



DC-3
Density Column
Clearing Device
Operator's Manual

Issue 11

Date of issue:

25th June 2003.

Techne is the trade mark of

Techne and Techne Inc

© Techne 2003



CONTENTS

DC-3 Operator's Manual	
	<i>page</i>
SAFETY and INSTALATION	
CE Declaration of Conformity	3
English	4
Français	6
Deutsch	8
Español	10
INTRODUCTION	12
Packing	12
Specification	12
Electrical Connection	13
OPERATION OF THE DC-3	14
SETUP OF THE DENSITY GRADIENT COLUMN	15
Liquid Systems	16
Liquid Preparation	17
Figure 1	18
Filling the Column	19
Calibrating the Column	19
INTRODUCING SAMPLES	20
Possible Sources of Error	21
Life of the Column	22
References	22
TECHNICAL INFORMATION	23
Operator maintenance	23
Replacement parts and Accessories	24





Techne
Duxford
Cambridge
CB2 4PZ



Declaration of Conformity

Techne Unit DC-3 has been designed to comply with the following European Standards:

EN 50081-1:1992 Electromagnetic Compatibility; Generic emission standard.

EN 50082-1:1992 Electromagnetic Compatibility; Generic immunity standard (Performance criterion B).

EN 61010-1:1993 Safety requirements for electrical equipment for measurement, control and laboratory use.

I have made all reasonable enquiries regarding the unit stated and its conformance to the following EU directives.

Low Voltage directive, 73/23/EEC and amendment 93/68/EEC, and

EMC Directive 89/336/EEC and amendments 91/263/EEC and 92/31/EEC .

To the best of my knowledge and belief these units conforms to these directives.

This Declaration is controlled under an ISO 9001:2000 system certificated by BSI Quality Assurance, certificate number FM13585.

Signature

Name

B C Coombes

Position

Quality Manager

Issue 5

23/07/2003

Introduction

Please read all the information in this booklet before using the unit.

Warning

HIGH TEMPERATURES ARE DANGEROUS: they can cause serious burns to operators and ignite combustible material.

Techne have taken great care in the design of these units to protect operators from hazards, but Operators should pay attention to the following points:

- USE CARE AND WEAR PROTECTIVE GLOVES TO PROTECT HANDS;
- DO NOT put hot objects on or near combustible objects;
- DO NOT operate the unit close to inflammable liquids or gases;
- DO NOT place any liquid directly in your unit;
- At all times USE COMMON SENSE.

Operator Safety

All Operators of Techne equipment must have available the relevant literature needed to ensure their safety.

It is important that only suitably trained personnel operate this equipment, in accordance with the instructions contained in this manual and with general safety standards and procedures. If the equipment is used in a manner not specified by Techne the protection provided by the equipment to the Operator may be impaired.

All Techne units have been designed to conform to international safety requirements and are fitted with an overtemperature cutout. On some models, the cutout is adjustable and should be set to suit the application. On all other models the cutout is preset to protect the unit.

If a safety problem should be encountered, switch off at the mains socket and remove the plug from the supply.

Installation

1. All Techne units are supplied with a power cable. This may be integral or plug-in.
2. Before connecting the mains supply, check the voltage against the rating plate. The rating plate is on the rear of the unit. Connect the mains cable to a suitable plug according to the table below.

Note that the unit must be earthed to ensure proper electrical safety.

<i>Connections</i>	<i>220V-240V</i>	<i>110V-120V</i>
Live	Brown	Black
Neutral	Blue	White
Earth	Green/yellow	Green

The fused plug supplied with the mains lead for use in the UK is fitted with the following value fuse to protect the cable: 10AMP.

The fuse in the unit protects the unit and the operator

Note that units marked 230V on the rating plate work at 220V; units marked 120V work at 110V. In both cases, however, the heating rate will degrade by approximately 8%.

3. Plug the mains cable into the socket on the rear of the unit.
4. Place the unit on a suitable bench or flat workspace, or in a fume cupboard if required, ensuring that the air inlet vents on the underside are free from obstruction.

After use

When you have finished heating samples, remember that parts of the unit – the tubes, blocks and associated accessories – may be very hot. Take the precautions listed earlier.

Guarantee

The unit is guaranteed against any defect in material or workmanship for the period specified on the enclosed guarantee card. This period is from the date of purchase, and within this period all defective parts will be replaced free of charge provided that the defect is not the result of misuse, accident or negligence. Servicing under this guarantee should be obtained from the supplier.

Notwithstanding the description and specification(s) of the units contained in the Operator's Manual, Techne hereby reserves the right to make such changes as it sees fit to the units or to any component of the units.

This Manual has been prepared solely for the convenience of Techne customers and nothing in this Instruction Book shall be taken as a warranty, condition or representation concerning the description, merchantability, fitness for purpose or otherwise of the units or components.

Operator maintenance

NOTE: THAT THIS EQUIPMENT SHOULD ONLY BE DISMANTLED BY PROPERLY TRAINED PERSONNEL.

REMOVING THE SIDE, FRONT OR REAR PANELS EXPOSES POTENTIALLY LETHAL MAINS VOLTAGES.

THERE ARE NO OPERATOR MAINTAINABLE PARTS WITHIN THE EQUIPMENT.

