

# BAF400T

**Institution: University of Cologne**

**Scientist in charge: Lhoussaine Belkoura**

## Freeze Etching System BAF 400 T

The BAF 400 T corresponds in its applications and features to the BAF 400 D. However, the diffusion pumping system is replaced by a turbo molecular pumping system.

This pumping system allows work in a clean residual gas atmosphere.

Work cycles and pumping time curves remain about the same.

### Specifications

#### 1. System Frame

Sectional steel frame construction; removable front, rear and side walls.

The removable table top is coated with light grey plastic. Drawer for accessories.

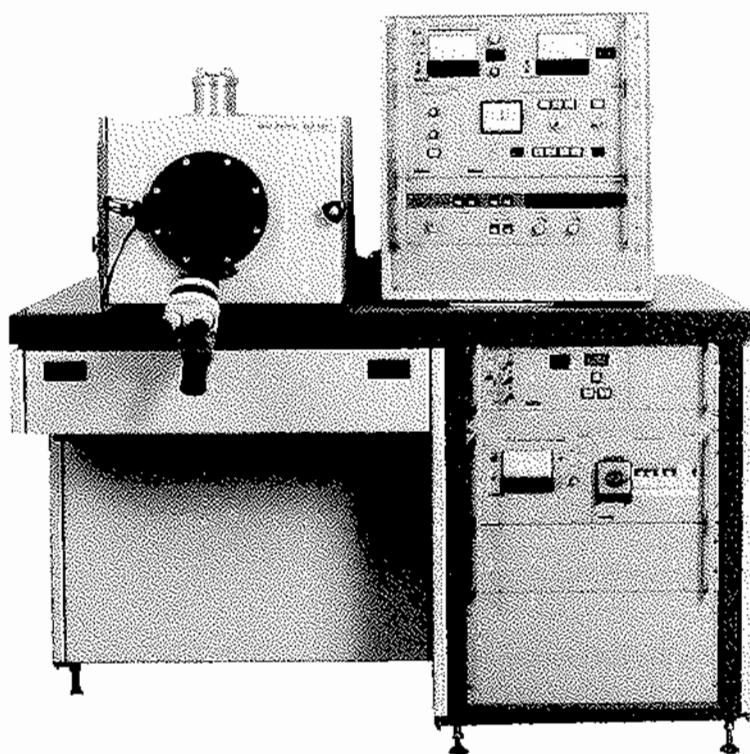
Dimensions: table height 850 mm; width 1,410 mm; depth 850 mm; total height 1,445 mm.

#### 2. Vacuum chamber

Made of stainless steel with aluminum front door; with the finest polish on the vacuum side. Open front side 300 mm high and 400 mm wide.

Consisting of:

- 1 Connecting flange DN 160 ISO for high vacuum pumping system
- 4 Connection ports of 32.5 mm in diam. to set up feedthroughs
- 2 Small flange connections DN 10 ISO-KF in vacuum chamber back wall
- 1 Connection port of 191 mm in diam. to install the microtome base plate
- 4 Connection ports of 32.5 mm in diam. in vacuum chamber floor
- 1 Connection port of 64 mm in diam. in vacuum chamber ceiling
- 1 Connection port of 64 mm in diam. in left side wall
- 1 Sight-glass DN 160 ISO in the front door



### Technical Data

Dimensions:	See scale diagram BAF 400 D.
Weight:	Approx. 450 kg without packaging. Approx. 800 kg with crating.
Electrical connection data:	
Voltages (3P + N + E)	3 x 380/220 V, 3 x 208 V,
Frequency:	50 Hz/60 Hz
Power input	2.5 - 4.5 kVA
Mechanical connection data:	
Compressed air connection (for microtome)	
Pressure min. - max.	3 - 5 bar
Connection: hose nipple	diam. 6 mm
Cooling water connection:	
Pressure min. - max.	2 - 4 bar
Throughflow quantity depending on input temp.	15-30 l/h
An input temperature of 20°C should not be exceeded.	
Cooling water inlet: hose nipple	diam. 13 mm
Cooling water outlet: hose nipple	diam. 13 mm
Atmospheric discharge	
Exhaust gases:	
Hose connection fitting	diam. 25 mm

**3. High Vacuum Pumping System**

Fully automatic turbo molecular pumping system.

