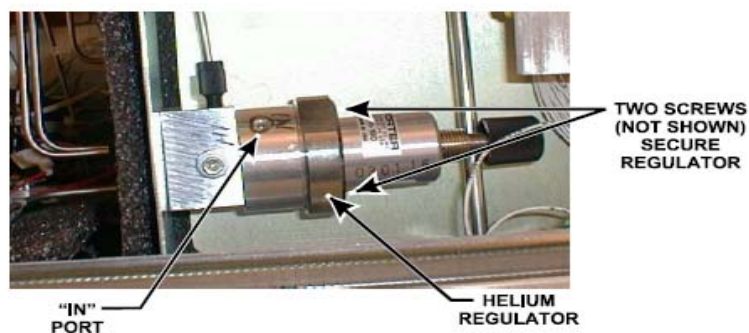


Figure 3-15
Helium Regulator

5. Install the 619-729 Tube from the top port in the helium regulator manifold and the front port on the flow controller figure 3-16 below. Use a 617-484 Nut and 617-485 Ferrule on each end of the 619-729 Tube. The 617-484 Nuts can be tightened with the 617-486 Nut Tool.

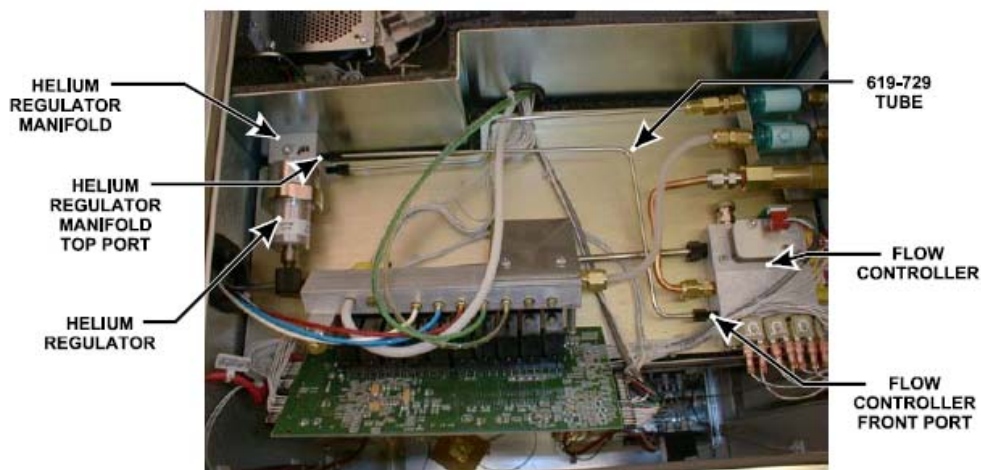


Figure 3-16
619-729 Tube Installation

6. From the left side of the unit, remove the existing tube that is connected from the regulator to the incoming scrubber. Also remove the existing tube connected from the regulator to the TC manifold number 4 port.

7. Refer to figure 3-17 and connect the 619-731 Tube between the incoming scrubber port and the Helium OUT port. Use a 617-484 Nut and 617-485 Ferrule on each end of the tubing. The 617-484 Nuts can be tightened with the 617-486 Nut Tool.
8. Refer to figure 3-17 and connect the 619-732 Tube between the Helium IN port and the TC Manifold #4 port. Use a 617-484 Nut and 617-485 Ferrule on each end of the tubing. The 617-484 Nuts can be tightened with the 617-486 Nut Tool.

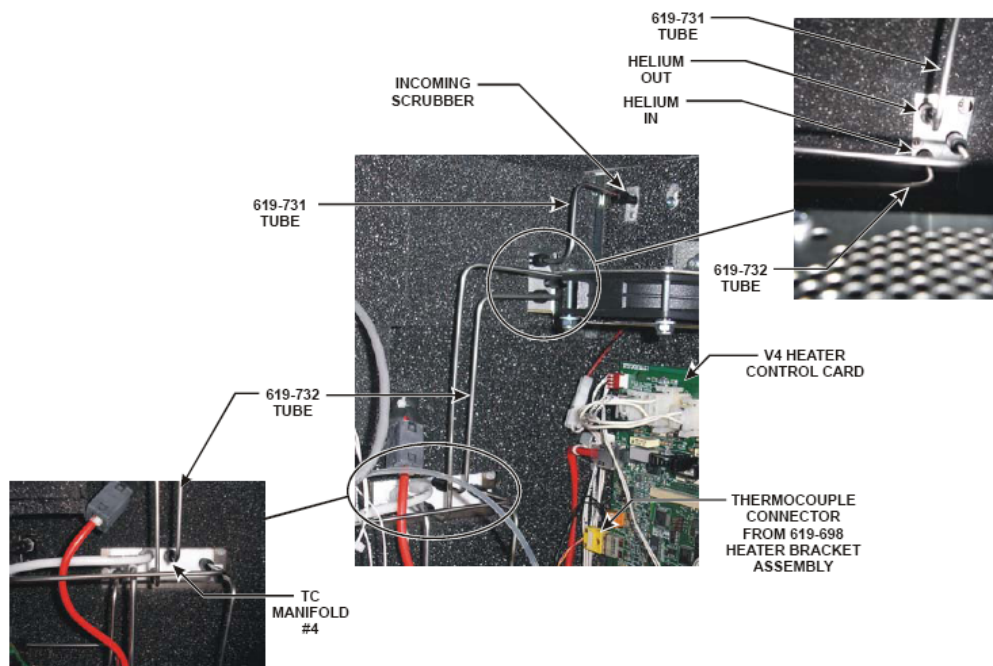


Figure 3-17
619-731 and 619-732 Tube Installation

Loading Head and Gas Lines

Note

- *Do not perform this installation until analyzing samples in the oxygen mode. When switching from the oxygen mode to any other mode, the determinator must be restored to the original set up.*
1. Turn OFF the gas supplies.
 2. Remove the loading head, lance and crucible from the determinator oxidation furnace then install the furnace adapter plate and 602-803 O-ring. Secure with the thumbscrews. Refer to Figure 3-22 on page 3-52.
 3. Turn the AC power OFF to the determinator.
 4. Remove the right side panel of the determinator. This panel will no longer be used.
 5. Locate and remove J512X from the Distribution Card and connect it to J512AI. Refer to figure 18 on page 3-48.
 6. Locate the 660-010-142 AC Power Harness and install connectors J512Z and J512AG to their respective connectors on the distribution card. If there is a connector already installed at J512Z then plug connector J512Z, from the harness, into J512X on the power distribution card.
 7. Place the new 660-010-143 right side panel near the right side of the determinator.
 8. Install the connector labeled J512AM, from the right side panel, to connector J512AM on distribution card. Refer to figure 18 on page 3-48.
 9. Install a red 618-044 Cable from J514A, on the right side panel, to J512Q on the distribution card.
 10. Install the green yellow ground wire to the chassis using a 190-277 screw and 193-008 washer.
 11. Install connector J514F from the AC power harness to connector J514F on the right side panel. Refer to figure 3-12 on page 3-49.
 12. Push the green yellow wire from the AC power harness over the ground terminal on the right side panel.
 13. Install the yellow thermocouple plug, from the catalyst heater, to connector TB1A on the catalyst heater control card located on the inside of the right side panel. Refer to figure 3-19 on page 3-49.
 14. Connect one end the 660-010-154 Adapter Cable to the cable from the catalyst heater, and connect the other end to J514C on the catalyst heater control card. Refer to figure 3-19 on page 3-49.

15. Disconnect the input tubing to the carbon IR cell. Refer to figure 3-20 on page 3-50.
16. Push the 601-691-001 Tubing over the barb fitting that was exposed when the original tubing was removed from the IR cell. Slide the tubing coming from the catalyst heater into it and then secure it with a 619-405 hose clamp. The disconnected tubing will hang free in the determinator.
17. Install the new right side panel, with catalyst heater, to the determinator using the hardware from the original side panel..
18. Turn on the AC power to the determinator.
19. Access the TruSpec software.
20. Click Configuration and select System. Click Enable Oxygen Add-On.
21. Connect tubing, between the TruSpec Determinator and TruSpec Oxygen Furnace as shown in figure 3-22 on page 3-52. Use 615-830-019 tubing and the 625-501-568 tubing assembly.
22. Remove the Aliquot Scrubber reagent tube and replace it with an empty tube. LECO P/N 619-268. Refer to Reagent Tube Packing on page 2-11 for location.
23. Turn the Gas Supplies ON.
24. Perform the Leak Check procedure. If it indicates any leaks in the system, first test the carrier and analyze flow lines using the leak detection solution.
25. Plug in the furnace and turn the AC power ON. Set the furnace temperature by pushing the temperature set dial (located on the front of the furnace) in, then turning it clockwise to set the furnace temperature to 1300°C.
26. Allow 20 to 30 minutes for the furnace to reach operating temperature. If the carbon black powder is fresh, allow an additional 15 minutes for the carbon to be "baked-off" before performing an analysis.

Conversion Back to CHN/CHNS

1. To convert the system back for CHN/CHNS analysis:
 - A. Press F8 and turn the gas OFF.
 - B. Set the TruSpec Oxygen furnace temperature to zero. When the temperature is below 600°C, relieve the furnace pressure by removing the reagent tube on the front of the Oxygen furnace.



If the internal pressure is not relieved before removing the loading head, carbon black powder will clog the loading head and coat the work area.

- C. Remove the Micro Interface Block and replace the lance and determinator load head.
- D. Remove the Right Side Panel of the determinator.
- E. Disconnect the gas tubing from the carbon IR cell to the catalyst heater on the side panel and connect the original tubing that was removed for Oxygen analysis.
- F. Install the Right Side Panel.
- G. Remove the empty Aliquot Scrubber tube and replace it with the packed tube. Refer to Reagent Tube Packing on page [2-11](#).
- H. Press F8 and turn the gas ON.
- I. Click Configuration and select System. Click Disable Oxygen Add-On.

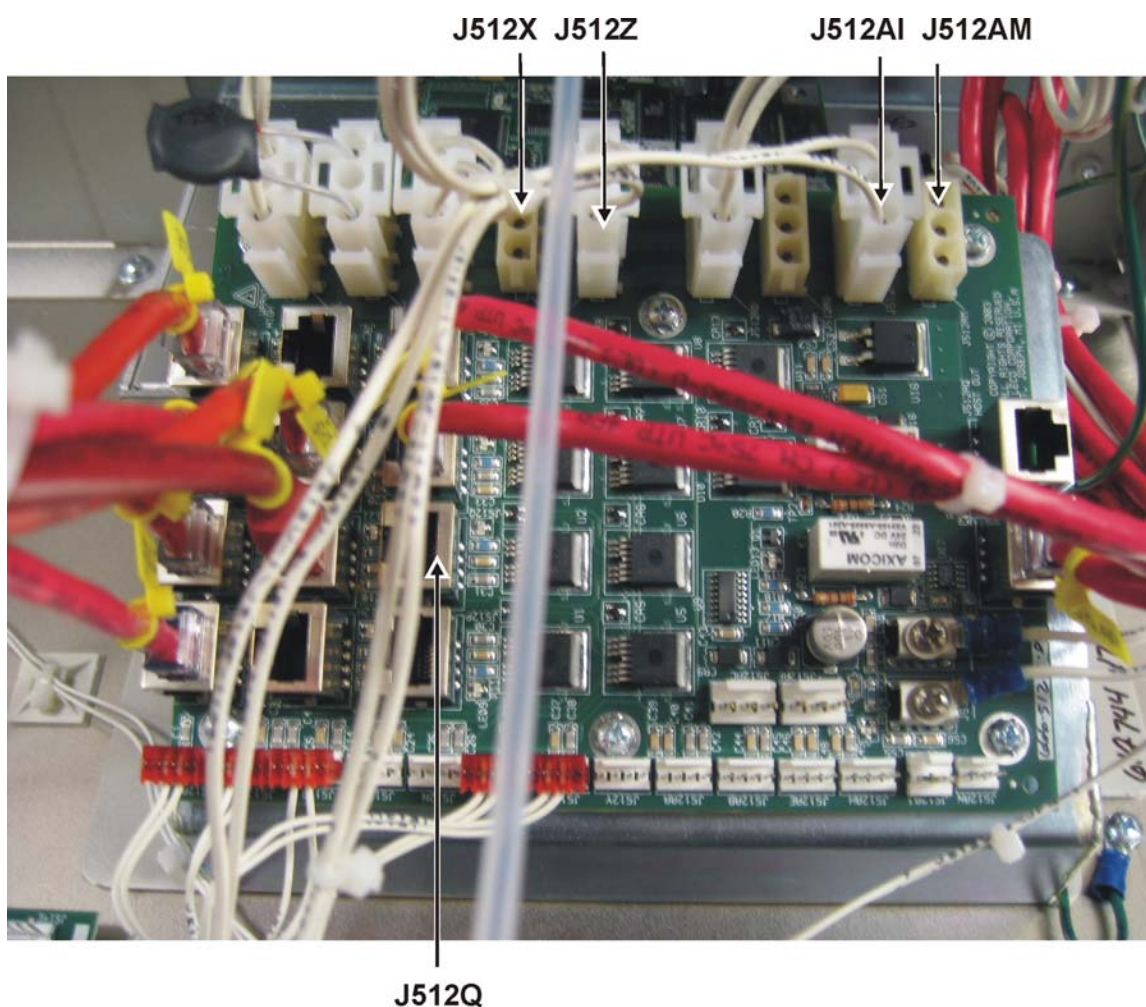


Figure 3-18
Distribution Card

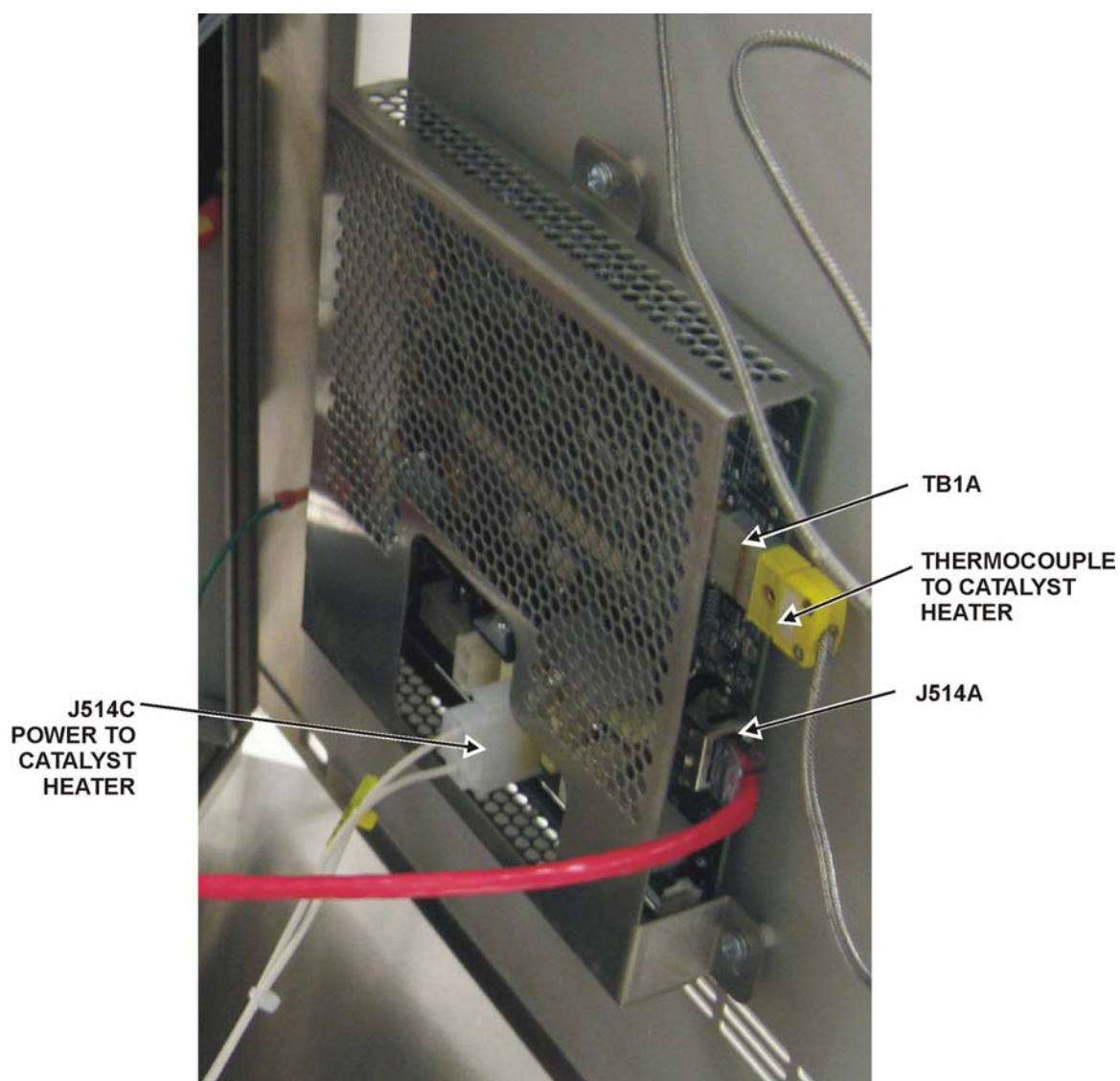
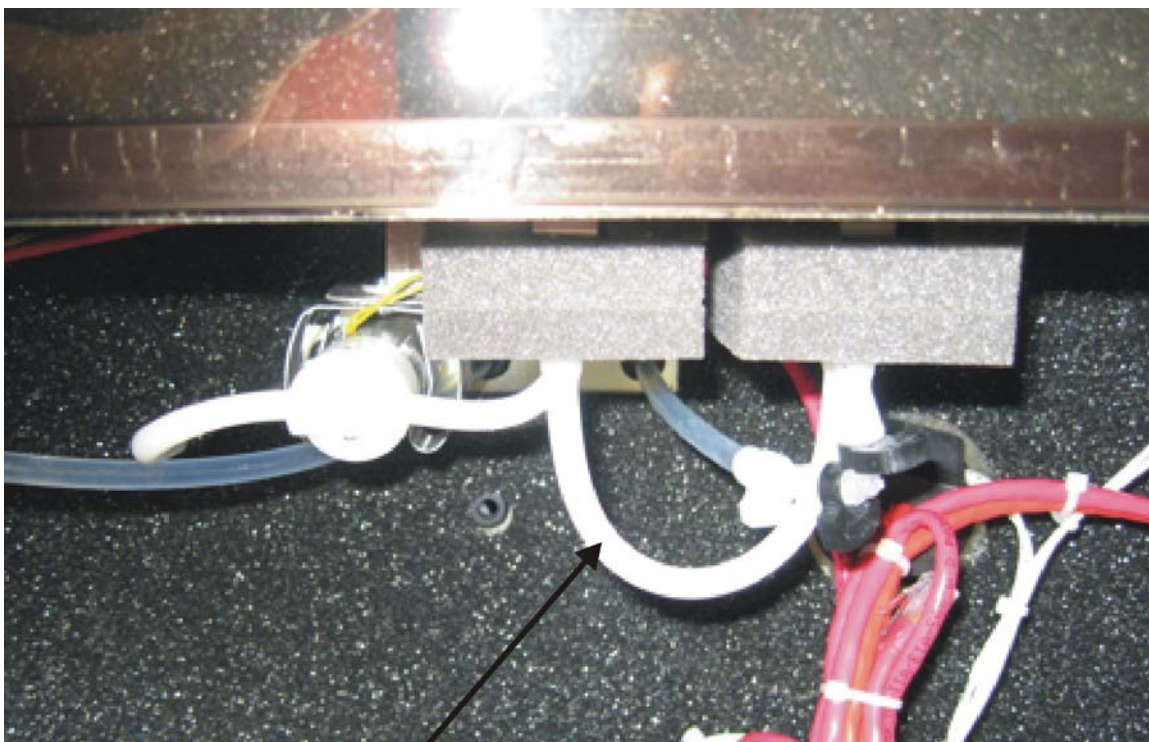


Figure 3-19
Catalyst Heater Control Card



DISCONNECT THIS TUBING, LET IT HANG, INSTALL TUBING FROM CATALYST HEATER TO BARB.

Figure 3-20
Carbon IR Cell Tubing Connection



Figure 3-21
Catalyst Heater Gas Connection

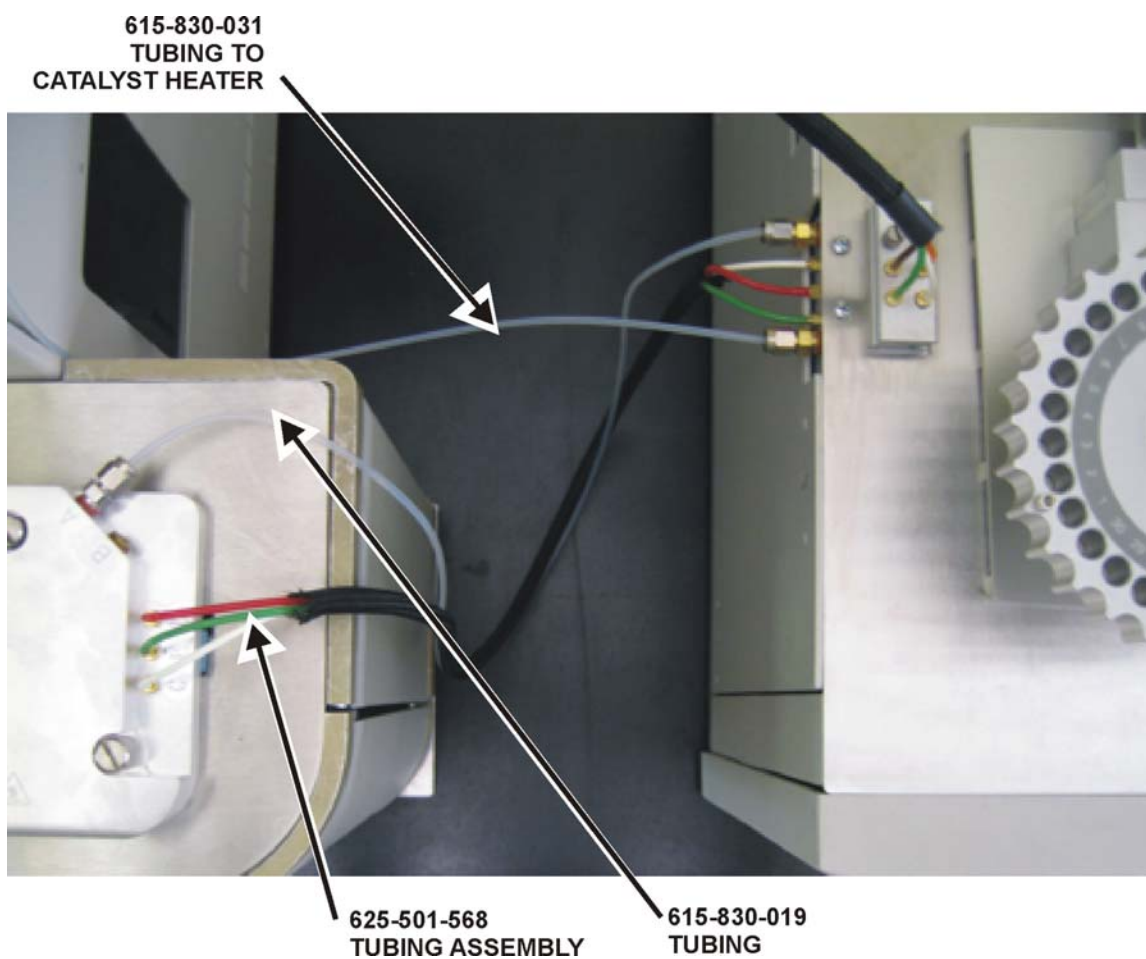


Figure 3-22
Oxygen Add-On Interface

Oxygen Catalyst Tube Packing

→
Note

- *The Oxygen Catalyst Heater is located on the right side panel of the determinator.*



→
WARNING

Use caution to prevent serious burns. If the catalyst tube is being repacked wait for the catalyst heater to cool performing the steps below.

1. Loosen the Screw in the Removal Block and remove the block from the top of the catalyst heater tube. Pull the catalyst heater down and remove the tube. Refer to Figure 3-23 on page [3-54](#).
2. Push the 501-621 Copper Turnings into the catalyst heater tube until one inch of the tube is filled. The copper turnings should rest at the neck above the narrow section of the tube.
3. Pour 50 grams 501-170 Rare Earth Copper Oxide onto the copper turnings until approximately $\frac{3}{4}$ of the tube is filled or the bottle is empty.
4. Insert the packed catalyst heater tube into the catalyst heater and push it over the o-ring on the lower block.
5. Push the catalyst heater up and install the Removal Block.

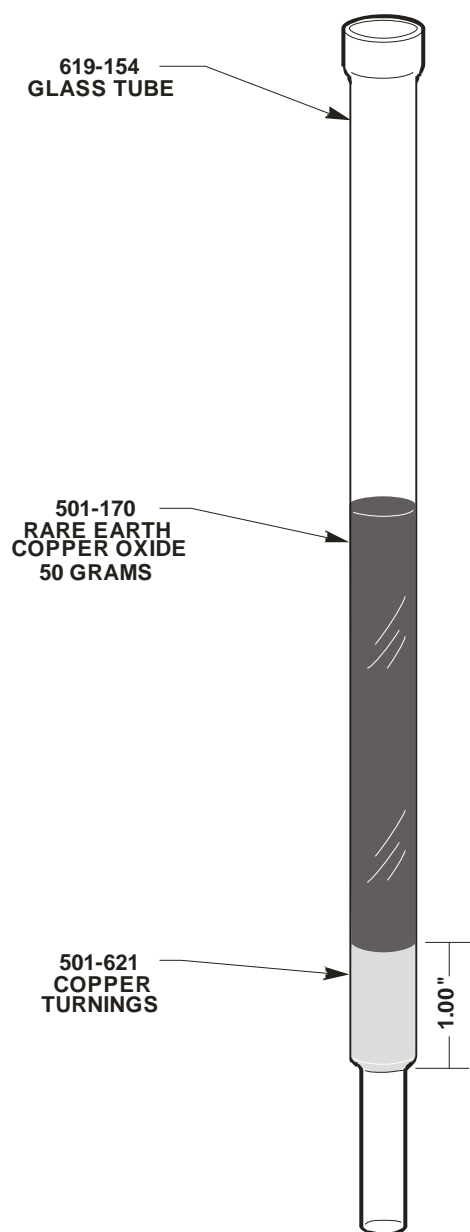


Figure 3-23
Oxygen Catalyst Heater Tube Packing

Operation

Controls and Indicators

Power On/Off Switch—Switches power on and off to the furnace. Also acts as a circuit breaker on the incoming facility line power. Located on the left side of the furnace.

Temperature Display—This LED window displays the set and current furnace temperatures.

Temperature Set Dial—Push this dial in and turn it to set the furnace temperature, clockwise for an increase, counterclockwise for a decrease. Release the dial when the temperature is properly set. The current temperature is shown on the display. Analysis can begin once the furnace displays the set temperature. Nominal temperature is 1300°C.

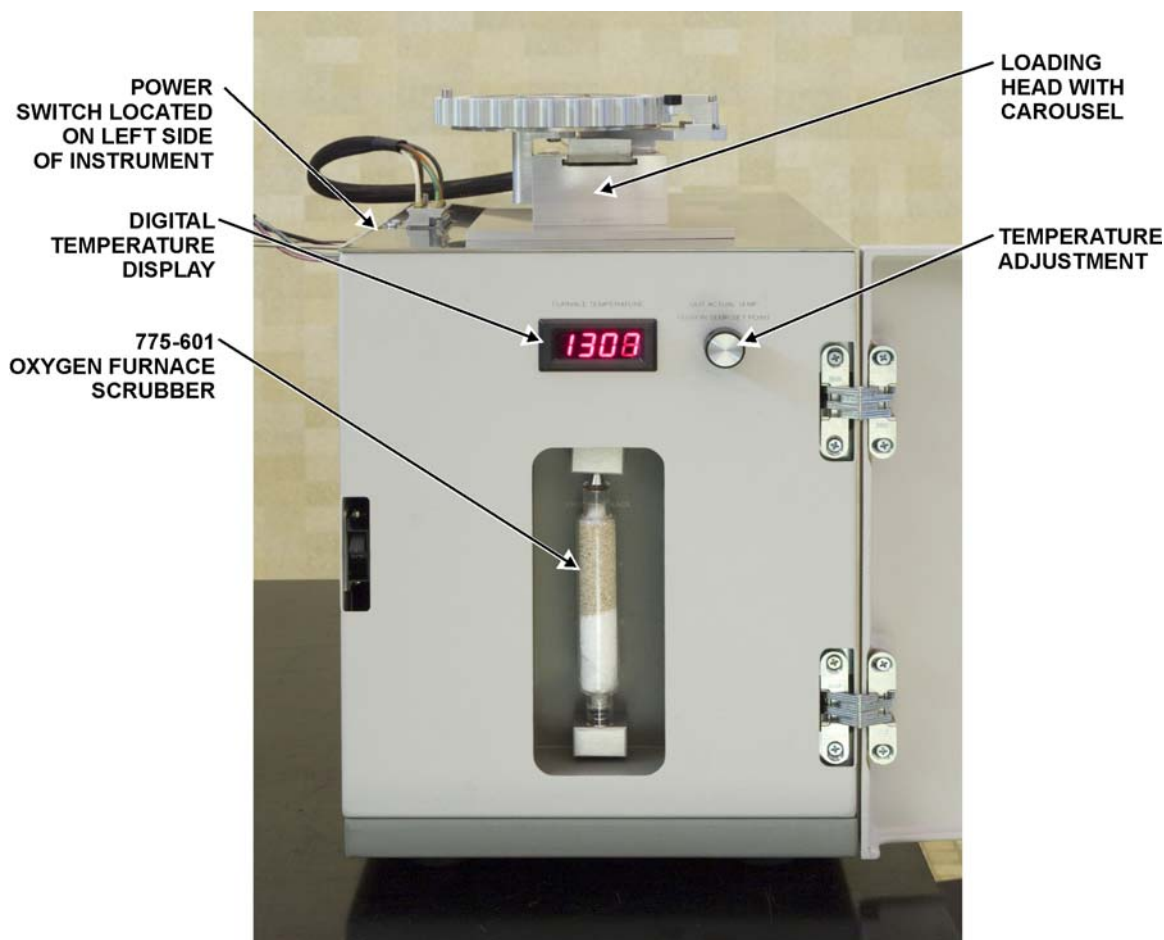


Figure 3-24
Controls and Indicators

Setup

1. Turn the AC power and gas supplies ON to both the TruSpec Micro Determinator and TruSpec O furnace.
2. Set the TruSpec O furnace temperature to 1300°C. Refer to Controls and Indicators on page 3-55.
3. Select the Configuration menu and click System. The System Configuration screen will appear.
4. Click the Micro Oxygen drop down arrow and select Enable.

System Configuration - TruSpec

System | Balance

Gas Conservation Timeout: 15 1 - 600 minutes

Auto Increment Sample Name: Enable

Nominal Mass mg: 1000

Sample Loading: 1 Carousels

Liquid Autosampler Port: COM2

Furnace Standby Temperature: 950

Sample Mass: Micro (up to 10 mgs)

Micro Oxygen: Disable

☐ CO2 Low Genesis II

☐ H2O Genesis II

Print

OK Cancel Help

5. Click OK. A dialog box may appear reminding the operator to connect the gas lines from the determinator to the TruSpec O. Verify that the gas lines were installed and click OK.

6. Select the Configuration menu and click Methods. The Method screen will appear.
7. Create a Method for oxygen analysis. Refer to Create a Method on page 4-39. To start use the values in the table below. If necessary the values may be changed to meet your needs.

| | |
|--------------------------------|------------|
| Analysis Parameters | |
| Combustion Furnace Temperature | 950°C |
| Afterburner Temperature | 850°C |
| Element Parameters | |
| Analyze | Yes |
| Baseline Delay Time | 15 seconds |
| Minimum Analysis Time | 60 seconds |
| Comparator Level | 1.00 |
| Ending Time | 1 second |
| Conversion Factor | 1.00 |
| Significant Digits | 5 |

8. Select the Configuration menu and click Counters. The Maintenance Counters screen will appear. The oxygen counters may be left at the factory defaults, listed in the table below, or edited as desired. Refer to Configure Maintenance counters on page 6-46.

| | Oxygen Add-On Reagents | Oxygen Add-On Scrubber |
|--------------|-------------------------------|-------------------------------|
| Type | Analyses | Analyses |
| Count Blanks | Yes | Yes |
| Count | 0 | 0 |
| Warn | 500 | 600 |
| Stop | 0 | 0 |
| Resets | 4 | 4 |

Sample Preparation

- **Note**
- *Tin capsules should be used for oxygen analysis.*

Sample preparation for the TruSpec O is the same as sample preparation for the TruSpec CHN Micro. Refer to page [3-23](#).

Sample Analysis

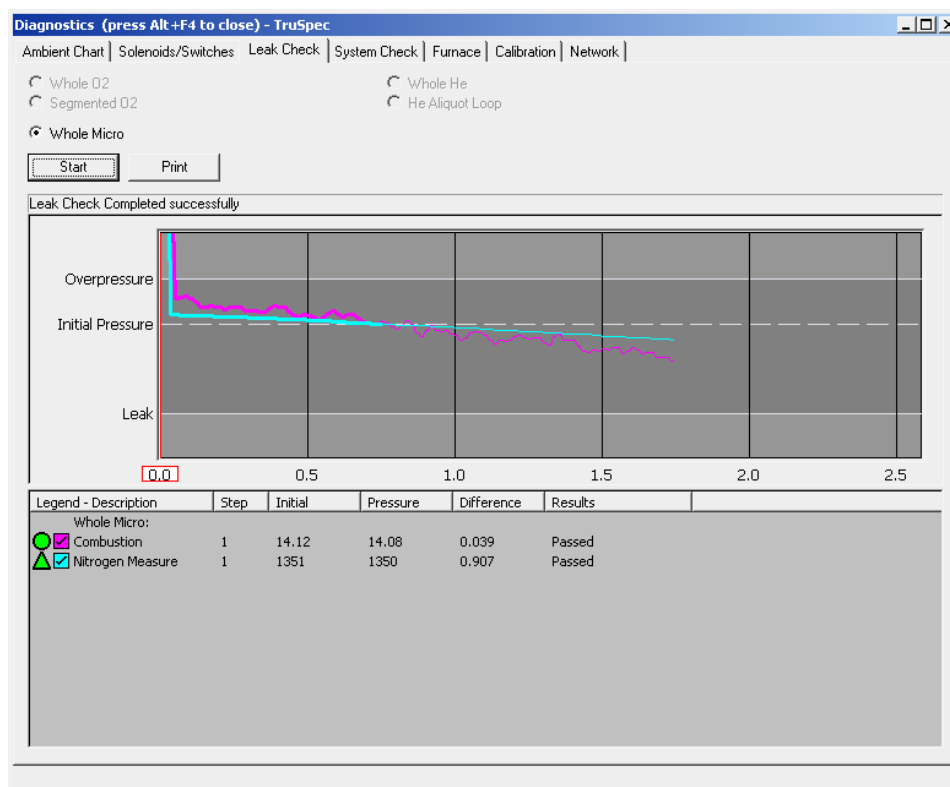
After setup and method development, oxygen analysis with the TruSpec O is the same as oxygen analysis with the TruSpec CHN Micro. Refer to Sample Analysis on page [5-27](#).

Leak Check, TruSpec Oxygen

Notes

- To perform a leak check click Start. Whole micro will automatically be selected. This is the only selection available.
- This procedure checks both the determinator and the Oxygen Add-On.
- To perform a leak check refer to the Leak Check procedure on page 8–22.

Leak Check Screen Example



Periodic Maintenance, Oxygen Add-On

The following schedule is a list of maintenance procedures that should be performed on a regular basis. For more information concerning periodic maintenance and periodic maintenance procedures, refer to the individual topics.



TRUSPEC OXYGEN ADD-ON

In order to obtain the best possible analysis results periodic maintenance must be performed at the intervals listed below.



Before performing any of the procedures listed below, cool the furnace to $< 600^{\circ}\text{C}$ and relieve the furnace pressure by removing the reagent tube on the front of the oxygen furnace. If the internal pressure is not relieved before removing the loading head, carbon black powder will clog the loading head and coat the work area.

| Maintenance Item | Location of Maintenance Item | Inspection, Cleaning, and Maintenance Interval |
|---|---|---|
| Catalyst Heater (Oxygen Furnace) | Located on right side panel of determinator. | Replace every 6000 analysis. Refer to page 3-53 . |
| Crucible | Inside furnace combustion tube | Replace every 100 analyses. Refer to page 3-41 . |
| Oxygen Furnace Scrubber | Behind front door of oxygen add-on. | Check daily and repack when anhydron cakes or lecosorb changes colors, about 600 analyses. Refer to page 3-38 . |
| Oxygen Furnace Reagents (carbon black). | Oxygen Add-On combustion tube. Turn gas off, reduce furnace temperature, wait a few minutes for pressure to drop to zero, remove inner combustion tube. | Replace every 500 analyses. Refer to page 3-41 . |
| Sliding Block and Loading Head | On top of the Oxygen Add-On Furnace. | The Loading Head should be inspected weekly and cleaned as necessary. Refer to page 3-61 . |

Sliding Block and Loading Head Cleaning

→
Notes

- *The sliding block and loading head should be inspected weekly and cleaned as needed.*
 - *The oxygen furnace temperature must be less than 600°C before this procedure is performed.*
 - *Refer to Figure 3-21 on page 3-55 when performing this procedure.*
1. Set the Gas Switch OFF.
 2. Remove the Carousel if used.
 3. Briefly left up the Reagent tube located on the front of the oxygen furnace too remove system pressure. Refer to Figure 3-24 on page 3-55.
 4. Loosen the Screw and remove the Pneumatic Gas Manifold Assembly from the top of the TruSpec O. Refer to Figure 3-29 on page 3-69.
 5. Remove the Handle Pin. This pin holds the sliding block to the piston shaft. Refer to Figure 3-21 on page 3-69.
 6. Remove the Slide Block, if the viewing port is dirty or if it is suspected that the internal o-ring may be leaking, remove the viewing port piston by applying a low pressure to the pneumatic fitting. Clean the port and window in the slide block.
 7. Clean the seal piston windows and all surfaces. Clean and lightly grease the Seal Piston O-rings, replace the o-ring if it is worn or damaged.
 8. Clean and lightly grease the O-ring on the bottom of the sliding block with silicone grease, replace the o-ring if it was worn or damaged.
 9. Clean all surfaces of the Loading Head Block exposed by the removal of the sliding block.
 10. Reinstall the Seal Piston with O-rings. The piston is installed correctly if the seal o-ring is exposed.
 11. Loosen the thumbscrews and place the Loading Head Assembly on a work surface.
 12. Turn the Loading Head Upside down and inspect the underside. If it is clean and you suspect no leaks, skip to step 16, otherwise perform the following steps.
 - A. Remove the two screws in the large cylinder mounting block.
 - B. Remove the Locating Pin screw from the side of the loading head.
 - C. Remove, clean and lightly grease the o-ring, located inside the locating pin screw hole.

- D. Remove the Cylinder and Piston (inside the loading head). Clean the piston and piston port hole. If there is scoring on the piston, replace it. Clean and lightly grease the small and two larger o-rings.
- E. Replace the Cylinder Mounting Block making sure the groove on the piston is aligned with the locating pin screw on the side of the block. Align the sample hole by manipulating the piston as it is reinserted into the loading head. Replace the screws in the cylinder mounting block. The head of the locating pin screw should be flush with the side of the loading head, seated against the o-ring and forming a seal against the piston hole. Don't force the pin screw in. It will damage the piston if not aligned properly.

Note

- *If needed, replace the gas manifold to get the piston to fully extend into the block. The use of a $\frac{7}{32}$ hex wrench, or similar diameter tool, inserted into the block sample hole through the piston hole from the bottom can aid in alignment of the groove for the alignment pin screw.*

- 13. Clean and lightly grease the O-ring on the sample drop plate.
- 14. Reinstall the Loading Head Assembly.
- 15. Replace the Sliding Block and secure it with the handle pin. If the pin does not slide in easily, realign the hole in the cylinder shaft
- 16. Reinstall the Gas Manifold Assembly and tighten the screw to secure it.
- 17. Perform a Leak Check.

Furnace Temperature Adjustment



ELECTRICAL SHOCK HAZARD

Hazardous voltages are present within this unit. Use caution when performing this procedure.

1. Set the gas switch Off.
2. Set the furnace power switch Off and disconnect the furnace from the facility power.
3. Remove the furnace right side panel and locate the Furnace Control Card. Refer to Figure 3-25 on page [3-64](#).
4. Controls R55, R56 and R64 have been set at the factory. If these controls should need adjustment, locate the controls and adjust control R55 to the 10 o'clock position, R56 to the 2 o'clock position and R64 to the 11 o'clock position. The middle range of the controls is the 12 o'clock position.
5. Turn R65 completely counter clockwise to set the current limit to zero.
6. Turn the furnace temperature control completely counter clockwise to set the temperature to zero.
7. Plug the furnace in and set the power switch On.
8. Observe the control card.
 - A. The yellow LED should be on.
 - B. The red LED should be off.
9. Place the positive (+) terminal of the digital voltmeter on TP1. Place the ground terminal on TP9. Adjust R3 (Over-temperature) until the digital voltmeter reads 7.15 volts at TP1.
10. Place the positive (+) terminal of the digital voltmeter on TP10. Leave the ground terminal on TP9. Adjust R24 until the digital voltmeter reads 0.28 volts at TP10.
11. Remove the digital voltmeter.
12. Turn the furnace temperature control clockwise to set the furnace to desired operating temperature (nominal is 1300°C).
13. Slowly adjust R65 (Current Limit) until the digital voltmeter reads 0.185 volts at TP8. As R65 is adjusted, the red LED should light up and the yellow light should be off. The heating element will be receiving current and the furnace should begin ramping to set temperature.

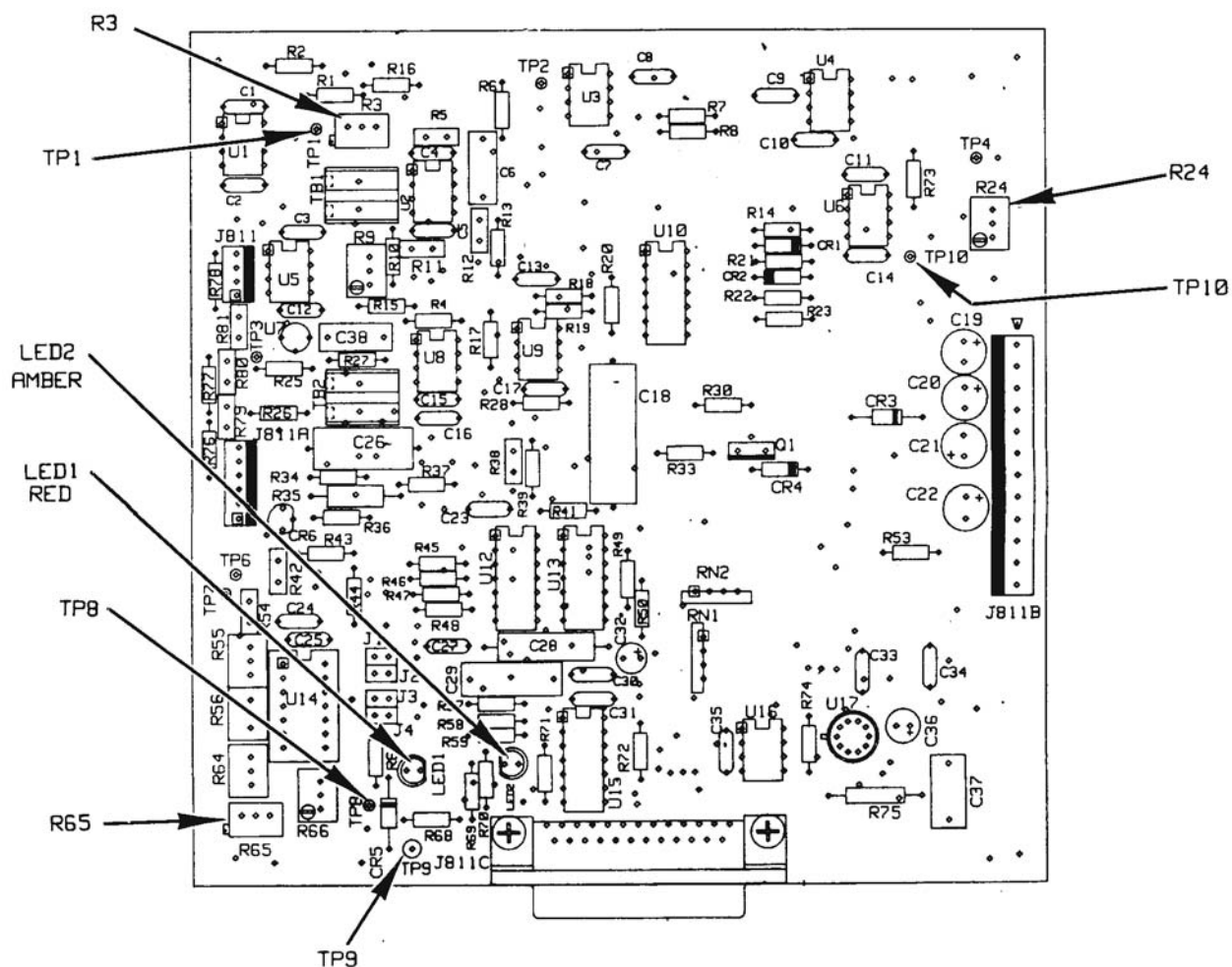


Figure 3-25
Furnace Control Card

Illustrations, TruSpec Oxygen

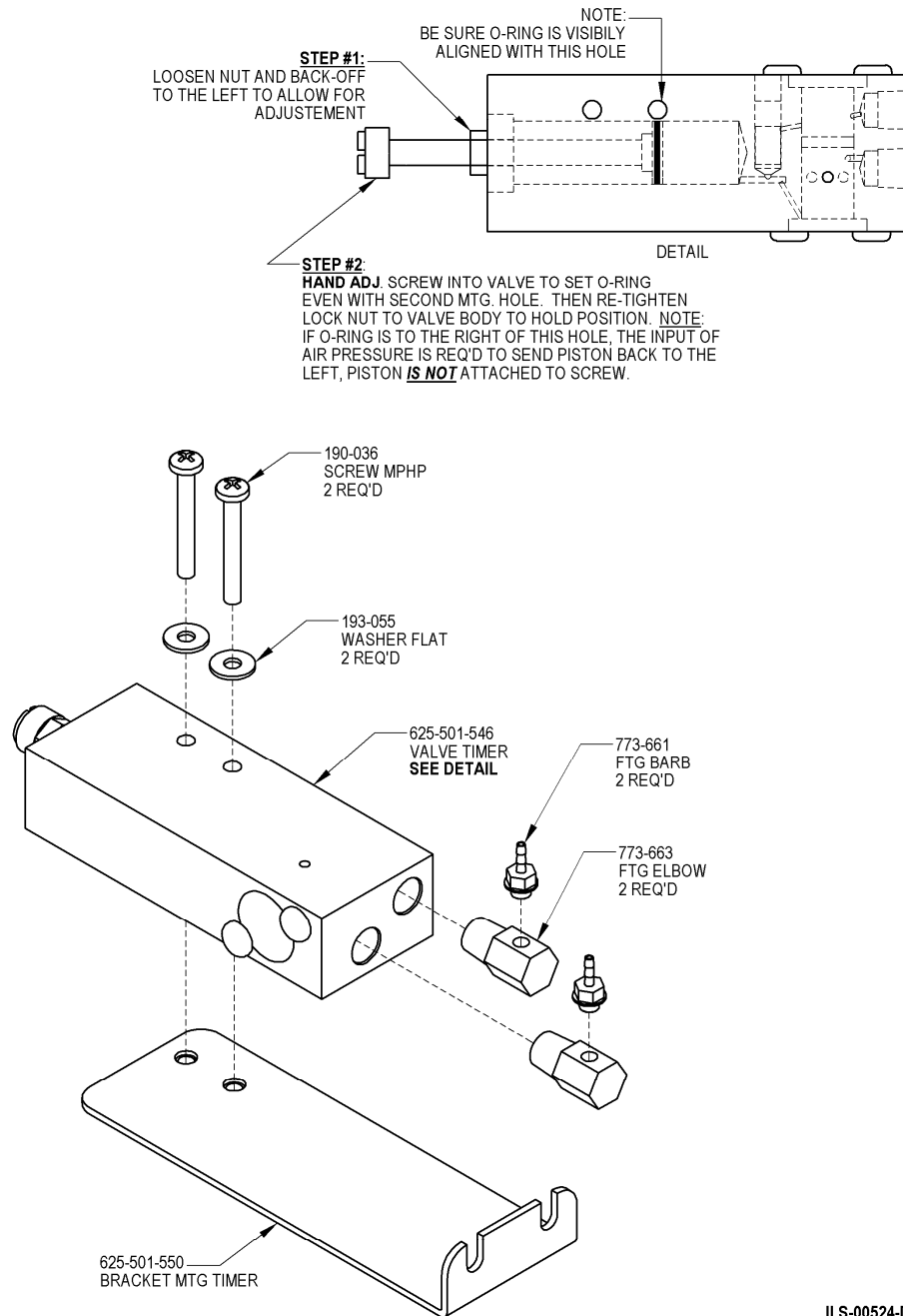
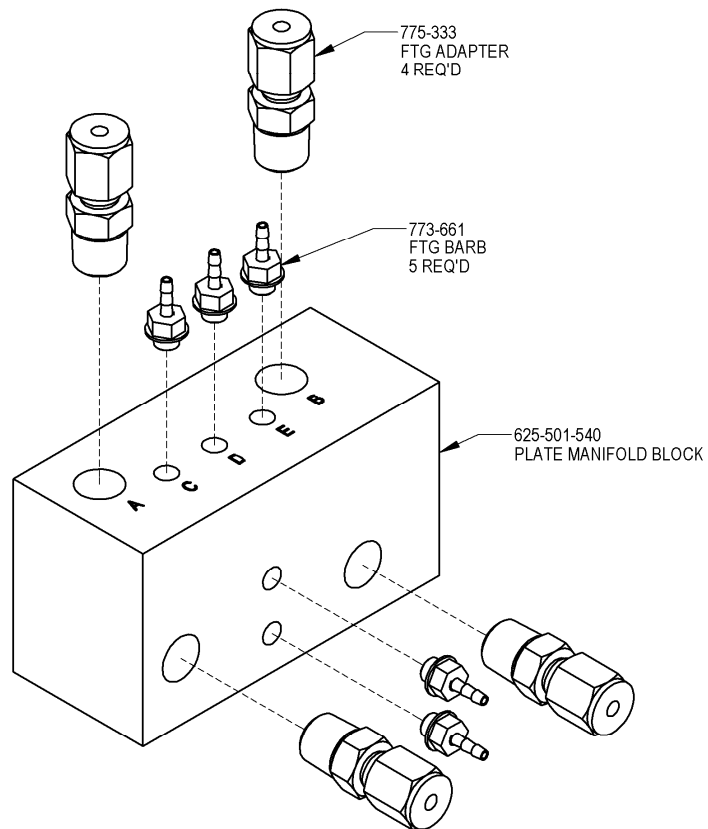
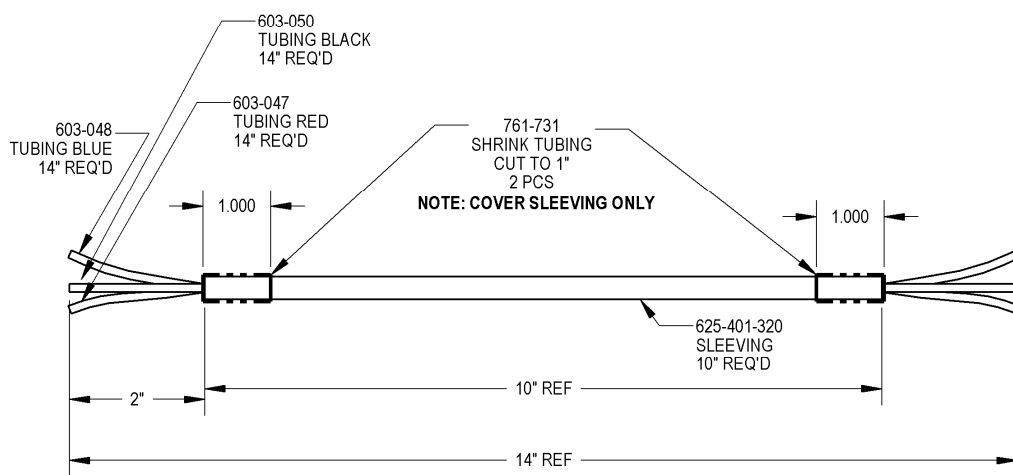


Figure 3-26
Timer Valve Assembly



ILS-00526-A

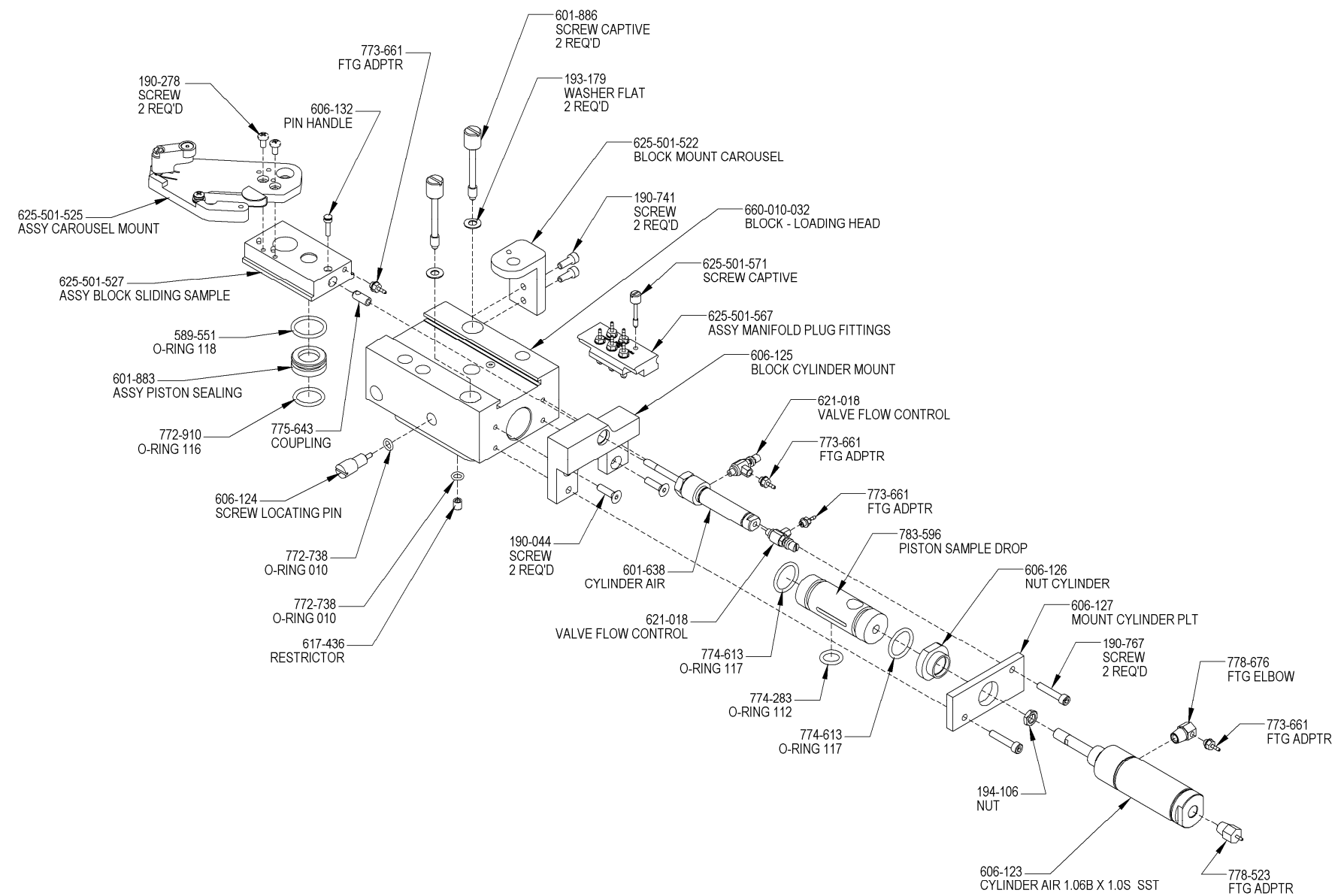
Figure 3-27
Manifold Assembly



ILS-00527-A

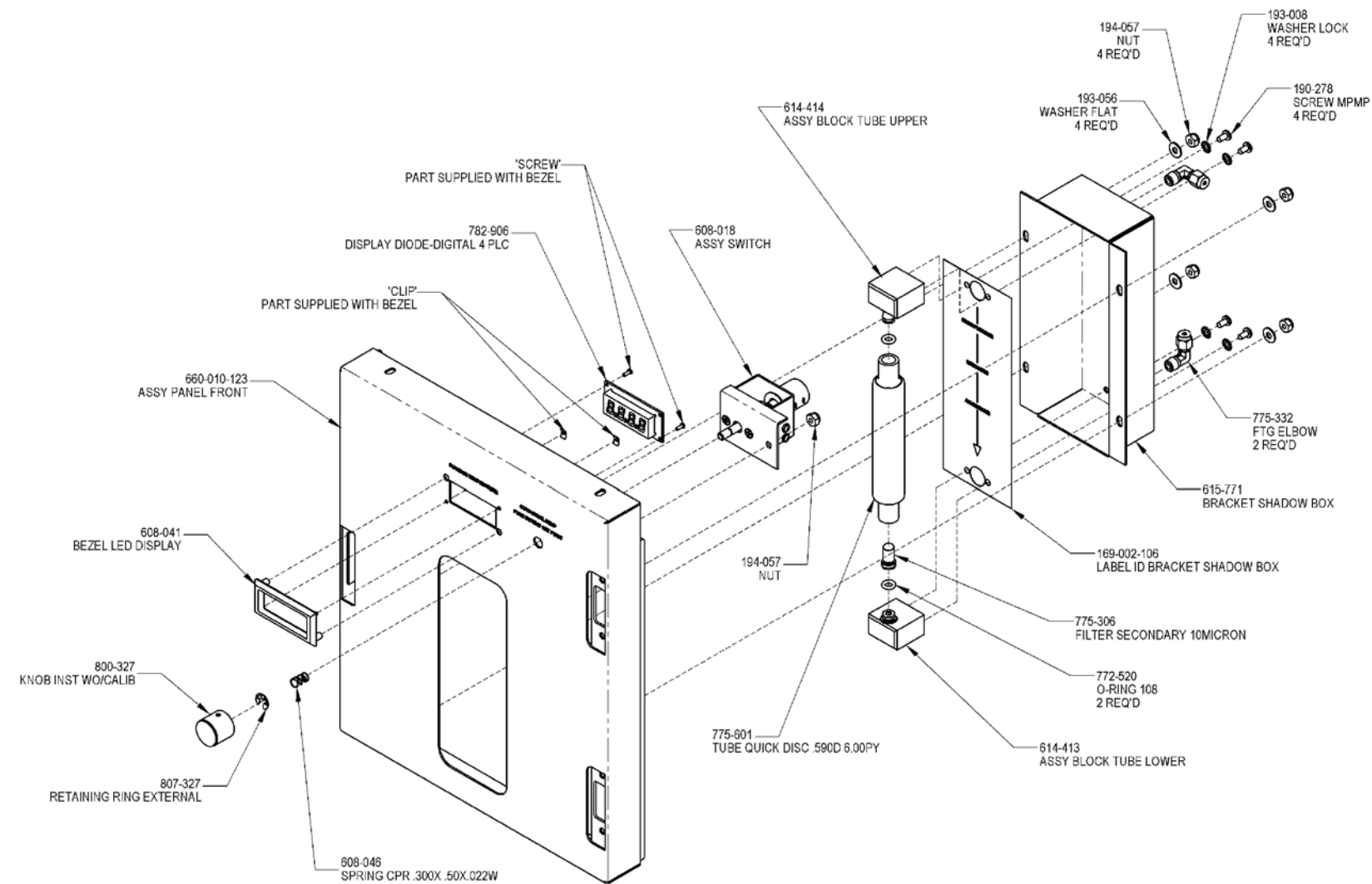
Figure 3-28
Pneumatic Line Assembly

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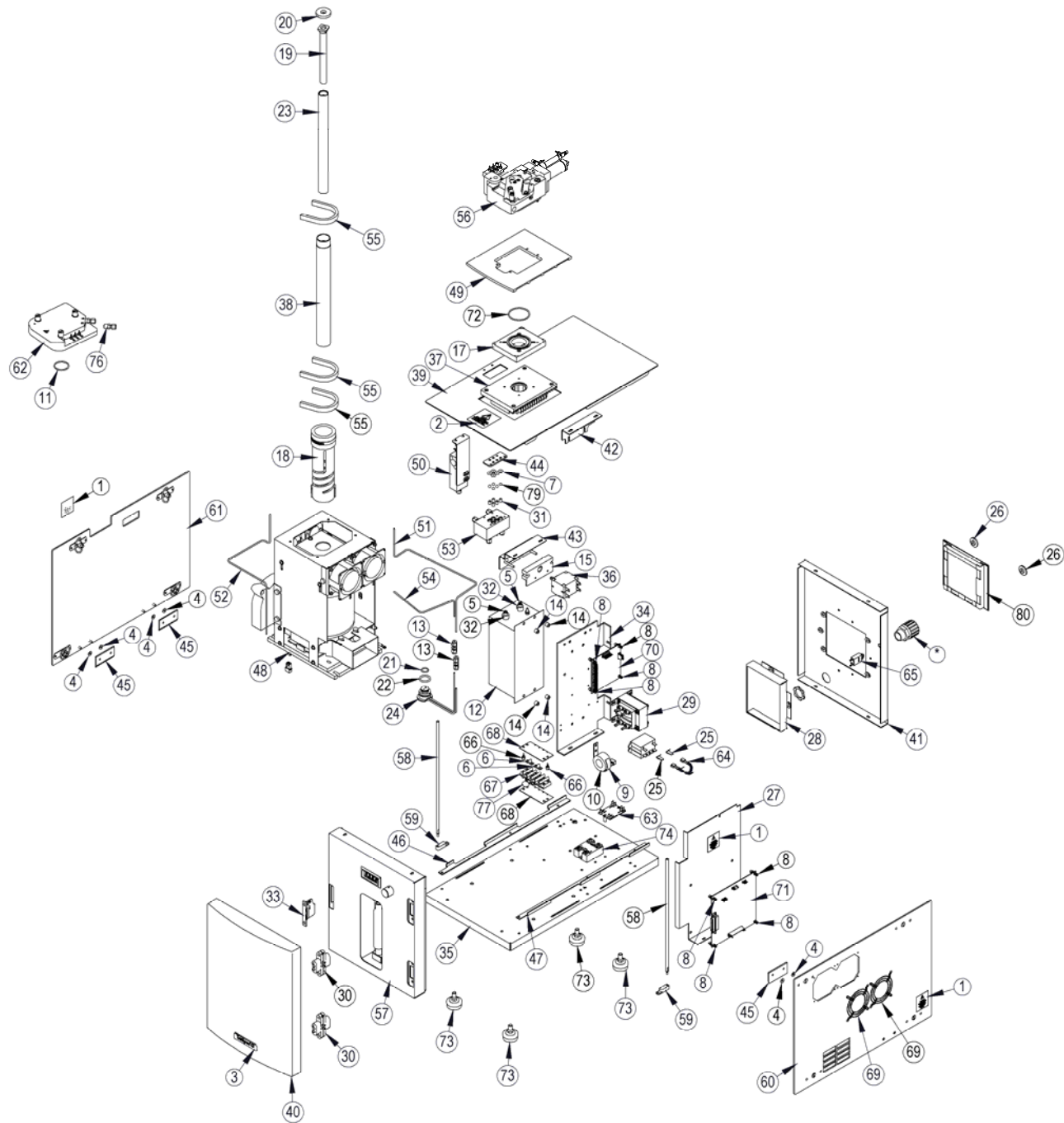
ILS-00523-E

Figure 3-29
Loading Head Assembly



ILS-00525-C

Figure 3-30
Front Panel Assembly



X = ASSY CARD REVISION AS INDICATED BY WORK ORDER OR KIT COMPONENT

| ITEM NO. | PART NUMBER | DESCRIPTION | ILS-00528/QTY |
|----------|-------------|---------------------------------------|---------------|
| 1 | 169-001-731 | LABEL WARNING CE HI VOLTAGE | 3 |
| 2 | 169-002-789 | LABEL CAUTION, REMOVE PRESSURE | 1 |
| 3 | 169-002-803 | LABEL ID TRUSPEC O | 1 |
| 4 | 193-055 | WASHER FLT 170X .437X.041TZP | 6 |
| 5 | 194-116 | NUT RND K 8-32X .28 NY | 4 |
| 6 | 540-132 | Strap-Connector Jumper Terminal Block | 2 |
| 7 | 601-505 | O-RING 201 171X .449X.139S | 5 |
| 8 | 602-581 | STANDOFF PC CARD .250 | 8 |
| 9 | 602-698 | BRACKET C CURRENT XFORMER RCG | 1 |
| 10 | 602-699 | ASSY TRANSFORMER CURRENT 100:1 | 1 |
| 11 | 602-803 | O-RING 125 1.290X 1.505X.103S | 1 |
| 12 | 603-787 | FILTER RFI 30 AMP | 1 |
| 13 | 604-399 | FTG UNION BR .12T - .12T | 2 |
| 14 | 604-422 | STANDOFF .192ID x .375OD x .310 ALUM | 4 |
| 15 | 606-585 | Mount Breaker Circuit Molded | 1 |
| 16 | 607-157 | RELAY DPST 24V | 1 |
| 17 | 608-028 | PLATE SAMPLE DROP | 1 |
| 18 | 608-052 | ELEMENT HEATING 7.75X3.00X2.12 | 1 |
| 19 | 608-065 | LANCE GRAPHITE | 1 |
| 20 | 608-087 | WASHER FLT .307X1.455X.25CER | 1 |
| 21 | 608-089 | O-RING 113 .549X .755X.103A | 1 |
| 22 | 608-090 | O-RING 212 .859X 1.125X.139A | 1 |
| 23 | 608-130 | TUBE QUICK DISC .950DX1.165GR | 1 |
| 24 | 608-133 | ASSY FITTING TUBE LOWER | 1 |
| 25 | 610-150 | TERMINAL LUG ADAPTER | 2 |
| 26 | 614-695 | TAB LOCKING | 2 |
| 27 | 615-770 | BRACKET CONTROL CARD | 1 |
| 28 | 615-774 | ASSY GUARD FILTER | 1 |
| 29 | 615-785 | Assy Transformer | 1 |
| 30 | 615-958 | Hinge Concealed Door Chrome | 2 |
| 31 | 617-212 | SPRING COMPRESSION GROUND ENDS | 5 |
| 32 | 617-457 | CAP INSUL POST .66 DIA X .40 | 4 |
| 33 | 617-713 | CATCH ASSY DOOR NON-MAGNETIC | 1 |
| 34 | 618-561 | ASSY PANEL DIVIDER | 1 |
| 35 | 618-565 | ASSY BASE VTF | 1 |
| 36 | 625-336 | CIRCUIT BRK 25 A 250V DPST PO | 1 |
| 37 | 625-401-359 | PLATE TOP FURNACE | 1 |
| 38 | 625-401-360 | TUBE MULLITE, MACHINED | 1 |
| 39 | 625-501-506 | ASSY WORK SHELF | 1 |
| 40 | 625-501-509 | DOOR - MACHINED | 1 |
| 41 | 625-501-514 | ASSY PANEL BACK | 1 |
| 42 | 625-501-528 | BRACKET PANEL DIVIDER | 1 |
| 43 | 625-501-530 | ASSY BRACKET CIRCUIT BREAKER | 1 |
| 44 | 625-501-543 | PLATE MANIFOLD BLOCK | 1 |
| 45 | 625-501-548 | PLATE GUIDE PANEL SIDE | 3 |
| 46 | 625-501-552 | ANGLE GASKET MTG L SIDE | 1 |
| 47 | 625-501-553 | ANGLE GASKET MTG R SIDE | 1 |
| 48 | 625-501-555 | ASSY FURNACE | 1 |
| 49 | 625-501-557 | BASE - MOUNT LOADING HEAD | 1 |
| 50 | 625-501-560 | ASSY VALVE TIMER | 1 |
| 51 | 625-501-561 | TUBE MANIFOLD TO COMB LOW | 1 |
| 52 | 625-501-562 | TUBE REAGENT BTM TO MANIFOLD | 1 |
| 53 | 625-501-565 | ASSY MANIFOLD CHECKV FITTINGS | 1 |
| 54 | 625-501-569 | TUBE REAGENT TOPADPTR LOWER | 1 |
| 55 | 625-505-643 | INSULATION HEATING ELEMENT | 3 |
| 56 | 660-010-031 | ASSY LOADING HEAD | 1 |
| 57 | 660-010-120 | ASSY PANEL FRONT | 1 |
| 58 | 660-010-124 | ROD SUPPORT | 2 |
| 59 | 660-010-125 | BLOCK SUPPORT | 2 |
| 60 | 660-010-126 | ASSY RIGHT PANEL | 1 |
| 61 | 660-010-127 | ASSY PANEL LEFT | 1 |
| 62 | 660-010-141 | ASSY BLOCK INTERFACE MICRO DEDICATED | 1 |
| 63 | 666-037 | ASSY CARD SSR PHASE CONTROLLER | 1 |
| 64 | 701-899 | Assy Dio IN4004 W/ .250 Spade | 1 |
| 65 | 702-422 | CIRCUIT BRK .5A 250V SPST PO | 1 |
| 66 | 767-571 | Support Circuit Board | 2 |
| 67 | 770-990 | Terminal Block .4POS .50 X 2.81 | 1 |
| 68 | 770-991 | Plate Designation Marker Strip 4 plc | 2 |
| 69 | 772-993 | GUARD FAN | 2 |
| 70 | 777-810X | ASSY CARD MULTI OUTPUT DC SUP | 1 |
| 71 | 777-811X | ASSY CARD FURNACE CONTROL | 1 |
| 72 | 779-513 | O-RING 135 1.925X 2.131X.103V | 1 |
| 73 | 780-970 | FOOT LEVELING .375-16X .625 | 4 |
| 74 | 781-165 | RELAY SOLID STATE 50A | 1 |
| 75 | 781-973 | FITTING NUT CONDUIT .75-14 | 1 |
| 76 | 782-502 | FTG ADPTR SS .12T-.12MPT | 1 |
| 77 | 783-199 | Assy Varistor with Lugs | 1 |
| 78 | 803-898 | FTGE ADPTR STG .75C .50/ .62NY | 1 |
| 79 | 805-079 | BALL BEARING | 5 |
| 80 | 660-010-160 | ASSY FRAME AND FILTER | 1 |

Figure 3-32
Oxygen Furnace Exploded View

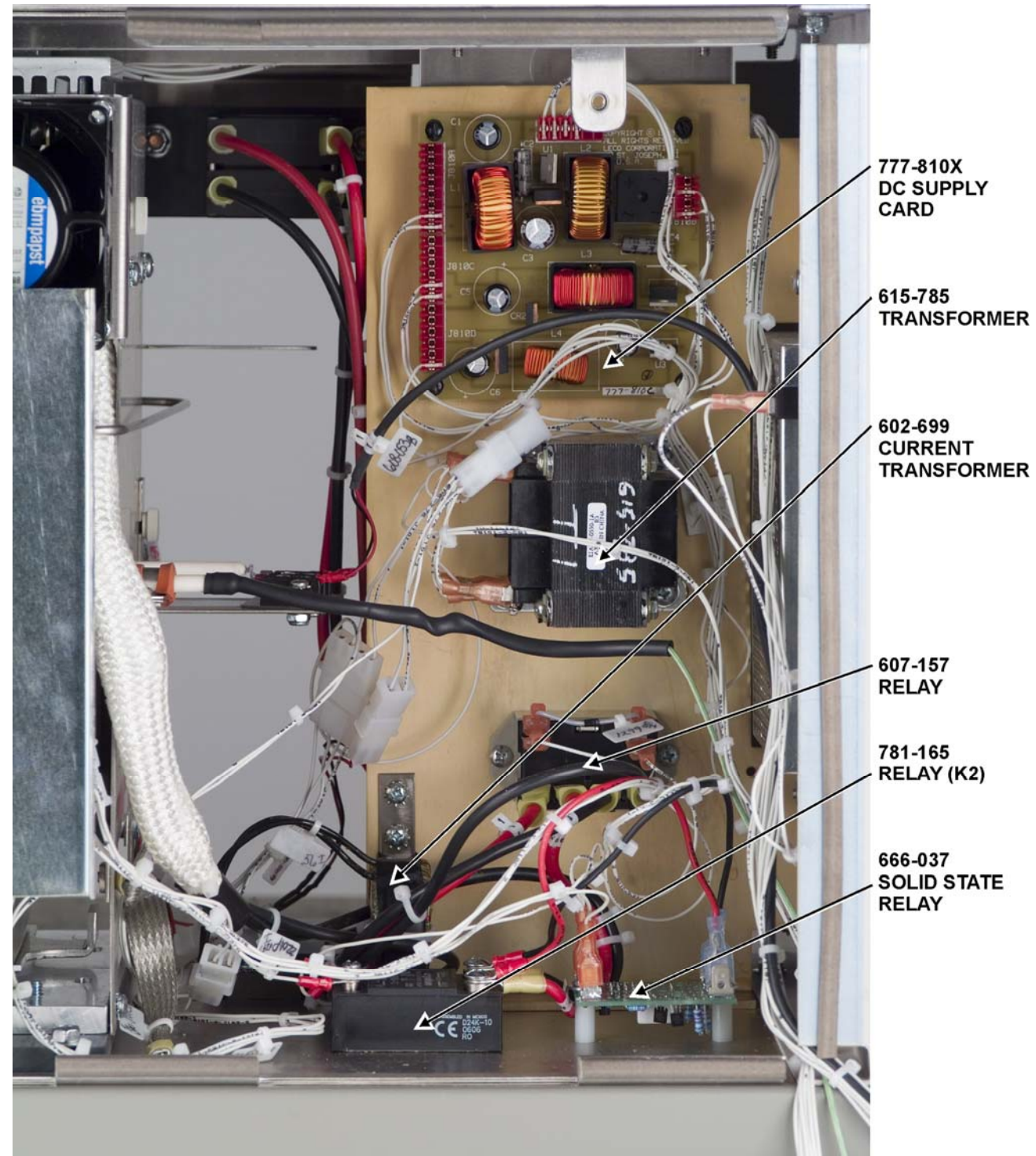


Figure 3-33
Right Side View – Divider Panel Removed

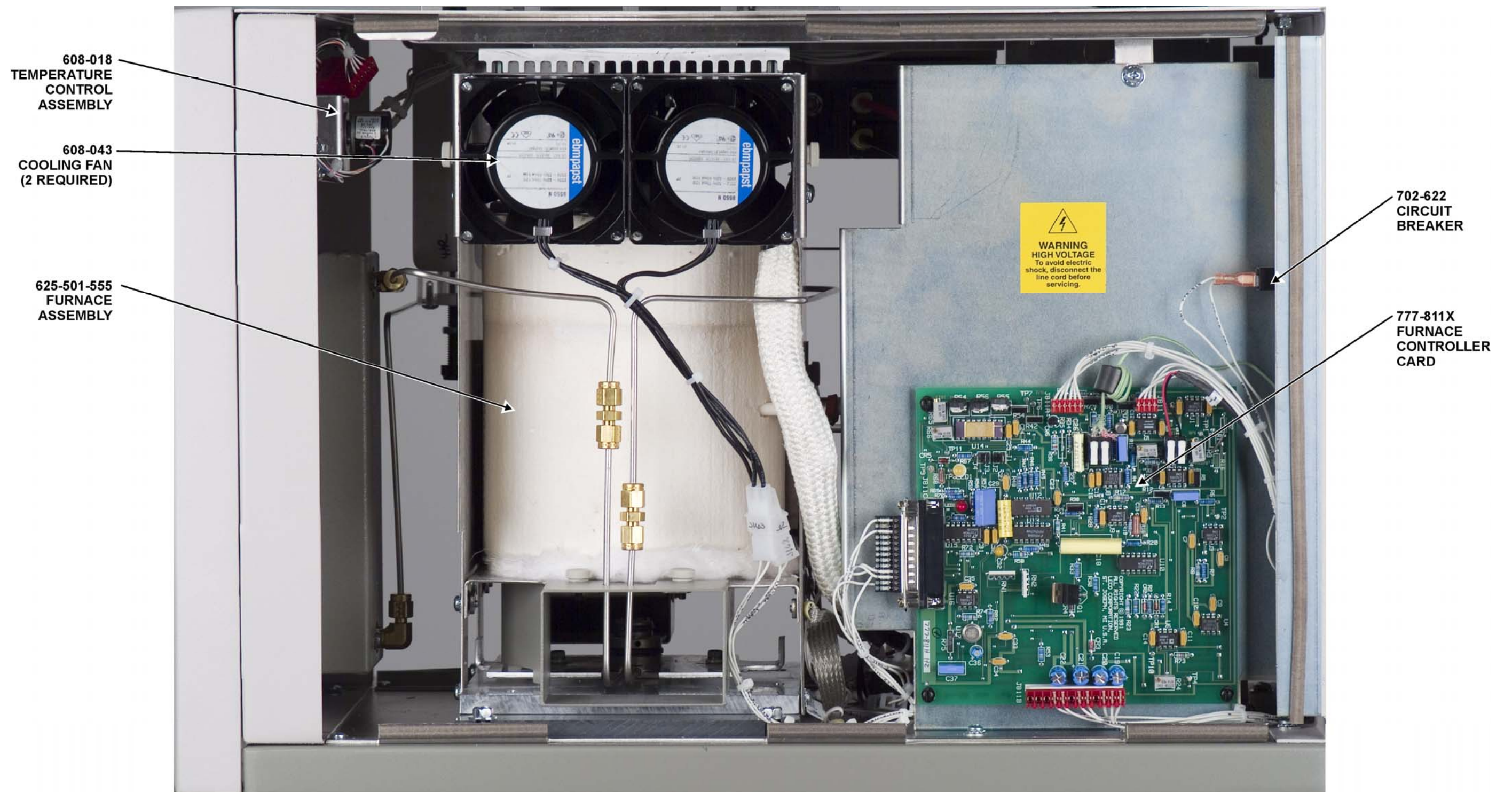


Figure 3-34
Right Side View

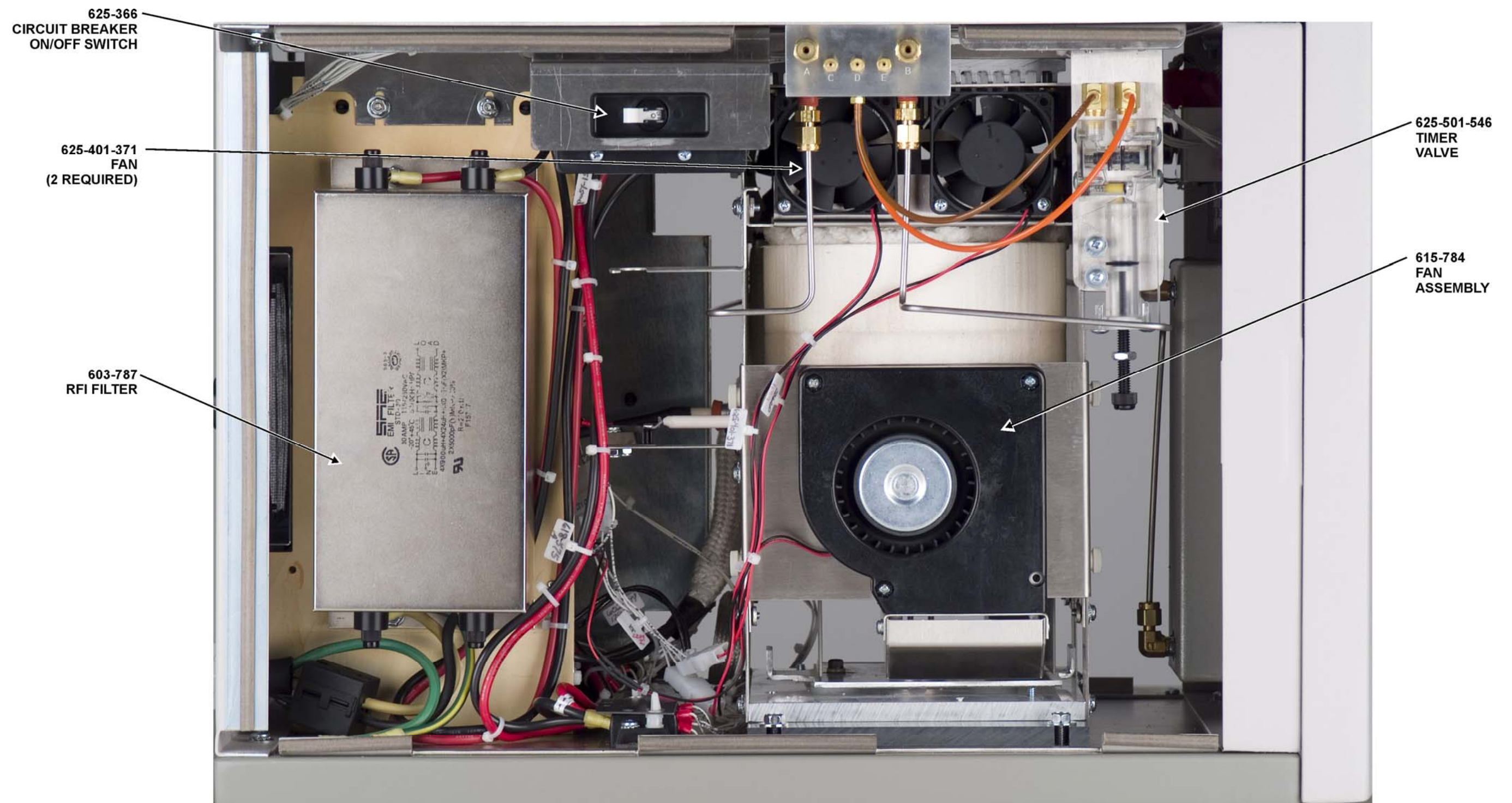


Figure 3-35
Left Side View

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4 System Setup

System Setup explains how to set the operating parameters. These procedures should be done before any samples are analyzed for the first time per the application.

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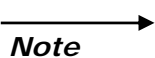
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Front Panel Controls and Functions



- Refer to Figure 4-1, page 4-6, for locations of controls and indicators.

Power On/Off Switch—Switches power on and off to the determinator. The power switch is also a circuit breaker, providing protection for the operator, determinator, and facility. The Power On/Off Switch is located on the right side of the instrument.

Incoming Helium Scrubber Reagent Tube—Purifies the incoming carrier gas by removing CO₂ and moisture.

Aliquot Dose Reagent Tube—Purifies the gas leaving the aliquot doser and catalyst heater by removing CO₂ and moisture.

Furnace Filter Tube—This tube is left empty except for screen filter.

Furnace Particle Filter—This tube is left empty except for screen filter.

Catalyst Heater Assembly—Removes oxygen and changes NO_x to N₂ before the sample gas enters the TC cell.

Loading Head—During analysis, a sample is placed in the loading head and automatically drops into the furnace for analysis.

Autoloader—The carousel is positioned above the loading head. One carousel can hold 29 samples and automatically drop them into the loading head for analysis.

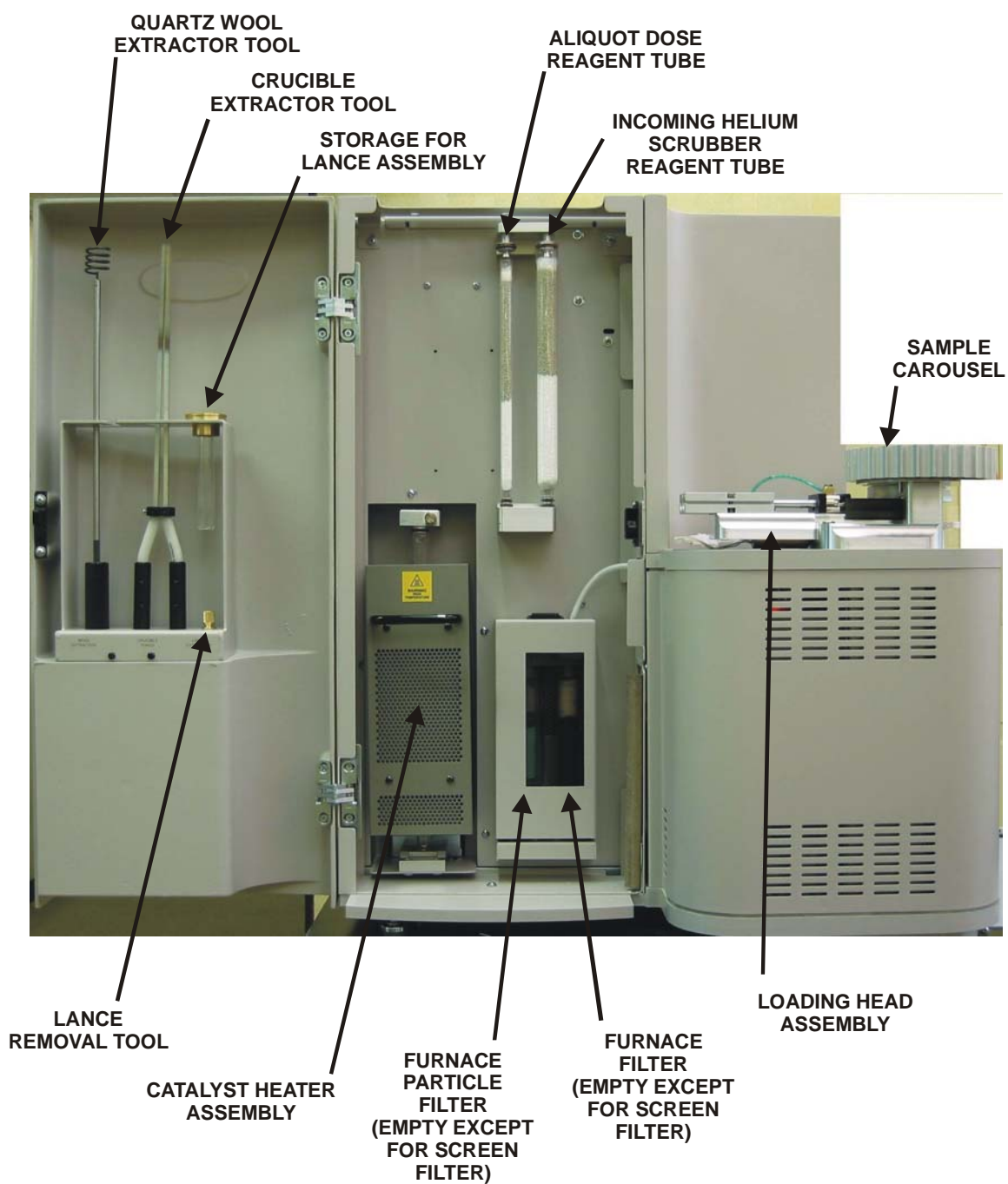


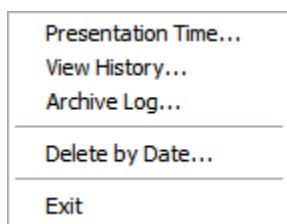
Figure 4-1
Front Panel Controls and Functions

Menu Overview

The following are the menu choices in the Windows® software. Clicking on any of these will open another set of menu choices.



Database Menu



Presentation Time—Refer to Presentation Time on page [4-87](#).

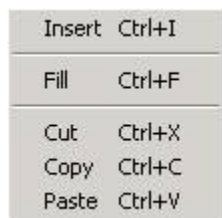
View History—Refer to View History on page [4-88](#).

Archive Log—Refer to Archive Log on page [4-89](#).

Delete by Date—Refer to Delete Analyzed Samples on page [4-93](#).

Exit—Used to exit the application program and returns to the Windows Operating System.

Edit Menu



Insert—Inserts a sample out of sequence, between unanalyzed samples, into the spreadsheet for analysis. Refer to Insert a Sample, page [5-49](#), for additional information.

Fill—A group of cells in the spreadsheet can be quickly filled with the same data. Refer to Fill Cells with the Same Data, page [5-50](#), for additional information.

Cut—Used to delete data from an entire row in the spreadsheet. Refer to page [5-51](#) for additional information.

Copy—Used to copy data from an entire row in the spreadsheet to the clipboard. Refer to page [5-51](#) for additional information.

Paste—Used to paste data from the clipboard to a selected row in the spreadsheet. Refer to page [5-51](#) for additional information.

View Menu

| | |
|-----------------------|------------|
| ✓ Toolbar | |
| ✓ Status Bar | |
| Log Bar | |
| First row | Ctrl+Up |
| Analysis row | Ctrl+Enter |
| Last row | Ctrl+Down |
| New Dashboard Pane... | |
| Screen Layouts | |

Toolbar—Toggles the toolbar off or on. Refer to Hide/Show the Toolbar, page [4-30](#), for additional information.

Status Bar—Toggles the status bar off or on. Refer to Hide/Show the Status Bar, page [4-30](#), for additional information.

Log Bar—Displays messages that are added to the log file. Refer to Log Bar, page [4-30](#), for additional information.

First Row—Automatically selects the first row of data in the spreadsheet. Refer to Go to First Row in the Spreadsheet, page [4-31](#), for additional information.

Analysis Row—Automatically selects the analysis row of data in the spreadsheet. Refer to Go to the Analyze Row in the Spreadsheet, page [4-31](#), for additional information.

Last Row—Automatically selects the last row of data in the spreadsheet. Refer to Go to Last Row in the Spreadsheet, page [4-31](#), for additional information.

New Dashboard Panel—Permits the operator to create or edit the properties of the dashboard. For more information refer to Create a Dashboard Panel on page [4-24](#).

Screen Layouts—Permits the operator to save a screen layout after configuration. By saving the screen layout the operator can return to a previous screen layout quickly. Screen layouts can be saved for specific applications. Refer to Screen Layouts on page [4-29](#).

Samples Menu

| | |
|------------------------|------------|
| Login... | F3 |
| Login Drift Samples... | |
| ✓ Balance | F4 |
| Analyze | F5 |
| Abort | F6 |
| Pause | F7 |
| Promote | Alt+Up |
| Promote : Analyze Next | Alt+Return |
| Demote | Alt+Down |
| Recalculate | |
| Transmit | |
| Print... | Ctrl+P |
| Print Preview | |
| Print Setup... | |
| Text Import Data... | |
| Text Export Data... | |
| Text Export Buffers... | |
| Transfer Export... | |
| Transfer Import... | |
| Sign... | |
| View Signatures... | |
| Delete | |
| View History... | |

Login—Used to login a sample or a standard into the spreadsheet. Refer to Sample Login, page 5-19, for additional information.

Login Drift Samples—Used to log a drift sample into the spreadsheet. Refer to Sample Login, page 5-19, and Drift Correction, page 5-44, for additional information.

Balance—Used to enter a mass from the balance into the sample login screen. Refer to Enter a Mass from the Balance, page 5-26, for additional information.

Analyze—Displays the sample login screen to login and analyze a sample, analyze a standard, or analyze multiple samples. Refer to Analyze a Sample, page 5-27, for additional information.

Abort—Used to stop or abort an analysis. Refer to Abort an Analysis, page 5-30, for additional information.

Pause—The operator can stop or pause analysis at a selected sample and then resume at a programmed date and time. Refer to Pause Analysis, page 5-34, for additional information.

Promote—Moves an unanalyzed sample, within the sample list, up the list towards the next sample to be analyzed.

Promote: Analyze Next—Moves an unanalyzed sample, within the sample list, up the list and positions it as the next sample to be analyzed.

Demote—Moves an unanalyzed sample, within the sample list, down the list towards the last sample to be analyzed.

Recalculate—After an analysis is complete, recalculate results can be used to recalculate the result if the extraction data or calibration has changed. Refer to Recalculate Results, page [5-53](#), for additional information.

Transmit—Transmit selected samples and transmits selected analyzed samples with a data format to a host computer. Refer to Transmit Selected Samples, page [5-82](#), for additional information.

Print—The print command accesses the report settings dialog box to print selected sample results on the system printer. Refer to Print Results, page [5-59](#), for additional information.

Print Preview—The print preview command accesses the report settings dialog box to preview how selected samples would print on the system printer.

Print Setup—Print Setup permits the operator to configure the printed page. The choices and functions will depend on the printer in use.

Text Import Data—Used to import sample data from another software application. Refer to Import Data, page [5-73](#), for additional information.

Text Export Data—Used to export sample data to another storage location like a floppy disk. Refer to Export Data, page [5-63](#), for additional information.

Text Export Buffers—Used to export selected sample plot data to a file or another application. Refer to Export Buffers, page [5-72](#), for additional information.

Transfer Export—Used to Export Sample Data to a File. The file can be saved on the systems hard drive or transferred to another media for safe storage. Refer to Transfer Export, page [5-83](#), for additional information.

Transfer Import—Used to Import Sample Data from a File and restore it in the spreadsheet. The file had to be saved using Export Sample Data to a File. Refer to Transfer Import, page [5-85](#), for additional information.

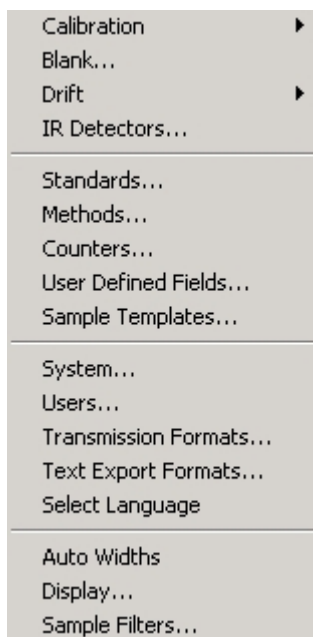
Sign—Used to add a signature to a sample that ensures the validity of the sample information has remained the same since it was signed. Refer to Sample Signature, page [5-57](#), for additional information.

View Signatures—Used to view a sample signature and determine if it is valid. Refer to View Signatures, page [5-58](#), for additional information.

Delete—Delete a sample removes a selected sample with sample data from the spreadsheet. Refer to Delete a Sample, page [5-52](#), for additional information.

View History—Used to look at a history log of the actions performed on a selected sample. Refer to View History of a Sample, page [5-56](#), for additional information.

Configuration Menu



Calibration—Matches the response of the instrument to known calibration samples. Refer to Calibration, page [5-39](#), for additional information.

From the Calibration fly-out menu the operator can select New Standard Calibration, page [5-41](#), Add Standards, page [5-42](#), View Calibration, page [5-42](#), and Edit or Manual Calibration.

Blank—Determines the amount of blank and adjusts the calibration (area) accordingly. Refer to Blank Calibration, page [5-40](#), for additional information.

Drift—Adjusts the original calibration response to match the current instrument response. Refer to Drift Correction, page [5-44](#), for additional information.

From the Drift fly-out menu the operator can select Drift Correction, page [5-44](#), View History, page [5-46](#), and Replace Drift Standard, page [5-47](#).

IR Detectors—This procedure permits the operator to adjust the instrument's detector linearity by applying different correction factors to the detector. Linearizations only affect the linearity of the IR Cells. Refer to IR Detector Linearization on page [9-35](#).

Standards—Used to enter standards into the calibration standards list. Refer to Login using Calibration Reference, page [4-60](#), for additional information.

Methods—Used to create a method for analysis. Refer to Method Configuration, page [4-39](#), for additional information.

Counters—Automatically determines when periodic maintenance is necessary. Maintenance data that was entered into login periodic maintenance is used by the counters to determine when maintenance is necessary. Refer to Configure Maintenance Counters, page 6-46, for additional information.

User Defined Fields—Permits the operator to add a unique field to the spreadsheet and sample login screen. The field can include a formula for calculation or contain only test. Refer to User Defined Fields, page 4-65, for additional information.

Sample Templates—A quick way for the operator to login a sample and enter a method, comment, and description. Create a sample template is used to develop a specific sample template. After a sample template is developed, use sample template to login a sample with predetermined sample analysis data. Refer to Sample Templates, page 4-62, for additional information.

System—Configure system sets the overall instrument operating settings to configure the instrument for a specific application or set of applications. Refer to System Configuration, page 4-32, for additional information.

Users—Determines which operators can use the instrument and what functions they can use. Refer to Users, page 4-17, for additional information.

Transmission Formats—Before data can be transmitted to a host computer, the transmitted data format must be configured to match the host requirements. Use transmission formats to configure data transmission. Refer to Data Transmit Format Configuration, page 5-74, for additional information.

Select Language—Permits the user to Select Language, page 4-16, of the software. A list of available languages will be displayed.

————→
Note

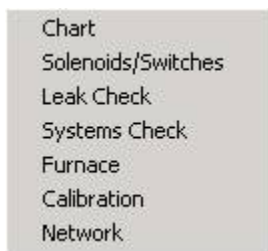
- *The On-board manual will remain in English regardless of language chosen.*

Auto Widths—Automatically adjusts the width of each cell to fit the text. For instructions, see Auto Widths, page 4-31, for additional information.

Display—Sets the desktop characteristics, as viewed on the computer monitor. Refer to Sample Display Configuration, page 4-21, for additional information.

Sample Filters—Sample Filters is used to display sample data based on a predefined requirement. Refer to Sample Filters, page 4-65, for more information.

Diagnostics Menu



Ambient Chart—Select Ambient Chart to monitor the System Operating Parameters and display the Ambient Monitor as a Chart and Graph. All parameters can be displayed. Refer to Ambient Monitor on page [8-5](#).

Solenoids—Select Solenoids to toggle the Solenoid Valves to verify proper operation, diagnose instrument problems and perform periodic maintenance. Refer to Solenoids and Switches on page [8-35](#).

Leak Check—Select Leak Check to determine if the instrument has a helium or carrier gas leak. Refer to Leak Check on page [8-22](#).

System Check—System check permits the operator to automatically check Network Communications, Solenoid Operation, Pneumatic Pressure, System Pressure, Temperature, Gas Flow and IR and TC Cells. Refer to System Check on page [8-32](#).

Furnace—Select Furnace to test and monitor the Furnace for proper operation. Refer to Furnace Diagnostics on page [8-19](#).

Calibration—Select Calibration to set the barometric pressure, calibrate the combustion flow, adjust the TC cell and perform a backup calibration. Refer to Calibrations on page [8-10](#).

Network—Select Network to test the Electronic Assemblies and upgrade Firmware. Refer to Network Diagnostics on page [8-16](#).

Maintenance Menu



Log-In—Used to login periodic maintenance after it was performed. Refer to Login Periodic Maintenance, page [6-44](#), for additional information.

View Log File—The system will automatically keep a record of various procedures that were performed. The record can be viewed using view log file. Refer to View Log File, page [6-45](#), for additional information.

Apply Power

1. The Power Switch on the right side of the instrument should be in the off position.
2. Connect the Instrument to the proper electrical power source if it wasn't done during installation. Refer to Instrument Installation, page [2-3](#), for addition information.
3. Turn the Gas Supplies ON with the regulators at the gas tanks. The oxygen and helium should be set to 35 psi (2.41 bars). The pneumatic should be set to 40 psi (2.76 bars).
4. Turn on AC power to the instrument and computer. Permit the computer to boot-up and run the application program.
5. Allow the temperature to stabilize for one hour before performing a system check or sample analysis.
6. Access the Ambient Monitor. Refer to Ambient Chart on page [8-6](#).
7. Verify that there are no alarms indicated by an exclamation marker in a yellow box to the left of the parameter. All alarms must be cleared before performing a sample analysis. To clear an alarm it may be necessary to perform hardware calibration, system maintenance or wait an appropriate amount of time for the instrument to warm-up. Refer to the Diagnostics and Service Section of this manual for more information.



POSSIBLE LEAK CHECK ERROR

The furnace temperature must reach the set temperature and stabilize before performing a leak check. Unstable furnace temperature may cause erroneous leak check results.

8. Perform a System Check to determine if the instrument is operating properly. Refer to System Check on page [8-32](#).
9. Perform a Whole Oxygen Leak Check and a Whole Helium Leak Check. Refer to Leak Check on page [8-22](#).

Select Language

Select Language permits the operator to select the software language. The available choices appear on the screen.

→
Notes

- *Although the language of the software will change, the on-board manual will remain in English.*
- *The languages displayed on the screen below are used as an example and may vary from the actual ones displayed on your computer monitor.*

1. From the Configuration menu, click Select Language. The Select Language dialog box will appear.



2. Select the language desired.
3. Click OK. Software will convert to language chosen.

Determining User Permissions

Users permits the system administrator to assign permission for users to perform selected functions on the instrument. The following section explains how to first add a user in Windows® and then add a user and assign user permissions for the instrument.

Add User in Windows

Before a user can be assigned to the instrument, that user must be added in Windows. To add a user to Windows, refer to the Windows help system as follows:

1. From the desktop, click Start and then click Help.
2. When the Windows help screen displays, click the Index tab if not already displayed.
3. In the dialog box, type Users and Passwords.
4. Make a selection from the Users and Passwords options list, click Display and follow the instructions provided.

To add a user, click Add.

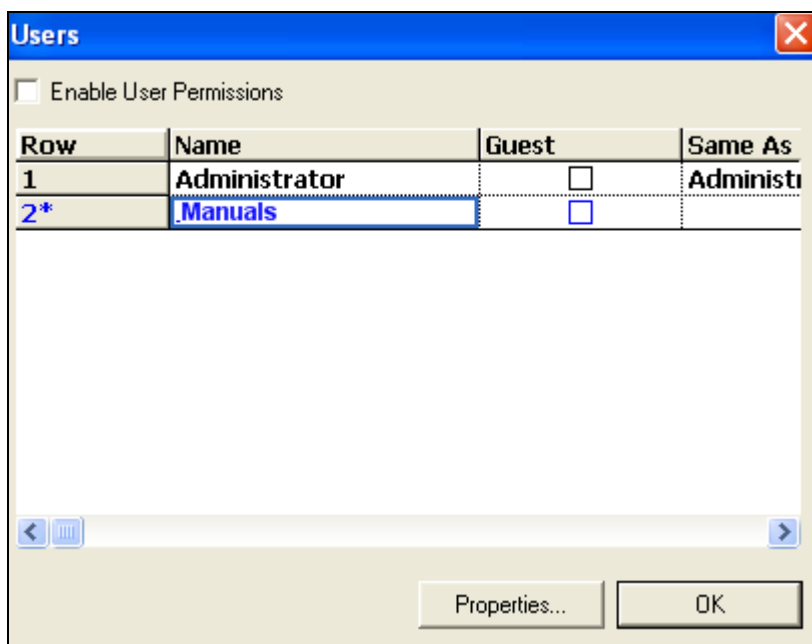
To delete a user, select the user and click Remove.

Add or Change User Permission for Instrument

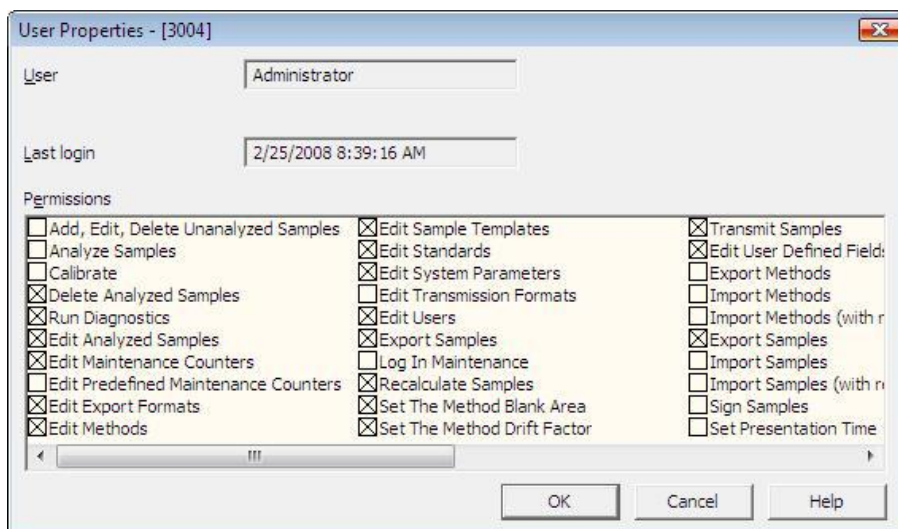
A user must be added in Windows before that user can be assigned permissions for the instrument. Refer to Users, above. Any users assigned to the system from Windows will appear in the Name column of the Users dialog box. The current user logged into the Windows system will display in blue in the Users dialog box. Only users assigned as administrators in Windows can add or change user permissions.

1. Click Configuration and select Users. The Users screen will appear.
2. Select the Enable User Permissions check box and user permissions will be checked during the operation of the instrument. When the Enable User Permissions checkbox is cleared, user permissions are not checked and all users can perform any function on the instrument.
3. Select the name of the user to add or change permission by clicking in the Row column for that user.

4. To disable all user permissions for a specific user, place a ✓ in the Guest column. When the user logs on to the system they will be considered a Guest and will have READ-ONLY access to the software. For Guest users, the check boxes listed on the User Properties dialog will be cleared as they cannot perform any of the tasks listed.



5. Click Properties. The User Properties dialog box will appear.



6. Select the desired check boxes to assign or remove user permission for the functions listed in the edit box. When an X displays, the user has permission to perform that function.
7. Click OK to close User Properties.

8. Repeat step 3, page 4-17- step 7, above, until all users have been assigned permissions; however, if one user requires the exact same permissions as a user that already has permissions assigned, the Same As column can be used to save time.
 - A. Select the name of the user to add or change permission by clicking in the Row column for that user.
 - B. Single-click in the Same As column.
 - C. From the list, select the name of the user that already has the same permissions assigned.