In the unlikely event that you experience any problems with your unit which cannot easily be remedied, you should contact your supplier and return the unit if necessary. Please include any details of the fault observed and remember to return the unit in its original packing. Techne accept no responsibility for damage to units which are not properly packed for shipping: if in doubt, contact your supplier. See the Decontamination Certificate supplied with your unit.

1.Cleaning

Before cleaning your unit ALWAYS disconnect it from the power supply and allow it to cool below 50° C.

Your unit can be cleaned by wiping with a damp soapy cloth. Care should be exercised to prevent water from running inside the unit. Do not use abrasive cleaners.

2.Fuses

Your unit is protected by one or two fuses. These should only be changed by suitably qualified personnel.

If the fuses blow persistently, a serious fault is indicated and you may need to return the unit to your supplier for repair.

Contact Information

For technical, sales or servicing information, contact your local Techne dealer or,
Techne, Duxford,
Cambridge, CB2 4PZ, United Kingdom.

Telephone:	+44(0)1223 832401
Fax:	+44(0)1223 836838
Service:	+44 (0)1223 836950 Out of office hours
e-mail:	sales@techne.com
Web site:	www.techne.com

or,

Techne Inc, 3 Terri Lane,
Suite 10, Burlington,
New Jersey 08016, USA.

Telephone:	609-589-2560
Toll free:	800-225-9243 ext 306
Fax:	609-589-2571
e-mail:	labproducts@techneusa.com
Web site:	www.techneusa.com

Introduction

Veillez lire attentivement toutes les instructions de ce document avant d'utiliser l'appareil.

Avertissement

DANGER DE TEMPERATURES ELEVEES : les opérateurs peuvent subir de graves brûlures et les matériaux combustibles risquent de prendre feu.

Techne a apporté un soin tout particulier à la conception de ces appareils de façon à assurer une protection maximale des opérateurs, mais il est recommandé aux utilisateurs de porter une attention spéciale aux points suivants :

- PROCEDER AVEC SOIN ET PORTER DES GANTS POUR SE PROTEGER LES MAINS.
- NE PAS poser d'objets chauds sur ou près de matériaux combustibles.
- NE PAS utiliser l'appareil à proximité de liquides ou de gaz inflammables.
- NE PAS verser de liquide directement dans l'appareil.
- FAIRE TOUJOURS PREUVE DE BON SENS.

Sécurité de l'opérateur

Tous les utilisateurs de produits Techne doivent avoir pris connaissance des manuels et instructions nécessaires à la garantie de leur sécurité.

Important : cet appareil doit impérativement être manipulé par un personnel qualifié et utilisé selon les instructions données dans ce document, en accord avec les normes et procédures de sécurité générales. Dans le cas où cet appareil ne serait pas utilisé selon les consignes précisées par Techne, la protection pour l'utilisateur ne serait alors plus garantie.

Tous les appareils Techne sont conçus pour répondre aux normes de sécurité internationales et sont dotés d'un coupe-circuit en cas d'excès de température. Sur certains modèles, ce coupe-circuit est réglable pour s'adapter à l'application désirée. Sur d'autres modèles, il est pré-réglé en usine pour assurer la protection de l'appareil.

Dans le cas d'un problème de sécurité, coupez l'alimentation électrique au niveau de la prise murale et enlevez la prise connectée à l'appareil.

Installation

1. Tous les appareils Techne sont livrés avec un câble d'alimentation qui peut être intégré à l'appareil ou à raccorder.
2. Avant de brancher l'appareil, vérifiez la tension requise indiquée sur la plaque d'identification. Raccordez le câble électrique à la prise appropriée en vous reportant au tableau ci-dessous. **Il est important que l'appareil soit relié à la terre pour assurer la protection électrique requise.**

<i>Connexions</i>	<i>220V-240 V</i>	<i>110V-120 V</i>
Phase	marron	noir
Neutre	bleu	blanc
Terre	vert/jaune	vert

Le fusible à l'intérieur de l'appareil est destiné à assurer la protection de l'appareil et de l'opérateur.

Remarque : les appareils dont la plaque indique 230 V peuvent fonctionner sur 220 V, et ceux dont la plaque indique 120 V peuvent fonctionner sur 110 V. Dans les deux cas cependant, la capacité de chauffage diminuera d'environ 8 %. La plaque d'identification se trouve à l'arrière de l'appareil.

3. Raccordez le câble d'alimentation à la prise située à l'arrière de l'appareil.
4. Placez l'appareil sur un plan de travail ou surface plane, ou le cas échéant, dans une hotte d'aspiration, en s'assurant que les trous d'aération situés sous l'appareil ne soient pas obstrués.

Après utilisation

Lorsque vous avez fini de chauffer les échantillons, n'oubliez pas que certaines parties de l'appareil - les éprouvettes, leurs supports et autres accessoires - risquent d'être très chaudes. Il est donc recommandé de toujours prendre les précautions citées plus haut.

Garantie

L'appareil est garanti contre tout défaut ou vice de fabrication pour la durée figurant sur la carte de garantie, à compter de la date d'achat de l'appareil. Au cours de cette période, toutes les pièces défectueuses seront remplacées gratuitement, dans la mesure où la défaillance n'est pas due à une mauvaise utilisation, un accident ou une négligence. Toute réparation sous garantie sera effectuée par le fournisseur.

Malgré la description et les spécifications de l'appareil données dans le manuel de l'utilisateur, Techne se réserve le droit d'effectuer les changements nécessaires à l'appareil ou à tout élément qui entre dans sa composition.