Consisting of:

- 1 DUO 016 B Rotary vane pump; Suction capacity at 50 Hz 16.2 m<sup>3</sup>/h.
- 1 TPH 520 Turbo molecular pump; Suction capacity for air: 500 l/s.
- 1 TCS 304 Pumping system control unit.
- 1 TCP 380 Drive, electronic.
- 1 TCV 103 Valve control unit.
- 1 TVF 012 Vent valve and
- 1 EVC 010 MF Angle vent valve.

**Ordering Information**

BAF 400 T basic system per specifications 1 through 7.

	Order No.
3 x 380/220 V, 50 Hz	BB P02 036
3 x 208 V, 60 Hz	BB P02 037
3 x 415/240 V, 50 Hz	BB P02 038

**4. Vacuum Measuring Equipment**

Consisting of:

- 1 TPG 300 Vacuum meter. Measuring range:  
100 to 5 x 10<sup>-9</sup> mbar, with automatic switching from fine to high vacuum.
- 1 TPR 010 Fine vacuum gauge
- 1 IKR 020 High vacuum gauge
- 1 Set of cables

**5. Water Battery**

To monitor the cooling circuit line.

**6. BNV 210 Power Distributor**

The system and the control system are connected to the mains via the BNV 210.

The front side contains:

The main switch, which can be locked.

A three pole automatic breaker for the pumping system.

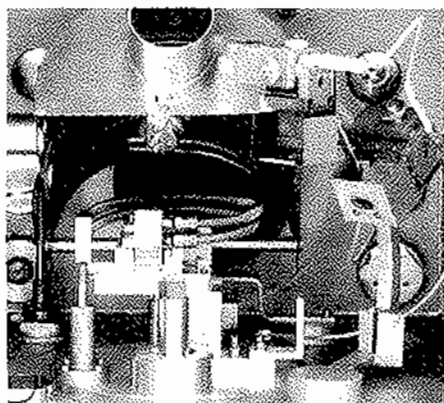
A two pole automatic breaker for the evaporation unit.

A one pole automatic breaker for five outlets located on the back side of the power distributor, used to connect additional equipment, if so desired.

**7. Tool Kit**

Includes all required system tools in a handy portable bag.

## Accessories

**Microtome Freeze Etching Device**

Consisting of:

- 1 Manual microtome drive for cutting- and knife advance movement
- 1 Nitrogen cooled vacuum chamber shield
- 1 Nitrogen valve battery
- 1 Evaporator gun mount with angle measuring scale
- 1 Specimen table for three 3mm in diam. gold specimen carriers
- 1 Incident light lamp

Order No. BB 176 440-T

**BMS 101 Control Unit**

To control the liquid nitrogen supply to the microtome freeze etching device.

Order No.

230 V/50 Hz	BG M05 750
208 V/60 Hz	BG M05 751
240 V/50 Hz	BG M05 752

**Rackmount Assembly, 4 units**

To receive control units, with 4 unit levels, e.g. BMS 101, BCM 101.

As table model.

Order No. BB 176 300-T

As rack stand.

Order No. BB 172 612-T

**Rackmount Assembly, 3 units**

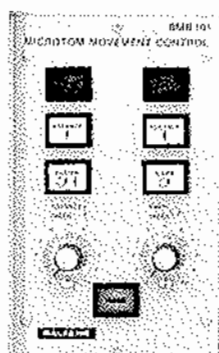
To receive control units, with 3 unit levels, e.g. EVM 030, QSG 060.

As table model.

Order No. BB 176 046-T

As rack stand.