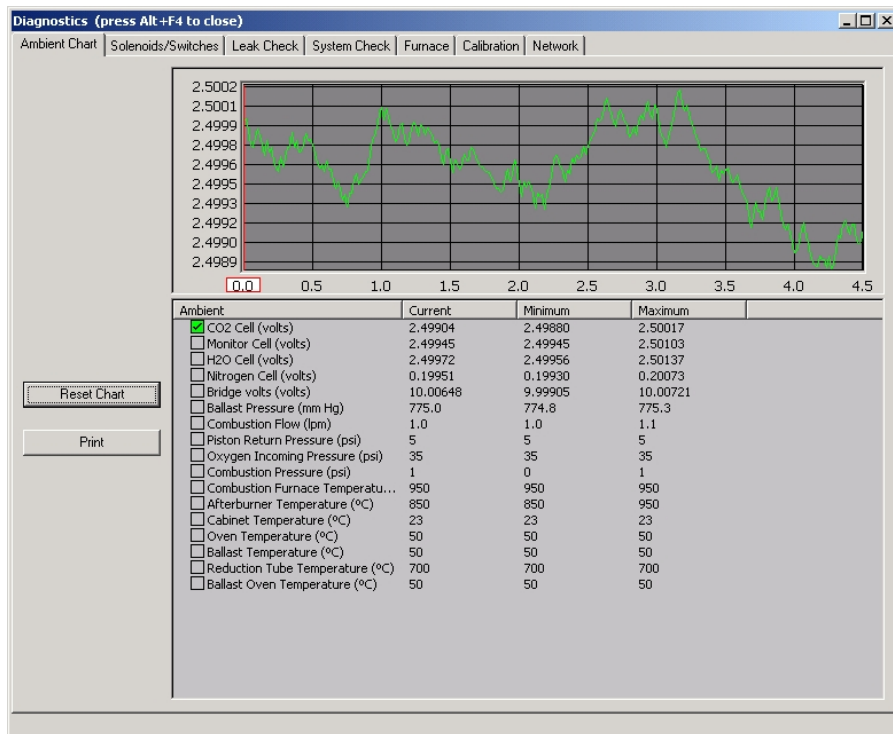
View the Ambient Monitor

The ambient monitor is used to display system parameter values and will continuously update as viewed by the operator.

→
Note

- *If the instrument has just been turned on, it will take a period of time for the system to stabilize.*

1. From the Diagnostics menu, click Ambient Chart.
2. Check that all system parameter values fall within the Ambient Monitor Ranges shown on page 8–9. If any values are out of range, refer to the corresponding topic for additional information.

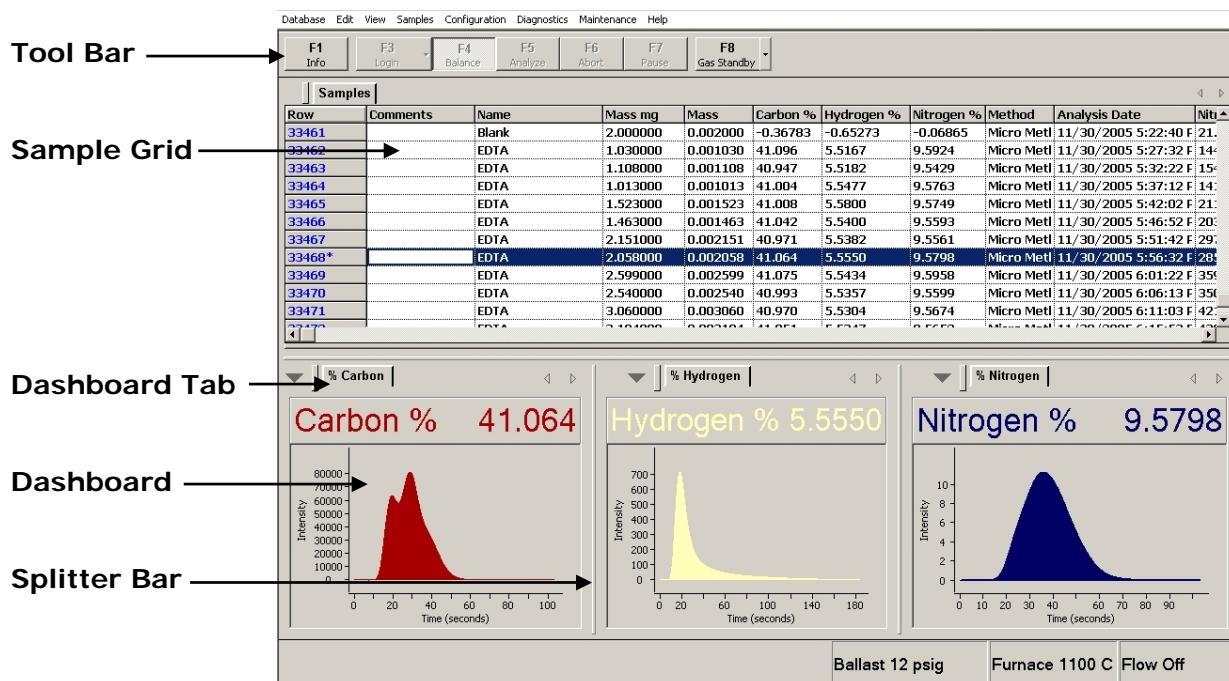


3. Click Close to exit the Ambient Chart.

Display Configuration

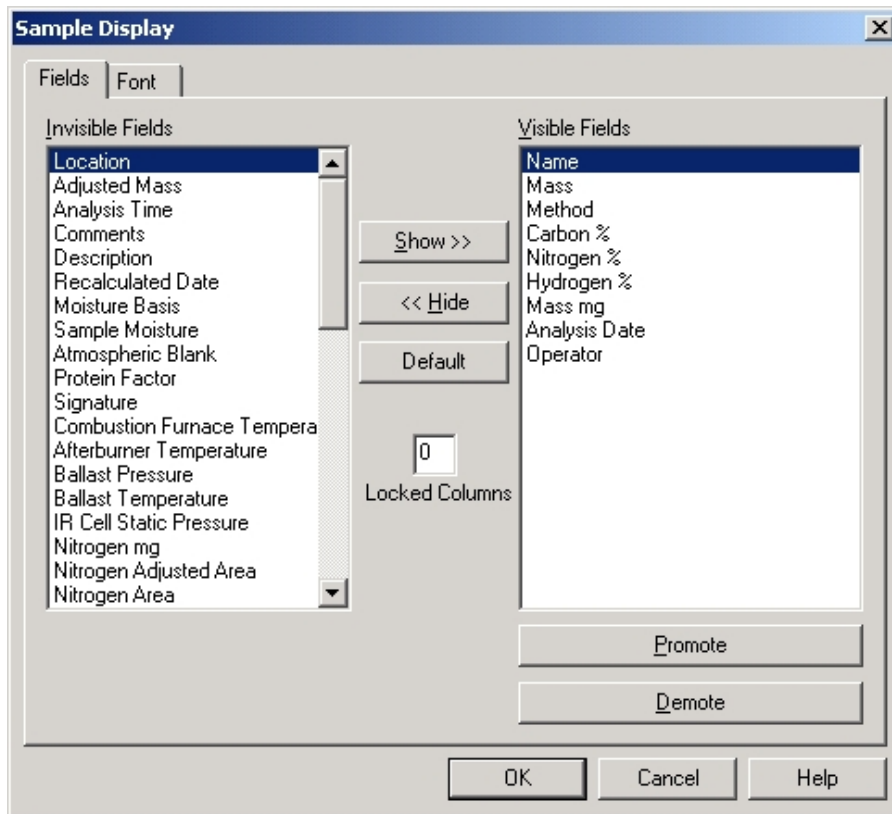
Main Screen Overview

The main screen appears when the determinator and computer are powered-up. A screen example of the default configuration is shown below. Like many Windows® programs, the screen can be configured by the operator as desired. Screen layouts or configurations can be saved and recalled.



Configure Fields

1. From the Configuration menu, click Display. The Sample Display screen will appear.

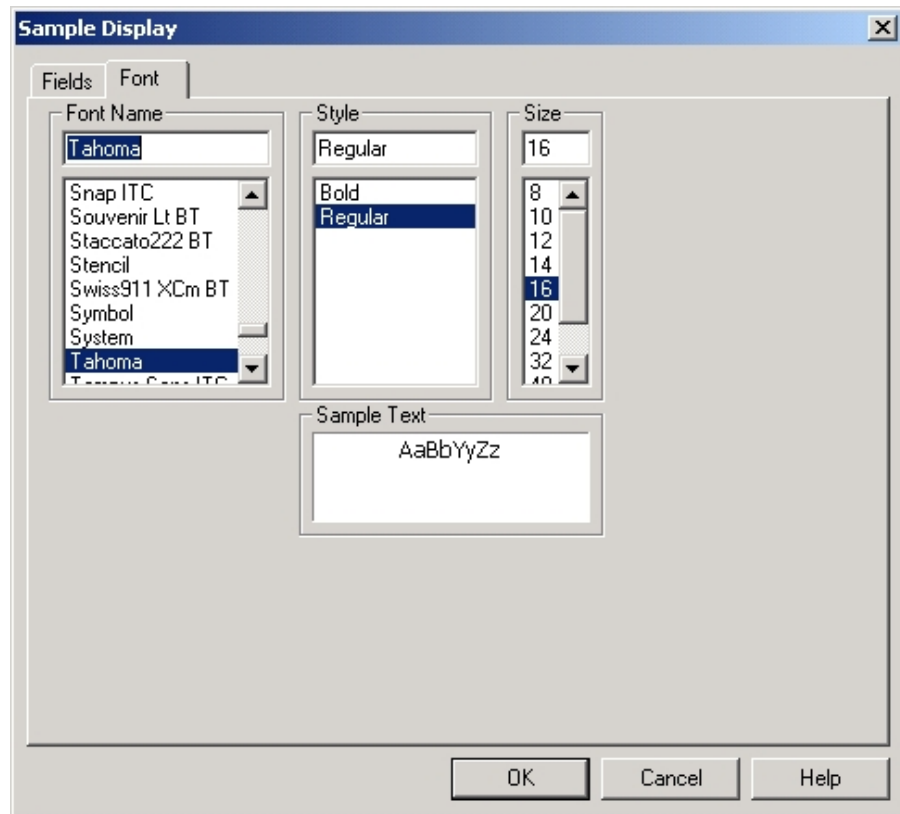


2. Click Fields to display or hide a field.
3. To show an invisible field, select the field to display and click Show.
4. To hide a visible field, select the field to hide and click Hide.
5. To change the order of fields shown on the spreadsheet, in the Fields List box select the field to move and click either Promote or Demote.

6. Click Default to list the default fields as Visible Fields.
7. Click in the Locked Columns box and enter the number of columns to lock in place. The columns are numbered from top to bottom under visible fields. When a column is locked it won't move position in the spreadsheet.

Configure Font

1. Click Font to change the font name, style, size, and color. The Font configuration screen will appear.

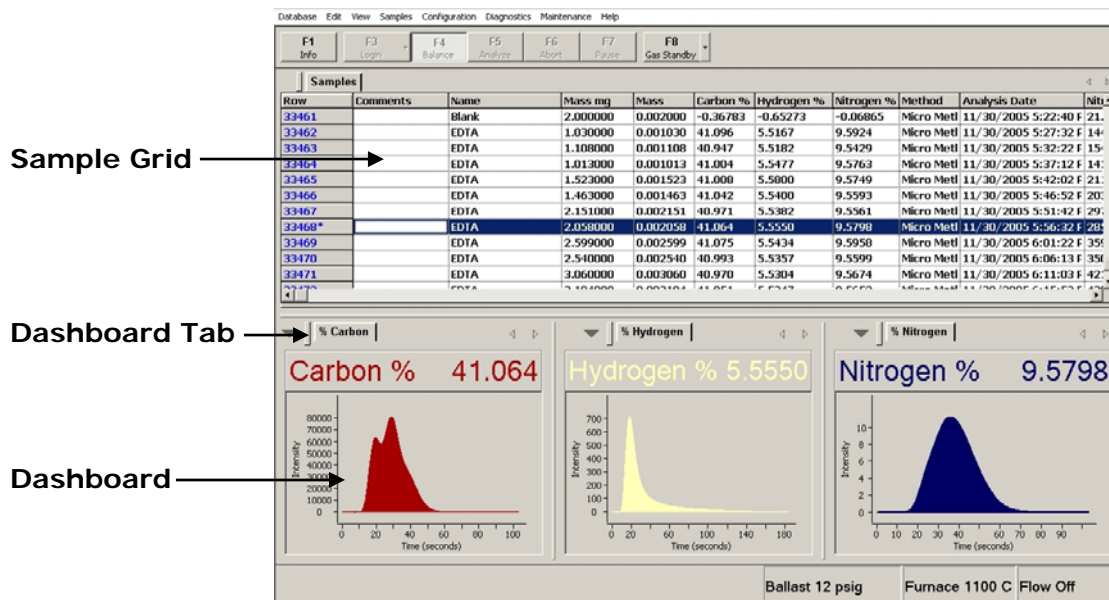


2. From the Font configuration screen select the Font Name, Style and Size. A sample of the selected Font will appear in the Sample Text preview box.

Create a Dashboard Panel

Notes

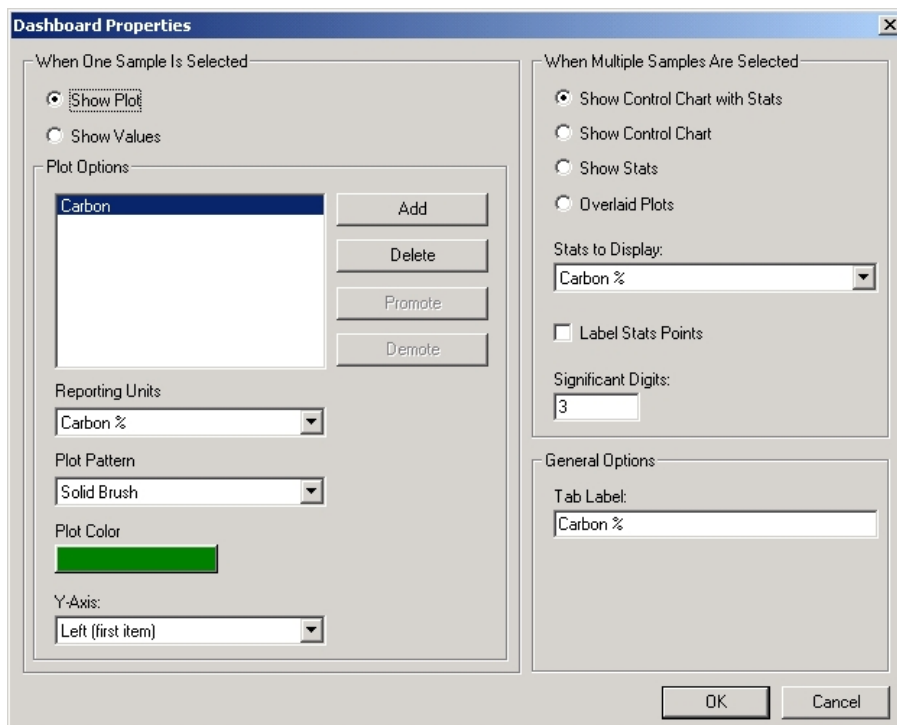
- The Dashboard Panel can display an element plot or element values. Refer to [Single Sample Selected](#) on page 4-25.
- The dashboard display will automatically change depending on the number of samples selected. Refer to [Multiple Samples Selected](#) on page 4-27.



Single Sample Selected

Show an Element Plot in the Dashboard

1. From the View menu, click New Dashboard Panel. A new dashboard will be created and the dashboard configuration dialog box will appear.



2. Click Show Plot on the left side of the screen.
3. Click Add in the Plot Options dialog box. A list of elements will appear. Select the element to plot and click OK. A new plot will appear.
4. Click the drop down arrow and select the Reporting Units for the element to plot.
5. Click the drop down arrow and select the Plot Pattern.
6. Click Plot Color and select the plot color.

- Click Y-Axis to select the Y-Axis to display. Selections: None, Left or Both.
- Click OK to save the dashboard configuration.

Show element Values in the Dashboard

- From the View menu, click New Dashboard Panel. A new dashboard will be created and the dashboard configuration dialog box will appear.

- Click Show Values on the left side of the screen.
- Click OK to save the dashboard configuration.

Dashboard Tab Label

Click inside the Tab Label edit box and enter a name that will appear in the tab for the created dashboard.

Multiple Samples Selected

1. From the View menu, click New Dashboard Panel. A new dashboard will be created and the dashboard configuration dialog box will appear.

Dashboard Properties

When One Sample Is Selected

☒ Show Plot
☐ Show Values

Plot Options

Carbon

Add
Delete
Promote
Demote

Reporting Units
Carbon %

Plot Pattern
Solid Brush

Plot Color
[Green]

Y-Axis
Left (first item)

When Multiple Samples Are Selected

☒ Show Control Chart with Stats
☐ Show Control Chart
☐ Show Stats
☐ Overlaid Plots

Stats to Display:
Carbon %

☐ Label Stats Points

Significant Digits:
3

General Options

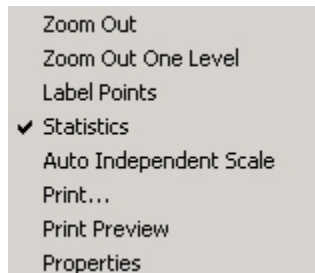
Tab Label:
Carbon %

OK Cancel

2. Use the dialog box on the right to select the information shown in the dashboard. Selections are:
 - Control Chart with Statistics*—A chart with plotted sample values in addition to the average value, standard deviation, relative standard deviation and the number of samples selected.
 - Control Chart*—A chart with plotted sample values.
 - Statistics*—The average value, standard deviation, relative standard deviation and the number of samples selected.
3. *Overlaid Plots*—Plots of each selected sample in the same dashboard.
4. Click the drop down arrow in the Stats to Display selection box and select the desired statistics shown in the dashboard.
5. Click the Label Stats Points check box to label the sample points on the chart. The numbers that appear with the point are the sample numbers selected.
6. Click inside the Significant Digits selection box to select the statistics number format.

Configure the Dashboard

To configure the dashboard, right click on the dashboard to display the configuration menu.



Zoom—Position the mouse cursor over the area of a plot to zoom in. Hold the left mouse button in and draw a box. The area inside the box will be magnified. Draw another box to zoom in farther. Click Zoom Out One Level to reduce the magnification by one level. Click Zoom Out to zoom out all levels and return to the original plot.

Label Points—Label points will place the sample number near the point on a control chart. Select multiple samples. Right click the desired dashboard and select Label Points.

Statistics—Statistics will display a control chart or multiple plots. Select multiple samples. Select statistics to display a control chart. Deselect statistics to display multiple plots.

Auto Independent Scale—When multiple selected plots are scaled differently, Auto Independent Scale rescales the plots so they can be compared together. Select Auto Independent Scale to rescale plots.

Properties—Displays the Dashboard Properties dialog box for advanced configuration or creation of a new dashboard. Refer to Create a Dashboard on page [4-24](#).

Position a Dashboard

Move the mouse pointer over the dashboard tab and hold the left mouse button down. Move the mouse to position the dashboard on the main screen.

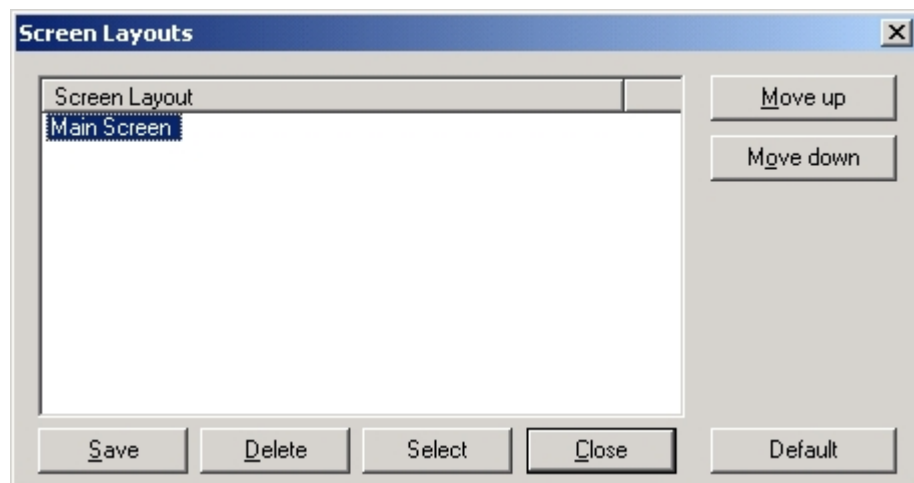
To size the dashboard, move the mouse over the splitter bars and hold the left mouse button down. Move the mouse to move the splitter bars.

Refer to Main Screen Overview on page [4-21](#).

Screen Layouts

After the Sample Grid and Dashboard are configured they can be save as a layout. By saving the layout you're always assured you can restore the configuration if it's lost.

1. Configure the main screen as desired. Refer to Display Configuration on page [4-21](#).
2. Click the View menu and select Screen Layouts. The Screen Layouts Screen will appear.



3. Click Save and enter a unique name for the current screen layout.
4. Click Close to exit and save the screen layout.

Move—Select a screen layout and click Move Up or Move Down to move a selected screen layout up or down the list.

Delete—Select a screen layout and click Delete to remove a screen layout from the list. After a screen layout has been removed it cannot be restored.

Select—Permits the operator to select a new screen layout. Highlight the desired screen layout and click Select. Click Close to exit.

Close—Click Close to exit screen layouts.

Default—Click Default to return to the factory default screen. Click Close to exit.

Hide/Show the Toolbar

If desired, the toolbar can be turned off or turned back on. The toolbar, located at the top of the screen, is a quick way to perform menu functions without accessing the menus.

1. From the View menu, click Toolbar. A check indicates the toolbar will be displayed.



Hide/Show the Status Bar

If desired, the status bar can be turned off or turned back on. The status bar, located at the bottom of the screen, will show operational functions of the instrument as they are currently in progress.

1. From the View menu, click Status Bar. A check indicates the status bar will be displayed.



Log Bar

The log bar, located at the bottom of the screen, displays information saved in the log file. It only appears when it displays information. This information may be communication failures, severe errors or operational procedures.

If Log Bar is not checked it will only display communications failures and severe errors.

If Log Bar is checked it will display any information saved in the log file. This includes communications failures, severe errors and operational procedures.

Examples of operational procedures are sample data changes, calibration changes, change to the sample mass and more.

Shortcuts to Move Between Samples

Go to First Row in the Spreadsheet

The first row in the spreadsheet can be quickly selected.

1. From the View menu, click First Row.
2. The cursor will automatically jump to the first row.

Go to Last Row in the Spreadsheet

The last row in the spreadsheet can be quickly selected.

1. From the View menu, click Last Row.
2. The cursor will automatically jump to the last row.

Go to Analyze Row in the Spreadsheet

The analyze row is the row in the spreadsheet that contains the next sample to be analyzed. This row can be quickly selected.

1. From the View menu, click Analyze Row.
2. The cursor will automatically jump to the analyze row.

Auto Widths

1. Select the Configuration menu
2. Click Auto Widths to adjust the size of each cell in the sample display to fit the text inside the cell.

System Configuration

System configuration permits the operator to set the overall instrument operating settings and parameter values for a desired application.

1. From the Configuration menu, click System. The System Configuration dialog box will appear.

System Configuration - TruSpec

System | Balance

Gas Conservation Timeout: 15 1 - 600 minutes

Auto Increment Sample Name: Enable

Nominal Mass mg: 1000

Sample Loading: 1 Carousels

Liquid Autosampler Port: COM2

Furnace Standby Temperature: 950

Sample Mass: Micro (up to 10 mgs)

Micro Oxygen: Disable

☐ CO2 Low Genesis II

☐ H2O Genesis II

Print

OK Cancel Help

2. Set the system parameters using the default values as a general guideline. Special settings for certain applications may be entered at this point. Refer to System Configuration Definitions, page 4-33, for setting and parameter values.
3. After entering all information, click OK.

System Configuration Definitions

Gas Conservation Timeout—The time in minutes, after analysis, when the instrument automatically switches to the gas conservation mode. Range: 1 to 600, Default: 15 minutes.

Auto Increment Sample Name—When enabled, if the file name ends with a number, it will incremented every time a new sample is logged in.

Nominal Mass—The mass value that will automatically appear during login. Typically, the blank mass value is 1.0 gram.

Sample Loading—Permit the operator to select how samples are loaded into the determinator. The following selections are available:

- *Manual*—Manual should be selected if samples are going to be manually dropped into the loading head. When manual is selected the autoloader (carousel) or liquid injector is not used.
- *Carousels*—Carousels should be selected if the autoloader (carousel) is used. Select the number of carousels in use. Selections: 1 through 4.

————→ **Note** • *The Liquid Autosampler Kit selections will only appear if the liquid autosampler was purchased and installed.*

- *Liquid Autosampler*—Liquid Autosampler should be selected if the Liquid Autosampler is used. The liquid loading head should be installed on the determinator.

Liquid Autosampler Port—Selects the communications port that the liquid autosampler is connected to. It is not necessary to configure this port. The software automatically configures it when the port is selected.

————→ **Note** • *When selecting a communications port for the liquid autosampler, do not select a same port that was selected for the balance and transmit data.*

Furnace Standby Temperature—Selects the combustion furnace temperature during gas conservation. Range 650 to 950 C. Reducing the furnace temperature during standby will increase the life of the combustion furnace and associated components.

Sample Mass—Selects the determinators hardware configuration. Selections: Macro (50 mgs to 1.5 grams) or Micro (up to 10 mgs).

Print—Click Print to receive a printout of the system configuration settings from the system printer. These may be saved for future reference.

Cell Configuration—CO₂ Low Genesis II and H₂O Genesis II. The Version II Cell check box should only be checked if version II cells are installed. This box will be automatically configured or manually configured by a LECO Service Engineer.

Balance Configuration

Balance Configuration permits the operator to select the desired balance parameter values to properly accept the balance's data.

Notes

- *The instrument will only support Sartorius® four or five place analytical balances. Other balances may be used; however, LECO is not responsible for installation or proper operation.*
- *For more information refer to the Balance Configuration Definitions on page 4-37.*

1. Set the instrument power switch to the On position.
2. Turn the power On to the balance by pushing the power on button, Figure 3-1, page 3-7.
3. From the Configuration menu, click System. The System Configuration window will appear.
4. Click the Balance tab.

The screenshot shows the 'System Configuration' dialog box with the 'Balance' tab selected. The dialog has a title bar with a close button. Below the title bar are two tabs: 'System' and 'Balance'. The 'Balance' tab is active, showing a list of configuration parameters, each with a dropdown menu. The parameters and their current values are: Port (COM1), Baud Rate (1200), Data bits (7), Parity (Odd), Stop bits (1), Readability (4), Balance Mode (Normal), Send Command (<ESC>P<CR><LF>), and Tare Command (<ESC>T). Below these parameters is a 'Print' button. At the bottom of the dialog are 'OK', 'Cancel', and 'Help' buttons. A 'Test Commands' section is located at the bottom left, containing 'Send' and 'Tare' buttons. To the right of these buttons is a text field labeled 'Weight from Balance:'.

| Parameter | Value |
|--------------|----------------|
| Port | COM1 |
| Baud Rate | 1200 |
| Data bits | 7 |
| Parity | Odd |
| Stop bits | 1 |
| Readability | 4 |
| Balance Mode | Normal |
| Send Command | <ESC>P<CR><LF> |
| Tare Command | <ESC>T |

5. Enter the following parameter values. Refer to Balance Configuration Definitions, page 4-37, for additional information.

| | |
|--------------|----------------|
| Port | COM1 (serial) |
| Baud Rate | 1200 |
| Data Bits | 7 |
| Parity | Odd |
| Stop Bits | 1 |
| Readability | 4 |
| Balance Mode | Normal |
| Send Command | <ESC>P<CR><LF> |
| Tare Command | <ESC> T |

6. When finished, click OK.

Balance Configuration Definitions

Baud Rate—Sets the data transmission speed in bits per second.

Selections: 1200, 2400, 4800, or 9600 bps. Default: 1200 bps

Data Bits—Used to select the number of bits per byte for data that will be transmitted. Selections: 5 to 8. Default: 7

Parity—Sets the method of error checking used. Selections: Even, Odd, or None. Default: Even

Stop Bits—Used to select the number of bits that are used to signal the end of a transmitted data byte. Selections: 1 or 2. Default: 1

Readability—The number of digits sent from the balance that is displayed on the spreadsheet. This number should equal the number of places available from the balance.

Balance Mode—If a balance is connected to the system set this parameter to Normal. If there isn't a balance connected to the system set this parameter to Disabled.

Send Command—The command sent from the instrument that the balance reads to send and enter the weight in the spreadsheet. Default <ESC>P<CR><LF>

Tare Command—The command sent from the instrument that the balance reads to set the weight displayed on the balance to zero. Default: <ESC> T

Print—Click Print to receive a printout of the system configuration settings from the system printer. These may be saved for future reference.

Test Commands

Send—Used to test the balance interface. Click Send to send a weight from the balance to the system and display the weight in the spreadsheet.

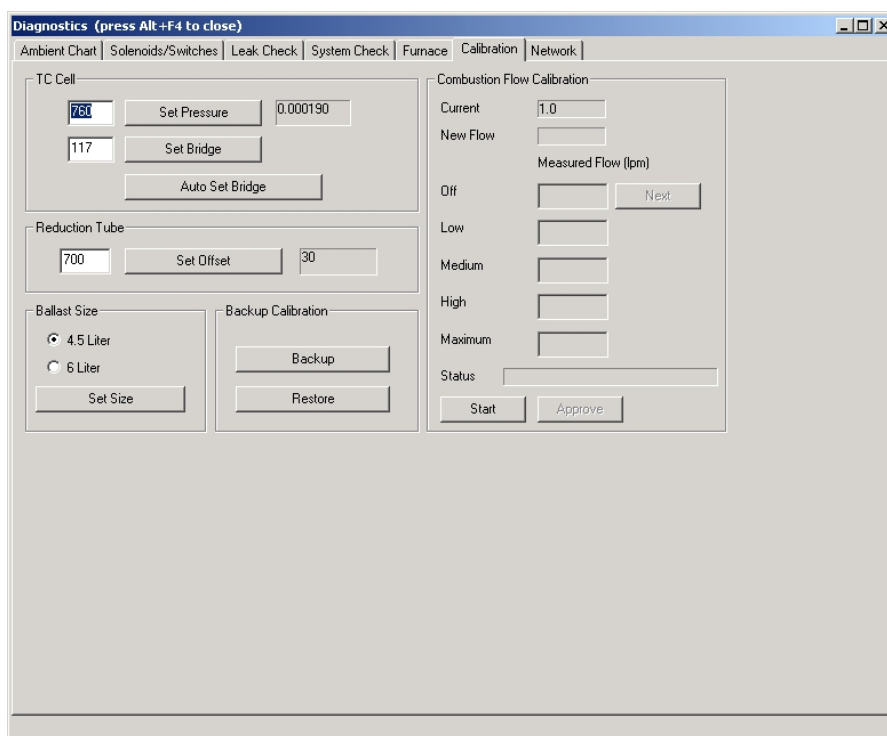
Tare—Used to test the balance interface. Click Tare to set the weight displayed on the balance to zero.

Barometric Calibration

Barometric Calibration sets the instrument's barometer to the current barometric pressure. An accurate, local, barometric pressure value must be available to perform this procedure. Refer to Barometric Pressure, page 7-12, for additional information.

Changes in barometric pressure will affect gas volume. For this reason, the correct barometric pressure must be manually entered to obtain the most accurate results.

1. From the Diagnostic menu, click Calibration. The Hardware Calibration dialog box will appear.



2. Click inside the barometric Pressure value box, located to the left of the Set Pressure button, and enter the current barometric pressure.
-
- *Use values in mm Hg for barometric pressure.*
3. Click the Set Pressure button to enter the current barometric pressure.
 4. Close the Hardware Calibration dialog box.

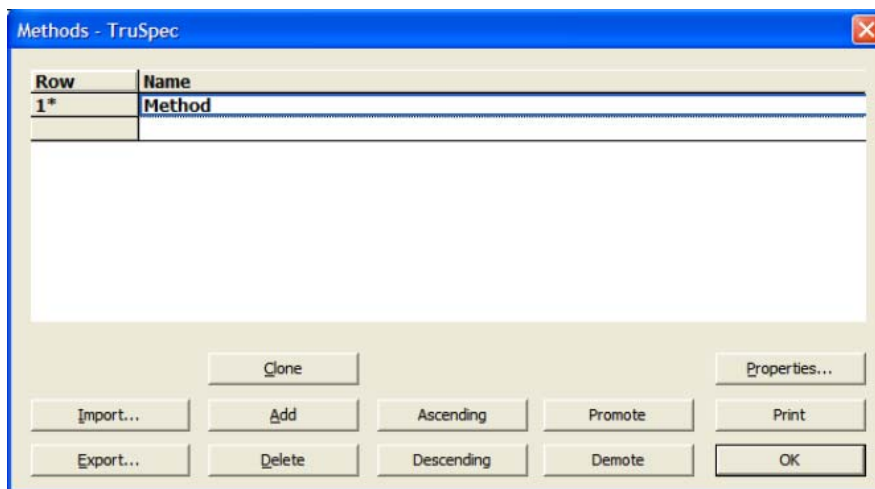
Note

Method Configuration

A method is a set of analytical parameters used to control the instrument during analysis and calculation of the final result. Before analysis, a method must be created or the default method used.

Create a Method

1. From the Configuration menu, click Method. The Method dialog box will appear.



2. Click Add to create a method. A row will be added to the bottom of the spreadsheet.

Note → • You can also click an empty row and enter a method name.

3. Click Properties. The Analysis Parameters dialog box will appear.

The screenshot shows the 'Methods' dialog box with the 'Analysis Parameters' tab selected. The 'Sample Size' section contains two radio buttons: 'Macro (50 mgs - 1.5 grams)' and 'Micro (20 micrograms - 50 mgs)'. The 'Micro' option is selected. Below this, there is a text field for 'No Sample Drop Detection' with the value '0' and the unit 'times N Blank'. The 'Furnace' section contains two text fields: 'Temperature' with the value '950' and a range of '0 - 1050 C', and 'Afterburner Temperature' with the value '850' and a range of '0 - 1050 C'. At the bottom of the dialog are three buttons: 'OK', 'Cancel', and 'Help'.

- A. Refer to Analysis Parameter Definitions, page 4-45, and enter the desired analysis property values.
- B. Click OK when finished.

Notes

- *TruSpec CHN (Macro)*—Although most official methods state 850°C as the acceptable temperature for combustion in the primary furnace, LECO recommends 950°C to achieve the highest level of sample oxidation.
- *TruSpec Micro*—Although most official methods state 850°C as the acceptable temperature for combustion in the primary furnace, LECO recommends 1100°C to achieve the highest level of sample oxidation.

- C. Click the Element Parameters tab to display the element properties dialog box.

Methods

Analysis Parameters | **Element Parameters** | Burn Profile | Macro Ballast Parameters | Liquid Autosampler

| | Nitrogen | Carbon | Hydrogen | Range |
|-------------------|----------|--------|----------|-----------------|
| Analyze* | Yes | Yes | Yes | |
| Minimum Analy | 30 | NA | NA | 0 - 400 seconds |
| Comparator Lev | 0.01 | NA | NA | 0 - 100% |
| Endline Time | 1 | NA | NA | 0 - 5 seconds |
| Conversion Fact | 1.00 | 1.00 | 1.00 | 0.01 - 99.9 |
| Significant Digit | 5 | 3 | 3 | 1 - 5 |

IR Analysis Stabilize Comparator 0 - 5

IR Baseline Delay Time 0 - 60 seconds

IR Baseline Time 1 - 30 seconds

IR Pressure Stabilization Comparator 0 - 2

IR Stop Flow Time 1 - 20 seconds

TC Baseline Delay Time 0 - 60 seconds

TC Baseline Time 1 - 10 seconds

OK Cancel Help

- D. Refer to Element Parameter Definitions, page 4-45, and enter the desired element property values.
- E. Click OK when finished.

- F. Click the Burn Profile tab to display the burn profiles properties dialog box.

Methods

Analysis Parameters | Element Parameters | Burn Profile | Macro Ballast Parameters

Burn Steps

| # | Time | Furnace Flow |
|---|------|--------------|
| 1 | 30 | Maximum |
| 2 | 30 | Medium |
| 3 | 30 | Maximum |
| 4 | | |

Add

Delete

OK Cancel Help

- G. Refer to Burn Profile Definitions, page 4-47, and enter the desired burn profile property values.
- H. Click OK when finished.

Note → • Refer to Setting the Burn Flow Profile, on page 4-48, for more information about Burn Profiles.

- I. Click the Macro Ballast tab to display the micro ballast properties dialog box.

The screenshot shows a software window titled 'Methods' with a close button (X) in the top right corner. It contains four tabs: 'Analysis Parameters', 'Element Parameters', 'Burn Profile', and 'Macro Ballast Parameters'. The 'Macro Ballast Parameters' tab is selected and active. Inside this tab, there are two main sections: 'Ballast' and 'Aliquot Loop'. The 'Ballast' section contains two input fields: 'Equilibrate Time' with a value of 30 and a range of 10 - 200 seconds, and 'Not Filled Timeout' with a value of 300 and a range of 60 - 900 seconds. The 'Aliquot Loop' section contains two input fields: 'Fill Time' with a value of 20 and a range of 10 - 30 seconds, and 'Equilibrate Pressure Time' with a value of 4 and a range of 1 - 10 seconds. At the bottom right of the dialog box are three buttons: 'OK', 'Cancel', and 'Help'.

| Section | Parameter | Value | Range |
|--------------|---------------------------|-------|------------------|
| Ballast | Equilibrate Time | 30 | 10 - 200 seconds |
| | Not Filled Timeout | 300 | 60 - 900 seconds |
| Aliquot Loop | Fill Time | 20 | 10 - 30 seconds |
| | Equilibrate Pressure Time | 4 | 1 - 10 seconds |

- J. Enter the desired Macro Ballast property values.
- K. Click OK when finished.

- L. Click the Liquid Autosampler tab to display the liquid autosampler properties dialog box.

Methods

Analysis Parameters | Element Parameters | Burn Profile | Macro Ballast Parameters | **Liquid Autosampler**

☐ Enabled

Syringe:

Syringe Washes

| | | | |
|--------------------|---|---------------------|---|
| Solvent A pre-wash | 1 | Solvent A post-wash | 0 |
| Solvent B pre-wash | 0 | Solvent B post-wash | 1 |
| Sample pre-wash | 1 | | |

Syringe Filling

| | | | |
|-----------------------|-----|---------------------|------|
| Sample Volume (mL) | 0.5 | Fill Volume (mL) | 0.5 |
| Viscosity Delay (sec) | 0 | Fill Speed (mL/sec) | 0.01 |
| | | Fill Strokes | 1 |

Injection

| | |
|-------------------------|-----|
| Injection Rate (mL/sec) | 0.1 |
|-------------------------|-----|

OK Cancel Help

- M. Check the Enable checkbox to enable the liquid sampler.
- N. Enter the desired Liquid Autosampler property values.
- O. Click OK when finished.

Analysis Parameter Definitions

Notes

- The TruSpec microanalysis kit must be installed before the microanalysis range can be selected. Refer to TruSpec Micro Kit Option on page 1–27.
- The TruSpec measurement range is determined by the sample size selected.

Sample Size—Selects the mode of operation, macro-analysis or microanalysis. The macro-analysis range is 50 mgs to 1.0 gram and the microanalysis range is up to 50 mgs. Select the range that corresponds to the expected sample analysis result.

No Sample Drop Detection—Determines if a sample has dropped into the furnace by comparing the nitrogen area of a blank analysis against the nitrogen area of the current analysis multiplied by a constant. The default constant value is 3. If the result area, multiplied by the constant value, is less than the blank area, analysis will stop and an error message will be logged.

Furnace Temperature—Sets the operating temperature of the furnace (primary furnace) as defined in the method. Typically the combustion furnace is set at 950°C.

Afterburner Temperature—Sets the operating temperature of the Afterburner (secondary furnace) as defined in the method. Typically the afterburner is set at 850°C.

Element Parameter Definitions

Analyze—Determines if a sample result will be calculated and displayed for selected element.

Minimum Analysis Time—The minimum amount of time allotted for analysis. This is also called integration time. During this time the cell output is being integrated to determine the result. Default: Nitrogen - 30 seconds.

Comparator Level—The minimum concentration percentage, expressed as a percentage of peak height and offset, which will stop analysis. Analysis will stop when the detection system output is below a significant concentration level. The comparator level is effective only after the minimum analysis time is met. Default: Nitrogen - 0.01%.

Endline Time—The amount of time used to collect baseline value after the peak. Collection begins after the comparator level has been reached. Endline Time is used in conjunction with the baseline taken before the peak. Default: Nitrogen - 1 second.

Conversion Factor—The factor used to convert Percent to User Defined. Percent multiplied by the Conversion Factor equals User Defined. Conversion Factor is only used when Percent is selected under Reporting Units. Refer to Reporting Units on page 4–24. Default: 1.

Significant Digits—The number of significant digits displayed in the analysis result. This includes the number of digits to the right and left of the decimal point. For example, three significant digits would produce answers displayed as 0.0325% and 0.0125%. Four significant digits would produce answers displayed as 0.03253% and 0.01253%. Default: Carbon - 3, Nitrogen - 5.

Standard Additions Offset—To apply the method for standard additions, check the Apply Standards Offset check box and select Linear for the calibration curve. Blank subtraction cannot be used. Refer to Method of Standard Additions on page 7–9.

IR Analysis Stabilize Comparator—Monitors the IR cell baseline for stability after the purge cycle is complete.

- Set to 0—IR cells will not be monitored for stabilization.
- Set to > 0—IR Cells will be monitored for stabilization after purge is complete to ensure baseline stability. The baseline rate of drift (slope) must stabilize below the entered (slope) value for at least 5 seconds before continuing with analysis.

Baseline Delay Time—The amount of delay time prior to collecting baseline data after the Analysis Stabilize Comparator is finished.

Baseline Delay Time for Nitrogen—Determines the time period to wait before baseline data after sample gas is dumped into the measurement system from the aliquot loop.

IR Baseline Time—The selected amount of time to collect baseline data.

IR Pressure Stabilization Comparator—Monitors gas pressure in the IR cells after sample gas from the ballast is isolated.

- Set to 0—Pressure in the IR cells will not be monitored.
- Set to > 0—IR Cell pressure will be monitored after sample gas from the ballast is isolated. The change in pressure (slope) must stabilize below the entered (slope) value for at least 5 seconds before continuing with analysis.

IR Stop Flow Time—Determines the time period to collect analysis data after the IR Pressure Stabilization Comparator is finished. Default: 5 seconds.

TC Baseline Time—Determines the amount of time to collect baseline data for the TC cell.

Burn Profile Definitions

Burn Steps—Selects the number of combustion steps for analysis. One to five steps may be added. Click Add to add steps. Click Delete to remove steps.

Time—The amount of time in seconds that the step will burn before the instrument switches to the next step. Click to enter the desired time.

Furnace Flow—The furnace gas flow rate. Selections are None, Low, Medium, High and Maximum. Click to enter the desired flow rate.

Setting the Burn Profile

The purpose of the burn profile is to achieve complete combustion, before filling the ballast volume, in the least amount of time with the most efficient use of oxygen. Rapidly combustible materials, such as sucrose, grains, and oils require a high initial flow to prevent incomplete combustion. Materials that burn slower require a medium initial flow until reaching combustion temperature.

To avoid incomplete combustion of the sample, it is recommended to start with a high flow, then decrease to medium flow. Low or erratic answers, or, in extreme cases, the presence of soot in the lance or filter tube may indicate incomplete combustion. The burning sample may be observed through the sample drop block during combustion. The tin capsule generally burns intensely after the sample is gone.

To select the flow rate and time period for each flow, refer to Create a Method, page 4-39.

Figure 4-2 below shows a typical burn profile. Flow 1 is set at high for 30 seconds. Flow 2 is set at low for 30 seconds. Flow 3 is set at high until end of analysis.

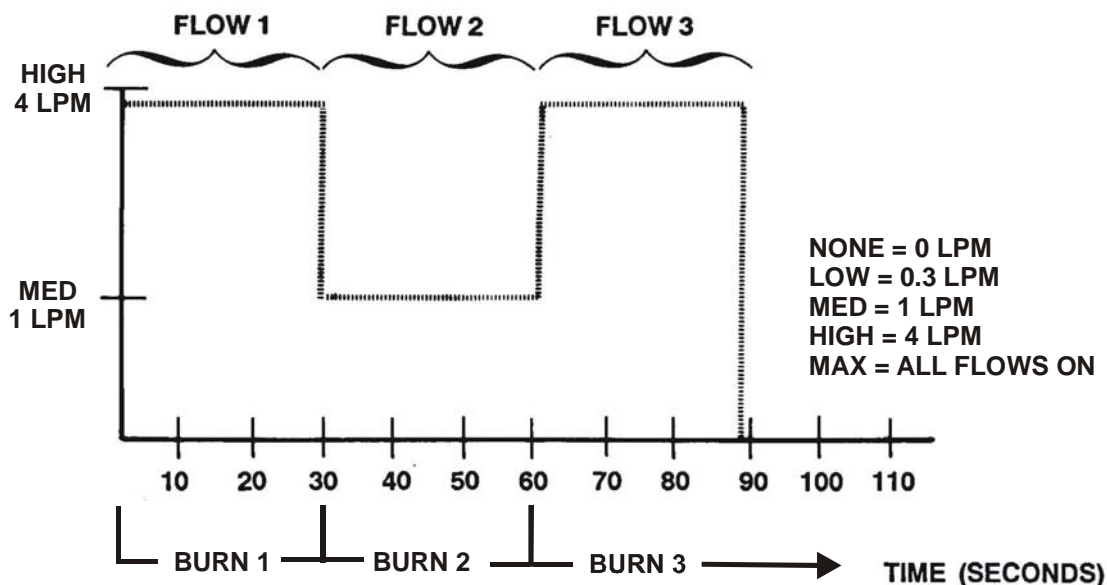


Figure 4-2
Burn Profile

Macro Ballast Definitions

Equilibrate Time—The time period for gases in the ballast to mix after it is filled.

Not Filled Time Out—If the ballast is not filled by the entered time period, analysis will abort. This could be caused by a leak in the system. This time period should be longer than the combined time of the burn steps.

Aliquot Loop Fill Time—The time period to wait for the aliquot loop to fill once the ballast has equilibrated and starts emptying.

Equilibrate Pressure Time—The time period to wait once the aliquot loop is filled and isolated to let pressure in the aliquot loop to stabilize.

Liquid Autosampler

Syringe—A drop down menu displays the available syringes; select the desired syringe. A blank cell means the auto sampler is not on or is not connected.

Solvent A Pre-Wash—Enter the number of times solvent A is drawn into the syringe and expelled into the assigned waste bottle.

Solvent B Pre-Wash—Enter the number of times solvent B is drawn into the syringe and expelled into the assigned waste bottle.

Sample Pre-Wash—Enter the number of times a sample solution is drawn into the syringe and expelled into the assigned waste bottle.

Solvent A Post-Wash—Enter the number of times to rinse the syringe after sample injection. (Minimizes cross contamination with the next sample.)

Solvent B Post-Wash—Enter the number of times to rinse the sample out of the syringe. (Minimizes cross contamination with the next sample.)

Sample Volume (ml)—Enter the sample volume amount in microliters (μL).

Viscosity Delay (sec)—Specify the length of pause allowing viscous samples to be drawn into the syringe.

Fill Volume (ml)—Controls the filling of the syringe. Air bubbles can remain below the plunger after the first pull up. If the plunger is moved up and down several times, the air bubbles are worked out; therefore, the syringe can be completely filled even when using very small sample volumes.

Fill Speed (ml)—Specify the speed of plunger movement (used in all syringe filling operations).

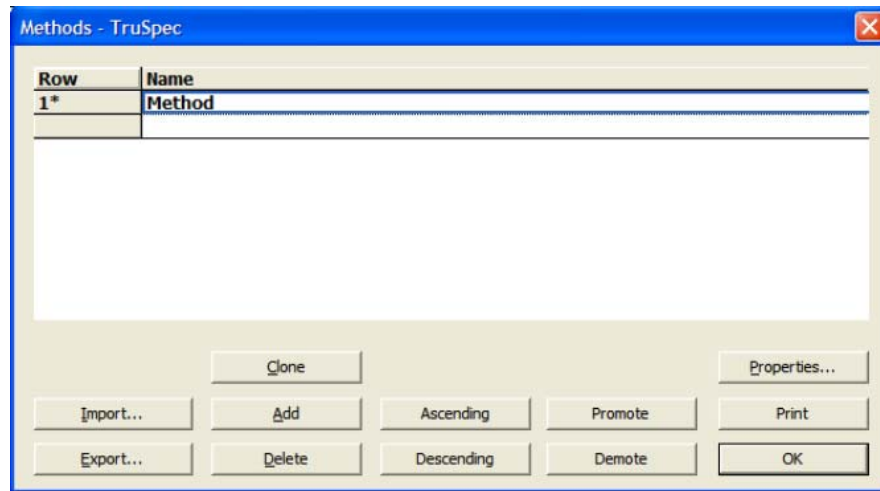
Fill Strokes—All fill strokes, except the last one, use the selected fill volume. If the selected sample volume is higher than the fill volume, the sample volume is used for all fill strokes. If 0 is selected the plunger is pulled up only once using the sample volume value.

Injection Rate (ml/sec)—Enter the speed the sample is expelled into the injector.

Edit a Method

Note → • *Using this procedure you can also edit the method list.*

1. From the Configuration menu, click Method. The Method screen will appear.
2. Select the Method to be edited.

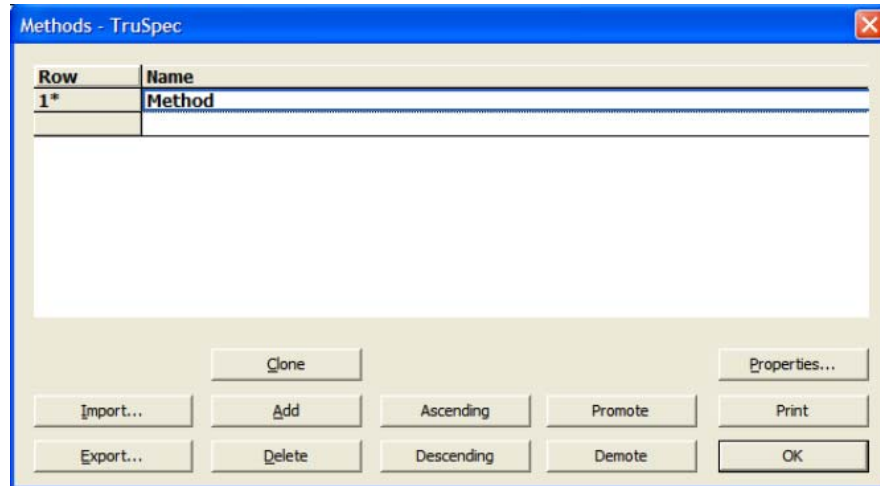


3. Click Properties to change the method properties. Refer to Create a Method page [4-39](#).
4. To move a selected method up towards the top of the list select it and click Promote.
5. To move the selected method down towards the bottom of the list select it and click Demote.
6. Select Ascending to list the method in ascending alphabetical order.
7. Select Descending to list the method in descending alphabetical order.
8. Click OK to save any changes and exit.

Clone a Method

→ **Note** • After a method is cloned the name and desired parameters can be changed to create another method.

1. From the Configuration menu, click Method. The Method screen will appear.

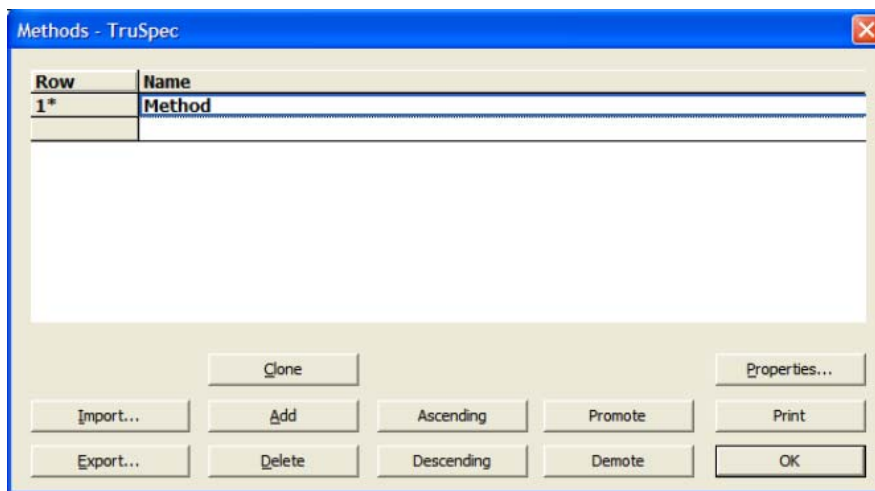


2. Select a method to clone by clicking on the method row.
3. Click Clone to add another method to the method list with the same method parameters as the selected method.
4. Click the cloned method name and change it to make it different from the selected method.
5. Click OK to exit and save the cloned method.

Export a Method

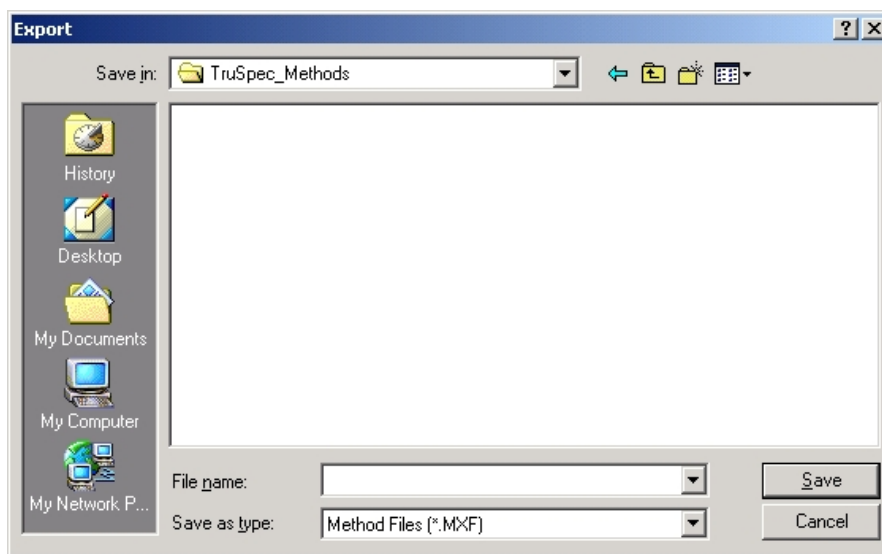
Export a Method permits the operator or manager to copy a method to a file. The method can be saved on the systems hard drive or transferred to another media for safe storage. If necessary, the method can be imported to the same instrument or transferred to another TruSpec instrument. Refer to Import a Method on page 4-55.

1. Click the Configuration menu and select Method. The Method screen will appear.

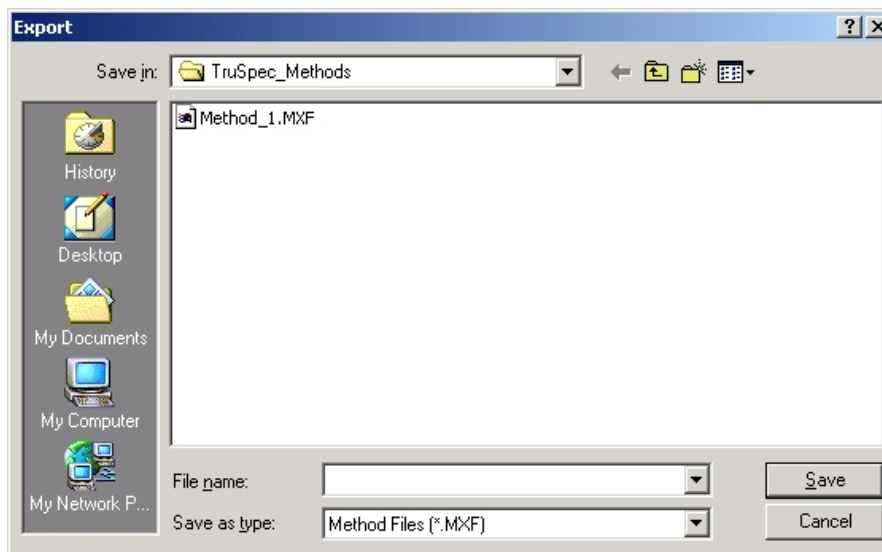


2. Select the method to export by clicking on it. An asterisk will appear next to the selected method.

3. Click Export. The export method selection screen will appear.



4. Select the folder to store the method in. The method name will appear as the file name. Do not enter an extension. The software will automatically add the proper file extension.

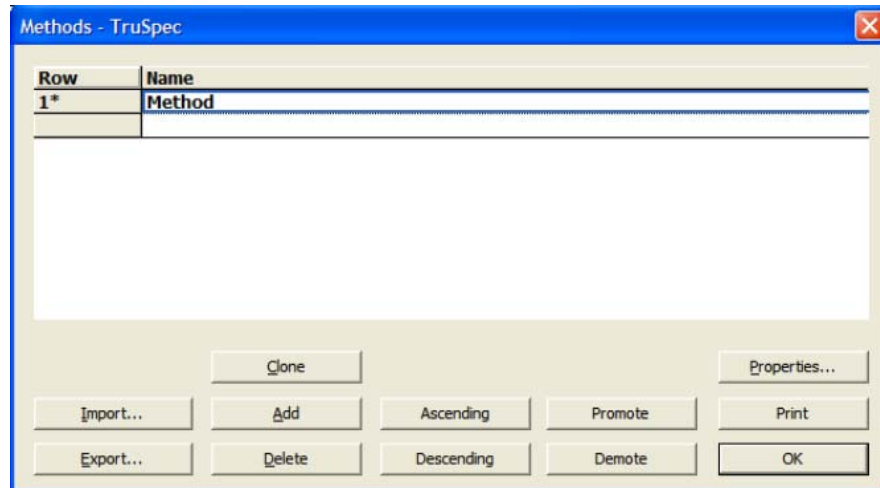


5. Click Save to copy the method to the selected file.

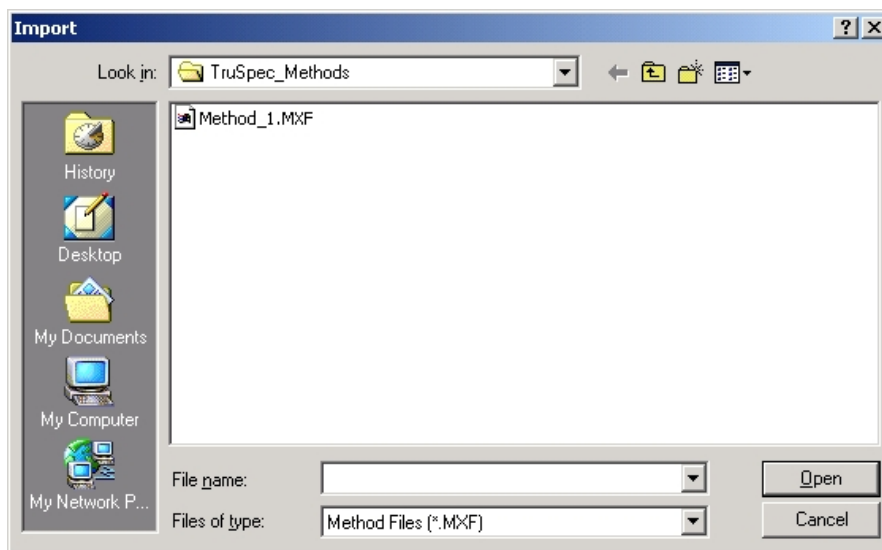
Import a Method

Import a Method transfers an exported method to an instrument and adds it to the method list. A method can be imported that was developed on the present instrument or another TruSpec instrument.

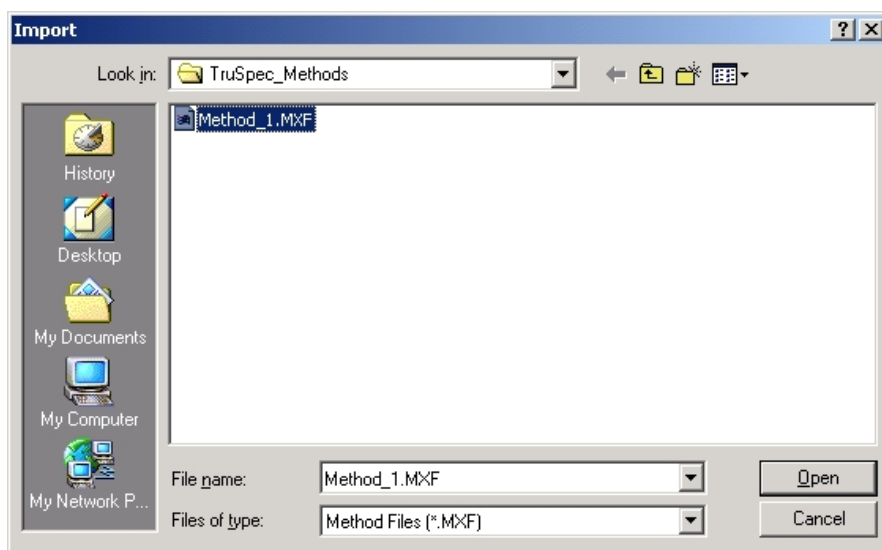
1. Click the Configuration menu and select Method. The Method screen will appear.



2. Click Import to import a saved method. The import method file selection screen will appear.



3. Select the Method File to import.



4. Click Open. The method will be added to the analysis method list.

Delete a Method

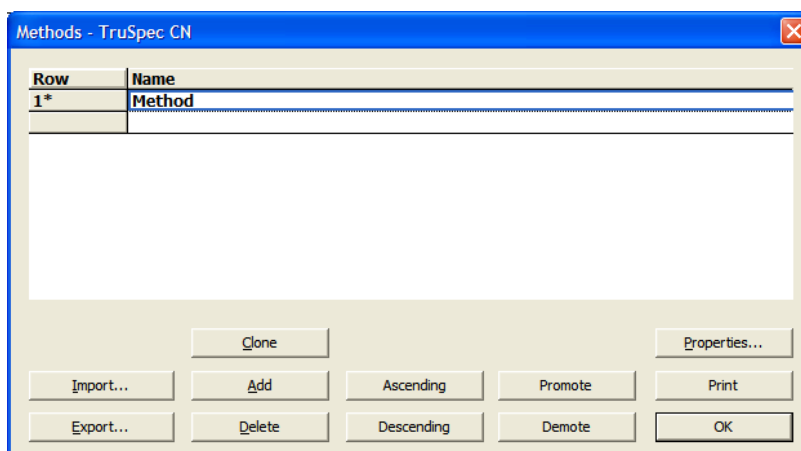


If a method is deleted using this procedure, all samples and calibrations associated with the method are also deleted.

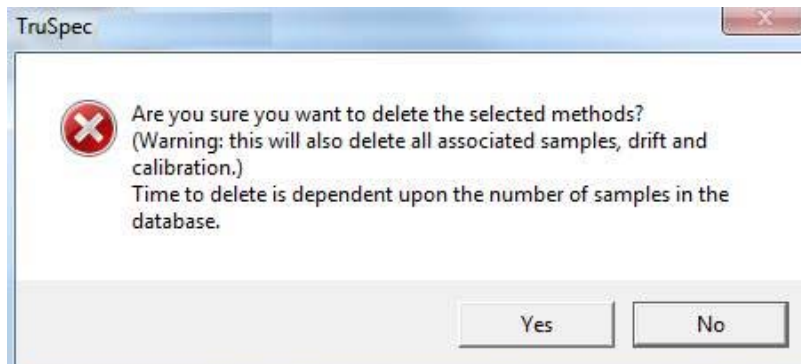


Once a method is deleted it cannot be restored.

1. From the Configuration menu, click Method. The Method screen will appear.



2. Select a method to delete by clicking on the method row.
3. Click Delete to delete the selected method from the method list. A confirmation dialog box will appear.



4. Click Yes to delete the selected method.

Define Calibration Standards

Define Calibration Standards creates a list of calibration standards and their values for use during calibration and drift correction.

- **Note**
- *LECO recommends that certified reference materials be used for calibration development on the TruSpec.*

1. From the Configuration menu, click Standards. The Standards dialog box will appear.

| Row | Name | Carbon % | Nitrogen % | Carbon LCL | Carbon UCL | Nitrogen LCL | Nitrogen UCL | Check Std. |
|-----|---------|----------|------------|------------|------------|--------------|--------------|------------|
| 1* | EDTA | 40.920 | 9.5700 | 51.070 | 52.110 | 11.050 | 11.150 | No |
| 2 | 502-272 | 51.590 | 11.100 | 51.070 | 52.110 | 11.050 | 11.150 | No |

Fields Add Ascending Promote Print
Delete Descending Demote OK

2. Click Fields to edit the displayed fields or columns on the Standards screen.
3. Click Add to list a standard. A row will be added to the bottom of the spreadsheet.
4. Click the row and enter a standard name, value, lower control limit (LCL) and upper control limit (UCL).

- **Notes**
- *The lower control limit, or LCL, is the minimum standard result value that will allow analysis to continue. If the standard result is below the lower control limit, a notice will appear and analysis will stop, permitting the operator to make corrections and then restart the analysis.*
 - *The upper control limit, or UCL, is the maximum standard result value that will allow analysis to continue. If the standard result is above the upper control limit, a notice will appear and analysis will stop, permitting the operator to make corrections and then restart analysis.*
 - *If an LCL or UCL value is not entered analysis will continue regardless of the result data.*

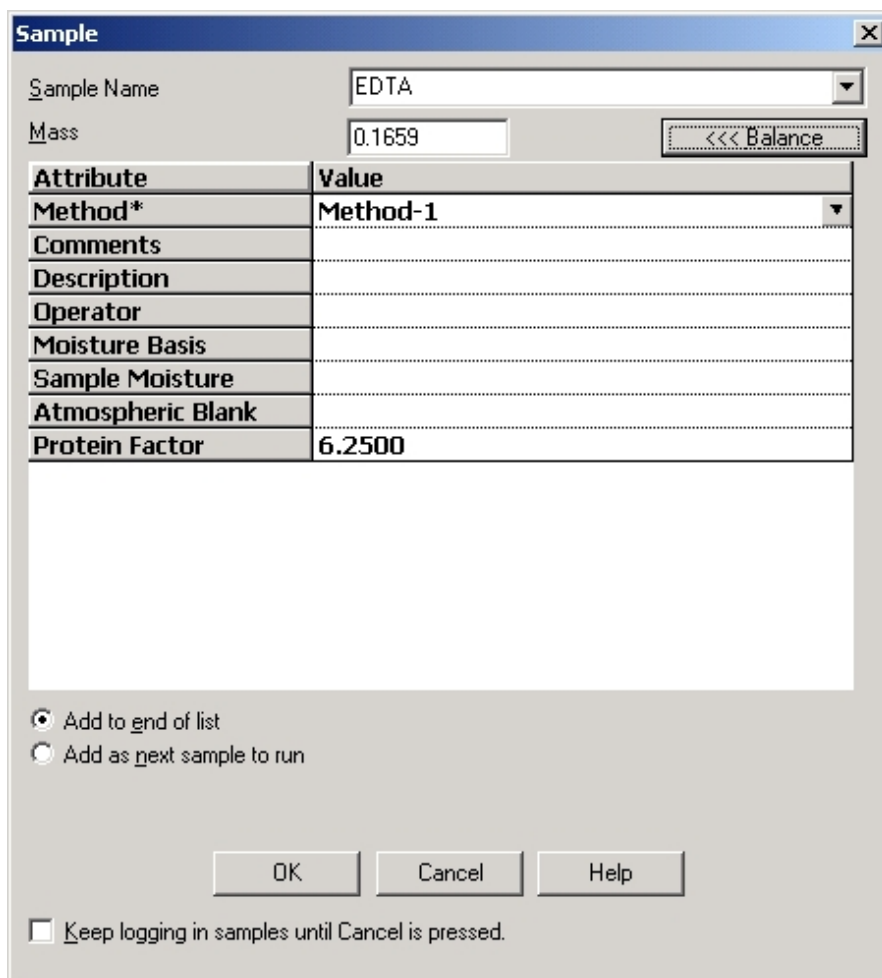
5. To move a selected standard up towards the top of the list select it and click Promote.

6. To move the selected standard down towards the bottom of the list select it and click Demote.
7. Select Ascending to list the standard in ascending alphabetical order.
8. Select Descending to list the standard in descending alphabetical order.
9. Click OK to save any changes and exit.

Login using Calibration Reference Material

- Note** → • Before a sample can be analyzed as a standard it must be added to the Standards List. Refer to Define Calibration Standards on page 4-58.

1. From the Samples menu, click Login. The Sample Login dialog box will appear.



The Sample Login dialog box is shown. It contains the following fields and controls:

- Sample Name:** A dropdown menu with "EDTA" selected.
- Mass:** A text box containing "0.1659".
- <<< Balance:** A button.
- Table:** A table with two columns: Attribute and Value.

| Attribute | Value |
|-------------------|----------|
| Method* | Method-1 |
| Comments | |
| Description | |
| Operator | |
| Moisture Basis | |
| Sample Moisture | |
| Atmospheric Blank | |
| Protein Factor | 6.2500 |
- Radio buttons:** "Add to end of list" (selected) and "Add as next sample to run".
- Buttons:** "OK", "Cancel", and "Help".
- Checkbox:** "Keep logging in samples until Cancel is pressed." (unchecked).

2. Click the drop down arrow, in the sample name selection box, and select a defined Standard from the list.
3. Enter the information required in the Login Screen. Refer to Standard Login Definitions, page 4-61, for additional information.
4. Click OK to login the standard.

Standard Login Definitions

Sample Name—The name or type of sample. A standard should be entered for the sample name. Click down arrow to select from the list of standards.

Mass—The mass of the standard. Click Balance to enter a mass from an external balance.

Method—The method used for analysis. Click the Down Arrow to select from the list of methods.

Comments—A statement used to explain an operation or procedure. This is an optional entry.

Description—A statement used to explain or identify a sample. This is an optional entry.

Operator—The name of the operator. This is an optional entry.

Moisture Basis—No entry should be made for standard login.

Sample Moisture—No entry should be made for standard login.

Add to End of List—Check to enter the logged in standard in the last row of the spreadsheet.

Add as Next Sample to Run—Click to enter the logged in standard after the last sample that was analyzed.

Keep Login Samples until Cancel is Pressed—Check this box to log consecutive standards. The dialog box will reappear after OK is clicked. This is an optional entry.

Sample Templates

Sample Templates is a quick way for the operator to login a sample and enter a method, comment, and description.

Create a Sample Template

1. An analysis method should be developed before a sample is logged in. Refer to Create a Method on page [4-39](#).
2. From the Configuration menu, click Sample Templates. The Sample Templates screen will be displayed.

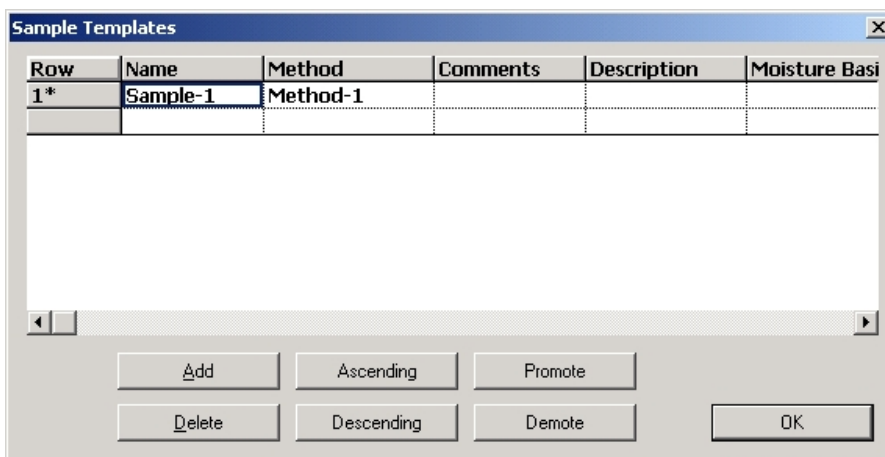
| Row | Name | Method | Comments | Description | Moisture Basis |
|-----|----------|----------|----------|-------------|----------------|
| 1* | Sample-1 | Method-1 | | | |

Buttons: Add, Ascending, Promote, Delete, Descending, Demote, OK

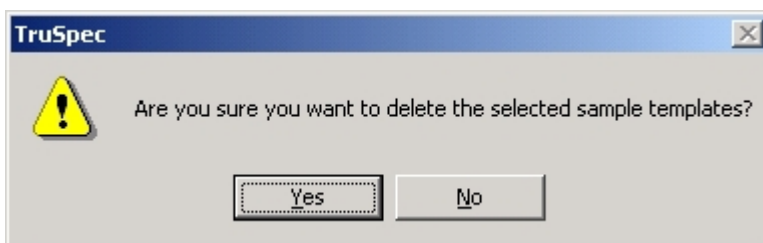
3. Click Add to create a method. A row will be added at the bottom of the list. Enter a method name.
4. To change the name, select the default name by clicking the name and entering a new name.
5. Click the method cell and enter a method.
6. Click the comments cell and enter any comments.
7. Click the description cell and enter a description.
8. Click OK to save any changes and exit.

Delete a Sample Template

1. From the Configuration menu, click Sample Templates. The Sample Templates screen will appear.
2. Select the Sample Template to delete.



3. Click Delete. The Sample Template Delete screen will appear.



4. Click Yes to delete the sample template or No to exit without deleting the sample template.

Edit the Sample Template List

1. Select a Sample Template and click Promote to move a selected method up towards the top of the list.
2. Select a Sample Template and click Demote to move the selected method down towards the bottom of the list
3. Select Ascending to list the transmission formats in ascending alphabetical order.
4. Select Descending to list the transmission formats in descending alphabetical order.
5. Select a Sample Template and click Delete to remove it from the sample template list.

Login using a Sample Template

1. From the Samples menu, click Login. The Sample Login dialog box will appear.

| Attribute | Value |
|-------------------|----------|
| Method* | Method-1 |
| Comments | |
| Description | |
| Operator | |
| Moisture Basis | |
| Sample Moisture | |
| Atmospheric Blank | |
| Protein Factor | 6.2500 |

2. Click the drop down arrow to the right of sample name and enter the desired sample name from the drop down list. The sample name, method comments, and description will automatically be entered into the spreadsheet.
3. Continue with sample login and enter the other necessary information.

—————→
Note

- Refer to Sample Login for additional information.

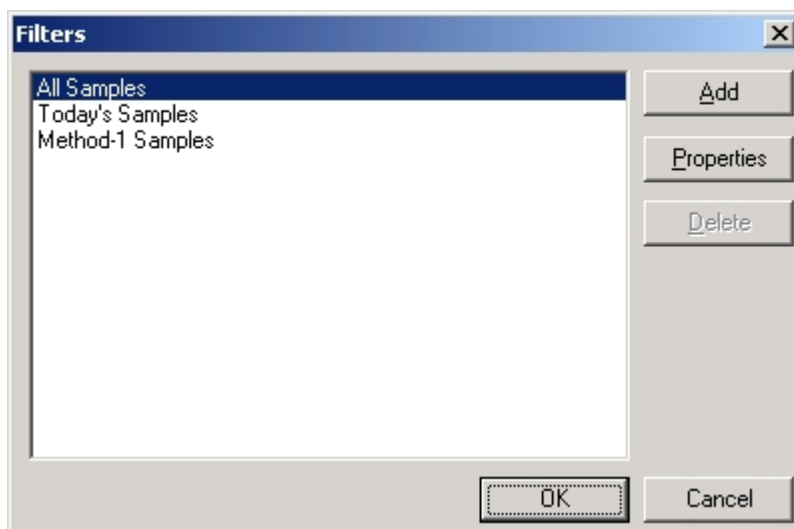
Sample Filters

Sample filters permits the operator to sort and display sample data based on a predefined requirement. Fields can be selected to display a certain name or value. Fields can also be mathematically compared and displayed according to a requirement.

- **Note**
- *There are three predefined fields:*
 - All Samples—displays all the sample data in the database.
 - Today's Samples—displays all samples run today.
 - Method-1 samples—displays all the samples run using Method-1.

Apply a Filter and Sort Sample Data

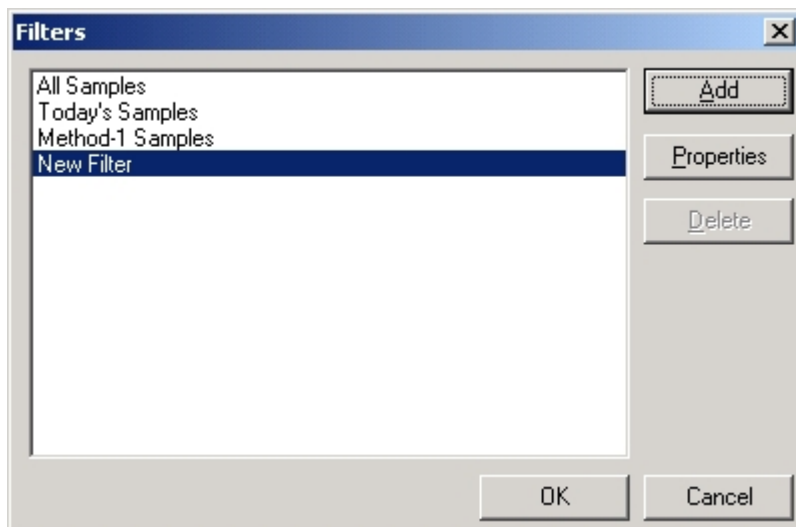
1. From the Configuration menu, click Sample Filters. The Sample Filters dialog box will appear.
- **Note**
- *The filters All Samples and Today's Samples will always appear. In addition, a filter will appear for each defined method.*



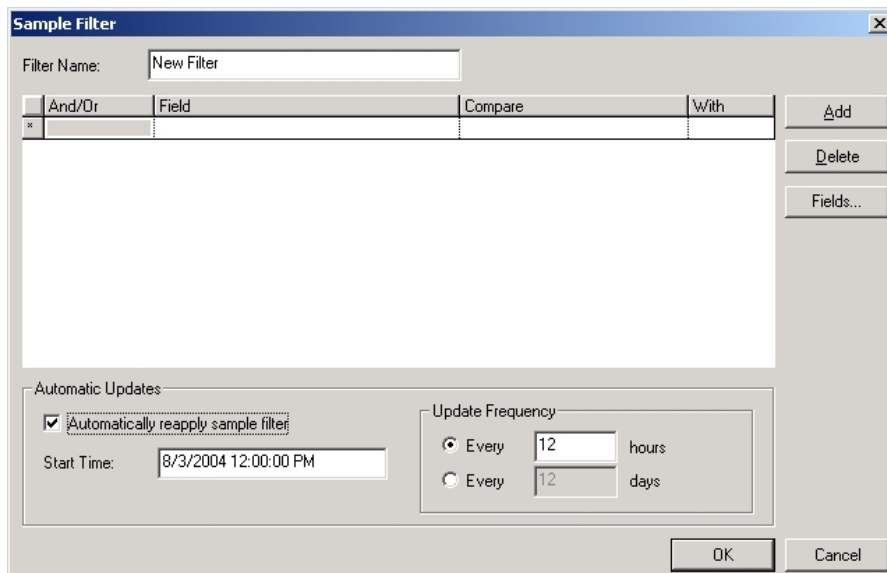
2. Select a sample filter and click OK. The dialog box will disappear and the sample grid will reappear with the filter applied.
3. Click Cancel to exit without applying the filter.

Define a Filter to Apply

1. From the Configuration menu, click Sample Filters. The Sample Filters Selection dialog box will appear.



2. Click Add to define and add a sample filter to the list. A new filter with the filter name New Filter will be added to the list.
3. To define the new filter select New Filter and click Properties. The Properties Dialog Box will appear.



4. From the Properties Dialog Box you can define the filter.
5. Click the Filter Name to enter and change the filter name. This is the name that will appear in the Sample Filter Selection dialog box.

6. Click the cell under Field and enter a sample field to sort. As examples, you can sort on a sample name or method. A drop down arrow will appear. Select the desired field from the list.
7. Click the cell under With to sort the field name with. As an example, the field name can be sorted with a specific sample name. Equal will automatically appear in the Compare field.
8. If you enter a numeric value in the With field click the compare cell and enter the desired operator. Operators are; equal, greater than, greater than or equal, less than, or less than equal. The field name will be sorted with the value using the compare operator.
9. Select a filter and click Fields to select the fields to display when the filter is used.
10. Select a filter and click Delete to delete the filter.

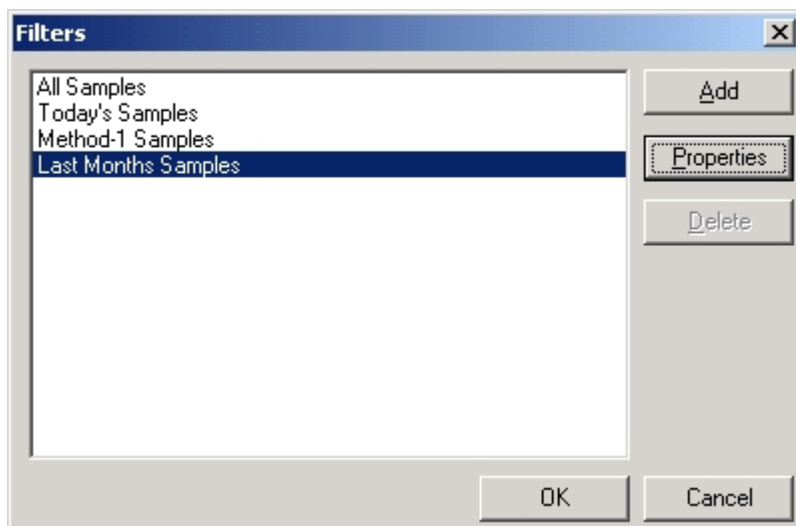
Automatically Reapply the Sample Filter

Automatically Reapply Sample Filter is used to reapply a defined sample filter at a predetermined time and frequency.

Example →

- *If you create a filter that displays samples from the previous 30 days, it will show samples from the last 30 days when it's first applied. If it's not reapplied, samples that originally matched the filter plus all the new samples will be added to the spreadsheet. To prevent this from happening, automatically reapply the filter every day, preferably at a time when the instrument isn't being used.*
1. From the Configuration menu, click Sample Filters. The Sample Filters dialog box will appear.
 2. Select the filter to automatically apply and click Properties. The Properties Dialog Box will appear.
 3. Check Automatically Reapply Sample Filters.
 4. Enter the time, date and update frequency.

1. From the Configuration menu, click Sample Filters. The Sample Filters dialog box will appear.
2. From the Configuration menu, click Sample Filters. The Sample Filters Selection dialog box will appear.



3. Select the filter to automatically apply and click Properties. The Properties Dialog Box will appear.
4. Check Automatically Reapply Sample Filters.
5. Enter the time, date and update frequency.

User Defined Fields

The User Defined Fields allows customized fields to be added to the spreadsheet. User defined fields can display results from functions or they can display customized text such as notes or comments.

1. From the Configuration menu, click User Defined Fields.

| Row | Name | Read Only | Numeric | Format | Formula | Login | Stats |
|-----|------|--------------------------|--------------------------|--------|---------|--------------------------|--------------------------|
| * | | <input type="checkbox"/> | <input type="checkbox"/> | | | <input type="checkbox"/> | <input type="checkbox"/> |

Buttons: Add, Delete, Cancel, Help, OK

2. Create or modify a user field as follows:

To create a user field, click Add. A new row will be inserted into the table.

To modify a user field, select the desired user field in the table.

To delete a user field from the table, select the row of the desired user field and click delete.

3. Complete the table for the new or revised user field as follows:

Select the **Read Only** check box to prevent the user field from being edited in the spreadsheet.

Select the **Numeric** check box to restrict text and only display numeric values.

For **Format**, enter a format to determine how the result of the user defined field displays in the spreadsheet. Refer to Number Formatting, page [4-71](#).

For **Formula**, enter a formula to use if the field will be used for a calculation. Refer to Formulas, page [4-72](#).

Select the **Login** check box and the field will appear in the Login Sample dialog box. Refer to Sample Login, page [5-19](#).

Select the **Stats** check box and statistics will be available in the Dashboard Properties dialog box as a value you can add when you select Show Value and then Add. Once selected as a Show Value, it is displayed on the dashboard. Refer to Configure Dashboard, page [4-28](#). When selected, both Read Only and Numeric are automatically selected.

Select the **Standard** check box and the user defined field can be used as a standard, which means the standard can define its value and range, and can be calibrated.

Number Formatting

Use the Format column in the User Defined Field dialog box to enter a number format. This format determines how the result of the user defined field appears in the spreadsheet. The following section provides examples of formats and how the result will display depending on which format is utilized.

Format Examples

| *Format Type | Number | Format for Result | Result |
|--------------|----------|-------------------|------------|
| A | 4.50360 | A | 4.50360000 |
| Fn.m | 0.123456 | F4.5 | 0.1235 |
| | 0.000789 | F3.5 | 0.00079 |
| | 0.000789 | F3.2 | 0.00 |
| | 321.8765 | F3.5 | 322 |
| Sn.m | 0.123456 | S4.5 | 1.235E-1 |
| | 0.000789 | S3.5 | 7.9E-4 |
| | 0.000789 | S3.2 | 0.0E-1 |
| | 321.8765 | S3.5 | 3.22E+2 |
| En.m | 0.123456 | E4.5 | 123.5E-3 |
| | 0.000789 | E3.5 | 790E-6 |
| | 0.000789 | E3.2 | 000E-3 |
| | 321.8765 | E3.5 | 322E+0 |
| In | 321.8765 | I2 | 322 |

- * A = Default format
- n = Total number of significant digits to be represented
- m = Maximum number of digits after the decimal to define readability
- I = Integer
- S = Scientific notation: An exponential format (y.yyy x 10^e) in which any number is expressed as a number between 1 and 10 multiplied by a power of 10 that indicates the correct position of the decimal in the original number.
- E = Engineering format: An exponential format that displays the exponent in multiples of 3.
- F = Fixed point format: A format in which the decimal point is located at a single unchanging position in a predetermined number of digits.

Formulas

Formulas can be entered into the Formula column of the User Fields dialog box and are used to calculate the result. The following section provides some example formulas and the result based on their calculation.

Formula Examples

| * Function Type | Example Function | Result |
|---|--|--|
| [Column Heading of Desired Analyte Value] | [Carbon %] | Analyte concentration value |
| @ABS(exp) | @ABS([Carbon %]-[Carbon Blank]) | Absolute value |
| @Log10(exp) | @Log10([Carbon ppm]) | Log base 10 |
| @Ln(exp) | @Ln([Carbon %]) | Natural log |
| @SQRT(exp) | @SQRT([Carbon %]) | Square root |
| @Maximum(exp1,exp2) | @Maximum([Carbon %],[Carbon Blank]) | Finds Maximum |
| @Minimum(exp1,exp2) | @Minimum([Carbon %],[Carbon Blank]) | Finds Minimum |
| @IF(cond, true, false) | @IF([Carbon ppm]>5,[Carbon ppm],0) | If the Carbon ppm value is > 5, the Carbon ppm value will display, otherwise 0 will display |
| @AND(cond1, cond2) | @IF(@And([Carbon %]>0.01,[Nitrogen %]>0.01), 1, 0) | If both Carbon and Nitrogen % are > 0.01, 1 will display, otherwise 0 will display |
| @OR(cond1, cond2) | @IF(@Or([Carbon %]>0.01,[Nitrogen %]>0.01), 1, 0) | If either Carbon or Nitrogen % are > 0.01, 1 will display, otherwise 0 will display |
| @XOR(cond1, cond2) | @IF(@XOr([Carbon %]>0.01,[Nitrogen %]>0.01), 1, 0) | If JUST Carbon % or JUST Nitrogen % is > 0.01 (not both), 1 will display, otherwise 0 will display |

- * exp = expression. Used to specify a field value or perform a calculation on field values. May be a single number or a function that returns a number.
 cond = condition. Used for comparisons based on a single condition or multiple conditions.

Managing Databases

NOTE →

Over time the instrument database can accumulate a great deal of information. It is good practice to establish a regular database backup procedure. Refer to [Creating and Retrieving Database Backups](#), page [4-75](#).

LECO software applications use a database to store and maintain all the information necessary to run the instrument, including methods, standards, system parameters, and sample results. A file system database is created automatically the first time the software is started. In addition, a database connection that contains the name and location of the database is created. The database connection is used to specify which database to open.

LECO software provides the means to create and maintain the instrument database and database connections. A database management wizard allows you to add database connections, to select a database connection for use, and to delete database connections. When you add a connection, it can be to a new database or to an existing database. The new connection name is added to the list of available database connections.

For 21 CFR Part 11 compliance, logging can be enabled when a database connection is created. When logging is enabled, Presentation Time, View History, and Archive Log appear on the Database menu in the instrument software.

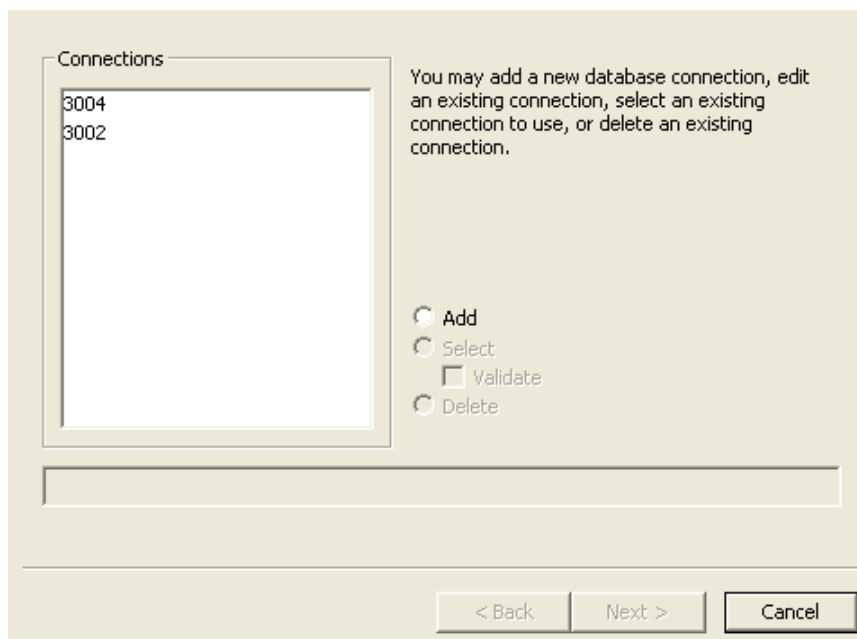
This section explains the following topics:

- Using the Start Dialog Box, page [4-74](#)
- Creating and Retrieving Database Backups, page [4-75](#)
- Selecting a Database Connection, page [4-76](#)
- Adding a Database Connection, page [4-77](#)
- Deleting a Database Connection, page [4-80](#)
- Validating a Database, page [4-80](#)
- Compacting/Repairing a Legacy Database, page [4-83](#)
- Managing Databases for 21 CFR Part 11 Compliance, page [4-83](#)
 - Enabling Logging for an Existing Database, page [4-83](#)
 - Enabling Logging for a New Database, page [4-85](#)
 - Presentation Time, page [4-87](#)
 - View History, page [4-88](#)
 - Archive Log, page [4-89](#)
 - Adding a Connection to an Archive Log Database, page [4-90](#)
 - Removing Results from Database, page [4-91](#)
 - Disabling Logging on an Existing Database, page [4-91](#)

Using the Start Dialog Box

The following section explains how to use the Start dialog box in order to add a new database connection, select and, optionally, validate an existing connection, or delete a database connection. A compact/repair selection is available for legacy databases.

1. Exit the instrument software.
2. Click Start on the Windows desktop, select Programs, select LECO, select the instrument, and then click Database Management. The Start dialog box will appear.



When database connections are created, they will appear under Connections. The file path for the selected database connection appears at the bottom of the Start dialog box. Database connections that are no longer valid appear with dimmed text in the Connections list. When the user selects a dimmed connection, the software allows the user to delete the database connection or to reconnect to the database.

Click Add to add a database connection. Refer to Adding a Database Connection, page [4-77](#).

Or

Click on an existing database connection and then make one of the following selections:

- Click Select to connect to a database that already exists. Refer to Selecting a Database Connection, page [4-76](#).

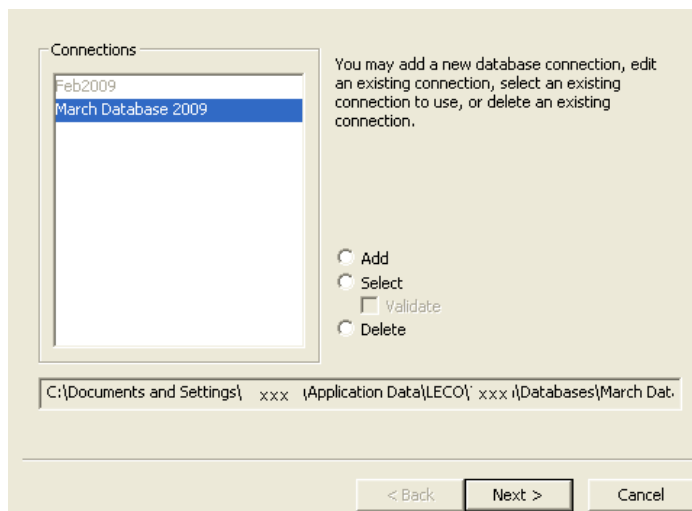
- Click Validate to validate the database with which the connection corresponds; however, Select must **also** be selected to perform validation. Refer to Validating a Database, page 4-80.
- Click Delete to remove a database connection. Refer to Deleting a Database Connection, page 4-80.
- Compact/Repair is not necessary for file system databases (and does not appear on the Start dialog box); however, it is available for Legacy Databases. Click Compact/Repair to compact an existing Legacy Database to conserve disk space and to repair a possibly corrupted Legacy Database. Refer to Compacting/Repairing Legacy Database, page 4-83.

Creating and Retrieving Database Backups

It is good practice to routinely back up data to prevent data loss in the event something such as a hard drive failure should occur. The procedure below explains how to backup a database and should be performed on a regular basis. This procedure applies for all databases whether or not logging is enabled.

Create Backup

1. In the Start dialog box, highlight the database connection of the database to back up. The file location of the corresponding database will appear as shown below.



2. Close the instrument software.
3. To locate the files for the database connection, right-click on Start on the desktop and use the Windows Start Menu to navigate to the folder location.
4. Select the folder and click Copy.
5. Paste the files to the desired storage media (e.g., CD, USB external drive, etc.) or network drive location.

Retrieve Backup

Data can be retrieved using either method described below. The instrument software must be closed to perform either procedure.

If there is a problem with the original database and the backup is to replace it, copy the backup database folder from where it was stored and use Windows Explorer to paste the folder into the original folder location for the database. Be aware that data generated in the original database between the time the back up was made and the time the backed up data is restored will be lost.

OR

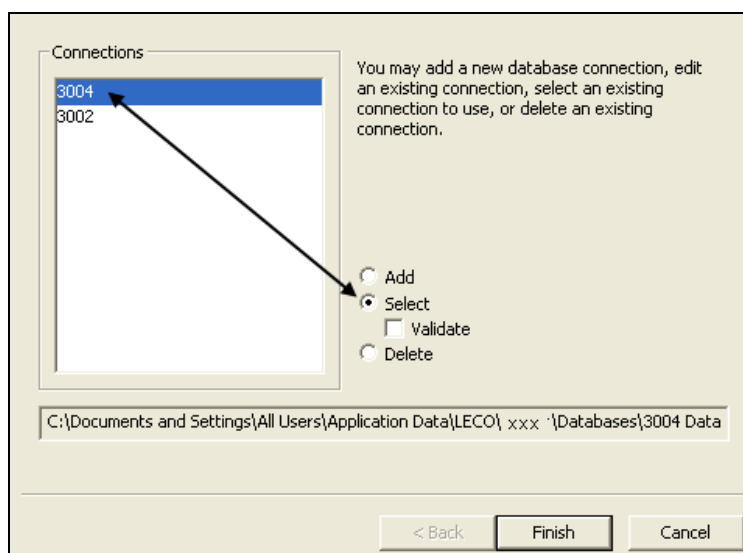
To access the backup as a separate database, copy the backup database to the desired location. If prompted, do not overwrite an existing database in this case. Use the Database Management wizard to add a database connection to this database. Refer to Adding a Connection to an Existing Database, page 4-77.

NOTE

If restoring from read-only media, after copying the database to its new location, use Windows Explorer to change the attributes for all folders and files so that they are not read only. To do this, right-click on the folder name, select Properties, and then clear the Read Only check box.

Selecting a Database Connection

1. Exit the instrument software.
2. Click Start on the Windows desktop, select Programs, select LECO, select the instrument, and then click Database Management. The Start dialog box will appear.



3. Under Connections, click on the desired database connection.
4. Click Select.

5. Click Finish to open the selected database.

Adding a Database Connection

The following section explains how to connect to an existing database or a new database.

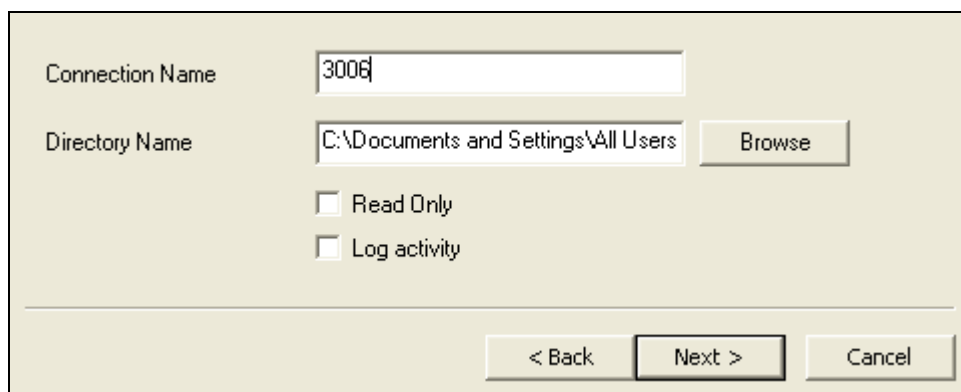
Refer to Adding a Connection to an Existing Database, page [4-77](#).

Refer to Adding a Connection to a New Database, page [4-78](#).

Adding a Connection to an Existing Database

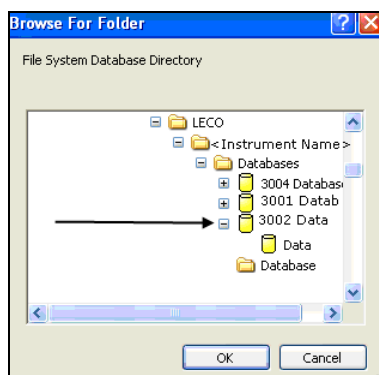
Connecting to an existing database allows you to use an existing file system database, which could be very important in a situation that required a software reinstall such as a system crash. This type of connection provides the means to reconnect to an existing database.

1. Exit the instrument software.
2. Click Start on the Windows desktop, select Programs, select LECO, select the instrument, and then click Database Management.
3. In the Start Dialog Box,
 - A. Select Add.
 - B. Click Next.
 - C. Select File System Database - Use Existing.
 - D. Click Next.
4. When the Connect File System Database dialog box appears, enter the information for the desired database as follows:



The image shows a 'Connect File System Database' dialog box. It has a light beige background. At the top, there is a text box labeled 'Connection Name' containing the text '3006'. Below this is a text box labeled 'Directory Name' containing the text 'C:\Documents and Settings\All Users'. To the right of the 'Directory Name' box is a 'Browse' button. Below the 'Directory Name' box are two checkboxes: 'Read Only' and 'Log activity', both of which are currently unchecked. At the bottom of the dialog box are three buttons: '< Back', 'Next >', and 'Cancel'. The 'Next >' button is highlighted with a black border.

- A. For Connection Name, enter a name for database connection that will also appear in the Start dialog box in the Connections list.
- B. For Directory Name,
 - 1) Select Browse.
 - 2) Navigate to the folder for the database and click on it as shown in the screen shot below. Do not click on the Data folder itself. The names assigned to the databases in the directory on your system may not match the folder names in the screen shot.
 - 3) Click OK.



5. If desired, select the Read Only check box. When selected, the database information can be viewed but not changed. When the check box is cleared, the database can be modified.
6. Clear the Log Activity check box.
7. Click Next.
8. Click Finish.

Adding a Connection to a New Database

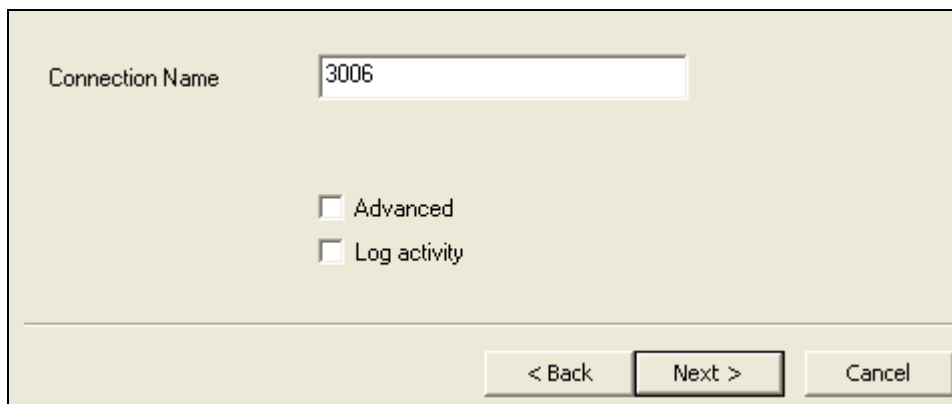
New databases will be file system databases. This database type uses files and folders as its storage media. The size of the database is only limited to the free space on the hard drive.

NOTE →

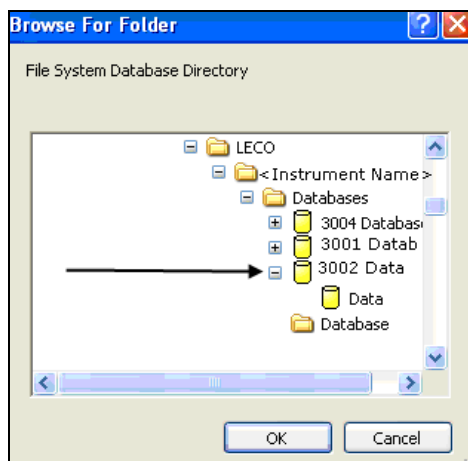
To prevent the database from running slow, it is recommended that virus checking of the database directory be disabled. It is also recommended to use NTFS as the hard drive file format.

1. Exit the instrument software.
2. Click Start on the Windows desktop, select Programs, select LECO, select the instrument, and then click Database Management.
3. In the Start Dialog Box,
 - A. Select Add.
 - B. Click Next.

- C. Select File System Database - Create New.
 - D. Click Next.
4. Complete the Create File System Database dialog box as follows:



- A. For Connection Name, enter a name for database connection that will also appear in the Start dialog box in the Connections list.
- B. To use the default location and name for the database folder, proceed to step C. To use another location,
 - 1) Create a folder in the desired location using Windows Explorer.
 - 2) Select the Advanced check box, and the Directory Name selection box will appear.
 - 3) For Directory Name, click Browse.
 - 4) Navigate to the folder for the database and click on it as shown in the screen shot below. There will not be a data folder since it is a new database. The names assigned to the databases in the directory on your system may not match the folder names in the screen shot.
 - 5) Click OK.

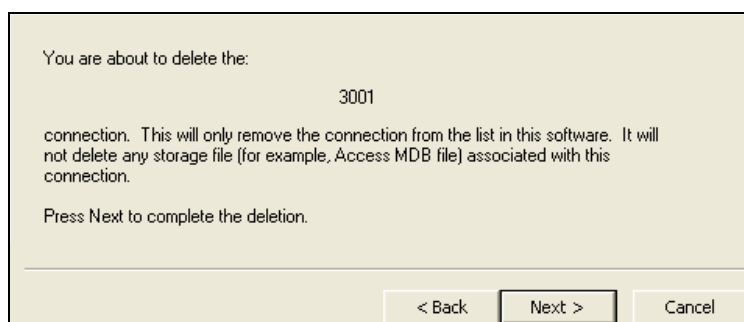


- C. Clear the Log Activity check box.
5. Click Next and the Start dialog box will appear.
6. The Select check box is automatically selected. Click Finish to access the newly created database.

Deleting a Database Connection

NOTE → Delete does not remove physical files from the hard drive. Use Windows Explorer to remove the physical files.

1. Exit the instrument software.
2. Click Start on the Windows desktop, select Programs, select LECO, select the instrument, and then click Database Management.
3. Under Connections, click on database connection to remove.
4. Click Delete.
5. Click Next. The Delete dialog box will appear.



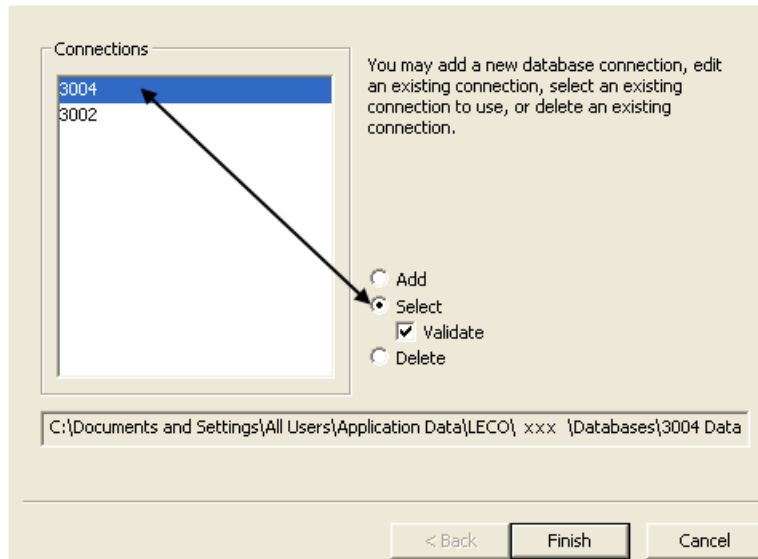
6. Click Next to remove the database.

