

# Semisolids

## Background: Semisolids Testing

Most pharmaceutical dosage forms applied directly to the skin for topical action are classified as semisolid, a group of products which include ointments, creams and gels. They are typically applied for immediate, localised relief.

These products are typically hydrocarbon-based or oil-in-water emulsions incorporating additional ingredients such as emulsifiers, stabilisers, pH buffers, preservatives, absorption promoters and perfumes.

USP Chapter <1724> details the performance testing required for semisolid drug products.



COPLEY®

# Semisolids

## Test Apparatus & Method

There are three different apparatuses for the *in vitro* determination of drug release from semisolid drug dosage forms:

- Vertical Diffusion Cell (VDC)
- Immersion Cell
- Flow Through Cell (Apparatus 4)

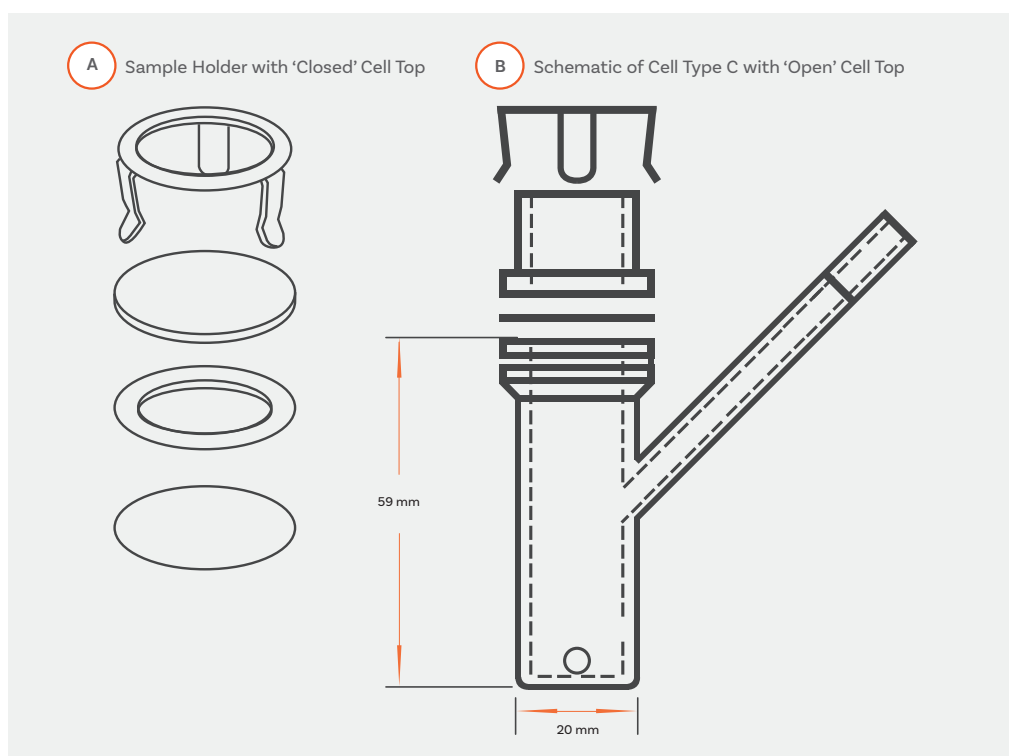
Due to its simplicity and reproducibility, the VDC, or Franz Cell, is typically the apparatus of choice.

The VDC comprises two parts: (a) the donor chamber containing the sample to be tested and (b) the receptor chamber containing the receptor medium.

The two parts are separated by an inert, highly permeable support membrane that acts as a conduit through which diffusion occurs.

The receptor chamber temperature is usually set to 32°C, to simulate normal skin conditions. At least 6 samples should be taken over a 6-hour period and analysed using HPLC or a similar analytical technique.

Results are calculated and expressed as the amount of drug released per unit membrane area ( $\text{mcg}/\text{cm}^2$ ) vs square root of time. This should yield a straight line. The slope of the line (regression) represents the release rate of the product.