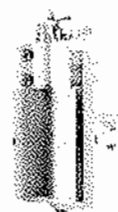
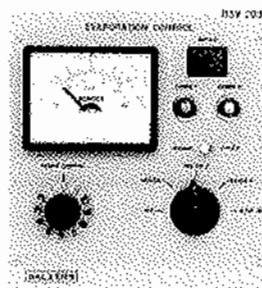
Order No. BB 176 047-T

**Motor Drive for Microtome**

With two separate drive motors for the cutting motion and the knife advance movement. Includes BMB 101 control unit.

Order No.

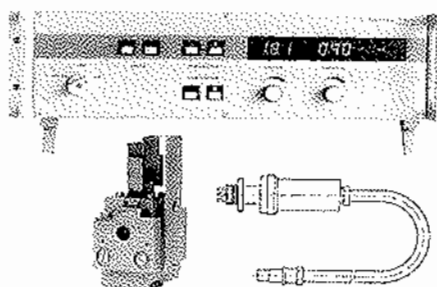
230 V/50 Hz	BB 172 550-T
208 V/60 Hz	BB 146 442-T
240 V/50 Hz	BB 146 443-T

**Resistance Heated Evaporation Device**

Consisting of:

- 1 Carbon-platinum evaporator for specimen shadowing
- 1 Carbon evaporator to produce specimen replicas
- 1 BSV 203 Control unit
- 1 High current power supply

Order No. BB 172 223-T

**EVM 030 Electron Beam Evaporation Device**

As an alternative to the resistance evaporation device.

Consisting of:

- 1 EVM 030 Control unit
- 2 EK 030 Evaporation guns
- 1 HV cable with vacuum feedthrough
- 1 Safety interlock switch
- 1 Vacuum relay
- 1 Grounding rod

As table model Order No.

208-230 V, 50/60 Hz	BU 020 035-T
240 V, 50/60 Hz	BU 020 050-T

For rack stand Order No.

208-230 V, 50/60 Hz	BU 020 056-T
240 V, 50/60 Hz	BU 020 057-T

**FET 004 A Nitrogen Filling Device**

To supply the freeze etching system, the baffle (in the BAF 400 D) or the nitrogen venting device with liquid nitrogen. Fits on the nitrogen storage receptacles with connection DN 50 KF.

FET 004 A, filling device with non-return valve, quick-action lock lever and centering ring, all complete.

Order No.

230 V/50 Hz	BU 012 042-T
115 V/60 Hz	BU 012 046-T
24 V/50 Hz	BU 012 047-T

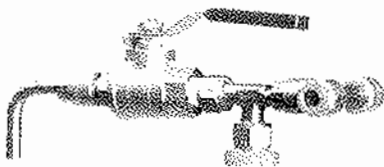
**LN<sub>2</sub> Dewar**

For liquid nitrogen.

Connecting flange DN 50 KF.

Content Order No.

50 l	B 6105 059 A5
100 l	B 6105 059 A8

**Manual Nitrogen Valve**

To extract liquid nitrogen from the nitrogen storage receptacle via the FET 004 A/M nitrogen filling device.

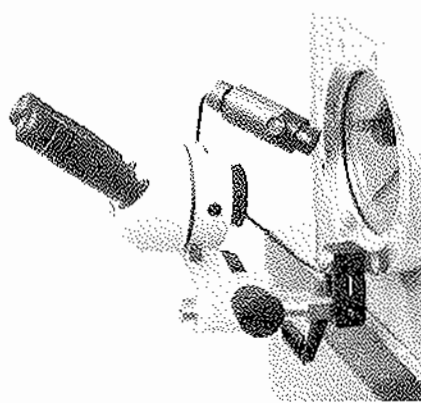
Order No. BU 012 041-T

**LN<sub>2</sub> Level Sensor**

For the 50 or 100 liter LN<sub>2</sub> Dewar.

Can be operated in conjunction with the microtome control unit BMS 101.

Order No. BB 172 233-T

**Binocular Microscope**

Magnification 7/14 fold.