Validating a Database

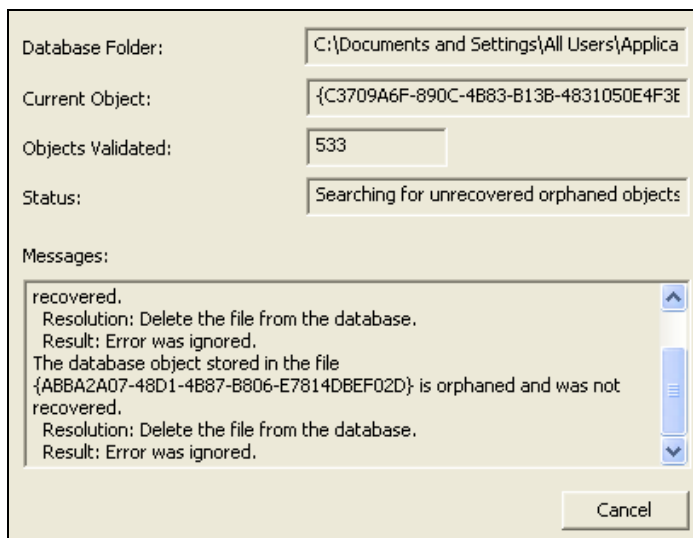
During database validation, the database files will be reviewed for corruption. If orphan objects are found, refer to Reviewing Orphan Objects, page [4-82](#).

To validate a database,

1. Exit the instrument software.
2. Click Start on the Windows desktop, select Programs, select LECO, select the instrument, and then click Database Management. The Start dialog box will appear.



3. Under Connections, click on a database to validate, click Select, and then click the Validate check box.
4. Click Finish. The Database Validation dialog box will display the status of the database validation.

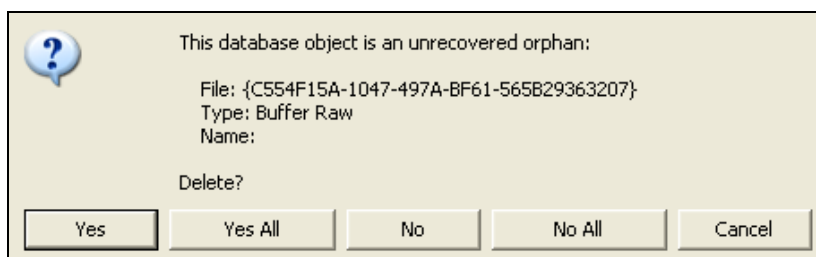


Reviewing Orphan Objects

When orphaned objects or corrupt database objects are discovered, a dialog box such as the one shown below will display. It is recommended to select No and review orphaned objects (such as samples, methods, and standards) as they display in the Orphaned Database Object dialog box to ensure they are valid.

If the database is being validated because database objects are missing, for example samples have disappeared from the spreadsheet, then recover the orphans by selecting No or No All. Select No to be prompted for each orphan or select No All to recover all orphans without being prompted for each one.

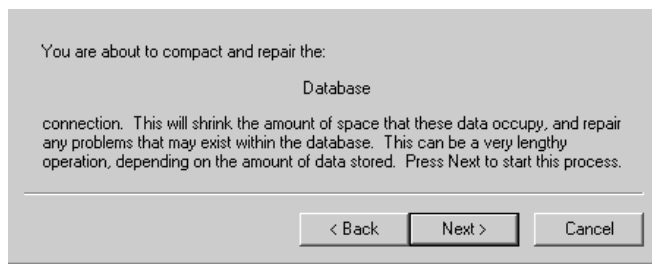
If all samples are displayed in the spreadsheet and there are no apparent problems with the database, then the orphans are likely objects that weren't completely removed from the database when they were deleted and these orphans can be deleted. Select Yes to be prompted before deleting each orphan or select Yes All to delete all orphans without being prompted for each one.



Compacting/Repairing a Legacy Database

NOTE → Compact/Repair is available on databases that are not file system databases. For file system databases, the compact/repair selection will not appear on the Start dialog box.

1. Exit the instrument software.
2. Click Start on the Windows desktop, select Programs, select LECO, select the instrument, and then click Database Management.
3. Under Connections, click on the database to compact/repair.
4. Click Compact/Repair.
5. Click Next and the following message will display.



6. Click Next to compact/repair the database.

Managing Databases for 21 CFR Part 11 Compliance

The following section provides further information about how to create and view log archive databases for 21 CFR Part 11 compliance. For general database topics such as Using the Start Dialog Box or Deleting a Database Connection, refer to Managing Databases, page [4-73](#).

In the software, logging can be enabled to keep a record of all changes as they are made to the database. Logging provides a history of the changes made as well as the current database values.

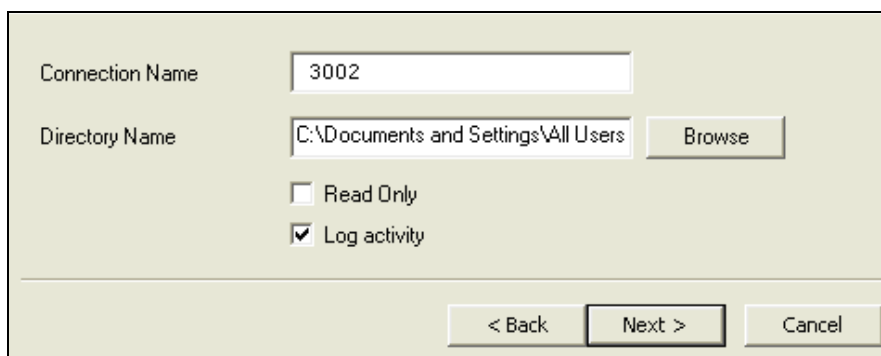
By default, logging is not enabled. Logging can be enabled or disabled when a database connection is added. Refer to Enabling Logging for an Existing Database Connection, below and Enabling Logging for a New Database, page [4-85](#).

Enabling Logging for an Existing Database

Connecting to an existing database allows you to use an existing file system database, which could be very important in a situation that required a software reinstall such as a system crash. This type of connection provides the means to reconnect to an existing database.

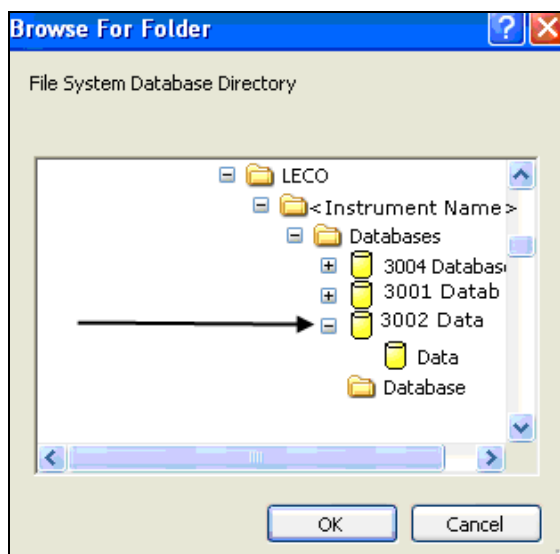
1. Exit the instrument software.

2. Click Start on the Windows desktop, select Programs, select LECO, select the instrument, and then click Database Management.
3. In the Start Dialog Box,
 - A. Select Add.
 - B. Click Next.
 - C. Select File System Database - Use Existing.
 - D. Click Next.
4. When the Connect File System Database dialog box appears, enter the information for the desired database as follows:



The image shows a 'Connect File System Database' dialog box. It has a light beige background. At the top, there is a label 'Connection Name' followed by a text box containing '3002'. Below this is a label 'Directory Name' followed by a text box containing 'C:\Documents and Settings\All Users' and a 'Browse' button to its right. Under the 'Directory Name' section, there are two checkboxes: 'Read Only' (unchecked) and 'Log activity' (checked). At the bottom of the dialog box, there are three buttons: '< Back', 'Next >', and 'Cancel'.

- A. For Connection Name, enter a name for database connection that will also appear in the Start dialog box in the Connections list.
- B. For Directory Name,
 - 1) Select Browse.
 - 2) Navigate to the folder for the database and click on it as shown in the screen shot below. Do not click on the Data folder itself. The names assigned to the databases in the directory on your system may not match the folder names in the screen shot.
 - 3) Click OK.



5. If desired, select the Read Only check box. When selected, the database information can be viewed but not changed. When the check box is cleared, the database can be modified.
6. Select the Log Activity check box to turn on logging for any future changes made to the database through the instrument software.
7. Click Next.
8. Click Finish.

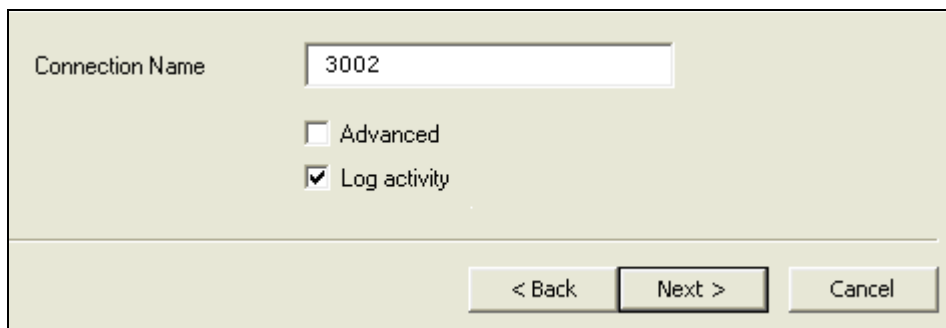
Enabling Logging for a New Database

New databases will be file system databases. This database type uses files and folders as its storage media. The size of the database is only limited to the free space on the hard drive.

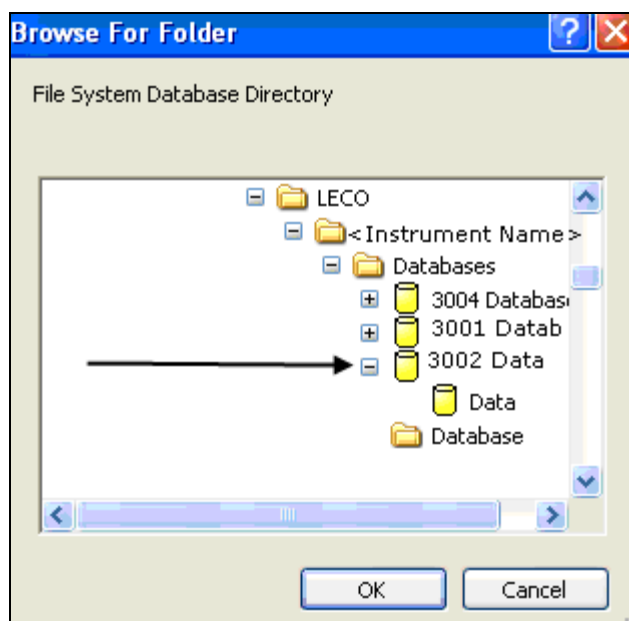
NOTE → To prevent the database from running slow, it is recommended that virus checking of the database directory be disabled. It is also recommended to use NTFS as the hard drive file format.

1. Exit the instrument software.
2. Click Start on the Windows desktop, select Programs, select LECO, select the instrument, and then click Database Management.
3. In the Start Dialog Box,
 - A. Select Add.
 - B. Click Next.
 - C. Select File System Database - Create New.
 - D. Click Next.

4. Complete the Create File System Database dialog box as follows:



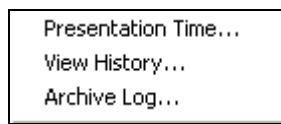
- A. For Connection Name, enter a name for database connection that will also appear in the Start dialog box in the Connections list.
- B. To use the default location and name for the database folder, proceed to step C. To use another location,
 - 1) Create a folder in the desired location using Windows Explorer.
 - 2) Select the Advanced check box, and the Directory Name selection box will appear.
 - 3) For Directory Name, click Browse.
 - 4) Navigate to the folder for the database and click on it as shown in the screen shot below. There will not be a data folder since it is a new database. The names assigned to the databases in the directory on your system may not match the folder names in the screen shot.
 - 5) Click OK.



- C. Select the Log Activity check box to turn on logging for changes made to the database through the instrument software.
5. Click Next and the Start dialog box will appear.
6. The Select check box is automatically selected. Click Finish to access the newly created database.

Database Menu

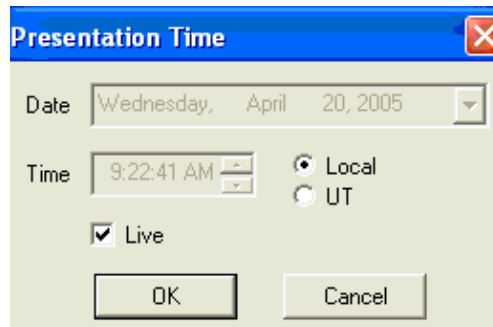
Items on the Database menu in the instrument software will only appear if logging was enabled when the database connection was created. Refer to Enabling Logging for an Existing Database, page [4-83](#).



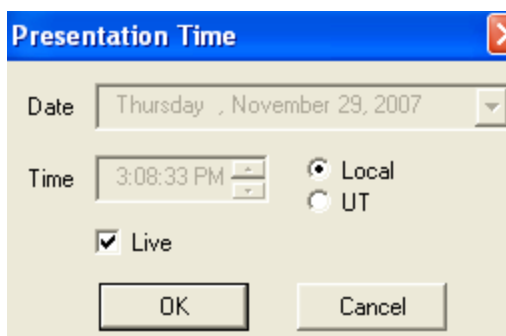
Presentation Time

When logging is enabled for a database connection, the presentation time can be used to view the database as it existed at some previous point in time. For example, it could be used to view results before a change in calibration was performed. While a presentation time is set, and the Live check box is not selected, changes are not allowed to the database. For example, samples cannot be added and changes cannot be made to methods.

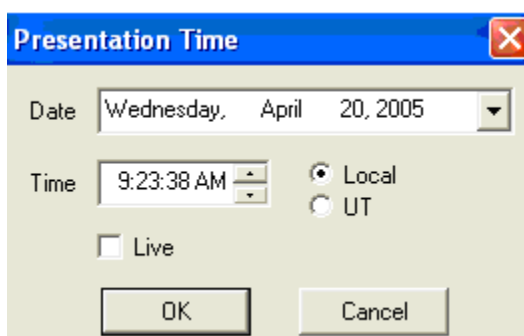
1. Click the Database menu in the instrument software and select Presentation Time. The Presentation Time dialog box will appear.



2. Select the time and date for the presentation time as follows:
Select the Live check box to view current information or clear the Live checkbox in order to select a different date and time.



When the Live check box is cleared, Date and Time are active.



- A. For Date, click the arrow to display a calendar.
- B. From the calendar, select a date. If desired, select the time and then select either Local or UT (Universal Time). Local displays the local time zone. UT displays the universal time that corresponds with the UTC (Universal Coordinated Time) as defined by the National Bureau of Standards.
- C. Click OK. The results as they were at the selected date and time will appear in the spreadsheet.

View History

When logging is enabled for a database connection, View History displays a log of database changes that could be used to identify the time/date when some particular change took place. It can only be used to identify who made a change because there is no description of what each change represents.

1. Click the Database menu in the instrument software and select View History. The View Log dialog box will appear.

2. The log items that appear in the View Log dialog box are explained below.

Date/Time displays the date and time that the database change occurred.

Entry ID displays a unique identifying number for the database object that was changed. For example, each sample would have a unique number.

Action displays Created, Modified or Deleted to indicate the type of action that occurred.

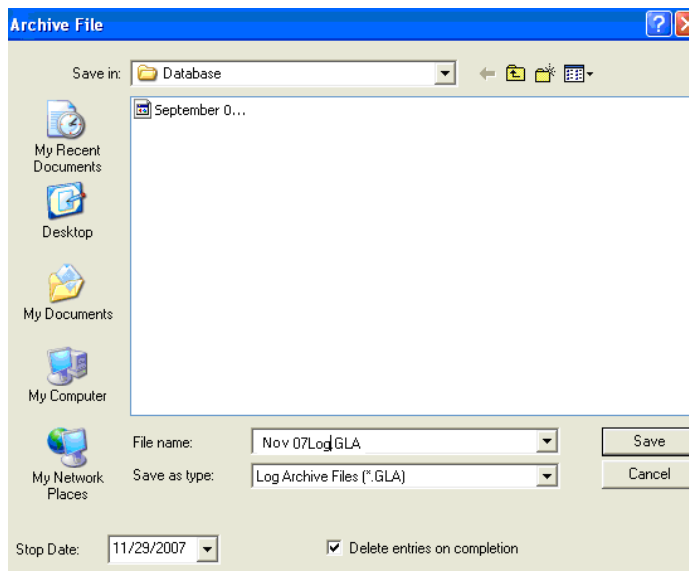
User displays the username of the person who performed the action.

3. Select the time zone to use for displaying Date/Time. Local displays the local time zone. UT displays the universal time that corresponds with the UTC (Universal Coordinated Time) as defined by the National Bureau of Standards.

Archive Log

When logging is enabled for a database connection, an Archive Log database can be created to copy log entries to another file and possibly reduce the amount of data stored in the database.

1. From the Database Menu in the instrument software, select Archive Log. The Archive File dialog box will appear.



2. In the Archive File dialog box,

- A. Select the Delete Entries upon Completion check box to delete entries from the database after they are copied to the output file. Clear the check box and entries will not be deleted from the database. Selecting this check box reduces the amount of data stored in database files. The file size may not change as a result of this, but space will be made available inside the file for more data to be stored. As a precaution, LECO recommends performing a regular database backup right before using Delete Entries upon Completion. Refer to Creating and Retrieving Database Backups, page [4-75](#).
 - B. For the Stop Date, click the arrow and select a date. Any log entries generated on or before this date will be placed into the output file.
 - C. Enter a filename for the log archive database.
 - D. Select the location for the log archive database.
 - E. Click Save.
3. After a log archive database is created, you can create a database connection to the archive log file and view the information in a read-only fashion, which means you can view the log archive database but cannot operate the instrument or analyze samples. Refer to Adding a Connection to a Log Archive Database, below.

Adding a Connection to a Log Archive Database

1. Exit the instrument software.
2. Click Start on the Windows desktop, select Programs, select LECO, select the instrument, and then click Database Management. The Start dialog box will appear.
3. In the Start Dialog Box,
 - A. Select Add.
 - B. Click Next.
 - C. Select Database Log Archive.
 - D. Click Next.
4. Complete the Connect Log Archive dialog box as follows:
 - A. For Connection Name, enter a name for database log archive connection that will also appear in the Start dialog box in the Connections list.
 - B. For File Name, Click Browse and navigate to the log archive file. The log archive file should have a .GLA file extension.
5. Click Next. The Start dialog box will appear.
6. Click Select and then click Finish.

Removing Results from a Database

When logging is enabled for a database connection, the amount of data stored in the database can become significantly large, and it may become necessary to remove results from the database. Deleting results in the instrument software will only increase the size of the database because the database keeps track of all changes when logging is enabled. The following procedure explains how to remove results from the database for file system databases or for other databases.

For File System Databases

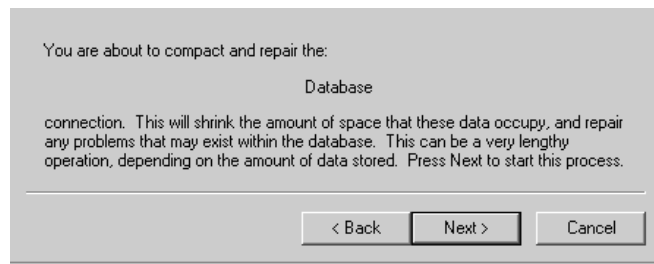
To remove results from a file system database, it is only necessary to create an archive log as explained below.

1. Create an archive log by following the steps in Archive Log, page [4-89](#).
2. Exit the instrument software.

For Legacy Databases

For databases that are not file system databases, use the following steps to compact/repair the database and recover the freed up space.

1. Create an archive log that has the Delete Entries Upon Completion check box selected by following the steps in Archive Log, page [4-89](#).
2. Exit the instrument software.
3. Click Start on the Windows desktop, select Programs, select LECO, select the instrument, and then click Database Management. The Start dialog box will appear.
4. Select the database connection for the database, **not** the archive log, click Compact/Repair, and then click Next. The following message will display.



5. Click Next to compact/repair the database.

Disabling Logging on an Existing Database

Use the following instructions to disable logging on a database in which logging is enabled.

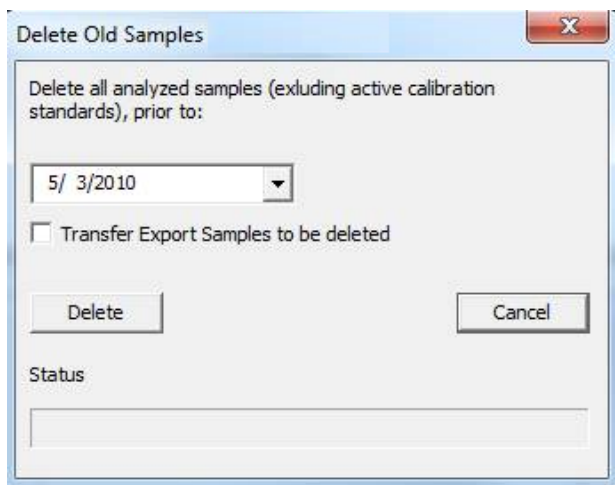
1. Exit the instrument software.

2. Click Start on the Windows desktop, select Programs, select LECO, select the instrument, and then click Database Management.
3. In the Database Start dialog box, select the existing database connection in which you prefer to disable logging. Remember the name of the database and the base file location because you will need this information in order to reconnect to the database in step 8.A, page 4-92.
4. Select Delete, and follow the instructions provided by the software. Refer to Deleting a Database Connection, page 4-80, for further information. The Delete operation will not delete the actual database; it will only remove the database connection name from the list.
5. Return to the Database Start dialog box.
6. In the Start dialog box, select Add, and then select Next.
7. Under Database Types, highlight File System Database-Use Existing, and click Next.
8. Complete the Connect Database dialog box as follows:
 - A. For the Connection Name, enter the same name as the database that was just deleted.
 - B. Enter the Path to the database files.
9. Verify that the checkbox next to Log Activity is blank and click Next.
10. Click Next and the Start dialog box will appear.
11. The Select check box is automatically selected.
12. Click Finish.

Deleting Analyzed Samples

The size of the database can be reduced by deleting analyzed samples. This procedure permits the operator to delete analyzed samples by prior date. Analyzed samples can be exported and then deleted by checking a check box.

1. Click Database and select Delete by Date.



2. Click the drop-down arrow and enter the prior sample deletion date.
3. If the prior samples to be deleted should be exported and saved before they're deleted, check the Transfer Export Samples to be deleted check box.
4. Click Delete to delete the prior analyzed samples or Cancel to cancel deletion.

This page intentionally left blank.

5 Operation

The Operation chapter explains how to prepare the sample for an analysis once the instrument is setup. First Time Analysis contains step-by-step procedures that explain how to create a method, login samples, and perform an analysis.

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Illustrations

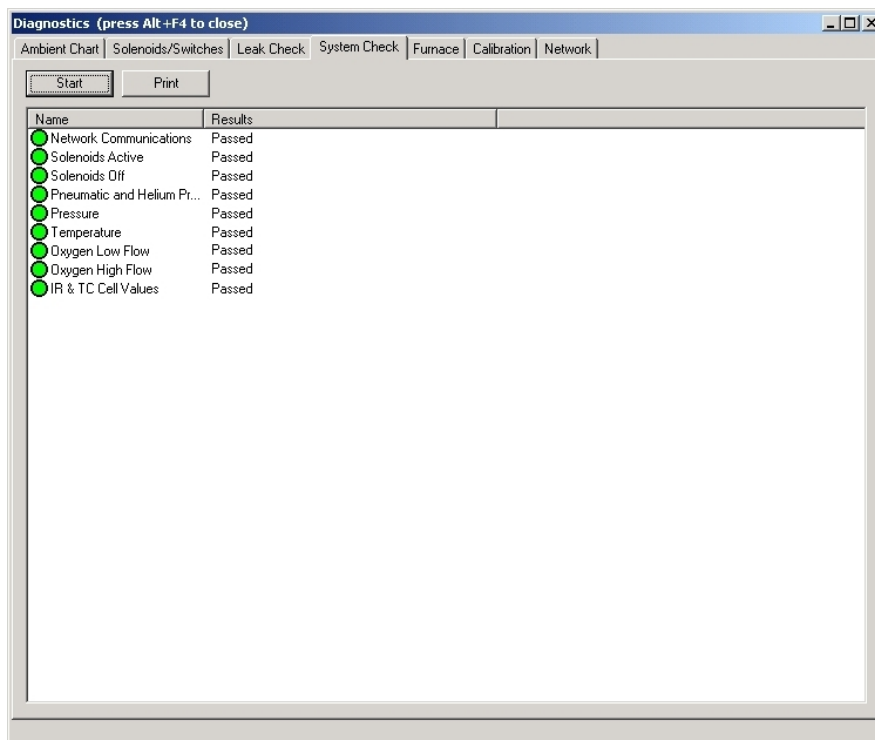
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First Time Analysis

————→
Note

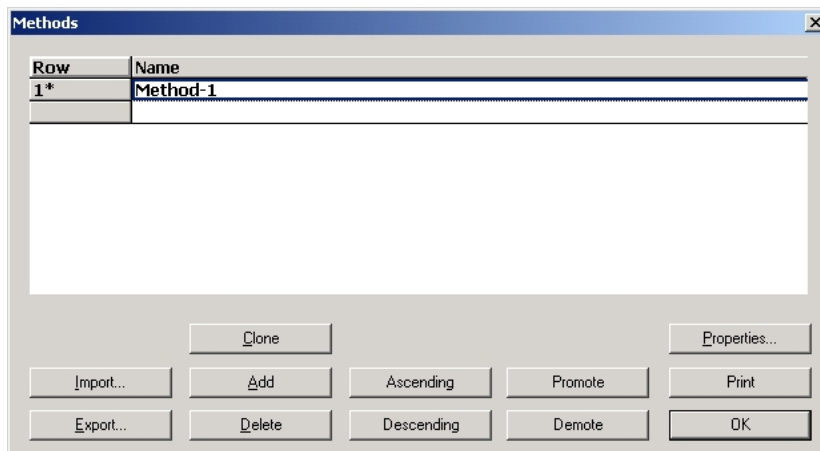
- *The first time the instrument is operated, and any time the software is updated, these steps must be performed in the order in which they appear.*

1. Perform a System check before operation to determine if the instrument is operating properly.
 - A. Let the instrument warm up and stabilize.
 - B. From the Diagnostics menu, click System Check.



- C. Check the results of all systems. The circle in front of the system name should be filled in green and in the results column all systems should indicate "Passed".
2. Perform a Leak Check, page [8-22](#), on both the oxygen and helium systems.

3. Create a method. Refer to Method Configuration, page 4-39, for additional information.
 - A. From the Configuration menu, click Method. The Method dialog box will appear.



- B. Click Properties. The Method Properties dialog box will appear.

Note

- *Unless otherwise directed by the LECO Application lab, make sure the method parameters have been set to their default values for the first time analysis.*

- C. Click OK to close the Method Properties dialog box.

4. Login a blank. Refer to Blank Login, page 5-17, for additional information.
 - A. From the Samples menu, click Login. The Sample Login dialog box will appear.

Sample

Sample Name: Blank

Mass: 1.0000 <<< Balance

Repetitions: 1

| Attribute | Value |
|-------------------|----------|
| Method* | Method-1 |
| Comments | |
| Description | |
| Operator | |
| Moisture Basis | |
| Sample Moisture | |
| Atmospheric Blank | |
| Protein Factor | |

☒ Add to end of list
☐ Add as next sample to run

OK Cancel Help

☐ Keep logging in samples until Cancel is pressed.

- B. Enter the information required in the dialog box. Refer to Blank Login Definitions, page 5-18, for additional information.

Notes

- Enter Blank for sample name, 1.000 for sample mass.
 - Analyze blanks until a plateau is reached (typically $\pm 0.001\%$). Analyze three to five additional blanks and set blank area using these values.
- C. Click OK to login the blank.
 - D. Enter a number one (1) in the Location column on the main spreadsheet. If the Location column is not visible, refer to Sample Display Configuration on page 4-21.

5. Analyze a blank. Refer to Analyze a Blank, page [5-27](#), for additional information.
 - A. From the Samples menu, click Analyze. Analysis will automatically start with the first blank.

Note

- *The blank results will probably start higher, drop slowly, and then stabilize. Highlight the last few blanks analyzed to check the precision. Highlight the entire row for samples selected and view statistics. Statistics should appear in the lower right corner of the screen. The SD of the blank should be 0.0010% at 1.0 g. If the SD precision is acceptable, keep the same blanks highlighted and proceed to the next step.*
6. Perform blank calibration. Refer to Blank Calibration, page [5-40](#), for additional information.
 - A. In the spreadsheet, select the analyzed blanks to set the initial blank calibration value area. These should be the same blanks used in the previous step.
 - B. From the Configuration menu, click Blank. The Blank dialog box will appear with a new blank calibration value.
- *Blank is the raw area of analyte that is subtracted from the raw area every analysis.*
- C. Click OK to enter the new blank calibration value.

7. Login a standard. Refer to Sample Login, page 5-19, for additional information.
 - A. From the Samples menu, click Login. The Sample Login dialog box will appear.

| Attribute | Value |
|-------------------|----------|
| Method* | Method-1 |
| Comments | |
| Description | |
| Operator | |
| Moisture Basis | |
| Sample Moisture | |
| Atmospheric Blank | |
| Protein Factor | 6.2500 |

- B. Enter the information required in the dialog box. Refer to Sample Login Definitions, page 5-21, for additional information.
 - 1) Enter the sample name of the standard.
 - 2) Enter the protein factor when answers are desired as protein (% protein format).

Note → • *When entering additional standards, it is only necessary to enter the mass. All other analysis parameter values will be automatically entered from the first sample.*

- C. Click OK to login the standard.

8. Analyze a standard. Refer to Analyze a Standard, page 5-28, for additional information.

- A. From the Samples menu, click Analyze. Analysis will automatically start with the first standard.

————→
Note

- *The answers may not appear accurate although they should be precise. Once standards have been run, select them and view the statistics. For multiple standards of the same weight (i.e. 0.20xx, 0.20xx, 0.20xx, etc), the RSD should be <0.35% RSD or within the certified tolerance of the reference material (which ever is greater).*

Accuracy—The amount of measurement deviation from a known accurate comparable source such as a standard calibration sample.

If repeated measurements are accurate, the instrument is precise. If repeated measurements are precise, the instrument is not necessarily accurate; calibration makes the instrument accurate.

Precision—The amount of measurement deviation from one measurement to another without regard to the accuracy or specific value of the measurement. It is the degree of refinement with which an operation is performed or a measurement stated.

————→
Note

- *Although the standards may not be correct, as long as they are close in numbers, the instrument has the precision it needs to continue. Once the instrument is calibrated, it should be both precise and accurate.*

9. Perform Calibration. Refer to Calibration, page 5–39, for additional information.
- A. In the spreadsheet, select the Analyzed Standard Samples for Calibration.

Notes

- *These should be the same standard samples used in the previous steps. If using single standard for calibration, weigh, login, and run Standards of the following weights: (3) 500 mg Standards, (3) 250 mg Standards, (3) 200 mg Standards, (3) 150 mg Standards, (3) 100 mg Standards, (4) 75 mg Standards, (4) 35 mg Standards. Once they have been run, highlight as in the previous steps and look at the statistics. For standards of varying weights (0.30xx, 0.25xx, 0.10xx, 0.00xx) RSD should be <0.50% RSD or within the certified tolerance of the reference material (which ever is greater). You can omit 1 or 2 answers that are not a good fit with the others in their respective weight groups.*
- *For calibrations that cover wide dynamic ranges, consult the LECO Applications Laboratory for support.*

- B. From the Configuration menu, click Calibrations. The Calibrations dialog box will appear.

Notes

- *For a calibration at one weight, the curve type selected must be Single Standard Calibration.*
 - *For a calibration at multiple weights with the same standard, use Linear, Quadratic or Cubic.*
 - *Refer to step 6 (Perform blank calibration) for additional information.*
- C. View the calibration curve. Make sure the calibration curve goes through, or comes close to every calibration point. If not, click the Curve drop down box and select another curve type. Refer to Standard Calibration, page 5–41, for additional information.
- D. Click OK to set the new calibration. The Save Calibration dialog box will appear.
- E. Click OK to enter the new calibration. The new calibration equation and the previous calibration equation will be displayed.
- F. Click Close.
10. Calibration is complete. Analyze varying weights of the calibration sample to check the calibration.

Shutdown Procedure

→
Notes

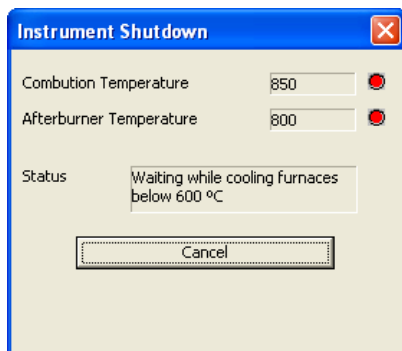
- Use this procedure to safely power down and turn off the instrument.
- If Cancel is clicked during this procedure shutdown will be aborted and the furnace temperatures restored to their original settings.
- During shutdown the gas is turned off.



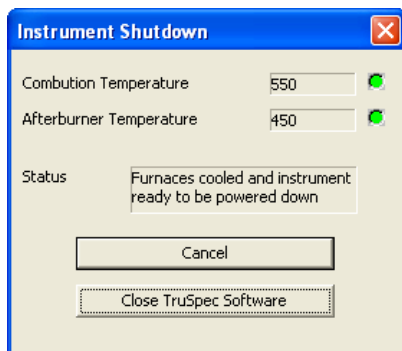
INSTRUMENT DAMAGE

Failure to cool the furnaces prior to turning the power switch OFF will result in overheating of the loading head assembly and possible damage to the furnace.

1. Click Maintenance and select Instrument Shutdown. The Instrument Shutdown screen will appear.



2. Wait until the combustion temperature and afterburner temperature drop below 600°C and the red indicators turn green.



3. Click Close TruSpec Software to exit the instrument application software.
4. Turn the AC power switch OFF.

Sample Preparation (Macro)

Notes

- Each sample holder type will require it's own blank value and should be used in the main calibration.
- Samples should be homogenized prior to encapsulation.
- Sample presses may be used to maximize sample size.

Gel Capsule Method

Notes

- Gel Capsules should only be used for nitrogen only analysis.
- Sample size is dependent upon the sample type, desired precision and optimum performance. Contact the LECO applications laboratory for further information.

1. Place the Sample Cup Holder on the balance.
2. Place the Gel Cap (small or medium) into the sample cup holder and tare the balance.
3. Remove the Capsule from the sample cup holder and add sample to capsule.
4. Place Capsule in the sample cup holder and weigh.
5. Record the mass in the spreadsheet or automatically through print function on the balance.

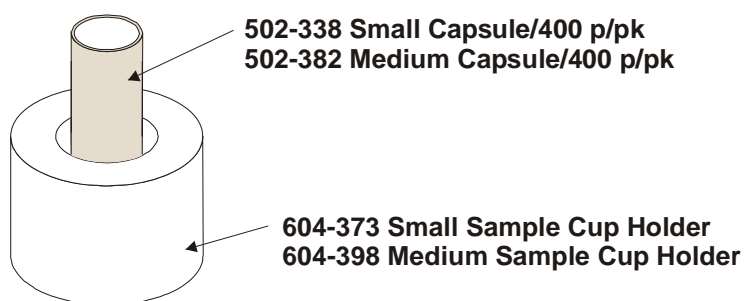


Figure 5-1
Sample Preparation—Gel Capsule Method

Note

- For analysis of multiple samples, install and use the 619-180 Carousel Assembly then load the samples in the proper order for analysis.

Tin Foil Method

Using the Quick Sampler

1. Place the small or large foil on the balance and tare.
2. Place the Foil Holder on a work surface and center the small or large foil on the holder.
3. Pull the Quick Sampler Plunger up by the handle end to make room for the sample in the bottom of the tube and press the tube into sample material. Make sure the sample is firmly packed.
4. Place the end of the tube in the center of the foil and work the tube into the foil by pushing gently and rocking the tube back and forth.
5. Firmly holding the tube in place, push the plunger down. When the sample is in the foil, remove the sampler.
6. Crimp the foil closed with tweezers.
7. Holding the sample in place with the tweezers, lift the sample up off the holder.
8. Enter the mass in the spreadsheet or automatically by pressing print on the balance.

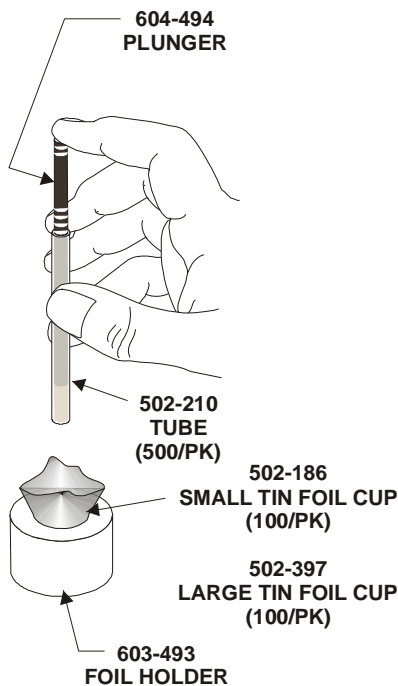


Figure 5-2
Sample Preparation—Quick Sampler Method

Manual Preparation

1. Place the Sample Cup Holder on the balance.
2. Place foil into the Sample Cup Holder and tare the balance.
3. Remove the foil and the sample cup holder from balance and add sample to foil.
4. Place the sample cup holder and foil on balance and weigh.
5. Remove the foil from the sample cup holder and twist to seal.
6. Enter the mass in the spreadsheet or automatically by pressing print on the balance.

→
Note

- *Sample size is dependent upon sample type, desired precision and optimal performance.*

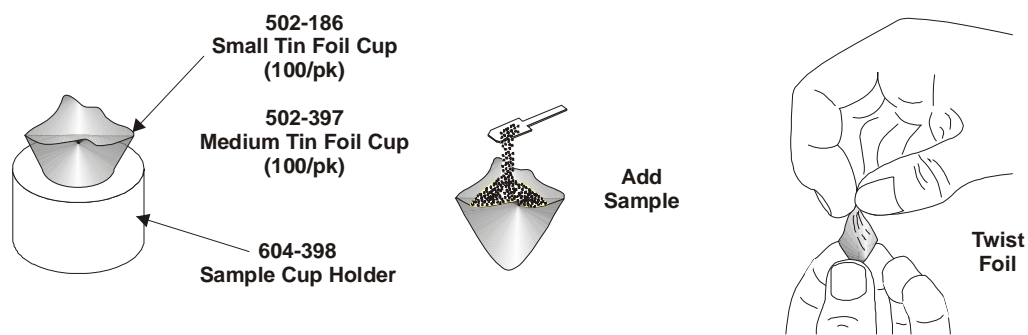


Figure 5-3
Sample Preparation—Manual Method

Using the Foiler

Note →

- *Use only small tin foil cups with the foiler.*

1. Place the Foil Capsule on the balance and tare the balance.
2. Place the Small Tin Foil Capsule in the foil holder.
3. Place the Funnel on the foil holder.
4. Add Sample.
5. Insert and press down the plunger to pack the sample.
6. Holding the plunger in place, lift the funnel up against the plunger, and then remove both pieces.
7. Crimp the Foil closed with tweezers.
8. Remove and weigh the sample.

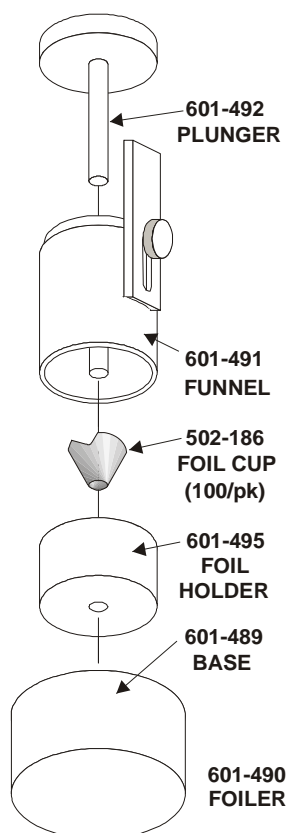


Figure 5-4
Sample Preparation—Foil Method

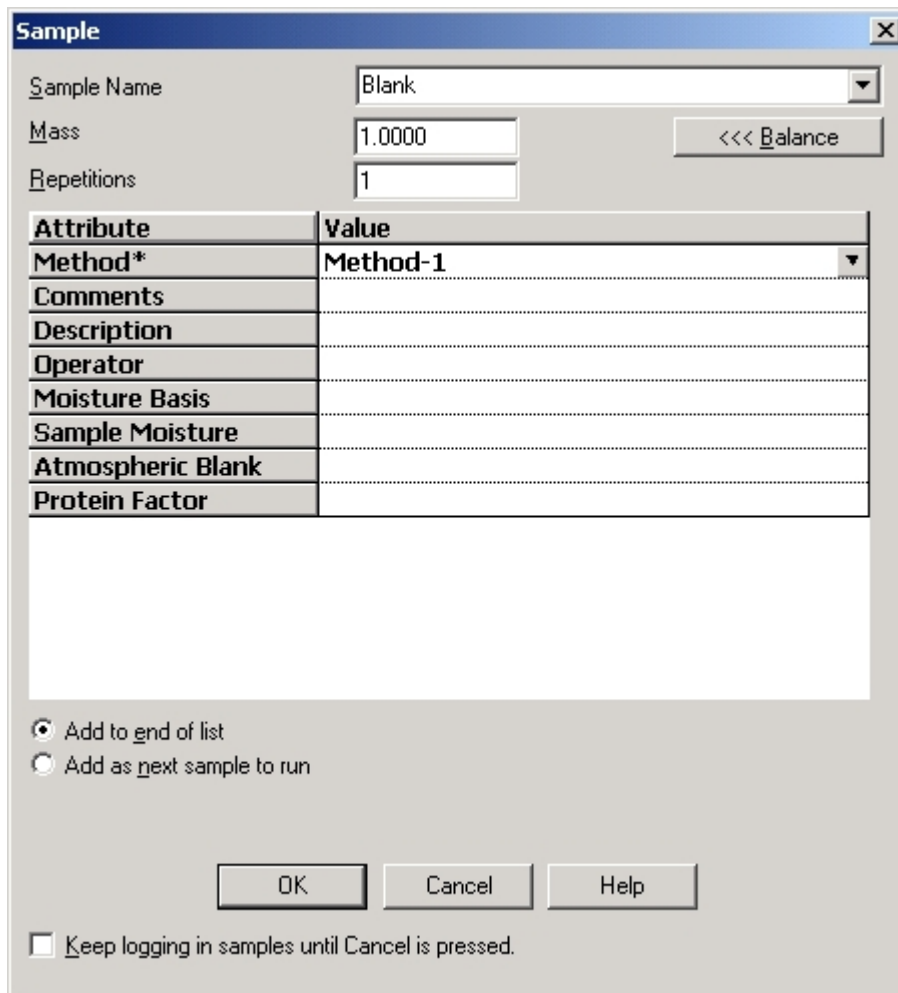
Login

Blank Login

Before a blank is analyzed, a sample named Blank must be entered into the spreadsheet. This procedure is called Blank Login.

Note → • An analysis method should be developed before a sample is logged in. Refer to Method Configuration on page 4–39.

1. Click Samples and select Login. The Sample Login dialog box will appear.



The image shows a 'Sample' dialog box with the following fields and controls:

- Sample Name:** A dropdown menu with 'Blank' selected.
- Mass:** A text input field containing '1.0000'.
- Repetitions:** A text input field containing '1'.
- <<< Balance:** A button.
- Table:** A table with two columns: 'Attribute' and 'Value'.

| Attribute | Value |
|-------------------|----------|
| Method* | Method-1 |
| Comments | |
| Description | |
| Operator | |
| Moisture Basis | |
| Sample Moisture | |
| Atmospheric Blank | |
| Protein Factor | |
- Radio Buttons:** Two options: 'Add to end of list' (selected) and 'Add as next sample to run'.
- Buttons:** 'OK', 'Cancel', and 'Help'.
- Checkbox:** 'Keep logging in samples until Cancel is pressed.' (unchecked).

2. Click the drop down arrow, in the sample name selection box, and select Blank from the list.
3. Type the number of blanks repetitions you require.
4. Enter the information required in the Login Screen. Refer to Blank Login Definitions, page 5-18, for additional information.
5. Click OK to login the blank.

Blank Login Definitions

Sample Name—The name or type of sample. Blank should be entered for sample name. Click the down arrow and select Blank.

Mass—The mass of the blank. A nominal mass equal to the weights of the samples to be analyzed should be entered.

Location—This position should be empty for blank analysis.

Method—The method used for analysis. Click the Down Arrow to select from the list of methods.

Comments—A statement used to explain an operation or procedure. This is an optional entry.

Description—A statement used to explain or identify a sample. This is an optional entry.

Operator—The name of the operator. This is an optional entry.

Moisture Basis—No entry should be made for blank login.

Sample Moisture—No entry should be made for blank login.

Atmospheric Blank—No entry should be made for blank login.

Protein Factor—The value used to calculate a protein result based on a nitrogen analysis. This is an optional entry.

Add to End of List—Check to enter the logged in blank in the last row of the spreadsheet.

Add as Next Sample to Run—Check to enter the logged in blank after the last sample that was analyzed.

Keep Login Samples until Cancel is Pressed—Check this box to log consecutive blanks. The dialog box will reappear after OK is clicked. This is an optional entry.

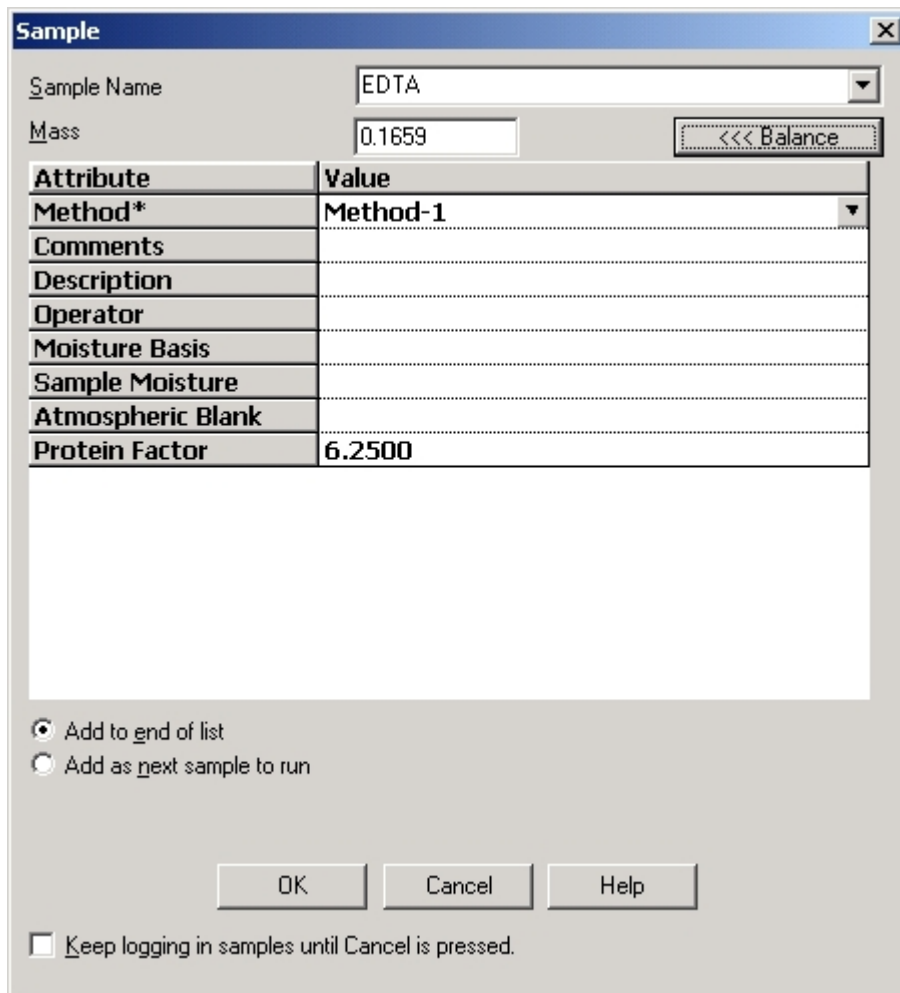
Sample Login

Before a sample is analyzed it must be entered into the spreadsheet. This procedure is called Sample Login. A sample that has been logged in may be named in various alphanumeric notations.

Notes

- An analysis method should be developed before a sample is logged in. Refer to Method Configuration on page 4–39.
- Prepare the sample for analysis. Refer to Sample Preparation, page 5–13, for additional information.

1. From the Samples menu, click Login. The Sample Login dialog box will appear.



The Sample Login dialog box is shown with the following fields and controls:

- Sample Name:** A text field containing "EDTA".
- Mass:** A text field containing "0.1659".
- <<< Balance:** A button next to the Mass field.
- Attribute/Value Table:**

| Attribute | Value |
|-------------------|----------|
| Method* | Method-1 |
| Comments | |
| Description | |
| Operator | |
| Moisture Basis | |
| Sample Moisture | |
| Atmospheric Blank | |
| Protein Factor | 6.2500 |
- Radio Buttons:**
 - ☒ Add to end of list
 - ☐ Add as next sample to run
- Buttons:** OK, Cancel, Help.
- Checkbox:** ☐ Keep logging in samples until Cancel is pressed.

2. Enter the Sample Name in the sample name selection box.
3. Enter the information required in the Login Screen. Refer to Sample Login Definitions, page [5-21](#), for additional information.
4. Click OK to login the sample.

Sample Login Definitions

Sample Name—The name or type of sample.

Mass—The mass of the sample. Click Balance to enter a mass from an external balance.

Location—The position in the autoloader where the sample is located.

Method—The method used for analysis. Click the down arrow to select from the list of methods.

Comments—A statement used to explain an operation or procedure. This is an optional entry.

Description—A statement used to explain or identify a sample. This is an optional entry.

Operator—The name of the operator. This is an optional entry.

Moisture Basis—The amount of moisture in the final product. A percentage should be entered. This is an optional entry.

Sample Moisture—The amount of moisture in the sample used to compensate the final result. A percentage should be entered. This is an optional entry.

Atmospheric Blank—Atmospheric Blank compensates the calculation of the final result for the nitrogen content that may be trapped within the sample. A percentage should be entered. This is an optional entry.

Protein Factor—The value used to calculate a protein result based on a nitrogen analysis. This is an optional entry.

Add to End of List—Check to enter the logged in sample in the last row of the spreadsheet.

Add as Next Sample to Run—Click to enter the logged in sample after the last sample that was analyzed.

Keep Logging Samples until Cancel is Pressed—Check this box to log consecutive sample. The dialog box will reappear after OK is clicked. This is an optional entry.

Correct for Moisture

Moisture basis and sample moisture compensates the calculation of the final result for moisture content. They should be entered during sample login.

Moisture Basis—Analysis assumes the sample is analyzed on a dry basis. Moisture basis adds a moisture value during calculation of the final result. When the sample is analyzed, its result is determined with a specific amount of moisture that is not in the sample (on a moisture basis).

Sample Moisture—Sample moisture is the amount of moisture contained in a sample before analysis. The moisture value is subtracted during calculation of the final result. The sample is analyzed "on a dry basis".

1. From the Samples menu, click Login. The Sample dialog box will appear.

Sample

Sample Name: EDTA

Mass: 0.1659 <<< Balance

| Attribute | Value |
|-------------------|----------|
| Method* | Method-1 |
| Comments | |
| Description | |
| Operator | |
| Moisture Basis | |
| Sample Moisture | |
| Atmospheric Blank | |
| Protein Factor | 6.2500 |

☒ Add to end of list
☐ Add as next sample to run

OK Cancel Help

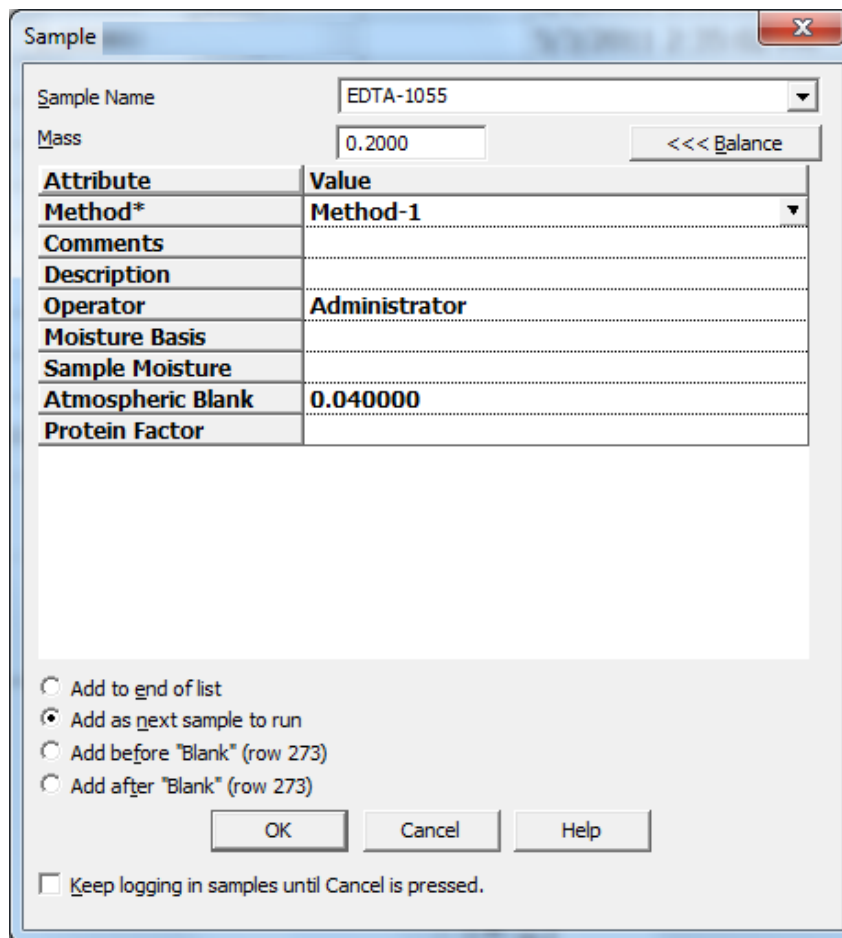
☐ Keep logging in samples until Cancel is pressed.

2. Click the Sample Moisture edit box and enter a value.
3. Click the Moisture Basis edit box and enter a value.
4. Click OK.

Correct for Atmospheric Blank

Analysis of powdered samples on the instrument may require sealing the tin foil sample cup before introducing the sample into the instrument. Powdered samples trap atmosphere, which includes nitrogen within the sample. When the tin foil sample cup is sealed atmospheric gas is trapped within the sample. Typically, for a sample mass of 0.25g, approximately 0.04% nitrogen is trapped within the sample. During sample analysis, if an Atmospheric Blank value is entered on the login screen, the value will be subtracted from the sample value.

1. From the Samples menu, click Login. The Sample Login Dialog box will appear.



The image shows a 'Sample Login' dialog box. At the top, there's a title bar with 'Sample' and a close button. Below the title bar, there are input fields for 'Sample Name' (containing 'EDTA-1055') and 'Mass' (containing '0.2000'). To the right of the 'Mass' field is a button labeled '<<< Balance'. Below these fields is a table with two columns: 'Attribute' and 'Value'. The table contains the following rows: 'Method*' with value 'Method-1', 'Comments' (empty), 'Description' (empty), 'Operator' with value 'Administrator', 'Moisture Basis' (empty), 'Sample Moisture' (empty), 'Atmospheric Blank' with value '0.040000', and 'Protein Factor' (empty). Below the table, there are four radio button options: 'Add to end of list', 'Add as next sample to run' (which is selected), 'Add before "Blank" (row 273)', and 'Add after "Blank" (row 273)'. At the bottom, there are three buttons: 'OK', 'Cancel', and 'Help'. Below these buttons is a checkbox labeled 'Keep logging in samples until Cancel is pressed.'.

| Attribute | Value |
|-------------------|---------------|
| Method* | Method-1 |
| Comments | |
| Description | |
| Operator | Administrator |
| Moisture Basis | |
| Sample Moisture | |
| Atmospheric Blank | 0.040000 |
| Protein Factor | |

2. Click the Atmospheric Blank edit box and enter a value.
3. Click OK.

————→
Note

- *If the atmospheric blank was not entered in login, it can still be corrected by entering the value in the spreadsheet during or after analysis and pressing the enter key.*

Enter a Mass from the Balance

————→
Notes

- *An external balance must be interfaced with the instrument to enter a mass automatically.*
- *The application must be controlling the balance before a mass can be automatically entered. Refer to Balance Installation on page [3–5](#) for more information.*

From the Sample Login Screen

1. Click Balance to enter a weight from an external balance.

Directly into the Spreadsheet

————→
Note

- *A sample will be added to the first row of the spreadsheet without a value entered for the mass.*
1. Place the crucible on the balance.
 2. Press Tare.
 3. Place the sample in the crucible.
 4. Press Print on the balance or click the Samples menu and select Balance. The sample mass will be entered into the first row of the spreadsheet without a mass entry.

Analyze a Sample

A blank is an analysis that is run without either sample or standard material being burned. Nothing can be in the furnace, capsule or tin sample cup. Anything that would be used with the sample, except the sample, can be dropped into the furnace during blank analysis. The area of the blank is subtracted from the sample or standard analysis.

Analyze a Blank

Analyze a Blank permits the operator to run an analysis without burning a sample. This is done in order to obtain data to set the blank area. Refer to Blank Calibration, page [5-40](#), for additional information.

- **Note**
- *Before proceeding, Blank Login, page [5-17](#), must be completed.*
1. Click Analyze (F5) analysis will automatically start with the first blank.
 2. Blank results will be shown in the spreadsheet and plot window.
- **Note**
- *Accept a blank value for all elements in the calibration.*

Analyze a Standard

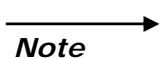
Analyze a Standard is used to analyze standard samples for calibration.

Notes

- *Before proceeding, Define a Calibration Standard, page 4–58, and Login using a Calibration Standard, page 4–60, must be completed.*
 - *For some applications it may be necessary to use a standard with the same density and/or concentration of sulfur. Consult the LECO Applications Laboratory for further assistance.*
 - *LECO recommends using certified reference materials for all calibrations.*
1. From the Samples menu, click Analyze, press F5 or click the F5 analyze button. The next unanalyzed sample will start.
 2. After analysis, the sample plot will appear in the window below the spreadsheet. The standard analysis result will appear in the spreadsheet under the element name.

Analyze a Sample

Sample analysis determines the element concentration in a sample.



Note

- *Before proceeding, Blank Calibration, page 5–40, Standard Calibration, page 5–41, and Sample Login, page 5–19, must be completed.*
1. From the Samples menu, click Analyze, press F5 or click the F5 analyze button. The next unanalyzed sample will start.
 2. After analysis, the sample plot will appear in the window below the spreadsheet. The analysis result will appear in the spreadsheet under the element name.

Abort an Analysis

An analysis in progress can be aborted. If the analysis is aborted, "Abort" will appear under analysis date.

- **Note**
- *Before proceeding, Analyze a Sample, page 5–27, must be completed.*

From the Samples menu, click Abort. The analysis in progress will be aborted.

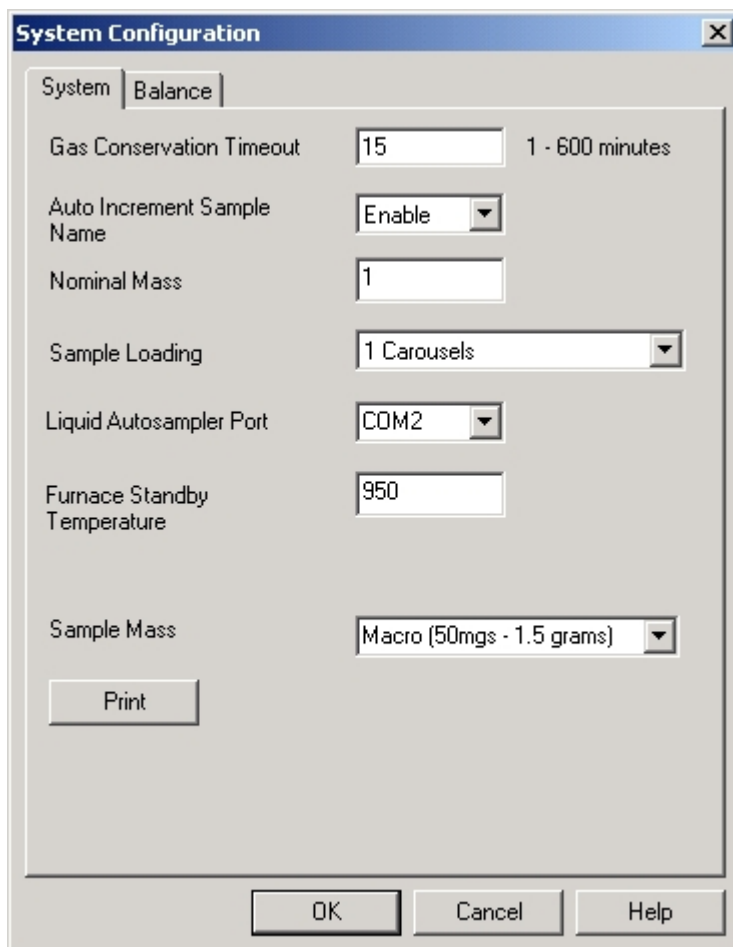
Analyze Multiple Samples

This procedure programs the instrument to analyze a group of samples without the aid of an operator during analysis.

- **Notes**
- *Before proceeding, Method Configuration, page 4–39, Blank Calibration, page 5–40, and Standard Calibration, page 5–41, must be completed.*
 - *Prepare the samples for analysis. Refer to Sample Preparation, page 5–13, for additional information.*

- **Note**
- **TruSpec CHN Macro**—Install and use the 619-180 Carousel Assembly then load the samples in the proper order for analysis.
 - **TruSpec CHN(S) Micro**—Install and use the 619-704 Carousel Assembly then load the samples in the proper order for analysis.

1. From the Configuration menu, click System. The System Configuration dialog box will appear.



The image shows a 'System Configuration' dialog box with a title bar containing a close button (X). It has two tabs: 'System' (selected) and 'Balance'. The 'System' tab contains several settings:

- Gas Conservation Timeout: 15 (range 1 - 600 minutes)
- Auto Increment Sample Name: Enable (dropdown)
- Nominal Mass: 1
- Sample Loading: 1 Carousels (dropdown)
- Liquid Autosampler Port: COM2 (dropdown)
- Furnace Standby Temperature: 950
- Sample Mass: Macro (50mgs - 1.5 grams) (dropdown)

There is a 'Print' button below the 'Sample Mass' dropdown. At the bottom of the dialog are 'OK', 'Cancel', and 'Help' buttons.

2. Click Auto Increment Sample Name to advance the sample name by 1. The last character in the sample names must be a number.
3. Click the Carousels drop down box and select the number of Carousels used for multiple sample analysis. The maximum number that can be selected is 4.
4. Click OK to close the System Configuration dialog box.

- From the Samples menu, click Login. The Sample dialog box will appear.

Sample

Sample Name: EDTA

Mass: 0.1659 <<< Balance

| Attribute | Value |
|-------------------|----------|
| Method* | Method-1 |
| Comments | |
| Description | |
| Operator | |
| Moisture Basis | |
| Sample Moisture | |
| Atmospheric Blank | |
| Protein Factor | 6.2500 |

☒ Add to end of list
☐ Add as next sample to run

OK Cancel Help

☐ Keep logging in samples until Cancel is pressed.

- Login a sample to analyze.
- Click the check box at the bottom of the window to keep logging in samples.
- Repeat step 6 until all samples are logged in.
- Click Cancel to close the Sample Login dialog box.
- View the location number of the first sample in the spreadsheet and compare it to the location of the first sample in the carousel. If the location numbers are not the same, click the Location Box of the first sample and enter the carousel location number of the first sample to analyze. The location numbers in the spreadsheet, following the first sample, will change consecutively.
- From the Samples menu, click Analyze to start the analysis.

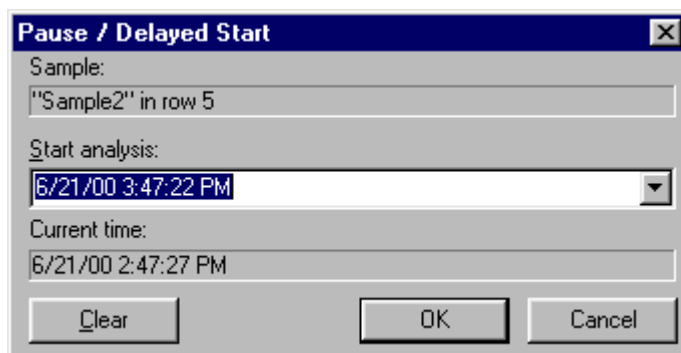
Delay Analysis

Delayed Analysis permits the operator to start an analysis at a later date and time.

Note

- *An analysis method should be developed before a sample is logged in. Refer to Method Configuration on page 4-39.*

1. Determine where in the sample list to pause or delay analysis and select the sample. The sample must be an analyzed sample.
2. From the Samples menu click Pause or press F7. The Pause/Delay Start dialog box will appear.



3. In the highlighted field, enter the date and time to start the delayed analysis. The date and time that appears may be edited. The format for entering the date and time is [05/01/2000 4:30:00 PM]. A space should be inserted after the date and time or select Manually if pausing for operator intervention.
4. Click OK to start the delayed analysis. A clock symbol will appear in the spreadsheet next to the sample that will be analyzed at the programmed delayed start time or if Manually was selected a red octagon will appear in the spreadsheet. The analysis will begin only when the operator clicks analyze.

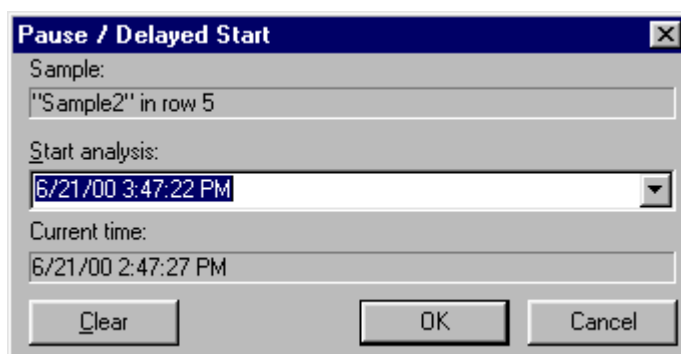
Pause Analysis

Pause Analysis permits the operator to pause analysis at a selected sample and then resume at a programmed date and time. When the programmed time is reached, analysis will continue.

Note

- Before proceeding, *Analyze Multiple Samples*, page 5–30, must be completed.

1. Determine where in the sample list to pause or delay analysis and select the sample. The sample must be an analyzed sample.
2. From the Samples menu, click Pause. The Pause/Delay Start dialog box will appear.

The image shows a Windows-style dialog box titled "Pause / Delayed Start" with a close button (X) in the top right corner. The dialog contains three text input fields. The first field is labeled "Sample:" and contains the text "\"Sample2\" in row 5". The second field is labeled "Start analysis:" and contains the date and time "6/21/00 3:47:22 PM". The third field is labeled "Current time:" and contains the date and time "6/21/00 2:47:27 PM". At the bottom of the dialog, there are three buttons: "Clear", "OK", and "Cancel".

3. In the highlighted field, enter the date and time to restart analysis. The date and time that appears may be edited. The format for entering the date and time is [06/01/2000 4:30:00 PM]. A space should be inserted after the date and time.
4. Click OK to program the pause. A clock symbol will appear in the spreadsheet next to the sample that will be analyzed after the pause.

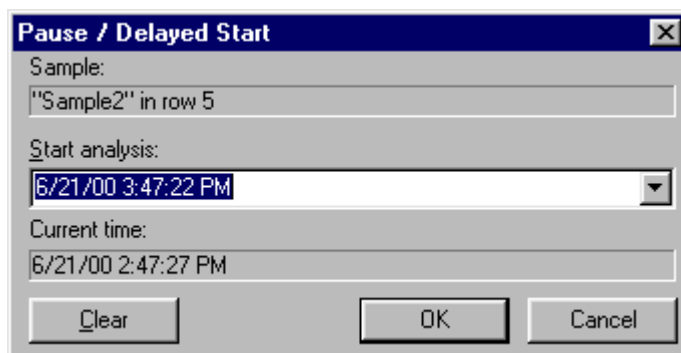
Cancel Pause

Cancel Pause permits the operator to remove a programmed delay analysis, pause analysis, or hold analysis from the spreadsheet.

Note

- Before proceeding, *Analyze Multiple Samples*, page 5–30, must be completed.

1. Click and select the row where the delay analysis, pause analysis, or hold analysis is programmed.
2. From the Samples menu, click Pause. The Pause/Delay Start dialog box will appear.

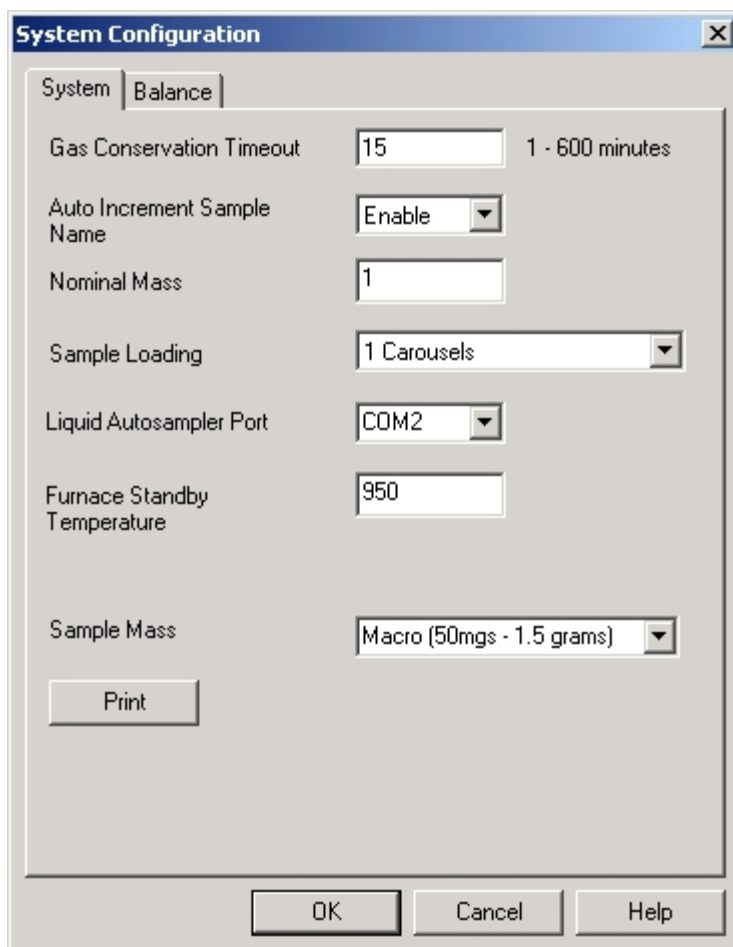


3. Click Clear. The programmed type, delay or pause will be removed.

Liquid Sample Analysis

Notes

- In order to perform a liquid analysis the liquid loading head and the liquid autosampler must be installed. Refer to Liquid Autosampler on page 3-9.
 - Analysis of liquid samples is very similar to solid samples with the exception of how they are loaded into the determinator. Use the procedure below to perform analysis of liquid samples.
1. From the Configuration menu select system. The system configuration screen will appear.
 2. Click the drop down arrow in the sample Loading selection box and select Liquid Autosampler. Refer to System Configuration, on page 4-32.



The image shows a 'System Configuration' dialog box with two tabs: 'System' and 'Balance'. The 'System' tab is active. It contains several configuration options:

- Gas Conservation Timeout: 15 (range 1 - 600 minutes)
- Auto Increment Sample Name: Enable (dropdown)
- Nominal Mass: 1
- Sample Loading: 1 Carousels (dropdown)
- Liquid Autosampler Port: COM2 (dropdown)
- Furnace Standby Temperature: 950
- Sample Mass: Macro (50mgs - 1.5 grams) (dropdown)

At the bottom left is a 'Print' button. At the bottom right are 'OK', 'Cancel', and 'Help' buttons.

3. Click the drop down arrow in the Liquid Autosampler Port selection box and select the proper Autosampler Port. This is the computer serial port that the autosampler is connected to. It is not necessary to configure this port. The software automatically configures itself when the autosampler is selected.
4. From the Configuration menu select Method. Select or create the proper Analysis Method. Refer to Method Configuration, Liquid Autosampler on page 4-39.
5. Fill the Wash Vials with the proper wash solution.
6. Empty the Waste Vial if necessary.
7. Prepare the Sample Vials and insert the tray in the tray holder.
8. Click the Samples menu and select Login. Login the desired samples. The location, volume and density must be entered. After volume and density are entered the software will calculate the mass.

Sample [X]

Sample Name: Liquid Sample

Mass: .2500 <<< Balance

| Attribute | Value |
|-------------------|----------|
| Location* | 1 |
| Autosampler Tray | Tray1 |
| Volume (mL) | .2500 |
| Density (g/mL) | 1 |
| Method | Method-1 |
| Comments | |
| Description | |
| Operator | |
| Moisture Basis | |
| Sample Moisture | |
| Atmospheric Blank | |
| Protein Factor | 6.2500 |

☒ Add to end of list
☐ Add as next sample to run

OK Cancel Help

☐ Keep logging in samples until Cancel is pressed.

9. Click the Samples menu and select Analysis or press F5 to start analysis. Refer to Analyze a Sample, on page 5-27, for more information.

Liquid Sample Login Definitions

Note

- In addition to the definitions listed below refer to the definitions on page 5-21.

Location—The sample location number. Refer to the illustration below.

Autosampler Tray—Click the drop down arrow and select the autosampler tray. If only one tray is used select Tray1.

Volume (ml)—The volume of sample drawn into the syringe.

Density (g/ml)—The sample density (grams per ml).

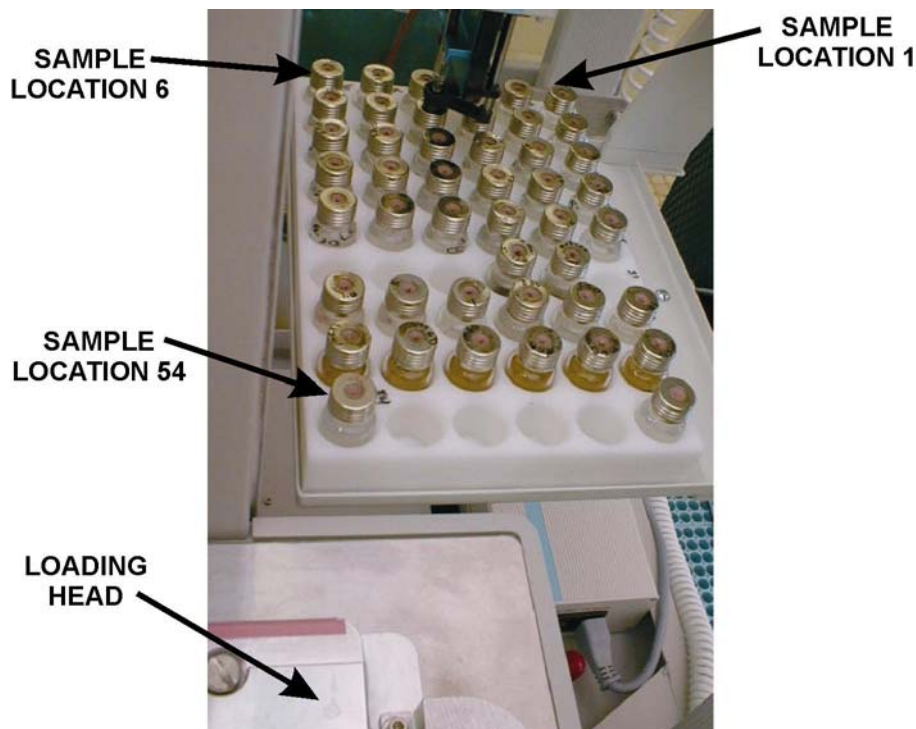


Figure 5-5
Autosampler Tray

Calibration

Calibration is the process that adjusts the instrument to produce the correct result when a calibration standard is analyzed. A calibration standard has a known or certified value.. First a Blank Calibration is performed, then Standard Calibration and then as daily maintenance both a Blank Calibration and Drift Correction.

Blank Calibration

Blank Calibration is used to calculate the blank or baseline. Sometimes this is called the blank area. Blank calibration calculates the instrument blank and adjusts the area of the analysis accordingly. The system blank should be determined every day by performing a blank calibration before analysis. A blank should be analyzed and the blank calibration set prior to standard calibration or drift correction. Refer to Blank Calibration on page [5-40](#).

Standard Calibration

Standard Calibration is used to calibrate the instrument with known calibration standards. A single point calibration can be performed using the curve type (single standard sample) (at a single mass) however; LECO recommends multipoint calibrations that employ 1/certified weighting. Additionally a blank calibration should be completed prior to performing any calibration. Since Standard Calibration is saved with each method, each method must be calibrated after it is created.

Standard Samples

During the calibration process only dried standards should be employed. The analytical accuracy depends on the accuracy of the standards. Drying the standards optimizes the accuracy. Standards should be dried according to label instructions. Refer to Calibration on page [5-41](#).

Drift Correction

Drift Correction is used to adjust the original calibration response to match the current instrument response. Drift calibration should be performed at the start of every day or when check standards fail to return the proper values. This insures accurate calibration and analysis results. Refer to Drift Correction on page [5-44](#). LECO recommends that all check standards be independent of the drift standards. After performing a drift correction, the result for the drift standard will be the same result that the drift standard returned during the original calibration (not the certified value).

Replace Drift Standard

Replace drift is used when a drift standard lot is changed. Replace drift compensates for differences in the drift standard lot and produces a more accurate drift calibration point. Refer to Replace Drift Standard on page [5-47](#).

Blank Calibration

Blank calibration calculates the instrument blank area and adjusts the analysis area accordingly.

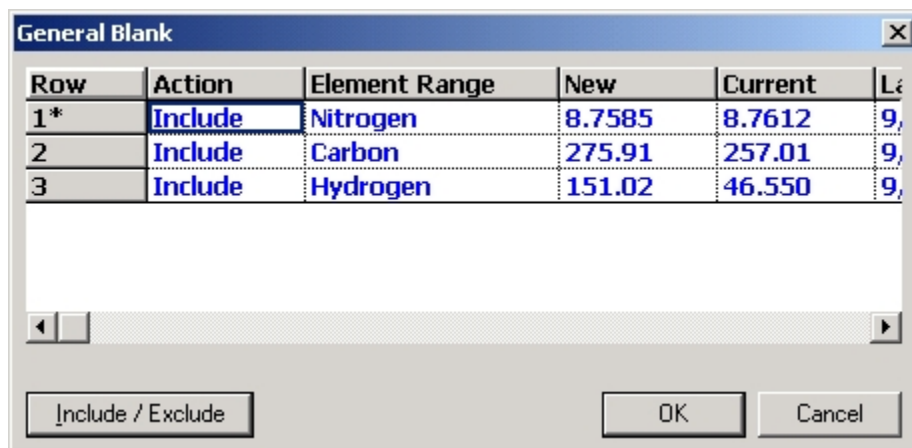
Notes

- Analyze 3 to 5 blank conditioning samples before setting the blank area.
- Analyze 3 to 5 blank samples to set the blank area.

1. Login and perform at least three blank analyses.
2. Select the results of the blank analyses from the spreadsheet.
3. Click Configuration and select Blank. The Element Selection screen will appear.

Note

- In the screen below, the software displays the data in blue to alert the operator that the data has changed.



4. Include or exclude an element by clicking a row to select the element and clicking Include/Exclude. The action box will indicate if the element is included or excluded. If the element is included a blank calculation will be calculated for that element.
5. Click OK to calculate the system blank based on the analysis results obtained in step one.

Standard Calibration

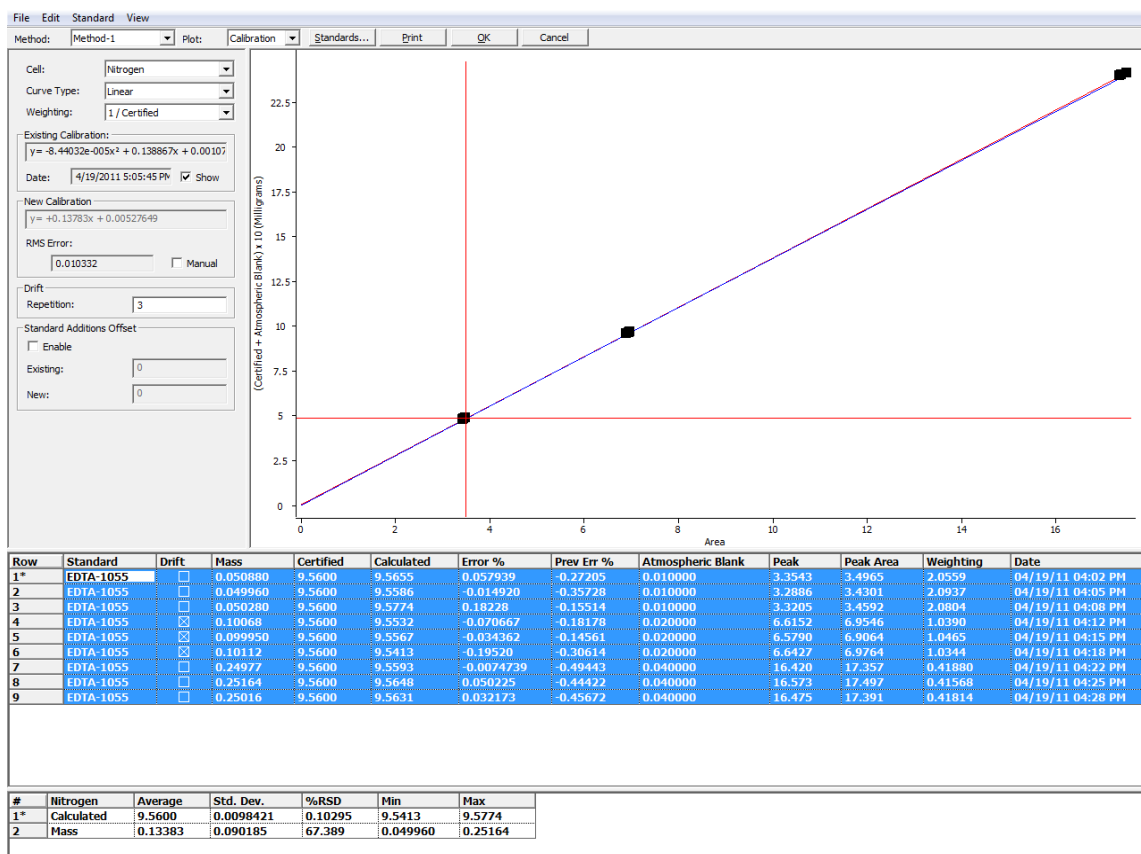
Standard Calibration is a process that adjusts the response of the instrument to that of known standards. The application software permits two different types of calibration: Single Standard or multipoint calibration. Since calibration is saved with each method, each method must be calibrated after it is created.

Notes

- Refer to *Standard Calibration Definitions* on page 5-43 when performing this procedure.
- The instrument Blank should be calibrated before performing standard calibration. Refer to *Blank Calibration* on page 5-40.
- LECO recommends multipoint calibrations that employs 1/certified weighting be used for standard calibration.
- Moisture is an optional entry for hydrogen and oxygen analysis. Moisture must be determined before analysis and logged in as Sample Moisture. Calibration will be compensated for moisture content. Refer to *Sample Login* on page 5-19.
- During standard analysis, if an Atmospheric Blank value is entered on the login screen, the value will be added to the standard value defined in the method. The new standard value will be used during calibration to calculate the final standard analysis result. A column will appear on the calibration screen listing the atmospheric blank value.
- During sample analysis, if an Atmospheric Blank value is entered on the login screen, the value will be subtracted from the sample value. The new sample value will be used during calibration to calculate the final sample analysis result.

New Standard Calibration

1. Login and perform at least three standard analyses.
2. Select the results of the standard analyses from the spreadsheet.
3. Click Configuration and select Calibrations.
4. Click New. The Calibration screen will appear.



- Click the arrow in the drop down box and Select a Cell (detector) to calculate a calibration for. A separate calibration can be calculated for each cell.
- Click the arrow in the drop down box and Select a Curve Type. LECO recommends multipoint linear or higher order curves.
- View the curve displayed on the graph. It should intersect the black squares which represents the standards. The curve fit can also be evaluated by selecting a Relative Error plot on the residual error plot.
- Click the arrow in the drop down box and Select the desired Weighting. LECO recommends 1/certified weighting be used for a standard calibration.
- Click OK to select the cell to calibrate. One or more cells can be selected.
- Click Print to print a copy of the calculated calibration on the system printer.
- Click OK to exit the calibration procedure and save the calibration curve.
- In the next dialog box highlight the cells that you wish to save the calibration for and click OK. The calibration is saved and associated with the method used to analyze the standards.

Add Standards

Add standards permits the operator to add analyzed standards to the list of standards used for calibration.

1. Select analyzed standard samples from the spreadsheet to be added to the list of standards used for calibration.
2. Click Configuration and select Calibrations.
3. From the fly-out menu click Add Standards.
4. The highlighted Analyzed Standards will be added to the list of samples used for calibration. To view the list of standard samples click new from the calibrations fly-out menu.

View Calibration

Permits the operator to view the current calibration. The calibration cannot be changed from this screen.

1. Click Configuration and select Calibrations.
2. From the fly-out menu click View Calibration.
3. The Calibration screen will appear. The screen will be the same as new calibration except most of the selections will not be available.

Edit Calibration

Permits the operator to view and edit the current calibration.

Standard Calibration Definitions

Cell Type—Selects the measurement cell that will be associated with the calibration curve. In this case only sulfur can be selected.

Curve Type—Selects the type of calibration curve. Select a curve that intersects each calibration result.

Weighting—Determines which calibration results, on the calibration curve, get priority.

- *Normal*—Each point gets equal priority.
- *Manual*—A manual weighting can be entered.
- *1/Certified*—A weighting factor that can be applied to the calibration data points. This will counteract a bias for higher concentrations that develops naturally from the curve fitting process.

Show—Click Show to show the last calibration. The last calibration will appear on the graph in blue.

Manual—Click Manual to enter a new calibration equation. This can be done if a calibration was lost and a previous calibration recorded.

RMS Error (Root Mean Square)—A method of quantifying the dispersion or spread of data. It is used in the PC software to determine which calibration curve is a better fit. The lower the RMS error the better the fit.

Zoom In—Draw a box around a calibration point to zoom in.

Zoom Out—Click on a calibration point with the right mouse button. A Zoom Out button will appear. Click the Zoom Out button to zoom out.

Drift Correction

Drift Correction is used to adjust the original calibration response to match the current instrument response. Drift calibration should be performed at the start of every day or when the check standard doesn't return the correct result. This insures accurate calibration and analysis results.

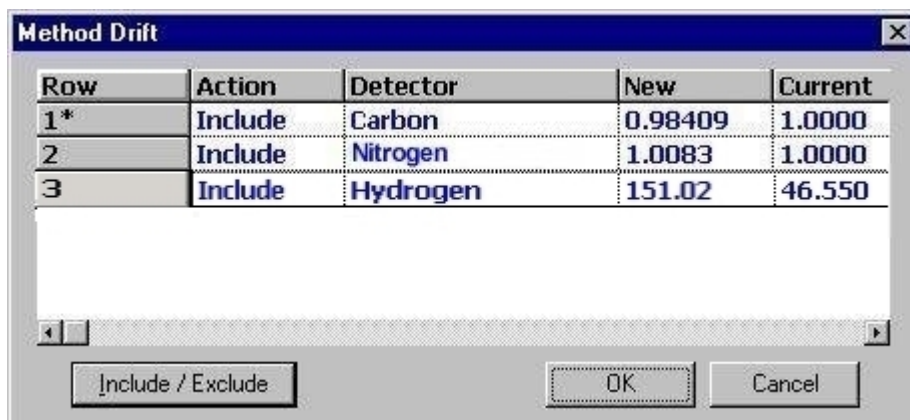
Notes

- *After calibration, a Standard in the center of the calibration range will be automatically selected (with a tolerance of $\pm 12.5\%$) to be the drift standard.*
- *A different Drift Standard can be manually selected from the standard calibration screen. Refer to Standard Calibration on page [5-41](#) for more information.*
- *A Blank Calibration should be performed before every Drift Correction. Refer to Blank Calibration on page [5-40](#) for more information.*
- *The Drift Standard should be homogenous and return precise results.*
- *Check Standards should be independent of the drift standard.*
- *The Drift Standard and the Samples to be analyzed should be in the center of the calibration curve.*

1. Click Samples and select Login Drift Sample.
2. Click Drift Standards and select the Drift Standard to log in. The drift standard must be within the specified mass range.
3. Perform a Standard analysis.
4. Select the result of the standard analysis from the spreadsheet.
5. Click Configuration and select Drift. The fly out menu will appear.
6. From the fly-out menu click Drift. The Calibration screen will appear.

Note

- In the screen below, the software displays the data in blue to alert the operator that the data has changed.



| Row | Action | Detector | New | Current |
|-----|---------|----------|---------|---------|
| 1* | Include | Carbon | 0.98409 | 1.0000 |
| 2 | Include | Nitrogen | 1.0083 | 1.0000 |
| 3 | Include | Hydrogen | 151.02 | 46.550 |

7. Include or exclude an element by clicking a row to select the element and clicking Include/Exclude. The action box will indicate if the element is included or excluded. If the element is included a drift calculation will be calculated for that element.
8. Click OK to calculate the drift based on the analysis result obtained in step one.

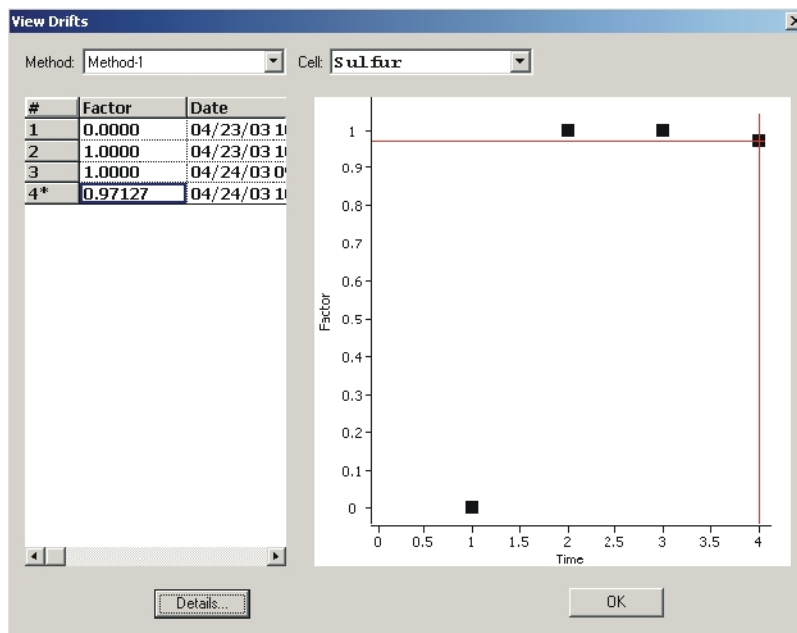
Notes

- If more than one drift standard is selected the drift factor will be the average of the selected standards.
- After a drift correction the drift standard results will match the result from the drift standard used in the original calibration curve not the certified value.

View History

View History plots past drift corrections on a graph. The operator or lab manager can use this information to determine instrument stability. After a pattern is determined the operator can watch for this. If a sudden change in this pattern occurs it might indicate a potential problem with the instrument.

1. Click Configuration and select Drift. The fly out menu will appear.
2. From the fly-out menu click View History. The View History screen will appear.

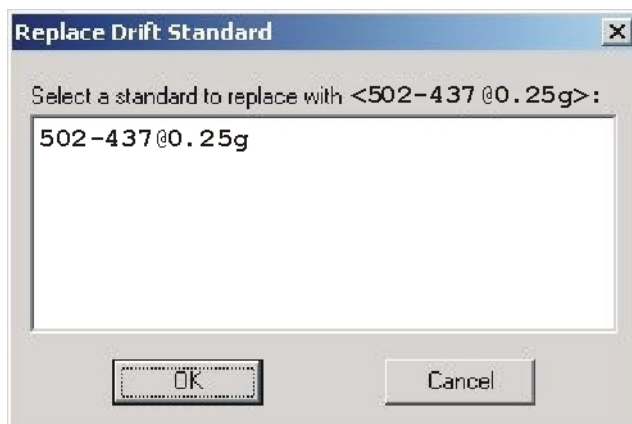


3. Click the Method drop-down arrow to select the method. Drift calibration history for each method can be viewed.
4. Click the Element drop-down arrow to select the detector. Drift calibration history for each detector can be viewed.
5. Click Details to view the last drift calibration values.
6. Click OK to exit the screen.

Replace Drift Standard

Replace Drift Standard is used when the operator switched to a new standard calibration sample lot. Since there are differences in a standard sample from one lot to another replace drift correction should be used to compensate for these differences and produce a more accurate calibration.

1. Define a new standard for the new lot. Refer to Add Standards on page 5-42.
2. Perform an analysis with the new standard defined in step 1.
3. Select the standard sample analysis result from step 2.
4. Click Configuration and select Drift.
5. Click Replace Drift from the fly-out menu.
6. A dialog box will appear. Select the Drift standard to replace.



7. Select the drift standard to replace then click OK. The new drift Standard is selected as the drift standard
8. Select the new drift standard just analyzed from the spreadsheet.

9. Click Configuration from the configuration menu and select Drift.
10. Click drift from the fly-out menu. The drift calibrations screen will appear.

| Row | Action | Detector | New | Current |
|-----|---------|----------|---------|---------|
| 1* | Include | Carbon | 0.98409 | 1.0000 |
| 2 | Include | Nitrogen | 1.0083 | 1.0000 |
| 3 | Include | Hydrogen | 151.02 | 46.550 |

Include / Exclude OK Cancel

11. Include or exclude an element by clicking a row to select the element and clicking Include/Exclude. The action box will indicate if the element is included or excluded. If the element is included a drift calculation will be calculated for that element.
12. Click OK to calculate the drift based on the analysis result obtained in step 2.

Samples

Sample Editing Functions

Insert a Sample

If a sample is going to be added to the last row of the spreadsheet, sample login should be used. If a sample should be inserted out of sequence, between unanalyzed samples, Insert a Sample should be used.

Note

- • *An analysis method should be developed before a sample is logged in. Refer to Method Configuration on page [4-39](#).*

1. Click and select a row in the spreadsheet after the last analyzed sample. Insert will insert a row before the selected row.
2. From the Edit menu, click Insert. A row will be inserted into the spreadsheet before the selected row.

Fill Cells with the Same Data

A group of cells in the spreadsheet can be quickly filled with the same data. As an example, the method could be changed in a group of logged in unanalyzed samples.

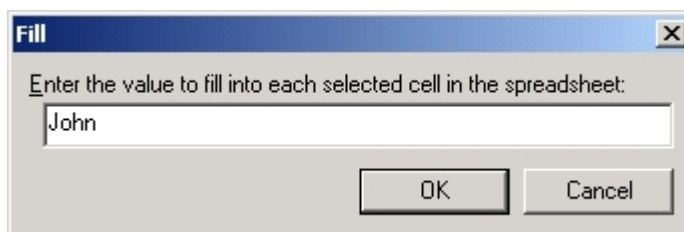
1. Click and drag the mouse pointer to select the cells to fill with the same data.

Note

- *In the example below the mouse pointer was dragged over the Operator cells to be filled with the same operator's name.*

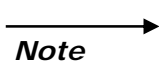
| Row | Name | Operator | Method |
|-----|----------|----------|----------|
| 1* | Sample-1 | | Method-1 |
| 2 | Sample-1 | | Method-1 |
| 3 | Sample-1 | | Method-1 |
| 4 | Sample-1 | | Method-1 |

2. From the Edit menu, click Fill. The Fill screen will appear.



3. Enter the data to fill into each selected cell.
4. Click OK.

Cut

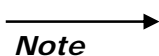


Note

- *Cut is used to remove a sample from the spreadsheet and copy it to the Windows® Clipboard. From there it can be pasted into another location in the spreadsheet.*

1. Select a sample by clicking on a row in the spreadsheet. The row should be highlighted.
2. Select the Edit menu and click Cut. The sample will be removed and cut to the clipboard.

Copy

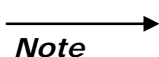


Note

- *Copy is used to copy a sample from the spreadsheet and copy it to the Windows® Clipboard. From there it can be Pasted into another location in the spreadsheet.*

1. Select a sample by clicking on a row in the spreadsheet. The row should be highlighted.
2. Select the Edit menu and click Copy. The sample will be copied to the clipboard.

Paste



Note

- *Paste is used to copy a sample that was cut or copied to the Windows® Clipboard and insert it into the spreadsheet.*

1. Select a sample location in the spreadsheet by clicking on a row. The row should be highlighted.
2. Select the Edit menu and click Paste. The sample will be copied to the spreadsheet.

Delete a Sample

- **Note**
- *Use Delete a Sample to remove a sample row from the spreadsheet.*
1. Select a row in the spreadsheet to delete. If more than one row should be deleted, click and drag the mouse pointer down the desired number of rows to delete. More than one row will be selected.
 2. From the Samples menu, click Delete.
 3. Click Yes to delete the row or rows of sample information. The selected sample information will be deleted from the spreadsheet. It is not possible to restore this data once it's deleted.
- **Note**
- *If a database is created with log activity enabled, a deleted sample can be viewed by setting the Presentation Time to a time prior to the deletion.*

Recalculate Results

1. Select the samples in the spreadsheet to recalculate.
2. From the Samples menu, click Recalculate. The selected samples will be recalculated using the new calibration.

————→
Notes

- *Results are automatically recalculated when a field in the spreadsheet is edited (ex. name, mass, method, analysis date, etc.).*
- *If the calibration is changed, it can be reapplied by following the procedure above.*

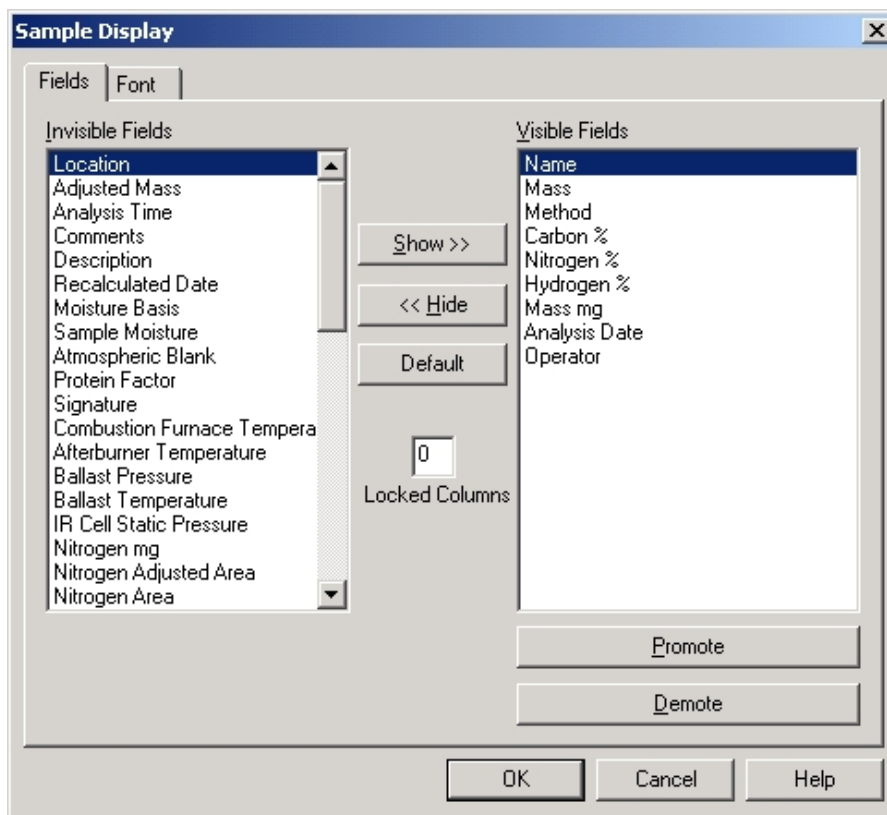
Display Protein Results

The nitrogen analysis results can be displayed as percent protein.

Notes

- A protein factor may be defined during login. Make sure a factor has been defined. Refer to Typical Protein Factors below.
- A protein factor may be entered in the spreadsheet if the field is visible.

1. From the Configuration menu, click Display. The Sample Display dialog box will appear.



2. Select Protein % from the Invisible Fields edit box.
3. Click Show to move protein % from the Invisible Fields to the Visible Fields edit box.
4. Click OK to display protein % and protein factor in the spreadsheet.

Typical Protein Factors

| Product | Protein Factors |
|----------------|-----------------|
| Wheat Products | 5.70 |
| Almonds | 5.18 |
| Peanuts | 5.46 |
| Tree Nuts | 5.30 |
| Coconuts | 5.30 |
| Dairy Products | 6.38 |
| Other Products | 6.25 |

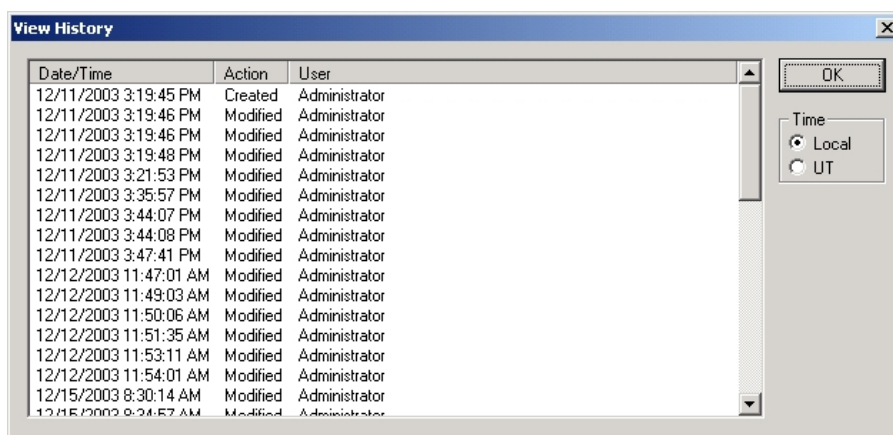
View History of a Sample

View History permits the operator or laboratory manager to look at a history log of the actions performed on a selected sample.

1. Select a sample in the spreadsheet to View History of.

| | | | | | | |
|----|------|--------|---------|----------------------|---------|---------|
| 8 | Feed | 1.0150 | General | 2/10/2003 3:30:39 PM | 0.00257 | 0.00173 |
| 9* | Feed | 1.0050 | General | 2/10/2003 3:35:40 PM | 0.00256 | 0.00206 |
| 10 | Feed | 0.9980 | General | 2/10/2003 4:10:40 PM | 0.00255 | 0.00206 |

2. Click the Samples menu and select View History. The View History screen will appear. Refer to View History Definitions below.



3. Click the Local Time button, in the Time screen, to display the time in local 12-hour time.
4. Click the UTC button, in the Time screen, to display the time in Universal Coordinated Time.
5. Click OK to exit view history.

View History Definitions

Date and Time—The date and time the action took place.

Action—The type of action performed on the sample. Examples are: Created the sample, modified the sample, and recalculated the sample.

User—The Operator that performed the action.

Sample Signature

A signature confirms that a user has accepted the sample information displayed in the spreadsheet. Any change to the sample information after it is signed will clear the signature. The signature can be used to ensure that the validity of the sample information has remained the same since it was signed.

————→
Note

- To view a sample signature, after it has been signed, refer to View Signature on page 5–58.

1. Click on a row, in the spreadsheet, to select a sample to sign.

| | | | | | | |
|----|------|--------|---------|----------------------|---------|---------|
| 8 | Feed | 1.0150 | General | 2/10/2003 3:30:39 PM | 0.00257 | 0.00173 |
| 9* | Feed | 1.0050 | General | 2/10/2003 3:35:40 PM | 0.00256 | 0.00206 |
| 10 | Feed | 0.9980 | General | 2/10/2003 4:10:40 PM | 0.00255 | 0.00206 |

2. Click the Samples menu and select Sign. The Sign screen will appear.

Sign

System: TruSpec

User: Instrument Operator

Date: Wednesday, February 12, 2003

Time: 8:14:06 AM

☒ Local ☐ UT

Name: James Miller

Description: Feed Sample from Lot # 11

OK Cancel

- A. A name will appear in the Name Entry box. It will be the name of the logged-on Windows® user. If desired the name can be changed. It's suggested that the current operators name be used.
- B. If desired, a description can be entered in the Description Entry box. This can be additional information about the sample or an event that took place. Any text can be entered.

- C. To display the time in local 12-hour time, click the Local button. To display the time in Universal Coordinated Time, click the UT button.
- D. Click OK to enter the signature.

Note → • The system name, user name, date, and time are obtained from the Windows® operating system. They cannot be changed from this screen.

View Signatures

View Signatures permits the operator or laboratory manager to view a sample signature and determine if it is valid. A sample must be signed before the signature can be viewed. Refer to Sample Signature on page 5-57.

Note → • If information associated with the sample was changed after it was signed, the signature will be cleared and the view signatures screen will not appear in step 2.