Ce manuel a été exclusivement rédigé à l'attention des clients de Techne, et aucun élément de ce guide d'instructions ne peut être utilisé comme garantie, condition ou représentation concernant la description, commercialisation, adaptation aux conditions d'utilisation ou autre des appareils ou leurs composants.

Entretien utilisateur

IMPORTANT : CET APPAREIL NE PEUT ETRE DEMONTE QUE PAR DU PERSONNEL QUALIFIE. LORSQUE LES PANNEAUX AVANT, ARRIERE ET LATERAUX SONT DEMONTES, L'OPERATEUR EST EXPOSE A DES TENSIONS QUI PEUVENT ETRE MORTELLES. CET APPAREIL NE CONTIENT AUCUN ELEMENT QUI DEMANDE UN ENTRETIEN DE LA PART DE L'UTILISATEUR.

Dans le cas peu probable où votre appareil présente un défaut de fonctionnement auquel il est difficile de remédier, il est alors préférable de contacter votre fournisseur et, le cas échéant, de renvoyer le matériel. Veuillez inclure une description détaillée du problème constaté et retourner l'appareil dans son emballage d'origine. Techne ne sera pas tenu responsable des dommages subis par tout appareil dont l'emballage est inadéquat pour le transport. Pour plus de sûreté, contactez votre fournisseur. Voir le certificat de décontamination livré avec le produit.

1. Nettoyage

Avant de nettoyer l'appareil, assurez-vous TOUJOURS que le câble d'alimentation est déconnecté et laissez la température redescendre en dessous de 50 °C.

Utilisez un chiffon imprégné d'eau savonneuse pour nettoyer l'appareil. Veillez à ne pas introduire d'eau dans l'appareil. N'utilisez pas de produits abrasifs.

2. Fusibles

La protection de l'appareil est assurée par un ou deux fusibles dont le remplacement ne peut être effectué que par un personnel qualifié.

Si les fusibles sautent sans arrêt, il s'agit d'un problème sérieux. Nous vous conseillons dans ce cas de prendre contact avec votre fournisseur pour réparation.

Einleitung

Bitte lesen Sie diese Bedienungsanleitung komplett bevor Sie dieses Gerät benutzen.

Warnung

HOHE TEMPERATUREN SIND GEFÄHRLICH: sie können dem Bediener ernsthafte Verletzungen zufügen und brennbare Materialien können sich leicht entzünden.

Techne hat bei der Konstruktion dieses Gerätes sehr darauf geachtet, daß der Bediener vor Gefahren geschützt ist. Dennoch sollten Sie auf die folgenden Punkte achten:

- SEIEN SIE VORSICHTIG UND TRAGEN SIE SCHUTZHANDSCHUHE
- Legen Sie heiße Gegenstände NICHT auf oder in die Nähe von leicht brennbaren Materialien; vermeiden Sie Arbeiten in der Nähe von leicht entzündbaren Flüssigkeiten oder Gasen.
- Bringen sie KEINE Flüssigkeiten direkt in Ihr Gerät.
- Benutzen Sie immer den normalen Menschenverstand

Sicherheit des Anwenders

Alle Benutzer von Techne Geräten müssen Zugang zu der entsprechenden Literatur haben, um ihre Sicherheit zu gewähren.

Es ist wichtig, daß diese Geräte nur von entsprechend geschultem Personal betrieben werden, das die in dieser Gebrauchsanweisung enthaltenen Maßnahmen und allgemeine Sicherheitsbestimmungen und -vorkehrungen beachtet. Wenn das Gerät anders eingesetzt wird als vom Hersteller empfohlen, kann dies die persönliche Sicherheit des Anwenders beeinträchtigen. Die Geräte von Techne entsprechen den internationalen Sicherheitsbestimmungen und sind mit einem automatischen Übertemperaturabschalter ausgestattet. Bei einigen Modellen ist der Übertemperaturabschalter verstellbar und sollte je nach Anwendung entsprechend eingestellt werden. Bei allen anderen Modellen ist der Temperaturschutz voreingestellt um Schäden am Gerät zu vermeiden. Wenn ein Sicherheitsproblem auftreten sollte, muß das Gerät ausgeschaltet und vom Stromnetz getrennt werden.

Installation

1. Alle Techne Geräte werden mit einem Stromanschlußkabel geliefert. Dieses ist entweder fest mit dem Gerät verbunden oder zum Einstecken.
2. Vergleichen Sie, ob die Spannung Ihrer Stromversorgung mit den Angaben auf dem Typenschild des Geräte übereinstimmen. Verbinden Sie das Stromanschlußkabel mit einer geeigneten Stromversorgung gemäß der nachstehenden Tabelle. Achtung: Das Gerät muß geerdet sein, um die elektrische Sicherheit zu gewährleisten!

<i>Verbindungen</i>	<i>220V-240V</i>	<i>110V-120V</i>
Stromführend	Braun	Schwarz
Neutral	Blau	Weiß
Erde	Grün/Gelb	Grün

Geräte, die für 230 Volt ausgelegt sind, können auch bei 220 Volt arbeiten, Geräte für 120 Volt auch bei 110 Volt. In beiden Fällen verringert sich die Aufheizrate um ca. 8%. Das Typenschild befindet sich hinten am Gerät.