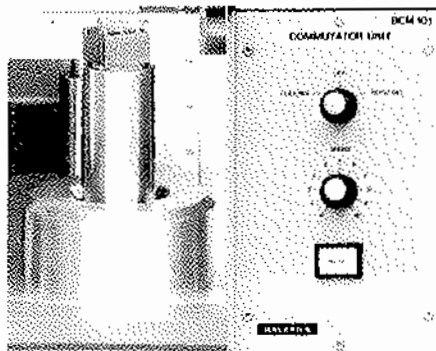
For observation of the specimen during specimen.

Order No. BU 004 025-T

**Incident Light Lamp**

Includes heating filter. Already included in microtome freeze etching device BB 176 440-T.

Order No. B 8010 120 14

**Rotary Specimen Cold Stage**

For rotary shadowing of specimens and to produce stable specimen replicas.

Is set up in place of the stationary specimen cooling stage.

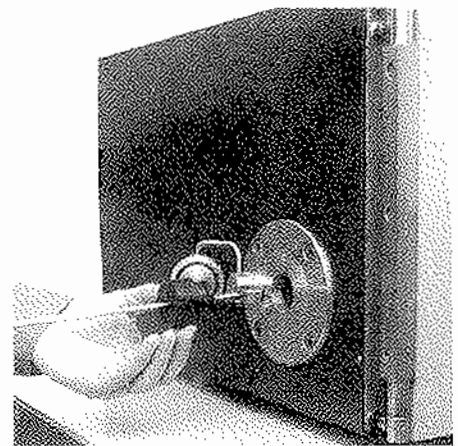
Consisting of:

- 1 Rotary specimen cold stage
- 1 BCM 101 Control unit
- 1 Set of cables.

For further information on rotary shadowing, please refer to Technical Report (BB 800 013 DE).

Order No.

230 V, 50 Hz BB 172 222-T

**Counter Flow Loading Device**

Used to insert a specimen table into the gaseous nitrogen vented vacuum chamber.

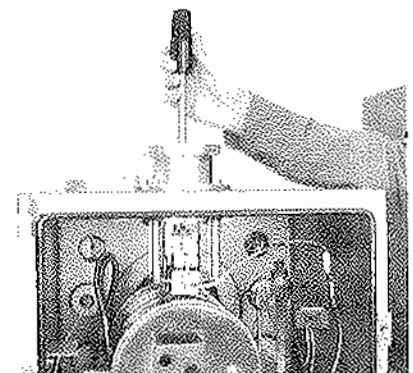
Consisting of:

- 1 Flange with locking cap.
- 1 Manipulator BB 172 957-T
- 1 Styrofoam box B 8010 124 55 with specimen table mount BB 172 026

Additionally required accessory:

Nitrogen venting device (BB 176 600-T)

Order No. BB 172 202-T

**Counter Flow Loading Device**

Used to insert the carbon electron beam evaporator into the gaseous nitrogen vented vacuum chamber.

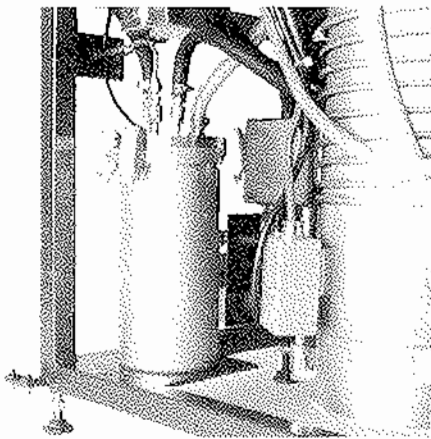
Consisting of:

- 1 Flange with locking cap.
- 1 Lead-in manipulator (BB 172 866-U)
- 1 Mounting device for EK 030 evaporation gun
- 1 Shortened mount with angle measuring scale for shadowing gun
- 1 Set of fittings for EK 030

Additionally required accessory:

Nitrogen venting device (BB 176 600-T)

Order No. BB 172 480-T



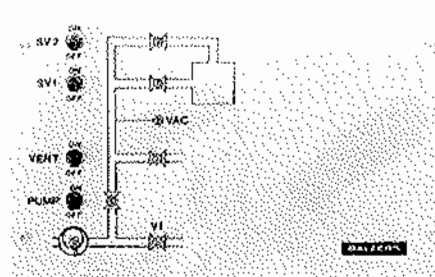
**Nitrogen Venting Device**

To vent the vacuum chamber with dry gaseous nitrogen.