Annex 1 of the EMA 'Guideline on quality of transdermal patches' suggests the use of the VDC for permeation studies on transdermal patches

# Vertical Diffusion Cell System: HDT 1000

## Simple, reproducible semisolid drug release measurement

With precision heating and integrated powerful magnetic stirrers, Copley's compact HDT 1000 test system offers full control over all test parameters and has become the benchmark vertical diffusion cell test system for many labs.

Using an innovative heating block approach, the HDT 1000 eradicates the difficulties and the "spaghetti" of tubing associated with water-jacketed cell systems and accommodates either endpoint, discrete manual or fully automatic sampling techniques. A dedicated stirrer mounted beneath each station ensures thorough mixing throughout testing for accurate sampling.



USP compliant



Innovative dry heating system  
simplifies test set-up



Precision control  
over all test  
parameters



Powerful magnetic stirrers  
ensure consistent mixing  
during testing



Novel cell clamps simplify  
cell preparation and  
sample collection




Small benchtop  
footprint saves precious  
benchtop space



# HDT 1000: Key Features



# Choose your HDT System



**HDT 1000**  
For higher throughput semisolids testing

**Cat. Number**  
7290

**Pharmacopoeial Compliance**  
USP <1724>

**User Interface**  
Touchpad and LED display

**Cell Capacity**  
Up to 10 diffusion cells

**Heating System**  
Dry heating block

**Temperature Range**  
Ambient - 150°C

**Stirrer Speed Range**  
400 - 2,000 rpm

**Sampling Technique Compatibility**  
End-point  
Discrete manual  
Fully automatic

**Unit Dimensions (w x d x h)**  
80 x 325 x 145 mm



**HDT 1**  
Basic, low cost test system for entry-level semisolids testing

**Cat. Number**  
7276

**Pharmacopoeial Compliance**  
USP <1724>

**User Interface**  
Touchpad and LED display

**Cell Capacity**  
1 single diffusion cell

**Heating System**  
Water bath

**Temperature Range**  
Ambient to 300°C

**Stirrer Speed Range**  
200 - 1,300 rpm

**Sampling Technique Compatibility**  
End-point  
Discrete manual  
Fully automatic

**Unit Dimensions (w x d x h)**  
190 x 300 x 100 mm

# Choose your HDT Accessories

## Cells

All cells supplied with Copley's Vertical Diffusion Cell systems are designed to simplify cell preparation and sample collection procedures.

For USP Models 'A', 'B' and 'C', vertical diffusion cells are supplied complete with individual cell tops for both 'closed or occluded' operation (as per Model 'A') and 'open' operation (as per Models 'B' and 'C' respectively), maximising the versatility of the HDT series.

To accommodate 'full thickness' membranes or skin, and in contrast to the Type 'B' and 'C' cells, which use a 3-pronged spring clip, a screw-type cell closure mechanism has been developed for the skin specific

cell that ensures proper contact between the sample and the receptor medium. All components of the cell are made from FDA-approved inert materials and a side sampling arm facilitates easy filling, sample withdrawal and media replacement.

Samples are separated from the receptor media by a synthetic inert and highly permeable support membrane.



### HDT

Cat. No.	Description
7290	10 Cell Vertical Diffusion Cell Test System HDT 1000 (excl. cells)
7276	Single Cell Vertical Diffusion Cell Test System HDT 1 (excl. cells)
7298	Vertical Diffusion Cell 11.28 mm x 7 mL Type 'B' (in Glass)
7299	Vertical Diffusion Cell 15 mm x 11 mL Type 'C' (in Glass)
7302	Vertical Diffusion Cell 15 mm x 12 mL for Skin (in Glass/Tecapro)
7295	Syringe 2 mL complete with Luer and sampling tube (Pk 10)
7296	Syringe 20 mL complete with Luer and media filling tube
7297	Parafilm Laboratory Film (250' x 2")
7289	Storage Rack for 10 Vertical Diffusion Cells (Types 'B', 'C' and Skin)
7277	IQ/OQ/PQ Documentation Pack for HDT 1/1000
7272	Qualification Tools for HDT 1/1000
7282	Re-calibration of Qualification Tools for HDT1/1000