3. Stecken Sie das Stromkabel in die vorgesehene Buchse hinten am Gerät.
4. Stellen Sie das Gerät auf eine ebene Arbeitsfläche bzw. (falls erforderlich) unter einen Laborabzug. Beachten Sie, daß die Entlüftungsrillen an der Geräteunterseite immer frei zugänglich sind.

Nach dem Gebrauch

Vergessen Sie nicht, daß Teile des Gerätes (die Gefäße, die Blöcke und andere Zubehörteile) nach dem Erhitzen von Proben noch sehr heiß sein können. Bitte beachten Sie die oben genannten Vorsichtsmaßnahmen.

Garantie

Die Garantiedauer des Gerätes ist auf der beiliegenden Garantiekarte angegeben und schließt Fehler im Material oder der Verarbeitung ein. Die Garantiedauer beginnt am Tag des Einkaufs. Sämtliche defekte Teile werden innerhalb dieses Zeitraumes kostenlos ersetzt unter der Voraussetzung, daß dem Defekt keine unsachgemäße Handhabung, Fahrlässigkeit oder ein Unfall zugrundeliegt. Der unter diese Garantie fallende Service wird vom Lieferanten geleistet.

Ungeachtet der in dieser Gebrauchsanweisung enthaltenen Beschreibungen und Spezifikationen, behält sich Techne hiermit das Recht vor, Änderungen an den Geräten bzw. an einzelnen Geräteteilen durchzuführen.

Diese Gebrauchsanleitung wurde ausschließlich dazu erstellt, um Kunden die Handhabung der Techne-Geräte zu erleichtern. Nichts in dieser Gebrauchsanleitung darf als Garantie, Bedingung oder Voraussetzung verstanden werden, sei es die Beschreibung, Marktgängigkeit, Zweckdienlichkeit oder sonstiges bezüglich der Geräte oder deren Bestandteile.

Wartung durch den Bediener

BEACHTEN SIE, DASS DIESES GERÄT NUR VON TECHNISCHEN FACHKRÄFTEN GEÖFFNET UND DEMONTIERT WERDEN DARF.

DURCH ENTFERNEN DES GERÄUSES ODER GEHÄUSETEILEN SIND BAUTEILE MIT LEBENGEFÄHRLICHEN SPANNUNGEN FREI ZUGÄNGLICH.

IM INNERN DES GERÄTES BEFINDEN SICH KEINE TEILE, DIE VOM ANWENDER GEWARTET WERDEN MÜSSEN.

Falls Ihr Gerät nicht ordnungsgemäß arbeitet, wenden Sie sich an Ihren Lieferanten oder senden Sie das Gerät wenn nötig zurück. Fügen Sie eine genaue Beschreibung des Defektes bei. Verpacken Sie das Gerät möglichst im Originalkarton. Bitte beachten Sie, daß Techne und thermo-DUX keine Haftung bei Transportschäden aufgrund unzureichender Verpackung übernehmen. Setzen Sie sich im Zweifelsfall mit Ihrem Lieferanten in Verbindung. Bitte beachten Sie die Entgiftungsbescheinigung, die Sie mit dem Gerät erhalten haben.

1. Reinigen

Bevor Sie Ihr Gerät reinigen, sollten Sie

- zuerst den Netzstecker ziehen
- das Gerät unter 50°C abkühlen lassen.

Ein feuchtes Tuch mit Seifenlösung reinigt Ihr Gerät am besten. Achten Sie darauf, daß kein Wasser in das Gerät gelangt. Verwenden Sie keine Scheuermittel.

2. Sicherungen

Die Stromzuleitung ist durch ein oder zwei Sicherungen geschützt. Diese sollten nur durch qualifiziertes Fachpersonal ausgetauscht werden. Wenn die Sicherung wiederholt durchbrennt, liegt ein größerer Defekt vor. Das Gerät muß zur Reparatur an Ihren Lieferanten eingeschickt werden.

Introducción

Le rogamos lea cuidadosamente la información contenida en este folleto antes de manipular el aparato.

Aviso

LAS TEMPERATURAS ELEVADAS SON PELIGROSAS: pueden causarle graves quemaduras y provocar fuego en materiales combustibles.

Techne ha puesto gran cuidado en el diseño de estos aparatos para proteger al usuario de cualquier peligro; aún así se deberá prestar atención a los siguientes puntos:

- EXTREME LAS PRECAUCIONES Y UTILICE GUANTES PARA PROTEGERSE LAS MANOS;
- NO coloque objetos calientes encima o cerca de objetos combustibles;
- NO maneje el aparato cerca de líquidos inflamables o gases;
- NO introduzca ningún líquido directamente en el aparato;
- UTILICE EL SENTIDO COMUN en todo momento.

Seguridad del usuario

Todos los usuarios de equipos Techne deben disponer de la información necesaria para asegurar su seguridad.

De acuerdo con las instrucciones contenidas en este manual y con las normas y procedimientos generales de seguridad, es muy importante que sólo personal debidamente capacitado opere estos aparatos. De no ser así, la protección que el equipo le proporciona al usuario puede verse reducida.

Todos los equipos Techne han sido diseñados para cumplir con los requisitos internacionales de seguridad y traen incorporados un sistema de desconexión en caso de sobretemperatura. En algunos modelos el sistema de desconexión es variable, lo que le permite elegir la temperatura según sus necesidades. En otros, el sistema de desconexión viene ya ajustado para evitar daños en el equipo. En caso de que surgiera un problema de seguridad, desconecte el equipo de la red.