Consisting of:

- 1 Water-heated LN<sub>2</sub> evaporator
- 1 Set of connecting lines

Order No. BB 176 600-T



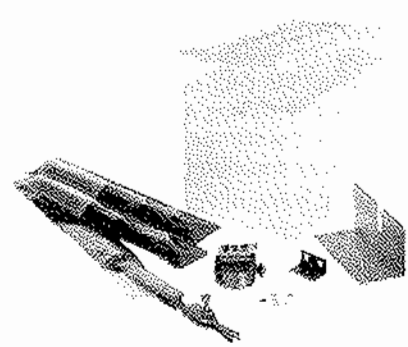
**ALC 101 Air Lock Chamber Control Unit**

To control air locks for specimen table and evaporation gun.

Cable included.

Order No.

220 V/50 Hz BB 172 490-T



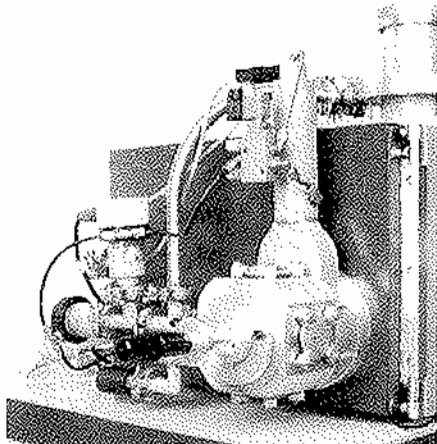
**DA 400 Double Replica Device**

With all required accessories to produce freeze fracture double replicas.

Consisting of:

- 1 Double replica specimen table (BB 172 221-T)
- 1 Styrofoam box (B 8010 124 55)
- 3 Centering tweezers (B 8010 120 38)
- 2 x 24 pieces, specimen carriers of 4.6 mm in diam..

Order No. BB 172 225-T



**Specimen Table Air Lock**

To set up a specimen table on to the specimen cold stage which is inside the vacuum chamber without interrupting the vacuum flow.

Consisting of:

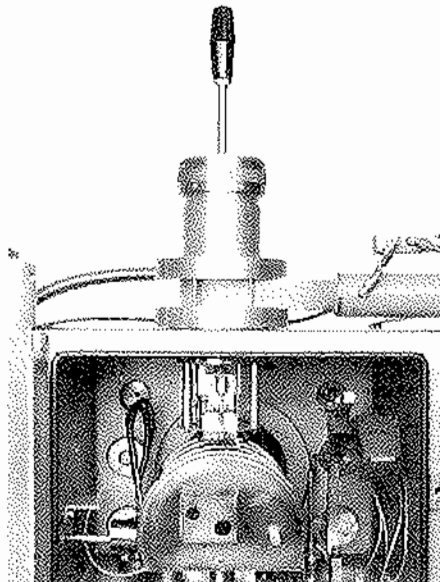
- 1 Air lock chamber
- 1 High vacuum slide valve (electro-pneumatic)
- 1 Manipulator
- 1 Vacuum gauge
- 1 Set of angle valves for bypass operation
- 1 Set of connecting cables

Additionally required accessory:

- 1 ALC 101 Control unit (BB 172 490-T)

Order No.

for 50 Hz BB 172 228-T  
for 60 Hz BB 005 132-W



**Evaporation Gun - Air Lock**

To set up the carbon evaporation electron beam gun in the vacuum chamber without interrupting the flow of the vacuum.