1. Click on a row to select a sample from the spreadsheet to view.

| | | | | | | |
|----|------|--------|---------|----------------------|---------|---------|
| 8 | Feed | 1.0150 | General | 2/10/2003 3:30:39 PM | 0.00257 | 0.00173 |
| 9* | Feed | 1.0050 | General | 2/10/2003 3:35:40 PM | 0.00256 | 0.00206 |
| 10 | Feed | 0.9980 | General | 2/10/2003 4:10:40 PM | 0.00255 | 0.00206 |

2. Click the Samples menu and select View Signatures. The View Signatures screen will appear.

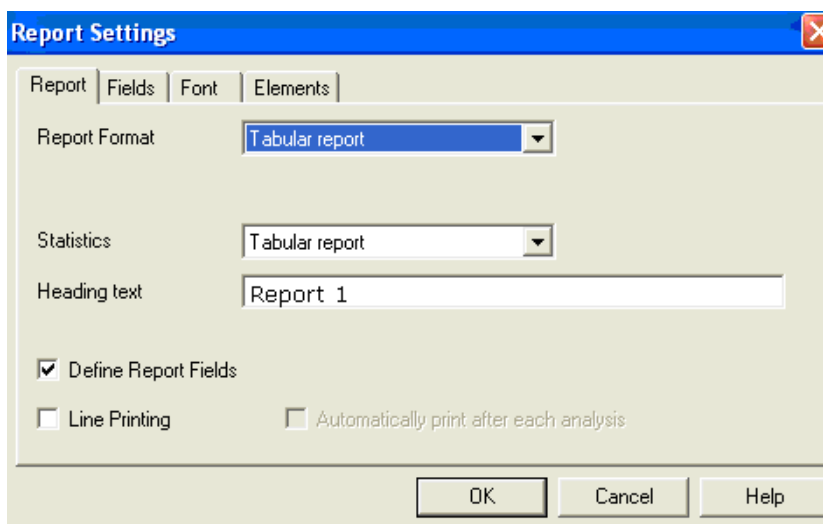
3. Click OK when finished viewing the signature information.

Printing Reports

Configuring Report before Printing

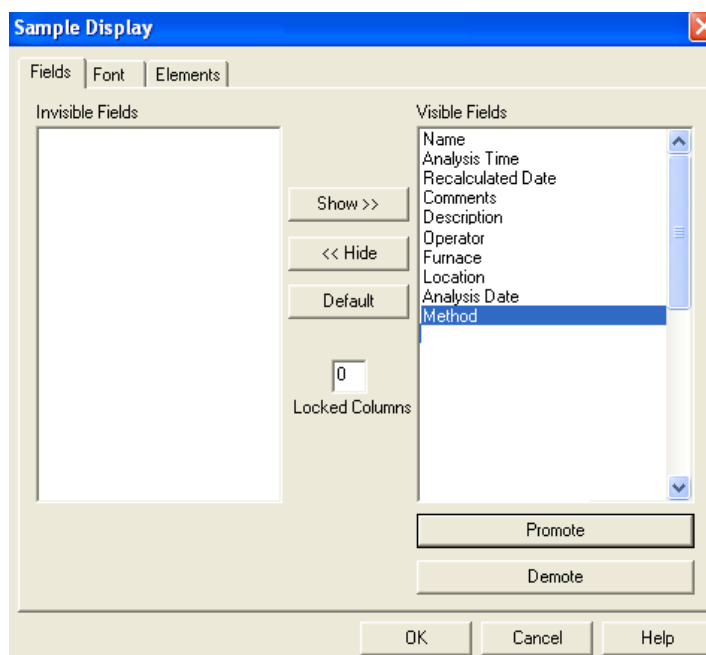
A report of analysis results can be generated and printed on the system printer. The following section explains how to use the Report Settings dialog box to determine the format of the report.

1. In the spreadsheet, select the samples as follows:
 - A. Place cursor in the column under row until a black arrow displays.
 - B. Hold down right mouse key and drag the mouse over the desired samples.
 - C. Unclick the mouse. Selected samples appear highlighted in blue.
2. Click Samples and select Print Preview. Click Print Preview to access the Report Settings dialog box in order to preview how selected samples will print on the system printer. The Report Settings Screen will appear.
3. Configure the report by clicking the Report tab, Field tab, Font Tab, and Element tab and entering the desired settings as explained in the steps below. The Fields tab will only appear when Define Report Fields is checked on the Report tab.



4. On the Report Tab,
 - A. Click the arrow next to Report Format to determine the format of the report.
 - Click Report with Plots to display a report with data plotted.
 - Click Tabular Report to display data in a table.

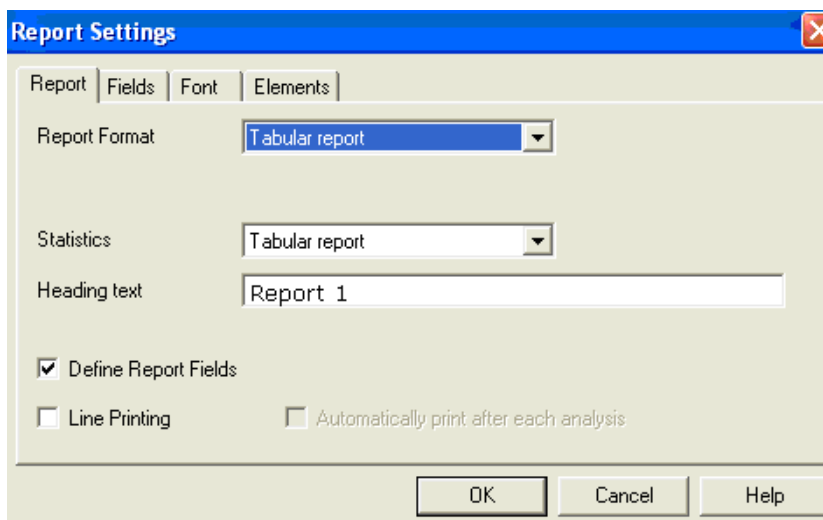
- Click Simple Print to display a report based on the columns that appear in the spreadsheet. This report can then be printed.
 - Click Group Report to display the average, the standard deviation, and the relative standard deviation when multiple samples are selected.
 - Click Ambients to display ambients.
 - Click Hardware Calibration to display the hardware calibration.
- B. Click the arrow next to Statistics to select how statistics will display.
- Select None, and statistics will not display.
 - Select Report with Plot, and statistics will display as a line plot.
 - Select Tabular Report, and statistics will display in a table.
- C. For Heading Text, enter a title for the report, if desired.
- D. Select the Define Report Fields check box and the Fields tab will display. Use the Fields tab to select the columns from the spreadsheet that will display in the report.
- E. For Line Printing, select the Automatically Print after Each Analysis check box. Enable line printing when printing with a dot matrix printer.
- F. When Line Printing is enabled, the Automatically Print After Each Analysis checkbox is enabled. When selected, a report will automatically print after each analysis.
5. Complete the Fields tab as follows to determine the fields that display in the report. The Fields tab will only display when Define Report Fields is checked on the Report tab. Fields that appear vary, depending on the instrument.



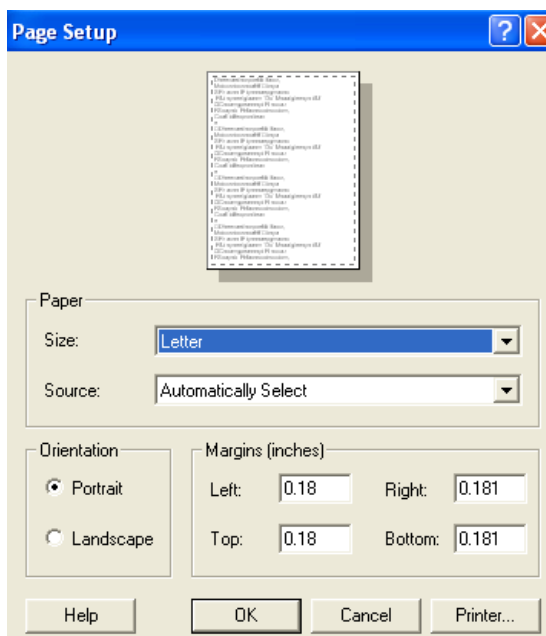
- To display a Field that does not appear in the report, select the field from Invisible Fields, and then click Show. The Field will automatically move to the Visible Fields column.
 - To remove a Field so that it does not display in the report, select the field from Visible Fields and then click Hide. The Field will automatically move to the Invisible Fields column.
 - To display the default fields, click Default.
 - To move a field so that it displays earlier in the report, select the Field from the Visible Fields column and click Promote until the field displays in the desired position.
 - To move a field so that it displays later in the report, select the Field from the Visible Fields column and click Demote until the field appears in the desired position.
6. Use the Font tab to configure the text in the report to improve the readability of the report. Refer to Modifying Font.
 7. Use the Elements tab to determine the elements that display in the report. Refer to Configuring Plot Properties.

Printing from the Software

1. From the spreadsheet, select the desired samples that have been analyzed to print. When several samples are selected, the software will group the samples by sample name.
2. Click Samples and click Print. Clicking Print or Print Preview will open the Report Settings dialog box.



3. Refer to Configuring Report before Printing, page 5-59, to format the report as desired.
4. From the Samples menu, click Print Setup. The Page Setup dialog box will display.



5. Use the Page Setup dialog box to change the size, orientation, and margins of the paper before printing.

NOTE → When multiple columns are selected to appear in the report, the font and page orientation can be adjusted to improve the readability of the report. The font size can be changed using the font tab as described in Configuring Report before Printing, page 5-59.

6. Click OK. The Print dialog box will appear.
7. Click OK to print.

Text Export Data

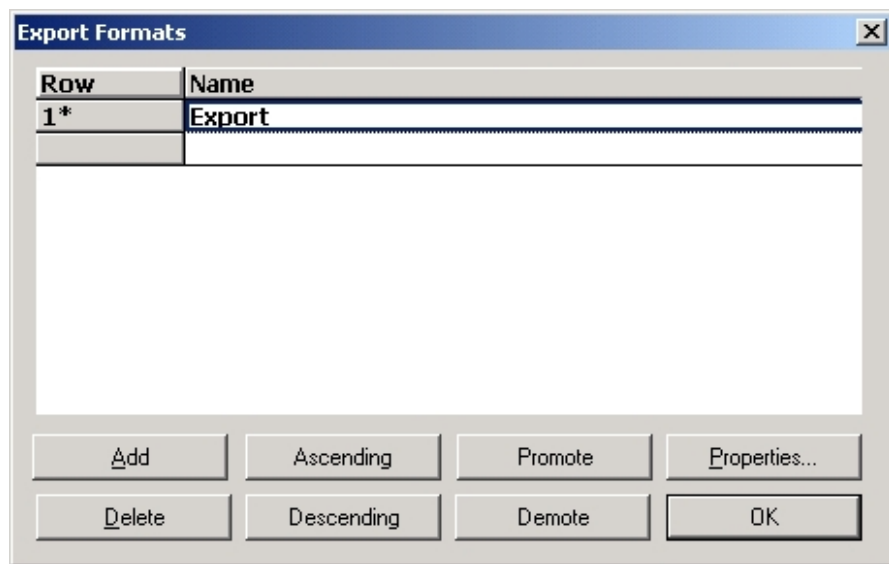
Notes

- Before sample data can be exported an export format must be configured.
- Multiple export formats can be configured.

Export Configuration

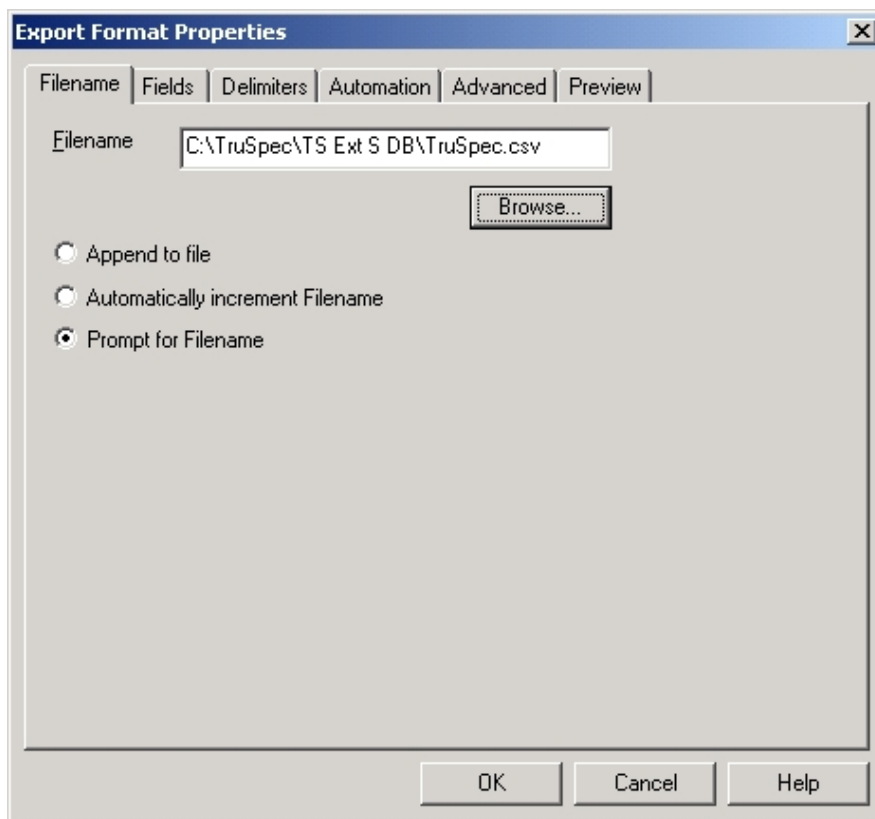
Filename

1. Select the Configuration menu and click Text Export Formats. The Export Format Screen will appear.



2. To move a selected method up towards the top of the list select it and click Promote.
3. To move the selected method down towards the bottom of the list select it and click Demote.
4. Select Ascending to list the method in ascending alphabetical order.
5. Select Descending to list the method in descending alphabetical order.

6. Click Properties to configure the text export format. The Filename screen will appear.



7. Enter a filename for the exported file or click browse and search for a file name.
8. Click Append to File, Automatically increment Filename or Prompt for Filename as desired. Refer to Export Configuration Definitions on page 5-64.
9. Click OK to save the changes and exit.
10. Click Cancel to exit this procedure without making changes.

Export Definitions

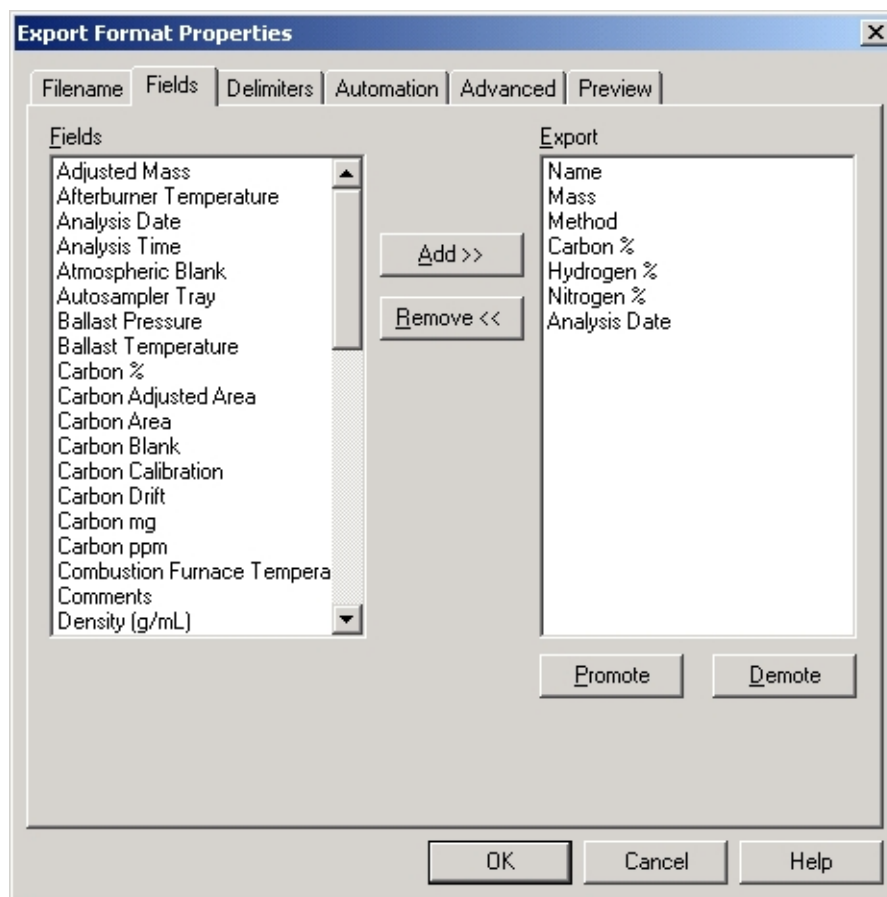
Append to File—When selected, the highlighted sample analysis data will be attached to the previously saved file.

Automatically Increment Filename—If the filename contains numbers, they will automatically be incremented by one when the file is saved.

Prompt for Filename—When selected, the export filename screen will appear when exporting a file, prompting the operator to enter a filename.

Fields

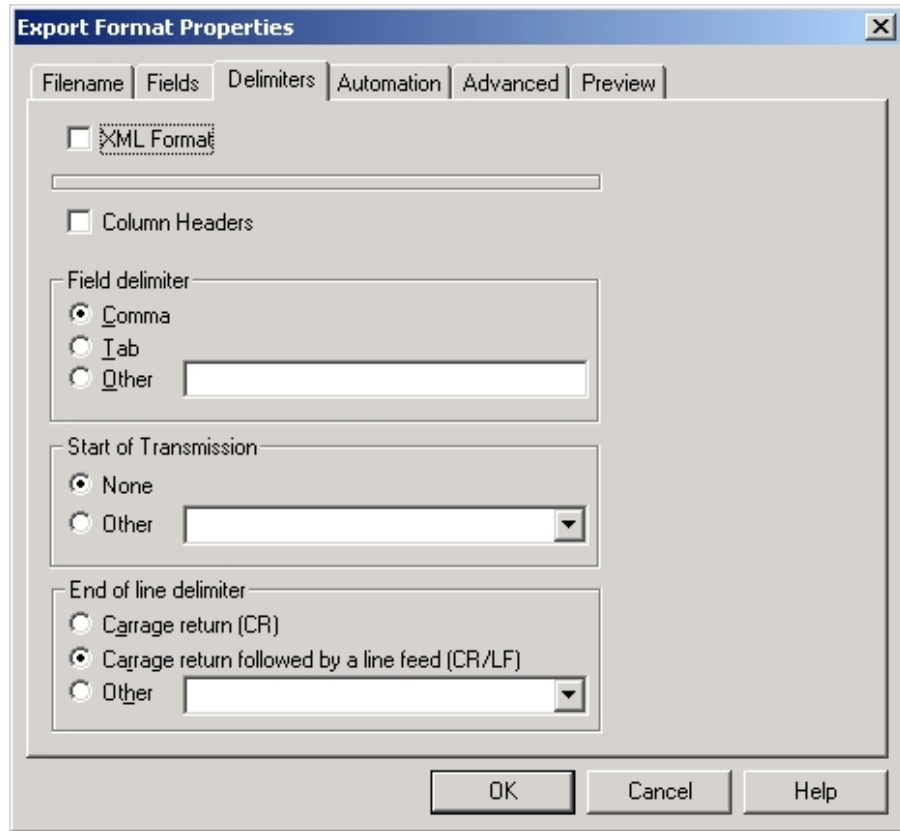
1. Click the Fields tab. The Fields Format Screen will appear. Select the desired fields to export in the file.



2. To Add an invisible field select the field and click Add.
3. To Remove a visible field select the field and click Remove.
4. To move a selected field up towards the top of the list, click Promote.
5. To move the selected field down towards the bottom of the list, click Demote.
6. Click OK to save the changes and exit.
7. Click Cancel to exit this procedure without making changes.

Delimiters

1. Click the Delimiters tab. The Delimiters Format Screen will appear. Select the desired delimiters to export in the file.

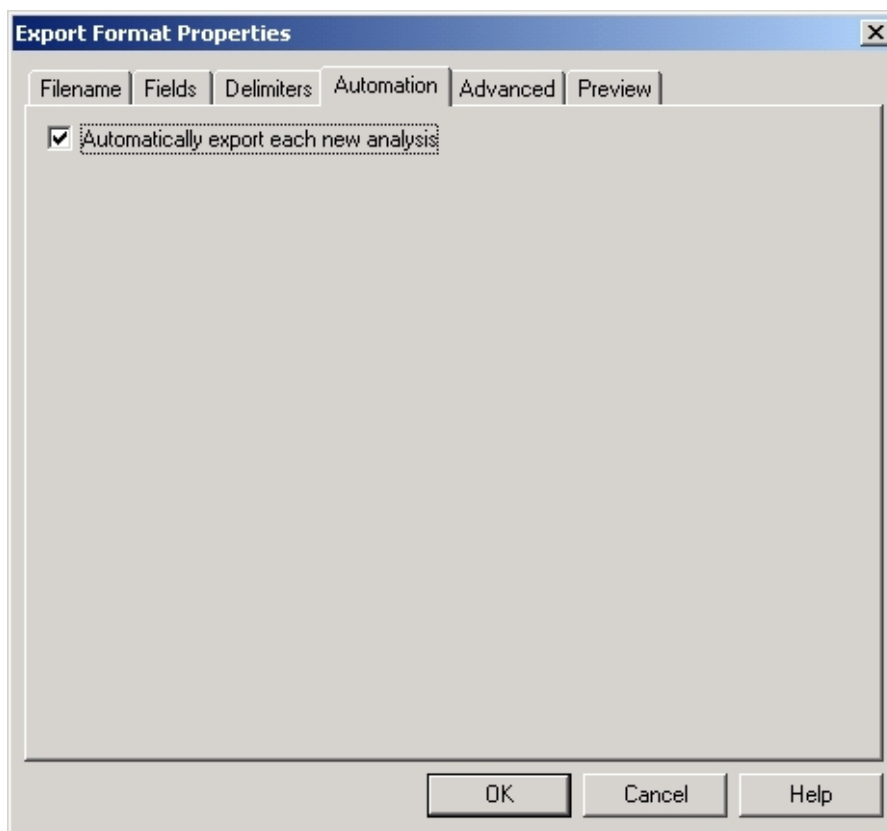


The image shows the 'Export Format Properties' dialog box with the 'Delimiters' tab selected. The dialog has a title bar with a close button. Below the title bar are tabs: 'Filename', 'Fields', 'Delimiters' (active), 'Automation', 'Advanced', and 'Preview'. The main area contains several options: an unchecked checkbox for 'XML Format', an unchecked checkbox for 'Column Headers', a 'Field delimiter' section with radio buttons for 'Comma' (selected), 'Tab', and 'Other' (with an adjacent text input field), a 'Start of Transmission' section with radio buttons for 'None' (selected) and 'Other' (with a dropdown menu), and an 'End of line delimiter' section with radio buttons for 'Carrage return (CR)', 'Carrage return followed by a line feed (CR/LF)' (selected), and 'Other' (with a dropdown menu). At the bottom right are 'OK', 'Cancel', and 'Help' buttons.

2. Click XML to export the text data in XML format. If XML is selected no other parameters in the screen can be configured.
3. Click Column Header to transmit the column header.
4. Select or enter the Field, Start of Transmission, and End of Line delimiters.
5. Click OK to save the changes and exit.
6. Click Cancel to exit this procedure without making changes.

Automation

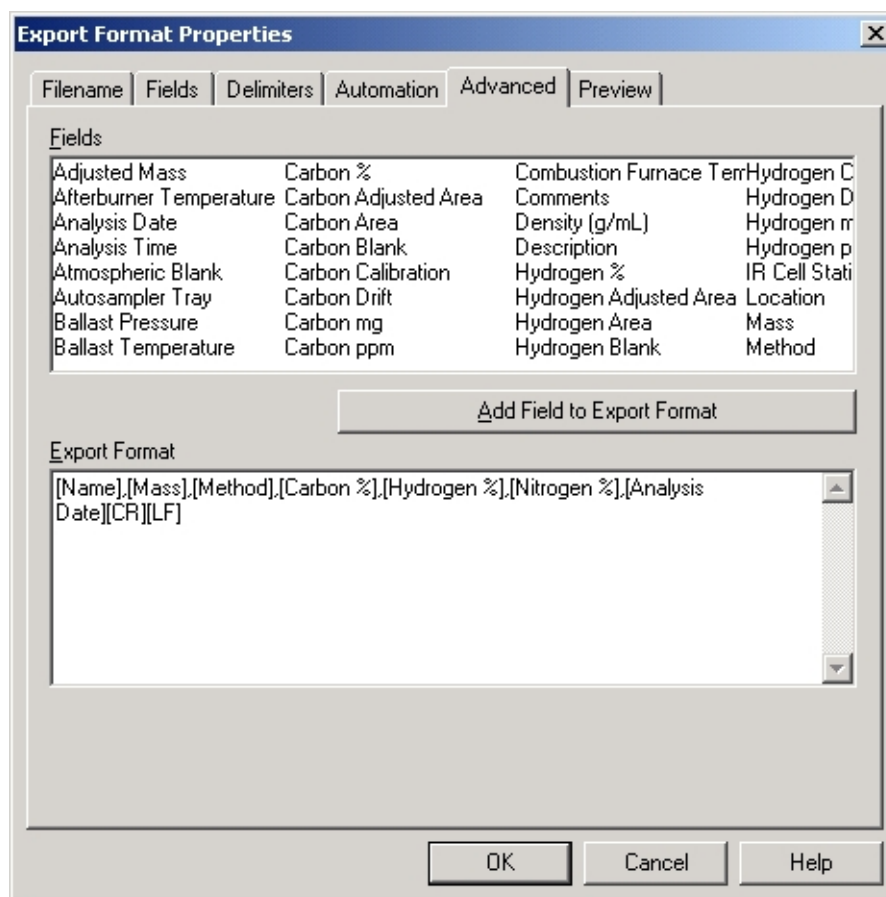
1. Click the Automation tab. The Automation Format Screen will appear.



2. Select Automatically export each new analysis to automatically export the analysis data after every analysis.
3. Click OK to save the changes and exit.
4. Click Cancel to exit this procedure without making changes.

Advanced

1. Click the Advanced tab. The Advanced Format Screen will appear.

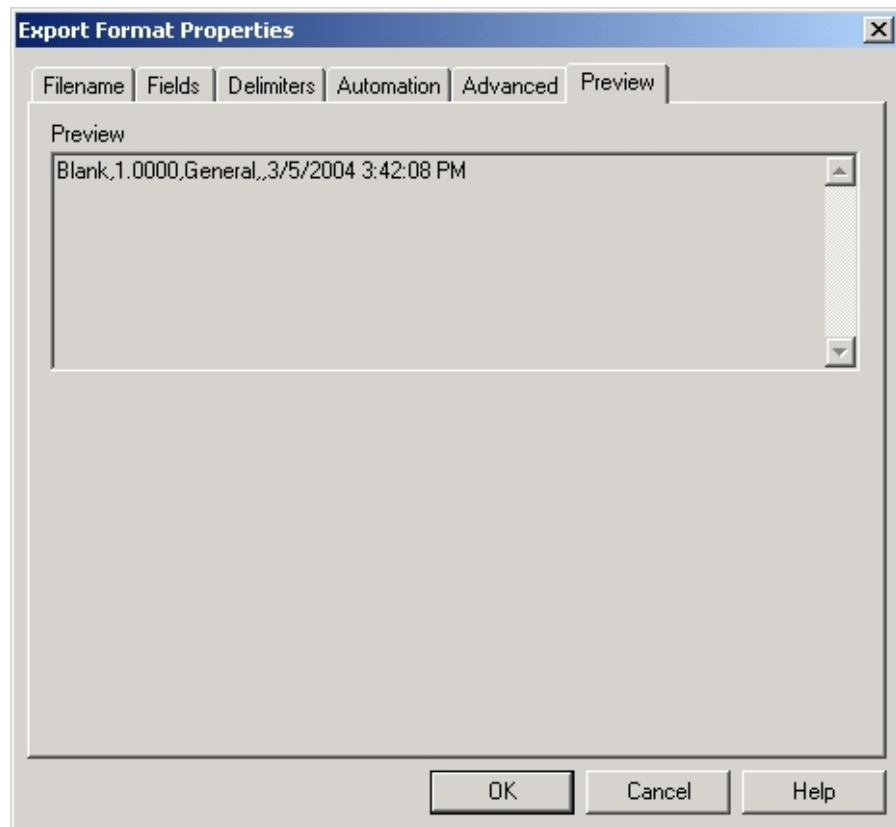


2. Position the cursor in the Export Format and click the mouse to place the cursor at the point in the format to edit a field.
3. Select a Field from the Fields box and click Add Field to Export Format to add a field.
4. Highlight a Field in the Export Format and then press Delete on the keyboard to delete it.
5. Click OK to save the changes and exit.
6. Click Cancel to exit this procedure without making changes.

Preview

1. Click the Preview tab. The Preview Export Format Screen will appear.

Note → • *This is a status screen to view the export data format. The export format cannot be changed from this screen.*



2. Click OK or Cancel to exit.

Export Text Data

Text Export Data permits the operator to select sample data and export that data to a file. Sample data can be inserted into an Excel® spreadsheet from the exported file.

1. Click and drag the mouse pointer to select the rows with sample data to export to a file.

→ **Note** • *If no sample is selected only the last sample in the spreadsheet will be exported and saved.*

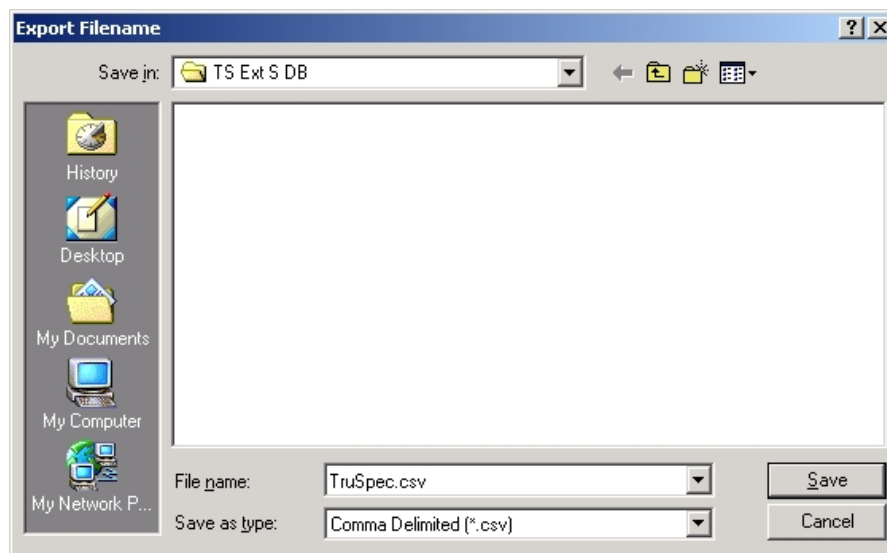
| Row | Name | Mass | Method | Analysis Date | Sulfur % |
|-----|-------|--------|---------|---------------------|----------|
| 1* | Blank | 1.0000 | General | 3/5/2004 3:37:13 PM | -0.00002 |
| 2 | Blank | 1.0000 | General | 3/5/2004 3:38:09 PM | -0.00001 |
| 3 | Blank | 1.0000 | General | 3/5/2004 3:39:03 PM | 0.00003 |
| 4 | Blank | 1.0000 | General | 3/5/2004 3:42:08 PM | 0.00000 |

2. Click the Sample menu and select Text Export Data. The Export Format selection screen will appear.

→ **Note** • *The format selection screen will not appear unless there is more than one format selected.*



3. Select the Export Format and click OK. The Export Filename selection screen will appear.



4. Enter a Filename and File Type.
5. Click Save to export and save the file.

Export Text Buffers

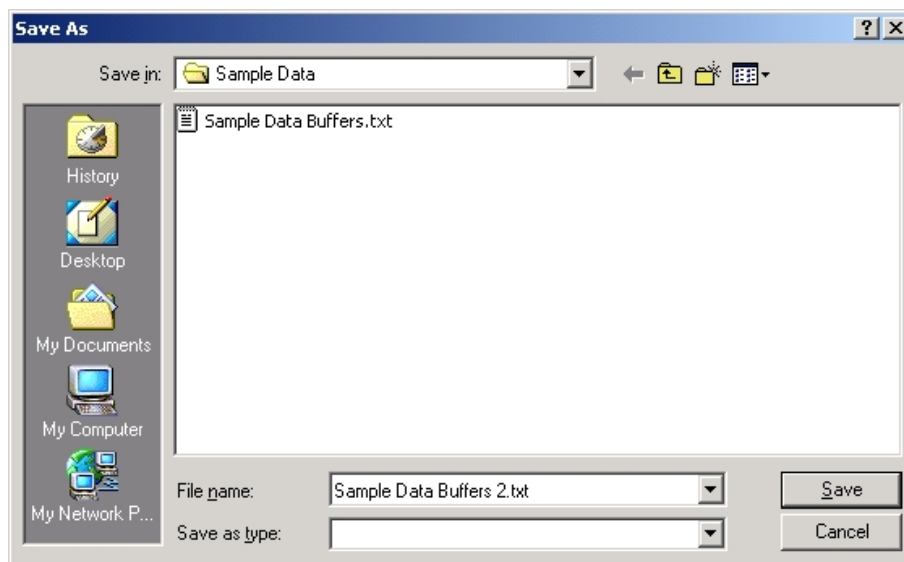
Text Export Buffers permits the operator to select sample plot data and export that data to a file. Sample plot data can be inserted into an Excel® spreadsheet from the exported file.

1. Click and drag the mouse pointer to select the rows with sample data to export to a file.

→ **Note** • *If no sample is selected only the last sample in the spreadsheet will be exported and saved.*

| Row | Name | Mass | Method | Analysis Date | Sulfur % |
|-----|-------|--------|---------|---------------------|----------|
| 1* | Blank | 1.0000 | General | 3/5/2004 3:37:13 PM | -0.00002 |
| 2 | Blank | 1.0000 | General | 3/5/2004 3:38:09 PM | -0.00001 |
| 3 | Blank | 1.0000 | General | 3/5/2004 3:39:03 PM | 0.00003 |
| 4 | Blank | 1.0000 | General | 3/5/2004 3:42:08 PM | 0.00000 |

2. Click the Sample menu and select Text Export Buffers. The Export Buffers Filename selection screen will appear.



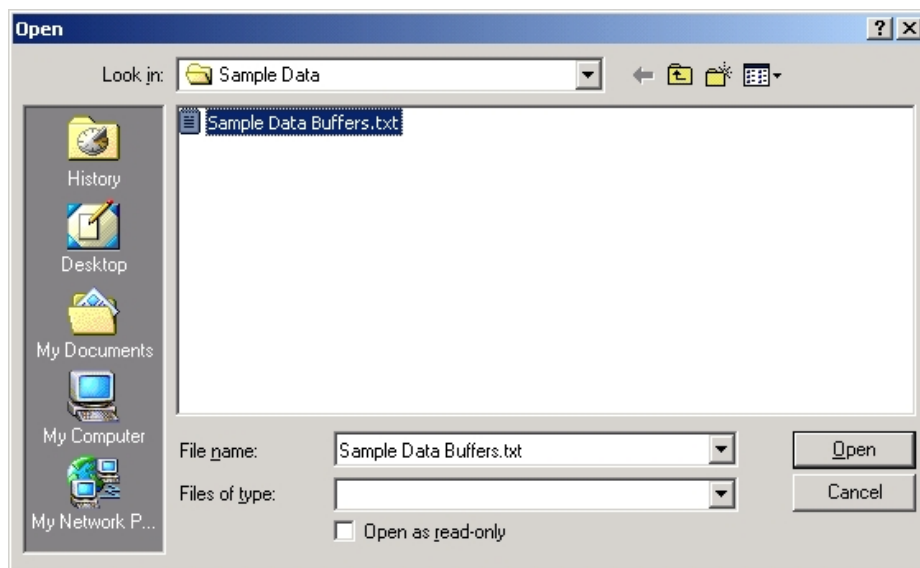
→ **Note** • *File extensions of (.txt) or (.csv) are good choices to insert the saved files into an Excel® spreadsheet.*

3. Enter a filename and extension. Click Save to export and save the file.

Text Import Data

Text Import Data permits the operator to import sample data from another application such as an Excel® spreadsheet.

1. Click the Sample menu and select Text Import Data. The Import File selection screen will appear.



2. Select the file to import.
3. Click Open to import the file.

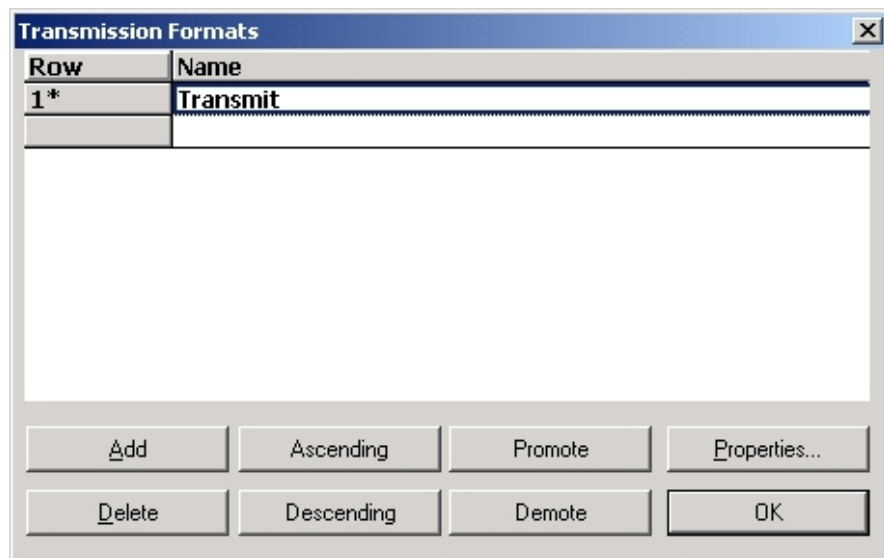
Transmit Data

Notes

- Before sample data can be transmitted to a peripheral device a transmit format must be configured.
- Multiple transmit formats can be configured.

Transmit Format Configuration

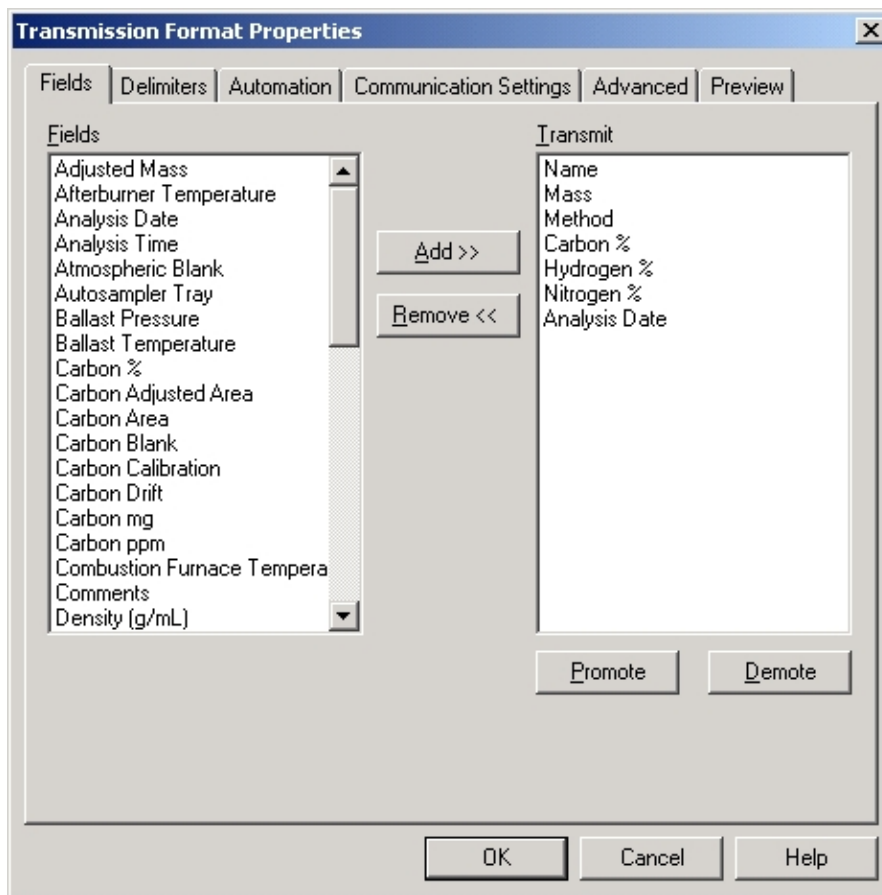
1. Click the Configuration menu and select Transmission Formats. The Transmission Formats screen will appear.



2. To add a new transmission format to the list, click Add and enter a transmission format name in the row that appears at the bottom of the list.
3. To move a selected transmission format up towards the top of the list select it and click Promote.
4. To move the selected transmission format down towards the bottom of the list select it and click Demote.
5. Select Ascending to list the transmission formats in ascending alphabetical order.
6. Select Descending to list the transmission formats in descending alphabetical order.
7. To delete a transmission format, select it and click Delete.
8. Click OK to save any changes and exit.

Fields

1. Select the transmission format from the transmission format screen and click Properties. The Transmission Format Properties screen will appear with the Fields tab selected.



2. To add a transmit field select the field and click Add.
3. To remove a transmit field select the field and click Remove.
4. To move a selected field up towards the top of the list, click Promote.
5. To move the selected field down towards the bottom of the list, click Demote.
6. Click OK to save the changes and exit.
7. Click Cancel to exit this procedure without making changes.

Delimiters

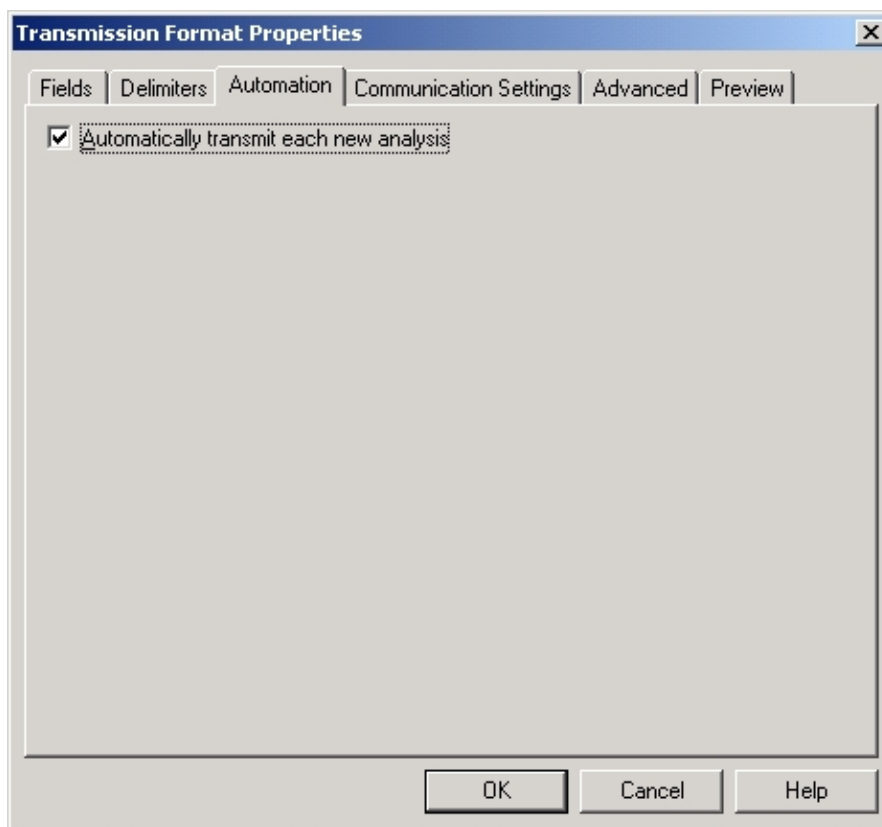
1. Click the Delimiters tab. The Delimiters Format Screen will appear. Select the desired delimiters to export in the file.

The image shows a Windows-style dialog box titled "Transmission Format Properties". It has five tabs: "Fields", "Delimiters", "Automation", "Communication Settings", and "Advanced", with a "Preview" button to the right. The "Delimiters" tab is selected. Inside the dialog, there is a checkbox for "XML Format" which is currently unchecked. Below it is a horizontal text input field. Another checkbox for "Column Headers" is also unchecked. The "Field delimiter" section contains three radio buttons: "Comma" (selected), "Tab", and "Other" (with an adjacent text input field). The "Start of Transmission" section has two radio buttons: "None" (selected) and "Other" (with a dropdown menu). The "End of transmission" section has three radio buttons: "Carriage return (CR)", "Carriage return followed by a line feed (CR/LF)" (selected), and "Other" (with a dropdown menu). At the bottom right are three buttons: "OK", "Cancel", and "Help".

2. Click XML to export the text data in XML format. If XML is selected no other parameters in the screen can be configured.
3. Click Column Header to transmit the column header.
4. Select or enter the Field, Start of Transmission, and End of Line delimiters.
5. Click OK to save the changes and exit.
6. Click Cancel to exit this procedure without making changes.

Automation

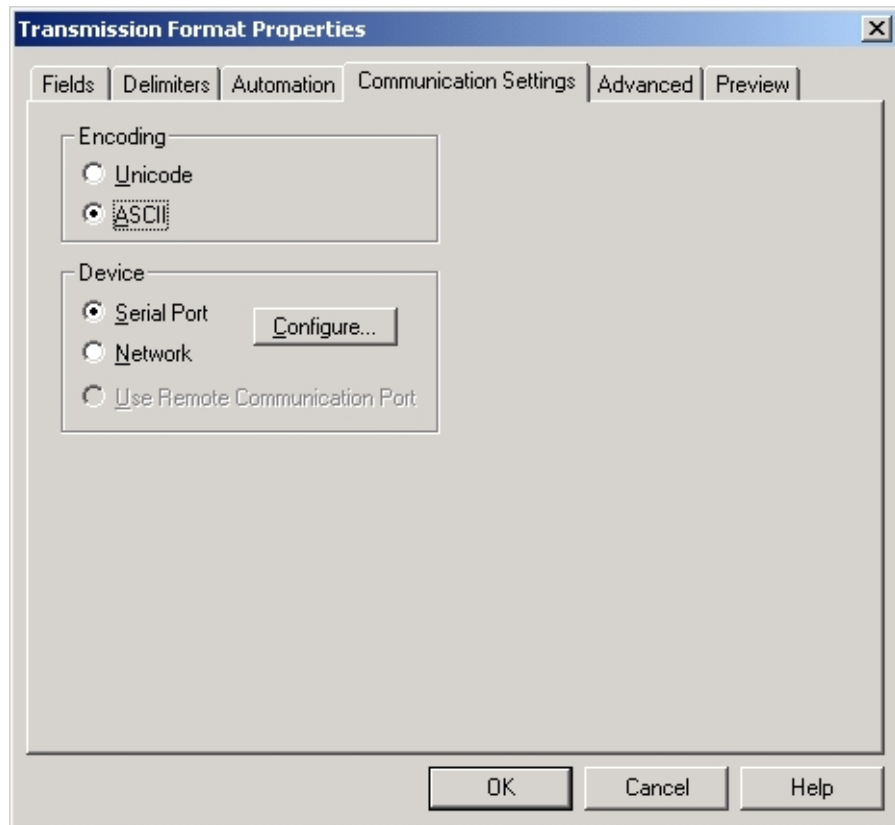
1. Click the Automation tab. The Automation Format Screen will appear.



2. Select Automatically export each new analysis to automatically export the analysis data after every analysis.
3. Click OK to save the changes and exit.
4. Click Cancel to exit this procedure without making changes.

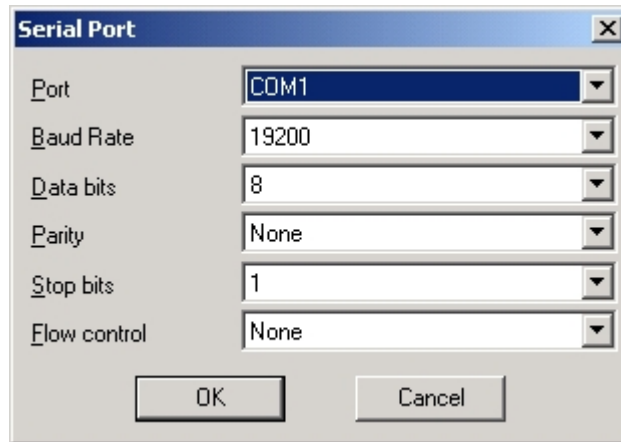
Communication Settings

1. Click the Communications Settings tab. The Communications Settings Configuration screen will appear.



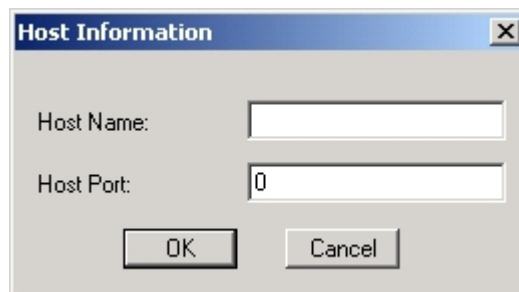
2. Click the radio button and select either Unicode or ASCII encoding.
3. Click the radio button and select Serial Port or Network.

4. Click Configure to configure serial or network communications.
5. If serial port was selected the Serial Port Configuration screen will appear. Select the Port, Baud Rate, Data Bits, Parity, Stop Bits and Flow Control.

A screenshot of the 'Serial Port' configuration dialog box. It has a title bar with a close button. The dialog contains several dropdown menus: 'Port' is set to 'COM1', 'Baud Rate' is set to '19200', 'Data bits' is set to '8', 'Parity' is set to 'None', 'Stop bits' is set to '1', and 'Flow control' is set to 'None'. At the bottom, there are 'OK' and 'Cancel' buttons.

| | |
|--------------|-------|
| Port | COM1 |
| Baud Rate | 19200 |
| Data bits | 8 |
| Parity | None |
| Stop bits | 1 |
| Flow control | None |

6. If network port was selected the Network Port Configuration screen will appear. Contact your network administrator to configure the network port.

A screenshot of the 'Host Information' dialog box. It has a title bar with a close button. The dialog contains two text input fields: 'Host Name' and 'Host Port'. The 'Host Port' field has the value '0'. At the bottom, there are 'OK' and 'Cancel' buttons.

| | |
|------------|---|
| Host Name: | |
| Host Port: | 0 |

7. Click OK to save the changes and exit.
8. Click Cancel to exit this procedure without making changes.

Serial Port Definitions

Baud Rate—Sets the data transmission speed in bits per second. Selections: 1200, 2400, 4800, or 9600 bps. Default: 1200 bps

Data Bits—Used to select the number of bits per byte for data that will be transmitted. Selections: 5 to 8. Default: 7

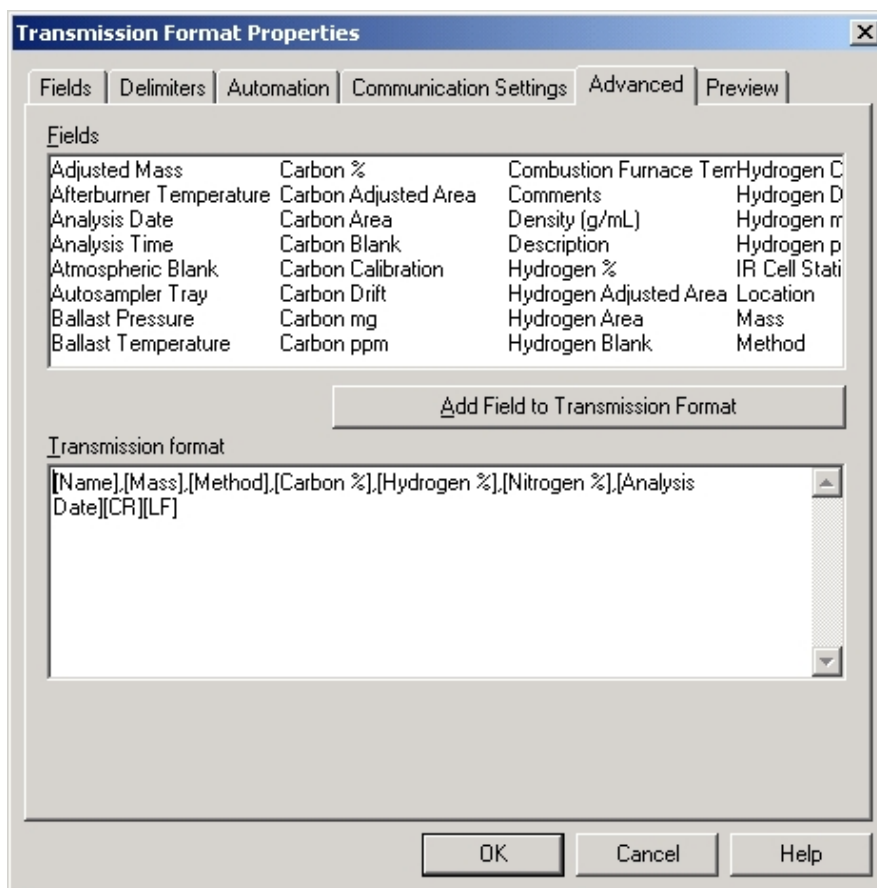
Parity—Sets the method of error checking used. Selections: Even, Odd, or None. Default: Even

Stop Bits—Used to select the number of bits that are used to signal the end of a transmitted data byte. Selections: 1 or 2. Default: 1

Flow Control—Selects the type of data flow control. Selections: Software (xon/xoff), Hardware or None.

Advanced

1. Click the Advanced tab. The Advanced Transmission Format screen will appear.



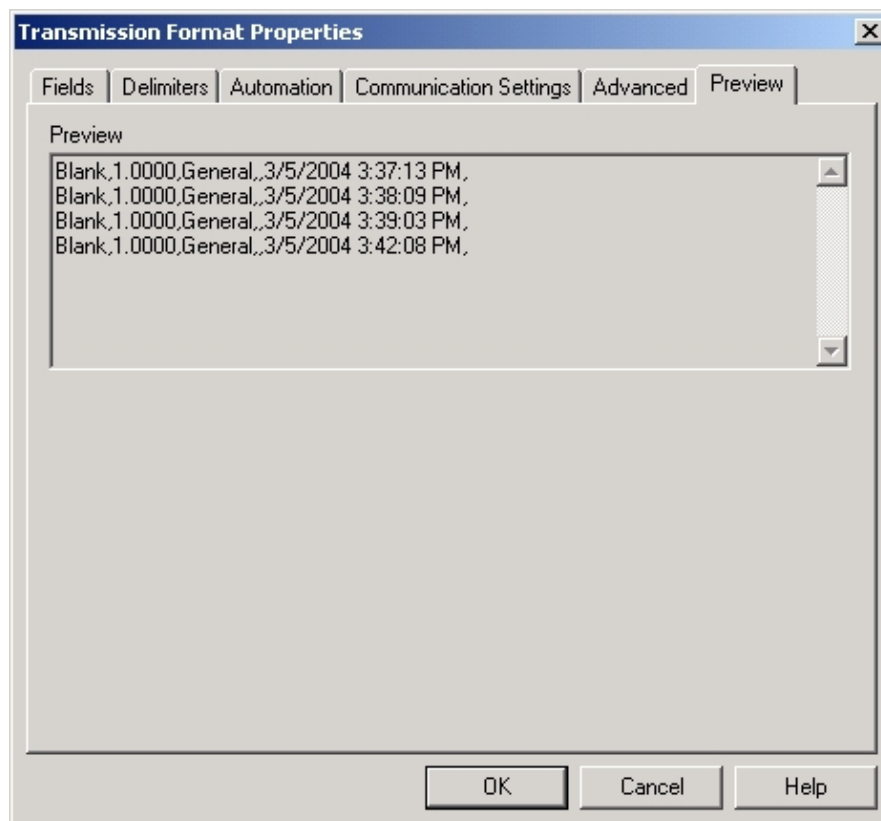
2. Position the cursor in the Export Format and click the mouse to place the cursor at the point in the format to edit a field.
3. Select a Field from the Fields box and click Add Field to Export Format to add a field.
4. Highlight a Field in the Export Format and then press Delete on the keyboard to delete it.
5. Click OK to save the changes and exit.
6. Click Cancel to exit this procedure without making changes.

Preview

1. Click the Preview tab. The Preview Transmission Format Screen will appear.

Note

- *This is a status screen to view the transmit data format. The transmission format cannot be changed from this screen.*



2. Click OK or Cancel to exit.

Transmit Selected Samples

Transmit Data permits the operator to select sample data and transmit the data to a peripheral device. Sample data can be transmitted from a serial port or over a network.

→ **Note**

- Before data is transmitted a transmission data format must be defined. Refer to [Transmit Data Format Configuration](#) on page 5–74.

1. Click and drag the mouse pointer to select the rows with sample data to transmit.

→ **Note**

- If no sample is selected only the last sample in the spreadsheet will be transmitted.

| Row | Name | Mass | Method | Analysis Date | Sulfur % |
|-----|-------|--------|---------|---------------------|----------|
| 1* | Blank | 1.0000 | General | 3/5/2004 3:37:13 PM | -0.00002 |
| 2 | Blank | 1.0000 | General | 3/5/2004 3:38:09 PM | -0.00001 |
| 3 | Blank | 1.0000 | General | 3/5/2004 3:39:03 PM | 0.00003 |
| 4 | Blank | 1.0000 | General | 3/5/2004 3:42:08 PM | 0.00000 |

2. Click the Sample menu and select Transmit. The Transmission Format selection screen will appear.

→ **Note**

- The transmission format selection screen will not appear unless there is more than one format selected.



3. Select the Transmission Format and click OK to transmit the selected sample data. Click Cancel to exit without transmitting any data.

Data Backup

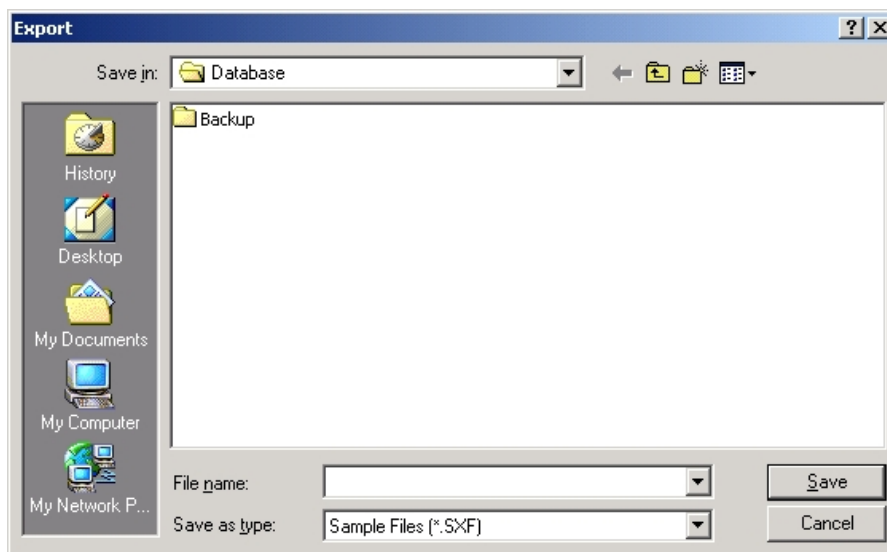
Data Backup permits the operator or manager to export sample data to a file. The file can be saved on the systems hard drive or transferred to another media for safe storage. If necessary, the file can be imported and the sample data restored. Refer to Transfer Import on page 5-85.

Transfer Export

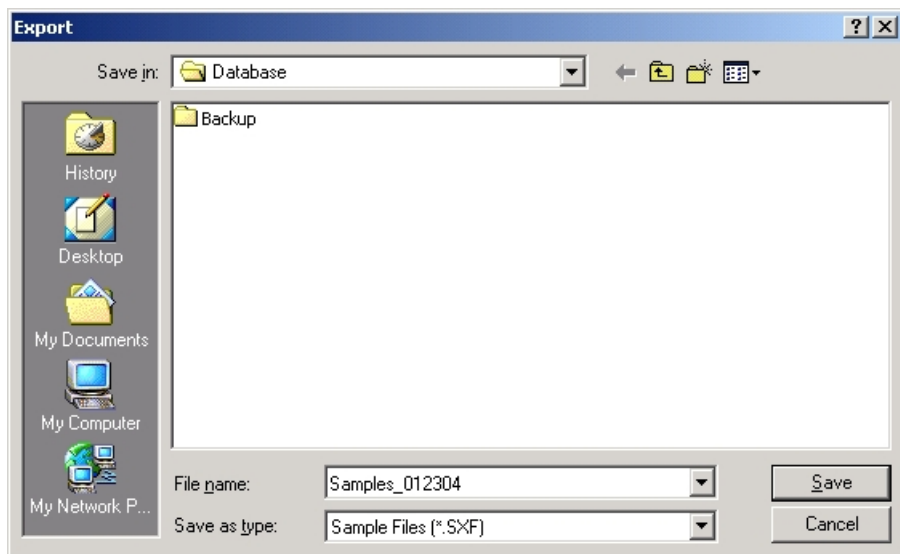
1. Click and drag the mouse pointer to select the rows with sample data to export to a file.

| Row | Name | Mass | Method | Analysis Date | Sulfur % |
|-----|-------|--------|---------|---------------------|----------|
| 1* | Blank | 1.0000 | General | 3/5/2004 3:37:13 PM | -0.00002 |
| 2 | Blank | 1.0000 | General | 3/5/2004 3:38:09 PM | -0.00001 |
| 3 | Blank | 1.0000 | General | 3/5/2004 3:39:03 PM | 0.00003 |
| 4 | Blank | 1.0000 | General | 3/5/2004 3:42:08 PM | 0.00000 |

2. Click the Sample menu and select Transfer Export. The export file selection screen will appear.



4. Select the folder to store the sample data and enter a unique file name without an extension. The software will automatically add the proper file extension.



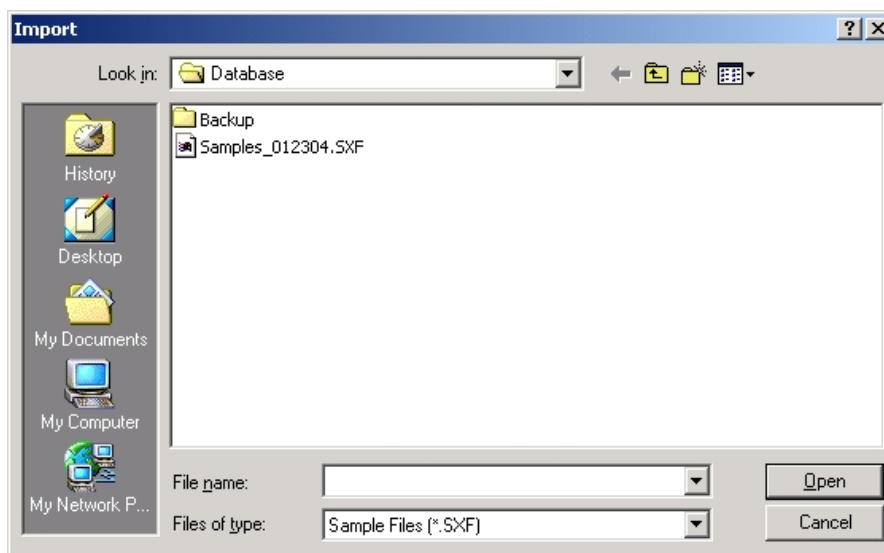
5. Click Save to export and save the sample data to a file.

Transfer Import

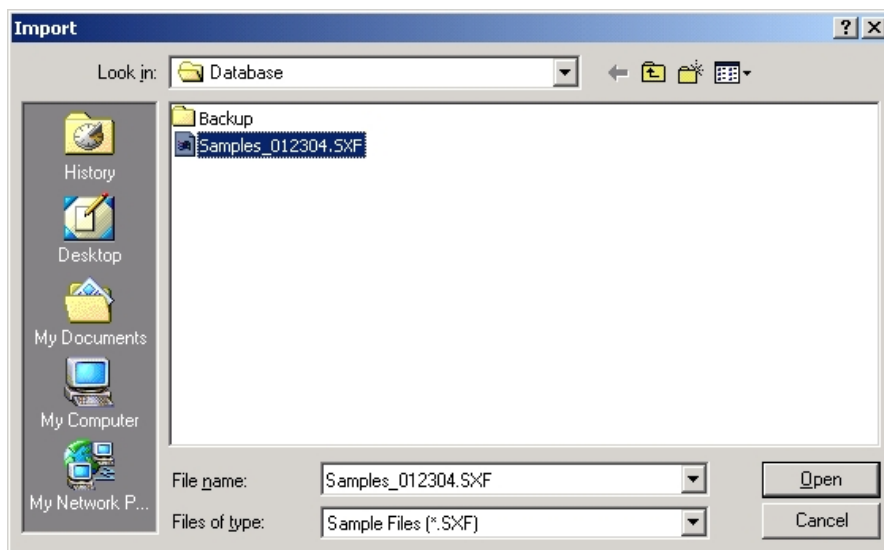
————→
Note

- *Transfer Import restores sample data that was saved as a file by Transfer Export. Refer to Transfer Export on page 5–83.*

1. Click the Sample menu and select Transfer Import. The Import File selection screen will appear.



2. Select the File to import by clicking on the file name.



3. Click Open. The sample data stored in the file will be restored as the last samples in the spreadsheet.

| Row | Name | Mass | Method | Analysis Date | Sulfur % |
|-----|-------|--------|---------|---------------------|----------|
| 1 | Blank | 1.0000 | General | 3/5/2004 3:37:13 PM | -0.00002 |
| 2 | Blank | 1.0000 | General | 3/5/2004 3:38:09 PM | -0.00001 |
| 3 | Blank | 1.0000 | General | 3/5/2004 3:39:03 PM | 0.00003 |
| 4 | Blank | 1.0000 | General | 3/5/2004 3:42:08 PM | 0.00000 |

Error Messages

Error messages that appear on the screen warn the operator of a condition that could yield an incorrect result or notify the operator of a component failure. Operator problems are most likely to occur after a manual procedure or a change in the setup, method, or system control parameters. When an error message occurs, refer to Error Message Definitions on page [5-88](#) for corrective action.

————→
Note

- *Please report any errors that are not defined on page [5-88](#) to the LECO Service Department.*

Error Message Definitions

Analysis Errors

| Message | Cause | Actions |
|---|--------------------------------------|---|
| A mass must be entered to analyze a sample. | No mass for sample | Enter a mass for the sample to be analyzed |
| A method must be defined to analyze a sample. | No method defined for sample | Select a method for the sample to be analyzed |
| Not Ready - <reason> | Hardware not ready to analyze sample | Fix or wait for indicated reason |

Pause

| | | |
|--|-----------------------------------|--------------------------------------|
| The date entered is not a valid date | Invalid data for Pause | Enter a valid date for the pause |
| First select an unanalyzed sample before selecting this command. | Tried to Pause an analyzed sample | Only use Pause on unanalyzed samples |

Analysis Warnings

| | | |
|---|---|--|
| The <element name> answer is outside the\n standard's defined control limits.\n | Element's results are outside the specified control limits for the defined standard | Check the analysis for anomalies, possibly need to drift the instrument. |
|---|---|--|

Leak Check

| | | |
|--|--|--|
| Failed to pressurize system for leak check. | Could not pressurize the system to check for leaks | Trouble shoot leak check for pressurization leak |
| Failed Stabilization | Pressure did not stabilize after pressurizing for Leak Check | Trouble shoot leak check for pressurization leak |
| Leak Check early termination on step <step number> | | |
| Leak (<step number>) | Leak in the indicated step | |
| Overpressure (<step number>) | Overpressured in indicated step | |

Carousel Interaction

| | | |
|--|---------------------------------|---|
| To use Location, go to system configuration and select the number of carousels being used. | Number of carousels is set to 0 | Enter the number of carousels to be used, or do not try to enter a location value |
| Current location range is <minimum value> - <maximum value> | Entered invalid location value | Enter a location value in the proscribed range |

Application Software

| | | |
|---|---|---|
| The application is already running. | Trying to open another instance of TruSpec while the application is running | Only run one instance of the application at a time |
| You must first exit the application before shutting down. | Session did not end, because you must shut down the application first | Shut down the application and then try to end the session |
| The selected language module could not be loaded. | Language module missing | Reinstall the software and retry |
| Missing IR Cell Linaizaion <file name> | Missing linearization file | Reinstall the software and retry |

Software Registration

| | | |
|--|--|---|
| The registration information could not be saved. | Unable to save the registration number for TruSpec, most likely to Permission restrictions on the user | Log on as Administrator and try entering the registration number again |
| Invalid software registration. | Incorrect software registration number for the instrument and the entered configuration | Verify that the instrument is powered, the information in the registration box is correct. Contact LECO for a correct registration number |
| Equipment number does not match. | Improper register code has been entered | Contact LECO |

Blank Calibration

| | | |
|---|--|--|
| First select the blanks to use for setting the new method blank area before selecting this command. | No samples selected | Select the samples to be used |
| The selected blanks must all have a method before setting the new method blank area. | No method in one or more of the selected samples | Select a method for each sample to be used |
| The selected blanks must all have been analyzed before setting the new method blank area. | One or more of the selected samples have not been analyzed | Analyze all of the samples to be used |
| The selected samples must all be blanks before setting the new method blank area. | Selection include some sample other than blanks | Select only blanks and try again |
| The selected blanks must all refer to the same method before setting the new method blank area. | Selected samples refer to multiple methods | Select only samples with the same method |

Standard Calibration

| | | |
|---|---|---|
| WARNING: The sample blank on one or more samples does not match the current method blank.\n Do you wish to recalculate the selected results for the current method blank? | Not all calibration samples are using the same blank | Decide whether to continue with calibration with using different or the same blank value |
| Warning: This action will change all cells to use single standard calibration. Do you still want to make the change? | Select an element to use Single Standard Calibration | Decide whether to select Single Standard Calibration for all elements |
| Warning: This action will change all other cells from single standard calibration to linear calibration. Do you still want to make the change? | Selected an element to switch from Single Standard Calibration to a regular curve order | Decide whether to stay in Single Standard Calibration for all elements or switch out of that mode |
| The selected standards must all have a mass before creating a calibration. | No mass for one or more selected samples | Enter a mass for all samples |

| | | |
|--|--|--|
| The selected standards must all have a method before creating a calibration. | No method in one or more of the selected samples | Select a method for each sample to be used |
| The selected standards must all have been analyzed before creating a calibration. | One or more of the selected samples have not been analyzed | Analyze all of the samples to be used |
| The selected standards must all refer to the same method before creating a calibration. | Selected samples refer to multiple methods | Select only samples with the same method |
| First select the standards to use for calibration before selecting this command. | No samples selected | Select the samples to be used |
| The selected samples must all be standards before creating a calibration. | Samples selected are not standards | Select only standards |
| Drift Failed | Error in UI grid creation or database access | Exit, restart and retry |
| No drifts to show. | No drift history | Action only accessible when there is a drift history |
| There are no drift standards defined. | No drift standards defined for the method | Pick drift standards for the method from the calibration window |
| Warning: This sample is used in calibration. This change will invalidate the current calibration and/or drift. Do you still want to make the change? | Changing a sample used for calibrating a method | Decide whether to accept the sample change and its effect on calibration |

Maintenance Counters

| | | |
|---|------------------------------------|--|
| This counter is required and cannot be deleted. | Tried to delete a required counter | Do not try to delete required counters |
| A counter with name <name> already exists | Trying to create a new counter | Use a different name |

Balance

| | | |
|---|--|---|
| The balance is sending more frequently than allowed.\□either the balance is configured incorrectly,\nor the print key on the balance was pressed twice. | Multiple mass entries from the balance in rapid succession | Check balance communication setting at the balance and the PC |
|---|--|---|

Users

| | | |
|--|---|--|
| You do not have permission to\n<name of action trying to be performed> | User is restricted from the action | Change user permission or sign on as a user with the proper permission |
| Access is Read Only | User is restricted from the action | Change user permission or sign on as a user with the proper permission |
| Failed to get the user name from operating system.\n Starting application in guest mode. | Operating system did not report a user name | Restart sysmte and retry, contact LECO |
| User <user name> does not exist in the application.\n Contact administrator to add the user.\n Starting application in guest mode. | User name does not exist | Have the user added to the system or sign on with a valid user |
| You cannot remove the rights to "<user name>" for the currently logged on user. | Tried to remove the rights for the currently logged on user | Alter the permissions from the administrator user |

Standards

| | | |
|--|---|--|
| You cannot name a standard "blank" | Tried to name a standard 'Blank' | Do not name standards 'Blank'. It is reserved for application use |
| You cannot delete standard "<standard name>".\nIt is referenced by a sample. | Tried to delete a standard still in use | Delete all references to the standard before deleting the standard |
| A standard with name <name> already exists | Trying to create a new standard | Use a different name |

Sample

| | | |
|--|--|--|
| You cannot delete sample "<sample name>".\n It is referenced by a calibration. | Tried to delete a sample used by calibration | Remove sample from calibration if it needs to be deleted |
| First select the samples to recalculate before selecting this command. | No samples selected | Select the samples to be used |
| One or More Cell(s) are Not Editable | Entering data into field that is not editable | Do not enter data into uneditable fields |
| There are no samples to delete. | No sample in the sample log | |
| The sample that is currently being analyzed was not deleted. | Can not delete a sample while it is being analyzed | Either stop the analysis and then delete the sample or wait for the analysis to complete |
| First select the samples to delete before selecting this command. | No samples selected | Select the samples to be used |

Sample Template

| | | |
|---|--|----------------------|
| A sample template with name <name> already exists | Trying to create a new sample template | Use a different name |
|---|--|----------------------|

Method

| | | |
|--|--|--|
| Methods have been lost for the following sample rows:\n<row numbers>\n The method <method name> with default settings has been created\n and inserted into each of the above sample rows. | Method missing | Software created default method, samples and method must be reviewed for integrity. |
| You will need to recalibrate method(s):\n<method names> | Calibrations were missing from the names methods | Calibrate each of the methods |
| You cannot delete method "<method name>".\n It is referenced by a sample. | Trying to delete a method which is still in use | Delete all samples and other information referenced by the method before deleting the method |
| The method <method name> does not exist. | Tried to enter the name of a non-existent method | Select an existing method or create a method with that name |
| A method with name <name> already exists | Trying to create a new method | Use a different name |

Export

| | | |
|--|---|---|
| Could not open the file\n<file name> for exporting.\n | This error can occur when trying to export a file | Verify that the file was not deleted or moved.; Verify that the file is not a read only file or it is currently open.; Retry exporting with a different name; If error persists, contact LECO |
| First select the samples to be exported before selecting this command. | No samples selected | Select the samples to be used |
| An error occurred exporting the method(s). | Database or file error | Retry with different export target |
| An error occurred importing the method(s). | Database or file error | Retry with different import target |
| An error occurred exporting the sample(s). | Database or file error | Retry with different export target |
| An error occurred importing the sample(s). | Database or file error | Retry with different import target |

Quality Control

| | | |
|--|---|-------------------------|
| Checks failed and no drift is scheduled. | Check standard failed and no drift action | Drift the instrument |
| Checks failed beyond the retry count. | Checks have failed too many times | Examine check standards |

Drift Calibration

| | | |
|---|--|--|
| Drift Mass Range Error : Nominal Mass (<nominal mass>); Range (<acceptable mass range>); Value Entered (<entered mass value>) | Entered a mass value outside the acceptable range for the drift standard | Only enter mass ranges appropriate to the drift standard |
|---|--|--|

Transmit

| | | |
|---|--|---|
| There are no samples to transmit. | No sample in the sample log | |
| First select the samples to transmit before selecting this command. | No samples selected | Select the samples to be used |
| A transmission format must be defined to transmit a sample. | A data transmit format has not been set up for this method | Create a data transmit format for the method. See setup transmission formats |
| A communications error occurred while transmitting. | AN undefined error occurred during data transmit | Verify the port exists, is active, and not is use by other applications; If error persists contact LECO |

Instrument Connection

| | | |
|---|---|--|
| Equipment access failed\n<reason>\nInstrument control will be disabled\nTrying stand alone registration | | |
| ...SR0: Cannot access USB DLL | There have been installation problems, the connections have been severed, or there is no power. | Ensure proper power cable connections; Check all cable connections; reinstall the software |
| ...SR1: Cannot access USB driver | The computer has an old copy of a necessary dll file | A user with full permission must reinstall the software |
| ...SR2: A newer version of the USB driver is required | The computer has an old copy of a necessary dll file | Install the latest software |

| | | |
|--|---|--|
| ...SR3: Cannot open USB device | Driver not running or installed properly, no connection, no power | Ensure proper power cable connections; Check all cable connections; reinstall the software |
| ...SR4: Cannot obtain USB device information | Either the connections have been severed or there is no power | Ensure power is reaching the instrument; Check and fit all instrument connections |
| ...SR5: Cannot find a USB device | Cannot obtain USB device information | Install the latest software |

External Sulfur Application Start

| | |
|--|---|
| The TruSpec External Sulfur option is not registered. The software is closing. Sulfur was not listed as a registered option. | Contact LECO for registration with Sulfur |
|--|---|

6 Maintenance

The Maintenance chapter includes procedures that should be performed on a regular basis to improve the instrument's performance and life span.

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Periodic Maintenance Schedule

The following schedule is a list of maintenance procedures that should be performed on a regular basis. For more information concerning periodic maintenance and periodic maintenance procedures, refer to the individual topics.



TRUSPEC MICRO

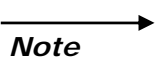
In order to obtain the best possible analysis results periodic maintenance must be performed at the intervals listed below.

| Maintenance Item | Location of Maintenance Item | Inspection, Cleaning, and Maintenance Interval |
|-------------------------------|--|--|
| Air Filter Cleaning | On the top of the instrument cabinet. | Vacuum daily and wash monthly to prevent clogging. Refer to page 6-8 . |
| Aliquot Dosing Valve | | Clean monthly to prevent leak check failure. Refer to page 6-9 . |
| Anhydron Tube (TruSpec Micro) | Accessed through door on right side of determinator. | Check daily and repack when anhydron cakes, about 100 analyses. Refer to page 3-26 . |
| Ballast Tank | | Clean monthly or if the ballast leak check fails or soot or ash is visible. Refer to page 6-11 . |

| | | |
|--|---|---|
| Carousel Cleaning | On top of the loading head assembly. | The carousel should be cleaned weekly. Refer to page 6-16 . |
| Reduction Heater Tube Packing | Inside catalyst heater assembly. WARNING: Disconnect facility power and let catalyst heater cool before removing reduction heater tube. | Refer to page 6-18 . |
| Combustion Tube Packing | Inside furnace assembly. WARNING: Disconnect facility power and let furnace cool before removing combustion tube. | Replace if cracked or plugged. Refer to page 6-28 (marco). |
| Heated Quartz Particulate Filter | Inside Afterburner Interface Block. | Replace when packing the combustion tube. Refer to page 6-28 . |
| Crucible Replacement | Inside combustion tube. Remove loading head and use tongs to remove crucible. WARNING: Furnace may be hot. | Refer to page 6-32 . |
| Loading Head Cleaning | On top of the furnace shelf above the furnace assembly. | Inspect every day and clean ashes and soot if necessary. Refer to page 6-34 . |
| Incoming Helium Scrubber, Repacking the Reagent Tube | Behind the access door on the front panel of instrument. | Replace every 90 days or when anhydronex cakes or lecosorb changes colors. Refer to page 6-40 . |

| | | |
|--|---|--|
| Aliquot Dose, Repacking the Reagent Tube | Behind the access door on the front panel of instrument. | Replace at counter limit (approximately 800 macro, 200 to 300 micro). Refer to page 6-40 . |
| O-rings | Located in various assemblies, reagent tubes, and loading head. | Replace when repacking or replacing the reagent tubes, cleaning an assembly, or when damaged. Refer to page 6-39 . |
| Screen Filter Cleaning | Inside reagent tubes at the bottom. | Clean when reagent tubes are packed. Refer to page 6-42 . |
| Duckbill Replacement—Liquid Loading Head | On the Liquid Loading Head. Refer to Figure 10-31 on page 10-37 . | Replace the Duckbill periodically or when it leaks. Refer to Check Valve Replacement on page 6-49 . |

Air Filter Cleaning



- *The air filter should be vacuumed daily and washed monthly to prevent clogging.*

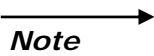
1. Locate the air filter on the top of the instrument.
2. Remove the air filter by sliding it out towards the left side of the instrument.
3. Inspect the air filter for damage. If it is damaged replace it.
4. Wash the air filter with a mild solution of detergent and water. Let it air dry.



To prevent damage to the instrument make sure the air filter is completely dry before reinstalling it on the instrument.

5. Lightly spray the air filter with air filter coating.
6. Install the air filter back into the instrument.

Aliquot Dosing Valve Cleaning



Note

- *The aliquot dosing valve should be cleaned monthly to remove dirt and other contaminants that may cause the valve to leak.*

1. Permit the furnaces to cool and shut down the instrument. Refer to the Shutdown Procedure on page [5-12](#).
2. Disconnect the instrument from the facility AC power source.



HIGH VOLTAGE HAZARD

This equipment operates from a 230V~ source. Contact with this voltage can be fatal. Disconnect the instrument from the facility AC power source before continuing with this procedure.

3. Remove the Left Side Panel and locate the Aliquot Dosing Valve.
4. Press in on the retaining clip and remove the valve stem by grasping the knurled knob and pull it to the left, Figure 6-1, page [6-10](#).
5. Use a cotton swab or pipe cleaner to clean the valve block.
6. Wipe the valve stem and apply a thin coat of vacuum grease to the 10 o-rings.
7. Press in on the retaining clip and reinsert the valve stem into the top of the aliquot dosing valve, until valve stem locks into place.
8. Reinstall the left side panel.
9. Connect the instrument to the facility AC power source.
10. Turn the power switch on.

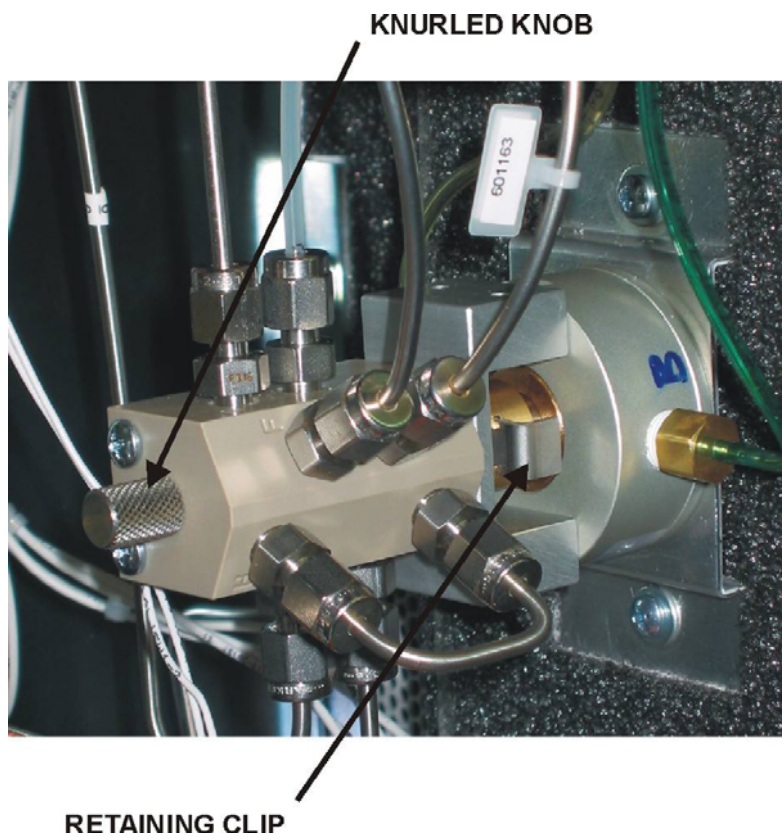
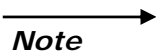


Figure 6-1
Aliquot Dosing Valve

Ballast Tank Cleaning



Note

- *If the ballast portion of the oxygen leak check fails repeatedly and no leaks are found in other areas, a dirty ballast tank could be the cause.*

Ballast Assembly Removal

1. Click Diagnostics and toggle the Piston Return Solenoid SV12. The box should NOT be checked.
2. Refer to the Shutdown Procedure on page 5-12 and turn the instrument off.
3. Disconnect the instrument from facility AC power.



WARNING

HIGH VOLTAGE HAZARD This equipment operates from a 230V~ source. Contact with this voltage can be fatal. Disconnect the instrument from the facility AC power source before continuing with this procedure.

4. Mark, identify, and disconnect the tubing and pinch valve electrical connections to the ballast assembly, Figure 6-3, page 6-14.
5. Disconnect the pneumatic tubing connection at the top of the ballast assembly.
6. Disconnect the ballast exhaust tubing connection from the inside rear panel of the instrument.
7. Remove the thumbscrew securing the top of the ballast assembly to the rear of the instrument, Figure 6-2, page 6-13.
8. Slide the Thermistor Latch towards the rear of the instrument and remove the Thermistor from the ballast, Figure 6-3, page 6-14.
9. Lift the ballast assembly up and slide it out of the instrument.
10. Disconnect the exhaust gas connections at the base of the ballast assembly, Figure 6-3, page 6-14.
 - A. Remove the thumbscrew securing the pinch valve assembly to the ballast.
 - B. Disconnect the tubing and electrical connections at the base of the ballast assembly.
 - C. Remove the pinch valve assembly from the ballast.

Ballast Cleaning

1. Remove the four nuts and four rods. Refer to Figure 6-4 on page [6-15](#).
2. Remove the ballast top and ballast base and push the piston out of the ballast tank.
3. Wash the piston, ballast top, and ballast bottom with soapy water, rinse, and let dry.
4. Clean and inspect the o-ring and replace the neoprene gaskets.
5. Lightly grease the inside of the ballast tank. The piston should slide easily from end to end. Make sure the magnet in the piston is positioned towards the top of the ballast assembly.
6. Reinstall the ballast top and ballast base.
7. Inspect all the tubing connection to the ballast assembly. Replace any tubing that is cracked.
8. Reinstall the ballast assembly into the instrument. Reverse and use the Ballast Assembly Removal procedure on page [6-11](#).
9. Reconnect the instrument to the facility AC power source.
10. Turn the AC power switch to the on.
11. Allow the instrument to warm up for one hour then perform the Leak Check procedure on page [8-22](#).

Ballast Tubing

Gas connections on the ballast and pinch valve assemblies are made with flexible tubing. This tubing is pushed onto barb fitting and metal tubing to form a gas tight seal. Refer to the figures on pages [6-13](#), [6-14](#), and [6-15](#).

In order to prevent leaks after maintenance, LECO recommends that the flexible tubing be replaced when the ballast is cleaned or when the tubing is removed from any fitting.

The flexible tubing is LECO part number 601-691-018 and is provided in the component pack. Refer to page [1-31](#).

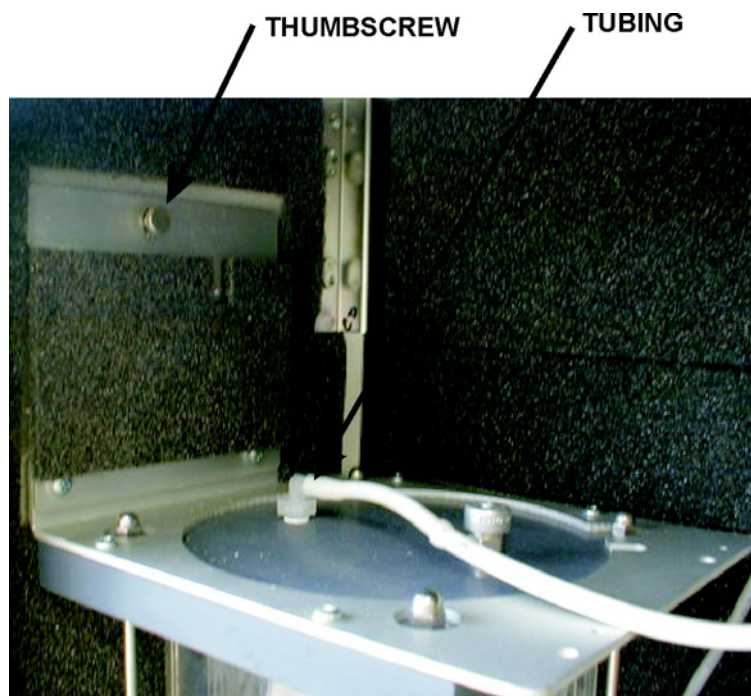


Figure 6-2
Ballast Top Assembly

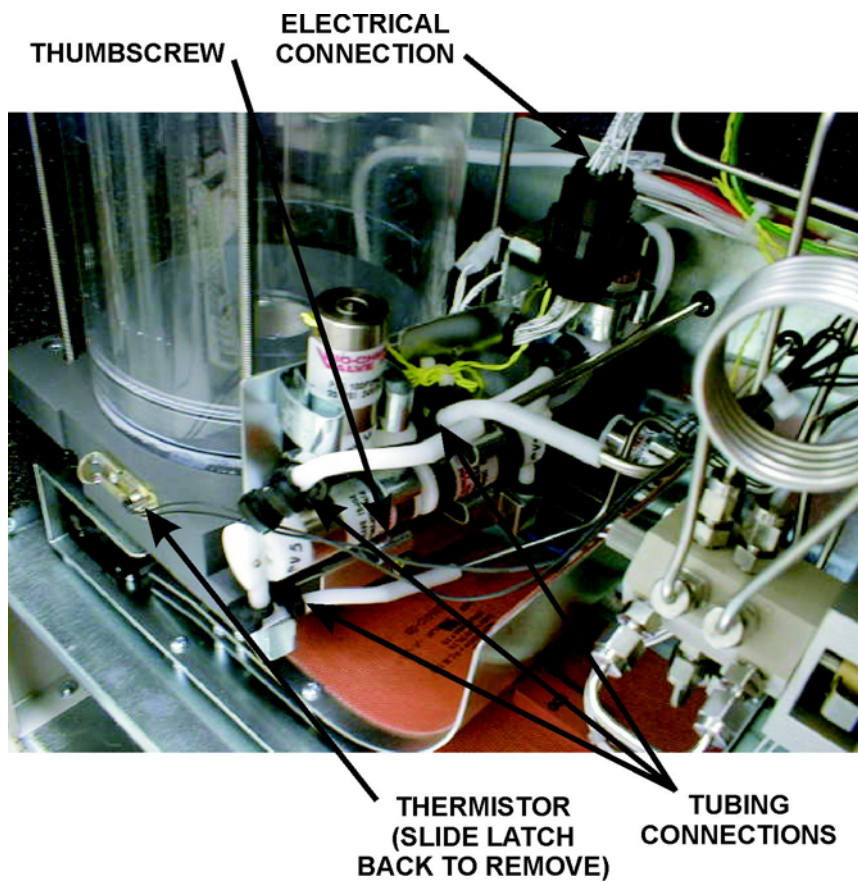


Figure 6-3
Ballast Base Assembly

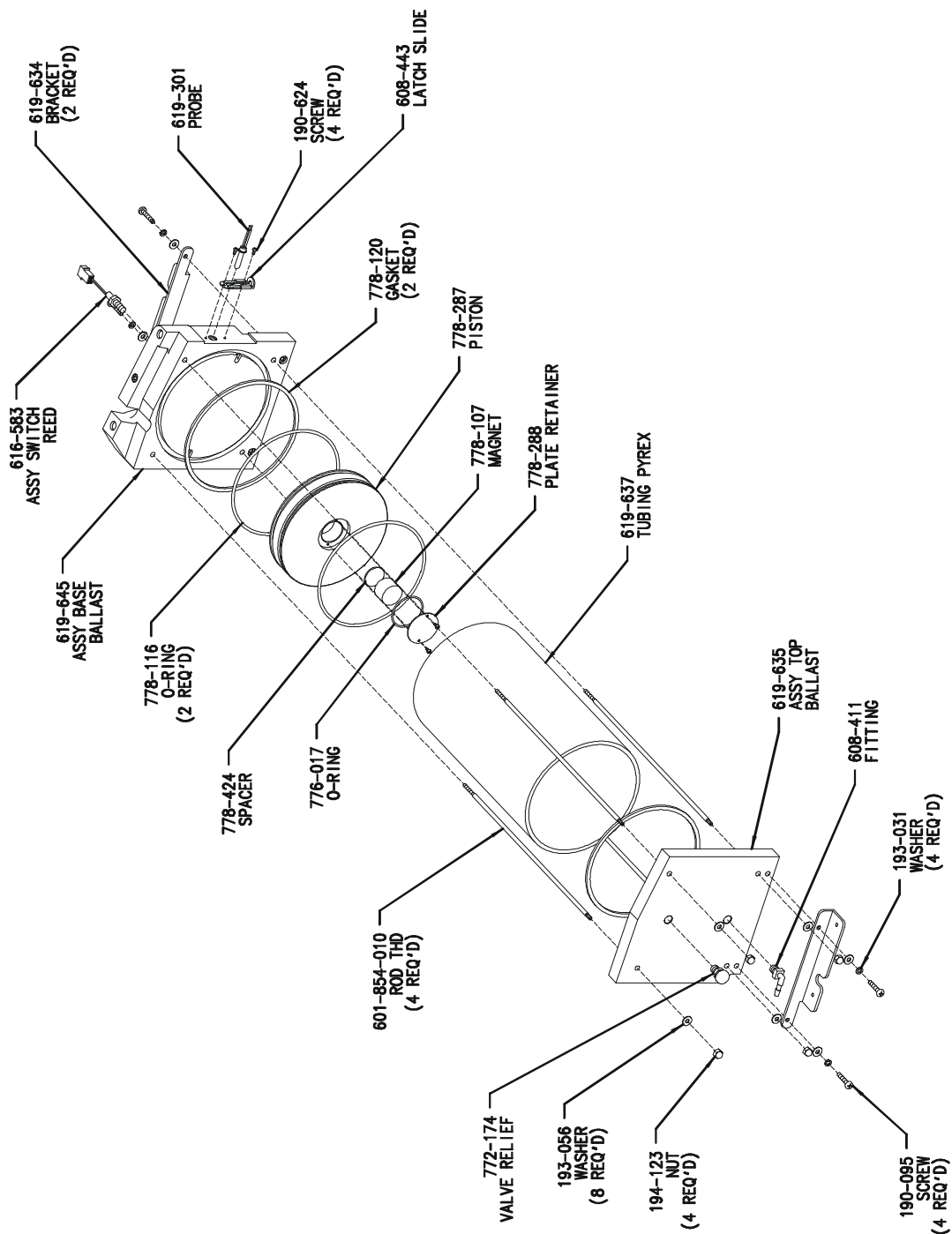


Figure 6-4
Ballast Disassembly

Carousel Cleaning

—————→ **Note** • *The carousel should be cleaned weekly to remove dirt and permit it to turn freely.*

1. Remove the carousel from the instrument by pulling it up and off the loading head, Figure 4-1, page 4-6.
2. Remove the four screws securing the bottom plate to the carousel body.
3. Wipe the carousel and bottom plate with a damp cloth.
4. Apply a thin coat of grease to the carousel bearings, Figure 6-6, page 6-17.
5. Reinstall the metal plate.

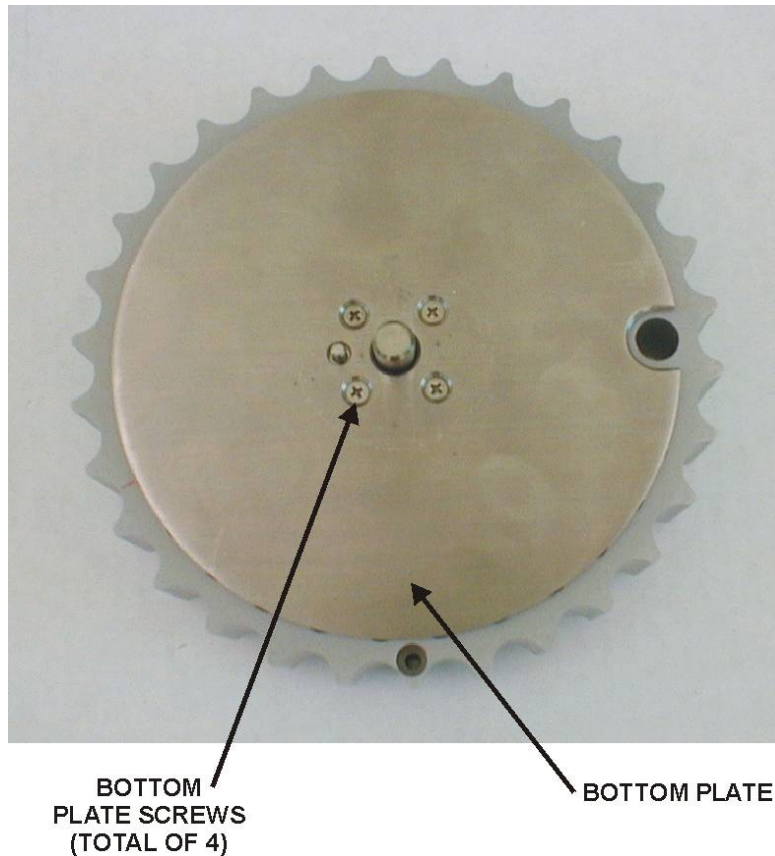
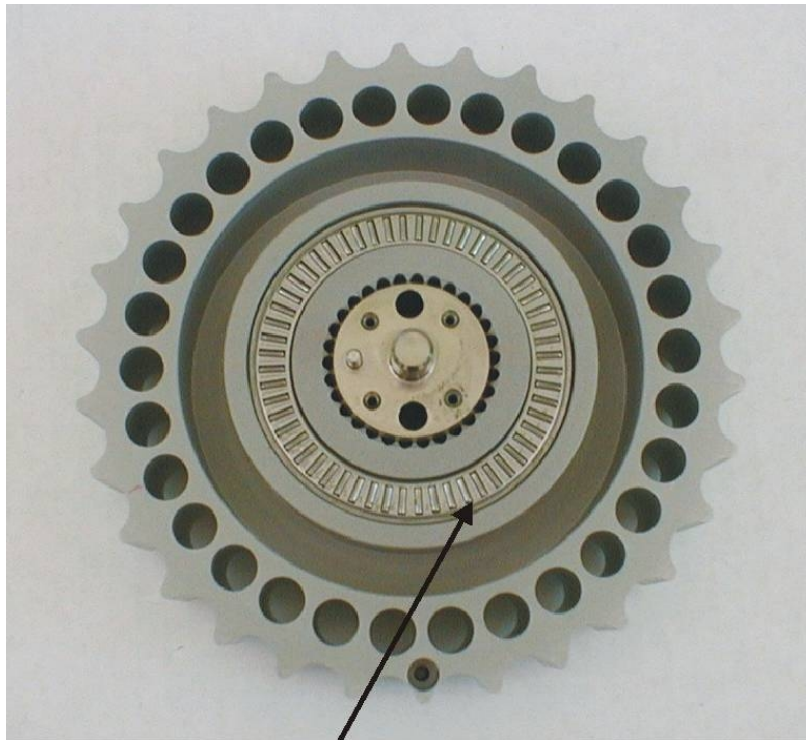


Figure 6-5
Carousel Bottom View



CAROUSEL BEARINGS

Figure 6-6
Carousel Bearings

Reduction Heater Tube Packing

→ **Note**

- *The reduction reagent materials should be replaced every six months if pure helium (99.99% or better) is used. If the helium carrier is contaminated with oxygen, the copper turnings will deplete in a shorter period of time.*

1. Set the gas flow to standby.
2. Remove the aliquot dose reagent tube and replace it with the purge tube. Position the purge tube with the purge hole towards the top.
3. Click Diagnostics and select Furnace. The Furnace Diagnostics page will appear.
4. In the Reduction Heater Control Temperature dialog box click Stop to set the catalyst heater temperature to 20°C.
5. Wait 30 minutes for the reduction heater to cool.



→ **WARNING**

HIGH TEMPERATURE HAZARD

The catalyst heater tube is extremely hot. Wait for the catalyst heater tube to cool before removing it.

6. Loosen the Thumbscrew and tilt the reduction Heater Assembly forward, Figure 6-7, page [6-20](#).
7. Lift the reduction heater tube and remove it from the reduction heater assembly.



→ **WARNING**

HIGH TEMPERATURE HAZARD

Set the catalyst heater tube aside on a cooling tray and allow the catalyst heater tube to cool to room temperature before proceeding.

8. Turn the reduction heater tube upside down and place a paper towel on the counter.
9. Tap the tube gently on the counter. The contents of the tube will slowly slide out.
10. Rinse or soak the reduction heater tube for two minutes with cold water. Tap the reduction heater tube on a waste container until the copper falls out.

11. Repack the clean or new reduction heater tube, Figure 6-8 on page 6-21.
 - A. Pack 1 inch of copper turnings into the bottom of the reduction heater tube.
 - B. Pack 1³/₄-inches of N-catalyst on top of the copper turnings. It is only necessary to replace the N-catalyst every second repacking.
 - C. Pour 1¹/₄-inch of copper turnings onto the N-catalyst.

Note

- *To prevent channeling and increase the number of analyses between reagent replacements, tap the reduction heater tube on the counter as you fill it. This will help insure even depletion of the copper sticks.*

- D. Fill the reduction heater tube with copper sticks.
12. Reinstall the repacked reduction heater tube into the reduction heater assembly. Make sure the bottom end of the reduction heater tube is positioned and sealed over the o-ring.
13. Tilt the reduction heater assembly forward and tighten the knurled screw.
14. In the Reduction Heater Control Temperature dialog box click Restart to set the reduction heater temperature.
15. Allow the catalyst heater tube to reach operating temperature. This should take 10 to 15 minutes.
16. Set the gas flow to Analyze and wait 30 seconds for the gas to escape out the purge tube hole.
17. Remove the purge tube and engage the top of the reagent tube. Allow three seconds to elapse to the engage the bottom end of the reduction heater tube.
18. Reset the Reduction Maintenance Counter under Reset Maintenance Counters on page 6-48.
19. Run several Blanks Analyses before beginning sample analysis.

**REDUCTION
HEATER**

THUMBSCREW



**Figure 6-7
Reduction Heater**

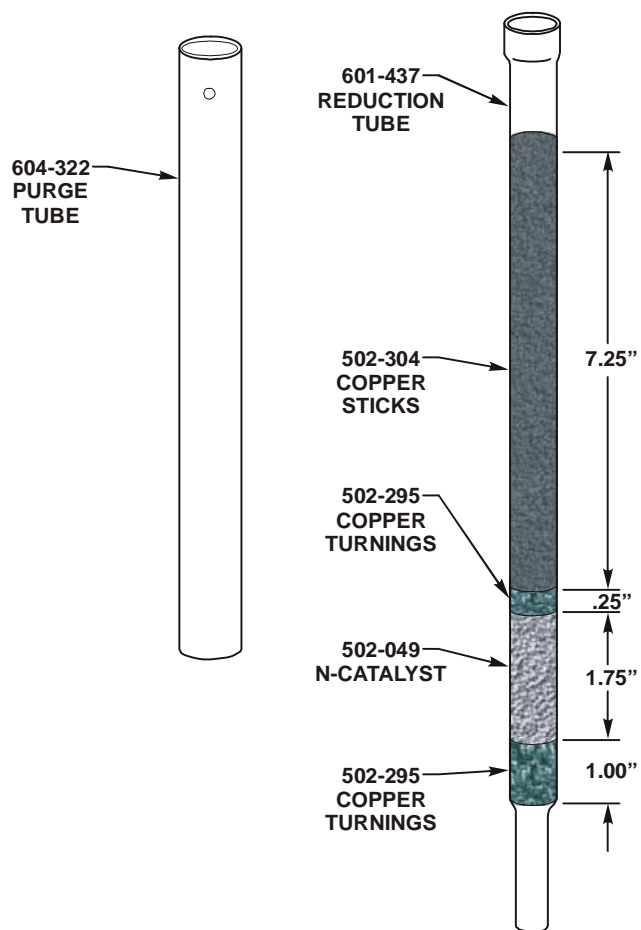


Figure 6-8
Packing the Reduction Heater Tube

Combustion Tube Removal and Replacement

1. Refer to the Shutdown Procedure on page [5-12](#) and turn the instrument OFF.



HIGH TEMPERATURE HAZARD

The combustion furnace is extremely hot. Wait for the combustion tube to cool before removing it.

2. Disconnect the instrument from facility AC power.



HIGH VOLTAGE HAZARD

This equipment operates from a 230V~ source. Contact with this voltage can be fatal. Disconnect the instrument from the facility AC power source before continuing with this procedure.

3. Refer to the Crucible Replacement procedure on page [6-31](#) and remove the loading head.
4. Remove the furnace top shelf.
5. Refer to the Crucible Replacement procedure on page [6-31](#) and remove the lance assembly.
6. Grab the top left corner of the furnace door and pull it open.
7. Remove the four screws in the loading head interface block and remove the block, Figure 6-9, page [6-24](#).
8. Remove the afterburner cap, Figure 6-9, page [6-24](#).
9. Remove the four screws in the afterburner interface block and remove the block, Figure 6-10, page [6-25](#).
10. Pull the furnace latch pin out and tilt the bottom of the furnace towards the front of the instrument. Release the latch pin, lift the furnace up and pull the furnace toward you. When the furnace is pulled out as far as it will go (about 2 inches) tilt the bottom of the furnace up until the latch pin snaps and locks the furnace into place. Refer to Figure 6-11, page [6-25](#).

11. Remove the two screws securing the furnace bottom assembly and remove the bottom assembly, Figure 6-12, page 6-26. Set it on the inner shelf of the furnace door. There will be an electrical connection attached to the furnace fan.
12. Wearing gloves, pull the combustion tube out through the bottom of the furnace.
13. Refer to the Combustion Tube Packing procedure on page 6-28 and repack the combustion tube.



POSSIBLE COMBUSTION TUBE DAMAGE

Do not touch the lower portion of the combustion tube without gloves. Body oil can promote devitrification that may cause the combustion tube to crack.

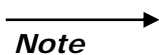
14. Insert the combustion tube into the furnace. The short end of the tube should be inserted into the afterburner side of the furnace.
15. If the height of the combustion tube needs to be raised perform the following steps. If the combustion tube is at the correct height skip to step 16. Replace the combustion tube o-rings if necessary.



COMBUSTION TUBE HEIGHT ADJUSTMENT

Only perform the next steps to adjust the height of the combustion tube. If the combustion tube height is correct skip to step 16.