Instalación

1. Todos los aparatos Techne se suministran con un cable de alimentación. Puede ser fijo o independiente del aparato.
2. Antes de conectarlo, compruebe que el voltaje corresponde al de la placa indicadora. Conecte el cable de alimentación a un enchufe adecuado según la tabla expuesta a continuación. El equipo debe estar conectado a tierra para garantizar la seguridad eléctrica.

<i>Conexiones</i>	220V-240V	110V-120V
Línea	Marrón	Negro
Neutro	Azul	Blanco
Tierra	Verde/amarillo	Verde

Asegúrese de que los equipos marcados 230V en la placa indicadora funcionan a 220V y de que los equipos marcados 120V funcionan a 110V. No obstante, en ambos casos la velocidad de calentamiento se verá reducida en un 8% aproximadamente. La placa indicadora está situada en la parte posterior del equipo.

3. Conecte el cable a la toma de tensión en la parte posterior del equipo.
4. Sitúe el aparato en un lugar apropiado tal como una superficie de trabajo plana, o si fuera necesario incluso en una campana con extractor de humos, asegurándose de que las entradas de aire en la parte inferior no queden obstruidas.

Después de su uso

Cuando haya finalizado el calentamiento de muestras, recuerde que las piezas del equipo, tales como tubos, bloques y demás accesorios, pueden estar muy calientes. Tome las precauciones mencionadas anteriormente.

Garantía

Este aparato está garantizado contra cualquier defecto material o de fabricación durante el periodo especificado en la tarjeta de garantía adjunta. Este plazo inicia a partir de la fecha de compra, y dentro de este periodo todas las piezas defectuosas serán reemplazadas gratuitamente siempre que el defecto no sea resultado de un uso incorrecto, accidente o negligencia. Mientras se encuentre bajo garantía las revisiones las debe llevar a cabo el proveedor.

A pesar de la descripción y las especificaciones de los aparatos contenidas en el Manual del Usuario, Techne se reserva por medio de este documento el derecho a efectuar los cambios que estime oportunos tanto en los aparatos como en cualquier componente de los mismos.

Este manual ha sido preparado exclusivamente para los clientes de Techne y nada de lo especificado en este folleto de instrucciones se tomará como una garantía, condición o aseveración de la descripción, comerciabilidad o adecuación para cualquier fin específico de los aparatos o sus componentes.

Mantenimiento

ESTE APARATO DEBE SER DESMONTADO SOLO Y EXCLUSIVAMENTE POR PERSONAL DEBIDAMENTE CAPACITADO.

EL RETIRAR LOS PANELES LATERALES, FRONTALES O TRASEROS SUPONE DEJAR AL DESCUBIERTO TENSION DE LA RED PELIGROSA.

EL EQUIPO NO CONSTA DE NINGUNA PIEZA DE CUYO MANTENIMIENTO SE PUEDA ENCARGAR EL USUARIO.

En el caso improbable de que experimentara algún problema con su aparato que no pudiera resolver con facilidad, debería ponerse en contacto con su proveedor y devolverlo si fuera necesario. Indique de forma detallada todos los defectos que haya notado y devuelva el equipo en su embalaje original. Techne no aceptará responsabilidad alguna por daños causados en equipos que no estuvieran debidamente embalados para su envío; si tuviera alguna duda, póngase en contacto con su proveedor. Sírvese consultar el Certificado de Descontaminación suministrado con su aparato.

1. Limpieza

Antes de limpiar su aparato, desconéctelo SIEMPRE de la fuente de alimentación y permita que se enfríe por debajo de los 50°C.

Este aparato se puede limpiar pasándole un paño húmedo enjabonado. Hágalo con cuidado para evitar que caiga agua dentro del mismo. No utilice limpiadores abrasivos.

2. Fusibles

Su aparato está protegido por uno o dos fusibles. Sólo deben cambiarlos personal debidamente capacitado.

Si los fusibles se fundieran repetidamente, esto indicaría una avería grave y puede que tuviera que devolverle el aparato a su proveedor para su reparación.

INTRODUCTION

Read the whole of this book before commencing work with the unit. Some of the DC-1 and DC-4 book is repeated here for your convenience. The clearing device consists of a conical plastic basket suspended by a nylon thread attached to a small reversible motor which is mounted on top of the plastic water jacket by two clamp screws. The basket is weighted to make it move axially within the graduated column tube and a fringe of polythene wipers around the edge of the basket ensures that all the specimens and floats within the column tube are collected as the basket is raised.

Packing

When you receive your unit, make sure you keep the original packing in case you ever need to return it for service or repair. The unit must be transported in the original packing to avoid damage. Techne accepts no responsibility for damage incurred unless the unit is correctly packed and transported in this way.

Specification

Housing	
Depth	114mm (4.5 in)
Width	94.4mm (3.6 in)
Height	114mm (4.5 in)
Basket	
Max diameter	50mm (1.9 in)
Length	54mm (2.1 in)
Thread	
Length when installed	914mm (36 in)
Material	Nylon
Speed	19.8mm/min (0.8 in/min)
Voltage	Cycles
220V/240V	50/60Hz
120V	50/60Hz
110V	50/60Hz

Electrical Connection

- 1 Before connecting the mains supply to the DC-3, check the voltage with that marked on the rating plate. Connect the mains cable to a suitable supply according to the table below. **Note that the unit must be earthed to ensure proper electrical safety.**

<i>CONNECTIONS</i>	<i>230V</i>	<i>110/120V</i>
Live	Brown	Black
Neutral	Blue	White
Earth	Green/yellow	Green

- 2 For connection of the Thermoregulator see the separate Operator's Manual.