Consisting of:

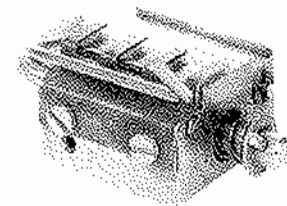
- 1 Air lock chamber
- 1 High vacuum slide valve (electro-pneumatic)
- 1 Evaporation gun fixture
- 1 Manipulator
- 1 Vacuum hose with corrugated metal sheathing
- 1 Set of connecting cables

Additionally required accessory:

- 1 ALC 101 Control unit (BB 172 490-T)

Order No.

for 50 Hz BB 172 825-T  
for 60 Hz BU 005 133-W



**Monolayer Freeze Fracture Device**

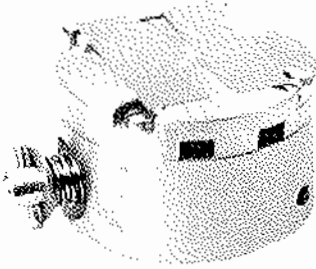
With all required accessories to produce freeze fractures of cell monolayers according to the Pfenninger technique.

Consisting of:

- 1 Specimen table (BB 172 704-T)
- 1 Centering device
- 1 Freezing manipulator
- 20 Specimen carrier sets (BB 176 872-T)

Order No. BB 172 231-W

## Specimen Tables

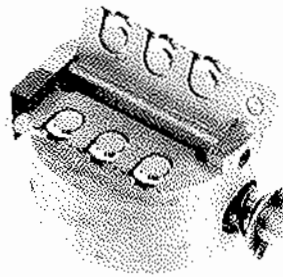
**Threefold Specimen Table**

For freeze drying of emulsions and suspensions.

With magnetic fixture for three grids of 3 mm in diam.

This specimen table lends itself to shadowing under extremely flat evaporation angles due to the thin retainer strips free of shadow projections.

Order No. BB 146 161-T

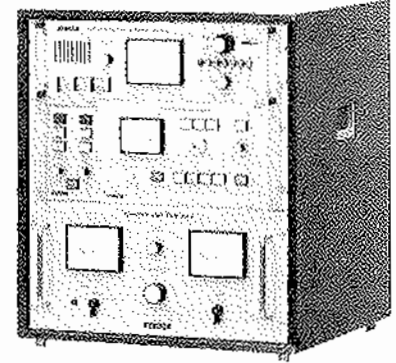
**Double Replica Specimen Table**

For simultaneous production of three freeze fracture specimens by breaking up the samples.

With mounting fixture for three 4.6 mm in diam. gold specimen carrier sandwiches.

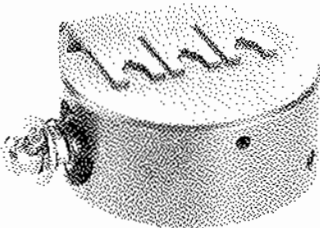
(Already included in the double replica device BB 172 225-T).

Order No. BB 172 221-T

**19" Table Rack**

To integrate control units such as QSG 060, EVM 030, BMS 101. 12 unit levels.

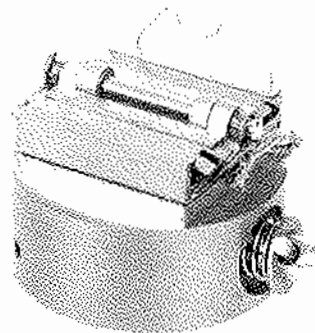
Order No. BB 172 224-T

**Threefold Specimen Table**

For targeted freeze cleaving of three specimens by freeze etching microtome. With bracket fixture for three 3mm in diam. gold specimen carriers.

(Already included in freeze etching microtome device).

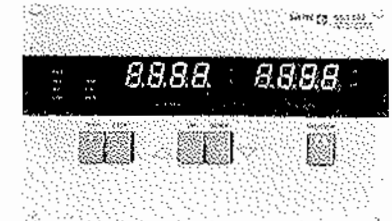
Order No. BB 172 160-T

**Double Replica Specimen Table**

For simultaneous production of three freeze fracture specimens by breaking up the samples.

With mounting fixture for five cryo-jet specimen carrier sandwiches.