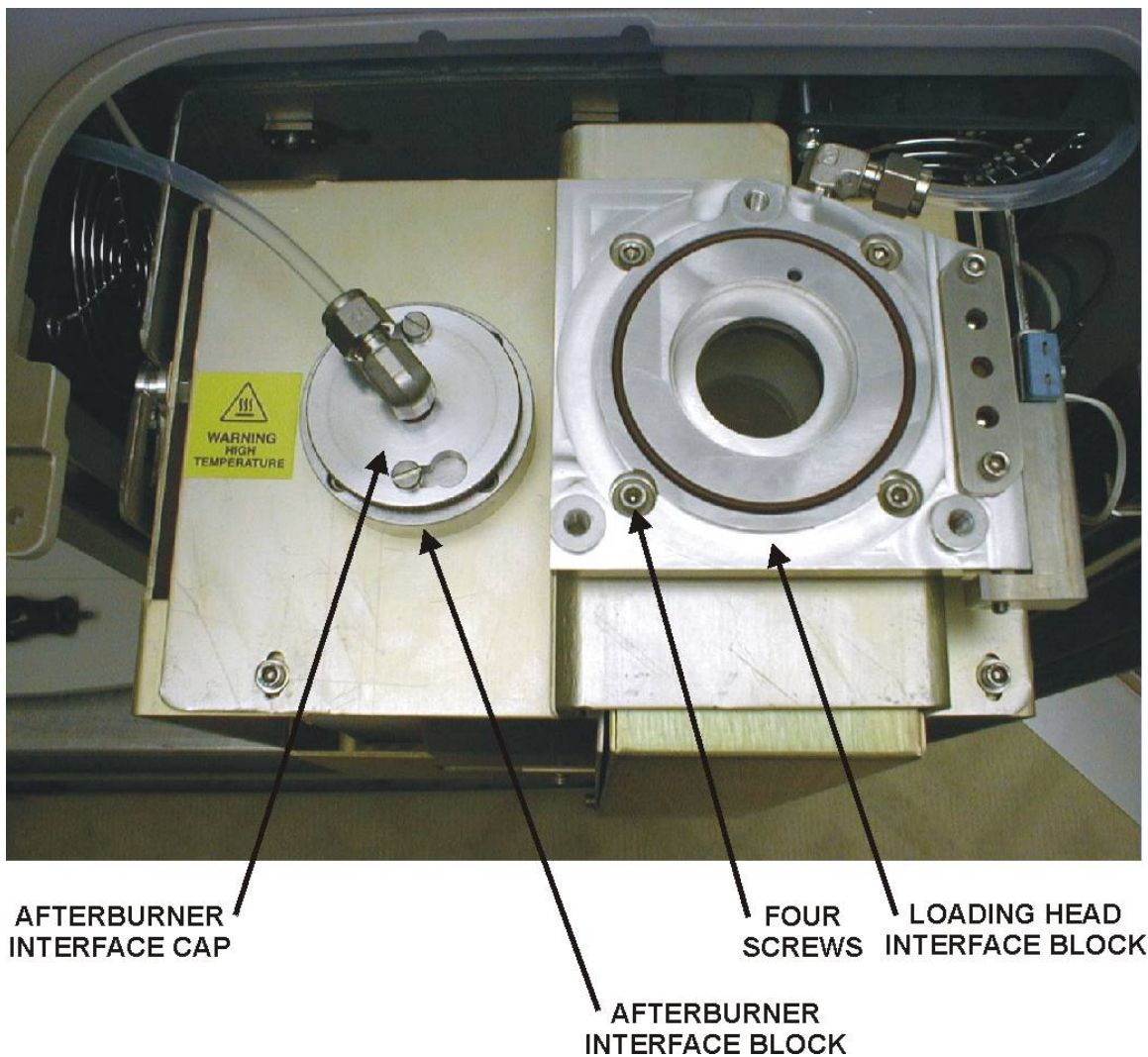
16. Loosen the combustion tube stop on the bottom of the furnace assembly, Figure 6-12, page 6-26.
17. Install the furnace bottom assembly.



- *Make sure Tabs on bottom of furnace are overlapped as shown in figure 6-12 on page 6-26.*

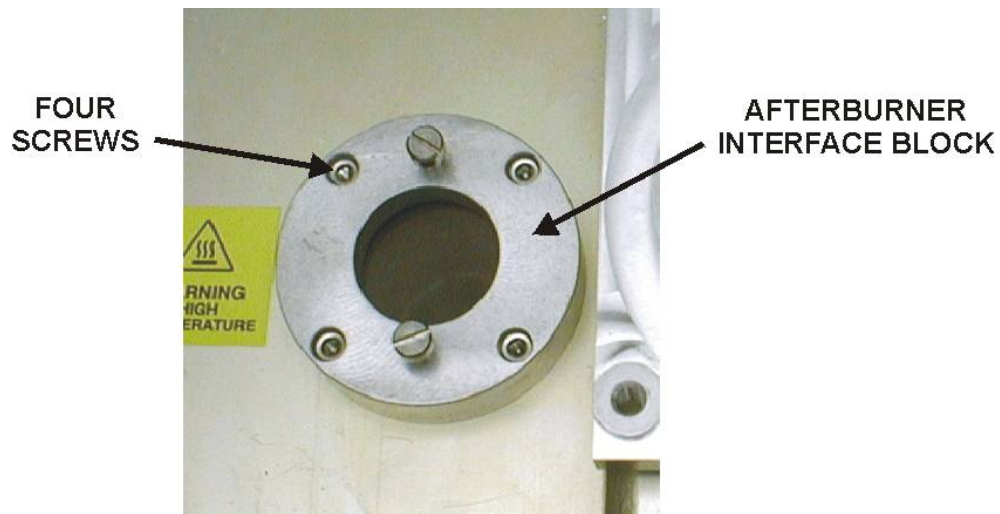
- A. Raise the combustion tube stop until resistance is met.
- B. Tighten the combustion tube stop screw.
- C. Reinstall the afterburner interface block using the four screws that were removed from the block, Figure 6-10, page 6-25.
- D. Replace the Quartz Filter in the afterburner interface block and clean the Screen Filter in the afterburner interface cap with a brush, Figure 6-13, page 6-27.

18. Reinstall the afterburner cap, Figure 6-9, page 6-24.
19. Reinstall combustion block, crucible and lance.
20. Reinstall the combustion tube furnace.
21. Replace loading head.



Note → • Use a small amount of 773-942 Anti-seize Compound on each of the four loading head interface block screws.

Figure 6-9
Furnace Interface Blocks



Note

- Use a small amount of 773-942 Anti-seize Compound on each of the four afterburner interface block screws when reinstalling the loading head block.

Figure 6-10
Afterburner Interface Block

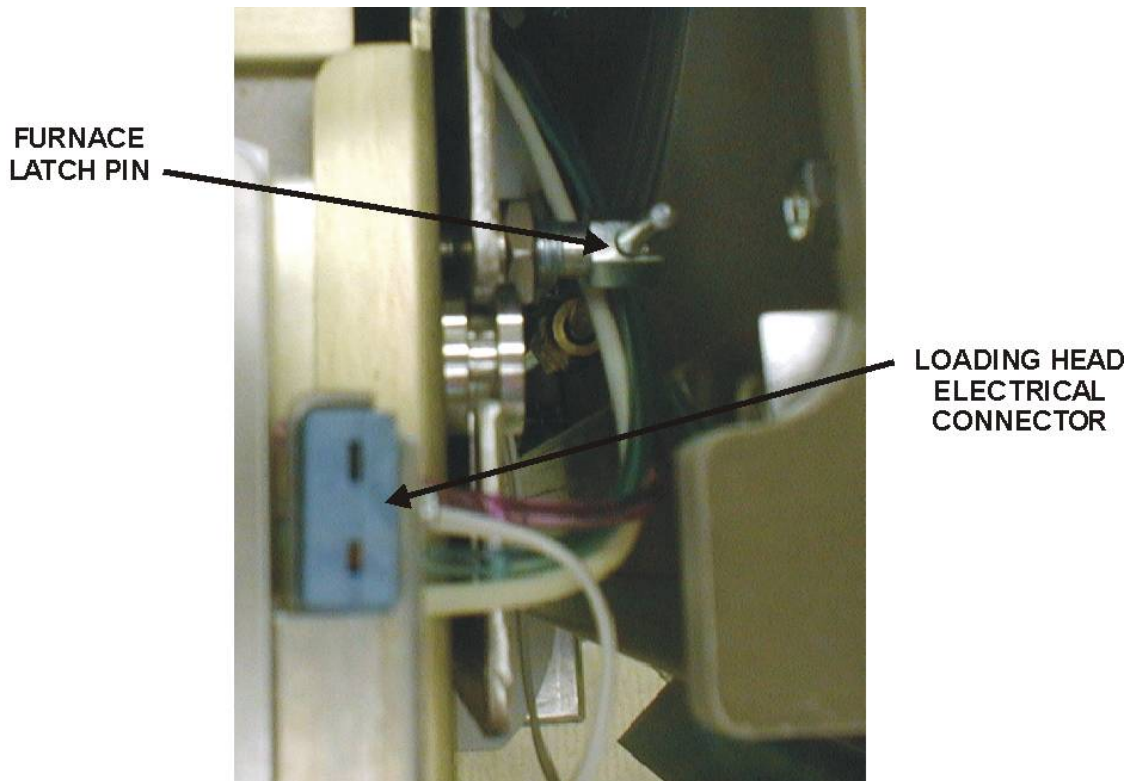
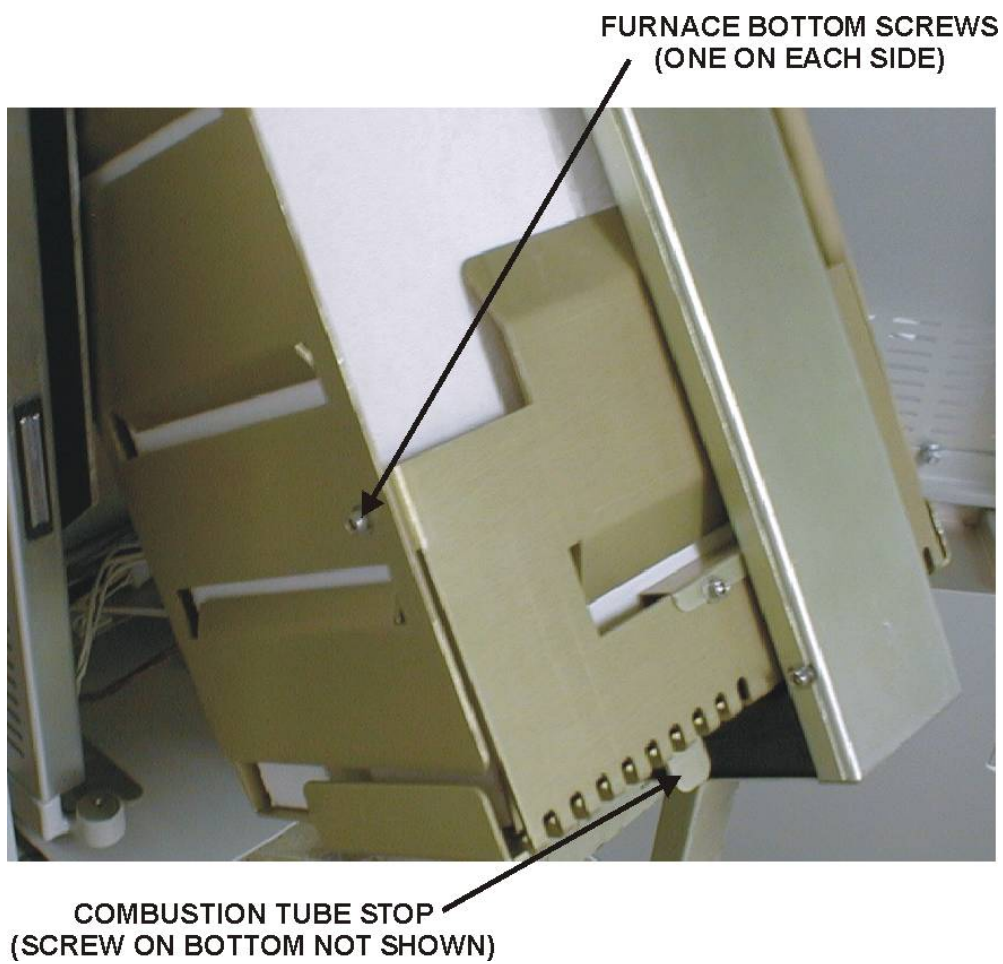


Figure 6-11
Furnace Latch Pin



NOTE: When reassembling furnace, make sure Tabs overlap as shown.

Figure 6-12
Combustion Furnace Assembly

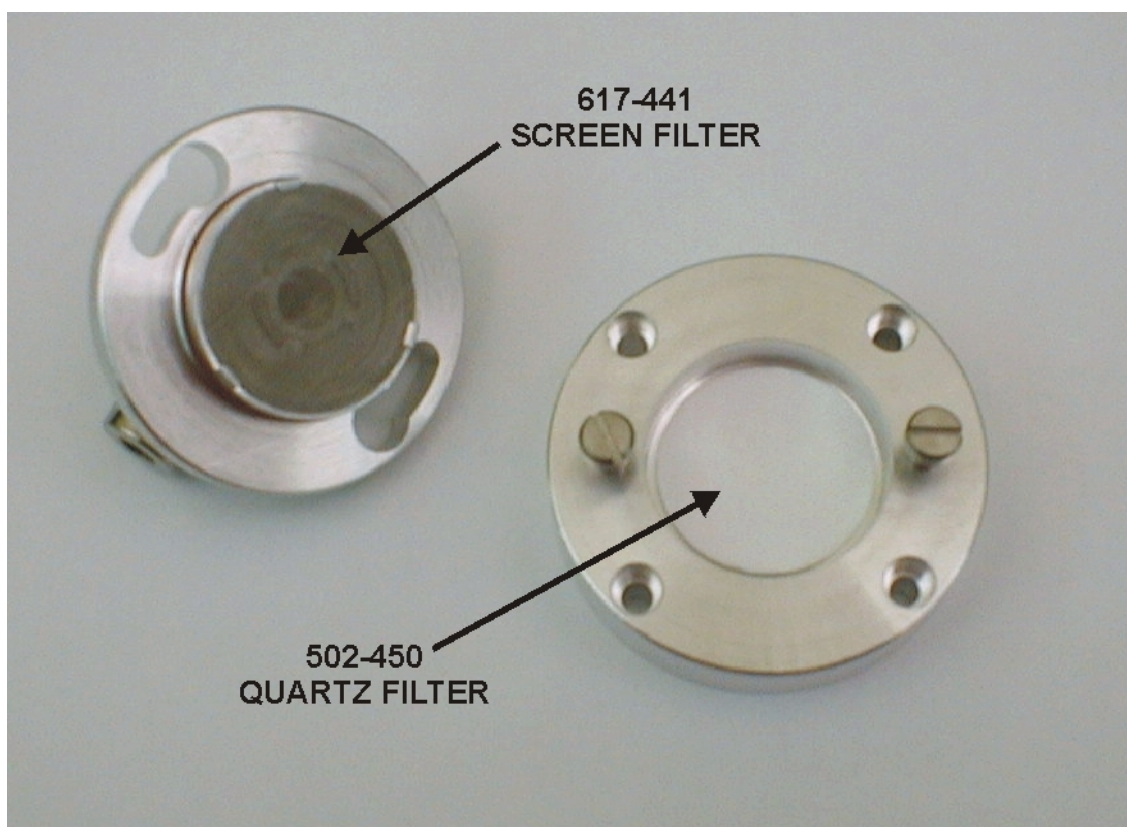


Figure 6-13
Heated Quartz Particulate Filter

Combustion Tube Packing (CHN Macro)

→
Notes

- *Only replace the combustion tube if it becomes cracked or plugged. The combustion tube can be reused even if it looks cloudy.*
- *The furnace reagents should be dried at 105°C for two hours before packing the combustion tube.*



POSSIBLE COMBUSTION TUBE DAMAGE Do not touch the lower portion of the combustion tube without gloves. Body oil can promote devitrification that may cause the combustion tube to crack.

1. Remove 1 quartz wool strip from the package. Separate it lengthwise into 2 sections being careful to match the outside diameter of the roll to the inside diameter of the combustion tube. Each section is $\frac{3}{4}$ -inch wide.
2. Using the quartz wool extractor, push two rolled quartz wool strips into the longer end of the combustion tube until the rolls are properly positioned in the combustion tube, Figure 6-14, page 6-30.
3. Using the quartz wool extractor, push two quartz wool rolls into the shorter end of the combustion tube until the rolls are properly positioned in the combustion tube.
4. Pour 40 cc of alumina oxide pellets into the shorter end of the combustion tube on top of the quartz wool.
5. Pour 30 cc of furnace reagent into the shorter end of the combustion tube on top of the alumina oxide.
6. Pour 30 cc of furnace reagent with magnesium oxide into the shorter end of the combustion tube on top of the other furnace reagent.
7. Add two quartz wool strips into the shorter end. Be careful to match the outside diameter of the roll to the inside diameter of the combustion tube. Each section is $\frac{3}{4}$ -inch wide.
8. Insert a honeycomb ceramic plug into the short end of the combustion tube until it rests on the quartz wool.
9. Insert the combustion tube into the furnace using the two high-temperature orange o-rings.

10. In the longer end of the combustion tube, insert the crucible until it rests on the quartz wool.
11. Using the crucible extraction tool. Measure the distance between the top of the crucible and the top of the lance, as it would be positioned.
12. Add or remove a small amount of quartz under the crucible to insure that the bottom of the lance will rest $\frac{1}{4}$ inch inside the top of the crucible.
13. Insert the Lance Assembly into the longer section of the combustion tube.

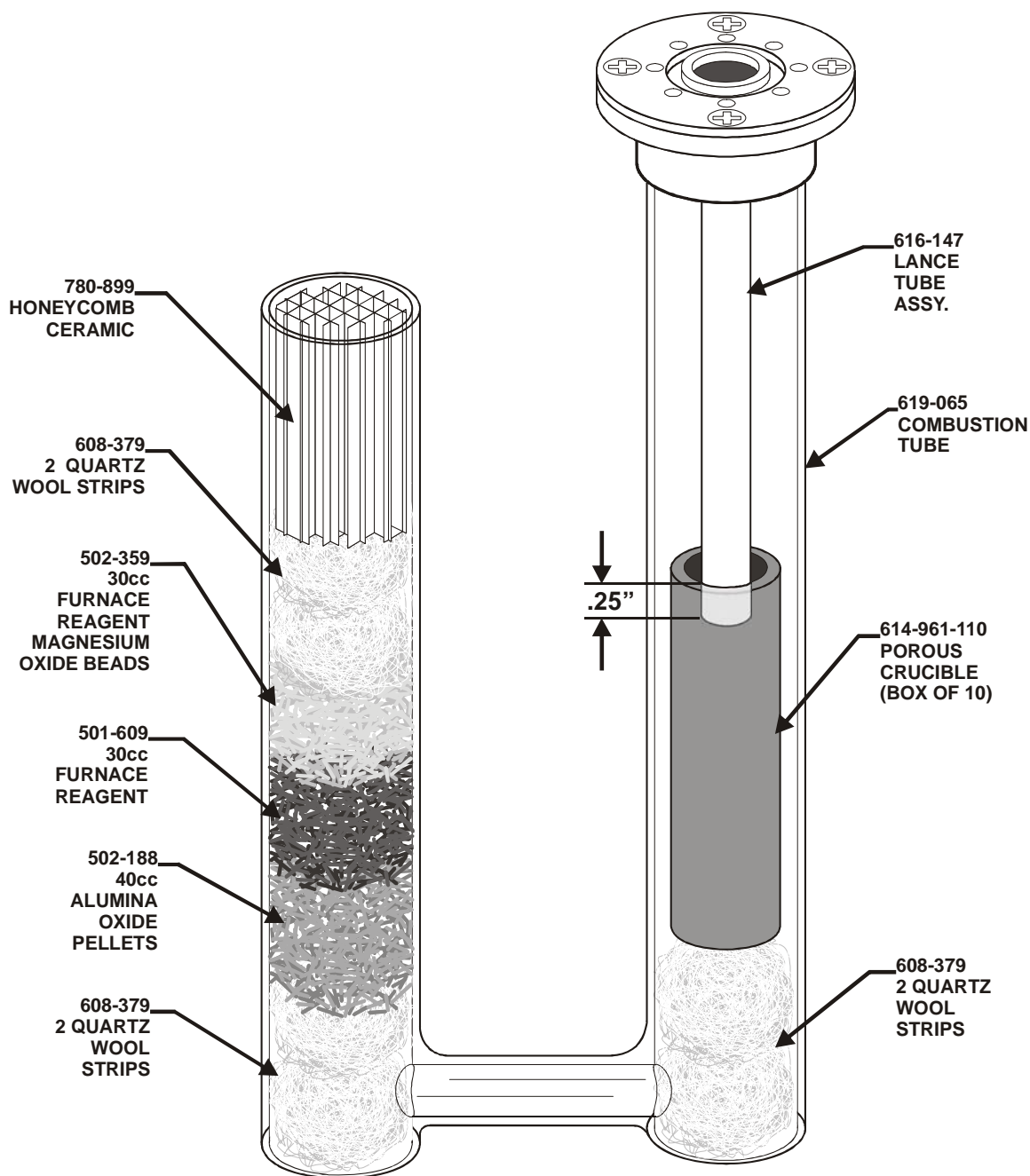
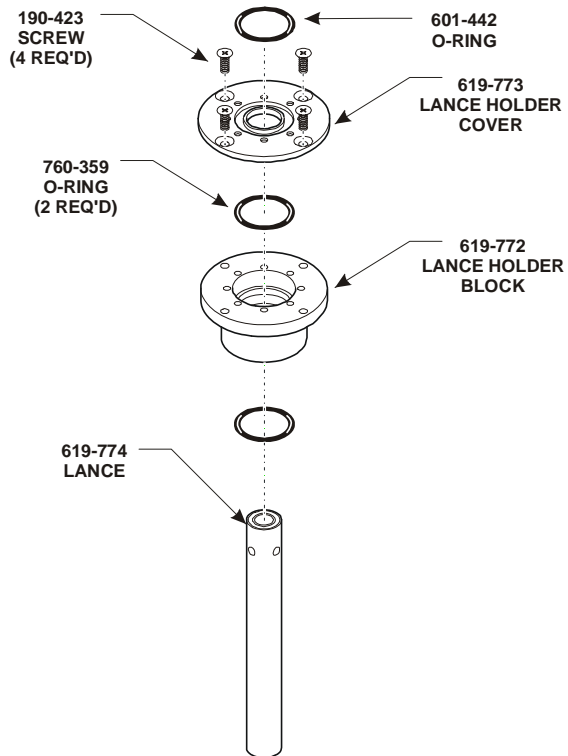


Figure 6-14
Combustion Tube Packing (CHN Macro)

CHNS MICRO



CHN MACRO/MICRO

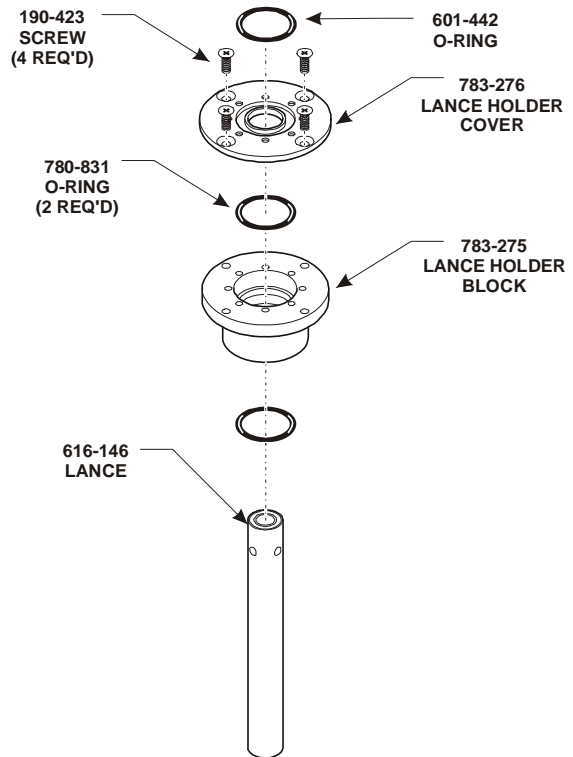


Figure 6-15
Lance Assemblies

Crucible Replacement



HIGH TEMPERATURE HAZARD

The crucible and furnace may be hot. To avoid burns, allow the instrument to cool to room temperature before replacing the crucible.

1. Remove the three screws securing the loading head to the furnace, Figure 6-17, page [6-33](#).



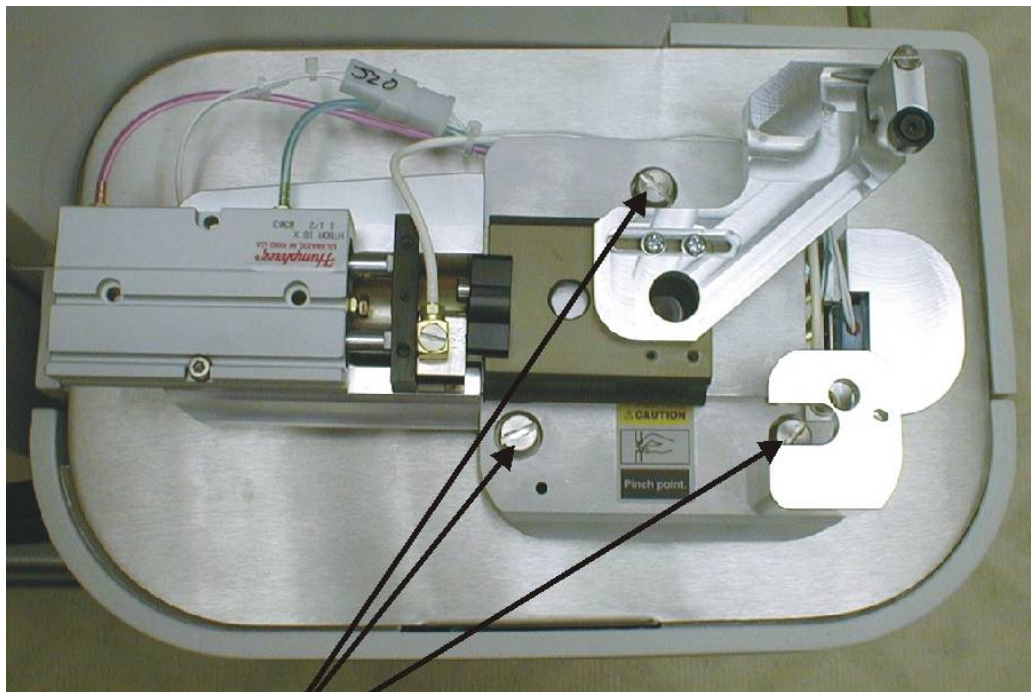
After the loading head is removed be careful not to damage the electrical connector on the bottom.

2. Lift the loading head and set it aside. It is not necessary to disconnect the gas lines.
3. Screw the lance extractor tool into the small hole on the lance head and remove the lance, Figure 6-18, page [6-33](#).
4. Place the lance and extractor tool inside the front door.
5. Using the crucible extractor tool, reach into the combustion tube and grasp the crucible. Lift the crucible out and discard when cool.
6. Using the crucible extractor tool, place a new crucible in the combustion tube and replace the lance and loading head.



To prevent damage to the loading head properly align the electrical connectors before pushing the loading head onto the instrument.

7. Allow the crucible to reach operating temperature.
8. Reset the crucible counter by accessing Reset Maintenance Counters, page [6-48](#).
9. Run two blank analyses to purge air and moisture from the system.



LOADING HEAD
REMOVAL SCREWS

Figure 6-16
Loading Head Removal Screws

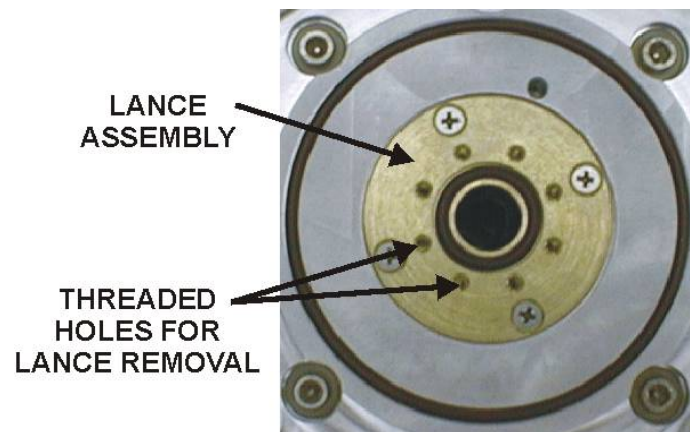


Figure 6-17
Lance Removal

Loading Head Cleaning

Disassembly

1. Remove the three screws securing the loading head to the furnace, Figure 6-17, page [6-33](#).



After the loading head is removed be careful not to damage the electrical connector on the bottom.

2. Lift the loading head and set it aside. It is not necessary to disconnect the gas lines.
3. Release the quick disconnect block and remove the slide block by pulling it away from the loading head Figure 6-19, page [6-35](#).
4. Clean the inner surface of the slide block and piston, Figure 6-20, page [6-36](#).
5. Clean and inspect the o-ring on the coupling block, Figure 6-20, page [6-36](#).
6. Turn the loading head over so the bottom is facing up.
7. Locate the lance shield, Figure 6-21, page [6-37](#).
8. Screw the lance extractor tool into one of the threaded holes and remove the shield.
9. Clean the lance shield.
10. Remove the female jaw, Figure 6-22, page [6-37](#). Clean the jaw and the inside of loading head.

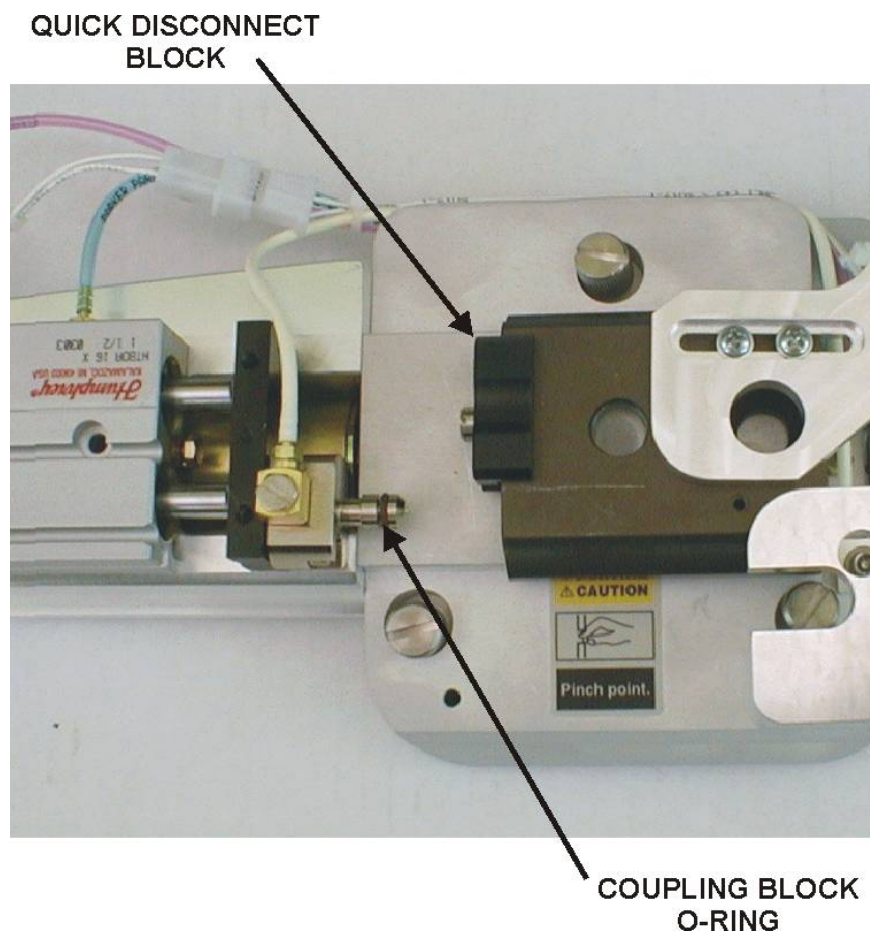


Figure 6-18
Slide Block Removal



Figure 6-19
Slide Block (Bottom View)

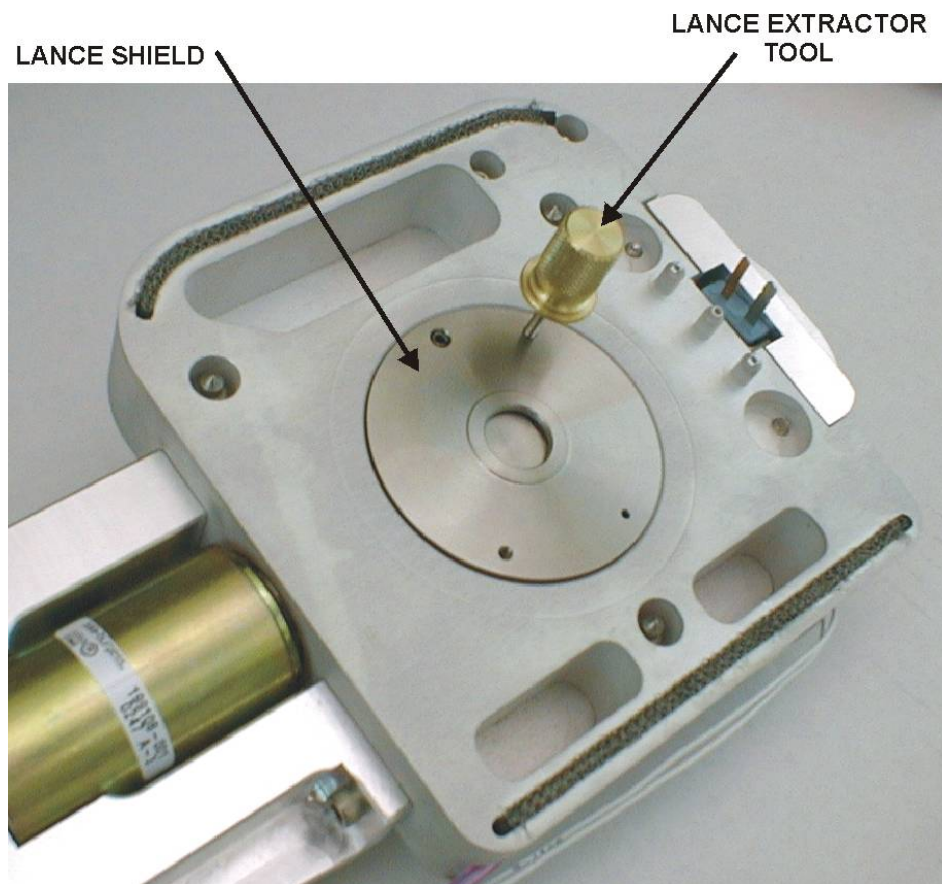


Figure 6-20
Lance Shield and Lance Tool

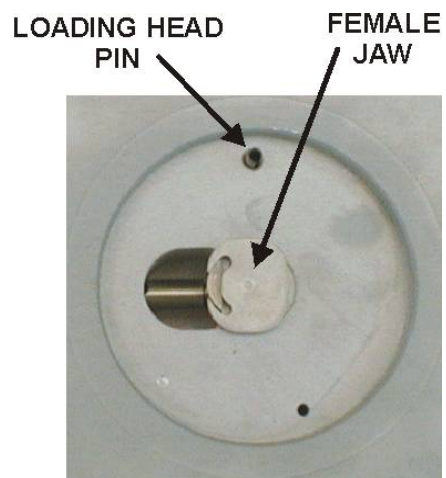
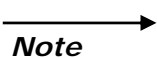


Figure 6-21
Female Jaw and Loading Pin

Reassembly

1. Insert the female jaw into the male jaw, Figure 6-22, page [6-37](#).
2. Line the pin inside the loading head with the largest hole in the lance shield.
3. Apply a very light coat of vacuum grease to the o-ring on the lance shield
4. Press the lance shield into the loading head.
5. Turn the loading head over.
6. Push the slide block onto the loading head.
7. Line up the cylinder and slide block.
8. Latch the quick disconnect block to secure the cylinder to the slide block.
9. Reinstall the loading head onto the instrument. Be careful not to bend the electrical connector on the bottom of the loading head.

O-rings



- *When repacking the reagent tubes, catalyst heater tube, or cleaning an assembly, lubricate each o-ring with vacuum grease. O-rings should be replaced when cracked, dry, burnt, or torn. DO NOT over-lubricate the o-rings; only apply a light coating of grease.*

1. Gently remove o-ring.
2. Lightly grease each o-ring making sure the grease is applied evenly without excess build-up.
3. Reinstall o-ring.

Reagent Tube Packing

→
Notes

- *Replace reagents when the counter reaches its limit (approximately 800).*
- *The reagent tube is also referred to as the measure flow scrubber and the helium scrubber.*



Anhydron is a strong dehydrating agent and potentially strong oxidant (over 150°C). Don not heat with organic matter, flammables or combustibles. Avoid contact with strong acids. Refer to material safety data sheet for safe handling and storage procedures.

Removal

1. Turn the Gas OFF.
2. Slide reagent tube upward until the bottom end can swing free.
3. Tilt out the free reagent tube end.
4. Pull the reagent tube downward off the top port.

Packing

1. Before repacking the reagent tube, remove all material from the inside of the reagent tube, rinse the reagent tube with water, and let it dry.
2. Insert a screen filter into the bottom of the reagent tube. Position the o-ring towards the bottom and push the screen filter up into the reagent tube $\frac{1}{4}$ -inch, Figure 6-23 on page [6-41](#).
3. Pack $\frac{3}{4}$ -inch of glass wool into the bottom of the reagent tube.
4. Fill the bottom $\frac{1}{3}$ of the reagent tube with Anhydron.
5. Fill the top $\frac{2}{3}$ of the reagent tube with Lecosorb.
6. Firmly pack $\frac{1}{2}$ -inch to $\frac{2}{3}$ -inch of glass wool into the top of the reagent tube.
7. Reinstall the reagent tube.
8. Reset the Reagent Tube Counter under Reset Maintenance Counters, page [6-48](#).
9. Clean excessive reagent from work area.

Install

1. Push the top end of the reagent tube over the top port.
2. Tilt the reagent tube inward and pull it down, pushing it over the bottom port.
3. Turn the gas on.

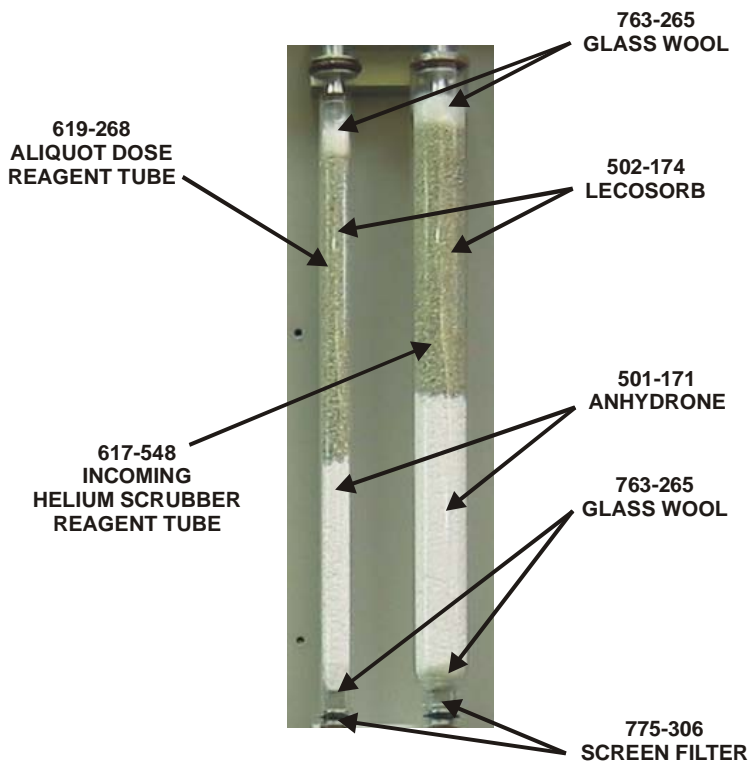


Figure 6-22
Reagent Tube Packing

Screen Filter Cleaning

————→
Note

- *The screen filters are located in the bottom of the catalyst heater and reagent tubes. The filters should be cleaned whenever the reagents are replaced.*

Removal

1. Turn the gas OFF.
2. Push down the button on the top of the furnace filter door and open the door. Refer to Figure 6-24, page 6-43.
3. Slide the furnace filter tube upward until the bottom end can swing free.
4. Tilt out the free furnace filter tube end.
5. Pull the furnace filter tube downward off the top port.

Cleaning

1. Remove the O-rings from the screen filters, Figure 6-24, page 6-43.
2. Inspect, clean and lightly grease the O-rings. If they are cracked or worn replace them. Set the o-rings aside.
3. Insert the Screen Filters in a ultrasonic cleaner.
4. Sonicate the Screen Filters for 10 minutes.
5. Remove the Screen Filters from the ultrasonic cleaner and let air dry.
6. Install the O-rings on the screen filters.
7. The Screen Filters can be inserted into the reagent tubes or stored for later use.

Install

1. Push the top end of the furnace filter tube over the top port.
2. Tilt the furnace filter tube inward and pull it down, pushing it over the bottom port.
3. Turn the gas on.

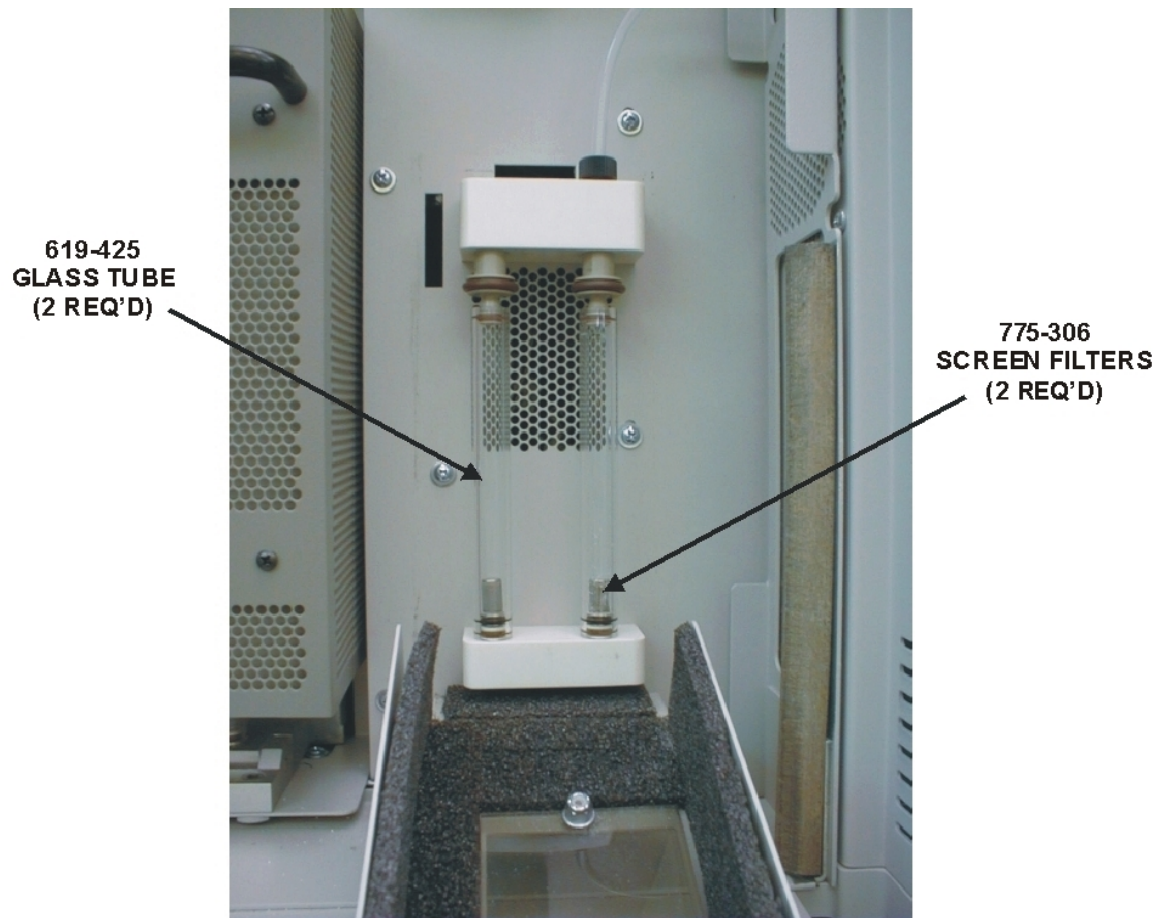


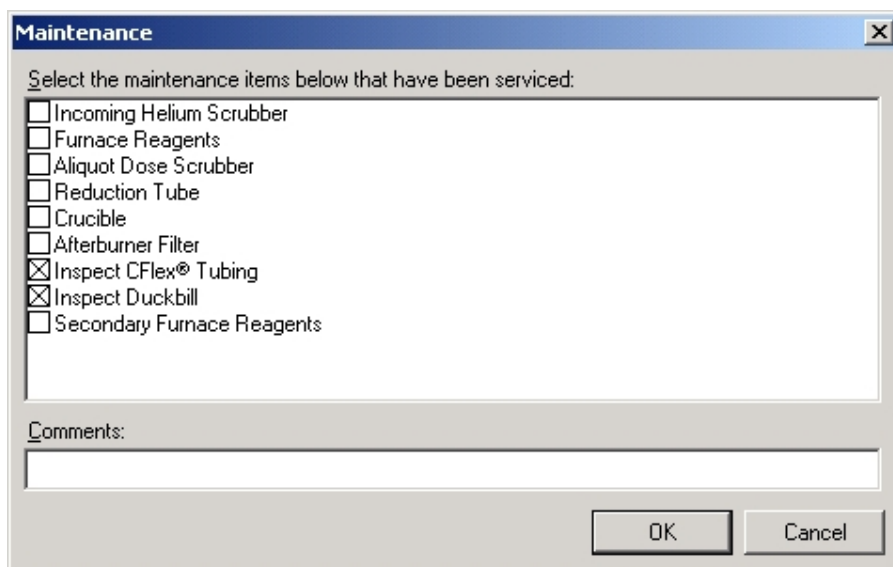
Figure 6-23
Screen Filter Locations

Login Periodic Maintenance

→
Note

- *After periodic maintenance has been performed, it should be logged in. This creates a periodic maintenance history file, sets the analysis counter back to zero, increments the reset counter, enters the reset date, and enters any comments.*

1. From the Maintenance menu, click Login. The Maintenance dialog box will appear.



Maintenance

Select the maintenance items below that have been serviced:

- ☐ Incoming Helium Scrubber
- ☐ Furnace Reagents
- ☐ Aliquot Dose Scrubber
- ☐ Reduction Tube
- ☐ Crucible
- ☐ Afterburner Filter
- ☒ Inspect CFlex® Tubing
- ☒ Inspect Duckbill
- ☐ Secondary Furnace Reagents

Comments:

OK Cancel

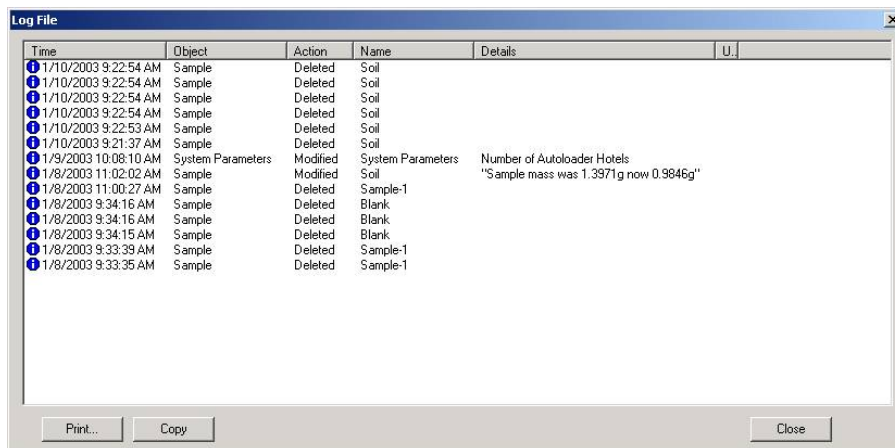
2. Click the check box before the item that periodic maintenance was performed on.
3. Click on the Comments box and enter any maintenance comments.
4. Click OK.

View Log File

————→
Note

- *The log file is a history of past events. Every time one of the following procedures is performed, it will be recorded in the log file.*
 - Change of Mass by Operator
 - Data Out of Range (Ambient Monitor parameter values)
 - Date of last calibration, drift or blank
 - Date scheduled maintenance is performed
 - Network Errors
 - Network Sign-on Errors
 - Sample Aborted
 - Sample Deleted
 - Standard check out-of-range

1. From the Maintenance menu, click View Log Files. The Log File window will appear.



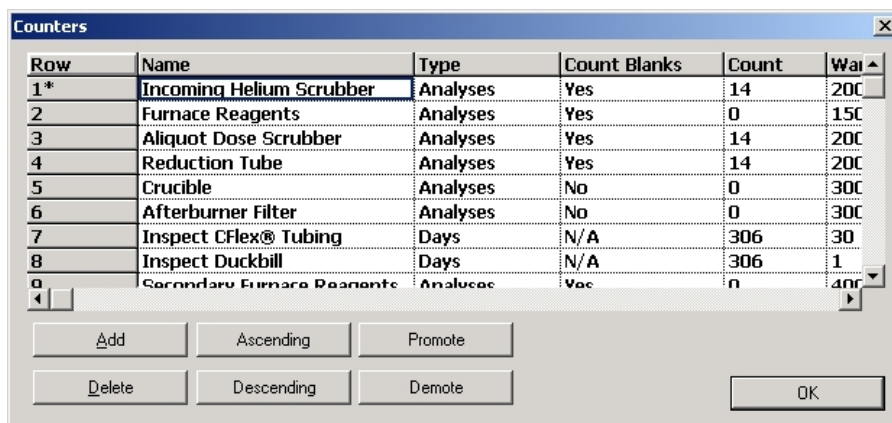
2. Click Print to receive a printout of the log file on the system printer.
3. Click OK when finished.

Configure Maintenance Counters

————→
Note

- *Maintenance Counters is a list of components and assemblies, within the instrument, that have been determined to require periodic maintenance. An analysis counter will determine when periodic maintenance is needed and alert the operator. After maintenance, a history log of maintenance performed is automatically generated. For information concerning periodic maintenance and procedures, refer to the Periodic Maintenance Schedule, pages 3–24 and 6–5. The counters should not be reset from this procedure. To reset the counters, refer to Reset Maintenance Counters, page 6–48.*

1. From the Configuration menu, click Counters. The Counters dialog box will appear.



The screenshot shows a dialog box titled "Counters" with a table of maintenance counters. The table has columns: Row, Name, Type, Count Blanks, Count, and Wait. The rows are numbered 1 through 8. Row 1 is highlighted. Below the table are buttons for Add, Ascending, Promote, Delete, Descending, Demote, and an OK button.

| Row | Name | Type | Count Blanks | Count | Wait |
|-----|----------------------------|----------|--------------|-------|------|
| 1* | Incoming Helium Scrubber | Analyses | Yes | 14 | 200 |
| 2 | Furnace Reagents | Analyses | Yes | 0 | 150 |
| 3 | Aliquot Dose Scrubber | Analyses | Yes | 14 | 200 |
| 4 | Reduction Tube | Analyses | Yes | 14 | 200 |
| 5 | Crucible | Analyses | No | 0 | 300 |
| 6 | Afterburner Filter | Analyses | No | 0 | 300 |
| 7 | Inspect CFlex® Tubing | Days | N/A | 306 | 30 |
| 8 | Inspect Duckbill | Days | N/A | 306 | 1 |
| 9 | Secondary Furnace Reagents | Analyses | Yes | 0 | 400 |

2. Click Add to define a maintenance counter.
3. Enter the information required in the dialog box. Refer to Maintenance Counter Definitions, page 6–47, for additional information.
4. To remove a counter select it and click Delete. Only counters added by the operator can be removed.
5. To arrange the counter in ascending alphabetical order click Ascending.
6. To arrange the counter in descending alphabetical order click Descending.
7. To move a counter up towards the top of the screen select the counter and click Promote.

8. To move a counter down towards the bottom of the screen select the counter and click Demote.
9. Click OK.

Maintenance Counter Definitions

Name—A name or description of the component or assembly that requires periodic maintenance.

Count Blanks—If Yes is entered and a blank is analyzed, the analyses counter will increment. If No is entered and a blank is analyzed, the analyses counter will remain at the same value.

Stop—The determined number of analyses that the analyses counter can reach before the instrument will automatically stop and prevent continued analysis. To turn this function off, enter 0.

Warning—The determined number of analyses that the analyses counter can reach before a warning message is displayed alerting the operator that periodic maintenance is necessary. Analysis will not stop when this counter limit is reached. To turn this function off, enter 0.

Analyses—The total number of samples analyzed.

Resets—The number of times that the maintenance item was serviced. The resets counter is incremented every time a maintenance item is checked in the Maintenance dialog box.

Reset—Displays the date and time the maintenance counter was reset.

Comments—A place for the operator to add notes or comments concerning maintenance.

Reset Maintenance Counters

————→
Note

- *Reset Maintenance Counters is used to reset the counters back to zero. After maintenance, a history log of maintenance performed is automatically generated. This information is used create that history log file.*

1. From the Maintenance menu, click Login. The Maintenance dialog box will appear.

Maintenance

Select the maintenance items below that have been serviced:

- ☐ Incoming Helium Scrubber
- ☐ Furnace Reagents
- ☐ Aliquot Dose Scrubber
- ☐ Reduction Tube
- ☐ Crucible
- ☐ Afterburner Filter
- ☒ Inspect CFlex® Tubing
- ☒ Inspect Duckbill
- ☐ Secondary Furnace Reagents

Comments:

OK Cancel

2. Select the item(s) that maintenance has been performed on.
3. Click OK.
4. A Confirmation dialog box associated with every counter will appear.
 - A. Click Yes if maintenance was performed.
 - B. Click No if maintenance was not performed.
 - C. Click Cancel to exit procedure.
5. The Confirm dialog box for the second maintenance item will appear.
 - A. Click Yes if maintenance was performed.
 - B. Click No if maintenance was not performed.
 - C. Click Cancel to exit procedure.
6. Continue until all maintenance items were displayed in the Confirm dialog boxes and answer Yes, No or Cancel to the procedure.

Duckbill Replacement

The Loading Head Check Valve should be periodically replaced to prevent a combustion gas leak. The life of the check valve will depend on the type of samples being run but in most cases it should be replaced daily. When the check valve leaks, a hissing noise may be heard indicating gas escaping from the loading head.



WARNING

When replacing the check valve the loading head will be hot. Use caution to prevent burns. Use insulated gloves if necessary.

Note

- For an exploded view of the Liquid Loading Head refer to Figure 10-30 on page [10-37](#).

1. Using a $\frac{3}{32}$ hex wrench, loosen the two screws in the top of the loading head and swing the Cap assembly to the right.
2. Remove the O-ring using the long end of the hex wrench.
3. Remove the Check Valve using the long end of the hex wrench.
4. Insert a new Check Valve into the loading head.
5. Insert the O-ring into the groove above the check valve.
6. Swing the Cap assembly back into place being careful not to move the o-ring.
7. Tighten the two screws holding the cap in place.
8. Check to make sure the syringe is properly aligned with the grooves in the cap assembly.

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7 Theory of Operation

The Theory of Operation chapter provides an overview of how the instrument operates and the stages of operation that generate reliable results.

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Theory of Operation TruSpec Macro

Note

- • As you read this section refer to the Measurement Flow Diagram on page 7-4.

The TruSpec CHN Macro is an instrument that determines the Carbon, Hydrogen and Nitrogen content of a variety of materials, including foods, feeds, oilseeds, fertilizers, meats and soils. The sample weight range is 50 milligrams to 1.5 grams. The instrument is connected to an external PC, and uses a Windows®-based software program to control the system operation and data management.

There are three phases during an analysis cycle: purge, combust, and analyze. In the purge phase, the encapsulated sample is placed in the loading head, sealed, and purged of any atmospheric gases that have entered during sample loading. The ballast volume (zero volume at this point) and gas lines are also purged.

During the combust phase, the sample is dropped into a hot furnace (950°C) and flushed with oxygen for very rapid and complete combustion. The products of combustion are passed through a secondary furnace (Afterburner, 850°C) for further oxidation and particulate removal. The combustion gases are then collected in a collection vessel known as the ballast.

In the analyze phase, oxygen flows into the furnace to combust the sample. The gases from combustion are collected in the ballast. The homogeneous combustion gases in the ballast are then purged through the CO₂ and H₂O infrared detectors and the 3cc aliquot loop. Once the gases have equilibrated, carbon is measured as carbon dioxide by the CO₂ detector and hydrogen is measured as water vapor in the H₂O detector. The gases in the aliquot loop are transferred to the helium carrier flow, swept through hot copper to remove oxygen and change NO_x to N₂ and then flow through Lecosorb and Anhydrone to remove carbon dioxide and water, respectively. A thermal conductivity cell is used to determine the nitrogen content.

The final result is displayed as weight percentage or in parts per million as determined by the operator. Results can be calculated on a user-defined basis – including dry-basis and total protein.

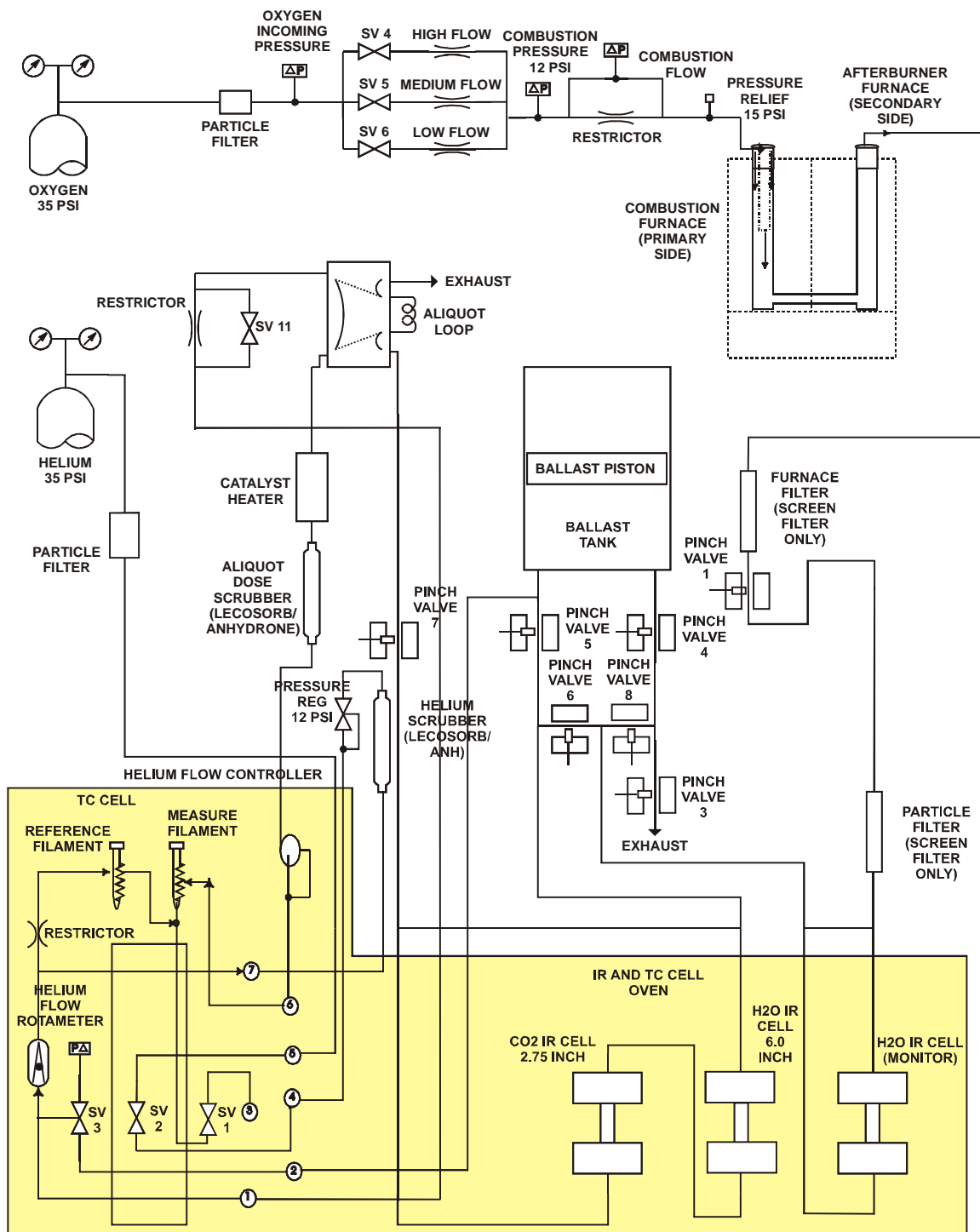


Figure 7-1
TruSpec CHN Macro Measurement Flow Diagram

Theory of Operation TruSpec Micro

Note

- • As you read this section refer to the Measurement Flow Diagram on page 7-6.

The TruSpec Micro is an instrument that determines the Carbon, Hydrogen, Nitrogen and Sulfur content in homogeneous organic materials. The nominal sample weight is 2 milligrams. The instrument is connected to an external PC, and uses a Windows®-based software program to control the system operation and data management.

There are three phases during an analysis cycle: purge, combust, and analyze. In the purge phase, the encapsulated sample is placed in the loading head, sealed, and purged of any atmospheric gases that have entered during sample loading.

During the combust phase, the sample is dropped into a hot furnace (1100°C) and dosed with oxygen for very rapid and complete combustion. The products of combustion are passed through a secondary furnace (Afterburner, 850°C) for further oxidation, reduction and particulate removal.

In the analyze phase, the combustion gases pass from the furnace through a heated manifold to the H₂O infrared detector for water analysis. After moisture is removed by the anhydron, the combustion gasses pass through the CO₂ detector for carbon measurement and the SO₂ detector for sulfur measurement (sulfur measurement is only possible with the TruSpec CHNS Micro). From the CO₂ detector the combustion gasses continue through Lecosorb and anhydron to remove CO₂ and H₂O after which Nitrogen is measured by thermal conductivity.

The final result is displayed as weight percentage or in parts per million as determined by the operator. Results can be calculated on a user-defined basis – including dry-basis and total protein.

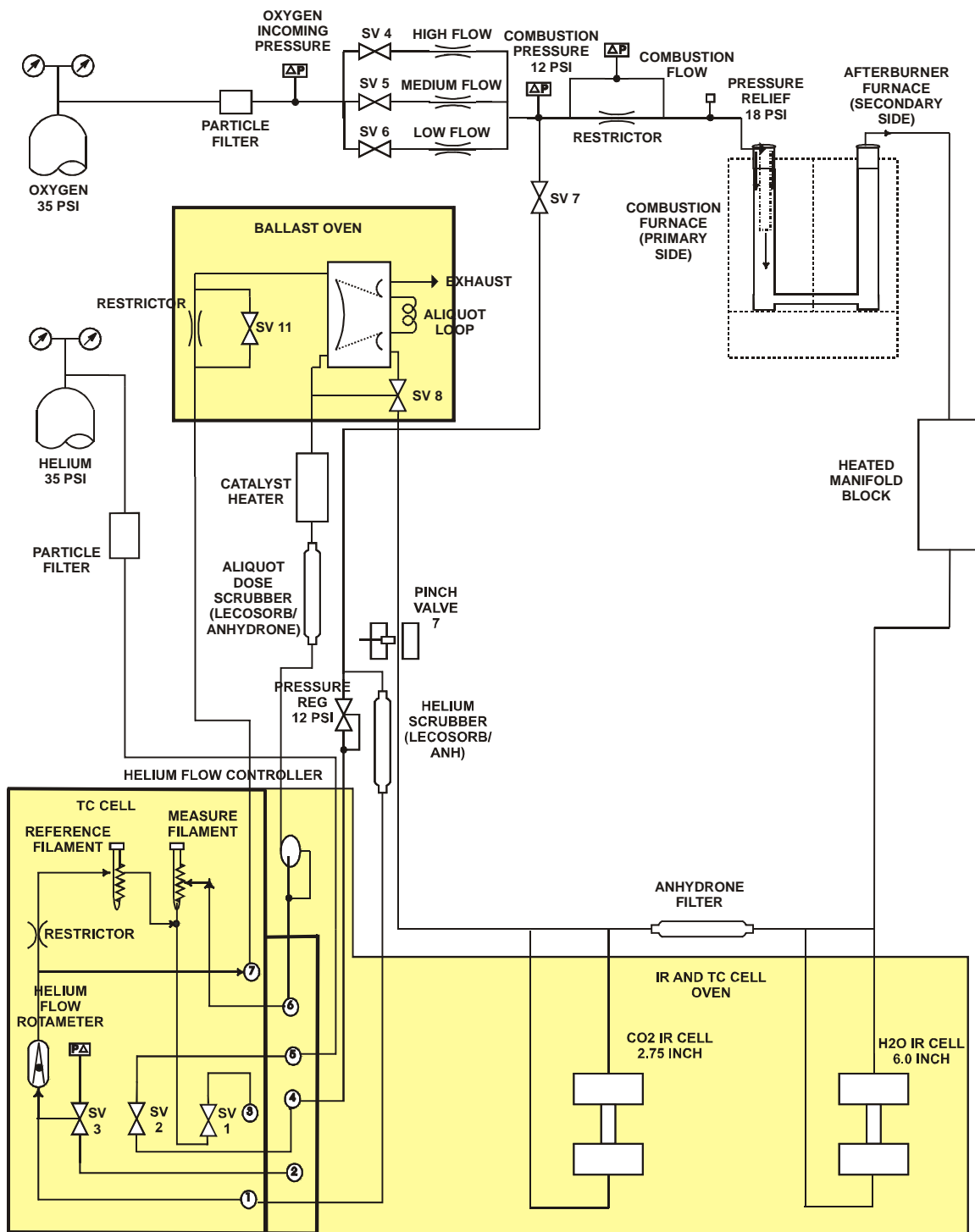


Figure 7-2
TruSpec CHN Micro Measurement Flow Diagram

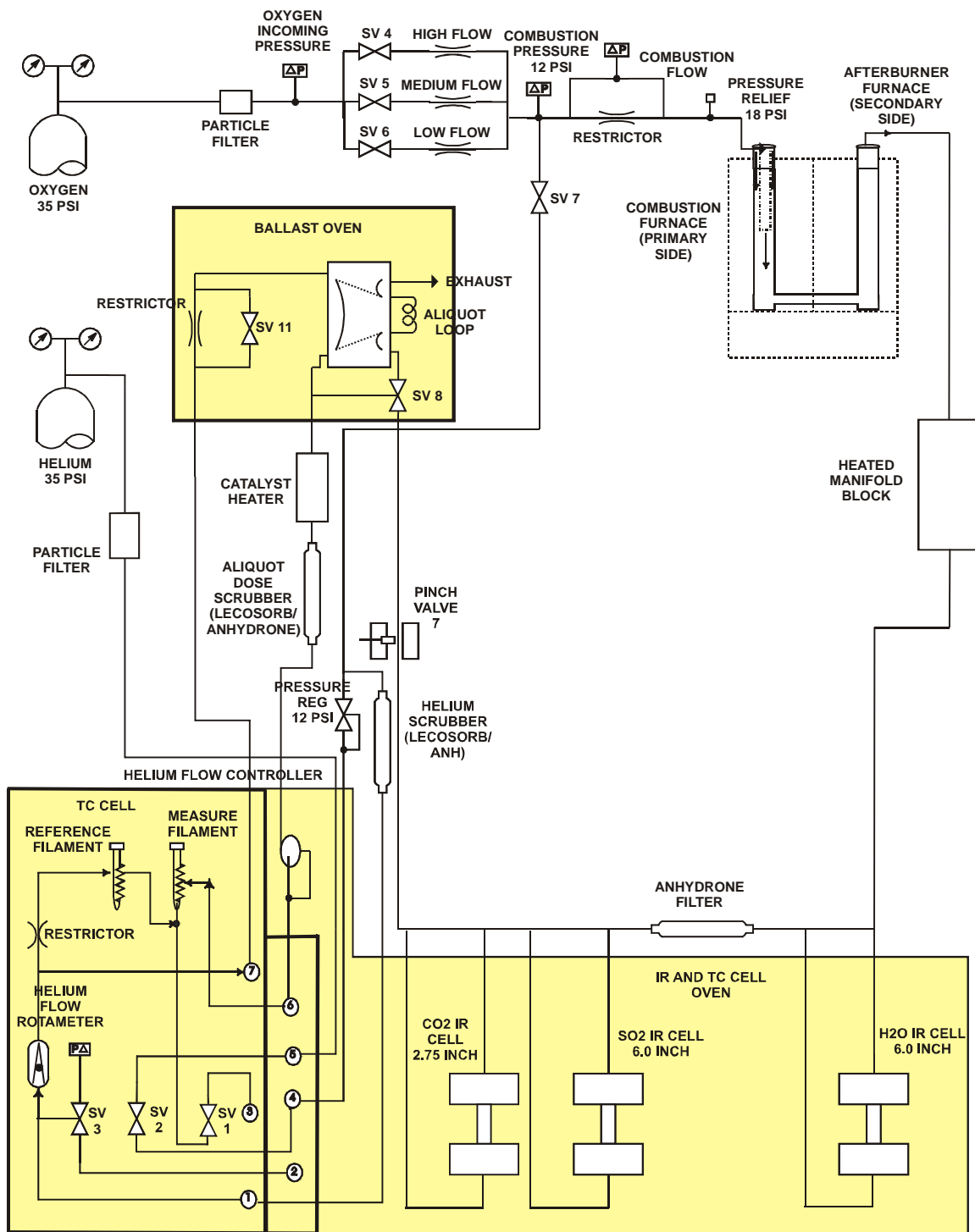


Figure 7-3
TruSpec CHNS Micro Measurement Flow Diagram

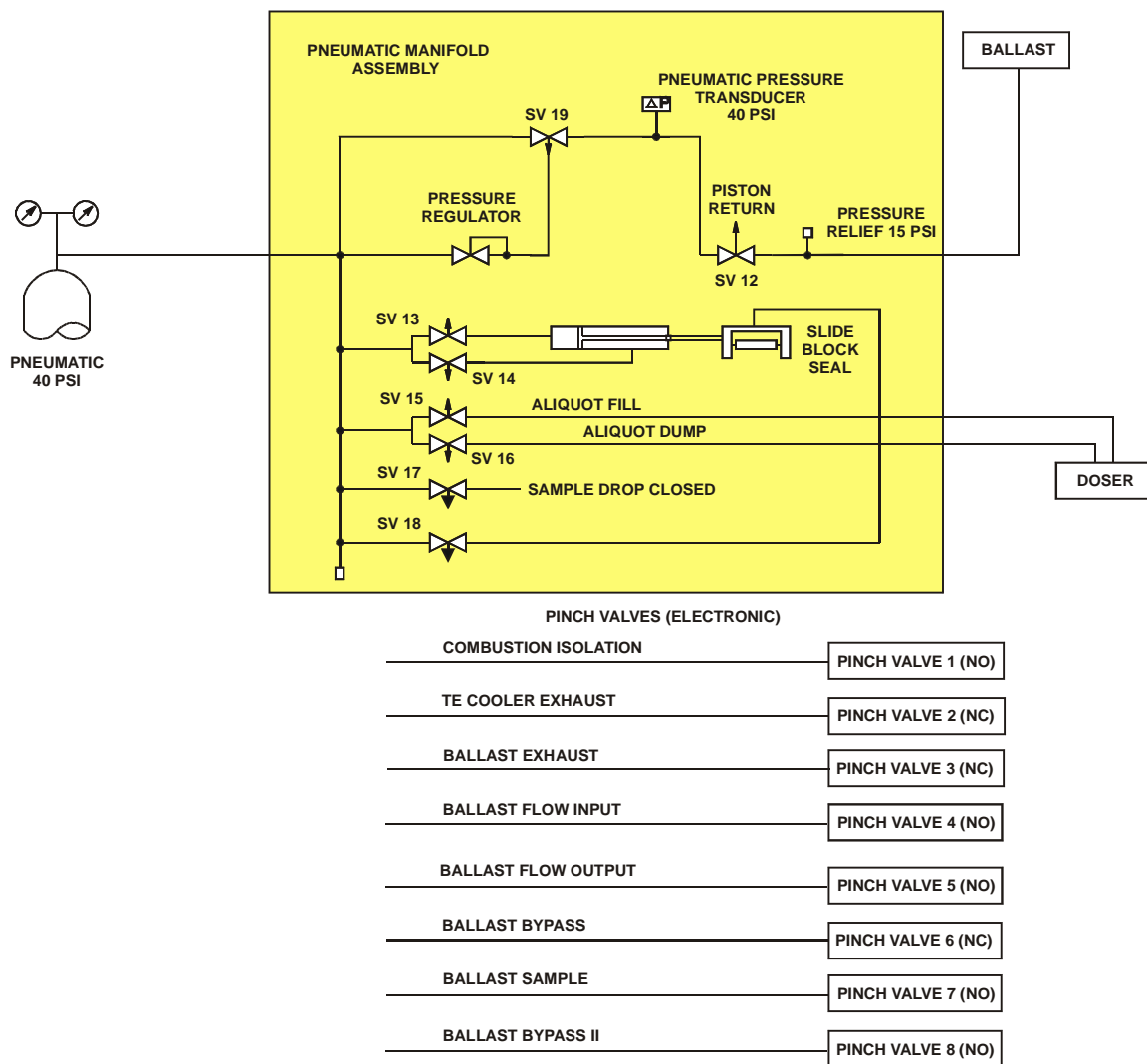


Figure 7-4
Pneumatic Flow Diagram

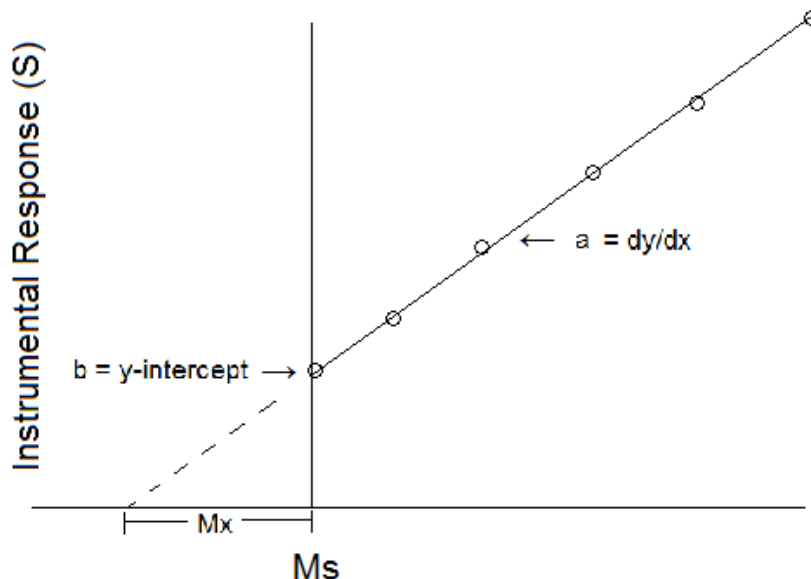
Method of Standard Additions

The method of standard additions is a common method for determining analyte concentrations in complex matrices such as soils, biological fluids, etc. Matrix interferences and background for many such samples may result in interferences with analyte signal that cause inaccurate determination of analyte concentration. The background may be determined by adding analyte to the sample and measuring the instrumental response. The difference between sample and spiked sample is assumed to be due only to change in analyte concentrations.

A simple procedure is generally used in which the sample is spiked at several increasing concentrations of analyte. The samples are analyzed and the response plotted with the standard added plotted on the x-axis and instrumental response on the y-axis. The slope (a) and y-intercept (b) are determined through linear regression analysis of the calibration curve.

$$S = aM_s + b \quad (1)$$

where: S = instrumental response (signal)
 M_s = volume of standard



The mass of standard $M_s(0)$ from that point to the first solution on the curve ($x = 0$) contains the same amount of analyte as the sample. So,

$$M_{xcx} = [M_s(0)]c_s \quad (2)$$

where:

M_x = mass of the sample aliquot

c_x = concentration of the sample

c_s = concentration of the sample

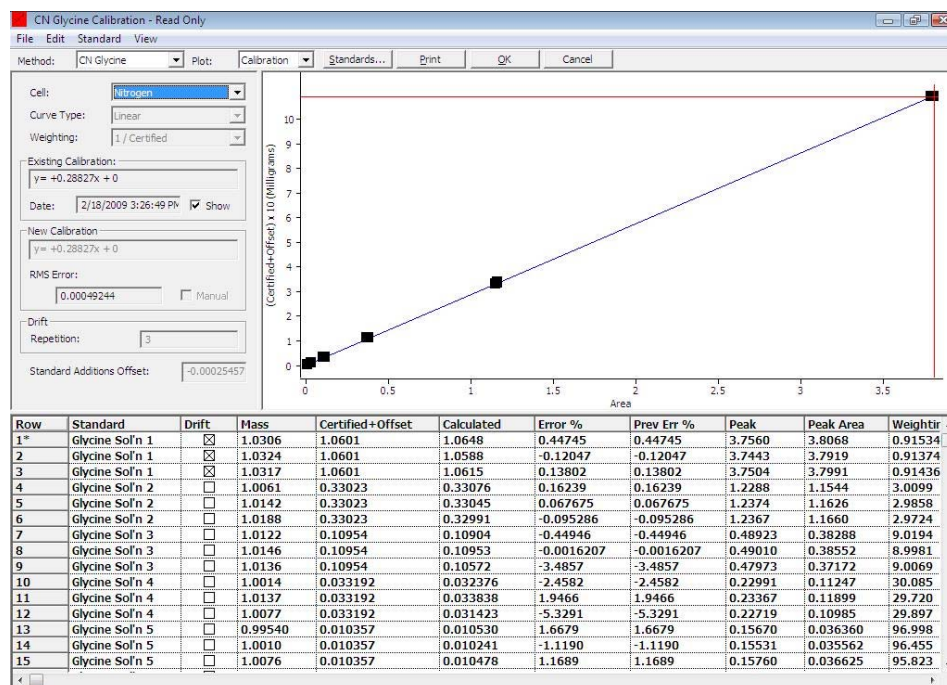
Combining equations 1 and 2 and solving for c_x :

$$c_x = (bc_s/aM_x)$$

The analyte concentration can then be calculated from the slope and intercept of the standard addition calibration curve.

As an example, this technique can be used to determine the unknown concentration of the nitrogen content in aqueous standards.

In the calibration screen example below, linear was selected and the standard additions offset appears on the calibration screen at the left.



Calculations

The following is a list of calculations used by the software to determine the final analysis result.

Adjusted Mass— $\text{Mass} * (1 - \text{Sample Moisture} / 100) * (1 / (1 - \text{Moisture Basis} / 100))$

Adjusted Area— $((\text{area} * (\text{Correction Factor}) - \text{blank}) * \text{drift} * \text{Sensitivity Factor})$

Nitrogen mg—Adjusted area passed through the calibration curve.

Nitrogen ppm— $\text{Nitrogen \%} * 10,000$.

Nitrogen %— $\text{Nitrogen mg} / \text{adjusted mass}$.

Drift Factor—Calculates a factor that returns the drift standard to the same calculated value that was determined during the calibration process.

Barometric Pressure

Barometric pressure, which directly affects gas volume, is sensed by a pressure transducer. The barometric pressure transducer constantly monitors the pressure and feeds this information to the software. The software uses this information to compensate analysis results. During initial setup, the barometric pressure transducer is calibrated by entering the current actual barometric pressure.

Pressure is often reported in inches of mercury (Hg) which must be converted to millimeters (mm) of mercury. To convert from inches of Hg to mm of Hg, multiply the barometric pressure by 25.4.

Pressure varies inversely with altitude and, if pressure readings are measured and reported from an altitude other than operation, adjustments should be made accordingly. The following table illustrates that as altitude increases, pressure decreases.

| Altitude | Pressure (mmHg) |
|----------|-----------------|
| 0 | 760 |
| 250 | 753 |
| 500 | 746 |
| 750 | 740 |
| 1,000 | 733 |
| 2,000 | 707 |
| 3,000 | 681 |
| 4,000 | 656 |
| 5,000 | 632 |
| 6,000 | 609 |
| 7,000 | 586 |
| 8,000 | 564 |
| 9,000 | 543 |
| 10,000 | 523 |

Adjust reported level to reflect the operation level with this formula:

$$\begin{array}{ccccc} \text{Operation Pressure} & & \text{Reported Barometric} & & \text{Adjusted Pressure} \\ \text{(from table)} & & \text{Pressure at 0 feet} & & \text{at Operation} \\ \hline & \times & & = & \\ 760 & & & & \end{array}$$

Enter the answer to this formula in the barometric pressure procedure.

Example

Barometric pressure is reported at 750 mmHg at sea level (0 feet) but operation altitude is 1000 feet. Adjust the reported sea level pressure to operation level pressure by using the formula:

$$\frac{733 \text{ mmHg}}{760 \text{ mmHg}} \times 750 \text{ mmHg} = 723 \text{ mmHg}$$

In this example, the barometric pressure to be entered into the instrument is 723 mmHg.

Thermal Conductivity Cell

The thermal conductivity cell has the ability to detect differences in the thermal conductivity of gases (see below). This TC cell is operated in a nitrogen optimized mode. The cell consists of two pair of matched filaments used in four legs of a Wheatstone bridge. The "reference" filaments are maintained in a constant gas and gas flow environment while the "measure" filaments are maintained in a constant gas flow environment, but the gas composition is allowed to vary. All filaments are mounted in an insulated metal block. A Filament Current Factor is calculated by the software to compensate for changes in the filament current due to TC cell temperature changes.

The Wheatstone Bridge is balanced with a specified bridge current while both filaments are essentially in identical environments.

The bridge current causes self-heating of the filaments. The temperature of the filaments is always much higher than the oven temperature in which the cell is located.

As long as both filaments remain in the same environment under which the bridge was balanced, the bridge output will remain at approximately 0.3 volts. Any disturbance of this environment will result in a change in bridge output. The bridge output is AC coupled to amplifiers that have an output offset.

Once the bridge is balanced and stabilized under proper conditions, the only variations in bridge output are due to variations in the type and quantity of gas present at the "measure" filaments. The bridge is balanced with Helium (He) flowing in the measure chamber and reference chamber. The introduction of nitrogen causes the temperature of the measure filaments to increase since nitrogen has a lower thermal conductivity than helium. In this instance, the bridge becomes unbalanced and an output becomes available to the preamp, resulting in a positive reading. The amount of nitrogen determines the magnitude of the readings. The sensitivity of the system is governed by bridge current and the difference in thermal conductivity between the analyze gas, nitrogen, and the carrier gas, helium.

| Gas | Symbol | MolecularWeight | ThermalConductivity |
|-----------------|------------------|-----------------|---------------------|
| Hydrogen | H ₂ | 2 | 39 |
| Helium | He | 4 | 33 |
| Neon | Ne | 20 | 10.4 |
| Oxygen | O ₂ | 32 | 5.7 |
| Nitrogen | N ₂ | 28 | 5.6 |
| Air (dry) | Air | 29 | 5.4 |
| Carbon Monoxide | CO | 28 | 5.4 |
| Water Vapor | H ₂ O | 18 | 4.0 |
| Argon | Ar | 40 | 3.8 |
| Carbon Dioxide | CO ₂ | 44 | 3.3 |
| Sulfur Dioxide | SO ₂ | 64 | 1.6 |

Figure 7-5
Thermal Conductivity of Gases

Infrared Radiation Cell

The descriptions that follow refer to CO₂ optimized detector. The analysis of hydrogen is identical with only the necessary change to accommodate a different gas (H₂O).

The infrared source (IR) consists of nichrome wire, which is resistance-heated to 850°C. The IR source radiates visible energy as well as all wavelengths in the infrared spectrum.

Carbon dioxide absorbs IR energy at a precise wavelength within the IR spectrum. Energy from the IR source is absorbed as the gas passes through the cell, preventing it from reaching the IR detector. All other IR energy is prevented from reaching the IR detector by a narrow band-pass filter. Because of the wavelength filter, the absorption of IR energy can be attributed only to carbon dioxide (CO₂). The concentration of CO₂ is detected as a level of energy at the detector.

One IR Cell is used as both a reference and for measurement. The total carbon, as carbon dioxide, is detected on a continuous and simultaneous basis. The cell consists of an IR source, a narrow band-pass filter, a condensing cone, an IR energy detector, and the cell body. Radiated energy enters the cell body through a window, travels through the cell body, then exits through a second window and a precise wavelength filter. The selective filter passes only the CO₂ absorption wavelength into a condensing cone that concentrates the energy at the detector. The solid state detector is AC coupled to a preamplifier. As the gas concentration increases, the voltage to the preamp decreases.

The starting reference level, or "baseline", for the detector is established by running 100% oxygen through the cell. The pure oxygen environment permits the maximum amount of energy to reach the detector. This maximum energy level is AC coupled to the preamp where it is amplified, rectified and filtered. It is then sent to an analog-to-digital (A/D) converter where it is converted to a digital signal.

As analysis begins, the cell output decreases with the amount of carbon (as CO₂) present in the cell. The computer reads the cell output and produces data points that are stored in memory. The computer then processes the curve, or graph, formed by these data points and after calibration forms a linear curve. The calibration curve is then used by the computer to accurately calculate the sample result.

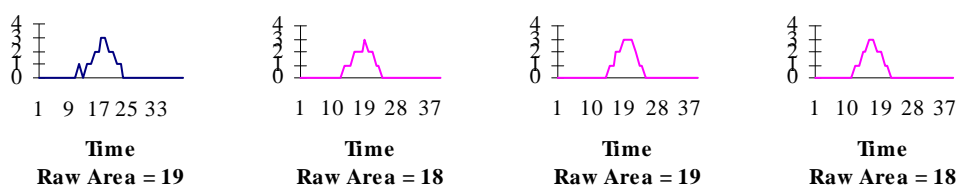
Theory of Calibration

Calibration compensates for differences between the total element measured and the actual element concentration. A programmed equation will correlate the response between the observed and theoretical measurement of analyte, permitting accurate measurements to be made.

The Windows[®] software provides several types of calibration curves. The calibration curves include single standard calibration, linear, quadratic, and cubic. First perform a blank calibration, then once a standard calibration has been defined re-calibration is not necessary unless a cell or flow has been changed. The daily routine will consist of determining the blank and performing a drift correction.

The first step to be performed is the determination of a method specific blank.

Several blanks should be analyzed. The linearization table is applied to the peak during the analysis. The area under the peak is calculated and stored as a raw area (Ar).

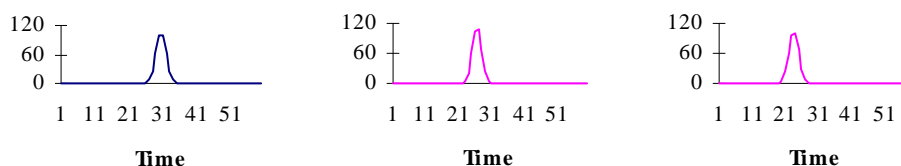


If the four blanks displayed above were selected in the software to calculate a blank, the result would be that the average of the four would be stored as the blank area (Ab).

$$Ab = \frac{19+18+19+18}{4} = 18.5$$

The blank area, Ab will be subtracted from every sample analyzed after it is set.

After the blank is defined, a calibration curve needs to be defined. Several standards need to be selected that will cover the operating range of analyte concentration for the samples of unknown analyte concentration. At least three replicates of each standard should be analyzed. Care must be taken to accurately compensate for trapped atmosphere, atmospheric blank, with each analyzed standard. If the calibration curve is constructed using more than one sample type, the atmospheric blank must be determined for each standard. This can be accomplished by analyzing the same sample mass encapsulated and in an open container, dissolving in water, or palletizing the sample. The difference in the results is the atmospheric blank.



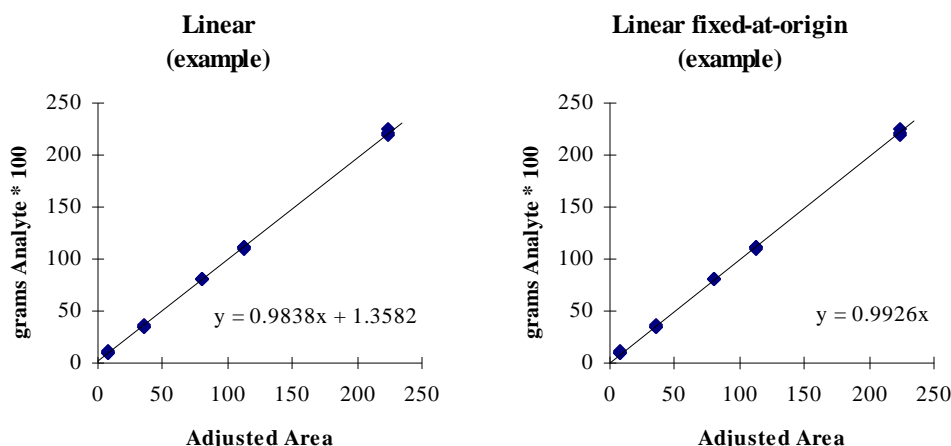
The area under the peak is calculated and stored as a raw area, A_r . The current blank area, A_b , is subtracted from the raw area, A_r , of the standard to yield the Area, A .

$$A = A_r - A_b$$

The area A , is adjusted for instrument drift by multiplying by the drift factor. Each time a calibration is performed the drift factor is reset to 1.0. The units of the area, A , are then adjusted to reflect absolute amount of analyte by multiplying by the sensitivity factor.

$$A_{adj} = A * Sensitivity Factor * Drift Factor$$

The resultant adjusted area, A_{adj} , of the standards are plotted against the known grams Analyte * 100 of the analyzed standards. The best-fit line, linear, quadratic, or cubic, is determined and taken as the calibration curve for the method. The default calibration curve has a slope of 1.0 and travels through the origin.



In general, the line that is to be selected is the line that yields the lowest RMS error. However, if none of the calibration standards are very low in analyte concentration, then linear fixed-at-origin should be selected. This should only be done if the samples of unknown analyte concentration do not fall in the range of very low analyte concentration.

If, however, the samples of unknown concentration mostly fall into the very low analyte concentration range, the 1/certified weighting should be selected. This type of weighting helps off set a natural bias to higher concentration standards during the least squares fitting process.

Aadj is now taken through the calibration curve to yield grams analyte * 100.

$$\text{grams Analyte} * 100 = \text{Adjusted Area} * \text{Slope} + \text{Intercept}$$

This is then generally converted to a percentage to be reported. The calculation is performed by dividing the grams analyte * 100 by the mass of the sample in grams.

$$\% \text{ Analyte} = \frac{\text{grams Analyte} * 100}{\text{Sample Mass}} - \text{Atmospheric Blank}$$

The instrument is now ready to give accurate results over the calibrated range for each calibrated cell.

There is a bit of daily maintenance that must be performed to ensure instrument accuracy. At least once per day, preferably at least once every four hours, or in the event of a method change, the blank must be verified. If it is different than the pre-defined blank, it must be reset.

Calibration Definitions

1/Certified Weighting—A weighting that can be applied to the calibration data points that will counteract a bias for higher concentrations that comes naturally out of the curve fitting routines.

Adjusted Area (Aadj)—Adjusted Area = Area (A) times Correction Factor times Sensitivity Factor times Drift Factor. Area (A) equals Raw Area (Ar) minus Blank Area (Ab).

Analyte—The substance whose physical or chemical properties are measured and correlated, directly or indirectly, to the desired information.

Atmospheric Blank—In every encapsulated sample there are both sample material and air (atmosphere). The amount of air trapped with the sample, atmospheric blank, is dependant upon the volume of sample (sample mass) and the physical state of the sample (pellet, liquid, powder, crystal, grain, etc.). After the combustion of the sample the nitrogen from sample and atmosphere are presented to the detector and mass.

Blank—The signal obtained during an analysis that cannot be attributed to the sample. The blank is due primarily to Argon impurities in the oxygen. The blank should be determined before calibration or drift correction.

Blank Area (Ab)—The area under the peak obtained when analyzing blank analyses. Each method shall require a defined blank or it will be defaulted to zero.

Blank—The signal obtained during an analysis that cannot be attributed to the sample. The blank is due primarily to Argon impurities in the oxygen. The blank should be determined before calibration or drift correction.

Calibration Curve—A series of standard samples containing known concentrations of the analyte are analyzed. These standards should cover the range of interest and have a matrix composition as similar to the samples as possible. A blank sample must be analyzed and subtracted from each of the standard samples. The Adjusted Area Aadj is plotted along the X-axis versus the known concentration along the Y-axis for each of the analyzed standard samples. The curve that best fits the plotted points is the calibration curve.

Calibration Factor—The slope of the obtained calibration curve.

Drift Correction—The process of determining the drift factor.

RMS Error—(Root Mean Square Error) A method of quantifying dispersion or spread of data. It is used in the Windows® software to determine which calibration curve is better. The lower the RMS error the better.

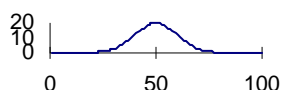
Drift Factor—A factor that is applied to the signal of an analyzed defined standard to adjust it to the expected signal; based on information extrapolated from the calibration curve. It is then used to adjust analyte signals to correct for instrument drift.

Linearization Table—A table containing peak heights and slopes. The purpose is to make minor adjustments to the signal to compensate for minor non-linearities in the IR cells.

Origin—The intersection of the X and Y axes. On the calibration curve this is zero concentration and zero signal.

Mass—The quantity of matter in an object. In the Windows® software mass is the equivalent of weight in the keypad software. Default Unit: gram.

Peak—When the analyte passes through the TC cell there is a change in the voltage of the detector that is proportional to the amount of analyte in the cell. After the analyte is passed the IR cell detector voltage returns to normal. The region of this voltage change is the peak.



RMS Error—(Root Mean Square Error) A method of quantifying dispersion or spread of data. It is used in the Windows® software to determine which calibration curve is better. The lower the RMS error the better.

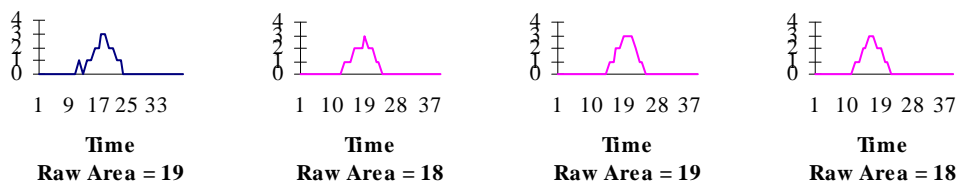
Sample—A determined mass of a substance of unknown analyte concentration. The analyte concentration will be determined by performing the analysis.

Sensitivity Factor—A multiplicative factor applied to the adjusted area (Aadj) for the purpose of adjusting the units and to give a calibration factor near 1.0.

Standard—A sample whose analyte concentration is accurately known.

Blank Analysis

Several blanks should be analyzed. The linearization table is applied to the peak during the analysis. The area under the peak is calculated and stored as a raw area (Ar).



If the four blanks displayed above were selected in the software to calculate a blank, the result would be that the average of the four would be stored as the blank area (Ab).

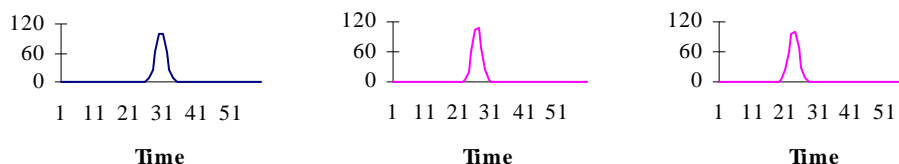
$$Ab = \frac{19 + 18 + 19 + 18}{4} = 18.5$$

The results for analyzed blanks will be calculated in the same manner as all other analyses. The result is displayed in percent. The blank is stored as an area. However, to avoid confusion, the blank that is listed on the print out and on the display is in percent. The concentration displayed is based on a 1 gram samples mass and the current calibration factor.

The blank area, Ab will be subtracted from every sample analyzed after it is set.

Standard Analysis

After the blank is defined, a calibration needs to be performed. At least three replicates of the same standard need to be analyzed in the same fashion as the blanks. The standard needs to be selected such that the analyte concentration is in the middle of the operating range. The linearization table is applied to the peak during the analysis.



The area under the peak is calculated and stored as a raw area, A_r . The current blank area, A_b , is subtracted from the raw area, A_r , of the standard to yield the Area, A .

$$A = A_r - A_b$$

The units of the area, A , are then adjusted to reflect absolute amount of analyte by multiplying by the sensitivity factor (different for each IR cell) and the calibration factor (1.0 is the default value).

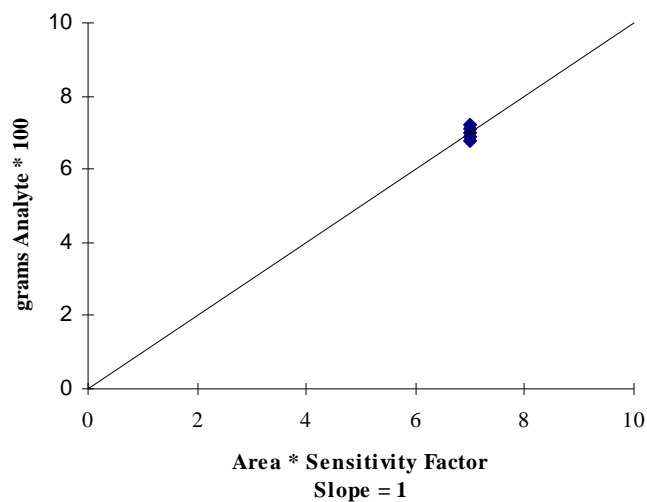
$$\text{grams Analyte} * 100 = A * \text{Sensitivity Factor} * \text{Calibration Factor}$$

The result is displayed generally as a percentage. This is calculated by dividing the absolute amount of analyte, A_2 , by the mass of the sample in grams and subtracting the atmospheric blank.

$$\% \text{ Analyte} = \frac{\text{grams Analyte} * 100}{\text{Sample Mass}} - \text{Atmospheric Blank}$$

The calibration factor is determined by comparing the % Analyte obtained by the analysis and the known % Analyte of the standard. A standard should be selected that has a known analyte concentration in the middle of the operating analyte concentration range. A ratio is taken of the known and observed analyte concentration. The resultant ratio is taken as the calibration factor. The calibration is then a line drawn from the origin having a slope equal to calibration factor.

$$\text{Calibration Factor} = \frac{\text{known \% Analyte in Standard}}{\text{Average \% Analyte in Standard obtained by Analysis}}$$



Now, samples of unknown analyte concentration may be analyzed. The process and order of events are the same as described before.

Note

- *The calibration should be adjusted when there is a substantial change in operating analyte concentration or if a standard fails to yield the known analyte concentration. Also, the blank must be performed before calibration and needs to be redefined anytime there is a change in method of analysis. Calibration and blank must be defined for each element analyzed or each cell used in the analysis.*

Drift Factor

The drift factor is applied to the peak area before it is taken through the calibration curve, preserving the integrity of the calibration curve. The drift factor is intended to make minor corrections to the accuracy of the results. It is necessary to compensate for changes that cannot be attributed to blank or method changes.

The drift factor is determined by comparing Area obtained from the analysis of standard samples to the theoretical area calculated from the calibration curve. A ratio is taken of the two. The resultant ratio is taken as the drift factor.

$$\text{Drift Factor} = \frac{\text{Theoretical area, } A, \text{ calculated from calibration curve}}{\text{Observed area, } A, \text{ from analysis of standard samples}}$$

Comparator Level

An analysis that lasts excessively long causes an unnecessary delay while an analysis that isn't long enough can cause loss of significant data collection. Since not all samples melt in the same way, analyses should not be performed based on time alone.

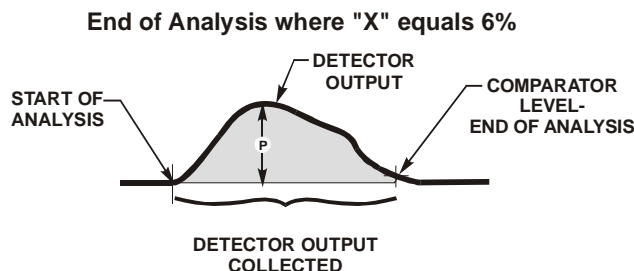
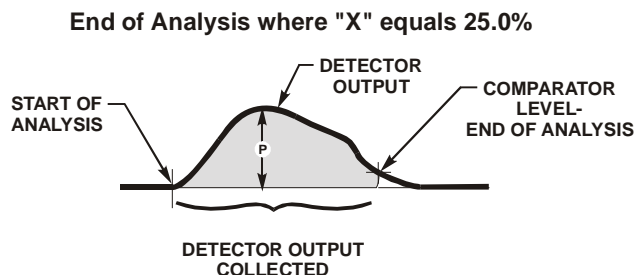
The length of each analysis is determined on an individual basis by the time-out and comparator level. An analysis ends when the time limit is reached and the A/D output of the detector, after passing its peak, is equal to the comparator level. This comparator level is a constant of five plus a percent of the peak:

$$\text{Method Comparator Level} = 5 + (X)(P).$$

Where P = detector A/D output peak and X = selected comparator level percentage.

During an analysis, the output of the detector, in the form of digital data, is collected and summed to arrive at the analysis result. If this data were plotted, it would reflect the "curve" of the detector output.

Shown below are two examples of the same detector output "curve" (buffer plot). The first example shows the amount of detector output collected during an analysis with a comparator level setting at 25% while the second example illustrates this at 6%.



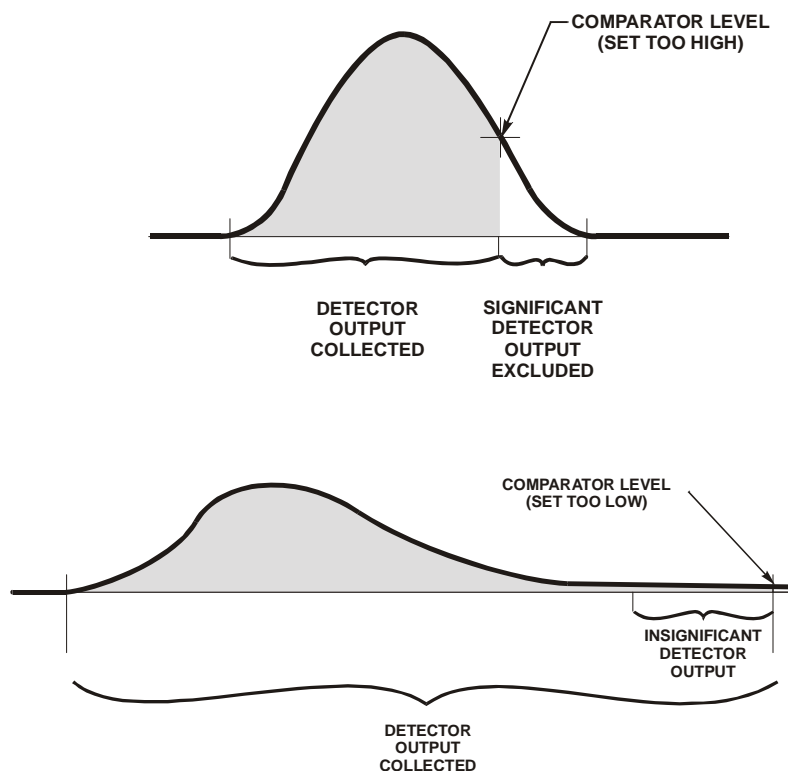
The following conclusions can be drawn from the examples:

- A high comparator level shortens analysis time.
- A low comparator level includes more sample gas, and therefore, more analyte, into answer calculations.
- A comparator level that is too low, however, results in the inclusion of very low concentrations, which don't significantly affect the result (noise), but lengthen the analysis.

A comparator level of one percent usually provides optimum performance by allowing the collection of all significant output within a reasonable time.

Extremely low output peaks may need a larger comparator level to exclude insignificant output levels produced toward the end of analysis and to cut down on drift. The minimum time should be extended to match what would be considered a reasonable time length for the analysis of such samples. The combination of a high comparator level setting and an extended minimum analysis time insures that all significant output is collected and analysis time lengths are consistent without being extensive.

Whenever the comparator level changes check the system calibration since interaction can occur.



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8

Diagnostics

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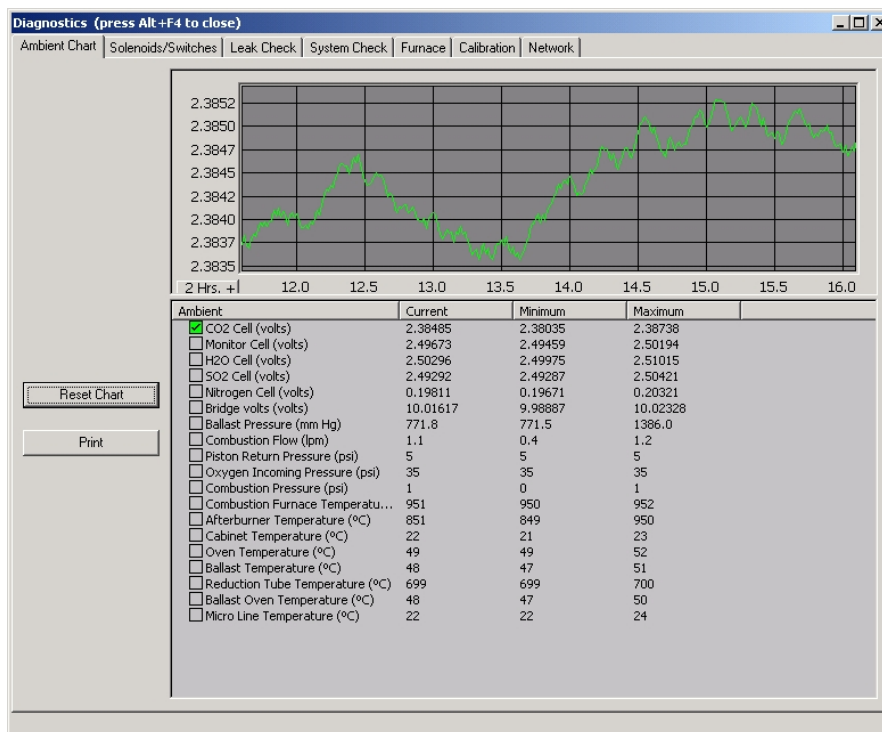
Ambient Monitor

The Ambient Monitor permits the service technician or operator to monitor instrument parameters and determine their status. Ambient Chart provides system parameters on a chart and graph. The selected parameters are not selectable by the operator; they were selected by LECO as being the most critical to monitor.