OPERATION OF THE DC-3

- Set up the column.
- Wet the calibrated glass density floats and place them in the basket.
- Switch the motor to the 'DOWN' position.
- As each float reaches it's own density in the column it remains at that level while the basket continues to descend.
- The basket takes approximately 40 mins to travel the whole length of the column tube in order not to disturb the gradient.
- Switch the motor 'OFF' when the basket has reached the bottom of the tube.
- Make the column graph.
- The unit is ready to use.
- When it becomes necessary to clear the column tube of specimens, switch the motor to the 'UP' position and the basket will be drawn upwards collecting all the floats and specimens on the way.

SETUP OF THE DENSITY GRADIENT COLUMN

Jacket Filling

Tempette:

Replace the elbow connection from the base of the pump with the outlet pipe adaptor provided. Connect the plastic tube (inside the perspex vessel) to the adaptor.

- Mount the Tempette into the rectangular hole in the top plate of the water jacket. Lightly screw in the Tempette's clamp until it makes contact with the outside wall of the water jacket.
- Fill the vessel to within one inch of the top with demineralised water (through the column tube aperture) and then stand the whole unit on the floor (or on a bench if more convenient) near to where the column is to be utilised.

Note: A demineralised water with about 2% Ethylene Glycol type anti-freeze is a very useful alternative as it reduces deposits and algae growth, etc.

- A thermometer can be inserted into the vessel through the small hole provided in the top; set the Tempette (fully described in a separate User's Manual) dial to approx 23°C and allow the water to heat up. As the required temperature is approached, as shown on the thermometer, rotate the dial back until the neon indicator switches off at the exact temperature. Check the temperature is 23°C +0.1°C after the unit has been controlling for a short time.
- If the ambient temperature is higher than 19°C, then cold water should be circulated through the cooling coil in order that the Tempette can operate efficiently.
- Insert the column tube into the water vessel. To overcome the buoyancy, hold the column down by stretching the rubber band over the metal tags which are under the top cover fixing screws. The column is now ready for the filling operation.

Liquid Systems

The following list has been extracted from ASTM D.1505 - 60T.

System	Density Range <i>g/ml</i>
Methanol-Benzyl Alcohol	0.80 to 0.92
Isopropanol-Water	0.79 to 1.00
Isopropanol-Diethylene Glycol	0.79 to 1.11
Ethanol-Carbon Tetrachloride	0.79 to 1.59
Toluene-Carbon Tetrachloride	0.87 to 1.59
Water-Sodium Bromide	1.00 to 1.41
Water-Calcium Nitrate	1.00 to 1.60
Zinc Chloride-Ethanol-Water	0.80 to 1.70
Carbon Tetrachloride-1.3-Dibromopropane	1.60 to 1.99
1.3 Dibromopropane-Ethylene Bromide	1.99 to 2.18
Ethylene Bromide-Bromoform	2.18 to 2.89
Carbon Tetrachloride-Bromoform	1.60 to 2.89
Tetrachloroethylene-Bromoform	1.55 to 2.70

Liquid Preparation

- When selecting the two liquids, the following are important requirements:
 - 1 Both liquids should be readily available and they must obviously be miscible.
 - 2 Preferably colourless, low viscosity liquids.
 - 3 The liquids must obviously span the required density gradient, and should easily wet the samples.
 - 4 The liquids must not have an adverse effect on the samples to be tested.
 - 5 The two liquids can themselves be prepared solutions prior to mixing in the filling device.
 - Assemble the flasks as shown in the diagram.
 - Close the outlet taps on the two conical flasks.
 - With the above considerations in mind, prepare two liquids;
 - 'a' having a density 20% (of the whole range) below the lowest density required and
 - 'b' having a density 30% (of the whole range) above the highest density required (ref BS3715).
 - Place them in the separate conical flasks.
 - Where the densities of the two liquids differ by 5% or more, it is necessary to put a greater volume of the liquid of the lower density in its flask.
 - The heights of the surfaces of the two liquids above the filling device platform should be in inverse proportion to their density. This will ensure that when the connecting tap between the two is opened, an approximate equilibrium condition will exist.
 - It is important that the total volume of the two liquids should be two litres.
- Note:** The wider the column range required, the more difficult it becomes to obtain linearity for ranges not exceeding approximately 0.3 g/ml but with ranges exceeding this value it may be necessary to either:
- 1 Use an auxiliary stirrer through the top of the flask with the magnetic stirrer. In this instance care must be taken not to introduce air bubbles into the liquid. or
 - 2 Considerably increase the total filling time; up to, say, four hours.
- If necessary, the liquids may be degassed by evacuation at a pump pressure of about 60cm. A water filter pump is suitable.