Order No. BU 012 059-T

**QSG 060 Quartz Crystal Film Thickness Measuring Device**

To determine the thickness of the evaporated shadowing and carbon layers and to indicate the coating rate.

Consisting of:

- 1 QSG 060 Film thickness measuring device
- 1 QSK 060 Quartz crystal head
- 1 Quartz crystal head mount
- 1 Oscillator
- 1 Set of connection cables
- 1 Pack of Quartz crystals (10)
- 1 Table rack

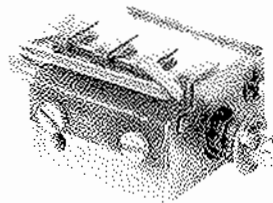
Order No.

230 V, 50/60 Hz BU 017 201-T

**Threefold Specimen Table**

For targeted freeze cleaving of three specimens by freeze etching microtome. With bracket fixture and support bracket for three cryo-jet specimen carriers.

Order No. BB 146 521-T

**Monolayer Freeze Fracture Specimen Table**

For simultaneous production of three monolayer freeze fracture specimens by breaking up the samples according to the Pfenninger technique.

With bracket fixture for three specimen carrier sets.

(Already included in the monolayer freeze fracture device BB 172 231-W).

Order No. BB 172 704-T

### Closed-Circuit Cooling System 0.5 kVA

To cool the BAF 400 D/T pumping systems.

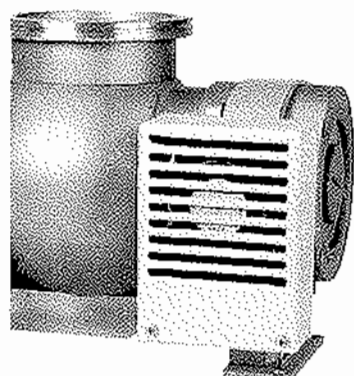
Is required when, for whatever economic reasons, no water connection is available to provide the adequate pressure needed.

Consisting of:

- 1 Closed-circuit system
- 1 Set of connection lines

Order No.

230 V/50 Hz	BU 009 005-T
208 V/60 Hz	BU 009 006-T

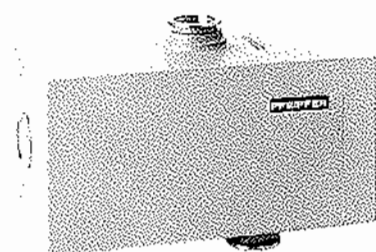


### Air Cooling for BAF 400 T

Is used for the turbo molecular pump TPH 520 in place of the serially equipped water-cooling system.

Order No.

230 V/50, 60 Hz	B 8010 027 01
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### Oil Mist Filter ONF 025

Prevents atmospheric buildup of oil mist. Is required when exhaust gas line is not available.

To be mounted directly to the pump port of the DUO 016 B rotary vane pump.

Consisting of:

- 1 ONF 025 Oil mist filter
- 1 Gasket
- 1 Mounting ring

Order No. BU 007 153-T

## Consumables

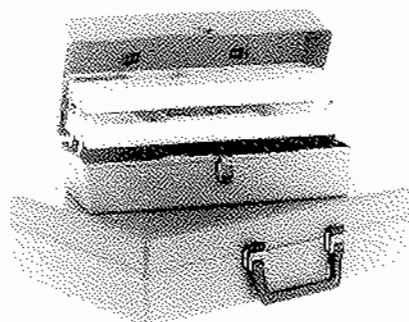
**Hard Metal Knife**

For the microtome freeze etching device.

Three are already included in the aids kit BB 176 442-T.

Order No.

10 pieces	BN 845 352-T
1 piece	BB 176 290

**Accessories Kit**

Contains all required aids used in freeze etching techniques.