Refer to Ambient Monitor Definitions, page [8-7](#), for information concerning the parameters and values displayed on the Ambient Chart screen.

Ambient Chart

1. Click Diagnostics and select Chart to display the Ambient Monitor Chart screen.



2. Click the Check Box, to the left of the desired parameter, to display the parameter value in the graph above the chart. More than one parameter can be displayed by holding down the Control Key and clicking the Parameter Check Box. A yellow circle with an exclamation mark inside, to the left of the check box, indicates the parameter value is outside the desired range.
3. Click the right mouse button, with the mouse pointer inside the graph, to reset, restore, zoom in, zoom out, and set the graph range. The parameter value is displayed on the vertical axis and the time is displayed on the horizontal axis. The box in the lower left corner of the graph displays the hours since the instrument was turned on or the graph reset. The hours reset to 0 after 24.
4. Click Reset Chart to reset the parameter values and time on the chart and graph.
5. Click Print to print the parameter values on the system printer.

Ambient Monitor Definitions

CO₂ Cell—The IR Cell output voltage in volts. A properly operating cell should have an output greater than 1.5 volts. There is no mechanical adjustment for output voltage. The output voltage is set by software.

H₂O Cell—The IR Cell output voltage in volts. A properly operating cell should have an output greater than 1.5 volts. There is no mechanical adjustment for output voltage. The output voltage is set by software.

SO₂ Cell (TruSpec CHNS micro only)—The IR Cell output voltage in volts. A properly operating cell should have an output greater than 1.5 volts. There is no mechanical adjustment for output voltage. The output voltage is set by software.

Nitrogen Cell—The TC Cell output voltage in volts. A properly operating cell should have an output greater than 0.0 volts. There is no mechanical adjustment for output voltage. The output voltage is set by software.

Bridge Volts—The output voltage of the TC cell bridge in volts. The bridge is a measurement device in the TC cell that develops an output signal based on the analyte concentration.

Ballast Pressure—The pressure measured by the transducer connected to solenoid valve SV3 in the TC cell. Measures TC cell helium gas pressure when SV3 is energized. Measures pressure inside the ballast when SV3 is de-energized and the system is sealed from atmosphere. Measures atmospheric pressure when SV3 is inactive and the system is open to the atmosphere and excess pressure has been vented.

Combustion Flow—The flow of oxygen gas into the combustion furnace. The nominal combustion flow rate is 0 to 6 lpm. Pressure transducers P2 and P3 measure combustion flow.

Pneumatic Incoming Pressure—Depending on the valve state, the pressure of the incoming pneumatic gas, the regulated pneumatic pressure and the ballast piston backpressure are measured by this parameter. The pneumatic incoming pressure should measure approximately 40 psi. The regulated pneumatic pressure should measure 0 to 40 psi depending when the measurement is taken. The ballast piston backpressure should measure 12 psi.

Oxygen Incoming Pressure—The incoming oxygen pressure measured by the instrument and set by the regulator at the oxygen tank. Pressure transducer P1 measures incoming oxygen pressure. The oxygen pressure is set to 35 psi.

Combustion Pressure—The pressure of the combustion gas as it enters the furnace. The values measured by pressure transducers P2.

Combustion Furnace Temperature—The temperature of the combustion furnace. Nominally this temperature should be set to 950°C for the macro determinator and 1100°C for the micro determinator. Range: Ambient to 1100°C. This temperature is measured by a thermocouple in the furnace.

Afterburner Temperature—The temperature of the afterburner or secondary side of the combustion furnace. Nominally this temperature should be set to 850°C. Range: Ambient to 1050°C. This temperature is measured by a thermocouple in the afterburner or secondary furnace.

Cabinet Temperature—The ambient temperature inside the instrument as measured by a temperature transducer. This value is in degrees centigrade. Before analysis the ambient temperature should be approximately 25°C or the ambient room temperature.

TE Cooler Temperature—The internal temperature of the Thermoelectric Cooler. Nominal Temperature: 5°C.

Oven Temperature—The temperature of the IR and TC cell oven compartment. This temperature should be at 50°C for the macro determinator and 60°C for the micro determinator.

Ballast Temperature—Temperature of the Ballast Tube. This temperature should be at 50°C.

Reduction (Catalyst) Tube Temperature—The temperature of the Catalyst Heater. This temperature is measured by a thermocouple in the catalyst heater and not adjustable by the operator. The temperature of the catalyst heater is 700°C

Ballast Oven Temperature—The temperature of the ballast oven compartment. This temperature should be at 50°C.

Micro Line Temperature—The temperature of the heated manifold block. The nominal temperature is 110°C.

Ambient Monitor Ranges

This symbol will appear next to the parameter name, on the ambient monitor screen, if the parameter value is out of minimum or maximum range.

→
Note

- *The instrument must be on for a least 2 hours and the oxygen flow set to low before checking the following parameter values.*

| Parameter | Minimum | Maximum |
|---|-----------|-----------|
| CO ₂ Cell | 1.5 volts | 4.8 volts |
| H ₂ O Cell | 1.5 volts | 4.8 volts |
| SO ₂ Cell (TruSpec CHNS micro) | 1.5 volts | 4.8 volts |
| Nitrogen | 0.0 volts | 1.5 volts |
| Bridge Volts | 5.0 volts | 11 volts |
| Ballast Pressure | 720 mmHg | 1300 mmHg |
| Combustion Flow | 0 lpm | 6 lpm |
| Pneumatic Incoming Pressure | 0 psi | 42 psi |
| Combustion Pressure | 0 psi | 20 psi |
| Combustion Furnace Temperature | 900°C | 1050°C |
| Afterburner Temperature | Ambient | 1050°C |
| Cabinet Temperature | Ambient | 50°C |
| TE Cooler Temperature | 2°C | 10°C |
| Oven Temperature | 45°C | 55°C |
| Ballast Temperature | 45°C | 55°C |
| Reduction Tube Temperature | 690°C | 710°C |
| Ballast Oven Temperature | 45°C | 55°C |
| Micro Line Temperature | 105° | 115° |

Calibrations

Calibrations permit the service technician or operator to set the barometric pressure, combustion flow calibration, select the ballast size and perform a backup calibration using the calibration disk supplied with the instrument.

Set (Barometric) Pressure

Set Pressure permits the service technician or operator to calibrate the barometric transducer located in the instrument.

Calibration is necessary for proper analysis results and varies with the location of the instrument. This procedure must be done when the instrument is installed at location. For more information about barometric pressure refer to the Barometric Pressure on page [7-12](#).

1. Determine the current barometric pressure at the location of the instrument. This can be done with an external barometer.
2. Click Diagnostics and select Calibration. The Hardware Calibration screen will appear.

The screenshot shows a software window titled "Diagnostics (press Alt+F4 to close)". It has a menu bar with "Ambient Chart", "Solenoids/Switches", "Leak Check", "System Check", "Furnace", "Calibration", and "Network". The "Calibration" tab is selected. The window is divided into two main sections. The left section, titled "TC Cell", contains two input fields: one with "760" and a "Set Pressure" button, and another with "117" and a "Set Bridge" button. Below these is an "Auto Set Bridge" button. The right section, titled "Combustion Flow Calibration", contains a "Current" field with "1.0", a "New Flow" field, and a "Measured Flow (lpm)" section with radio buttons for "Off", "Low", "Medium", "High", and "Maximum". There is a "Next" button next to the "Off" radio button. Below these are "Status" and "Start" buttons, and an "Approve" button. At the bottom right, there is a "Backup Calibration" section with "Backup" and "Restore" buttons. The "Ballast Size" section on the left has radio buttons for "4.5 Liter" (selected) and "6 Liter", with a "Set Size" button.

3. Enter the Barometric Pressure from the external barometer in the edit box to the left of Set Pressure in the TC Cell Box.
4. Click Set Pressure to set the pressure entered in the edit box.
5. Click Close to exit this procedure and save the setting.

Set Bridge

Set Bridge sets the gain of the TC Cell.

→
Note

- *The TC Cell gain has been set during the manufacturing process. It is not necessary to reset the gain unless it has been serviced or replaced.*

1. Click Auto Set Bridge to automatically set the gain of the TC Cell. The gain factor will appear in the edit box to the left of the set bridge button.
2. To manually set the gain, enter the gain factor in the edit box and click Set Bridge. The gain factor must be between 0 and 255. This can be used for troubleshooting or servicing the instrument.

Combustion Flow Calibration

Combustion Flow Calibration sets the combustion gas flow rate. A calibrated external gas flow meter must be attached to the instrument exhaust port before this procedure is performed.

→
Note

- *The combustion furnace was calibrated during the manufacturing process. It is not necessary to recalibrate the combustion furnace unless it has been serviced or replaced.*

1. Click Start and wait for the gas flow to stabilize. Enter the flow rate indicated on the external gauge in the edit box.
2. Click Start and enter the gas flow rates for all flows.
3. When finished click approve to enter the new calibration.
4. Remove the external flow meter.

Backup (Hardware) Calibration

Backup Calibration permits the operator to save hardware calibration parameter values in a designated file on the system hard drive. This file can be accessed at a later time to restore hardware calibration values that may have been lost or changed. It is not necessary to backup the calibration values to save them; the instrument will automatically save them in a system file. It is necessary to save them in a backup file if you think you'll ever need to restore them to earlier defined hardware calibration values.

Backup Calibration saves the following parameter values:

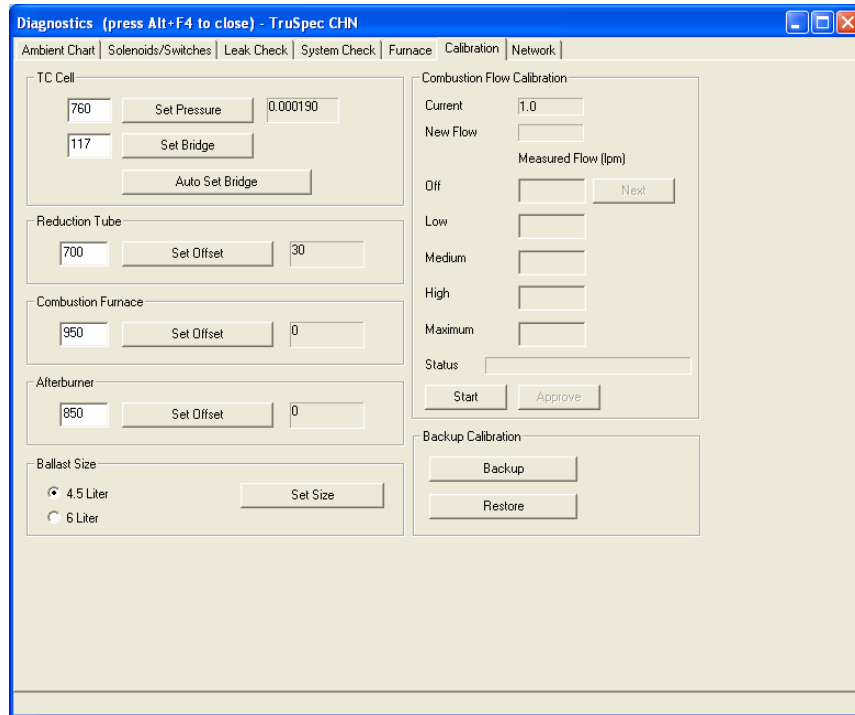
- Barometric Pressure Calibration
- Combustion Flow Calibration
- TC Bridge Value
- Furnace Calibrations
- IR Cell Reference and Saturation Values

Notes

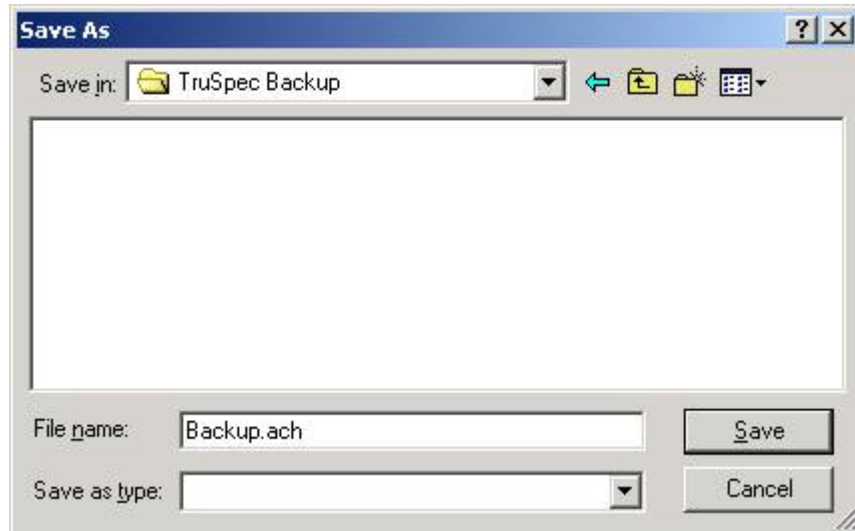
- *Perform this procedure if you feel it will be necessary to restore calibration values that were lost.*
- *It is not necessary to perform this procedure to save the calibration values. The instrument automatically does this in a system file.*

Backup Calibration Values

1. Click Diagnostics and select Calibration. The Hardware Calibration screen will appear.



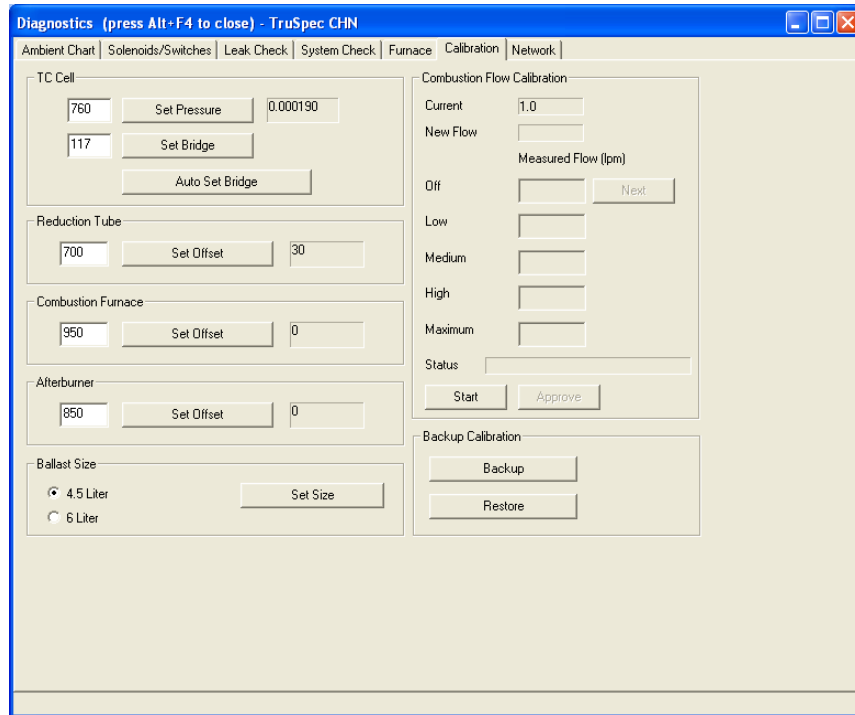
2. Click Backup to create a backup file of the hardware calibration parameter values. The file save as dialog box will appear.



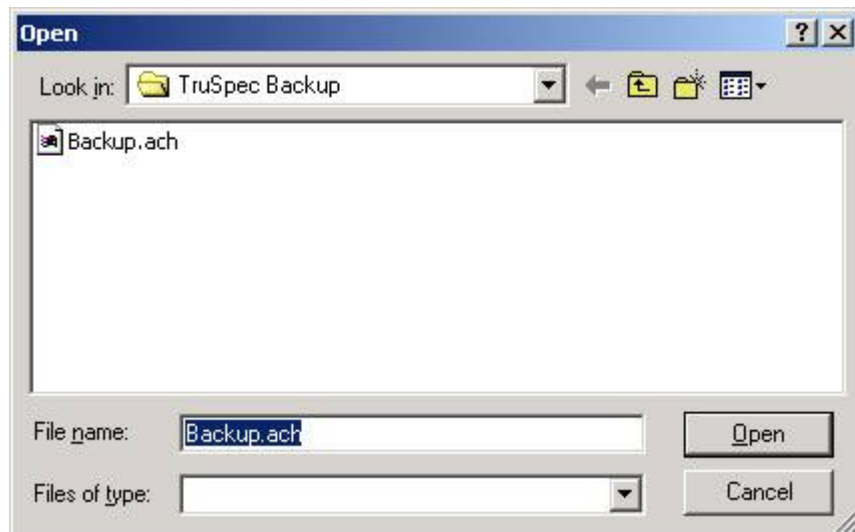
3. Enter the file name and folder location in the dialog box.
4. Click Save to save the backup file.

Restore Calibration Values

1. Click Diagnostics and select Calibration. The Hardware Calibration screen will appear.



2. Click Restore to load the hardware calibration values that have been saved in a backup file. The file open dialog box will appear.



3. Select the folder and backup file from the dialog box.
4. Click Open to load the calibration values from the selected backup file.

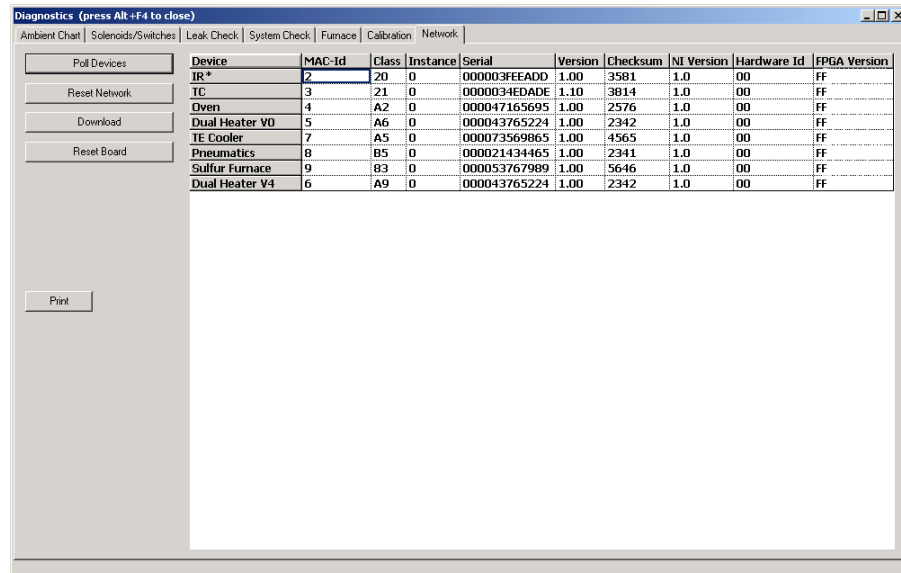
Network Diagnostics

The electronic design of the instrument is modular. It consists of a main controller, similar to a host computer, and peripheral electronic assemblies, which are controlled from the main controller. During operation all peripheral assemblies communicate with the main controller over a common electronic bus. Because of this arrangement information can be displayed and assemblies controlled from the network screen.

From the Network screen the type of hardware installed can be identified, the version of firmware identified, the operational status of the peripheral devices can be determined, the network can be reset, a network device can be reset and the firmware can be upgraded.

The spreadsheet in the upper right area of the screen lists the device, identification, classification, instance used, serial number, version number of the application software, checksum of the applications software and the version of the network software. Refer to Network Definitions on page [8-18](#).

1. Click Diagnostics and select Network. The Network screen will appear.



| Device | MAC-Id | Class | Instance | Serial | Version | Checksum | NI Version | Hardware Id | FPGA Version |
|----------------|--------|-------|----------|--------------|---------|----------|------------|-------------|--------------|
| IR* | 2 | 20 | 0 | 000003FEEADD | 1.00 | 3581 | 1.0 | 00 | FF |
| TC | 3 | 21 | 0 | 0000034EDADE | 1.10 | 3814 | 1.0 | 00 | FF |
| Oven | 4 | A2 | 0 | 000047165695 | 1.00 | 2576 | 1.0 | 00 | FF |
| Dual Heater V0 | 5 | A6 | 0 | 000043765224 | 1.00 | 2342 | 1.0 | 00 | FF |
| TE Cooler | 7 | A5 | 0 | 000073569865 | 1.00 | 4565 | 1.0 | 00 | FF |
| Pneumatics | 8 | B5 | 0 | 000021434465 | 1.00 | 2341 | 1.0 | 00 | FF |
| Sulfur Furnace | 9 | B3 | 0 | 000053767989 | 1.00 | 5646 | 1.0 | 00 | FF |
| Dual Heater V4 | 6 | A9 | 0 | 000043765224 | 1.00 | 2342 | 1.0 | 00 | FF |

Poll Devices

Click Poll Devices to send a signal over the network to determine what is connected to the network. Network hardware should appear under devices indicating they are functioning and signing on to the network.

Reset Network

Click Reset Network to restart the network software. If something or some operation causes an error this may correct it.

Upgrade a Device

1. To upgrade a device with a new version of application firmware, click the Device to upgrade. Then click Download to download the new firmware.
2. Click Reset Board to restart firmware application program on the circuit board.

Network Definitions

Device—The name of the electronic assembly connected to the network. Example: TC Cell.

MAC-id—The network ID number assigned to the electronic assembly connected to the network. This number is assigned at power up and can vary.

Class—The type number of the electronic assembly signed on to the network. Example: 21 is the class number assigned to the TC Cell.

Instance—A unique number assigned to an electronic assembly. If two or more of the same type electronic assemblies are installed in the instrument this number will be different for each assembly and is used by the controller to differentiate one from the other.

Serial—The hardware ID number assigned to the electronic assembly. This number is assigned during manufacturing and is unique to each electronic assembly. The serial number is stored on the circuit board in a PROM.

Version—The version number of the application software located on the electronic assembly. This software can be upgraded from the network procedure.

Checksum—A number unique to the application software to verify if the software was properly installed. There will be a checksum number supplied with any software upgrades. Make sure that the number appearing in the checksum cell is the same as the number supplied with the software upgrade.

NI Version—The version number of the network control software installed in the electronic assembly. This software is located in a PROM and cannot be upgraded from the network procedure.

Hardware ID—Additional circuit board hardware identification.

FPGA Version—The version of the FPGA (Field Programmable Gate Array) software.

Furnace Diagnostics

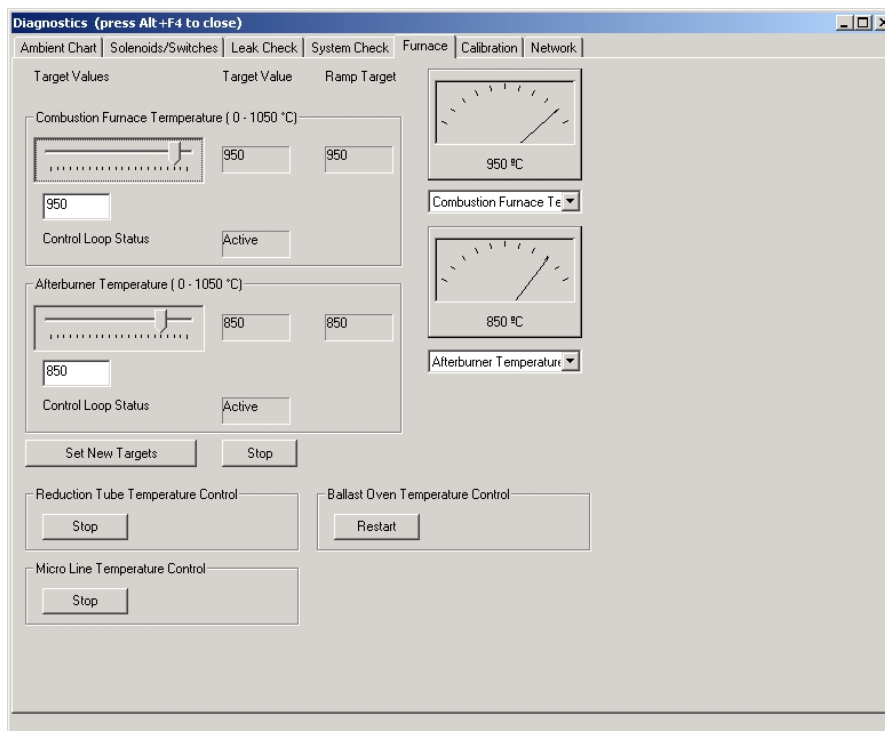
The Furnace diagnostics screen is used to test the furnace and verify proper operation. The meters on the right side of the screen can be used to monitor Furnace Temperature and Furnace Over Temperature.

When testing the furnace, set the temperature and observe the target value. The furnace should ramp to the set value and remain there. Refer to Furnace Diagnostics Definitions on page [8-21](#).



Furnace over temperature is measured by a second thermocouple in the furnace. This is a safety function to prevent excessive furnace temperature. Furnace over temperature should usually be a lower than the current furnace temperature. If this value is significantly different than the current furnace temperature contact the LECO service department.

Click Diagnostics and select Furnace. The Furnace diagnostics screen will appear.



Furnace Temperature Control

The Combustion Temperature and Afterburner Temperature dialog boxes permit the operator to set the furnace temperatures for service and Maintenance.



After exiting diagnostics any temperatures that were changed will revert back to their previous settings.

Combustion Furnace and Afterburner Temperature Control

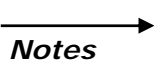
1. Click the temperature edit box, or move the slider, and enter the desired furnace temperature.
2. Click Set New Targets to set the furnace temperature. The furnace will increase or decrease in temperature to the set temperature.



LECO doesn't recommend using the stop button to set the furnace to ambient. This disables electronic control of the furnace. Instead, set the target temperature below ambient and click Set New Targets.

3. Click Stop to disable control of the furnace temperature. The temperature will decrease to ambient.

Reduction Tube Temperature Control



- *The reduction tube temperature control dialog box is used to turn the reduction heater off or on. When control is turned on the reduction tube temperature is automatically set to 700°C.*
 - *The reduction tube heater is also referred to as the catalyst heater.*
1. Click Stop to turn temperature control of the reduction tube heater off.
 2. Click Restart to turn temperature control of the reduction tube heater on.

Micro Line Temperature Control

Notes

- *The micro line temperature control dialog box is used to turn the micro line heater off or on. When control is turned on the micro line heater temperature is automatically set to 110°C.*
 - *The micro line heater is used to heat the combustion gas as it leaves the combustion furnace.*
 - *This setting is only for the TruSpec Micro.*
1. Click Stop to turn temperature control of the micro line heater off.
 2. Click Restart to turn temperature control of the micro line heater on.

Ballast Oven Temperature Control

Note

- *The ballast oven temperature control dialog box is used to turn the ballast oven heater off or on. When control is turned on the ballast oven temperature is automatically set to 50°C.*
1. Click Stop to turn temperature control of the ballast oven heater off.
 2. Click Restart to turn temperature control of the ballast oven heater on.

Furnace Diagnostics Definitions

Target Value—The temperature that the furnace will ramp to. This can be higher or lower than the current temperature. This value is set by the slider and appears in the window below target value.

Ramp Target—The current temperature of the furnace. The ramp target temperature will change at the furnace temperature increases or decreases.

Leak Check

————→
Note

- *DO NOT perform a leak check until the furnace temperature has stabilized.*

This procedure automatically checks the combustion (oxygen) and measurement (helium) system of the instrument for a gas leak. The entire system or a segment of the system can be checked. Performing both tests can isolate a leak. If the system leak check fails, perform a segmented test to determine which section of the system is leaking.

During a leak check the system is pressured above current system furnace pressure and sealed. It's then permitted to equilibrate. For the next 60 seconds the system pressure is measured. If the pressure doesn't fall below 5 mm Hg of the pressurized value or rise above 2.5 mmHg of the pressurized value the leak check will pass. If the pressure changes more the leak check fails.

If pressure has increased a solenoid valve is not operating properly or the catalyst heater temperature has not stabilized. If pressure has decreased gas could be leaking out of the system.

If the system leaks "**Leak Check Failed**" appears in the leak check status bar. If the system doesn't leak "**Leak Check Passed**" appears in the status bar.

Let the instrument warm up for at least for 30 minutes before performing a leak check. A Leak check should be preformed at the start of each day.

How to Perform a Leak Check

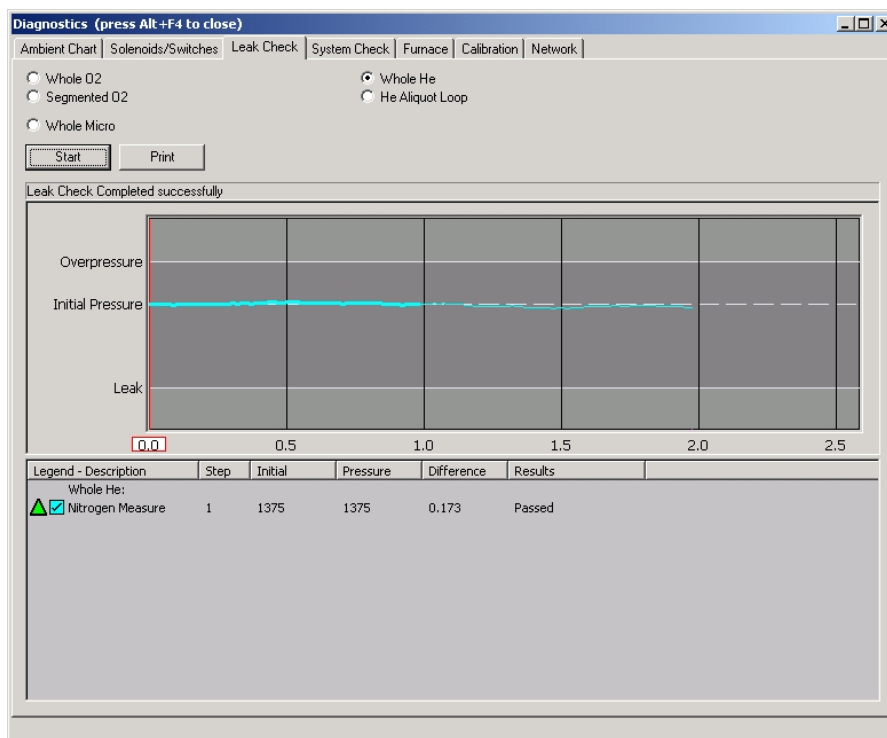
There are two leak checks, a whole system leak check and a segmented system leak check. Like its name implies, the segmented leak check isolates small sections of the system and tests them individually. When performing a leak check, first perform a whole system check and determine if the systems passes. If it does, STOP there, it's not necessary to continue with the segmented test. If the whole system leak check doesn't pass, then perform a segmented test. By isolating sections of the system you can determine which section is leaking and concentrate your service efforts in that area.

It's possible for the whole system leak check to pass, and a segmented leak check to fail. The whole system has a greater volume than the isolated systems. Because of this, a small leak to the whole system leak check looks like a large leak to an isolated segment leak check. As long as the whole system leak check passes the instrument is operating properly and is capable of producing excellent results.

Note

- Refer to *Leak Check Screen Definitions and Leak Check Legend Symbols* on page 8–24 for additional information.

6. Click Diagnostics and select Leak Check. The Leak Check screen will appear.



7. Click a button in the upper left of the screen to select the leak check procedure to perform. Only one procedure can be selected at a time.
8. Click Start to perform a leak check. System pressure is monitored in the chart at the middle of the screen.
9. Click Stop to abort a leak check in progress.
10. Click Print to print the results of a completed leak check on the system printer.

Leak Check Definitions


- **Note**
- Refer to the *Leak Check Diagrams* on page [8-26](#) to determine where each system, listed below, is located in the instrument.
- Whole Oxygen*—Click this button to pressurize and leak check the entire combustion system.
- Whole Helium*—Click this button to pressurize and leak check the entire measurement system.
- **Note**
- The *Segmented Oxygen* consists of four different sections, *Combustion, Ballast, IR Monitor Cell and IR Cells*.
- Segmented Oxygen*—Click this button to pressurize and leak check the combustion system. The combustion system will be leak checked in three steps.
- He Aliquot Loop*—Click this button to pressurize and leak check the measurement system. The measurement system will be leak checked in two steps.
- Whole Micro*—Click this button to pressurize and leak check the entire TruSpec Micro combustion system. The TruSpec Microanalysis Kit must be installed for this selection to appear. Refer to TruSpec Micro Kit on page [1-27](#).
- Initial Pressure (graph)*—The system pressure before the leak check is started. The system is pressurized to this value.
- Overpressure (graph)*—Overpressure is approximately 2.5 mmHg above initial pressure. If the pressure rises above this value the leak check will fail.
- Leak (graph)*—Leak pressure is approximately 5 mmHg below initial pressure. If the pressure falls below this value the leak check will fail.

Leak Check Legend Symbols

Under Legend on the leak check screen are two columns of symbols.

The first column represents the measurement transducer. After the test is complete, the color of the symbol represents test results.


The second column represents test progress. Before the test starts the box is empty, no color. As soon as the test starts the box is filled with a color. After the test is complete a check mark appears in the box.

 Combustion Pressure Transducer symbol. After the leak check is finished the color indicates the test result.

Green—The leak check passed.

Red—The leak check failed. Decrease in system pressure. An X will appear over the symbol.


Yellow—The leak check failed. Increase in system pressure.

 Ballast Pressure Transducer symbol. After the leak check is finished the color indicates the test result.


Green—The leak check passed.

Red—The leak check failed. Decrease in system pressure. An X will appear over the symbol.

Yellow—The leak check failed. Increase in system pressure.

 This symbol indicates leak check progress. No color indicates leak check is not started.

 This symbol indicates leak check progress. Color indicates leak check has started.

 This symbol indicates leak check progress. A check mark indicates leak check has finished.

Leak Check Flow Diagrams

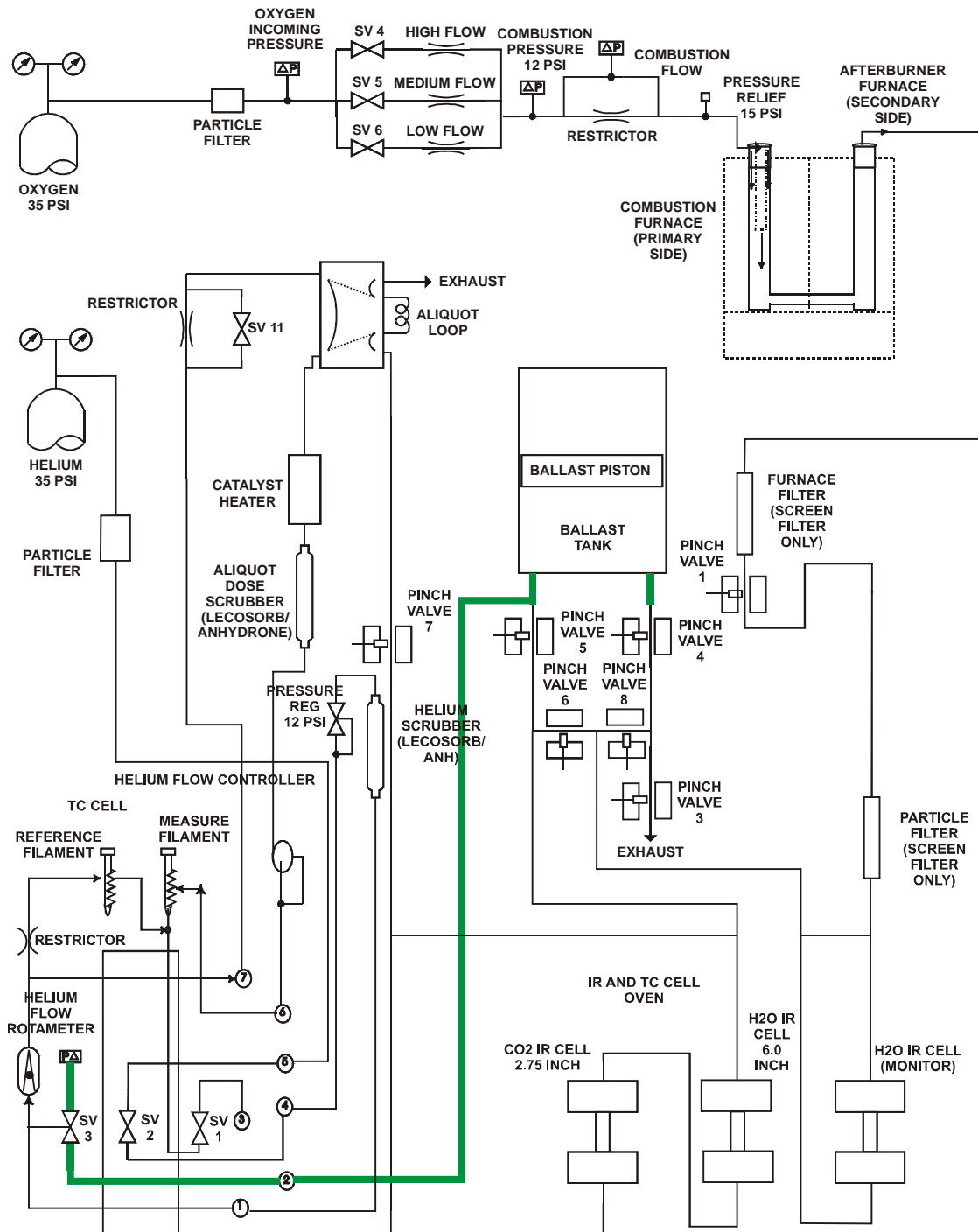


Figure 8-1
Ballast Leak Check—TruSpec CHN

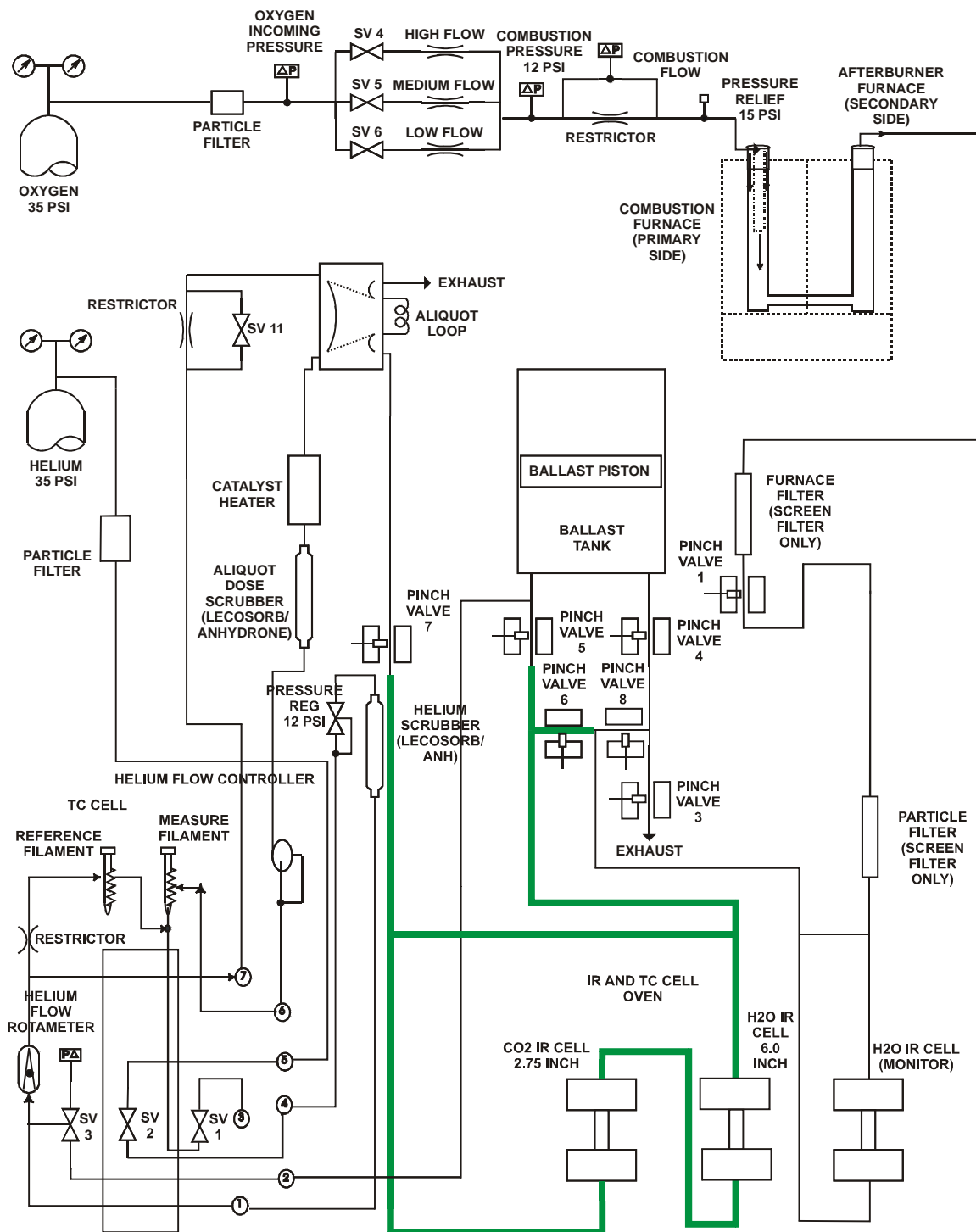


Figure 8-2
IR Cells Leak Check—TruSpec CHN

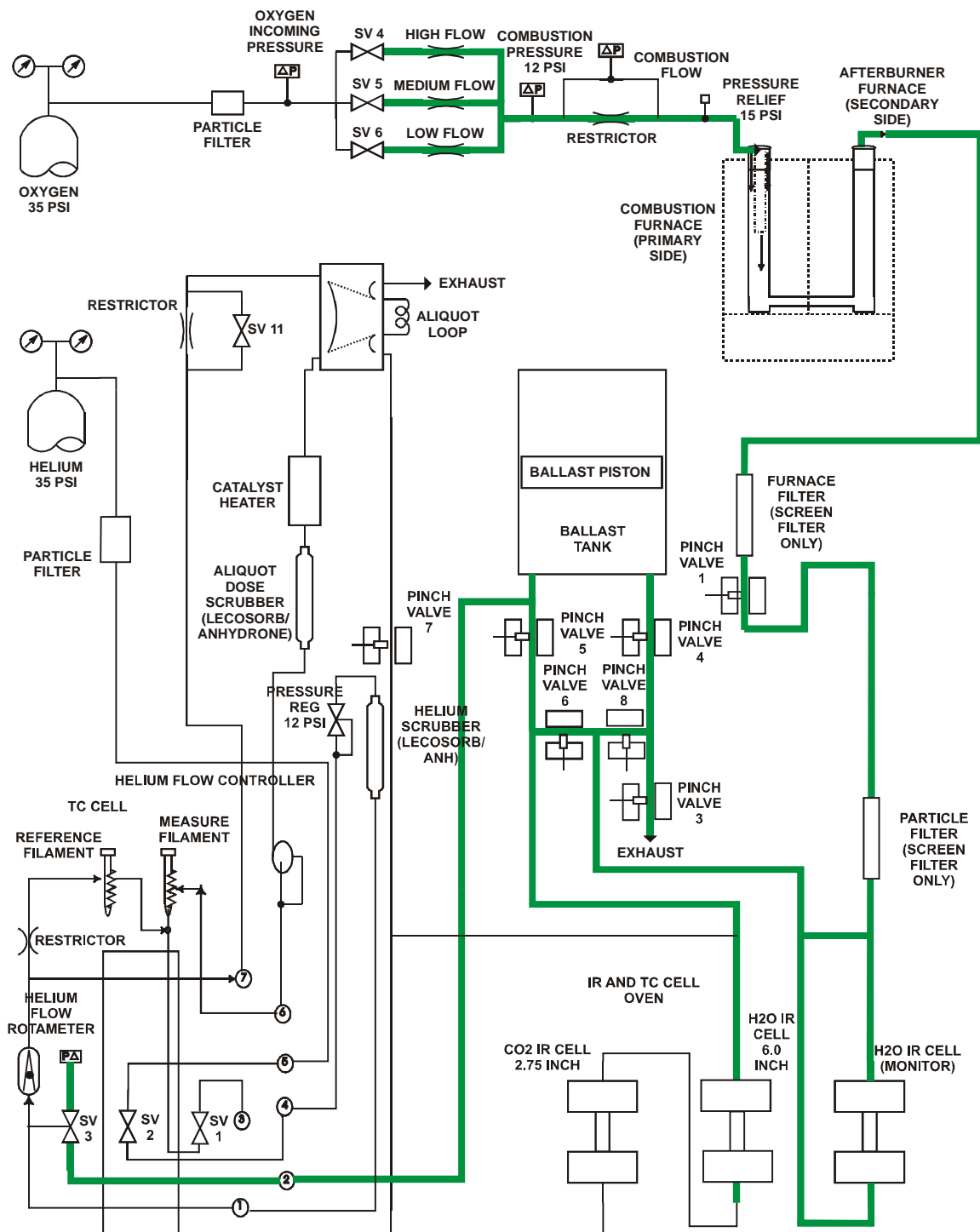


Figure 8-3
Oxygen System Leak Check—TruSpec CHN

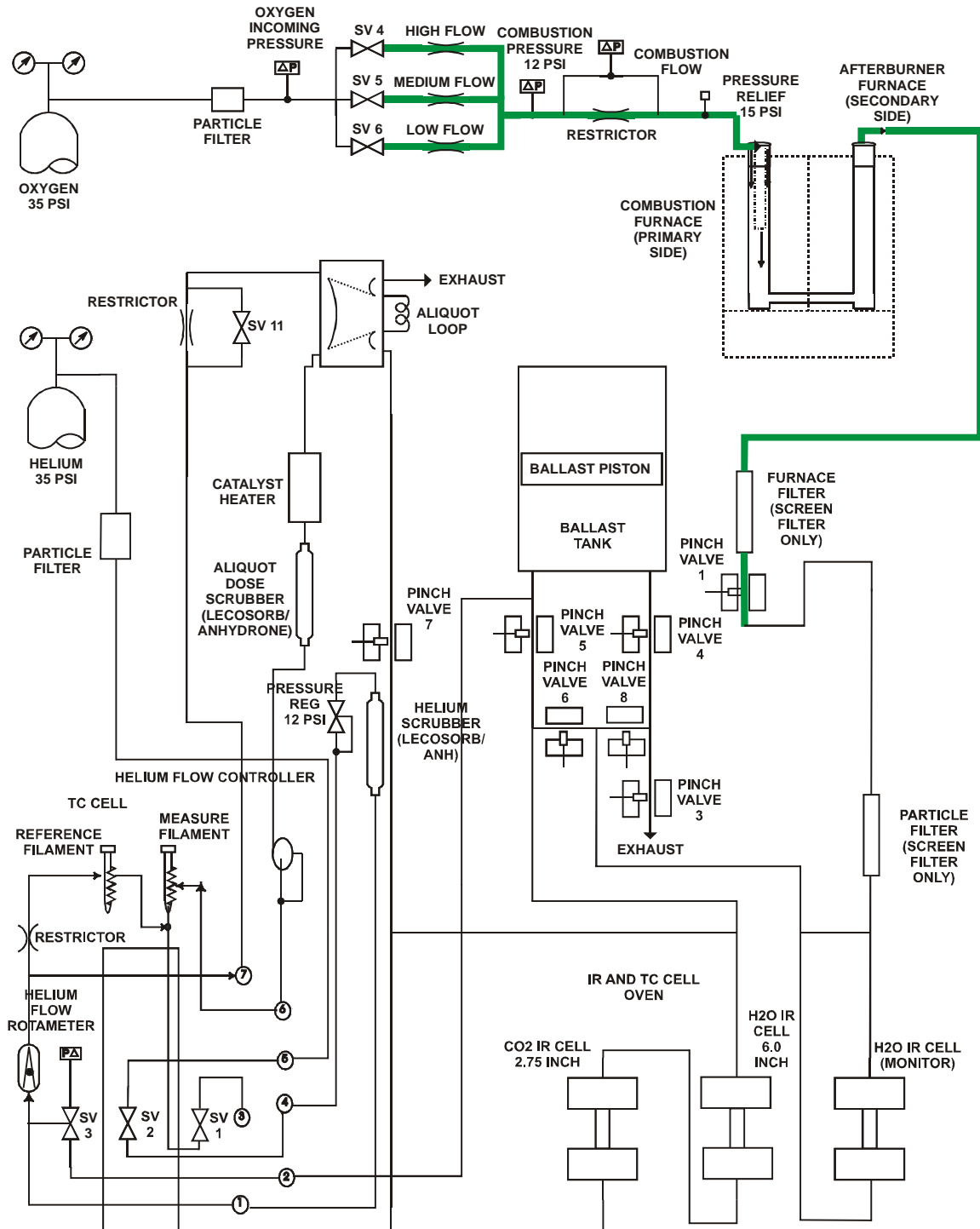


Figure 8-4
Combustion System Leak Check Diagram—TruSpec CHN

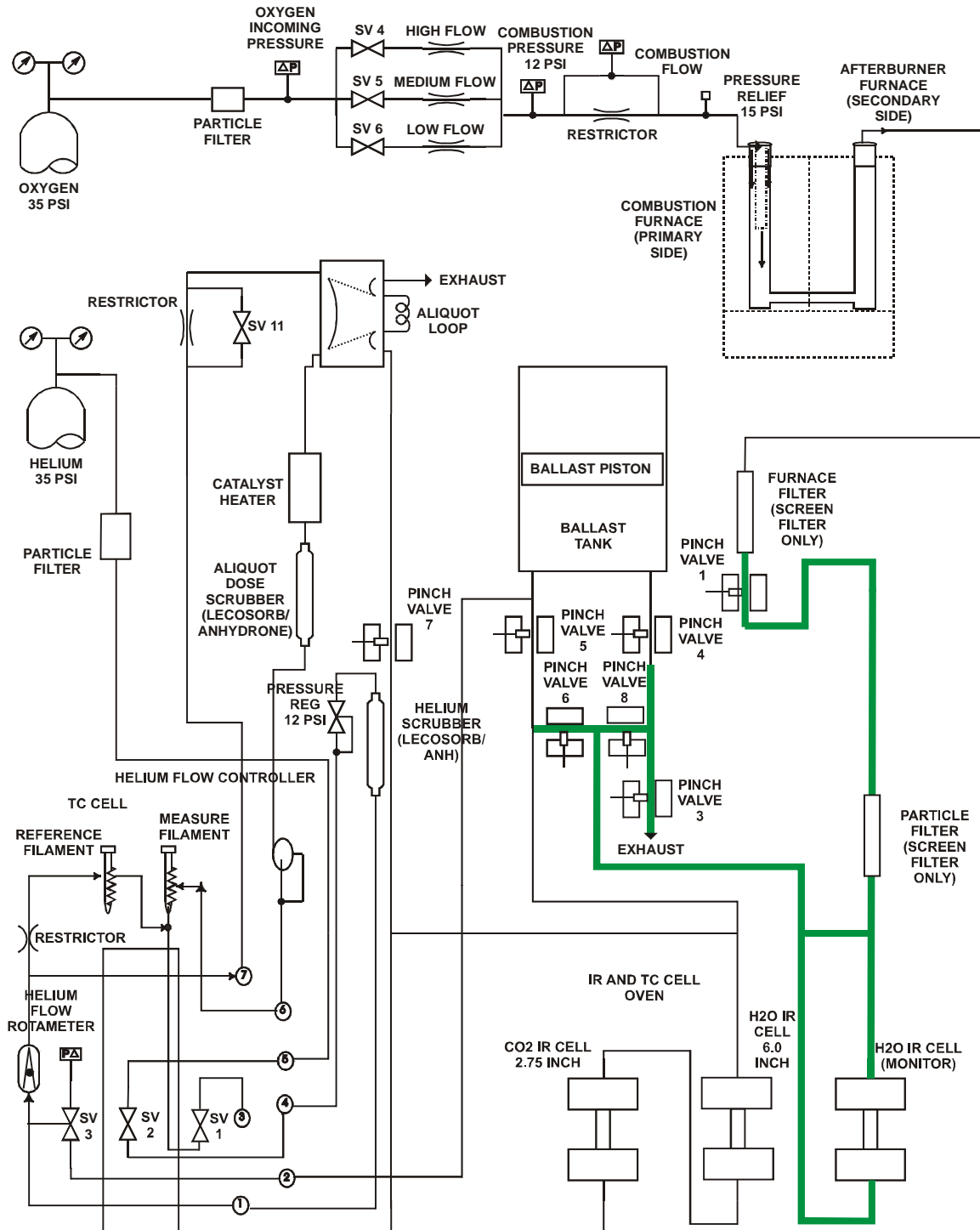


Figure 8-5
IR Monitor Cell Leak Check—TruSpec CHN

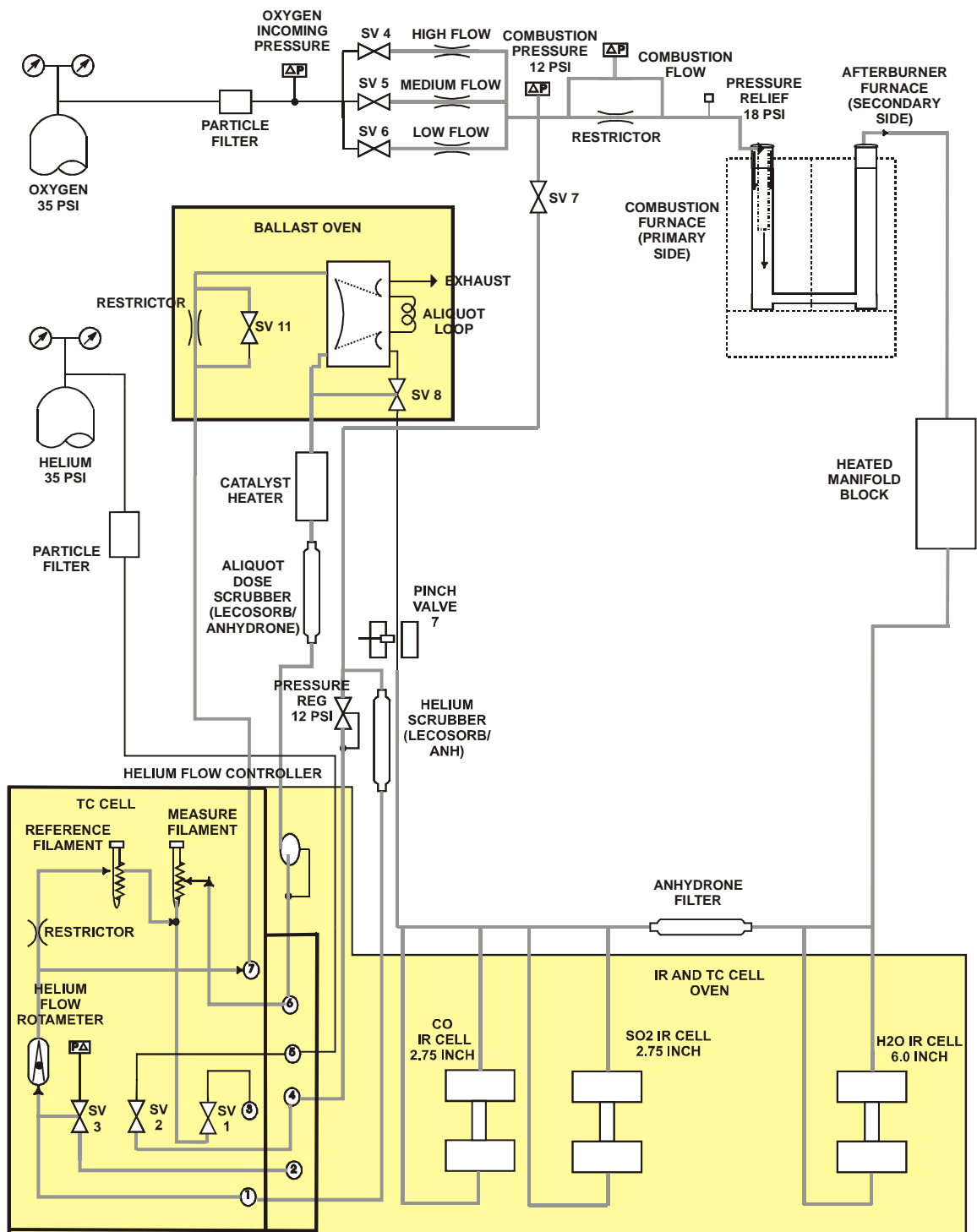


Figure 8-6
Combustion System Leak Check—TruSpec Micro

System Check

System check is a quick way to determine if major systems in the instrument are operating properly. All systems should have a green indicator beside them before the instrument is used for analysis.

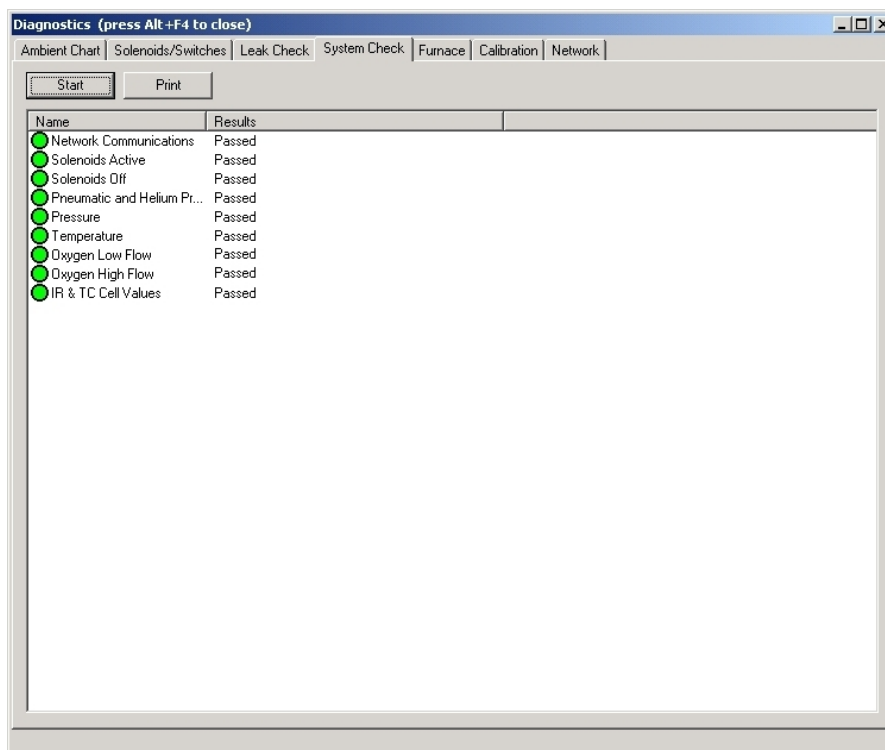
The results of system check will be listed in the results column to the right of the item checked. If any of the system checks fail, the reason will be listed in the results column.

If a system fails system check, it will be necessary to correct the failure before analysis. Refer to System Check Definitions on page 8-33.

→
Note

- *If System Check is run in the micro-mode, Oxygen Low Flow and Oxygen High Flow will be skipped. This prevents rapid depletion of the reagents.*

1. Click Diagnostics and select System Check. The System Check screen will appear.



2. Click Start to system check and test the systems listed on the screen.
3. The results of system check will be displayed to the right of the system being checked under the results column. An X inside the circle to the left of the system also indicates the system checked failed.
4. Click Print to print the results of the system check on the system printer.

System Check Definitions

Network Communications—Communications between all electronic assemblies are checked and monitored. If any device on the network fails to communicate this system check will fail. Refer to Network Diagnostics on page [8-16](#) for more information.

Solenoid Active—During this check each solenoid valve is activated and monitored. If any solenoid valve fails to activate system check will fail. Refer to Solenoids and Switches on page [8-35](#) to check each solenoid valve individually.

Solenoids Off—During this check each solenoid valve is deactivated and monitored. If any solenoid valve fails to deactivate system check will fail. Refer to Solenoids and Switches on page [8-35](#) to check each solenoid valves individually.

Pneumatic and Helium Pressure—Checks the incoming pneumatic and helium pressures to determine if they have been turned on and set to the proper value. If this check fails check the pneumatic and helium gas tanks to determine if the gas has been turned on and the regulator properly set. If any pressure falls outside the range listed below the test will fail.

- Pneumatic Pressure Range—38 to 42 psi.
- Helium Pressure Range—10 to 13.1 psi.

Pressure—Checks the combustion, incoming oxygen and TC ballast pressures for their proper values. If any pressure falls outside the range listed below the test will fail.

- Combustion Pressure Range—0 to 2 psi.
- Incoming Oxygen Pressure Range—30 to 40 psi.
- TC Ballast Pressure Range—700 to 780 mmHg.

Temperature—Checks the temperature of all heaters to determine if they're properly set and operating. If any temperature falls outside the range listed below the test will fail.

- TE Cooler Temperature Range—2°C to 10°C.
- Oven Heater Temperature Range—5°C to 55°C.
- Combustion Furnace, Afterburner Furnace, Reduction Heater Temperature Range— \pm 10% of set point.
- Oven Temperature Range—set point to + 50°C.

Oxygen Low Flow—Checks oxygen low flow. If any pressure falls outside the range listed below the test will fail.

- Low Flow Range—0.19 to 0.41 lpm.

Oxygen High Flow—Checks oxygen high flow. If any pressure falls outside the range listed below the test will fail.

- High Flow Range—3.99 to 5.01 lpm.

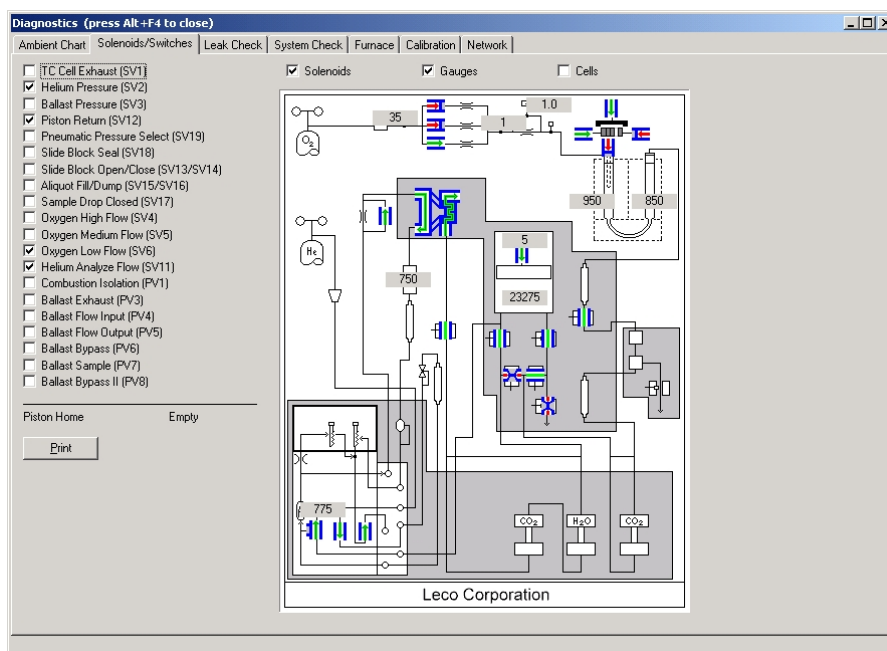
IR and TC Cell Values—Checks the IR and TC cell output voltages to determine if they are in the proper range. Refer to Ambient Monitor Definitions on page [8-7](#) for more information. If any voltage falls outside the range listed below the test will fail.

- IR Cell Output Voltage Range—1.0 to 4.8 volts
- TC Cell Output Voltage Range—0.1 to 1.5 volts

Solenoids and Switches

Solenoids and Switches permit the service technician or operator to individually activate and deactivate each of the solenoid valves. This is a diagnostic test to determine the condition of the valve and its operational result. As an example, the slide block can be moved to determine its condition by toggling the Slide Block solenoid valve. To determine what each valve may affect refer to the Measurement Flow Diagram, on page 7-4.

1. Click Diagnostics and select Solenoids and Switches. The Solenoids and Switches screen will appear.



2. Click the Check Box next to the desired solenoid valve or switch to activate or deactivate it. A check mark in the box indicates it's activated.
3. Check Solenoids to highlight and locate the solenoid valves on the flow diagram.
4. Check Gauges to locate the system pressure gauges and display their current pressure reading on the flow diagram.
5. Check Cells to locate the IR and TC cells and display their current cell voltage on the flow diagram.

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9 Service

This section contains common service procedures that may correct operational problems with the instrument. If you still experience difficulties after referencing this information, please contact the LECO Service Department at 269-982-5497 for assistance.

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Installing LECO Software

The following section explains the required settings, below, and the installation procedure, page 9-7, for LECO software. Additional information can be found in Configuring the Ethernet Adaptor, page 9-13, Configuring Firewall Settings, page 9-17, and Registering the Software, page 9-18.

Required Settings for LECO Software

Operating System (OS) Requirements

The following table explains the minimum settings required for LECO software. LECO recommends that the system always be updated to correspond with the latest service packs available at www.microsoft.com.

| Windows OS | Minimum Requirements |
|------------|----------------------|
| 2000 | *SP4; **URP1; ***IE6 |
| XP | SP2 |
| Vista | None |

*SP=Service Pack; **URP=Update Rollup; ***IE=Internet Explorer

OS User Permission Requirements

The following table shows the minimum permissions that a user must have in the Microsoft Windows OS in order to perform certain tasks in the software. Refer to Users Permissions.

| Task | Minimum Permission |
|---------------------|--------------------|
| Using Software | Standard User |
| Installing Software | Administrator |
| Upgrading Software | Administrator |
| Setting up Users | Administrator |
| LECO Service | Administrator |

Data File Permissions

To use LECO software, read-write access is required for all the data files. The proper permissions are automatically set up during the software installation; however, if these permissions are ever changed, file access errors can occur. The following table shows the data folders that require read-write permissions.

| Windows OS | Data Folder (including all subfolders/files) (Use the appropriate drive letter, typically C.) |
|-------------------|--|
| 2000 | C:\Documents and Settings\All Users\Application Data\LECO |
| XP | C:\Documents and Settings\All Users\Application Data\LECO |
| Vista | ProgramData\LECO (hidden OS folder) |

Antivirus Software

LECO recommends that antivirus checking be turned off for the files listed below to avoid interference with data collection or storage.

| Windows OS | Data Folder (including all subfolders/files) (Use the appropriate drive letter, typically C.) |
|-------------------|--|
| 2000 | C:\Documents and Settings\All Users\Application Data\LECO |
| XP | C:\Documents and Settings\All Users\Application Data\LECO |
| Vista | ProgramData\LECO (hidden OS folder) |

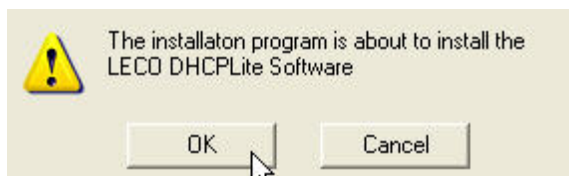
Control Panel Settings

| Control Panel Item | | Required Setting |
|---------------------------|-------------------------|--|
| Power Options | Power Schemes | Always On |
| | Turn off Hard Disks | Never |
| User Accounts | Use Fast User Switching | If Fast User Switching is active (off by default on PCs from LECO), close the LECO software in one account before switching to a different account and trying to run it there. |

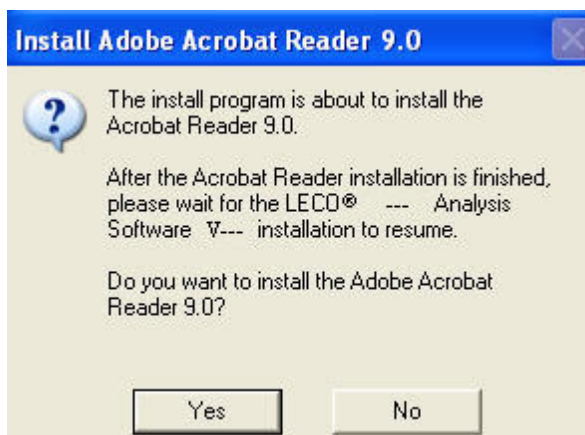
Software Installation Procedure

NOTE →

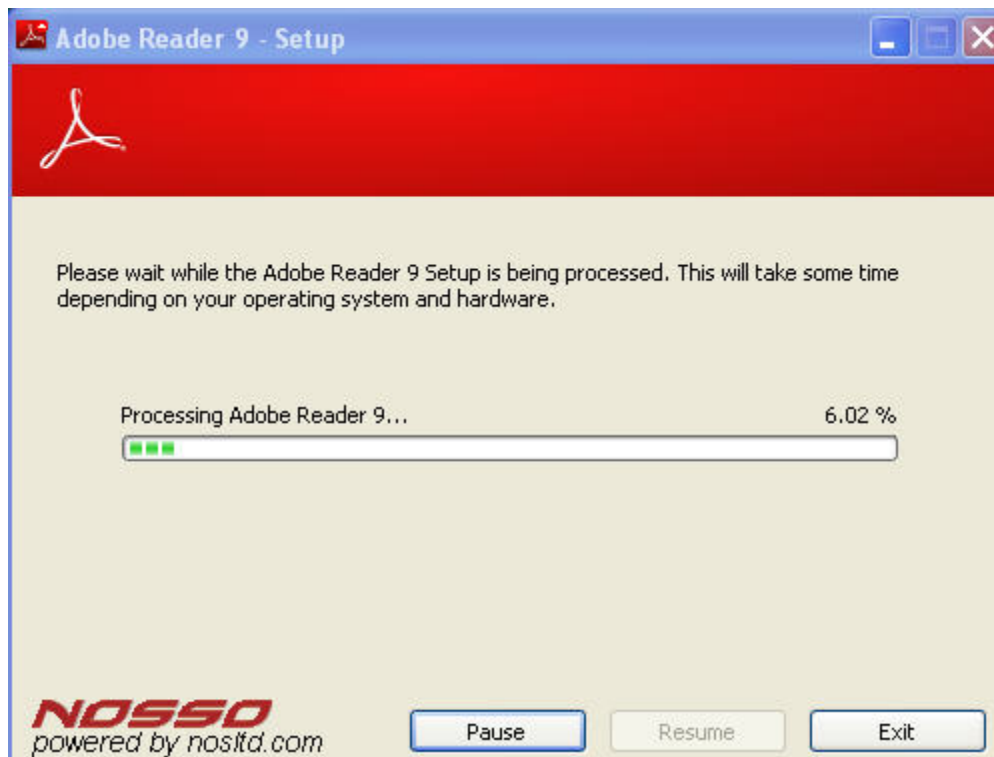
- The software must be started at least once on the administrative level since the software must be able to access and modify the registry.
 - Do not install the Copy Protection Key until after the software has been installed.
1. Verify the instrument is turned off.
 2. Turn on the computer tower.
 3. Install the communications cable (typically Ethernet or USB) as appropriate for the instrument.
 4. For an Ethernet connection, configure the Ethernet adapter. Refer to Configuring Ethernet Adapter, page 9-13.
 5. Log in to the operating system as administrator.
 6. Insert the software installation CD-ROM into the CD-ROM disk drive (typically D).
 7. Install the LECO DHCLite software by clicking OK when the following message appears. (If the LECO DHCLite software is already installed or not applicable, this message will not appear.)



8. If a version of Adobe Reader is already installed, refer to step 14. If Adobe Reader is not installed, the following dialog box will appear.



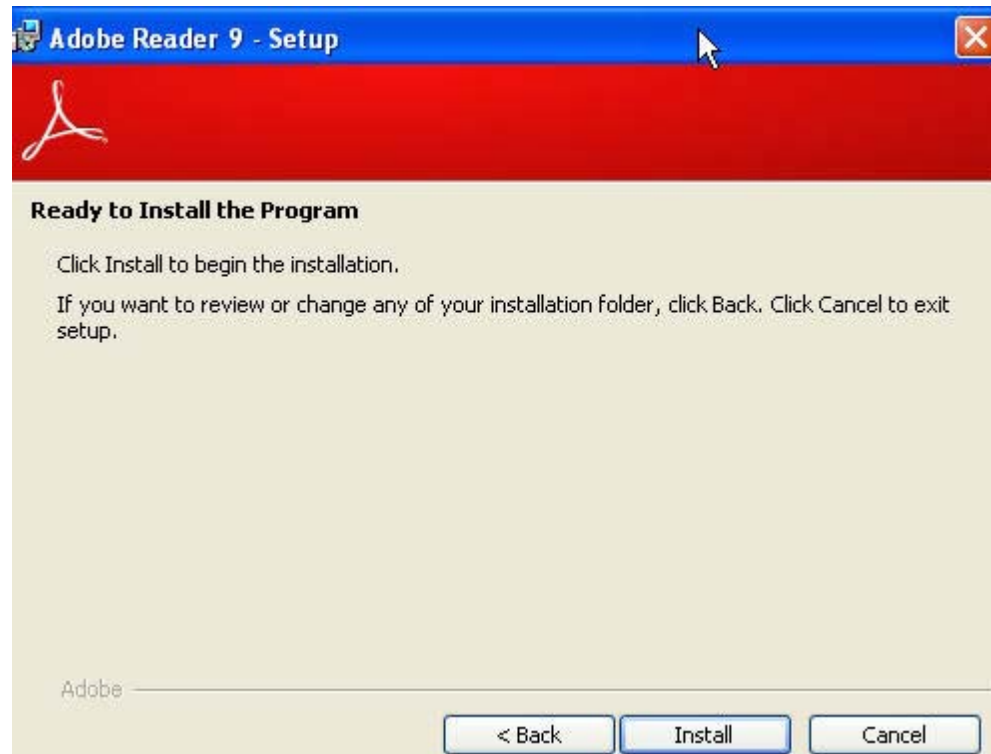
9. Select Next. The following message box will appear to indicate Adobe Reader is preparing for installation.



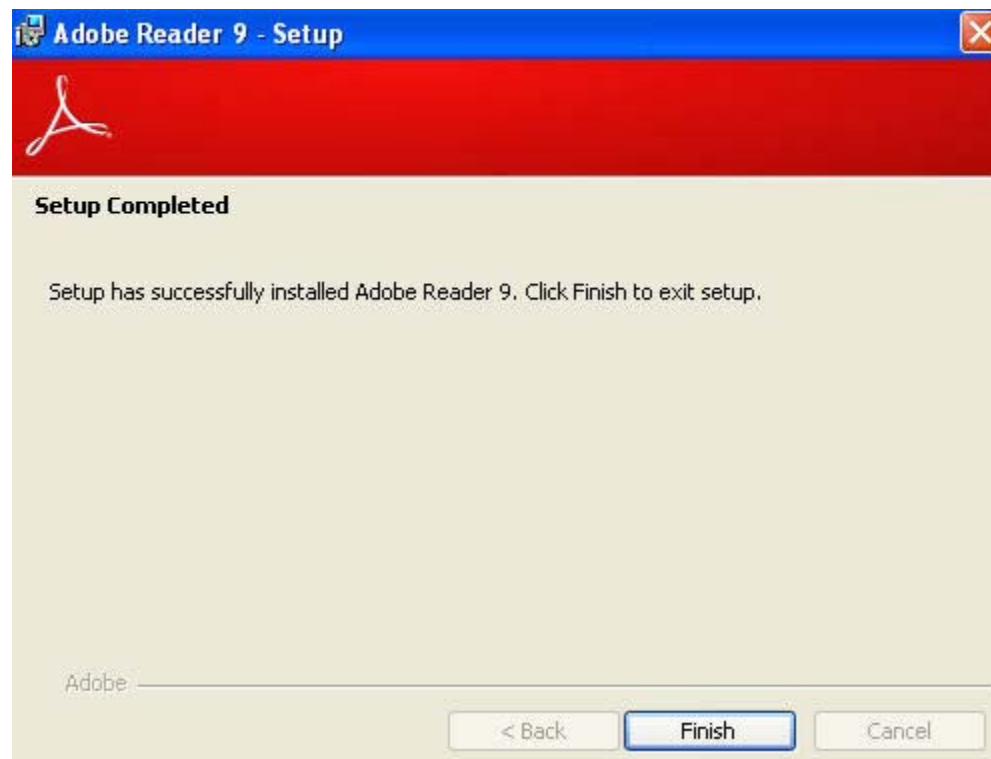
10. Determine the folder location for Adobe Reader. Select Next for the default location, or select Browse, select a different location, and then select Next.



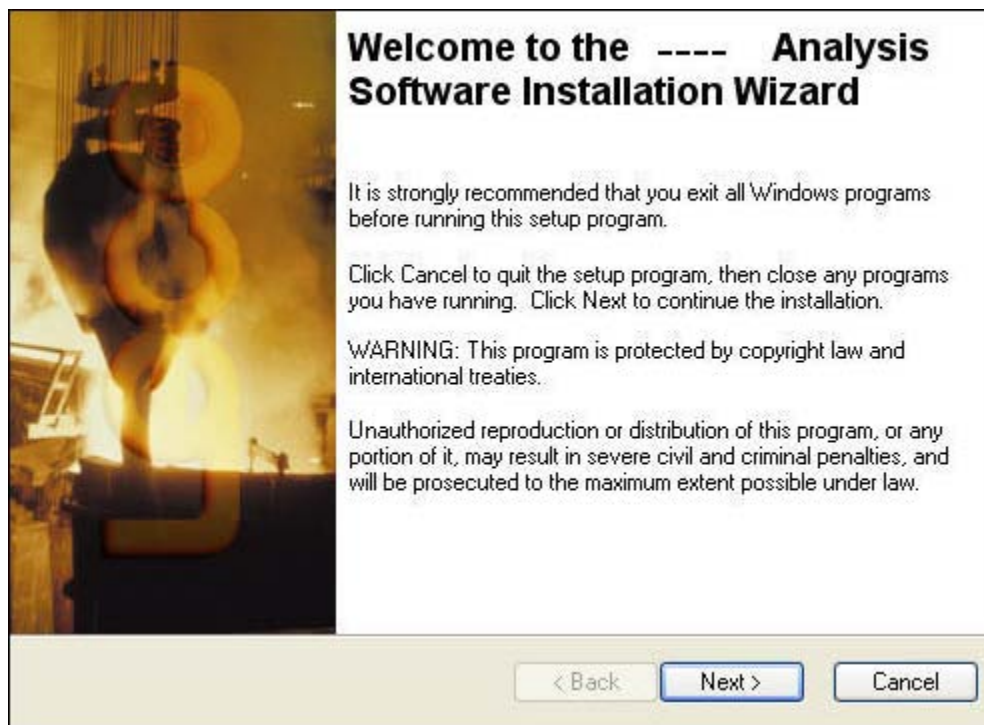
11. When the "Ready to Install Program" dialog box appears, click Install.



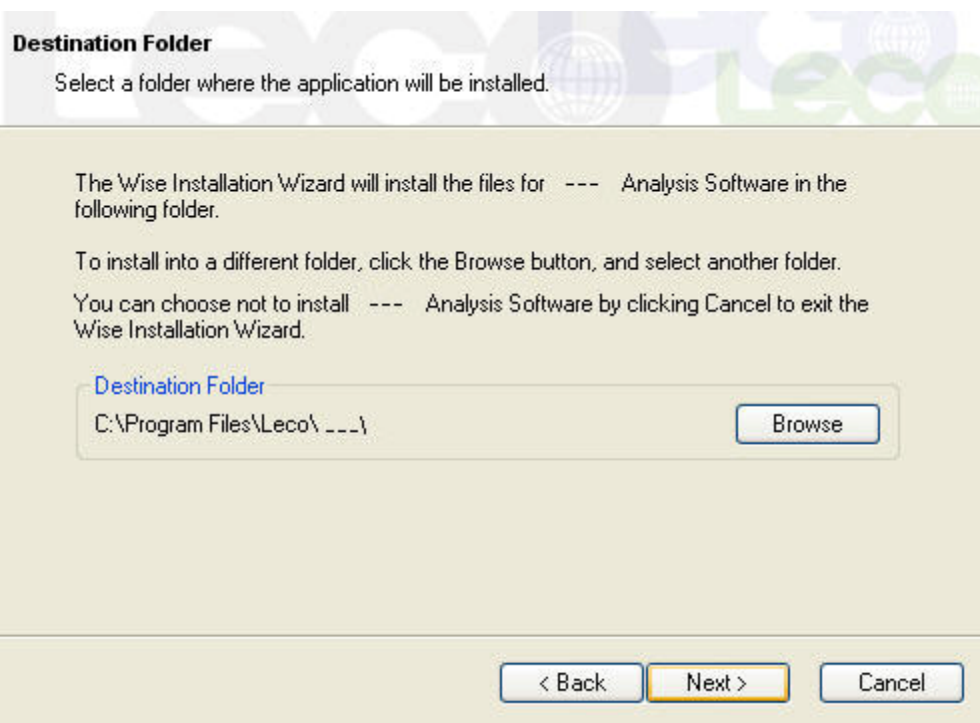
12. When the "Setup Completed" dialog box appears, click Finish.



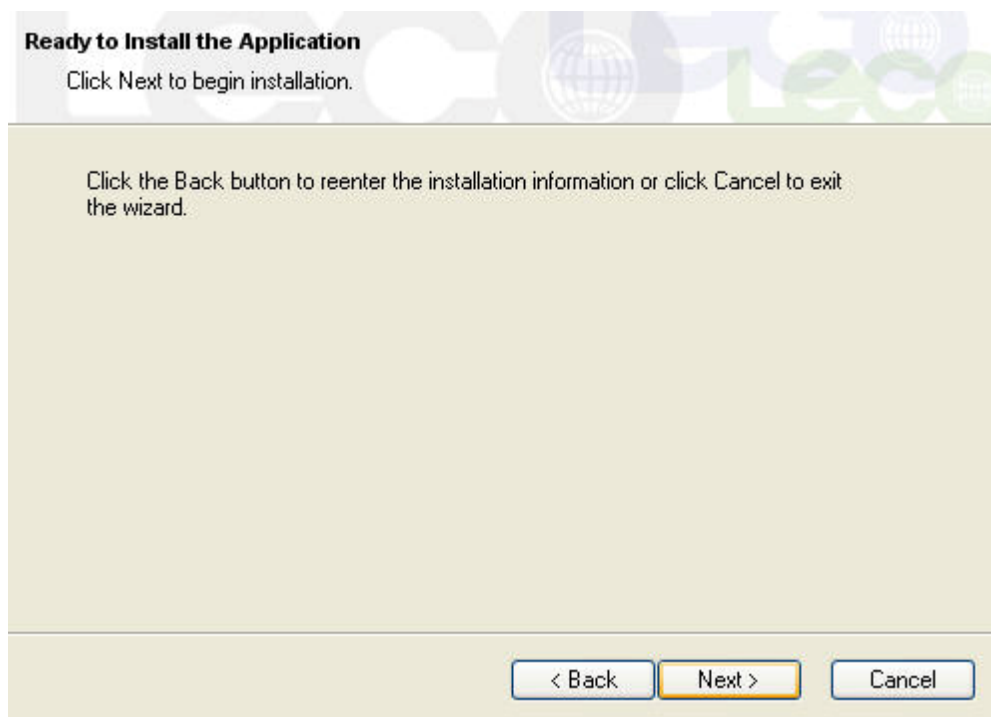
13. If the instrument software Welcome dialog box does not appear
 - A. Select the Start button in the lower left-hand corner.
 - B. Select Run. The Run dialog box is displayed.
 - C. Enter D:\Setup.exe and then select OK. (The letter D indicates the location of the CD Rom drive. Typically this drive is D, but the letter that is entered should correspond with the CD-ROM drive on the computer's hard drive.)
14. At the instrument software Welcome dialog box, click Next.



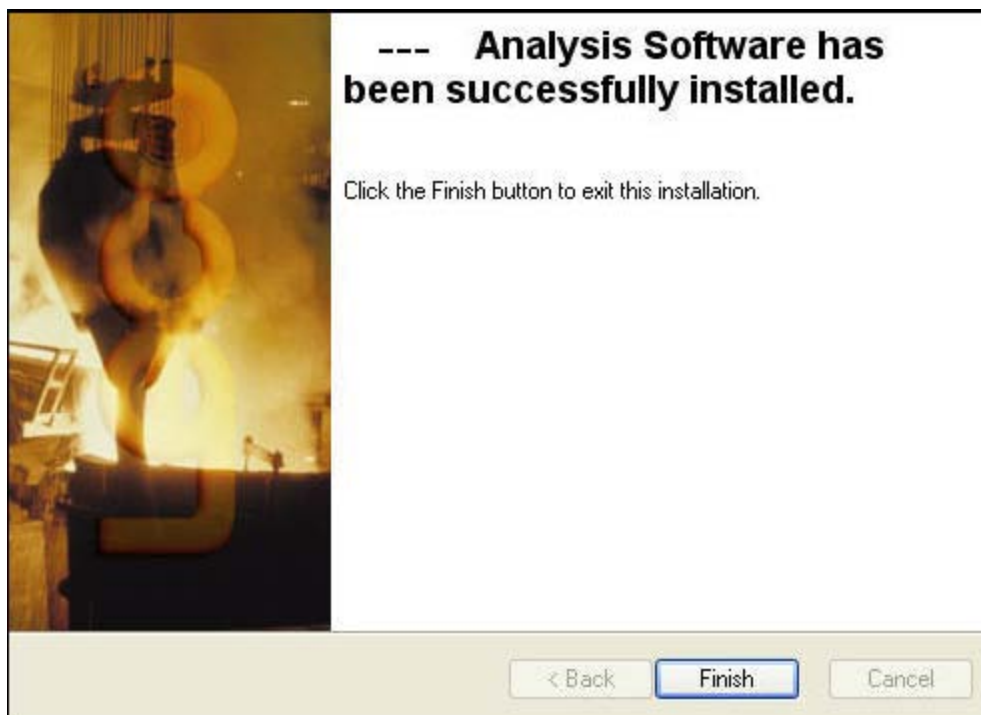
15. Determine the folder location for the software. Select Next for the default location, or select Browse, select a different location, and then select Next.



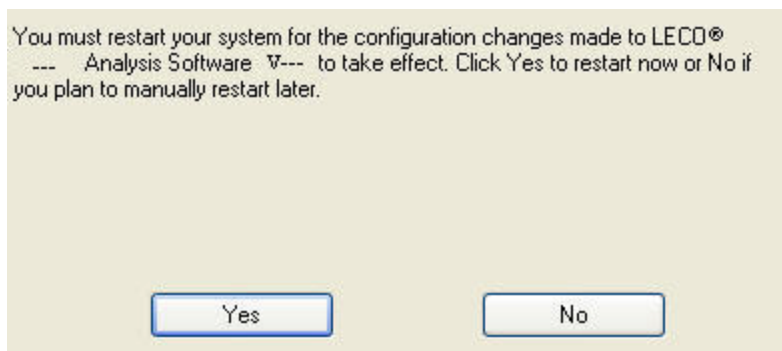
16. Select Next to install the software.



17. Once the software has installed successfully, select Finish. The icon for the instrument software will appear on the desktop.



18. After installing the software, it may be necessary to restart the system. If the following dialog box displays, select Yes to immediately restart the system.



19. Turn on the instrument.
20. Turn on the gas supplies.
21. Double-click the desktop icon for the instrument software to start the software.
22. If the Edit Registration dialog box appears, refer to Registering the Software, page [9-18](#).

Configuring the Ethernet Adapter

The following procedure is necessary for the proper operation of the software with a Copy Protection Key and applies for computer systems that are not supplied by LECO. For computers supplied by LECO, this configuration has already been completed.

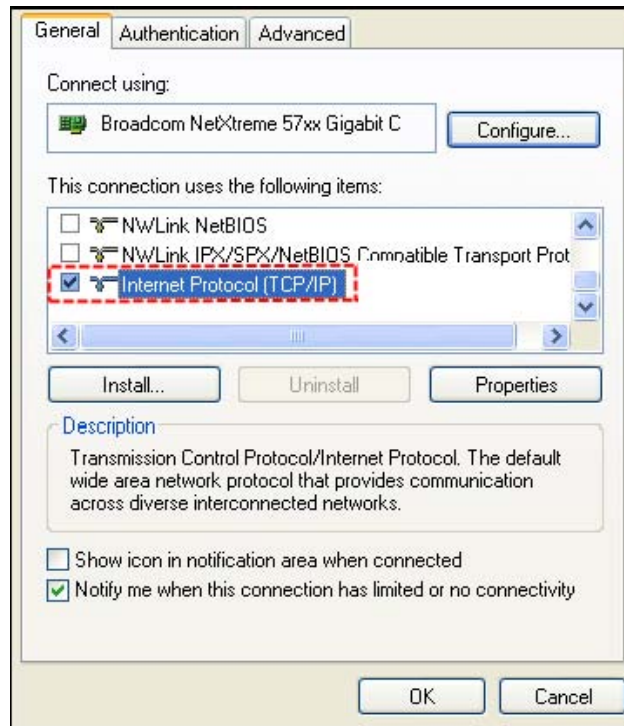
NOTE → It is required that PCs used for running LECO applications be configured with a separate Ethernet adapter dedicated for communications with LECO instrumentation. (Connection to a network would require a second Ethernet port.)

Windows XP

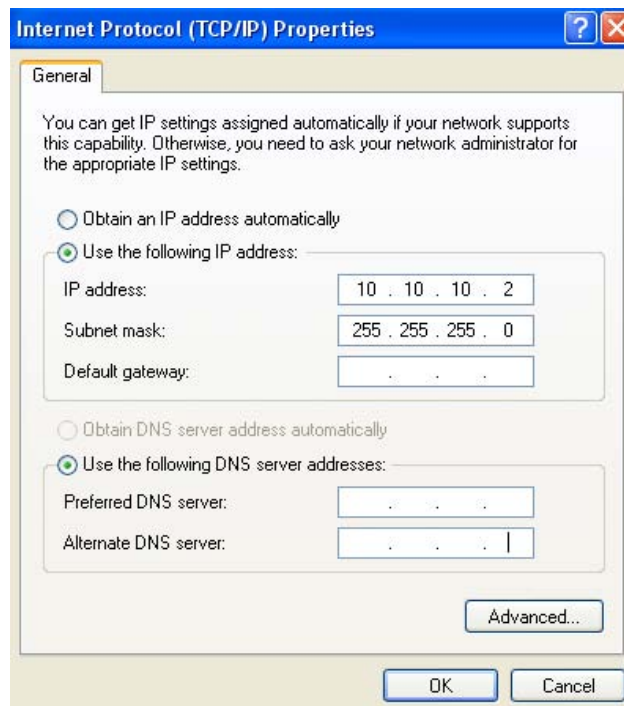
1. Determine if a network connection is installed as follows: click Start on the Windows® desktop, select Settings, Control Panel, and then double-click on Network Connections. If a network connection exists, it will appear in the Network Connections dialog box. An example is displayed below.



2. If a network connection is not installed, install an Ethernet adapter. Refer to the instructions supplied with the Ethernet adapter for installation procedures.
3. Once the Ethernet adapter is installed and with the computer on, select Start, Settings, Control Panel, and then double-click on Network Connections.
4. Click on the name of the connection for the instrument and then rename it to LECO Hardware.
5. Right-click on LECO Hardware and select Properties. The Properties dialog box will appear.



6. Select the Internet Protocol (TCP/IP) check box. The other check boxes should be cleared.
7. Click on Internet Protocol (TCP/IP) and select Properties. The TCP/IP Properties dialog box will appear.




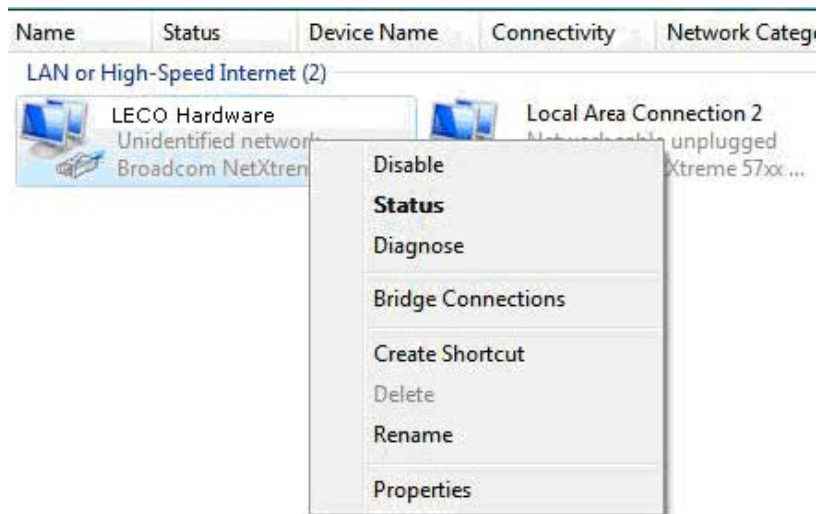
8. Enter the IP address as 10 10 10 2.
9. Enter the Subnet Mask as 255 255 255 0.

10. Default Gateway, Preferred DNS Server and Alternate DNS Server should be left blank.
11. Click OK.
12. Click OK again to save the settings.

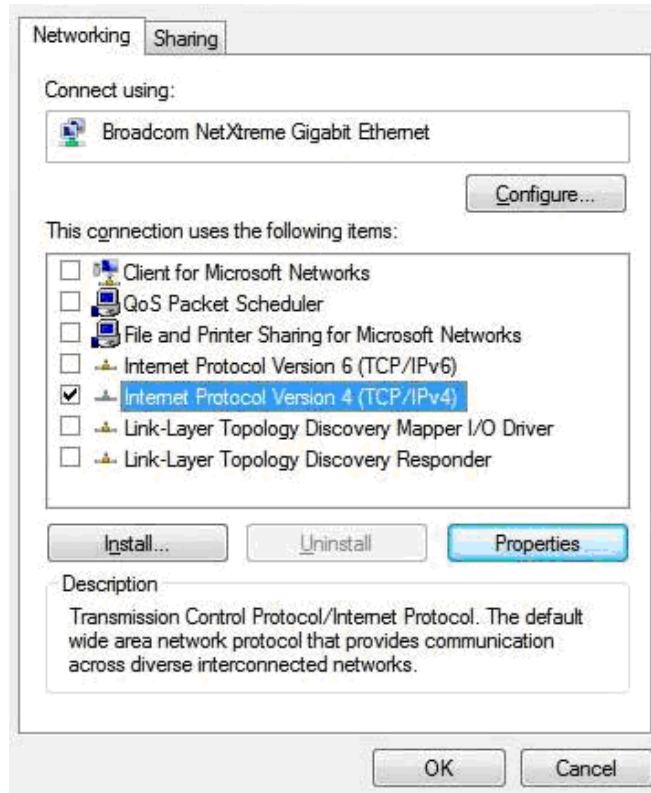
Windows Vista

The following steps apply when using the Windows Vista operating system.

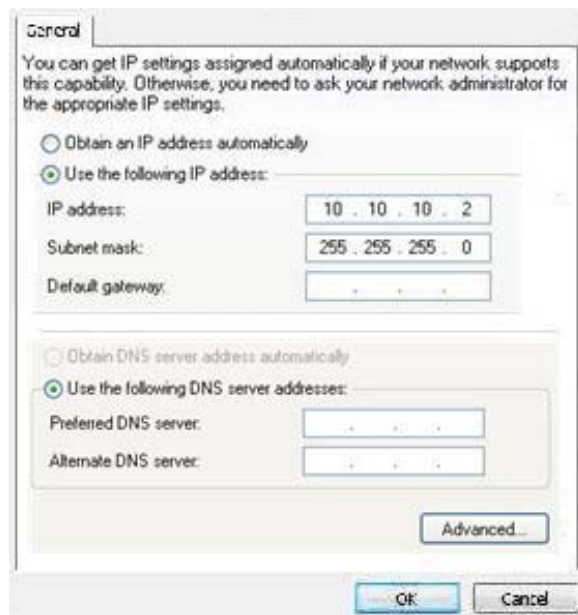
1. Click  on the Windows desktop.
2. From the Start Menu, select Control Panel.
3. From the Control Panel, select Network and Internet, click Network and Sharing, and then select Manage Network Connections.
4. On the Manage Network Connections tab, click on the connection that will be used for the instrument.
5. Click on the name of the connection and rename it to LECO Hardware.



6. Right-click and select Properties.
7. Clear all of the check boxes except Internet Protocol Version 4 (TCP/IPv4) as shown below.



8. Highlight Internet Protocol Version 4 (TCP/IPv4) by clicking on it and then select Properties.
9. For IP address, enter 10 10 10 2, and for Subnet mask, enter 255 255 255 0. The remaining fields should be empty as shown below.
10. Click OK.



Configuring Firewall Settings

When the LECO software is installed, it automatically configures the Microsoft Windows firewall settings for the instrument software. (If the Microsoft Windows firewall settings are ever changed, the easiest fix is to reinstall the LECO software.)

The following steps apply only when a firewall program other than Microsoft Windows is used.

1. If another firewall program is installed, search all folders and subfolders in C:\Program Files\LECO and C:\Program Files\Common Files\LECO folders and note the .exe files that are found.

NOTE →

- These are the default locations; however, the default location may vary if it was changed during the software installation.
2. Follow the instructions for the firewall program to grant these .exe files permission in order to run the LECO software.

Registering Software

With a new instrument and PC from LECO, all that is required is to insert the copy protection key into a USB port. Refer to Troubleshooting Copy Protection Key, page 9-24, for further information.

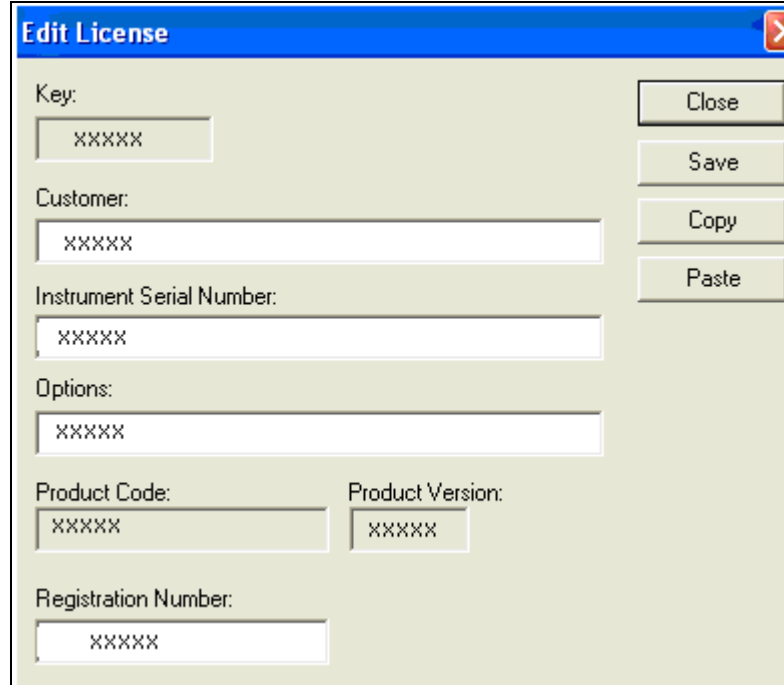
The following procedure applies when the license is being upgraded due to the addition of new hardware or a new software version. The software must be registered before it can be used. If a PC is not purchased from LECO, refer to Submitting Registration Information to LECO, page 9-20, and contact LECO Service for further information about registering the instrument.



Do not insert the copy protection key into the USB port until the LECO software is installed and the PC has been rebooted.

1. Install Copy Protection Key into a USB port on the computer.
2. Double-click the software's desktop icon.
3. In the software main window, click Help and then click About.
The following dialog box appears:

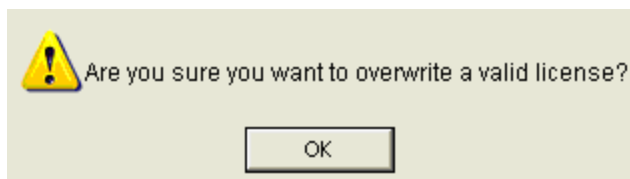
4. Click Change. The Edit License dialog box will appear.

The image shows a software dialog box titled "Edit License". It has a blue title bar with a close button (X) in the top right corner. The dialog box contains several input fields and buttons. On the left side, there are labels for "Key:", "Customer:", "Instrument Serial Number:", "Options:", "Product Code:", "Product Version:", and "Registration Number:". Each label is followed by a text input field containing "xxxxxx". On the right side, there are four buttons: "Close", "Save", "Copy", and "Paste", arranged vertically. The "Close" button is at the top, followed by "Save", "Copy", and "Paste" at the bottom.


5. Registration information can be entered in two ways as explained below. It is preferable to copy and paste the information to help avoid errors.
- Type in the registration information exactly as it appears.
 - If the upgrade information is received in an email from LECO, copy and paste the registration information as explained in the following steps.
- A. In the email, highlight the information beginning with <base64> </base64> as shown below.

```
<base64>  
58  
D7IJxwMAvPoSTEVDTyBEb2N1bWVudGF0aW9ulpBOAQ1HQ3hHQyBTY3JpcHRzAA1j  
ZW8ydmdldGuIEw==  
</base64>
```

- B. Copy the information by pressing at the same time Ctrl and C on the keyboard.
- C. On the Edit License dialog box, click Paste. (Do not press CTRL and V on the keyboard.)
- D. Click Save.
- E. Click OK when the following dialog box appears:



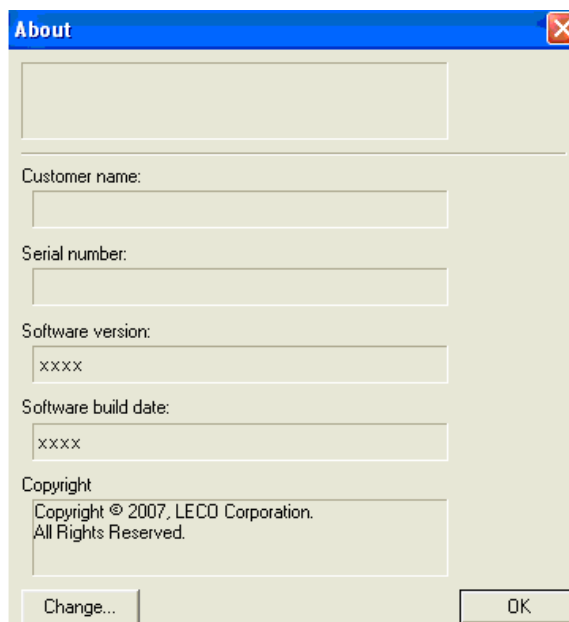
Troubleshooting Software Registration

| Error Message | Checks and Solutions |
|---|--|
| <p>Invalid Registration Error Message</p>  | <p>Verify all entries in the Edit License dialog box exactly match the registration information.</p> <p>Check capitalization.</p> <p>Check that the product version is correct. For example, the Product Version in the Edit License dialog box will appear as 400 (no period) but on the Help/About dialog box, the product version will appear as 4.00 (with a period).</p> <p>Check that the registration number is correct.</p> <p>Check that the spacing between words is accurate.</p> |

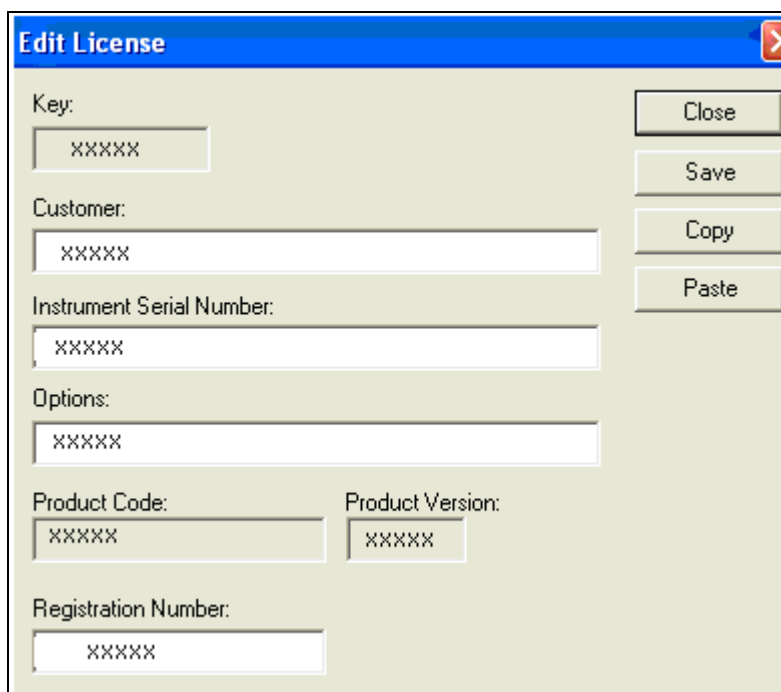
Submitting Registration Information to LECO

If the PC is not purchased from LECO, it may be necessary to submit the registration information to LECO Service. Contact LECO Service who will assist you in the registration process. LECO Service will require your company name, serial number, model number, and any options purchased. The following section explains this procedure.

1. In the software, click Help and then select About.
2. On the About dialog box, click Change.



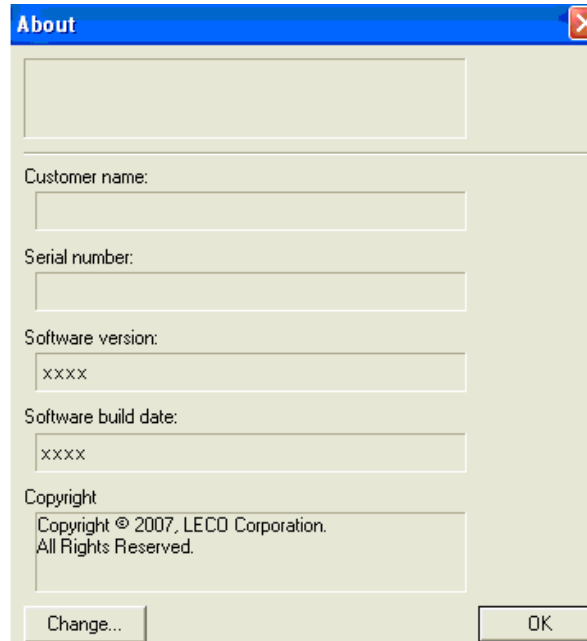
3. The Edit License dialog box will appear. Enter your Customer (company), Instrument Serial Number, and Options.