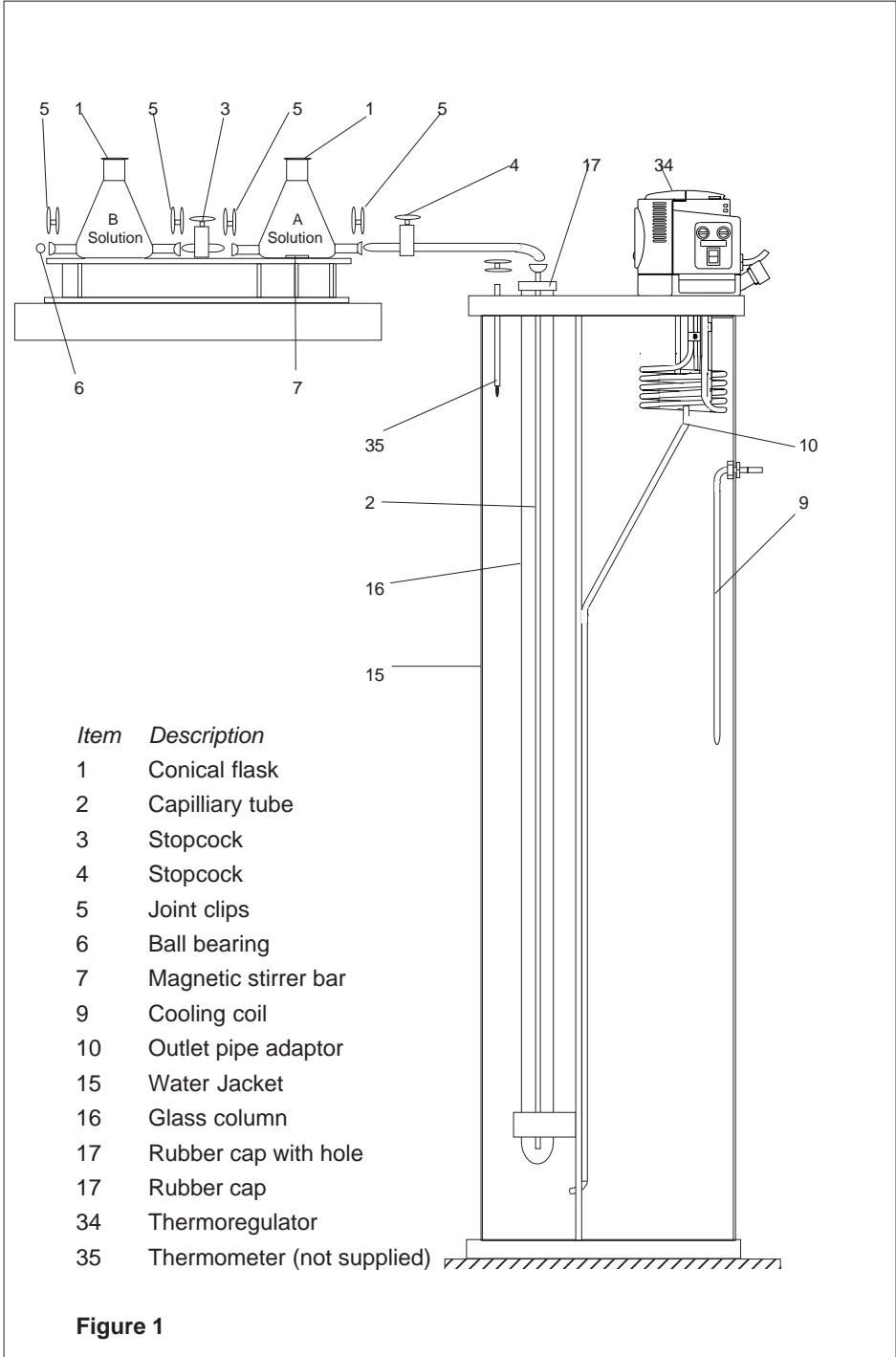


Figure 1

Filling the Column

- Insert the capillary filling tube (item 2) down into the column tube until its lower end rests on the bottom.
- Link up the rest of the apparatus as shown in fig 1 using a small amount of silicon grease on all the joints; the stirrer and flasks can stand on a bench alongside the column.
- Connect the magnetic stirrer to the correct electrical supply and switch on.
- Fully open the connecting tap between the two vessels. Allow time for hydrostatic equilibrium to be established between the two vessels and then open the outlet tap to the capillary tube.
- The column will slowly fill, and should take about 2 hours.
- Regulation of filling rate is possible by adjustment of the outlet tap but this **must not** be done once a filling operation has started.
- During a filling operation the density of liquid 'a' will increase continuously as the liquid of higher density in flask 'b' flows into it. This will introduce a solution of continually graded density into the column.
- Shut off the outlet tap when the column tube is sufficiently filled above the scale top mark.
- Switch off the stirrer.
- Very slowly and carefully remove the capillary filling tube.
- Retain some of the denser liquid for subsequent specimen wetting.

Calibrating the Column

- Position the apparatus where it is to be used.
- Select eight calibrated glass density floats to cover the density range of the column, and ensure they are very clean.
- Starting with the highest value float, wet each one in some of the left over solution and place them into the column. The DC-3 may be used for this. Before actually releasing the floats ensure that they have no visible air bubbles attached.
- The floats will then assume their own density level in the column.
- By measuring the height of each float in the column and knowing the density of the float a calibration graph can be drawn.

If the readings obtained from several specimens of the same sample are widely different, then more specimens should be tested to see if the spread of results is real.

INTRODUCING SAMPLES

Since a large number of samples may eventually be placed into the column, some form of identification is necessary. This is best achieved by identifying the shape of the specimens in simple geometric forms. It is important that their centre of volume is easily known, and by combinations of geometric shapes a large number of different specimens is possible.