# Cell Specification



**Type 'B' Cell**

**Cat. Number**  
7298

**Sample Holder Type**  
Clip

**Sample Holder Material**  
Glass

**Receptor Material**  
Glass

**Operation**  
Open, Closed/Occluded

**Receptor Volume**  
7 mL

**Max Membrane/Skin Thickness**

Open	0.5 mm
Closed/Occluded	0.5 mm



**Type 'C' Cell**

**Cat. Number**  
7299

**Sample Holder Type**  
Clip

**Sample Holder Material**  
Glass

**Receptor Material**  
Glass

**Operation**  
Open, Closed/Occluded

**Receptor Volume**  
11 mL

**Max Membrane/Skin Thickness**

Open	0.5 mm
Closed/Occluded	0.5 mm



**Skin Cell**

**Cat. Number**  
7302

**Sample Holder Type**  
Screw

**Sample Holder Material**  
Tecapro

**Receptor Material**  
Glass

**Operation**  
Open, Closed/Occluded

**Receptor Volume**  
12 mL

**Max Membrane/Skin Thickness**

Open	4.0 mm
Closed/Occluded	2.5 mm

# Membranes

Copley offers a range of three synthetic membranes:

- **PVDF**

A hydrophilic polymeric membrane  
Pore size: 0.45 microns.

- **Supor Polyethersulfone**

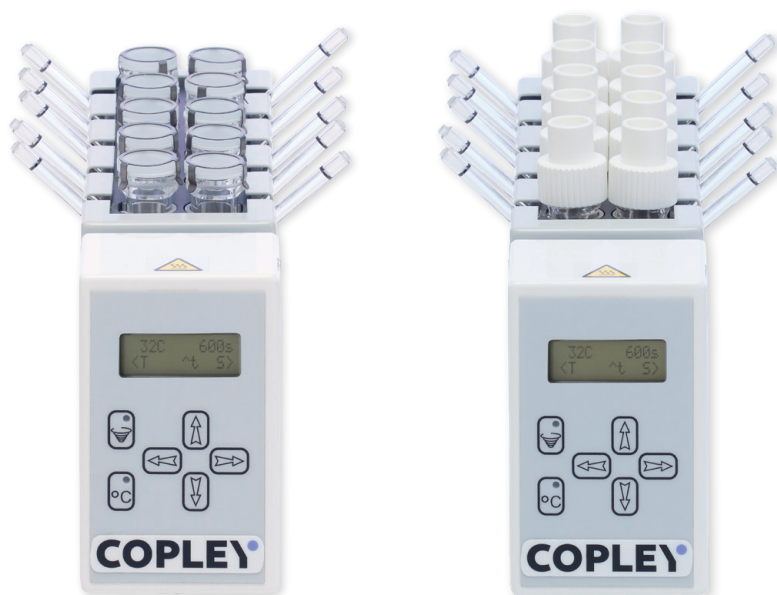
A hydrophilic polyethersulfone membrane with a 0.45 m pore size. These membranes have reduced protein binding and fewer leachables than Tuffryn membranes.

- **Strat-M Membranes**

Newer, multi-layered membrane offering higher correlation to human skin than simpler synthetic alternatives, without the high test variability associated with biological models and does not require wetting.

## HDT Cell Membranes

Cat. No.	Description
7270	Pack of 100 PVDF Membranes 25 mm o.d.
7274A	Pack of 100 Supor Polyethersulfone Membranes 25mm o.d.
7275	Pack of 60 Strat-M Membranes 25 mm o.d.
7304	25 mm Punch For VDC Skin/Membrane



## VDC HDT 1

A simple test system for a single diffusion cell.

This is a smaller alternative to the main HDT 1000, ideal for entry-level semisolids testing.