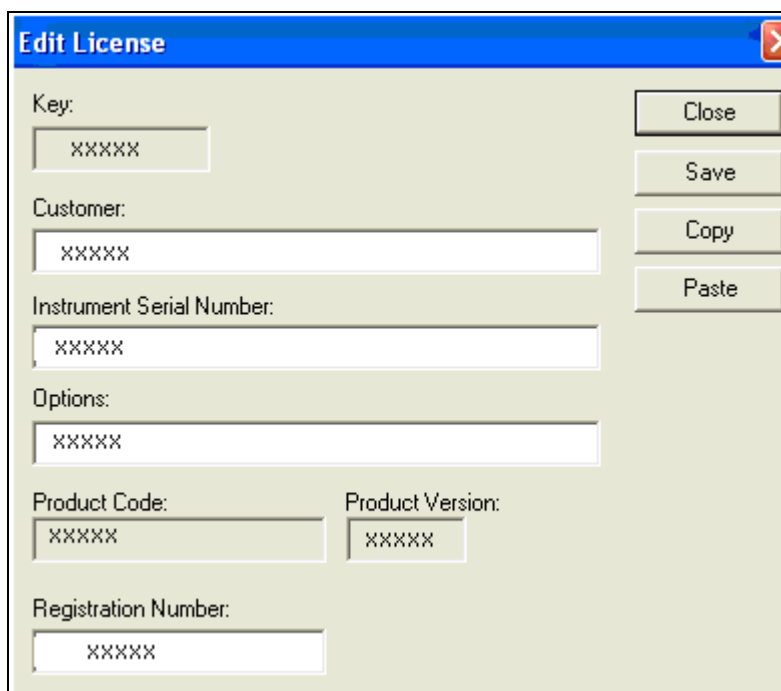
4. Click Copy.
5. Open a blank email message and press Ctrl and V on the keyboard to paste the license information into the email message.
6. Send the email or just the Key number to the LECO designee.

Adding an Option or Changing Customer Name

1. Request/purchase option from LECO. LECO will provide a new key number and registration information.
2. In the software, click Help on the Menu bar and then select About.
3. On the About dialog box, click Change.



4. The Edit License dialog box will appear.



The 'Edit License' dialog box is shown with the following fields and buttons:

- Key:** Text box containing 'xxxxxx'
- Customer:** Text box containing 'xxxxxx'
- Instrument Serial Number:** Text box containing 'xxxxxx'
- Options:** Text box containing 'xxxxxx'
- Product Code:** Text box containing 'xxxxxx'
- Product Version:** Text box containing 'xxxxxx'
- Registration Number:** Text box containing 'xxxxxx'
- Buttons:** Close, Save, Copy, Paste

5. Registration information can be entered in two ways as explained below. It is preferable to copy and paste the information to help avoid errors.
- Type in the registration information exactly as it appears.
 - If the upgrade information is received in an email from LECO, paste the registration information as explained in the following steps.
 - A. Select all of the text in the email from LECO.
 - B. On the Edit License dialog box, click Paste. The information from the email, including customer name and any options will appear in the Edit License dialog box.
 - C. Click Save.

Troubleshooting Copy Protection Key

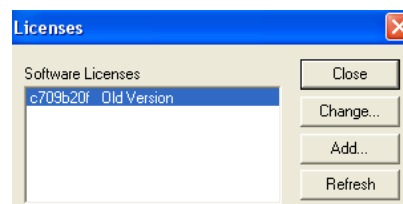
- A Copy Protection Key is required to use the software.
- Do not insert the copy protection key into the USB port until the LECO software is installed and the PC has been rebooted.
- The Copy Protection Key should remain installed in one of the USB ports while using the software.

Copy Protection Key Error Messages



The Copy Protection Key Not Found or License Not Valid dialog box may appear if the copy protection key is not installed, the software is not registered, or the software is already running. Follow the steps below.

- Verify the copy protection key is installed. If not,
 1. Click OK, and then insert the copy protection key.
 2. On the Licenses dialog box, click Close. The software login will appear.
- If the copy protection key is installed, the software may not be registered.
 1. Click OK.
 2. Insert the copy protection key. The Licenses dialog box will appear.

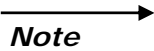


3. Click on the old version and then click Change. Follow the instructions in Registering the Software beginning with step 5.
- If the copy protection key is installed, the software may already be running on the computer. Click Close.



Loading Head Alignment and Adjustment

Initial Alignment



- *Before the load head assembly is ever placed onto the load head interface block, the following procedure must be followed to insure easy removal/installation of the load head assembly.*
1. Loosen the following screws to allow alignment the loading head assembly, to the load head interface block on the dual furnace assembly.
 - A. Loosen (2) screws, 190-867, which secure the 619-161 male mounting block to the loading head assembly. Refer to Figure 9-1, page [9-27](#).
 - B. Loosen the screw, 190-945, which secures the connector assembly to the 619-161 male mounting block.
 - C. Loosen the (2) setscrews, 190-513, in the 619-161 male mounting block.
 - D. Loosen the (2) screws, 190-724 that secures the 619-139 female mounting block to load head interface block on the furnace assembly.
 - E. Loosen the screw, 190-945, which secures the connector assembly to the 619-139 female mounting block.
 - F. Back off the setscrew, 190-513, in the 619-139 female mounting block.
 2. With everything above loosened, carefully align loading head assembly and the load head interface block on the furnace assembly.
 3. Grab the loading head at each side, carefully line-up the male electrical connector on the loading head and the female connector on the loading head interface block. At the same time, make sure the three nipples from the loading head are lined up with the bores on the load head interface block. Once aligned, push down. You may hear a hissing sound.
 4. Tighten the captive screws in the loading head to secure it to the loading head interface block. Any hissing sound should disappear. If a hissing sound continues, remove load head and refer to the loading head interface block maintenance on page [9-29](#).

5. After the loading head is secured to the load head interface block.
 - A. Tighten the screw, 190-945, which secures the connector assembly to the 619-139 female mounting block.
 - B. Tighten the setscrew, 190-513, in the 619-139 female mounting block until it hits the base loading head.
 - C. Tighten the (2) screws, 190-724, which secure the 619-139 female mounting block to the base loading head, 619-164.
 - D. Tighten the screw, 190-945, which secures the connector assembly to the 619-161 male mounting block.
 - E. Tighten the (2) setscrews, 190-513, in the 619-161 male mounting block until it hits the loading head top.
 - F. Tighten the (2) screws, 190-867, which secure the 619-161 male mounting block to the load head assembly.
6. To check alignment, remove and install the TruSpec loading head assembly.
7. If load head is easily removed and installed then you have successfully aligned the TruSpec load head assembly.
8. If the loading head is NOT easily removed and installed, then repeat steps 1 thru 4.

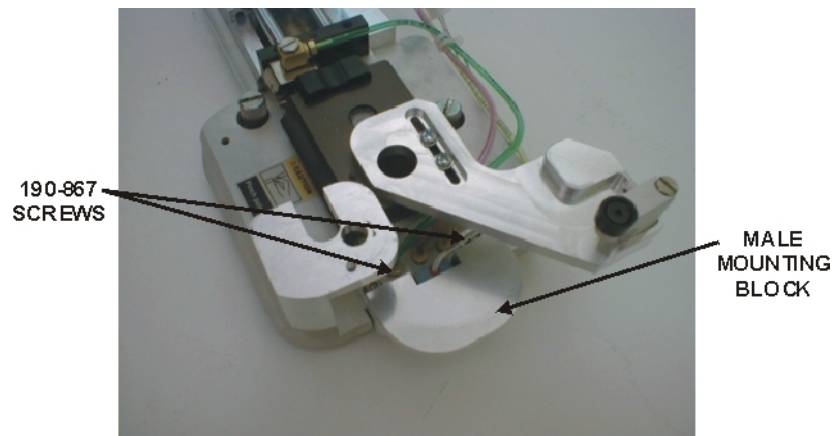


Figure 9-1
Loading Head Alignment—Part 1

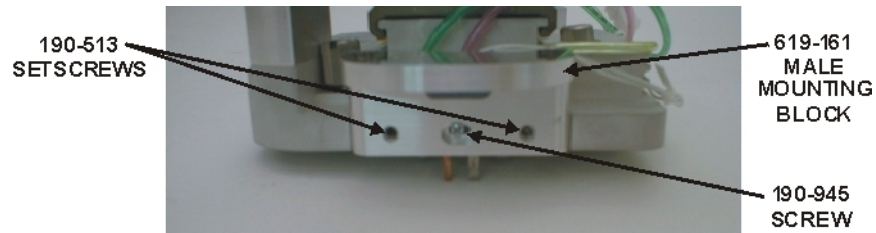


Figure 9-2
Loading Heading Alignment—Part 2

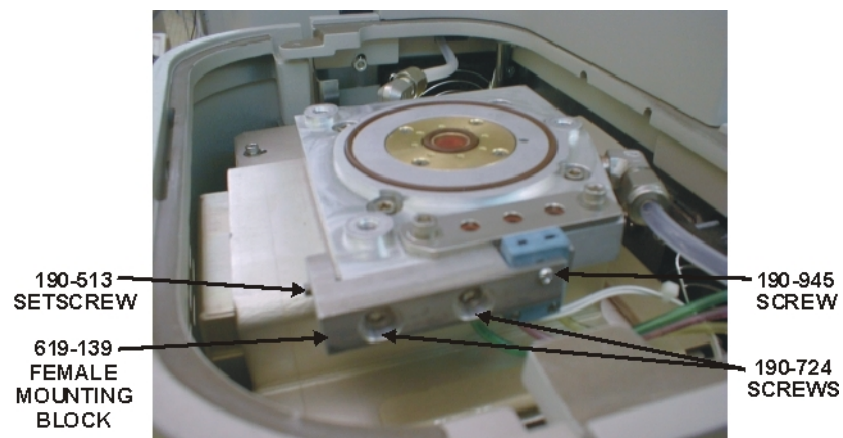


Figure 9-3
Loading Heading Alignment—Interface Block

Initial Adjustment

1. Adjust slide block speed by:
 - A. Click Diagnostics and select Solenoids and Switches.
 - B. Uncheck the Slide Block Seal, SV18, to turn it off.
 - C. From the Diagnostics screen, toggle the slide block, SV13 and SV14, open and closed. Adjust the speed control screws on SV13 and SV14 to slow the movement if necessary.

————→
Note

- *Solenoid valves SV13 and SV14 are the only valves on the pneumatics manifold that have speed adjustments.*
2. Adjust the carousel indexer. Refer to the Carousel Alignment Procedure on page [9-31](#).

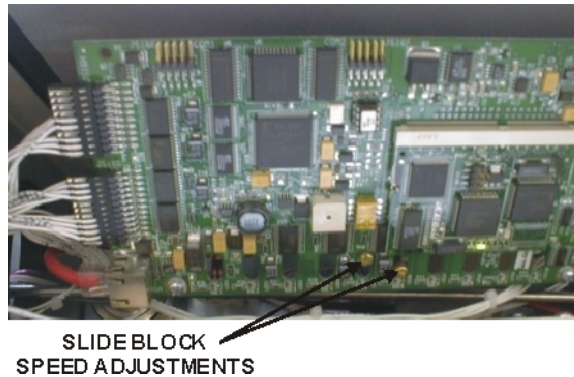


Figure 9-4
Slide Block Speed Adjustments

Loading Head Interface Block Cleaning

————→
Notes

- *This procedure should be used to clean and service the Loading Head Interface Block.*
- *Perform the Instrument Shutdown procedure before removing the Loading Head. Refer to Instrument Shutdown on page [5-12](#).*

Disassembly

1. Turn off the pneumatic gas supply.
2. Remove the loading head. Refer to the load head removal procedure on page [9-25](#).
3. Remove top furnace plate.
4. Remove lance assembly. Refer to the lance assembly removal procedure.
5. Remove and inspect the load head block interface seal o-ring, 601-504. Lightly apply a thin coating of vacuum grease to the o-ring.
6. From Diagnostics access the Solenoids and Switches screen.
 - A. Toggle the Set Slide Block Seal (SV18) solenoid to relieve pressure in lines.
 - B. Toggle Slide Block Open and Close (SV13/SV14) solenoid to relieve pressure in lines.
7. Remove the (2) 8-32 socket head screws, 190-867, which secure the valve cap.
8. Carefully remove the valve cap. Make sure the three o-rings underneath the valve cap remain on the interface block.
9. Inspect and clean valve cap.
10. Inspect and clean three o-rings. Lightly apply a thin coating of vacuum grease to the o-rings.
11. Remove (2) balls, 805-079, and (2) springs, 617-212, from two outside bores.
12. Inspect and clean the balls, springs, and holes.

Assembly

1. Insert (2) springs, 617-212, into two outside holes in load head interface block. Springs cannot be inserted into middle hole.
2. Place (2) balls, 805-079 into two outside holes in load head interface block.
3. Lightly coat the o-rings with vacuum grease and place the three o-rings into the three holes on the load head interface block.
4. Place the clean valve cap onto load head interface block. Line-up the corresponding holes on the valve cap to the mating holes on the load head interface block. Tighten the screws to secure valve cap.
5. Install the loading head to interface block seal o-ring.
6. Apply a light coating of vacuum grease to the o-ring on top of the lance assembly and install the lance assembly into the loading head.
7. Turn on the pneumatic gas supply.

Carousel Alignment

→
Notes

- *Alignment must be after once the loading head is adjusted. Refer to Loading Head Adjustment on page 9-25.*
- *When the carousel is properly adjusted it will not make a ringing noise when actuated.*



PINCH HAZARD

Keep your hands away from the carousel and loading head during operation.

1. Click Diagnostics and select Solenoids and Switches.
2. Uncheck the Slide Block Seal (SV18) solenoid to open it.
3. Click the Slide Block solenoid (SV13/SV14) and move the slide block to the closed position.
4. Loosen the carousel actuator arm mounting screws. Refer to Figure 9-5, page 9-32.
5. Position the hole in the center of the arm over the hole in the slide block.
6. Be sure that the edges of the two pieces are parallel.
7. Tighten the carousel actuator mounting screws just enough that the arm can be moved along the slot.
8. Place the carousel on the loading head.
9. The lever on the arm should line up with the tooth on the carousel. If it doesn't move the actuator arm until it does. Refer to Figure 9-6, page 9-32.
10. Once it is aligned, take the carousel off and tighten the two screws.
11. Place the carousel back on the loading head and cycle the Slide Block solenoid several times to insure that it is indexing the carousel one position at a time.
12. If the carousel is moving too fast or too slow in either direction, adjust the speed controls on solenoid valves SV13 and SV14. Refer to Figure 9-4, page 9-28.

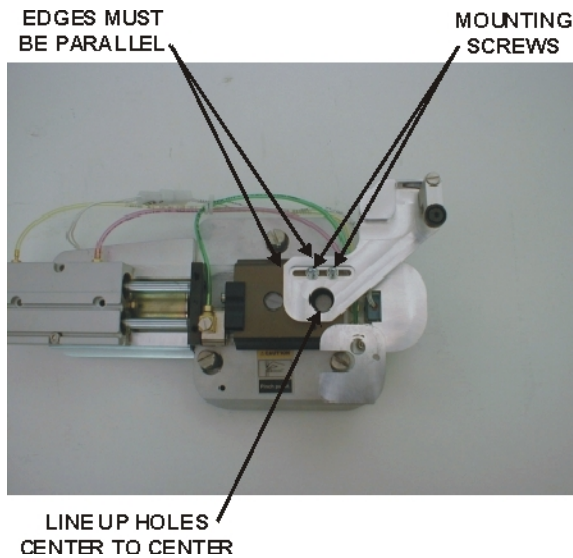


Figure 9-5
Carousel Actuator Arm Alignment

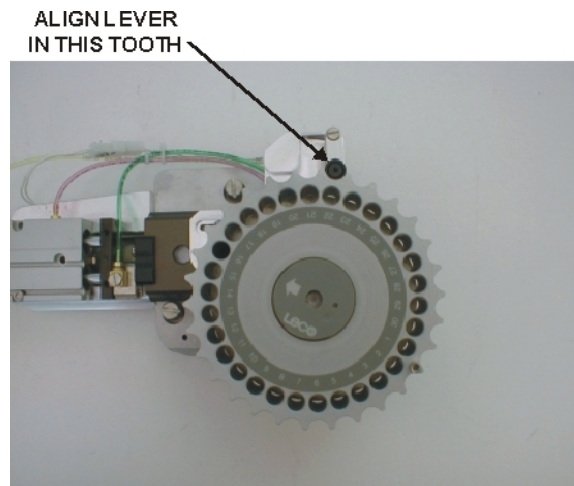


Figure 9-6
Carousel Alignment

TC Cell Removal and Service

→
Notes

- *This procedure should be used to clean and service the TC Cell.*
- *Perform the Instrument Shutdown procedure before removing the TC cell. Refer to Instrument Shutdown on page [5-12](#).*



SHOCK HAZARD

Turn the AC power OFF and disconnect the instrument from the facility electrical power source.

Removal

1. Remove the right side panel from the instrument.
2. Remove the plastic cover from the oven assembly.
3. Loosen the TC cell Thumbscrew.
4. Remove the TC cell cover.
5. Disconnect the network electrical connection to the TC cell.
6. Loosen the Captive Screw.
7. Pull the TC cell away and out of the oven.

Service

1. Check the condition of the o-rings. If they are cracked or worn replace them.
2. If you having a problem with the TC Cell, ambient values, a gas leak, or measurement results, contact the LECO service department for further information.

IR Cell Removal and Service

- **Notes**
- *This procedure should be used to clean and service the IR Cell.*
 - *Perform the Instrument Shutdown procedure before removing the IR cell. Refer to Instrument Shutdown on page [5-12](#).*



SHOCK HAZARD

Turn the AC power OFF and disconnect the instrument from the facility electrical power source.

Removal

1. Remove the right side panel from the instrument.
2. Remove the plastic cover from the oven assembly.
3. Remove the foam insulation covering the IR cells.
4. Remove the two IR cell mounting screws.
5. Pull the IR cell away and out of the oven.

Service

1. Check the condition of the o-rings. If they are cracked or worn replace them.
2. If you having a problem with the IR Cell, IR Cell ambient values, a gas leak, or measurement results, contact the LECO service department for further information.

IR Detector Linearization

Before the instrument or a replacement IR detector is installed at a customer site, the reference and saturation values are determined for the IR detector. These values are entered by LECO into the software to produce correct analytical results. For accurate analysis results, these values must match characteristics of the detector. The following procedure should only be used if an IR detector is replaced or if the values have been lost and need re-entered.

- Note** →
- *It is only necessary to perform this procedure if an IR detector is replaced. The reference and saturation values to enter during this procedure can be found on a tag attached to the replacement IR detector.*

1. Click Configuration and select IR Detectors. The IR Detector Linearization screen will appear.

| | Reference | Saturation | |
|----------|-----------|------------|-------------|
| CO2 | 0 | 0 | Advanced... |
| H2O | 0 | 0 | Advanced... |
| SO2 | 0 | 0 | Advanced... |
| O | 0 | 0 | Advanced... |
| CO2 High | 4.999 | 0.0001 | Advanced... |

Import... Get Reading OK

Export... Print Cancel

2. All the IR Detectors for the system are listed. If the IR detector has been replaced, enter the reference and saturation that are provided on the tag attached to the replacement IR detector.
3. Refer to the IR Detector Linearization Definitions, page 9-36, for additional information.

IR Detector Linearization Definitions

Reference—the output voltage of the cell when no analyte is present.

Saturation—the output voltage of the cell when the maximum amount of analyte it can measure is present.

Advanced—used to access the break and slope table. Refer to Breaks and Slopes on page [9-37](#).

Import—used to import a file of reference and saturation values that had been previously exported for all IR detectors. This will overwrite the reference and saturation values for all detectors. Ensure the values being imported are correct for the currently installed detectors before you import them.

Export—used to export or save a file of reference and saturation values for all IR detectors.

Get Reading—used to enter the reference and saturation values by running the appropriate amount of analyte (none or max) through the system and capturing the voltage.

Print—used to print out the reference and saturation values. If a break and slope table is used, it will also print.

Break and Slope Values

Note

- The Break and Slope values are not used by LECO but can be used by the operator to customize their instrument.

| # | Break | Slope |
|----|-------|-------|
| 1* | 56000 | 1.000 |
| 2 | 56000 | 1.000 |
| 3 | 56000 | 1.000 |
| 4 | 56000 | 1.000 |
| 5 | 56000 | 1.000 |
| 6 | 56000 | 1.000 |
| 7 | 56000 | 1.000 |
| 8 | 56000 | 1.000 |
| 9 | 56000 | 1.000 |
| 10 | 56000 | 1.000 |

Checkbox—specifies whether or not the break and slope table should be used.

Break and Slope—allows advanced customization of the detector's linearization.

Set to Defaults—resets the table back to the original factory default values.

IR Cell Saturation Optimization

This procedure will automatically adjust the IR detectors saturation value, improving the characterization of the individual IR detector in the instrument as a system. This procedure should be used during the installation of new IR Cells. It can also be used to compensate for minor variations over the life of the IR cell.

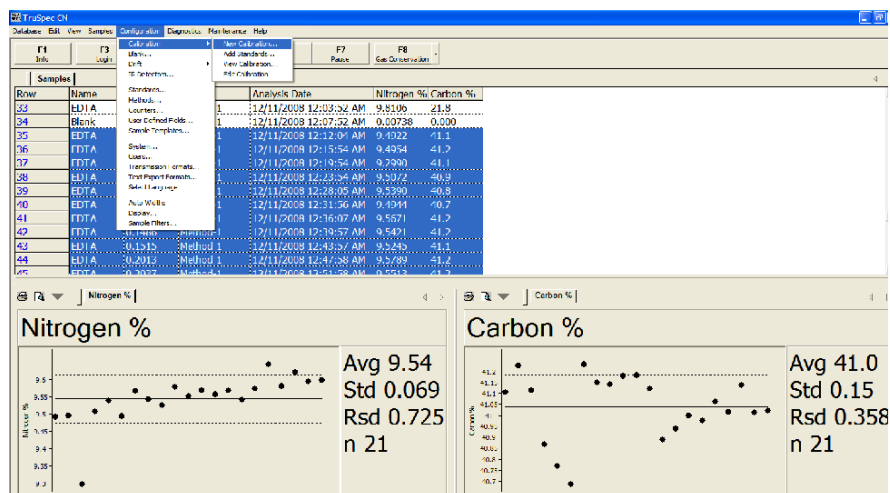
NOTE → EDTA, LECO P/N 502-092, is required to perform this procedure.

1. Create a method using all of the default method properties. Refer to Create a Method page [4-39](#).
2. Click Diagnostics and select Leak Check. Refer to Leak Check on page [8-22](#).
 - A. Perform the Whole Oxygen Leak Check.
 - B. Perform the Whole Helium Leak Check.
 - C. Steps A and B must pass before continuing.
3. Click Diagnostics and select Systems Check.
 - A. Perform a Systems Check.
 - B. All items in Systems Check must pass before continuing.
4. Analyze 15 blanks. Refer to the Blank Login on page [5-17](#).
5. Choose the last 10 blank results to calculate the statistical results. The standard deviation of the last 10 blanks should be less than or equal to 10 ppm or 0.001% for carbon.
6. Set the system blank based on the last 10 blank results run in the previous step. Refer to the Blank Calibration on page [5-40](#).
7. Define EDTA as a calibration standard. Refer to Define Calibration Standards on page [4-58](#).
8. Analyze 3 samples of EDTA at approximately 100 mg. These samples are used for conditioning and will not be used for analytical purposes later.

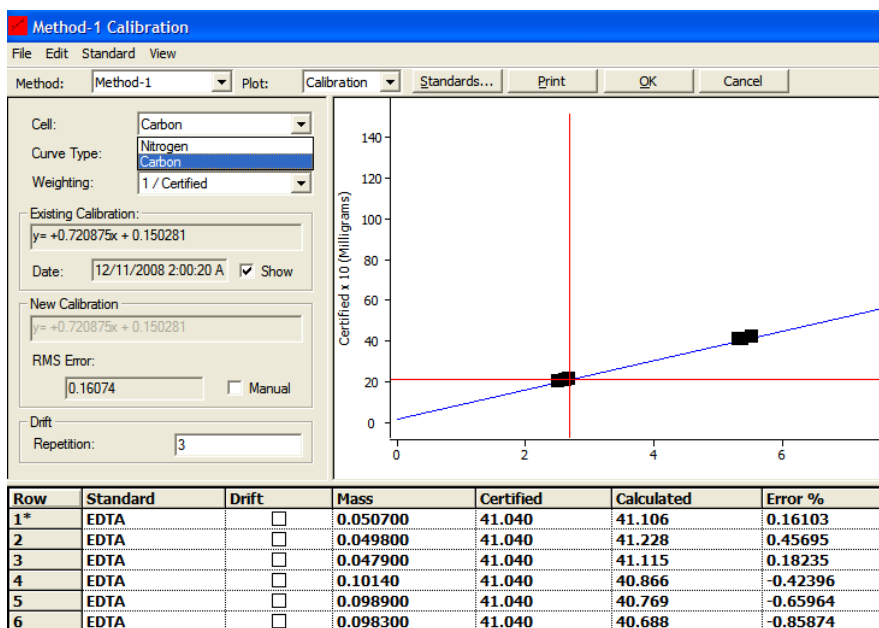
9. Analyze the samples listed in the table below. Use the Method created in step 1. Log in each sample using the drop down box in Name for the EDTA samples.

| Replicates | Standard | Mass (mg) |
|------------|----------|-----------|
| 3 | EDTA | 50 |
| 3 | EDTA | 100 |
| 3 | EDTA | 150 |
| 3 | EDTA | 200 |
| 3 | EDTA | 250 |
| 3 | EDTA | 300 |
| 3 | EDTA | 350 |

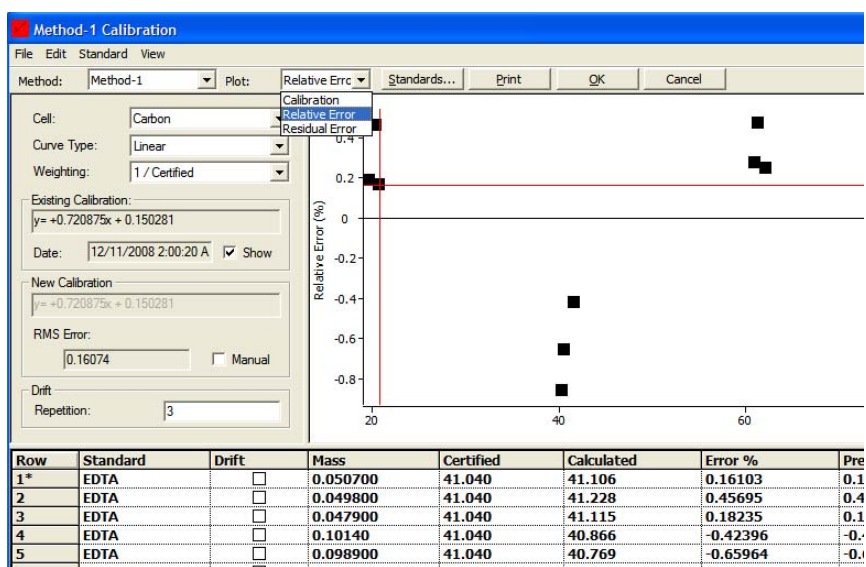
10. Select the sample data run in step 9 and click Configuration, then select Calibration.



- Select the Carbon cell from the cell drop down box.



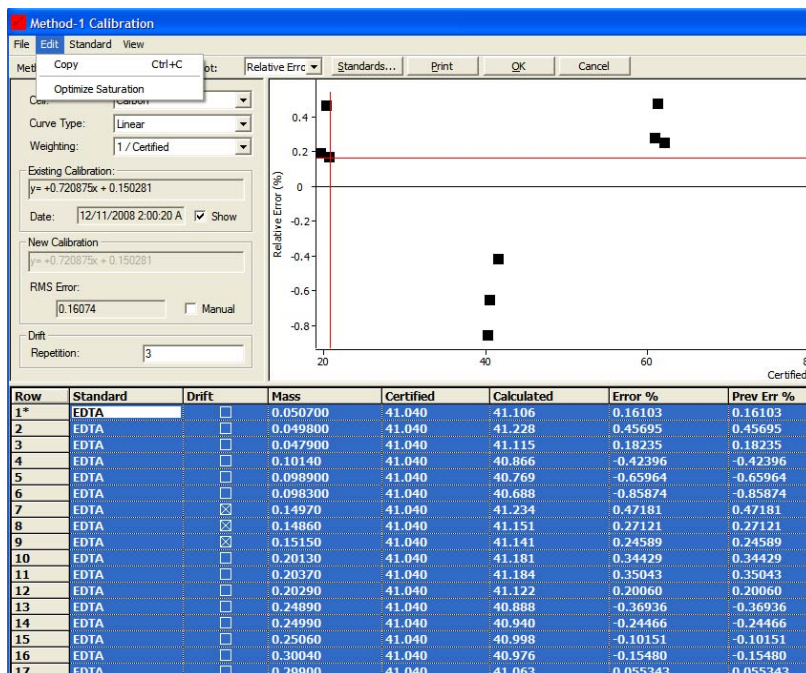
- Change the plot to Relative Area.



- Within the grid of the calibration screen, select the results of the EDTA analyses.
- Click Edit and select Optimize Saturation.

NOTE →

If any of the data points are shown in red and excluded automatically, override them and include the points by double clicking on the excluded data row within the grid.



15. The software will automatically calculate an optimized saturation value for the Carbon IR Cell and display a dialogue box with the new and previous Carbon IR cell saturation values. Select OK to accept the new carbon IR cell saturation value.
16. Recalibrated all the existing methods within the database using the new carbon IR settings and table.

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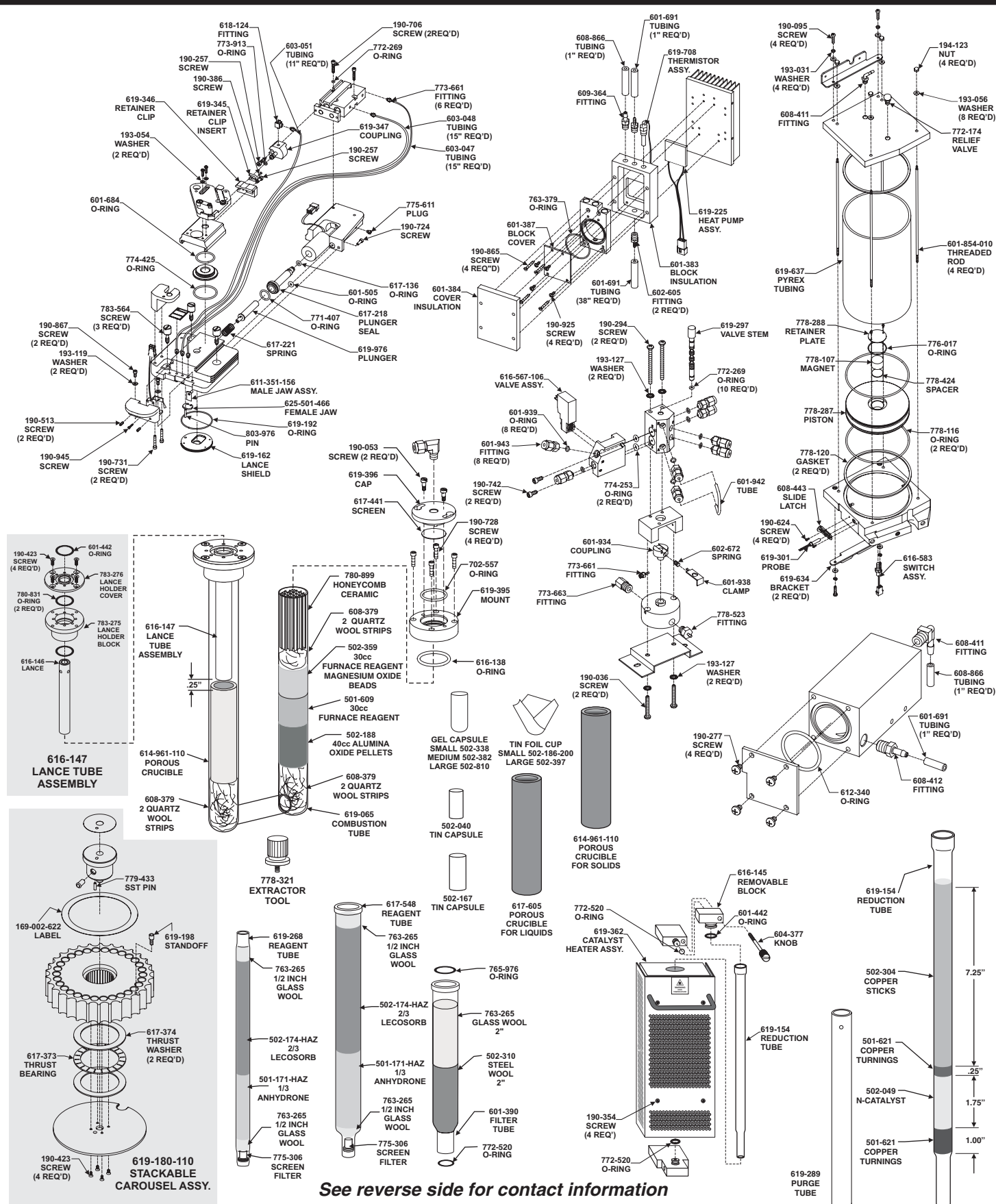
10 Illustrations

The Illustration chapter can be used to locate parts within the instrument and part numbers.

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| | |
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Note: Part numbers and standards' values may change. Consult LECO for the latest information.



See reverse side for contact information

GENERAL COMBUSTION SUPPLIES

| | |
|-------------|--|
| 502-188 | Alumina Oxide Pellets 200 g bottle |
| 501-171-HAZ | Anhydrous 454 g (1 lb.) bottle |
| 502-189 | Copper Sticks 100 g ampule |
| 502-304 | Copper Sticks 100 g bottle |
| 502-304-500 | Copper Sticks 500 g bottle |
| 501-621 | Copper Turnings 200 g bottle |
| 501-609 | Furnace Reagent (Calcium Oxide/Kaolin) |
| 501-081 | Glass Wool 454 g (1 lb.) box |
| 763-265 | Glass Wool 227 g (0.5 lb.) package |
| 501-077 | Iron Chip 908 g (2 lb.) bottle |
| 502-174-HAZ | Lecosorb 500 g bottle |
| 502-359 | Magnesium Oxide Beads 200 g |
| 502-049 | N-Catalyst 50 g bottle |
| 608-379 | Quartz Wool Strips 10/pk |
| 502-310 | Steel Wool 454 g (1 lb.) |

CAPSULES AND CRUCIBLES

| | |
|-------------|--|
| 502-338 | Gel Capsule, Small 400/pkg |
| 502-382 | Gel Capsule, Medium 400/pkg |
| 502-810 | Gel Capsule, Large 400/pkg |
| 614-961-110 | Porous Crucibles for solids 10/pk <i>(use only with 614-962 lance)</i> |
| 617-605 | Porous Crucibles for liquids 10/pk |
| 501-059 | Tin Capsules 100/bottle |
| 502-040 | Tin Capsules 100/bottle |
| 502-040-100 | Tin Capsules 1000/bottle |
| 502-167 | Tin Capsules, Large 100/bottle |
| 502-186-200 | Tin Foil Cups, Small 100/bottle |
| 502-186-100 | Tin Foil Cups, Small 1000/bottle |
| 502-397 | Tin Foil Cups, Large 100/bottle |
| 502-397-400 | Tin Foil Cups, Large 400/bottle |

OPERATION ACCESSORIES

| | | | |
|-------------|-----------------------------|-------------|------------------------------------|
| 502-005 | Brush | 604-373 | Sample Cup Holder, Small |
| 601-981 | Wire Brush | 601-490-110 | Sample Foiler Kit |
| 616-152 | Crucible Extractor Tool | 778-405 | 10-Sample Storage Block |
| 775-306 | Secondary Filter, 10 micron | 501-614 | Spatula |
| 775-307 | Filter Tool, Thumbscrew | 619-180-110 | Stackable Carousel Assembly |
| 502-023 | Funnel Quick Disc | 502-007 | Tube Cleaner |
| 778-321 | Lance Extraction Tool | 502-028 | Tweezers |
| 502-213 | Leak Detection Solution | 604-378 | Tweezers, Curved |
| 601-470-110 | Liquid Injector Kit, Manual | 501-241 | Vacuum Grease |
| 603-350 | Tool O-ring Installation | 619-380 | Vacuum Cleaner Attachment Assembly |
| 762-515 | Tool O-ring Removal | 619-377 | Bypass Plate |
| 616-504 | Particle Filter | | |
| 604-398 | Sample Cup Holder, Large | | |

COMBUSTION TUBES AND GLASSWARE

| | |
|---------|--|
| 601-390 | Glass Filter Tube (wide mouth top, small bottom) requires one (1) 765-976 Top O-ring and one (1) 772-520 Bottom O-ring for sealing |
| 771-030 | Glass Filter Tube (small mouth top and bottom) requires 772-520 O-rings for sealing |
| 775-601 | Reagent Tube, requires 772-520 O-rings for sealing |
| 601-437 | Reduction Tube, requires 601-442 O-rings for sealing |
| 780-899 | Honeycomb Ceramic Stop |
| 619-065 | Combustion Tube |
| 617-441 | Screen Filter |
| 502-450 | Quartz Filter |

*Values vary—contact LECO for current levels.

NOTE: Part numbers and standards' values may change.
Consult LECO for latest information.

United States:

Ph: 1-800-292-6141

Fax: 269-982-8977

Canada:

Ph: 1-800-268-0215

Fax: 905-564-6582

represented by:

Other Countries:

Ph: 269-983-5531

Fax: 269-983-3850

SET-UP STANDARDS

SOY FLOUR (250 grams)

| Part No. | % C | % H | % N | % S |
|----------|-----|-----|----------|-----|
| 501-561 | — | — | 8.0–10.0 | — |

CORN FLOUR (250 grams)

| Part No. | % C | % H | % N | % S |
|----------|-----|-----|---------|-----|
| 501-563 | — | — | 0.8–1.6 | — |

ORCHARD LEAVES (20 grams)

| Part No. | % C | % H | % N | % S |
|----------|-----------|---------|---------|-----------|
| 502-055 | 44.0–52.0 | 5.7–6.5 | 2.0–2.8 | 0.15–0.25 |

SOIL (65 grams)

| Part No. | % C | % H | % N | % S |
|----------|-----------|-----|-----|-----|
| 502-062 | 0.75–1.25 | * | * | * |
| 502-308 | 2.50–3.50 | — | * | * |
| 502-309 | 10.0–14.0 | — | * | * |

TOBACCO LEAVES (20 grams)

| Part No. | % C | % H | % N | % S |
|----------|-----------|---------|---------|---------|
| 502-082 | 35.0–47.0 | 4.0–7.0 | 2.0–4.0 | 0.3–0.8 |

EDTA (50 grams)

| Part No. | % C | % H | % N | % S |
|----------|-------------|-----------|-----------|-----|
| 502-092 | 40.80–41.20 | 5.46–5.54 | 9.52–9.60 | — |

EDTA (250 grams)

| Part No. | % C | % H | % N | % S |
|-------------|-------------|-----------|-----------|-----|
| 502-092-250 | 40.80–41.20 | 5.46–5.54 | 9.52–9.60 | — |

GLYCINE (50 grams)

| Part No. | % C | % H | % N | % S |
|----------|-------|------|-------|-----|
| 502-211 | 32.00 | 6.67 | 18.66 | — |

CORN GLUTEN (50 grams)

| Part No. | % C | % H | % N | % S |
|----------|-----------|---------|-----------|----------|
| 502-272 | 51.0–53.0 | 7.0–7.5 | 11.0–12.0 | 0.75–1.0 |

ALFALFA (50 grams)

| Part No. | % C | % H | % N | % S |
|----------|-----------|---------|---------|-----------|
| 502-273 | 45.0–47.0 | 5.5–6.5 | 2.5–5.0 | 0.25–0.35 |

WHEAT FLOUR (50 grams)

| Part No. | % C | % H | % N | % S |
|----------|-----------|---------|---------|-----------|
| 502-274 | 44.0–46.0 | 6.0–7.0 | 2.5–3.5 | 0.15–0.25 |

RYE FLOUR (50 grams)

| Part No. | % C | % H | % N | % S |
|----------|-----------|---------|---------|-----------|
| 502-275 | 43.5–45.5 | 6.0–7.0 | 1.5–2.5 | 0.10–0.20 |

OAT MEAL (50 grams)

| Part No. | % C | % H | % N | % S |
|----------|-----------|---------|---------|-----------|
| 502-276 | 45.0–47.0 | 6.0–7.0 | 2.5–3.5 | 0.15–0.25 |

BARLEY (50 grams)

| Part No. | % C | % H | % N | % S |
|----------|-----------|---------|---------|-----------|
| 502-277 | 45.0–47.0 | 6.0–7.0 | 1.0–3.0 | 0.10–0.20 |

RICE FLOUR (50 grams)

| Part No. | % C | % H | % N | % S |
|----------|-----------|---------|---------|-----------|
| 502-278 | 43.0–45.0 | 6.0–7.0 | 1.0–3.0 | 0.10–0.20 |

SUCROSE (50 grams)

| Part No. | % C | % H | % N | % S |
|----------|-------|------|-----|-----|
| 501-441 | 42.10 | 6.48 | — | — |

REFERENCE MATERIALS

COAL PROX-PLUS (50 grams)

| Part No. | Desc. | % C | % H | % N |
|----------|--------|------|-----|------|
| 502-442 | Low | 75.3 | 4.9 | 1.1 |
| 502-443 | Medium | 69.4 | 5.1 | 1.1 |
| 502-444 | High | 78.7 | 5.4 | 1.48 |

COKE PROX-PLUS (50 grams)

| Part No. | Desc. | % C | % H | % N |
|----------|-----------|------|------|------|
| 502-452 | Prox Plus | 93.3 | 3.94 | 1.43 |

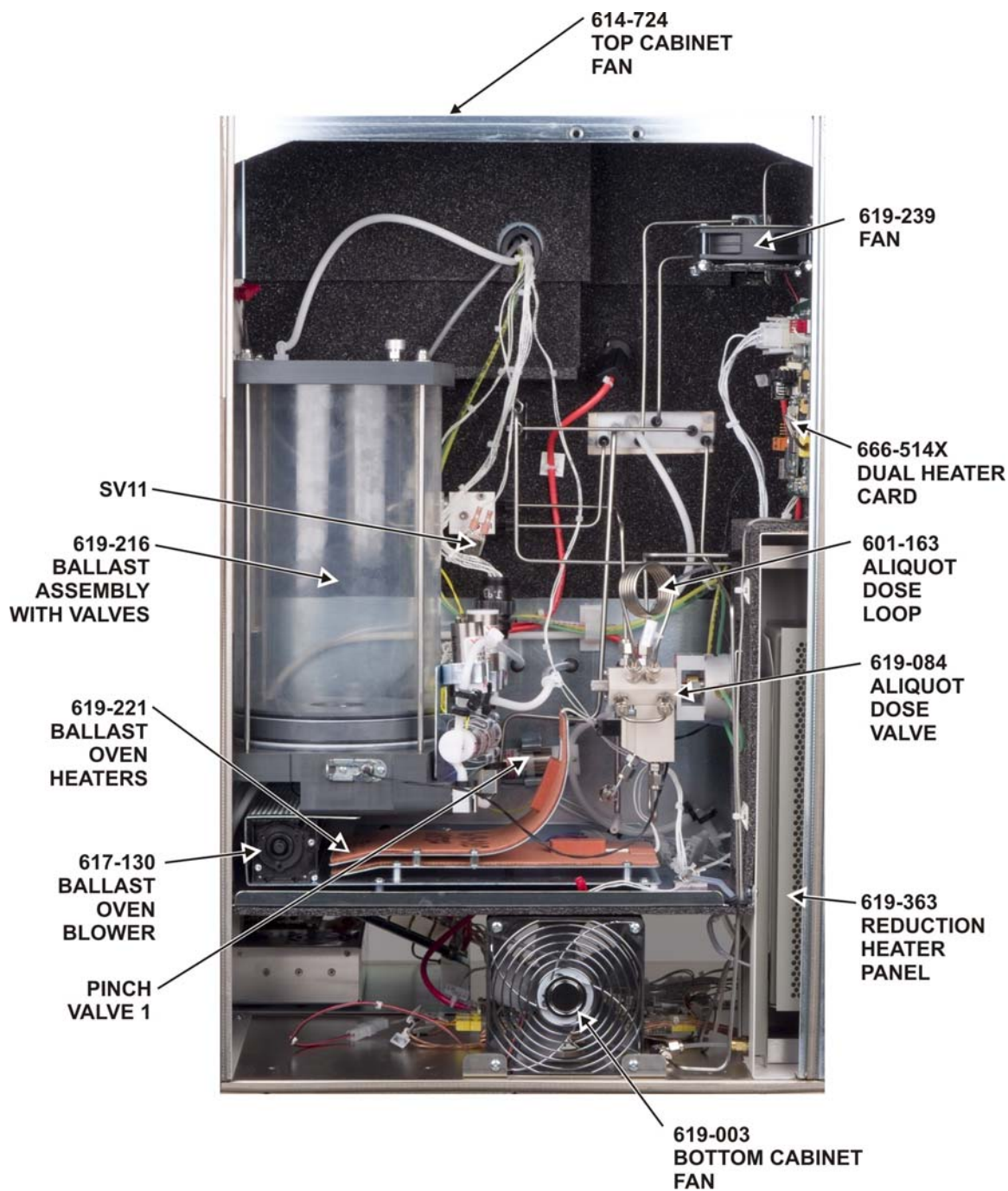
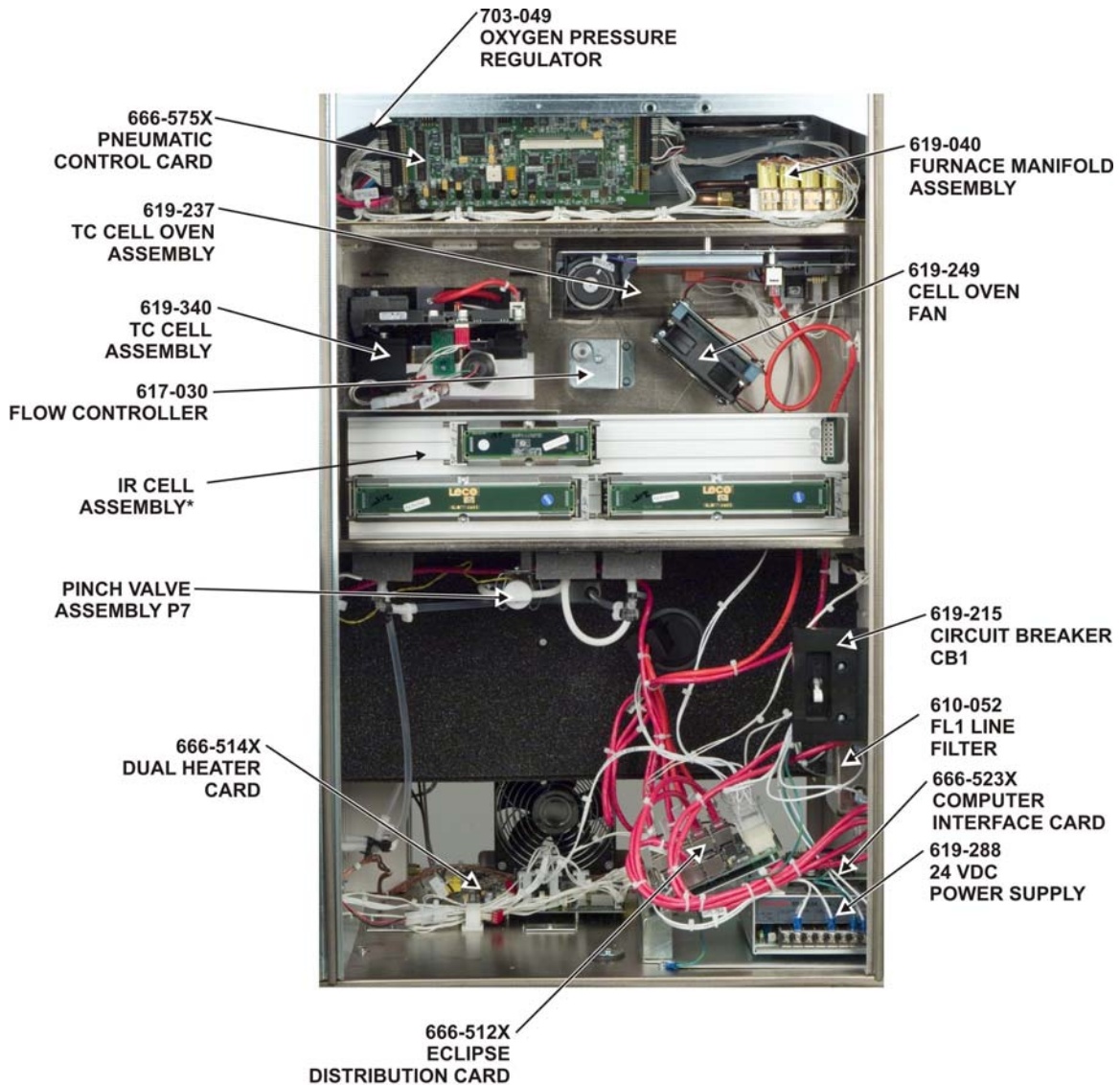
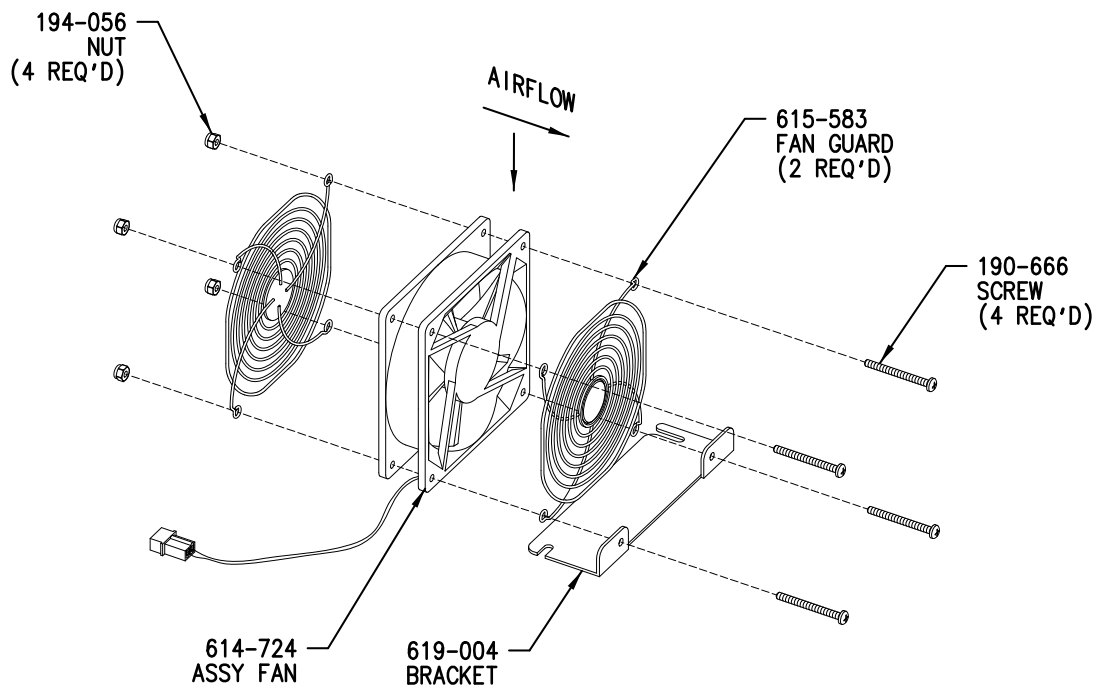


Figure 10-3
Left Side View



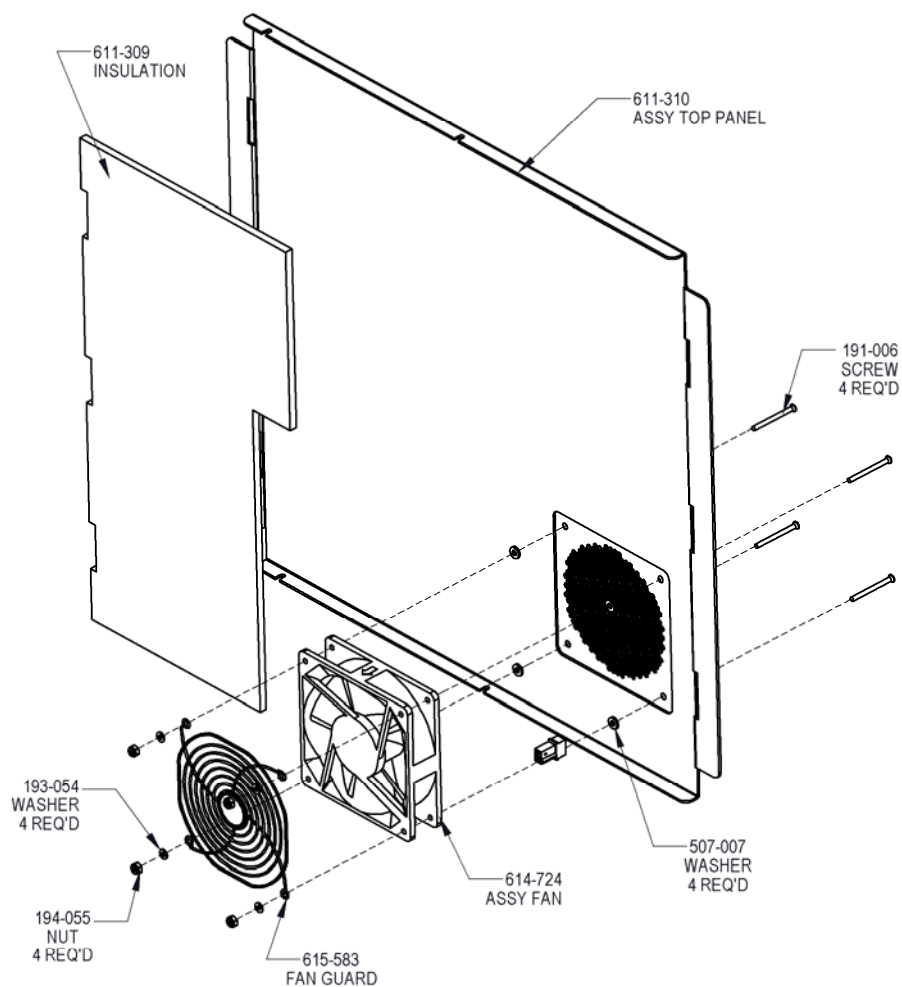
*THE NUMBER AND TYPE OF
IR CELLS WILL VARY DEPENDING ON
THE INSTRUMENT MODEL. REFER TO
THE ILLUSTRATION SECTION OF THIS
MANUAL FOR PART NUMBERS)

Figure 10-4
Right Side View



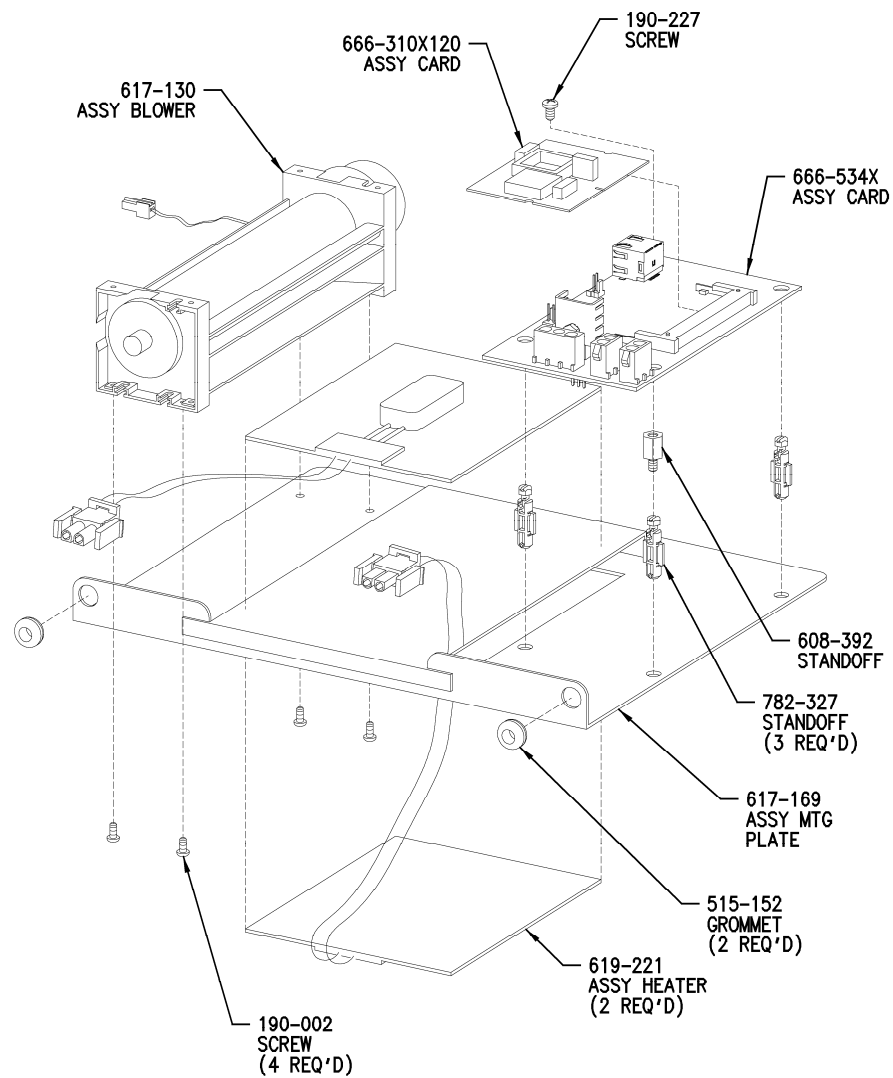
ILS-00309-000

Figure 10-5
Mounted Fan Assembly 619-003



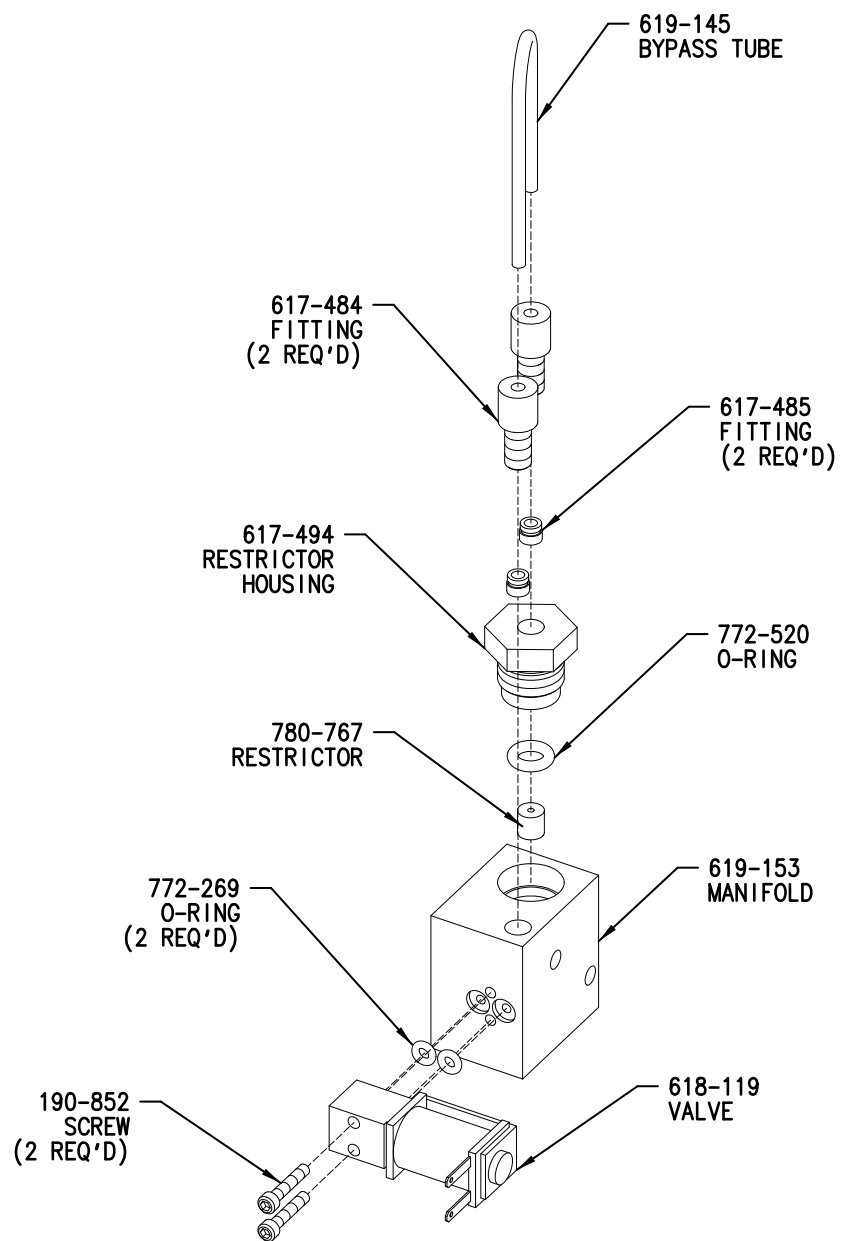
ILS-00311 - D

Figure 10-6
Top Panel Assembly 619-247



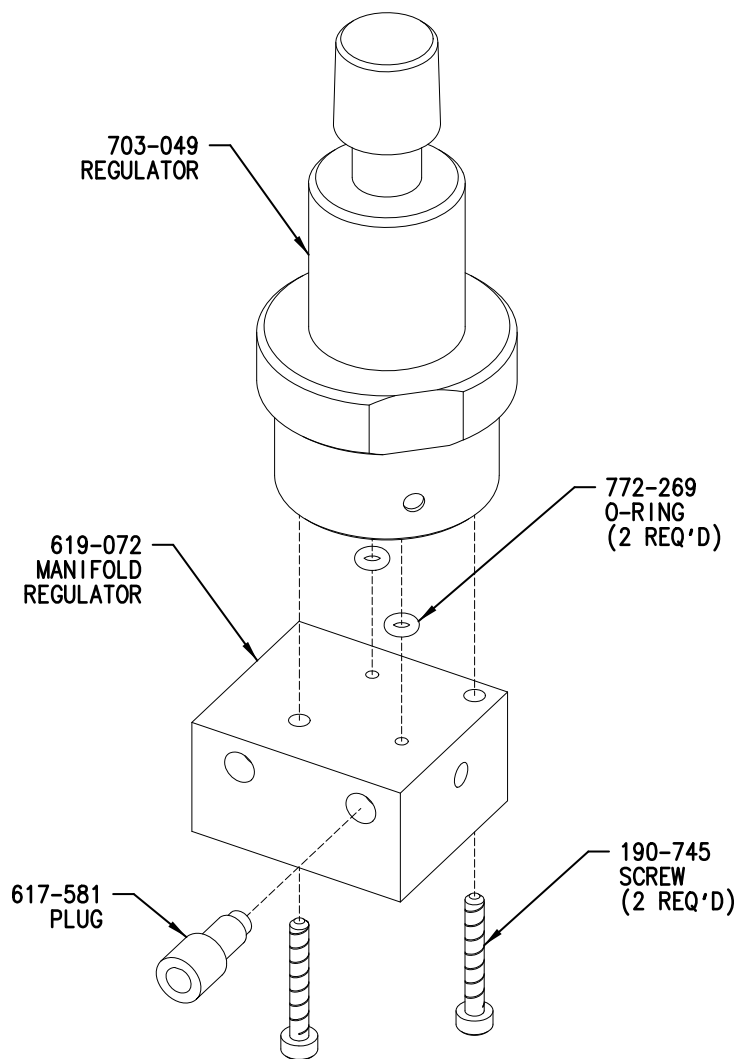
ILS-00312-B

Figure 10-7
TC Oven Assembly 619-237



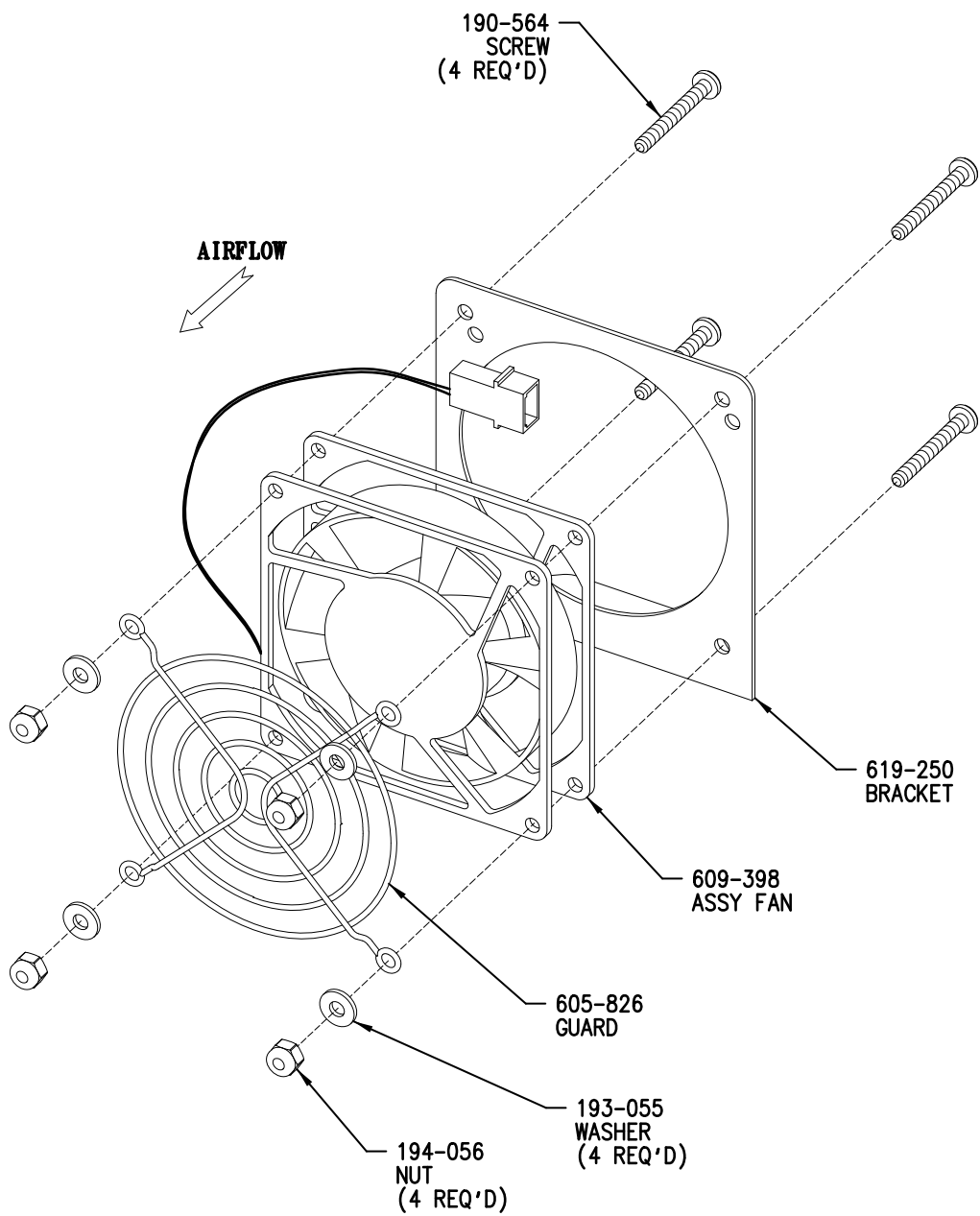
ILS-00313-000

Figure 10-8
Gas Conversion Manifold Assembly 619-223



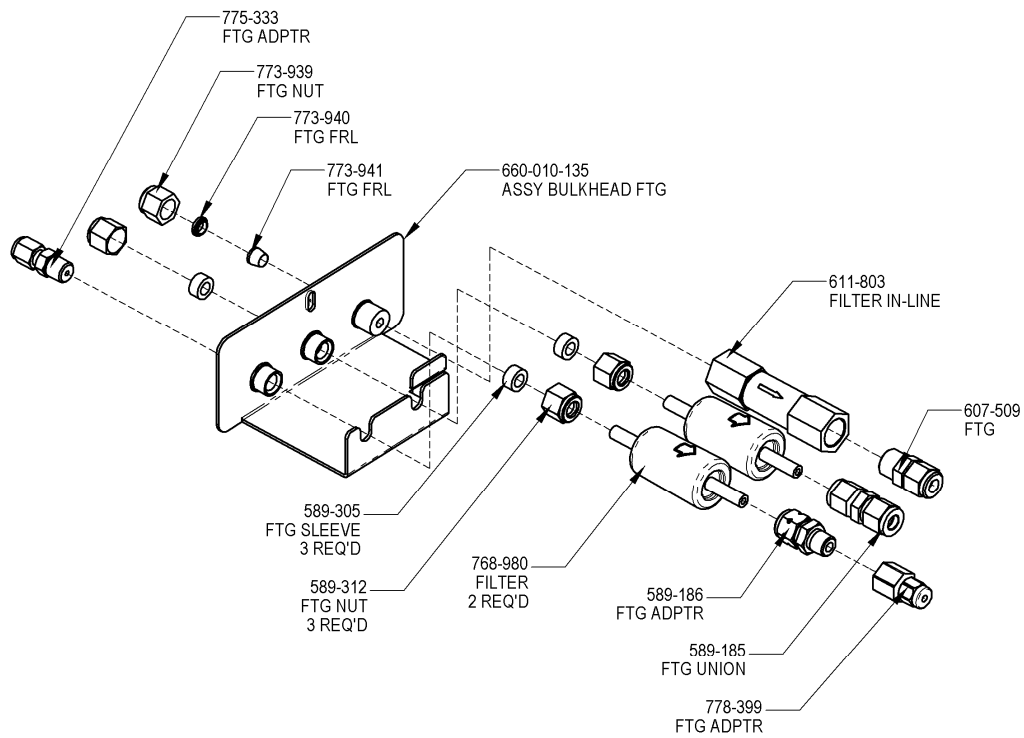
ILS-00317-000

Figure 10-9
Oxygen Manifold Regulator Assembly 619-222



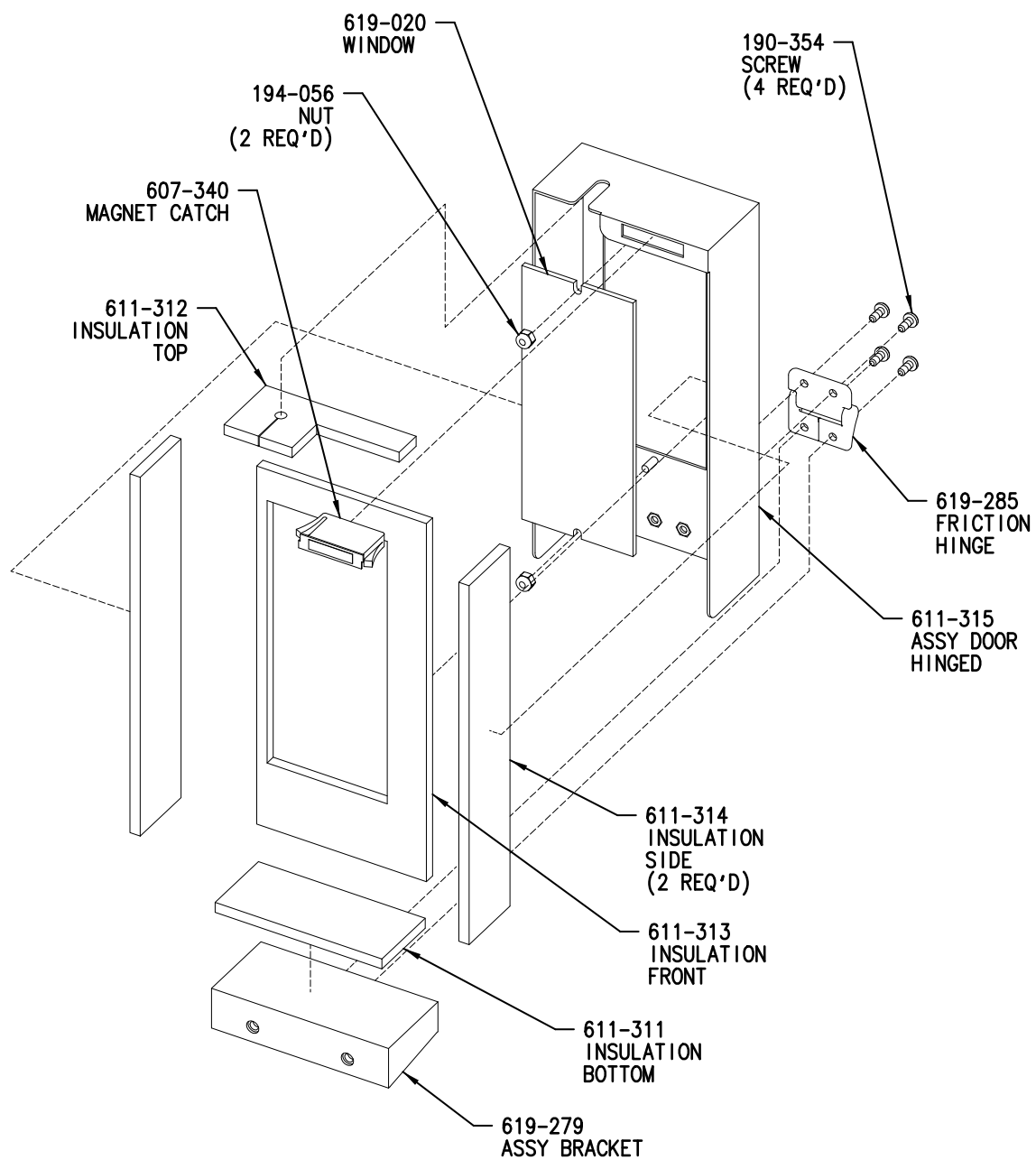
ILS-00417-000

Figure 10-10
Oven Fan Assembly 619-240



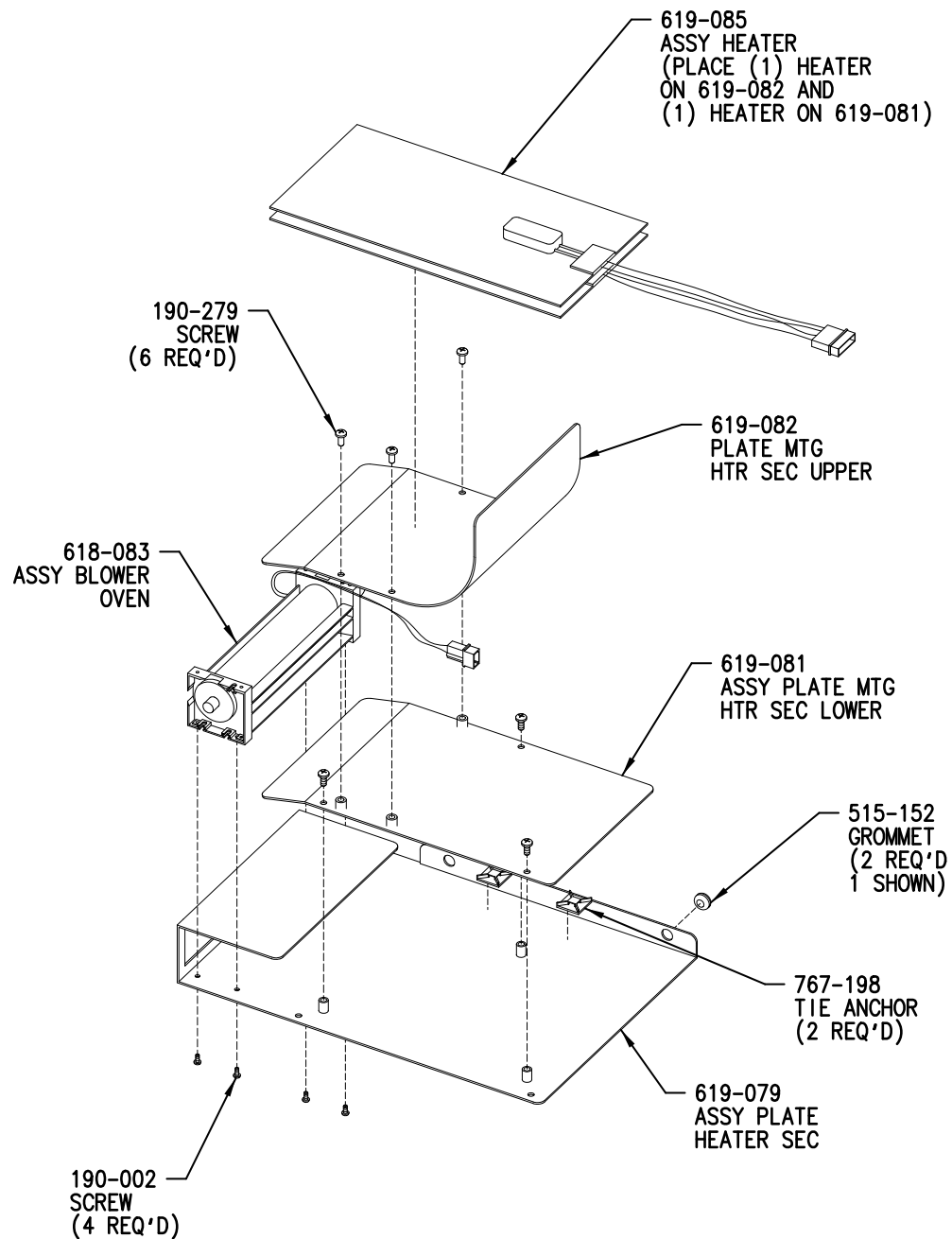
ILS-00319-C

Figure 10-11
Incoming Gas Filter Assembly 621-116



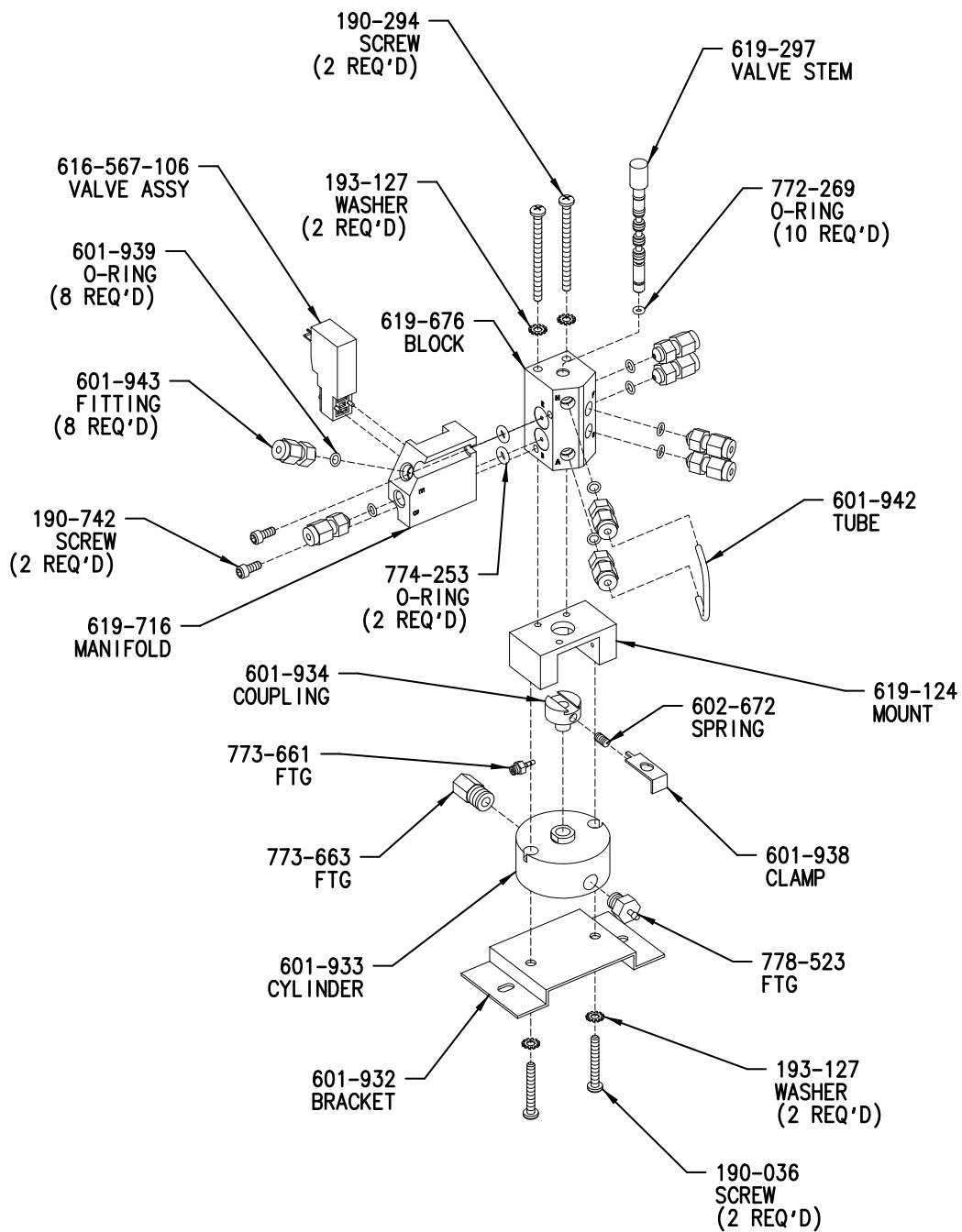
ILS-00320-004

Figure 10-12
Filter Door Assembly 619-280



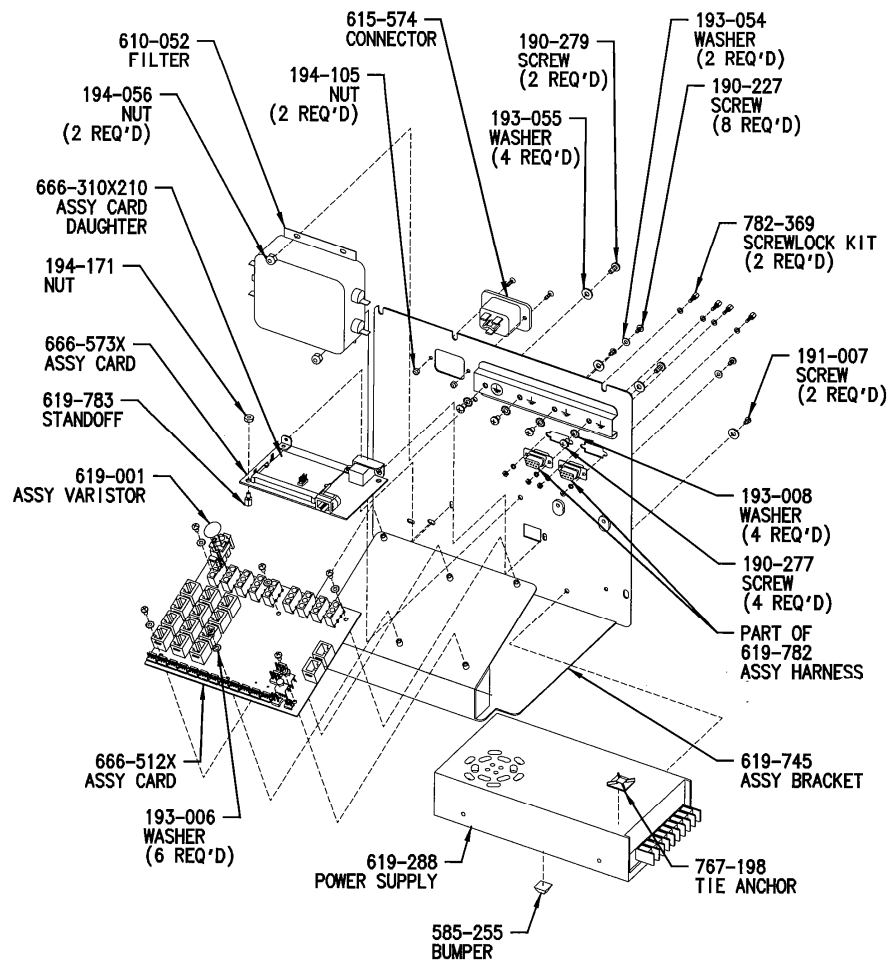
ILS-00322-000

Figure 10-13
Secondary Oven Heater Assembly 619-080



IIS-00420-000

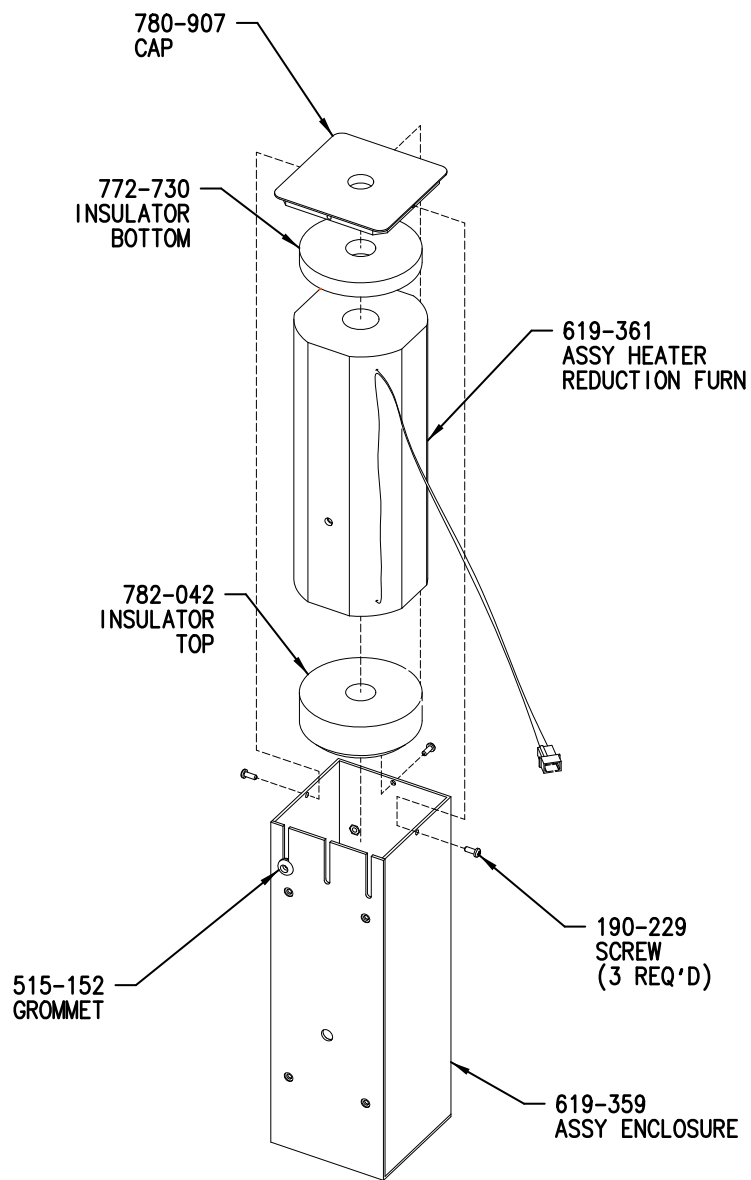
Figure 10-14
Aliquot Dose Valve Assembly 619-675



ORIGINAL

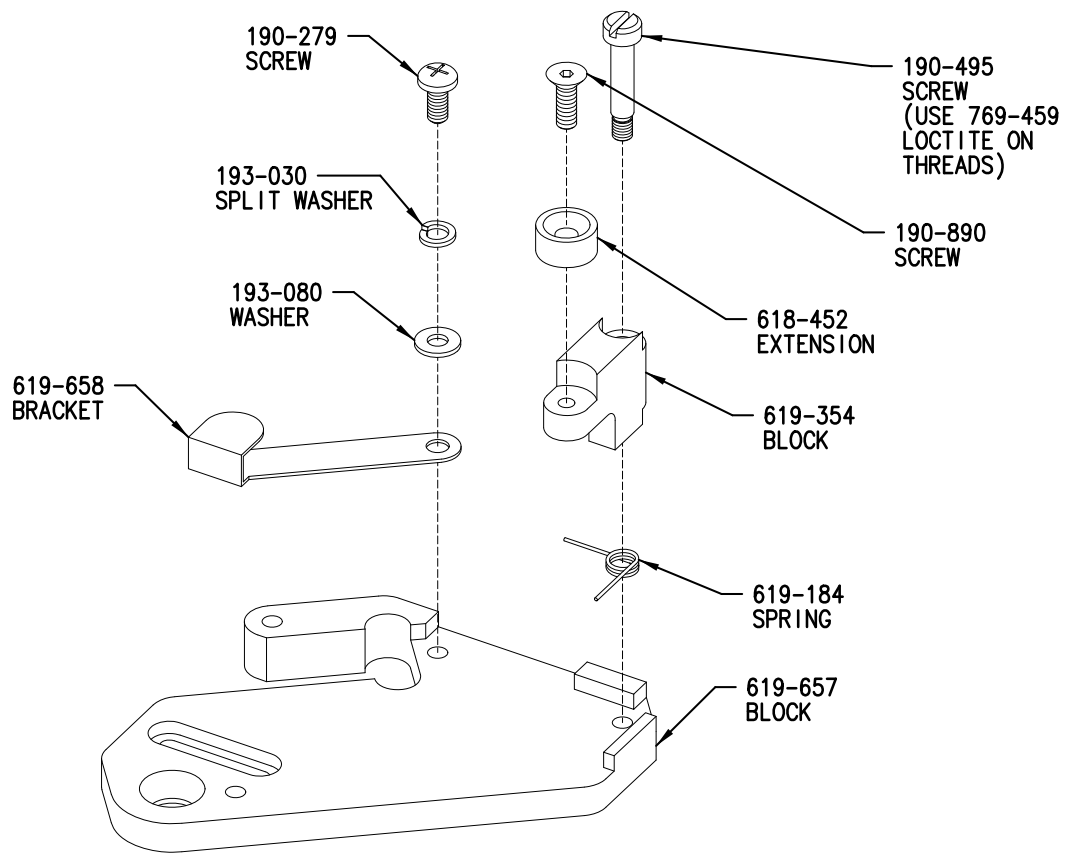
ILS-00315-003

Figure 10-15
AC Power Distribution Assembly 619-744



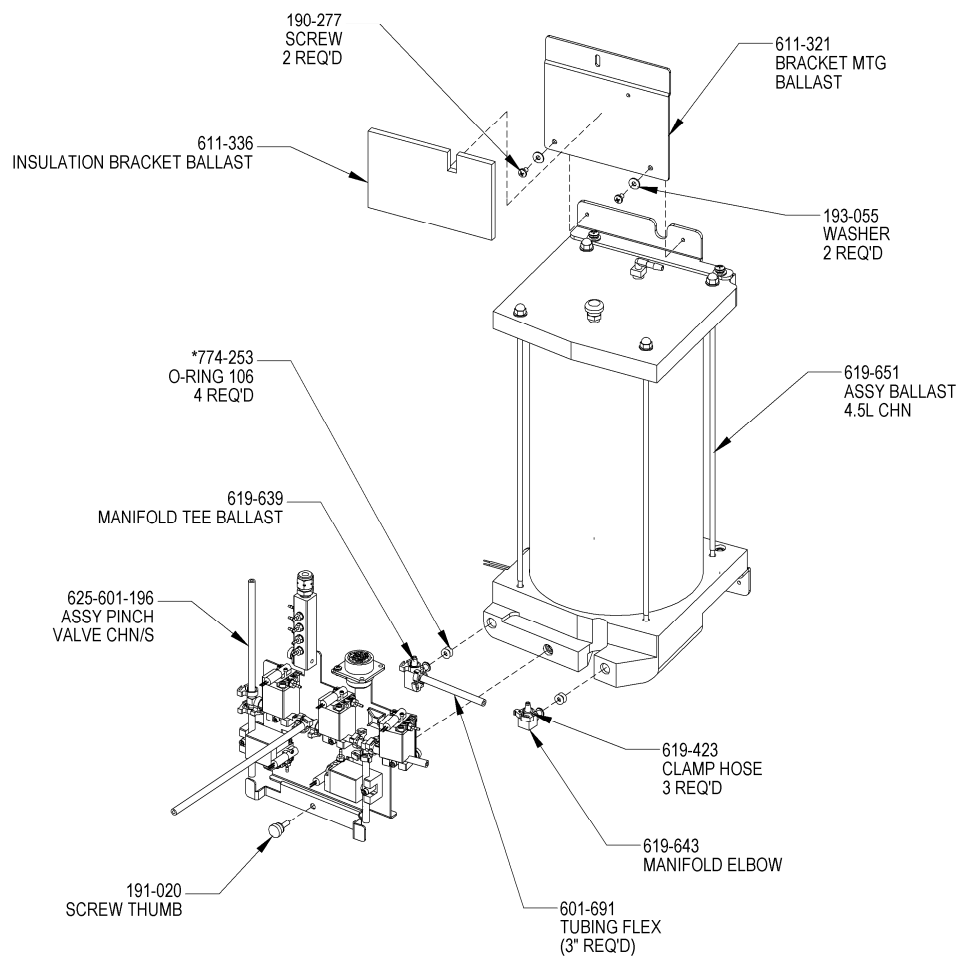
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Figure 10-16
Reduction Heater Assembly 619-362



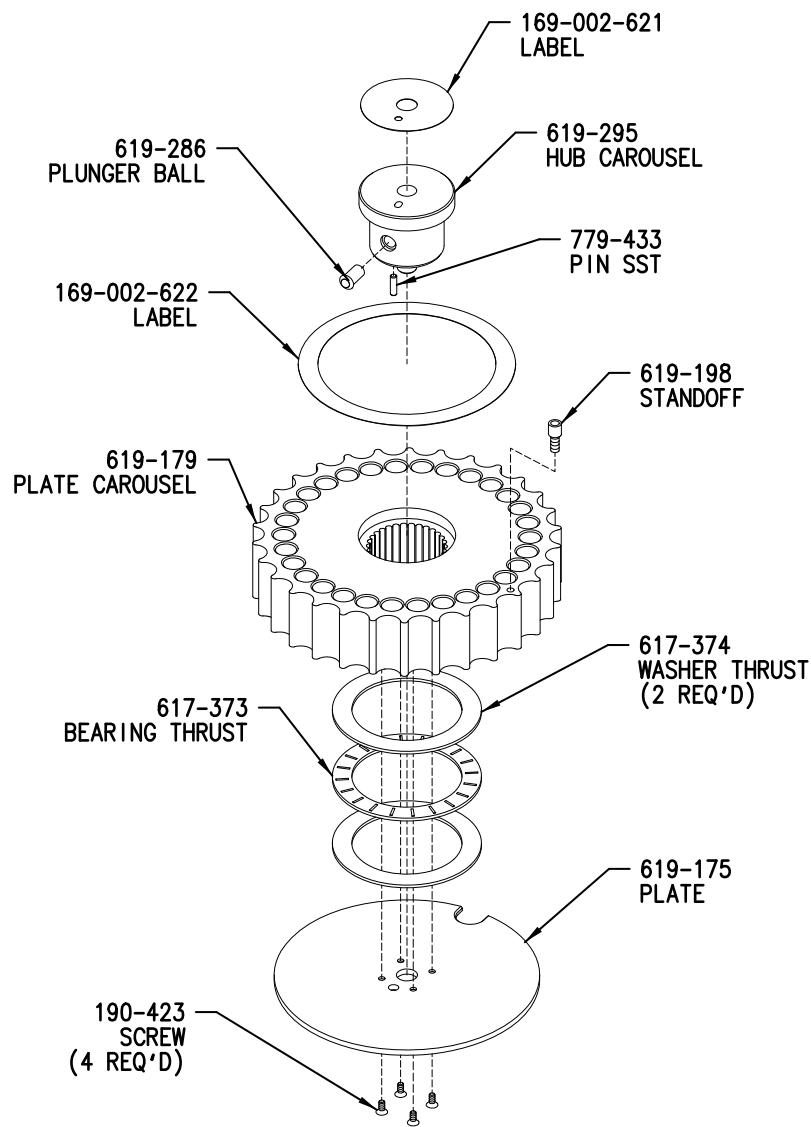
ILS-00310-002

Figure 10-17
Slide Block Adapter Assembly 619-656



ILS-00349-D

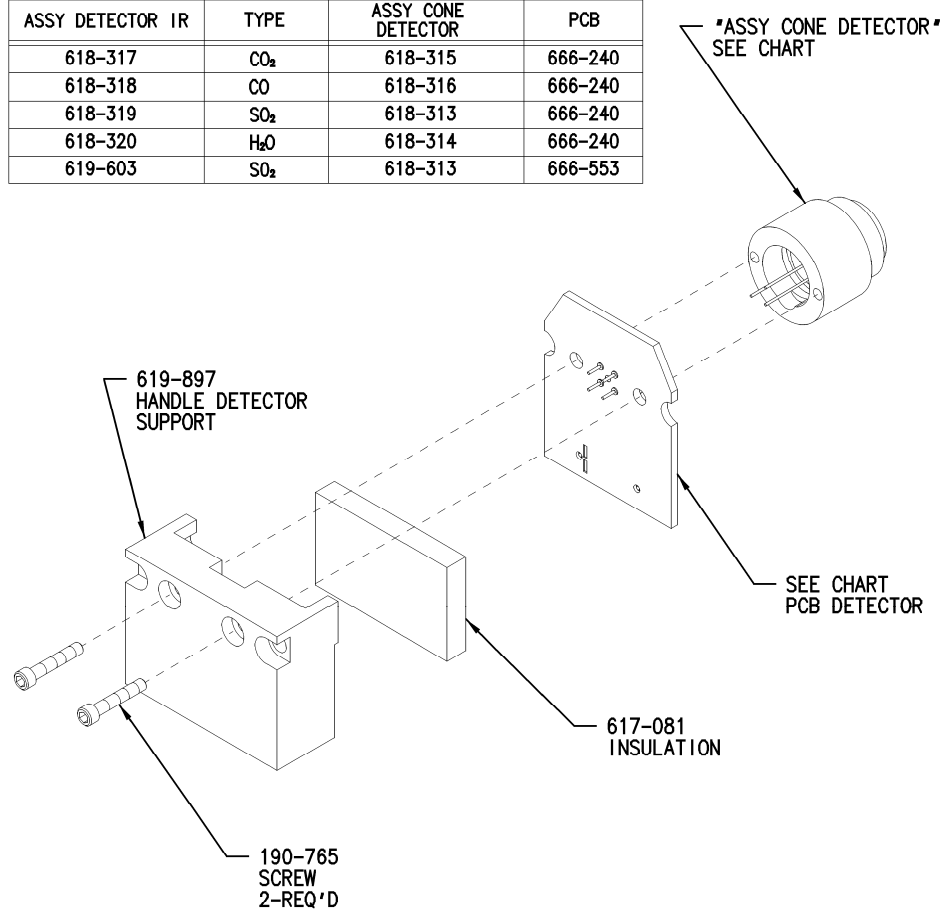
Figure 10-18
Ballast Assembly with Valves



ILS-00336-000

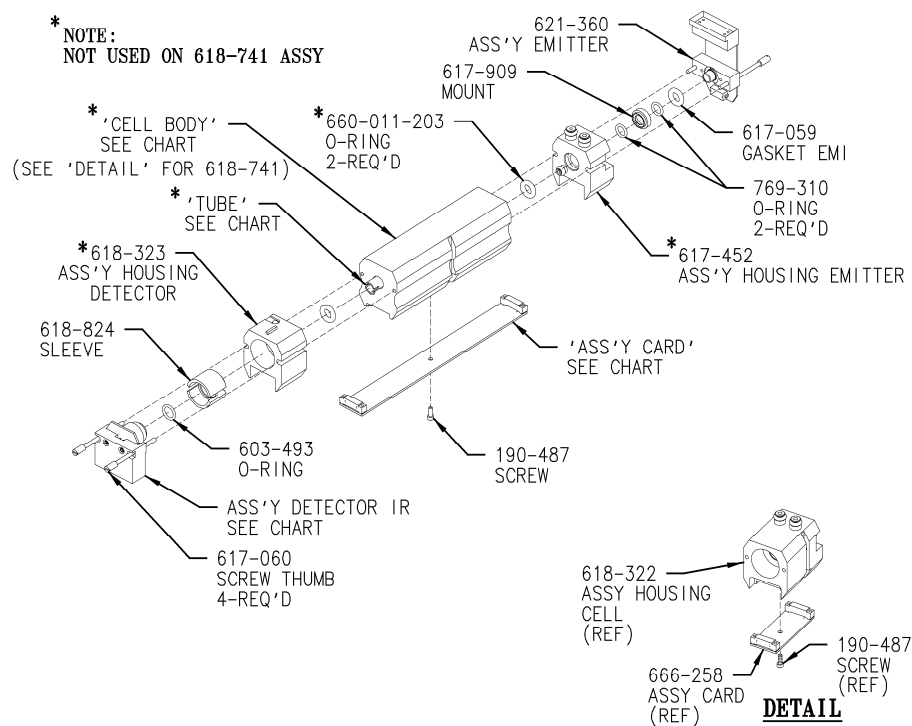
Figure 10-19
Carousel Assembly 619-180

| ASSY DETECTOR IR | TYPE | ASSY CONE DETECTOR | PCB |
|------------------|------------------|--------------------|---------|
| 618-317 | CO ₂ | 618-315 | 666-240 |
| 618-318 | CO | 618-316 | 666-240 |
| 618-319 | SO ₂ | 618-313 | 666-240 |
| 618-320 | H ₂ O | 618-314 | 666-240 |
| 619-603 | SO ₂ | 618-313 | 666-553 |



ILS-00089-F

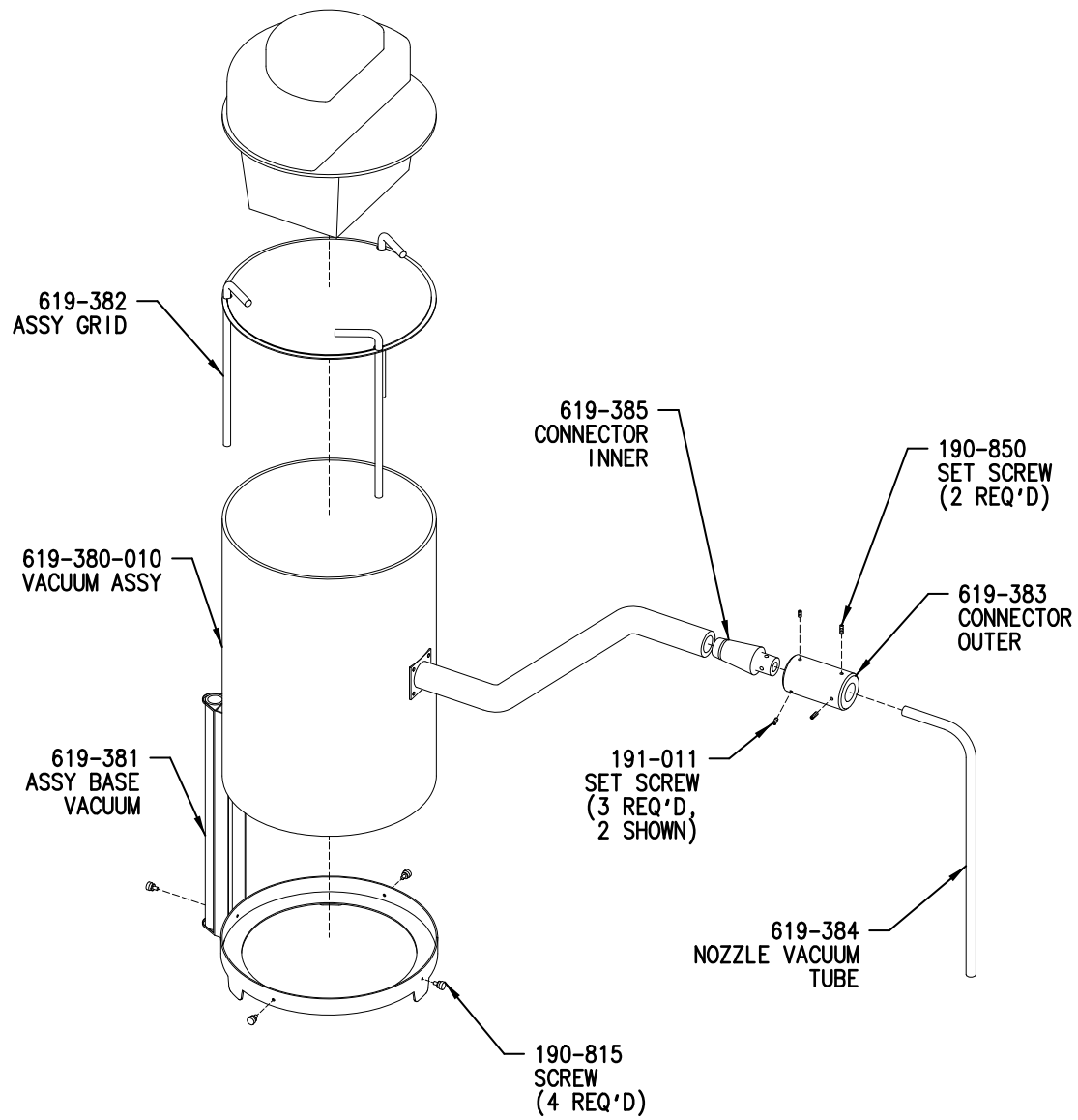
Figure 10-20
IR Cell Detector Assembly



| ASS'Y CELL P/N | ASS'Y CONE DETECTOR | CELL BODY | TUBE | ASS'Y CARD | CELL TYPE | CELL LENGTH | INSTRUMENT |
|----------------|---------------------|-----------|---------|------------|------------------|-------------|--|
| 617-092 | 618-320 | 618-307 | 617-807 | 666-260 | H ₂ O | 6.00" | RH600, ROH600, TCH600, TRUSPEC CHN |
| 618-841 | 618-317 | 618-839 | 617-806 | 666-259 | CO ₂ | 2.75" | RH600, ROH600, TCH600, RO600, TC400, TC500, TC600, TRUSPEC CN, TRUSPEC CHN |
| 618-842 | 618-318 | 618-839 | 617-806 | 666-259 | CO | 2.75" | ROH600, TCH600, RO400, RO500, RO600, TC600 |
| 618-741 | 618-317 | 618-322 | --- | 666-258 | CO ₂ | .725" | CS600, CSHS600, C600, TRUSPEC CN, TRUSPEC N |