Always use a sharp cutting tool to avoid straining the material.

- After the specimens have reached equilibrium their positions (centres of volume) can be determined by means of the antiparallax scale on the column tube.
- The density of the specimen can then be read directly off the graph.
- When attempting to assess density to ± 0.0002 g/ml the specimens should always be double checked, even by immersion in a second column.
- The graph should be replotted each time the column is used.
- If practical it is advisable to allow at least 12 hours before taking readings of specimen density.

- 1 The specimens may have **voids** or have **air bubbles** attached.
In such cases the highest density value should be accepted especially if it is the most frequent one.
- 2 **Foreign matter** embedded in the specimens.
In this case, cut the specimen in to two ore more pieces and determine the density of these by replacing in a column.
- 3 The column becoming so **choked with specimens** that interference between them may prevent precise readings.
It is possible to clear the column of all specimens and floats by means of a mesh basket, DC-3, which is drawn very slowly up through the column. However, it is often economic to simply scrap the column and make a fresh one.

Life of the Column

- The life of a column varies greatly but normally lasts around fifteen weeks if undisturbed.
- However, sometimes a column might have to be discarded as soon as it is made because the graph obtained is unacceptable. This occurs particularly if there has been unevenness in the flow during filling. For example, if the capillary becomes blocked or if there is an air bubble in the capillary.
- It is impossible to give a quantitative guide to the expected life of a column because it depends on many factors, some of which may be impossible to control.
- In general it can be said that any disturbance that produces convection currents will hasten the deterioration compared with that calculated from the diffusion equation.
- Thus the service life will depend on the number of samples tested, the way the samples are inserted, the amount of differential evaporation, and temperature gradients.

Note: A column clearing device is available, but has been omitted as standard equipment because it is only necessary where either the rate of sample testing is high or if the column solutions are expensive.

References

'Measuring the density of polyolefins with an improved Gradient column' N. Payne and C.E. Stephenson. Materials Research & standards 4 3-7. (January 1964)

BS 2782:Part 6:Methods 620A to 620D:1991

ASTM D. 1505 - 60T.

TECHNICAL INFORMATION

Brief fault finding notes are given in this section.

NOTE THAT ELECTRICAL EQUIPMENT SHOULD ONLY BE DISMANTLED BY PROPERLY TRAINED PERSONNEL. REMOVING THE CASE EXPOSES POTENTIALLY LETHAL MAINS VOLTAGES. THERE ARE NO USER MAINTAINABLE PARTS WITHIN THIS EQUIPMENT.

User Maintenance

General

In the unlikely event that you experience any problems with your Density Column or accessories which cannot be easily remedied, you should contact your supplier and return the unit if necessary. Please include details of the fault observed and remember to return the unit in its original packing. Techne accept no responsibility for damage to units which are not properly packed for shipping: if in doubt, contact your supplier.

Fuses

If the power lamp, on the front panel, fails to light when power is supplied to the unit the fuses may have blown. Check that there is no external cause such as a faulty plug.

These should only be changed by a suitably qualified person. If the fuses blow persistently, a serious fault is indicated and you may need to return the unit to your supplier for repair.

Cleaning your Density Column

Before cleaning your unit ALWAYS disconnect from the power supply and allow to cool.

You can clean the case of the Filling Device with a cloth dampened in water or ethanol. Only use a damp cloth for the Density Column. No part of the unit should be immersed in solvents. Do not use acetone or abrasive cleaners.

Before using any cleaning or decontamination method except those recommended in this manual, the responsible body should check with Techne that the proposed method will not damage the equipment.

Replacement Parts and Accessories

DC-1 and DC-4

When ordering spare parts check fig 1, page 18, to obtain the correct item reference and always quote the instrument serial number.

<i>Item N°</i>	<i>Description</i>	<i>Qty</i>	<i>Notes</i>
1	F2019 CONICAL FLASK	2	
2	F2020 CAPILLARY TUBE	1	
3	F2021 STOPCOCK	1	
4	F2022 STOPCOCK	1	
5	F2023 JOINT CLIP	5	
6	F2024 BALL BEARING	1	
7	F2025 MAGNETIC STIRRER BAR	1	
8	5000821 9mm x 6mm PORTEX TUBE	1	
9	F1947 COOLING COIL	1	
10	6005730 REDUCING NOZZLE	1	
12	6009689 OUTLET PIPE ADAPTOR	1	
14	6002848 CABLE CLIP	2	
15	6100255 WATER JACKET	1	DC-1
16	F2015 GLASS COLUMN ASSEMBLY	1	DC-1
15	6101029 WATER JACKET	1	DC-4
16	F2015 GLASS COLUMN ASSEMBLY	2	DC-4
17	6002014 RUBBER CAP WITH HOLE	2	
17	6002027 RUBBER CAP	2	
18	5000823 5/16 x 3/16 RUBBER TUBING N.5	1	
34	FJP8D TE-8J THERMOREGULATOR	1	240V
34	FJP8P TE-8J THERMOREGULATOR	1	120V
34	FJP8Y TE-8J THERMOREGULATOR	1	100V

DC-3

<i>Number</i>	<i>Description</i>	<i>Qty</i>
1	6004806 BOBBIN	1
2	6004919 BASKET ASSEMBLY	1
3	6005924 LINE GUIDE	1
4	6001259 SHOULDER SCREW	2