Consisting of:

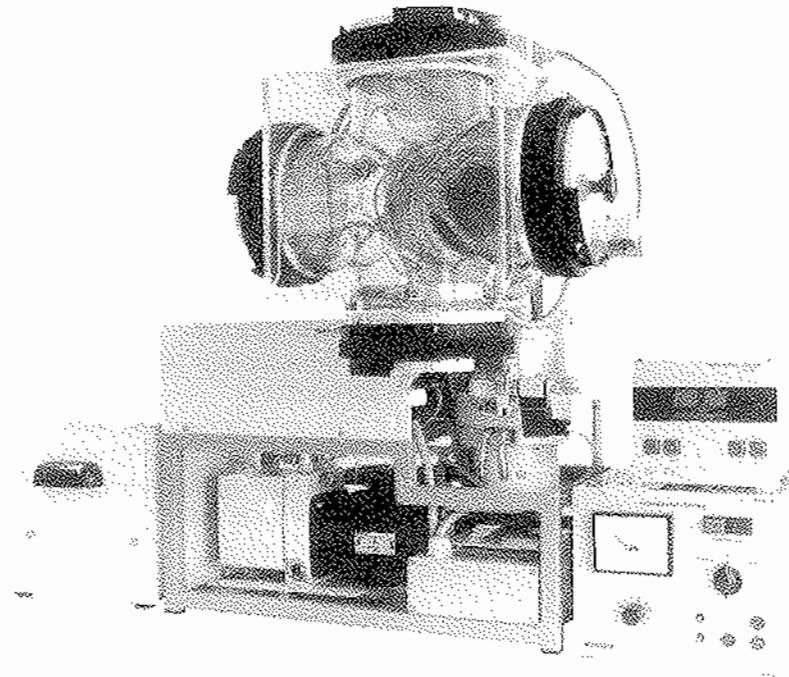
- 1 Dewar receptacle with freon liquefier (0.5 l)
- 1 Brass stirring rod
- 1 Dewar receptacle with specimen basket (0.5 l)
- 20 Specimen carriers, flat with diam. 3mm
- 20 Specimen carriers with center cavity of 3mm diam..
- 1 Cleaning brush
- 1 Pair of tweezers, sharp, bent
- 3 Hard Metal knives
- 2 Spot plates with cover plates
- 1 Fishing kit with eyelash set, platinum loop and two glass fishing rods, one fine, one large
- 1 Set of hexagon head socket wrenches SW 3, 4, 5 and 6
- 1 Hexagon head socket wrench with handle SW 3
- 1 Set of wrenches SW 8/10, 11/14, 12, 13/15, 14/17
- 1 Special wrench for nitrogen valve
- 1 Pair of crucible tongs
- 1 Replacement solenoid valve
- 4 Gaskets
- 1 Set of lamps, fuses etc.
- 1 Replacement mirror
- 1 each: Tube of Molykote paste G, Apiezon M and Silicon grease DC 340
- 1 Steel wire brush
- 2 Scotch-Brite cleaning cloths
- 1 Copper tube: diam. 6 x 1 mm; length 1.8 m
- 1 Armaflex insulated hose: 10/36 in diam. length: 1.8 m
- 1 Set of SERTO fittings
- 1 Universal portable case
- 1 Standard portable case
- 1 U-box for standard portable case

Order No. BB 176 442-T

## Freeze Etching System BAF 080

### Applications

- To produce freeze fractures using the double replication device.
- To conduct freeze drying processes.
- To conduct normal, portrait and rotary shadowing.
- To produce high resolution replication layers by evaporation of carbon/platinum or tantalum/tungsten for TEM applications.
- To produce the highest resolution mixed layers by evaporation of platinum/iridium/carbon for scanning tunneling microscopy.
- To produce the highest resolution sputtered layers of chromium, tungsten or platinum for FE-SEM.



### Features

- Design based on the reliable High Vacuum Coating System BAE 080.
- Extremely clean vacuum due to turbo molecular pumping system.
- Easy conversion to accommodate other specimen processing techniques.
- Easily portable table model.
- Cooling specimen tables with exact temperature control.
- LN<sub>2</sub> cooled, shielded specimen cage prevents extensive water vapor contamination from spreading on specimens.
- Choice of resistance-, electron beam evaporation- or sputtering device applications.
- For additional features, see BAE 080-T.