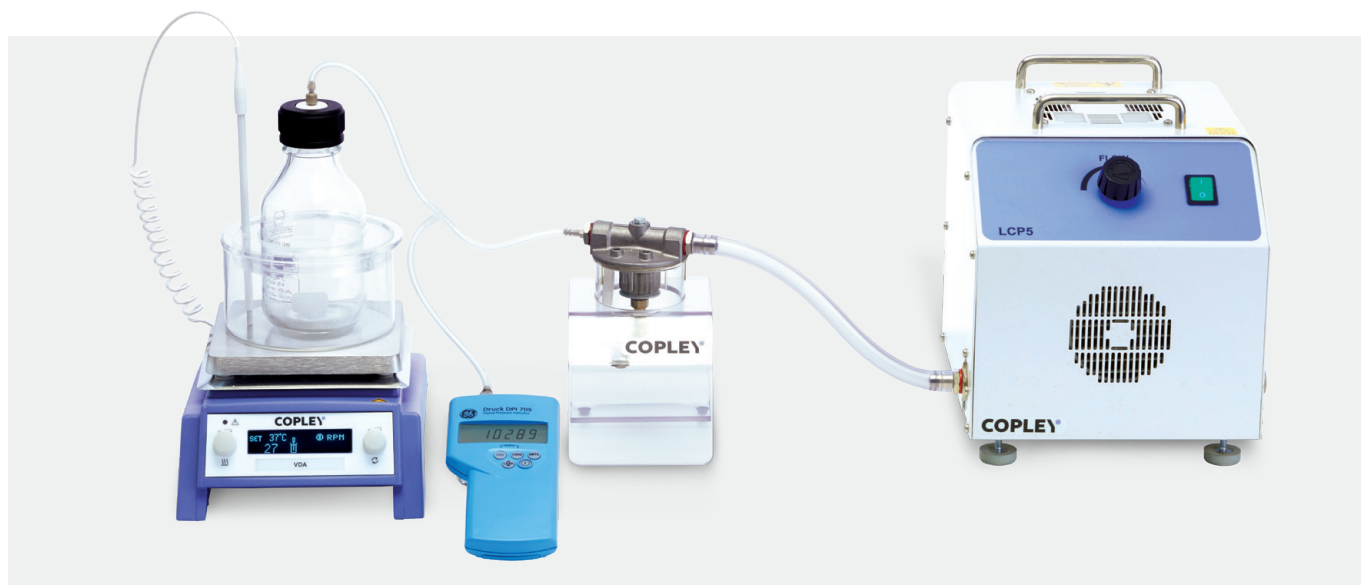




## Degassing

The Vacuum Deaeration Apparatus Model (VDA) from Copley is an easy-to-use and inexpensive unit designed to degas receptor medium prior to its use, ensuring that diffusion is unimpeded by the collection of gas beneath the membrane. Once deaerated, the system can be used to maintain the temperature of the degassed dissolution medium to the required temperature for testing.

Used in combination with a vacuum pump, pressure meter and dissolved oxygen meter, the VDA system guarantees oxygen levels below 4 ppm, exceeding the recommendations set out in the pharmacopoeias (USP suggests an oxygen concentration <6 ppm is an adequate level of dissolution media deaeration).



### The VDA system comprises of:

- 500 mL pressure bottle containing receptor medium
- Water bath to heat the contents of the bottle to 45°C
- A magnetic stirrer/heater to stir the content of the bottle whilst heating it and the surrounding water bath
- A condensate filter to prevent condensate from damaging the vacuum pump

The following items are required in addition to provide a full system:

- A vacuum pump
- A differential pressure meter to display pressure and test for leaks
- A dissolved oxygen meter to measure and display dissolved oxygen levels in the media

### VDA

Cat. No.	Description
7291	Vacuum Deaeration Apparatus Model VDA
7300	IQ/OQ/PQ Documentation Pack for VDA
7903	Low Capacity Vacuum Pump Model LCP5
7293	Digital Differential Pressure Meter
7294	Dissolved Oxygen Meter