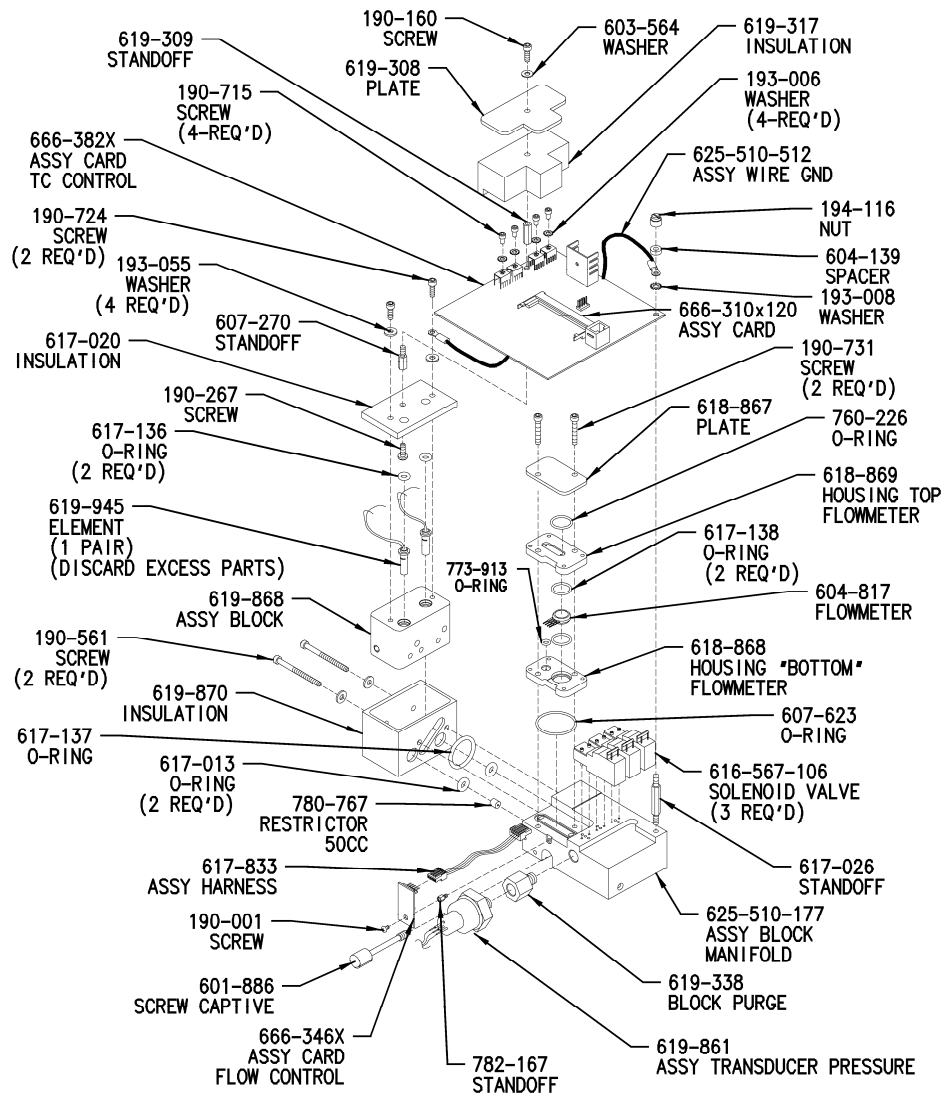
ILS-00071-S

Figure 10-21
IR Cell Assembly



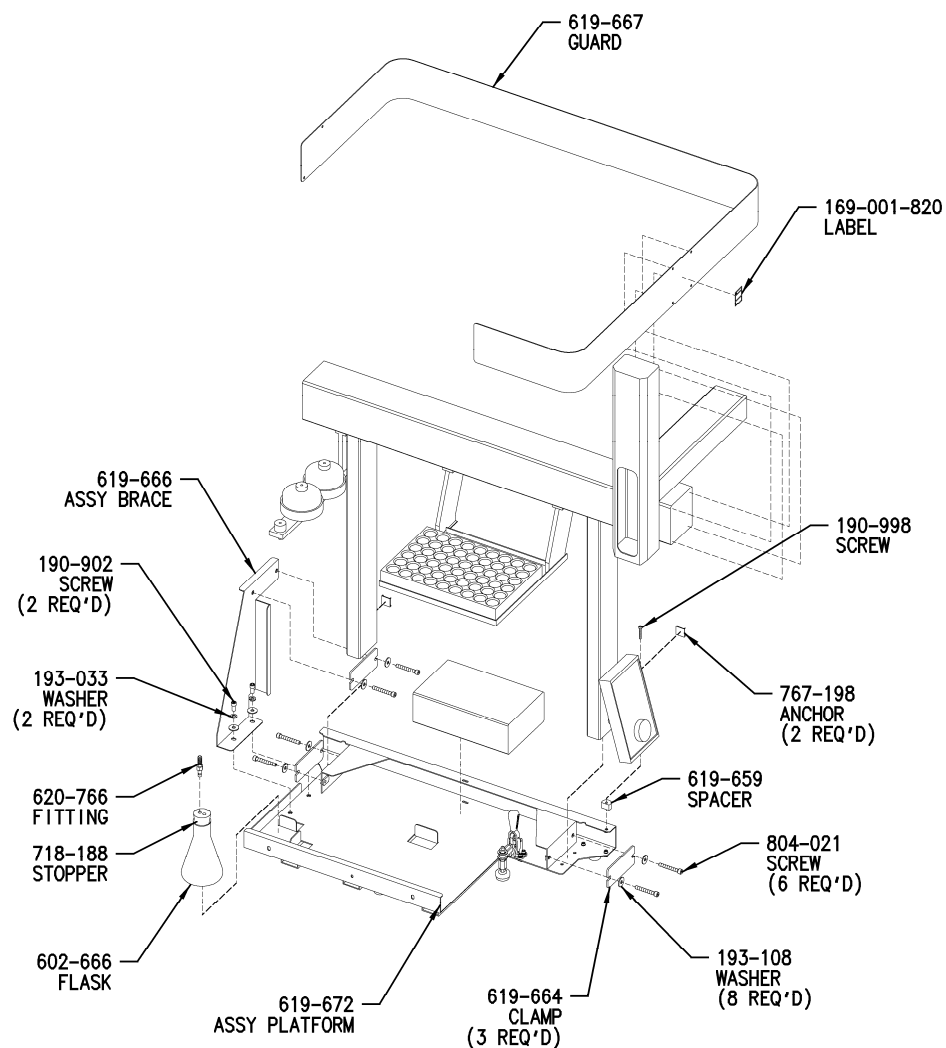
ILS-00340-000

Figure 10-22
Vacuum Assembly 619-380



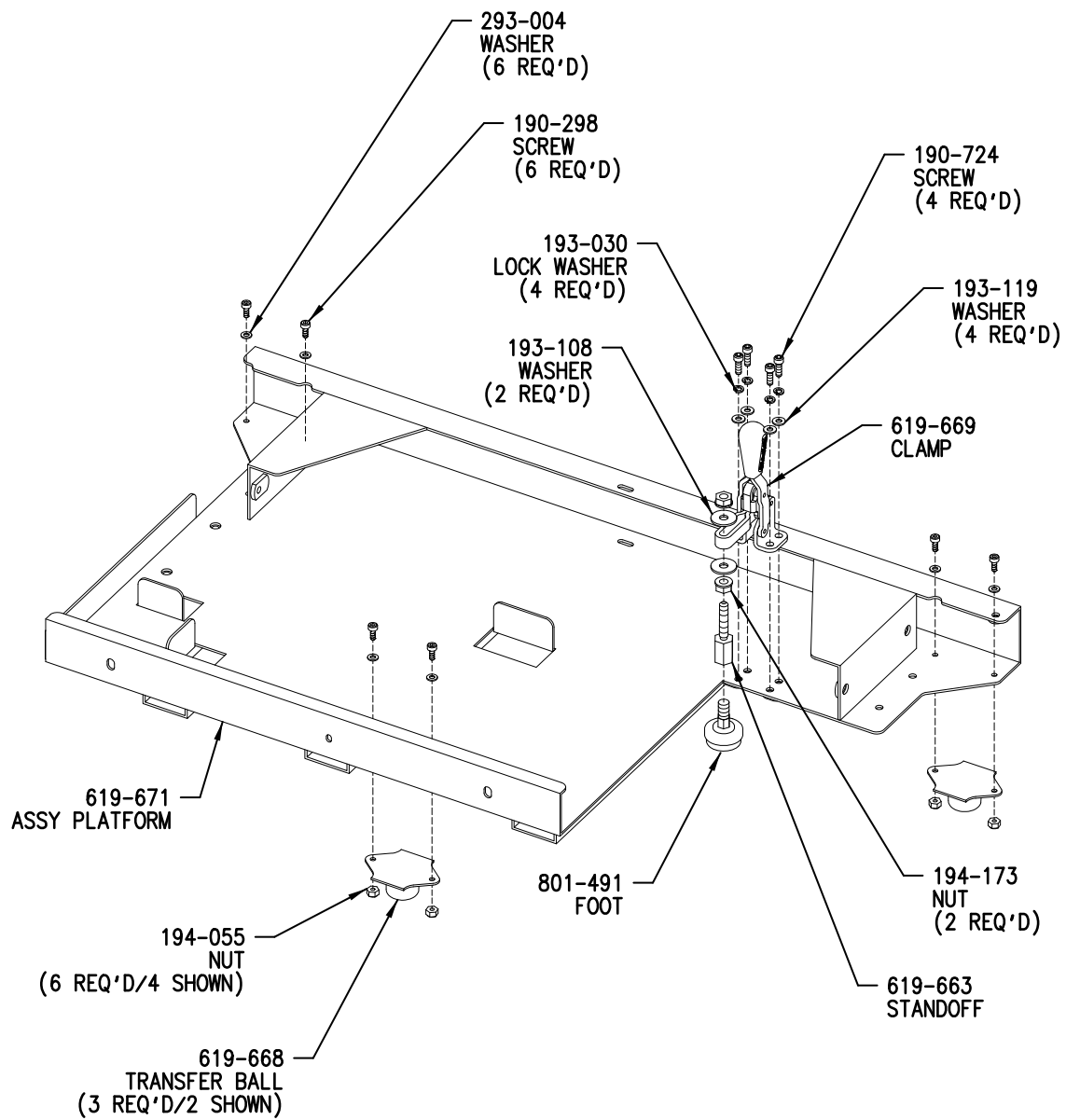
ILS-00328-N

Figure 10-23
TC Cell Assembly 619-941



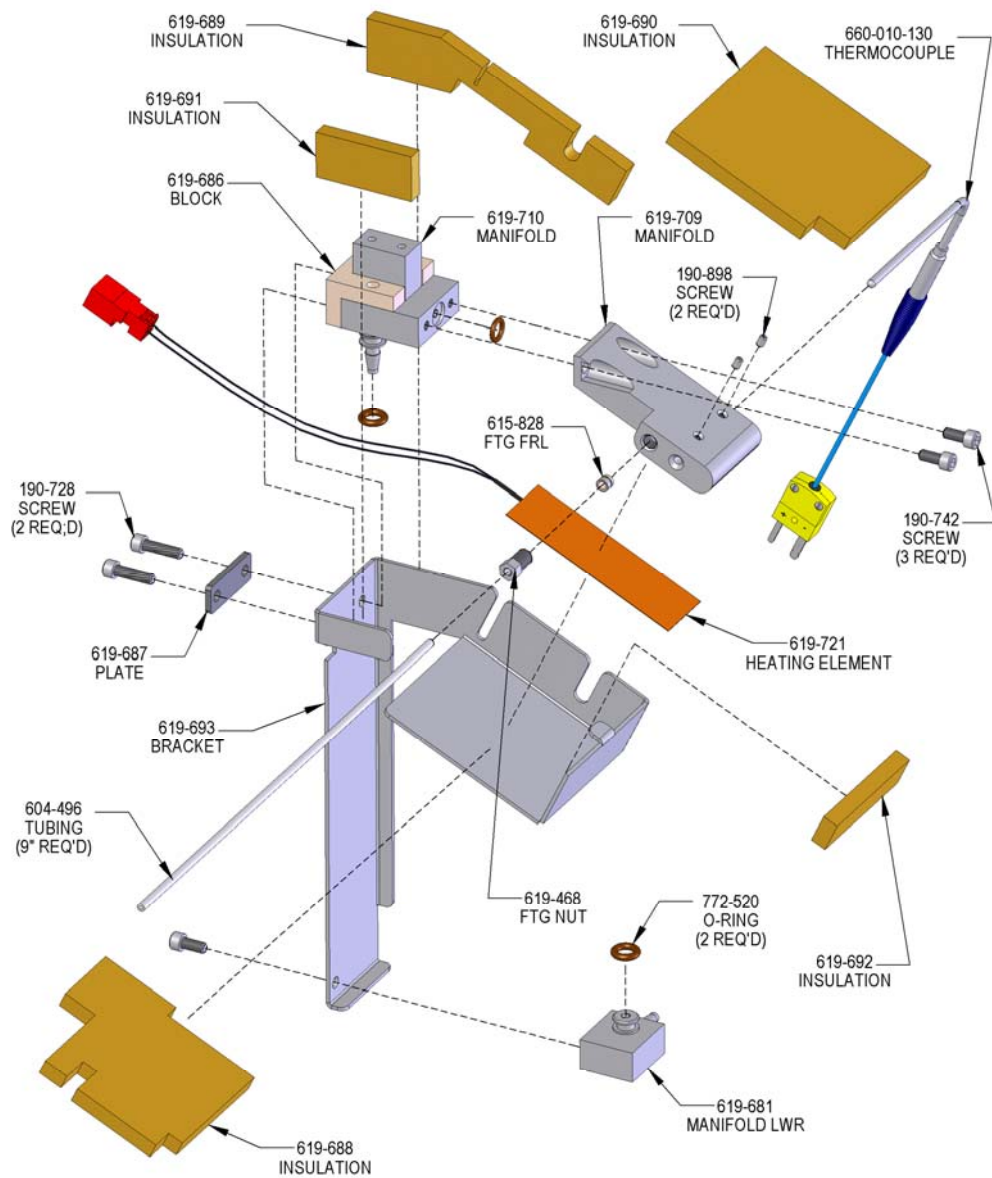
ILS-00396-B

Figure 10-24
Liquid Autosampler – Exploded View



ILS-00397-000

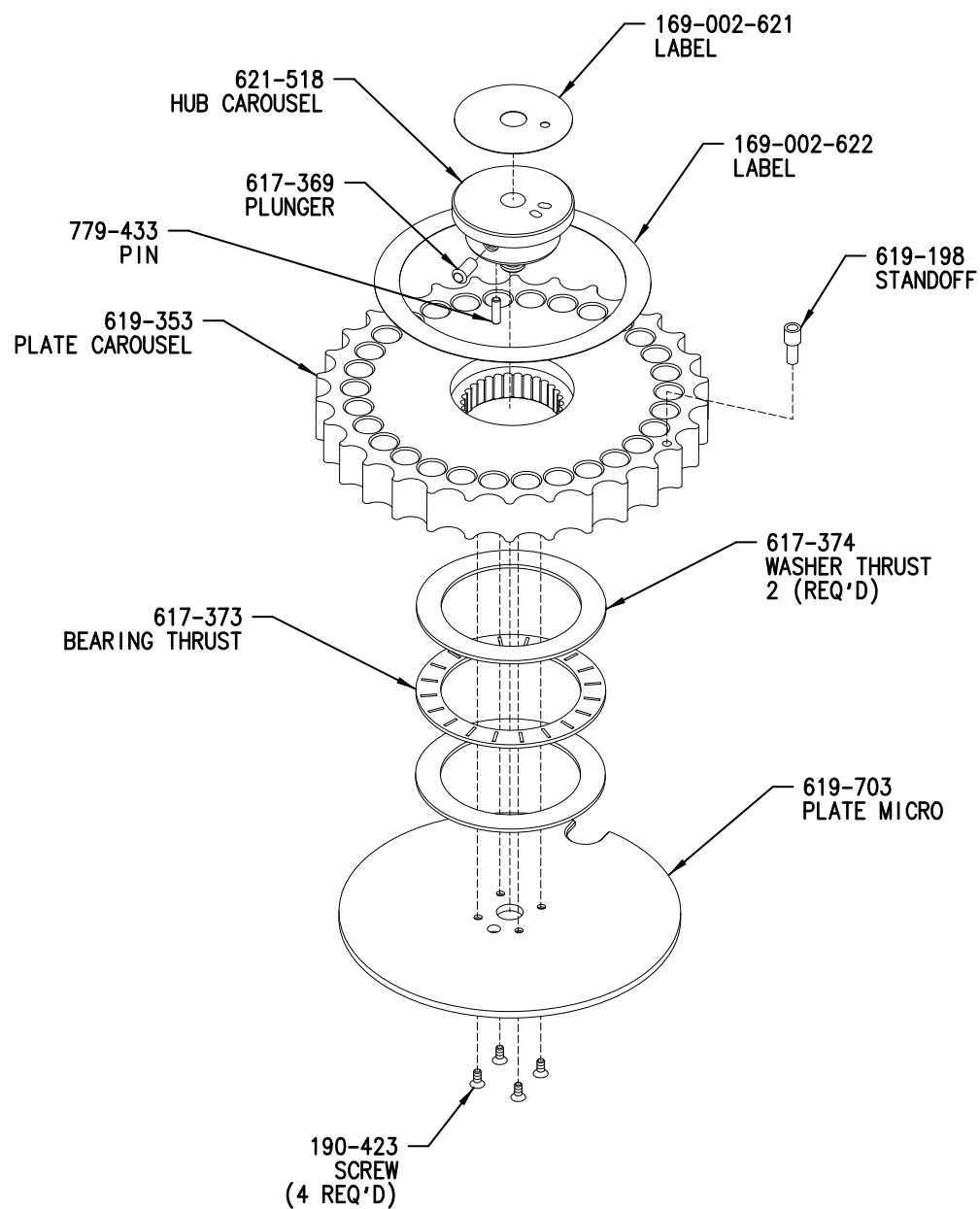
Figure 10-25
Autosampler Base Assembly



ILS-00418-C

NOTE: Used in TruSpec Micro only.

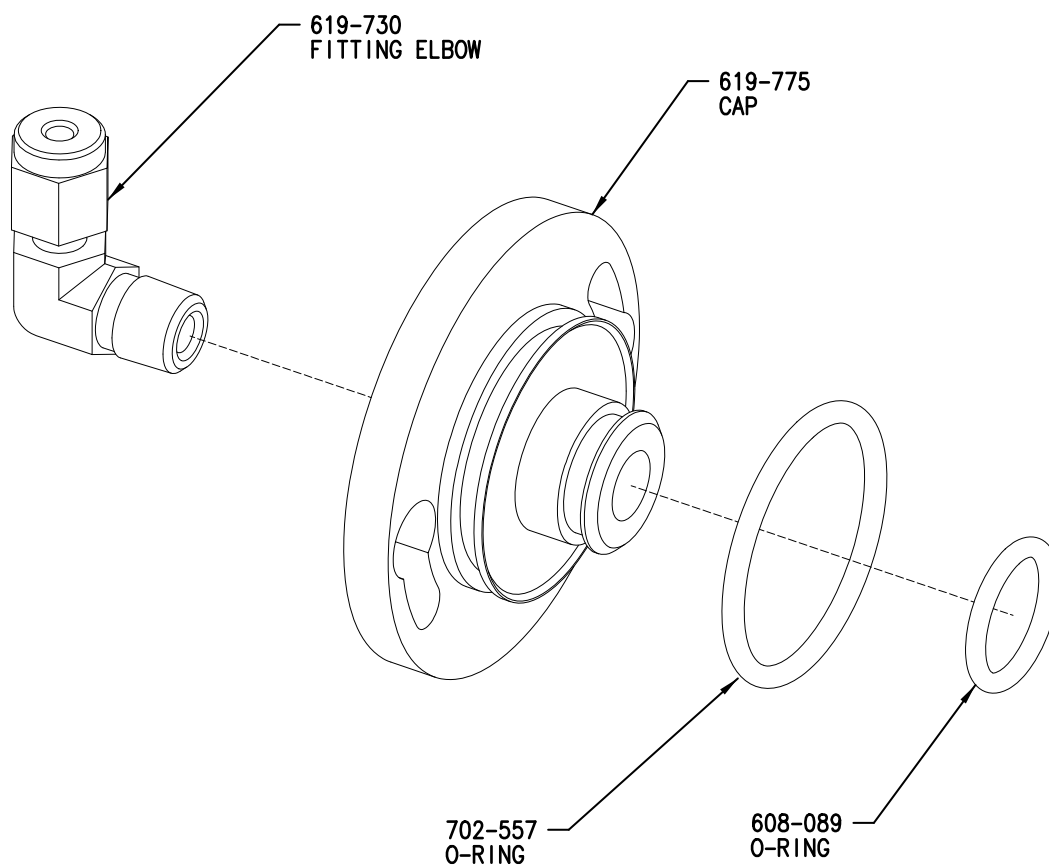
Figure 10-26
Heater Bracket Assembly 619-698



ILS-00419-000

NOTE: Used in TruSpec Micro only.

Figure 10-27
Micro Carousel Assembly 619-704



ILS-00480-000

NOTE: Used in TruSpec Micro only.

Figure 10-28
Combustion Tube Cap 619-746

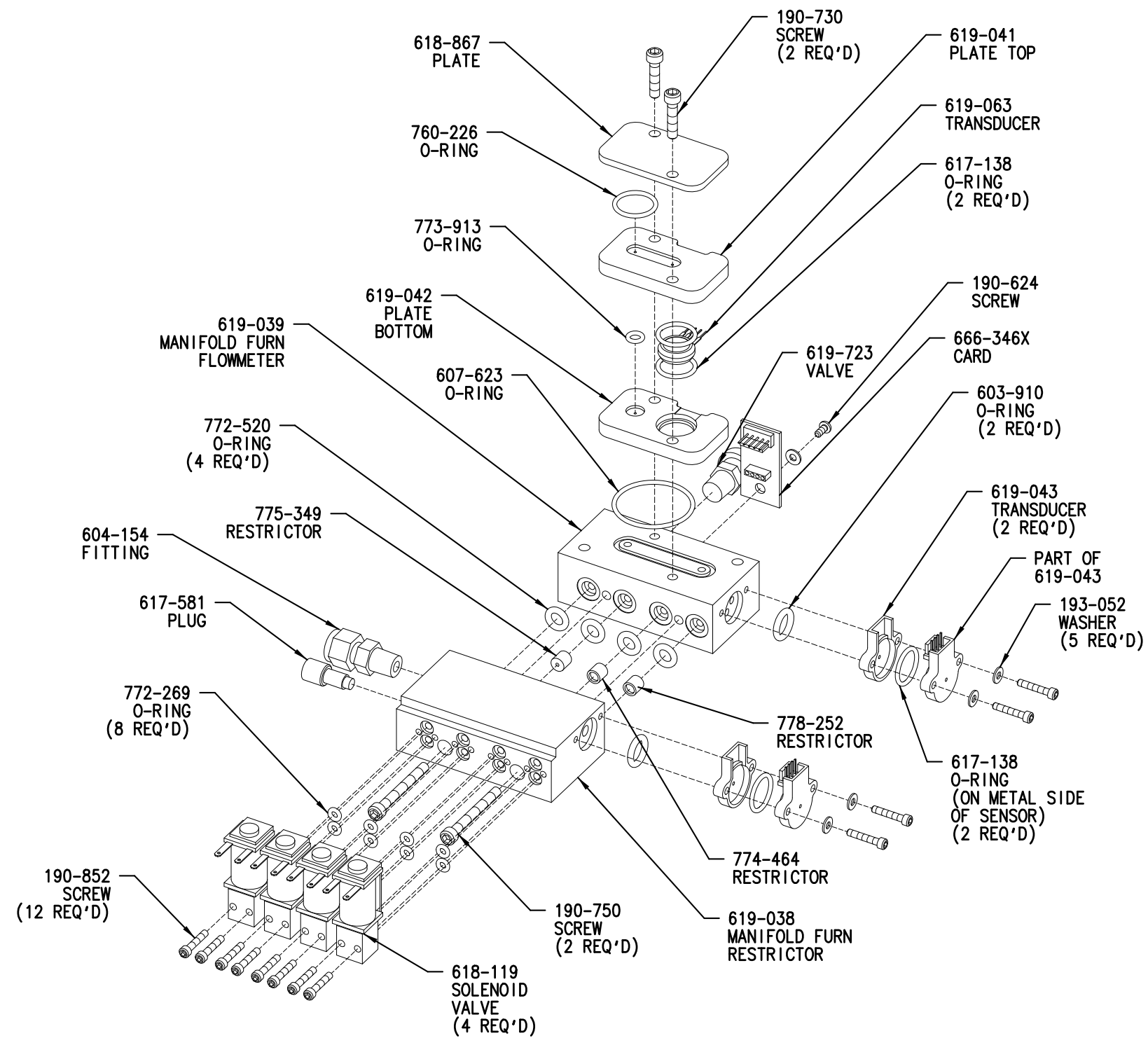


Figure 10-29
Furnace Manifold Assembly 619-724

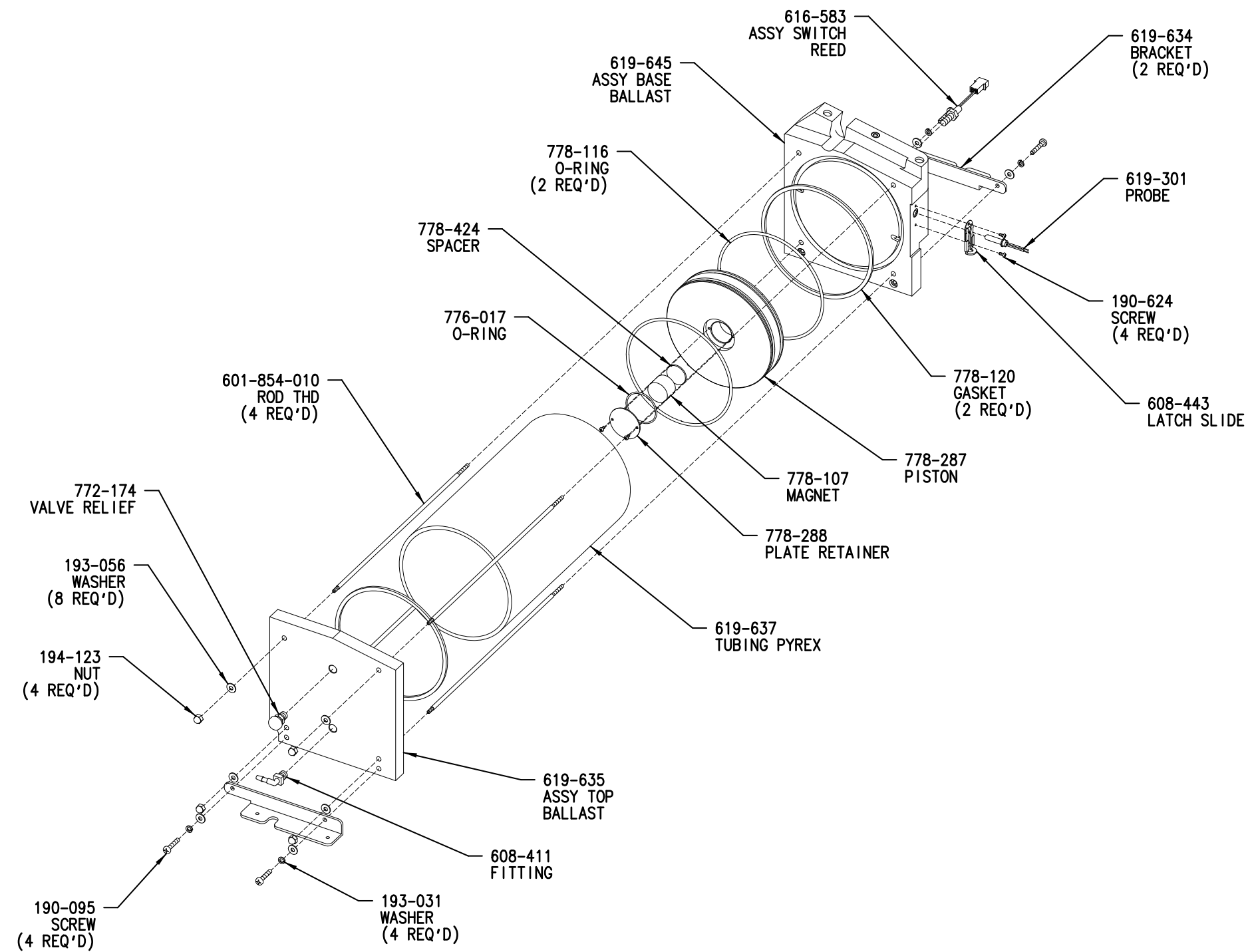
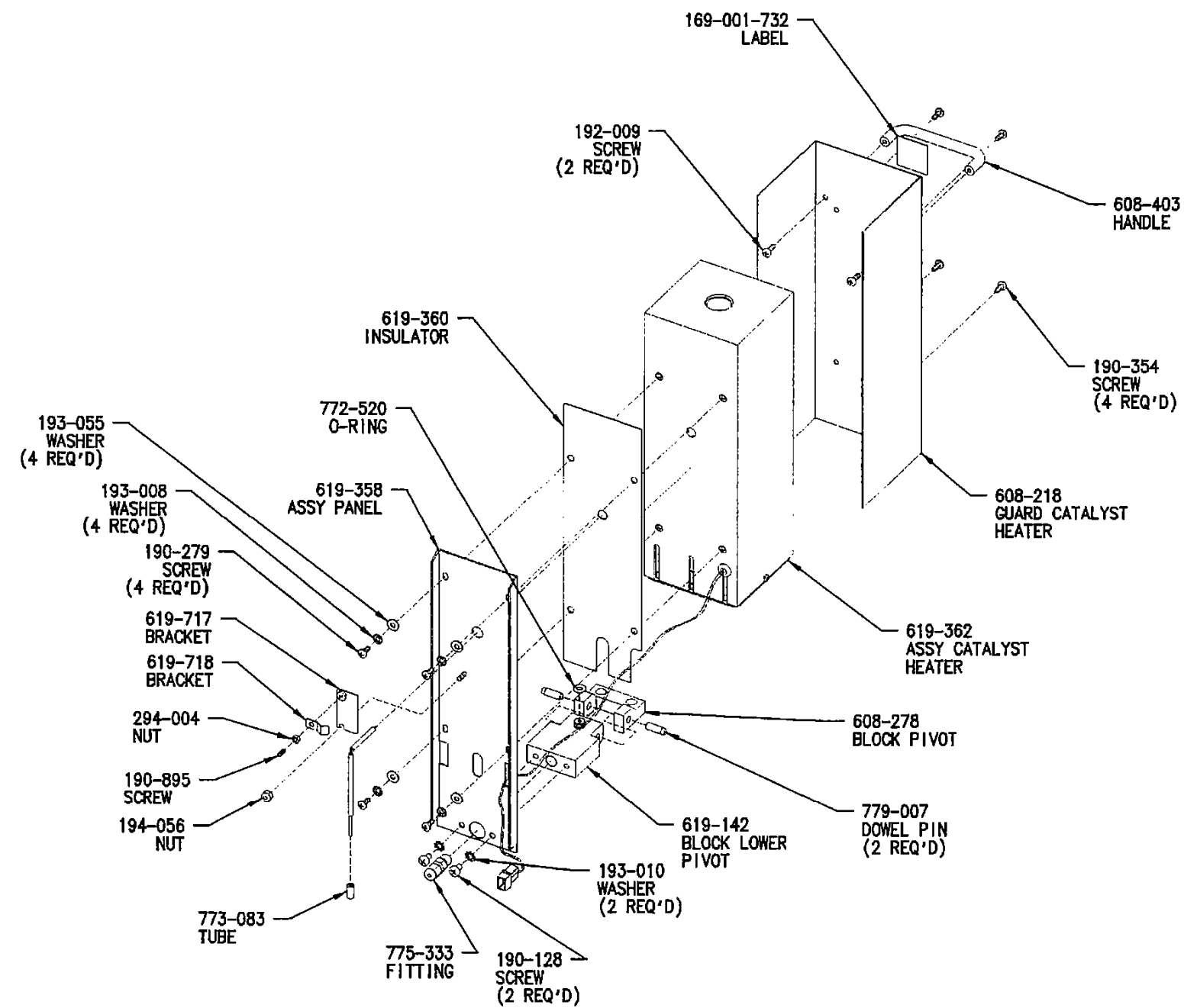


Figure 10-30
Ballast Assembly



ORIGINAL

ILS-00328-004

Figure 10-31
Reduction Heater Panel 619-719

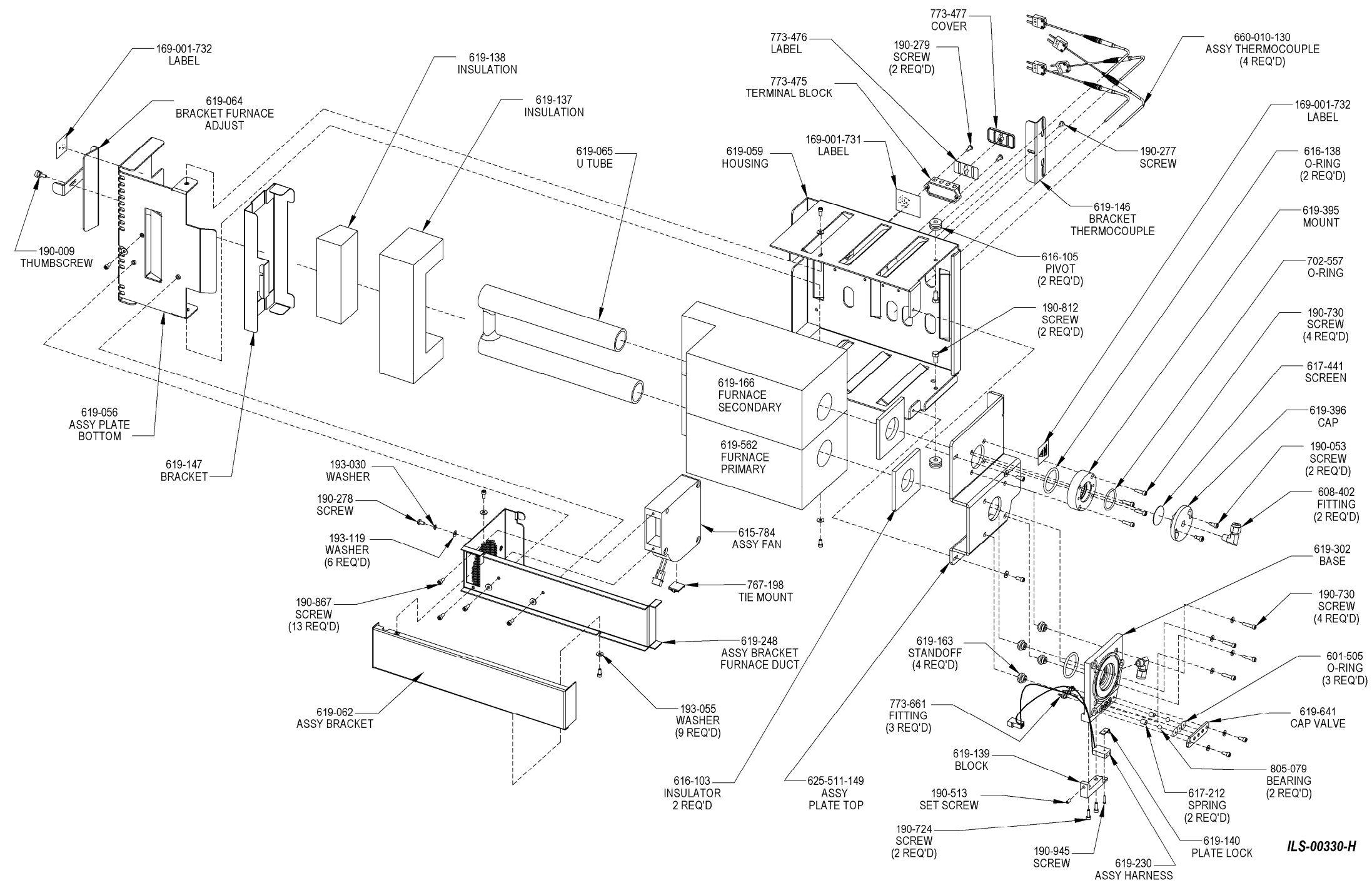


Figure 10-32
Furnace Assembly 625-401-358

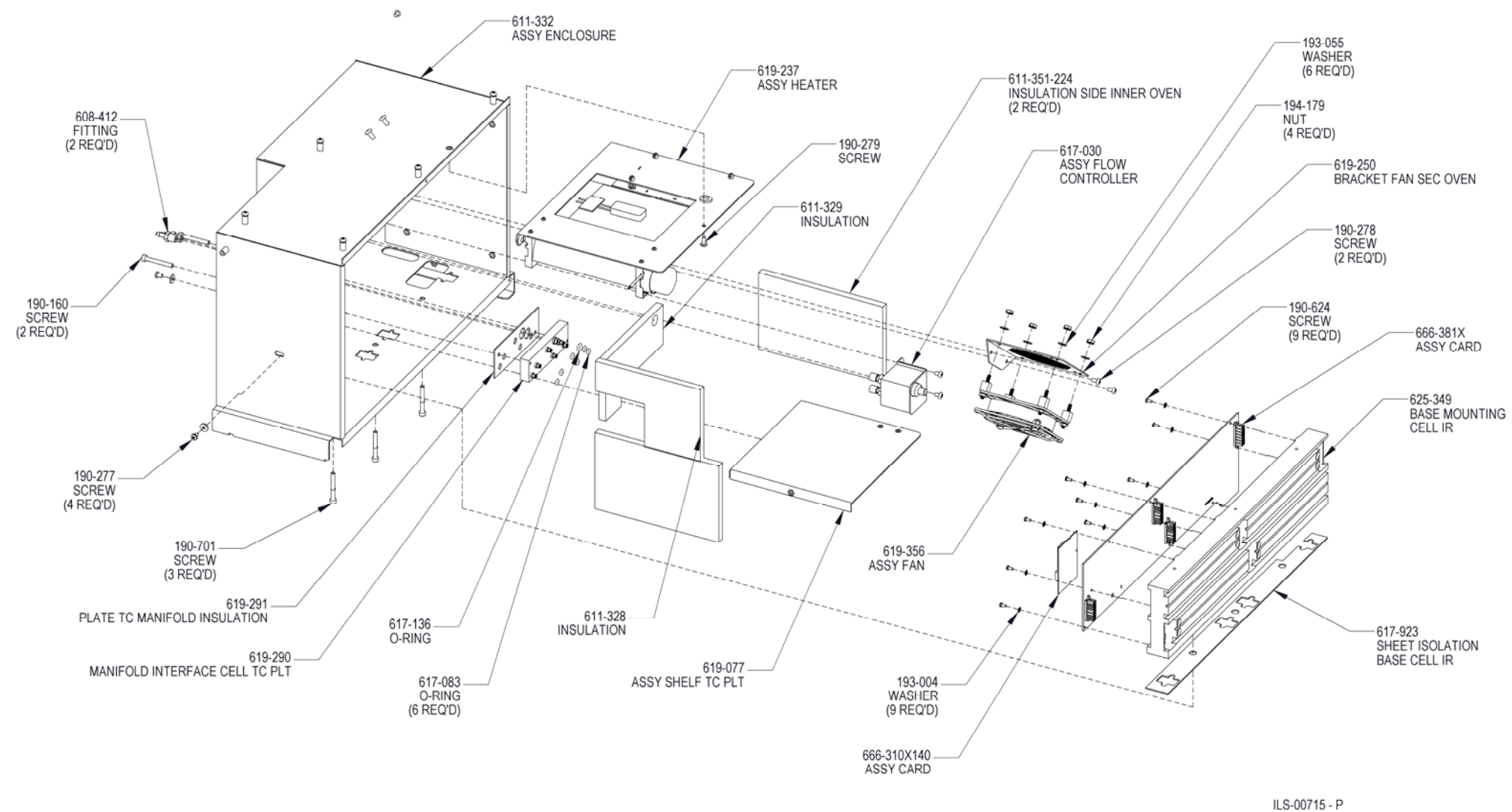


Figure 10-33
Cell Oven Assembly Part 1

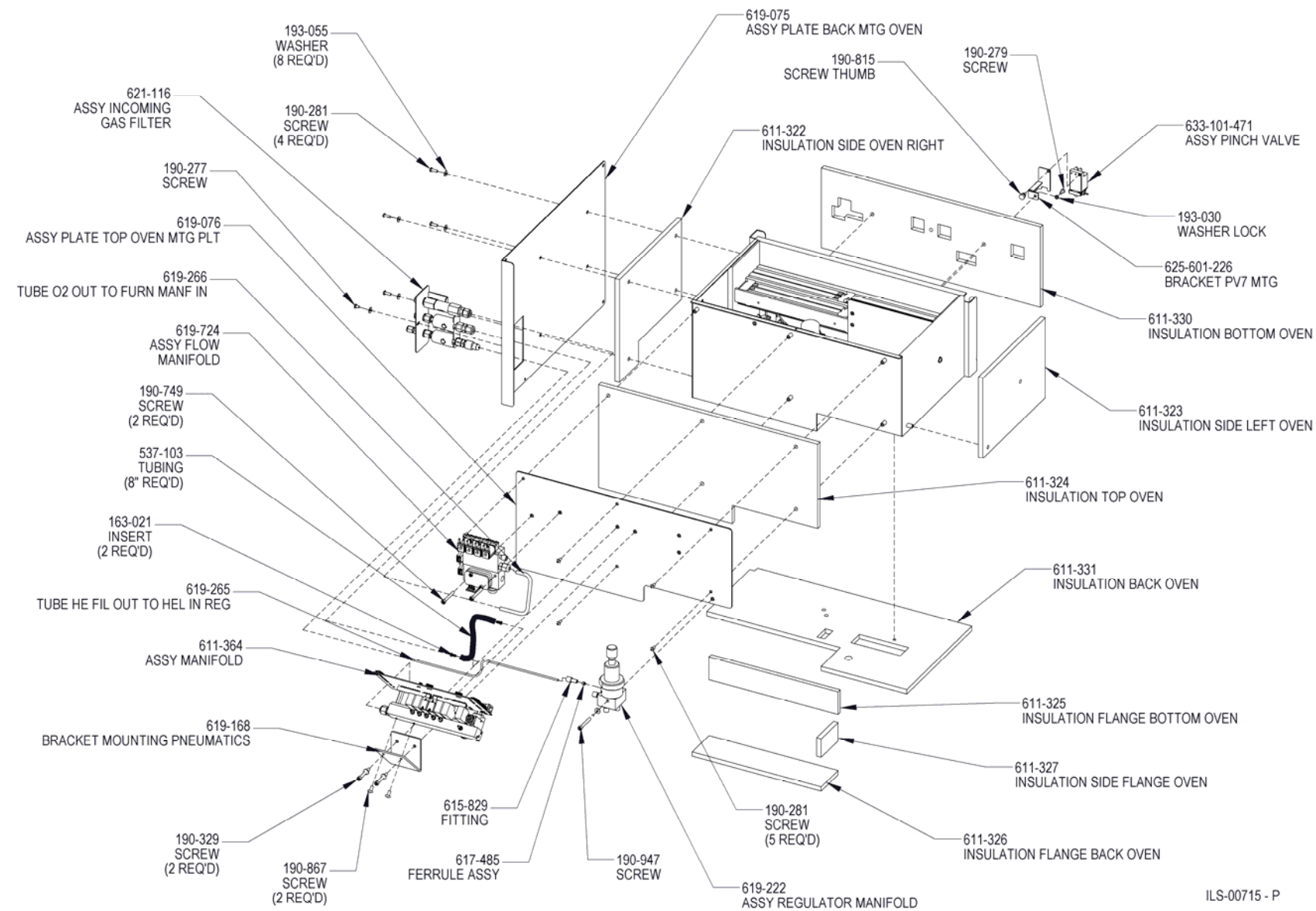
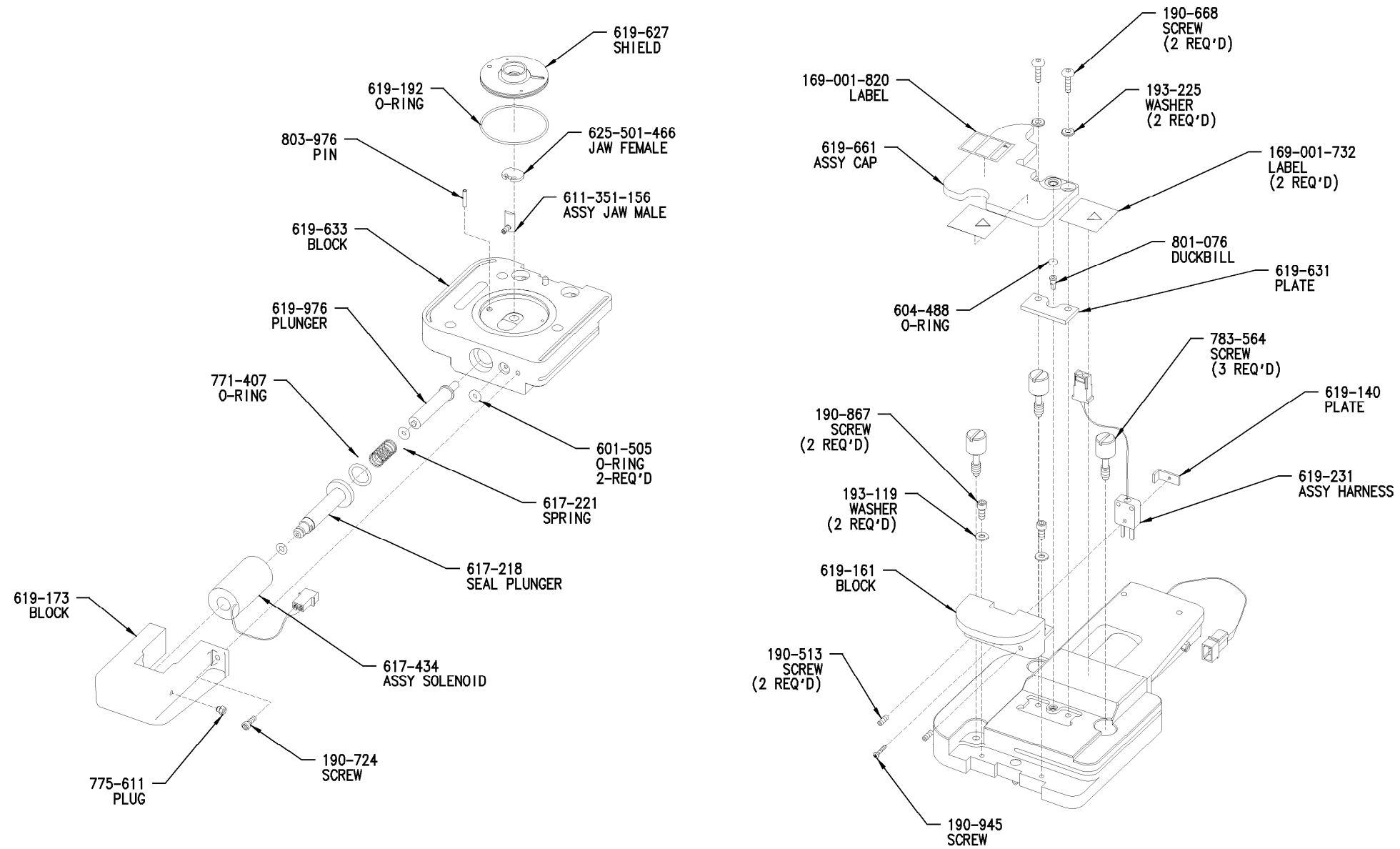
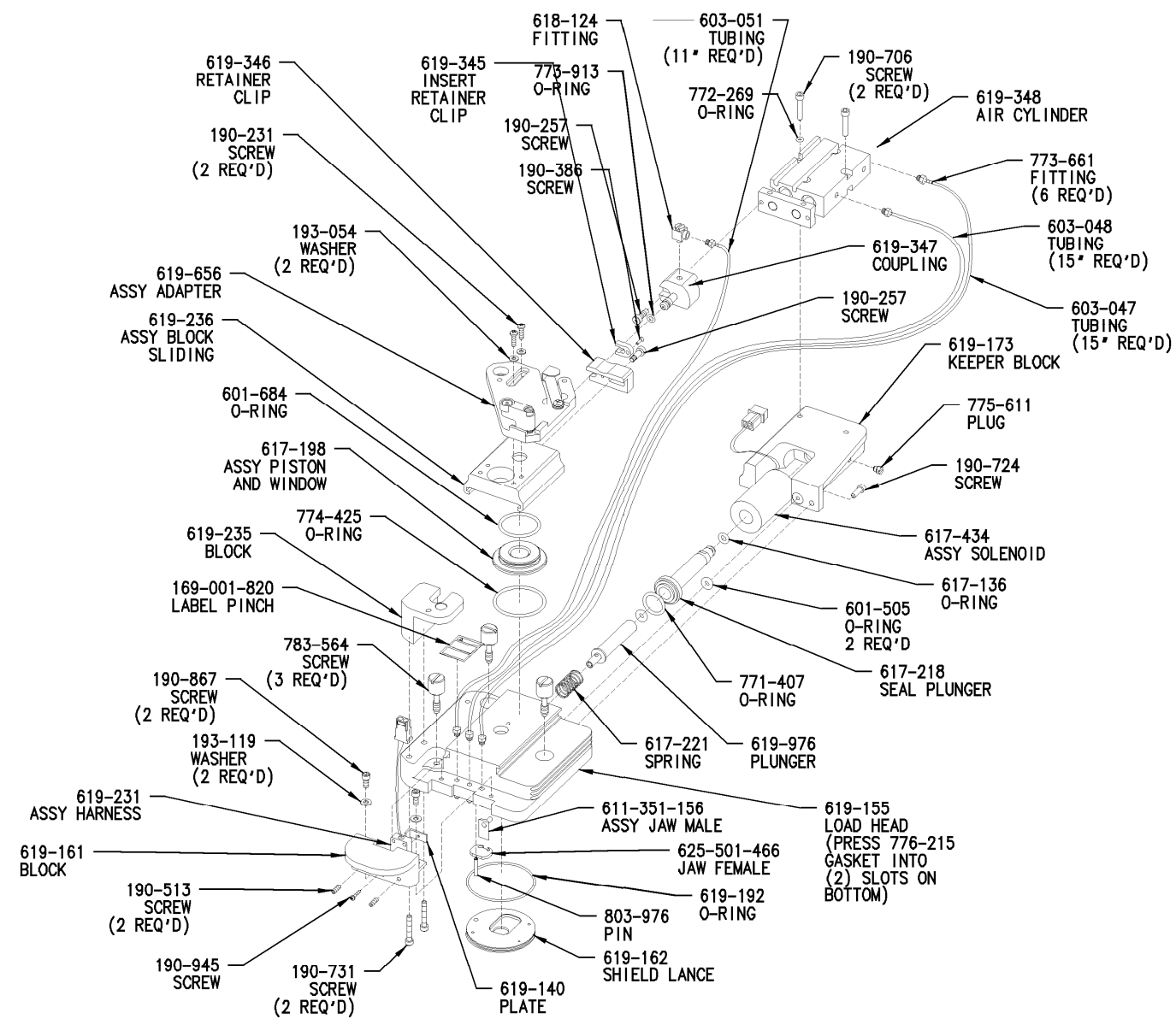


Figure 10-34
Cell Oven Assembly Part 2 619-390



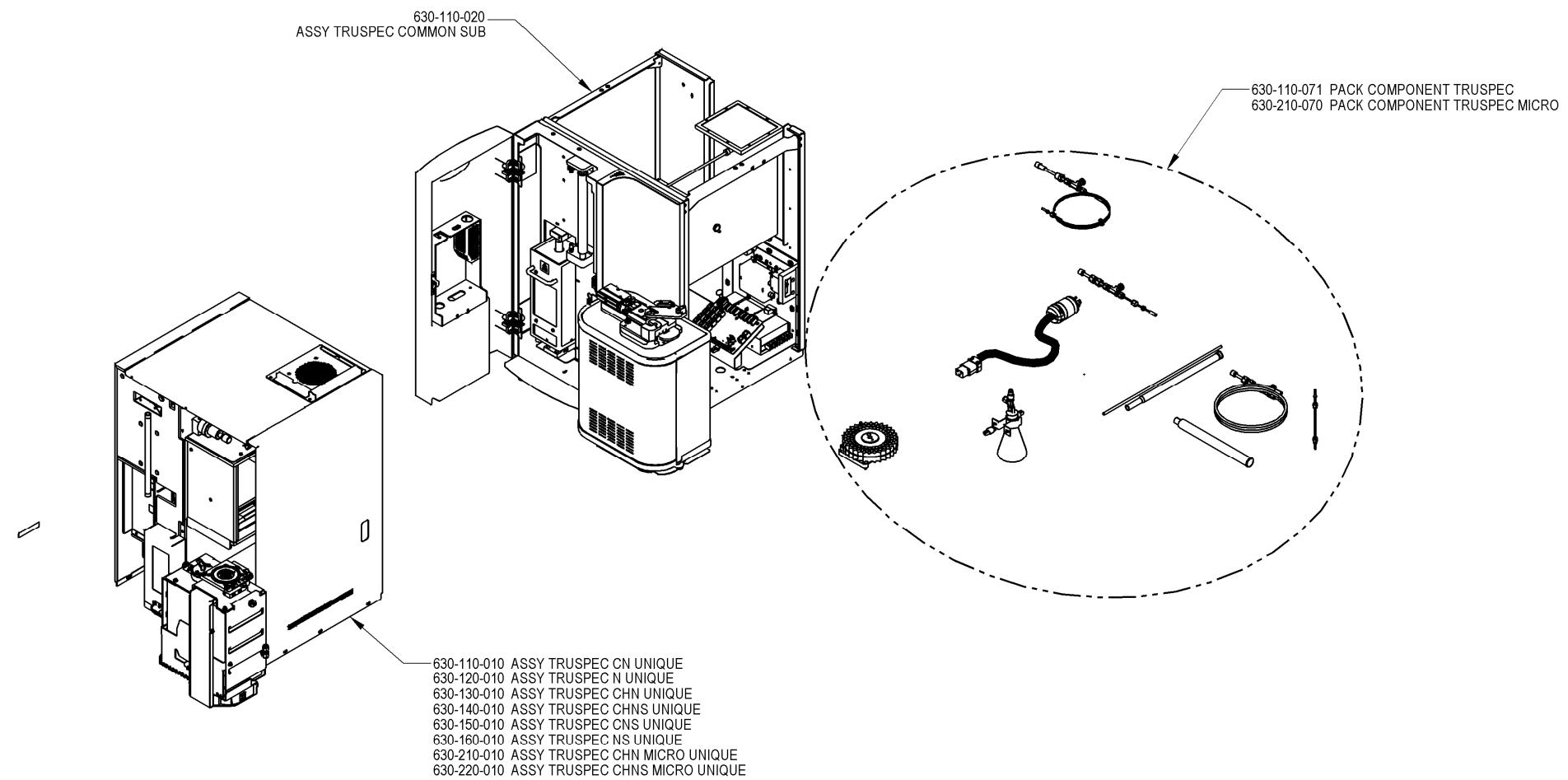
IIS-00395-C

Figure 10-35
Liquid Loading Head Assembly 619-662



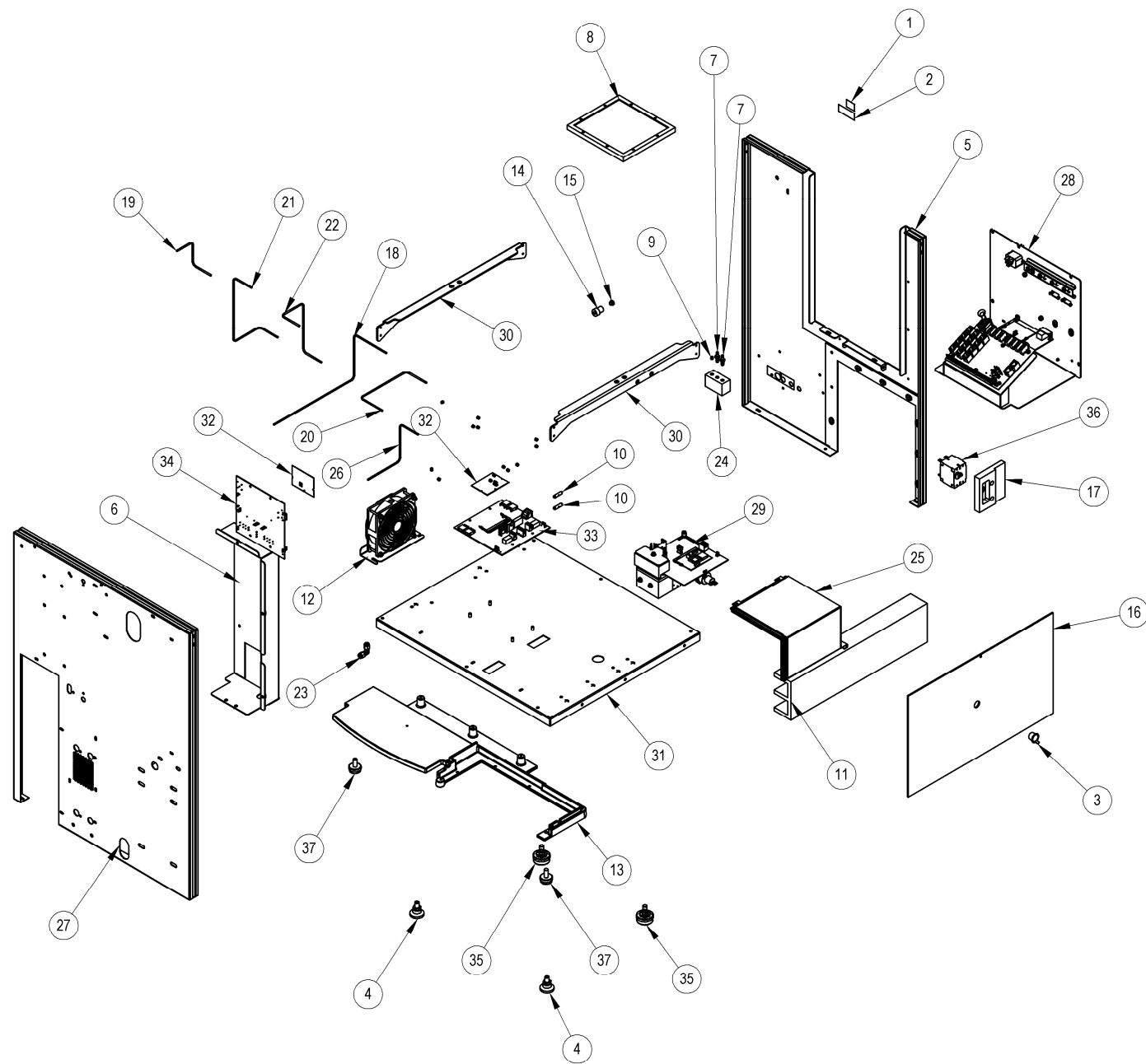
IIS-00327-G

Figure 10-36
Loading Head Assembly 619-349



ILS-00642-A

Figure 10-37
Exploded View # 1



630-110-020 ASSY TRUSPEC COMMON SUB SHEET 1

| ITEM NO. | PART NUMBER | DESCRIPTION | QUANTITY |
|----------|-------------|-------------------------------------|----------|
| 1 | 169-001-730 | LABEL ID CE | 1 |
| 2 | 169-002-499 | LABEL ID C-TICK | 1 |
| 3 | 516-011 | CAP PRTV C .610/.695 PLE L/T | 1 |
| 4 | 606-259 | ASSY PAD LEVELING SLIDE | 2 |
| 5 | 611-340 | ASSY PANEL BACK TRUSPEC P/PNT | 1 |
| 6 | 611-341 | ASSY WALL LOWER OVEN SEC P/PNT | 1 |
| 7 | 611-996 | FTG ADPTR TZ .187T - 1/4-28 | 2 |
| 8 | 614-704 | FILTER AIR 6.00 x 7.00 x .47 | 1 |
| 9 | 617-485 | FERRULE W/ SST LOCKRING .12T TEFZEL | 14 |
| 10 | 617-565 | PIN MOUNTING IR SST | 2 |
| 11 | 617-570 | INSULATION COVER IR CELL | 1 |
| 12 | 619-003 | ASSY FAN MOUNTED | 1 |
| 13 | 619-005 | CASTING BASE FRONT ENCLOS MACH | 1 |
| 14 | 619-044 | FTG NUT RND .25T PK 1/2-20 BLK | 1 |
| 15 | 619-045 | FTG FRL EFTE .25T | 1 |
| 16 | 619-070 | COVER ENCL OVEN FRONT | 1 |
| 17 | 619-151 | BOX SHADOW CB 12 AMP | 1 |
| 18 | 619-205 | TUBE SEC REA OUT/BOT-FC I | 1 |
| 19 | 619-206 | TUBE INC/SCR TOP - HE REG | 1 |
| 20 | 619-207 | TUBE TC#6 MAN TO FC BOT | 1 |
| 21 | 619-210 | TUBE HE REG IN TO TC #4 MAN | 1 |
| 22 | 619-211 | TUBE HE OUT REG BLOCK - TC#5 MAN | 1 |
| 23 | 619-243 | FTG EL 90 SS .12T-.12T | 1 |
| 24 | 619-246 | ASSY MANIFOLD EXHAUST | 1 |
| 25 | 619-339 | ASSY COVER CELL TC TRUSPEC | 1 |
| 26 | 619-620 | TUBE TC#7 TO SCR OUT BOT | 1 |
| 27 | 619-685 | ASSY PANEL INNER FRONT | 1 |
| 28 | 619-744 | ASSY POWER SUPPLY DISTR AC | 1 |
| 29 | 619-941 | ASSY MODULE CELL TC TRUSPEC | 1 |
| 30 | 621-430 | Support Corner Frame TC | 2 |
| 31 | 660-010-146 | ASSY BASE TRU-SPEC | 1 |
| 32 | 666-310X120 | ASSY CARD PGM NI SERVER SGL B | 2 |
| 33 | 666-514X | ASSY CARD SM ECL DUAL HTR V0 | 1 |
| 34 | 666-514X140 | ASSY CARD SM ECL DUAL HTR V4 | 1 |
| 35 | 780-970 | FOOT LEVELING .375-16X .625 | 2 |
| 36 | 789-320 | CIRCUIT BRK 15 A 250V DPST PO | 1 |
| 37 | 801-491 | LEVELER FOOT | 2 |

ILS-00643 - B

Figure 10-38
Exploded View # 2

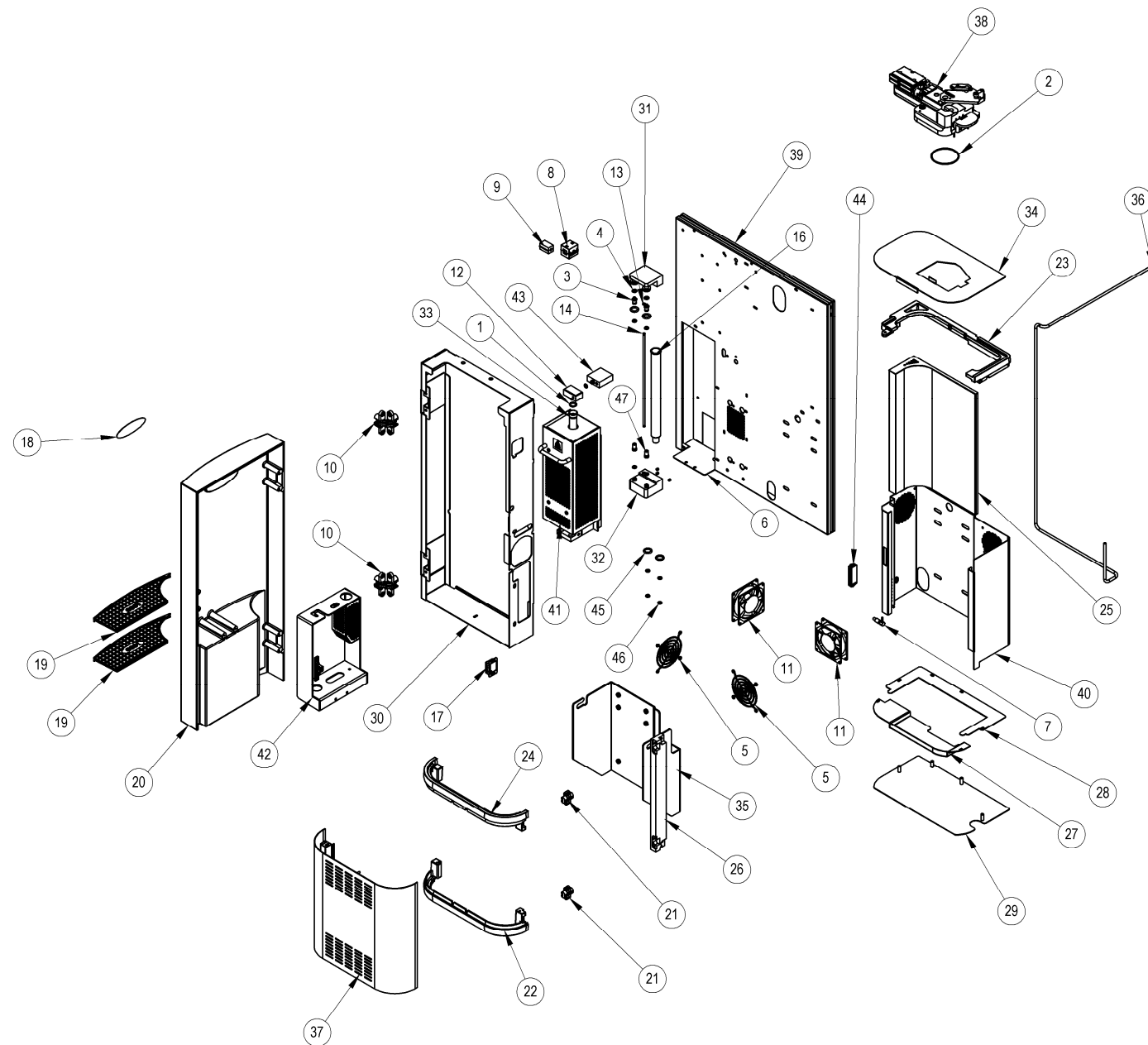
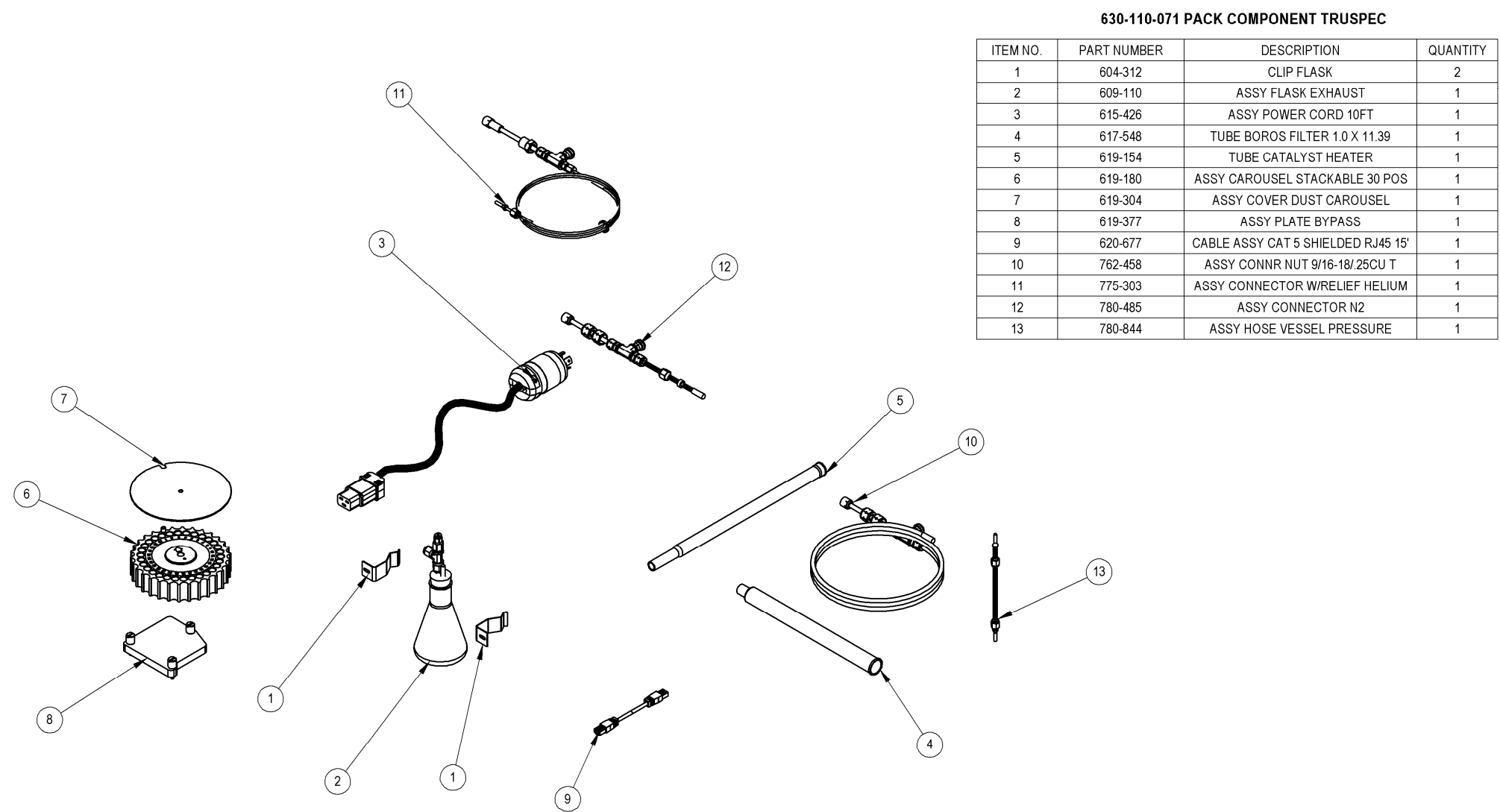


Figure 10-39
Exploded View # 3

630-110-020 ASSY COMMON SUB SHEET 2

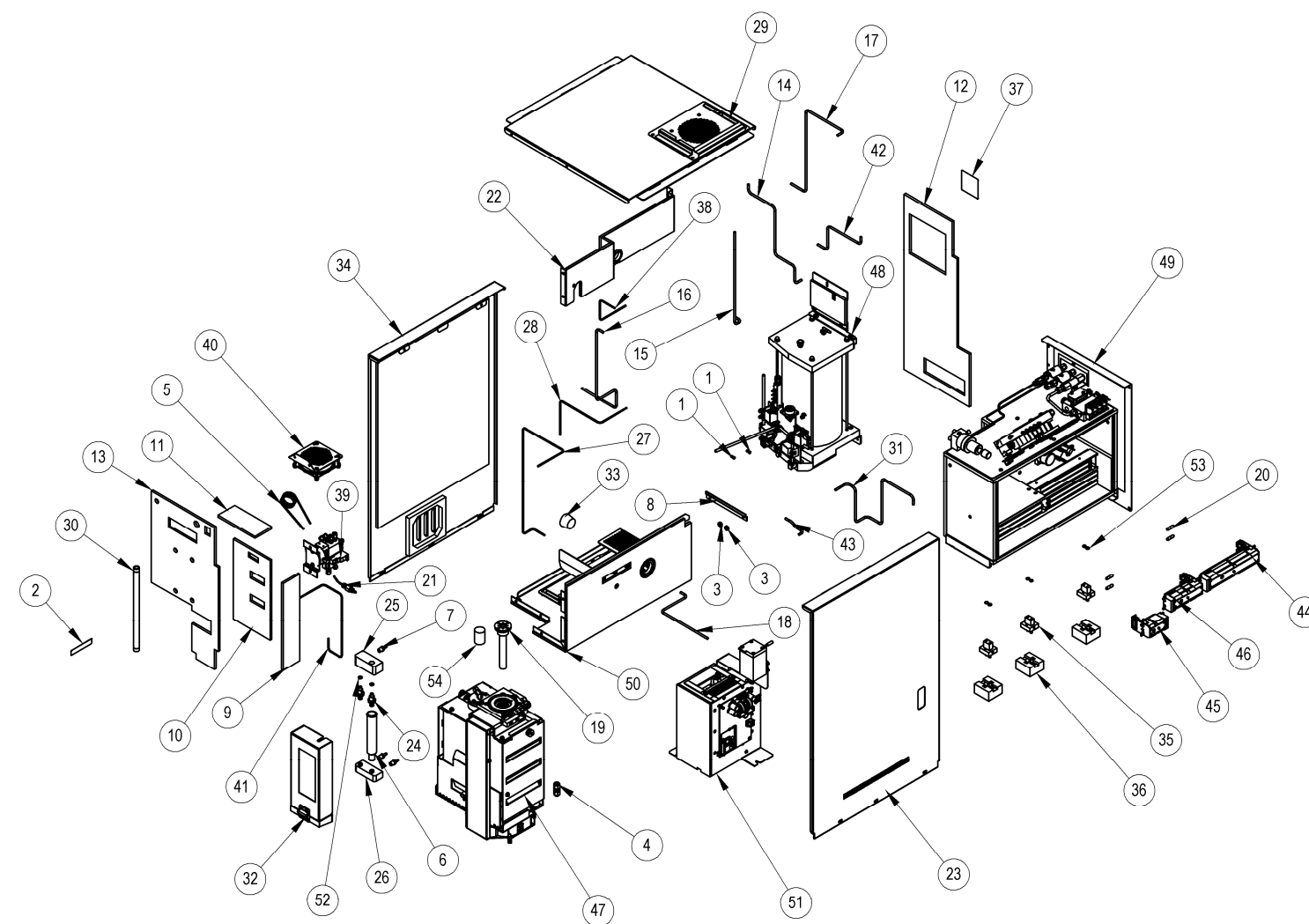
| ITEM NO. | PART NUMBER | DESCRIPTION | QUANTITY |
|----------|-------------|--|----------|
| 1 | 601-442 | O-RING 113 .549X .755X.103V | 1 |
| 2 | 601-504 | O-RING 147 2.675X 2.881X.103V | 1 |
| 3 | 605-795 | STEM QUICK DISCONNECT TUBE | 2 |
| 4 | 605-797 | WASHER FLT W/SEAL | 2 |
| 5 | 605-826 | GUARD - FINGER FAN | 2 |
| 6 | 611-341 | ASSY WALL LOWER OVEN SEC P/PNT | 1 |
| 7 | 615-525 | PLUNGER SPRING LCK .375-16 | 1 |
| 8 | 615-639 | BEAD FERRITE SPL 1.28 X .51 | 1 |
| 9 | 615-640 | BEAD SNAP-ON FERRITE SERIAL | 1 |
| 10 | 615-958 | HINGE CONCEALED DOOR CHROME | 2 |
| 11 | 616-140 | ASSY FAN AND CONNECTOR | 2 |
| 12 | 616-145 | BLOCK REMOVABLE CAT HTR | 1 |
| 13 | 617-083 | O-RING 104 .112X .318X.103V | 2 |
| 14 | 617-171 | TUBE INTERCONNECT SST | 1 |
| 15 | 617-485 | FERRULE W/ SST LOCKRING .12T TEFZEL | 3 |
| 16 | 617-548 | TUBE BOROS FILTER 1.0 X 11.39 | 1 |
| 17 | 617-713 | CATCH ASSY DOOR NON-MAGNETIC | 1 |
| 18 | 617-718 | LABEL LECO ELLIPTICAL 4.13 X 1.2 | 1 |
| 19 | 617-819 | PAD SHELF FOAM DOOR FRONT | 2 |
| 20 | 617-836 | DOOR FRONT TC 600 MACHINED | 1 |
| 21 | 617-875 | HINGE CONCEALED DOOR SLOTTED | 2 |
| 22 | 619-006 | CASTING TRIM FRONT BOT P/PNT | 1 |
| 23 | 619-007 | CASTING TRIM TOP BACK P/PNT | 1 |
| 24 | 619-008 | CASTING TRIM FRONT TOP P/PNT | 1 |
| 25 | 619-057 | ASSY SHROUD FRONT DECORATIVE | 1 |
| 26 | 619-058 | BAR MOUNTING HINGE | 1 |
| 27 | 619-068 | ASSY FLOOR PAN C | 1 |
| 28 | 619-071 | PAN FLOOR A PLT | 1 |
| 29 | 619-087 | ASSY PLATE FURN BAFFLE PNT | 1 |
| 30 | 619-111 | ASSY FRAME FRONT P/PNT | 1 |
| 31 | 619-148 | ASSY BLOCK REAGENTS UPPER PLT | 1 |
| 32 | 619-149 | BLOCK REAGENTS LOWER | 1 |
| 33 | 619-154 | TUBE CATALYST HEATER | 1 |
| 34 | 619-167 | PLATE COVER TOP | 1 |
| 35 | 619-169 | BRACKET ASSY FURNACE | 1 |
| 36 | 619-264 | TUBE FURN FLOW CONN TO LOAD HEAD | 1 |
| 37 | 619-311 | ASSY SHROUD FRONT P/PNT | 1 |
| 38 | 619-349 | ASSY LOADING HEAD | 1 |
| 39 | 619-685 | ASSY PANEL INNER FRONT | 1 |
| 40 | 619-694 | ASSY SHROUD SIDE | 1 |
| 41 | 619-719 | ASSY PANEL HEATER CATALYST | 1 |
| 42 | 619-733 | ASSY HOLDER TOOL W/GUARD | 1 |
| 43 | 625-511-114 | BLOCK STATIONARY CAT HTR | 1 |
| 44 | 703-041 | CATCH MAGNET SNAP-IN LARGE | 1 |
| 45 | 765-976 | O-RING 208 .609X .887X.139V | 4 |
| 46 | 772-520 | O-RING 108 .237X .443X.103V | 9 |
| 47 | 775-306 | FILTER SECONDARY 10MICRON | 2 |

ILS-00643 - C



ILS-00645-A

Figure 10-40
Exploded View # 4



630-150-010 ASSY TRUSPEC CNS UNIQUE

| ITEM NO. | PART NUMBER | DESCRIPTION | QUANTITY |
|----------|-------------|-----------------------------------|----------|
| 1 | 163-020 | FTG INSERT SS .250TP-.187ID | 2 |
| 2 | 169-002-674 | LABEL ID TRUSPEC CN | 1 |
| 3 | 515-152 | GROMMET PLAIN | 2 |
| 4 | 589-185 | FTG UNION BR .25T -.25T | 1 |
| 5 | 601-163 | LOOP SAMPLE SST 3CC | 1 |
| 6 | 601-390 | TUBE QUICK DISC .590 X .875 6PY | 1 |
| 7 | 608-412 | FTG ADPTR PP .15HB-.12MPT | 3 |
| 8 | 609-040 | BRACKET BALLAST MTG | 1 |
| 9 | 611-333 | INSULATION SIDE HTR CATALYST | 1 |
| 10 | 611-334 | INSULATION HTR CATL OVEN SEC | 1 |
| 11 | 611-335 | INSULATION TOP HTR CATALYST | 1 |
| 12 | 611-337 | INSULATION BACK OVEN SEC | 1 |
| 13 | 611-338 | INSULATION FRONT OVEN SEC | 1 |
| 14 | 611-351-151 | TUBE FLTR TO .725 CO2 IR | 1 |
| 15 | 611-351-152 | TUBE PV5/PV6 TO 2.75 CO2 IR | 1 |
| 16 | 611-351-153 | TUBE PV5/BALLAST TO MANF PORT 2 | 1 |
| 17 | 611-351-154 | TUBE .725 CO2 IR TO PV3/PV4/PV6 | 1 |
| 18 | 611-351-155 | TUBE PV7 OUT TO DOSER PORT E | 1 |
| 19 | 616-147 | ASSY TUBE LANCE U | 1 |
| 20 | 617-565 | PIN MOUNTING IR SST | 4 |
| 21 | 619-002 | ASSY UNION .187SS-.125T-.125HB | 1 |
| 22 | 619-028 | ASSY UPPER WALL SECOND OVEN | 1 |
| 23 | 619-046 | PANEL SIDE RIGHT P/PNT | 1 |
| 24 | 619-126 | INSERT MOUTH TUBES FILTER | 2 |
| 25 | 619-128 | BLOCK UPPER FILTER PARTICLE | 1 |
| 26 | 619-150 | BLOCK LOWER SIDE BY SIDE | 1 |
| 27 | 619-208 | TUBE SEC SCR TOP CAT HEAT BOT | 1 |
| 28 | 619-213 | TUBE GAS CONS TOP TO DOSER G | 1 |
| 29 | 619-247 | ASSY PANEL TOP W/FAN | 1 |
| 30 | 619-268 | TUBE REAGENTS STRAIGHT | 1 |
| 31 | 619-269 | TUBE FLTR IN TO TE COOLER OUT | 1 |
| 32 | 619-280 | ASSY DOOR FILTER | 1 |
| 33 | 619-310 | STOPPER RUBBER #7 SOLID | 1 |
| 34 | 619-368 | ASSY PANEL SIDE LEFT W/INS | 1 |
| 35 | 619-369 | ASSY MANIFOLD INLET IR INTL PL | 3 |
| 36 | 619-397 | INSULATION CAP | 3 |
| 37 | 619-485 | NAMEPLATE ID TRUSPEC CNS | 1 |
| 38 | 619-621 | TUBE TC #1 TI GAS CONS BOT | 1 |
| 39 | 619-675 | ASSY VALVE DOSING 8 PORT W/BYPASS | 1 |
| 40 | 619-705 | ASSY FAN BALLAST W/BKT | 1 |
| 41 | 619-727 | TUBE DOSER B TO CAT HEAT TOP | 1 |
| 42 | 619-741 | TUBE FUR SCRUB OUT TO PV1 IN | 1 |
| 43 | 619-742 | TUBE PV1 TO PRECOOLER IN | 1 |
| 44 | 625-345 | ASSY CELL IR SO2 6.00 | 1 |
| 45 | 625-348 | ASSY CELL IR .725 CO2 | 1 |
| 46 | 625-386 | ASSY CELL IR CO2 2.75 LOW GAIN | 1 |
| 47 | 625-401-358 | ASSY FURNACE DUAL | 1 |
| 48 | 625-601-440 | ASSY BALLAST W/VALVES 4.5L CN/N | 1 |
| 49 | 625-601-463 | ASSY OVEN CELL | 1 |
| 50 | 625-601-464 | ASSY SHELF W/HEATER | 1 |
| 51 | 660-010-134 | ASSY COOLER TE W/HOUSING | 1 |
| 52 | 769-310 | O-RING 011 .301X .441X.070S | 2 |
| 53 | 772-738 | O-RING 010 .239X .379X.070V | 6 |
| 54 | 780-899 | STOP CERAMIC HONEYC 1.12D X 1.50 | 1 |

ILS-00651-B

Figure 10-41
Exploded View # 5

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11 Schematics

The Schematics chapter provides electronic information for service of the instrument. For part numbers of circuit boards, assemblies and components refer to the schematic diagrams.

[Schematic Diagrams](#) 11-2

Schematic Diagrams

Figure 11-1 TruSpec CHN Cabinet Schematics - 1 of 4..... 11-3

Figure 11-2 TruSpec CHN Cabinet Schematics - 2 of 4..... 11-4

Figure 11-3 TruSpec CHN Cabinet Schematics - 3 of 4..... 11-5

Figure 11-4 TruSpec CHN Cabinet Schematics - 3 of 4..... 11-6

Figure 11-5 TruSpec O Furnace - 1 of 2 11-7

Figure 11-6 TruSpec O Furnace - 2 of 2 11-8

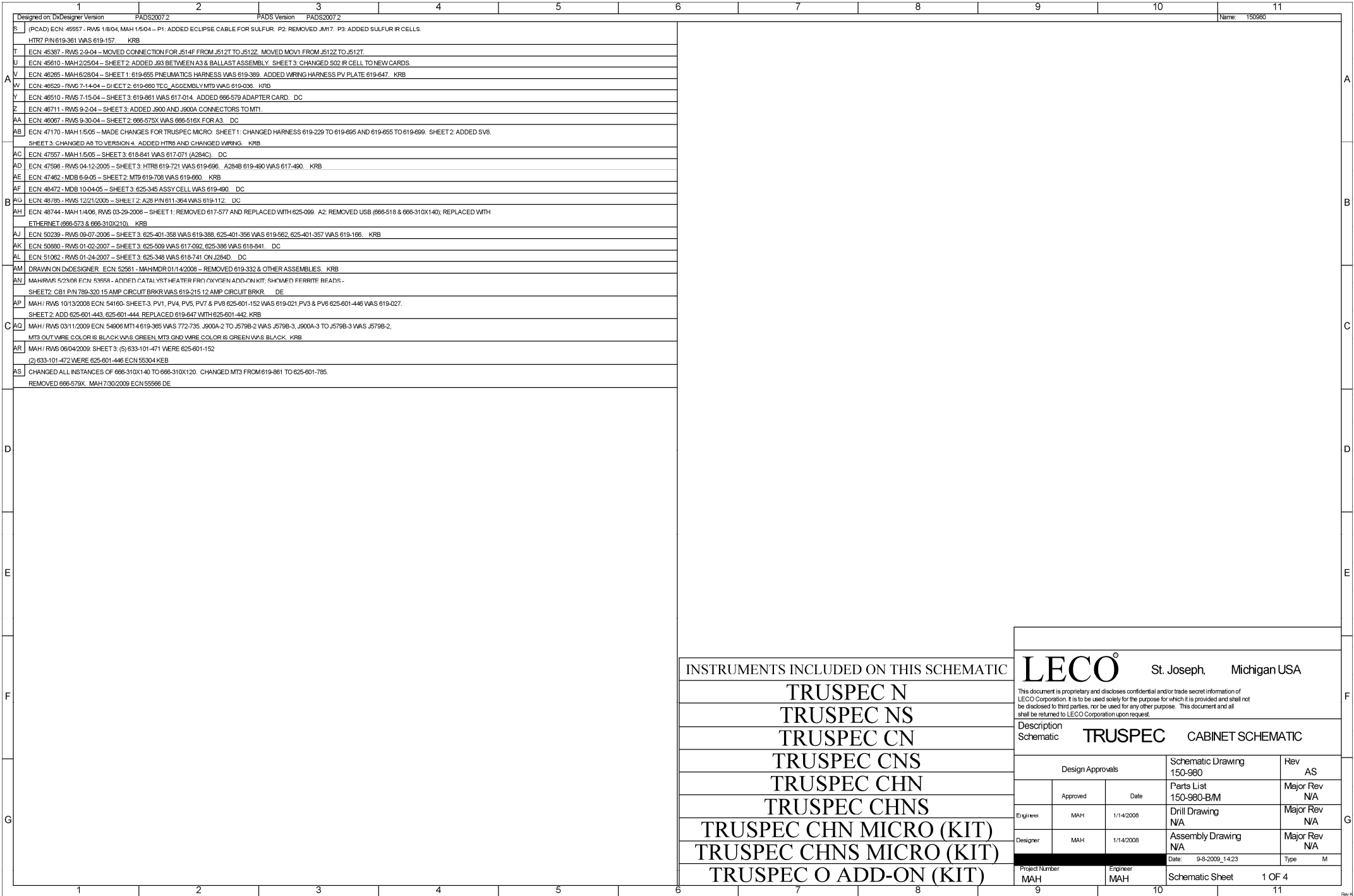


Figure 11-1
TruSpec CHN Cabinet Schematics - 1 of 4

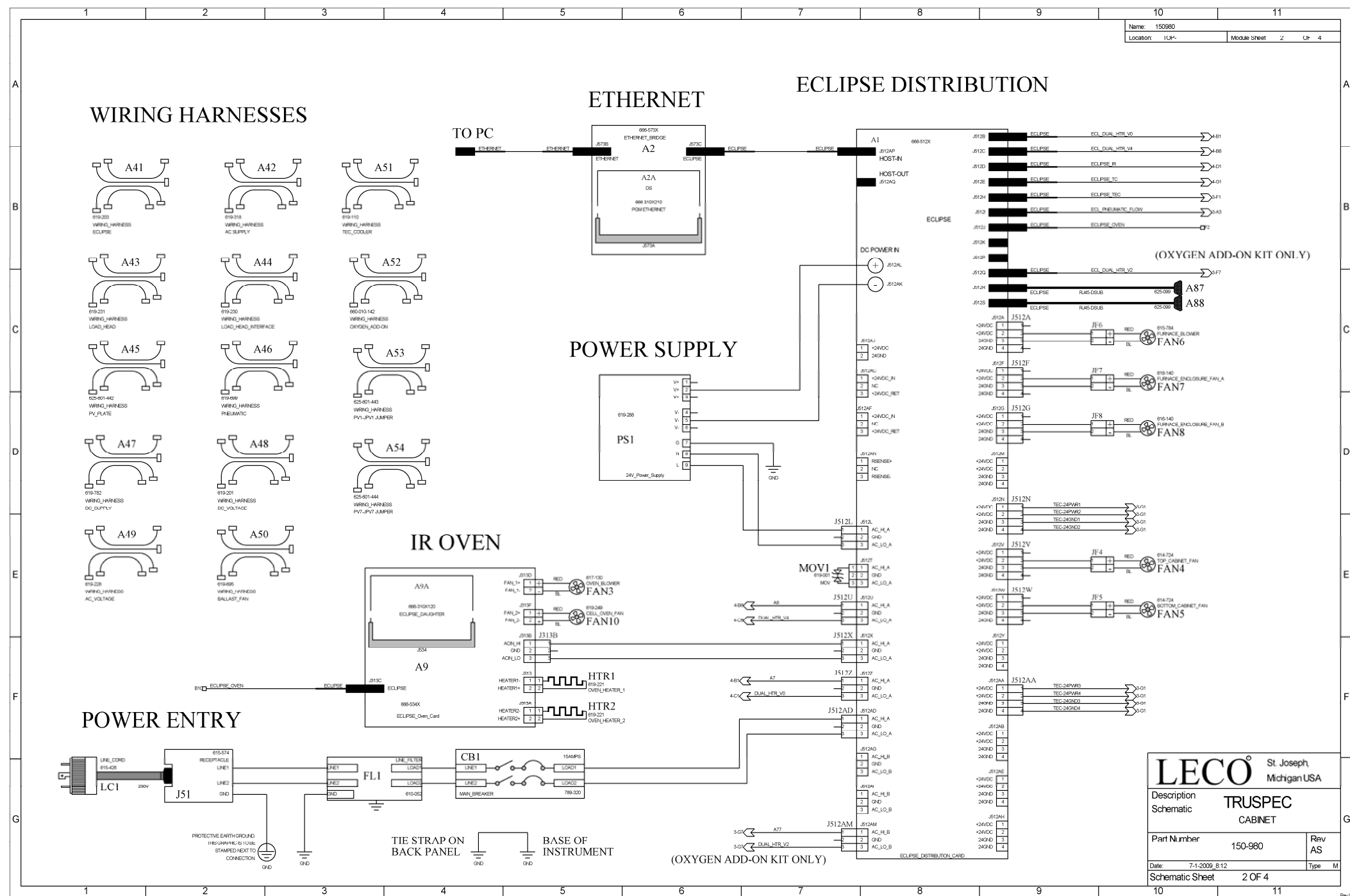
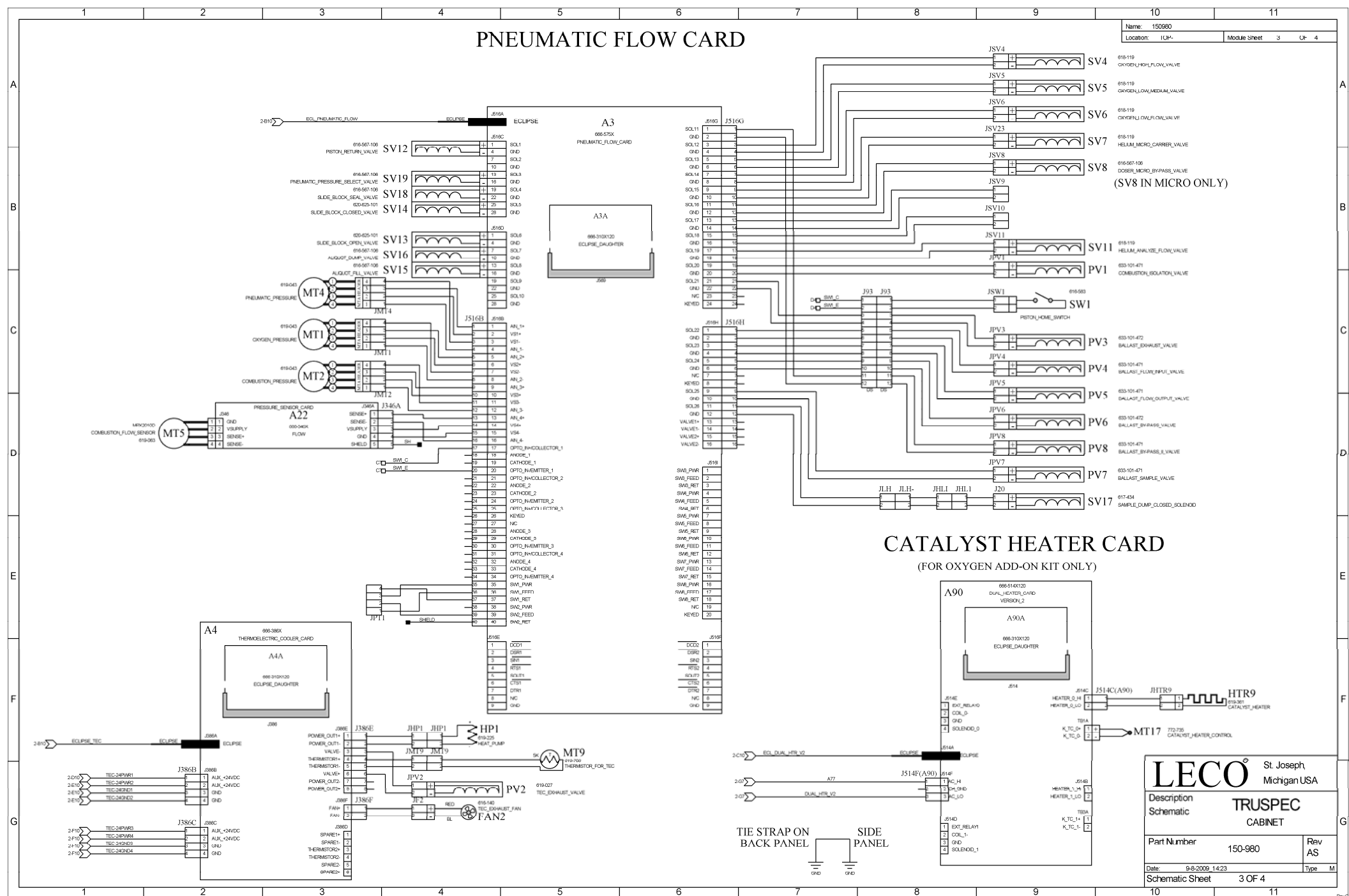
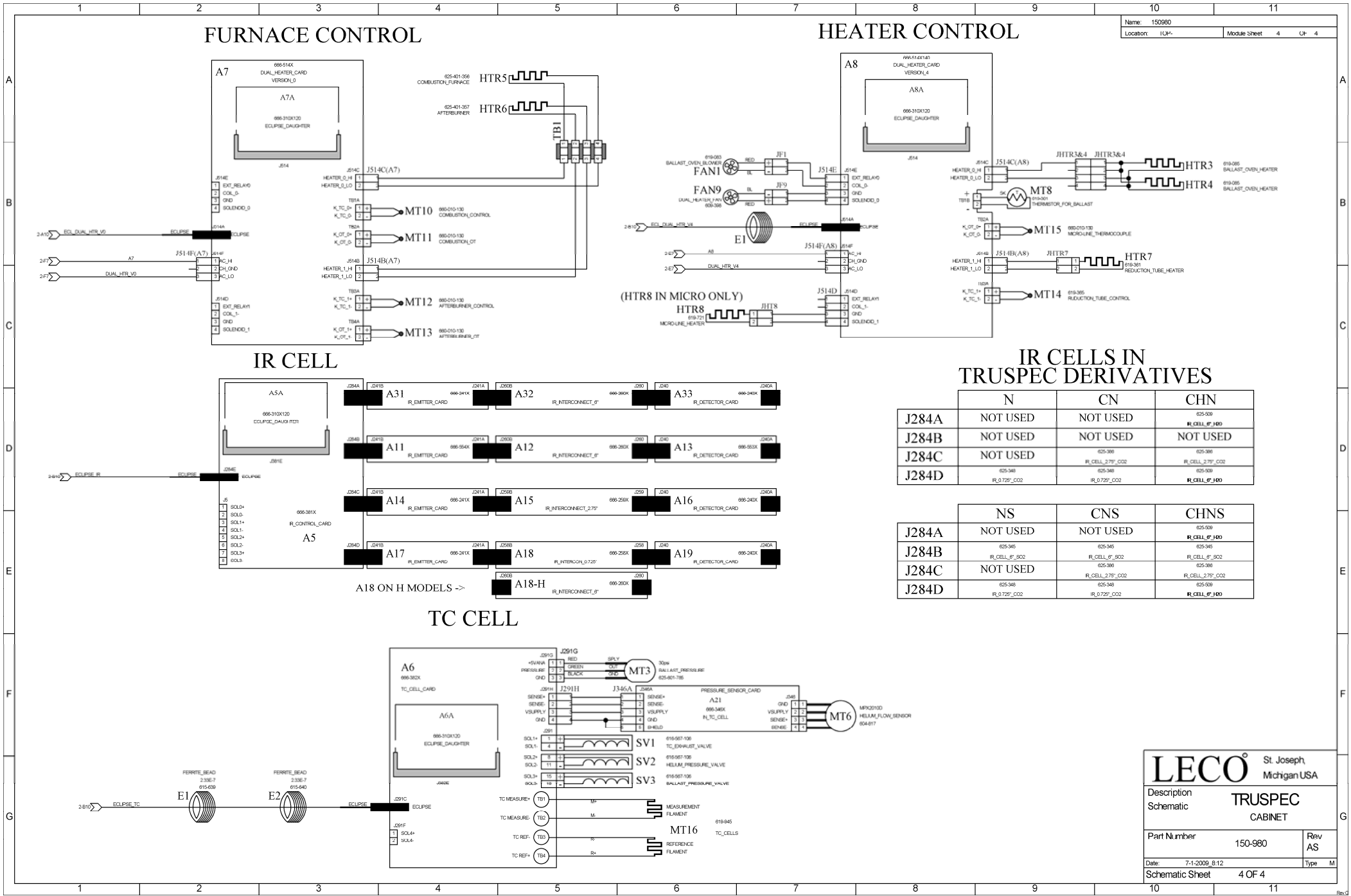
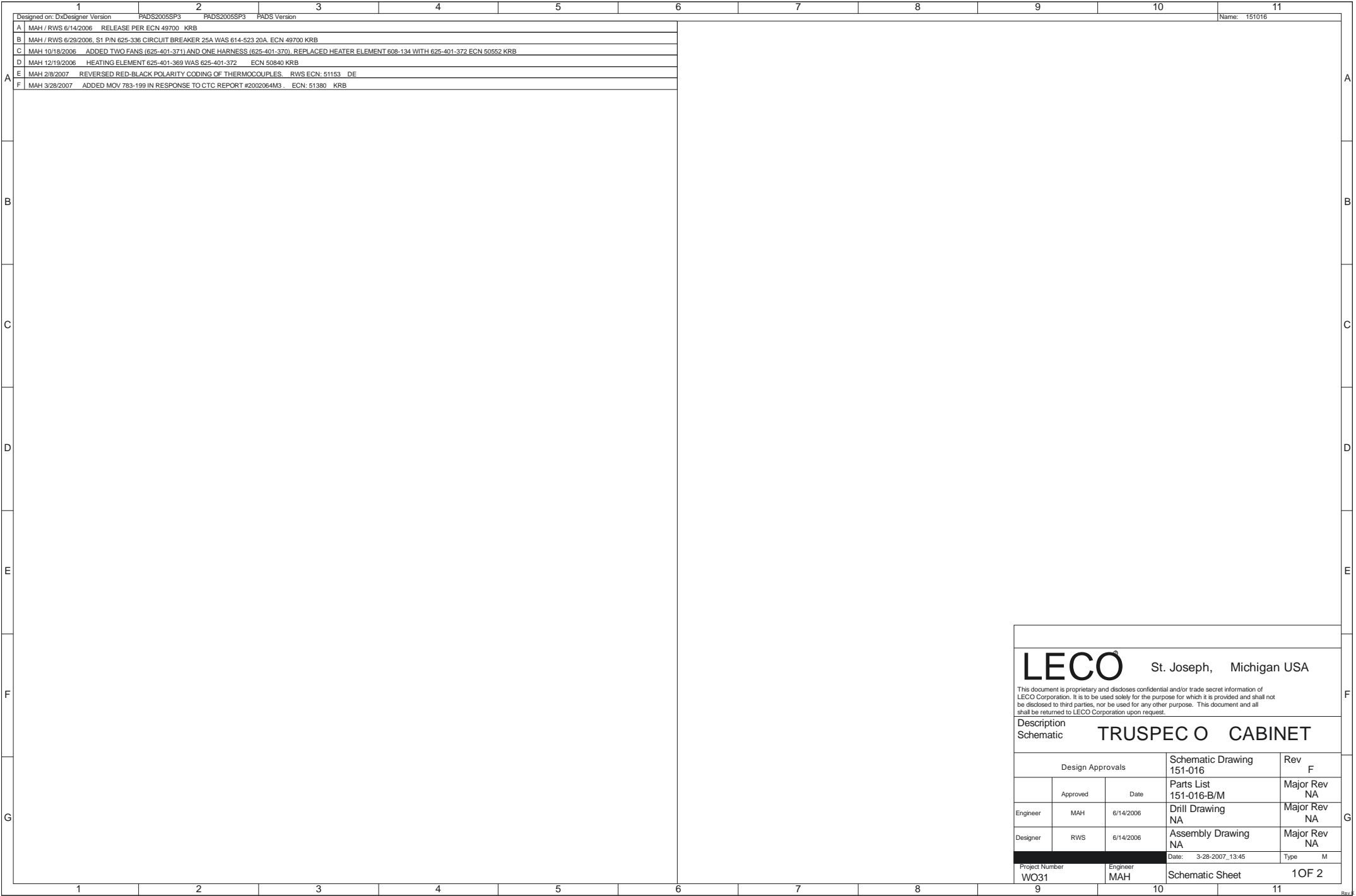


Figure 11-2
TruSpec CHN Cabinet Schematics - 2 of 4







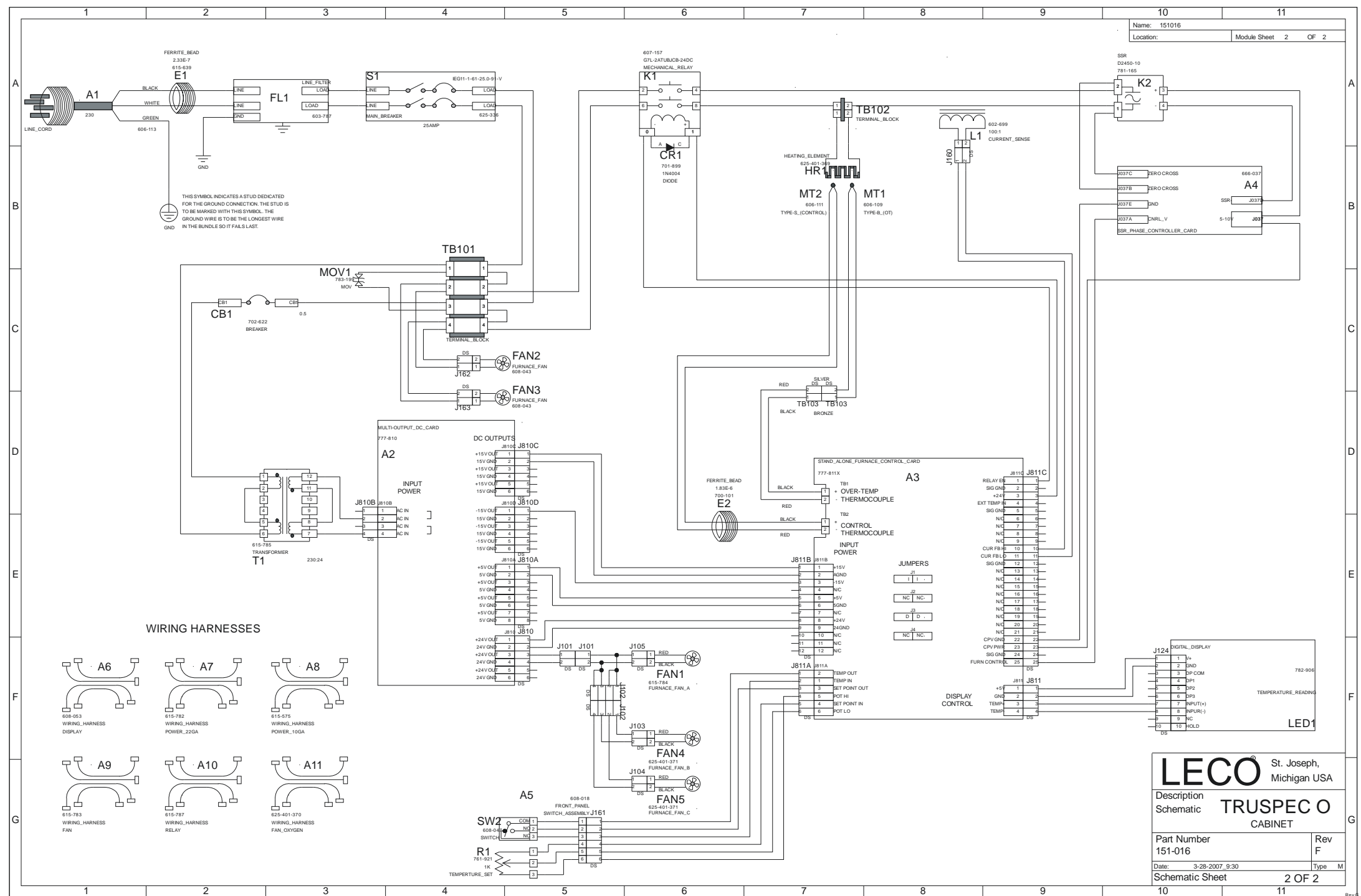


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