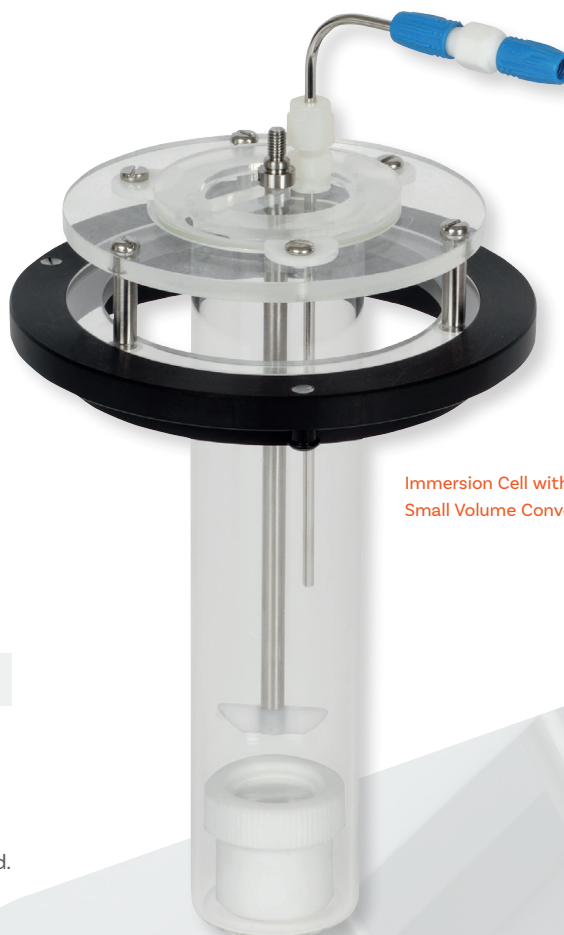
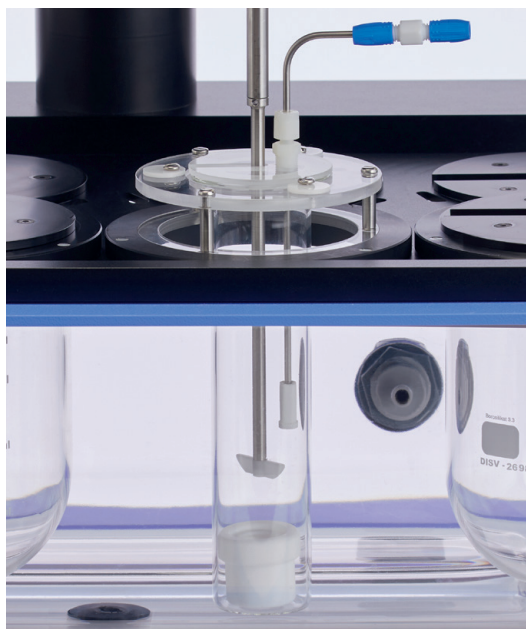
## Immersion Cell

An alternative to the Vertical Diffusion or Franz Cell for testing semisolids, the Immersion Cell (USP Model A) is described with the conventional USP Apparatus 2 for Dissolution testing on Page 75.

Accommodating a 25 mm diameter membrane, the Immersion Cell is comprised of 4 main parts:

1. A retaining ring to secure the membrane to the cell body
2. A washer to hold the membrane in contact with the sample
3. The membrane or skin
4. The cell body which contains the compartment in which the sample to be tested is placed

The immersion cell is used with a special flat-bottomed version of the 200 mL Small Volume Conversion Kit (see Page 38) to eradicate the issue of dead space under the cell that would occur with a round bottomed vessel.



Immersion Cell with 200 mL  
Small Volume Conversion Kit

### Immersion Cell & Accessories

Cat. No.	Description
7280	Immersion Cell
7281	200 mL Small Volume Conversion Kit for Immersion Cell
7270	Pack of 100 PVDF Membranes 25 mm o.d.
7274A	Pack of 100 Supor Polyethersulfone Membranes 25mm o.d.
7275	Pack of 60 Strat-M Membranes 25 mm o.d.



Immersion Cell