

# **Cell Selection Guide**

This document is meant to provide guidance to researchers that are new to diffusion to help them decide which cell will work best for their application.

#### Vertical Diffusion Cell or Franz Cell:

A versatile blown glass diffusion cell with an open donor chamber which locates the membrane horizontally and is usually used in the development of transdermal products. Franz Cells are the most widely used and have a tremendous amount of scientific data behind them.

Franz Cells are well suited to testing semi-solids, and small volumes of liquids that do not need to be heated or agitated. They are the most versatile diffusion cells. The donor and receptor chambers can have additional porting for flow through studies or custom sampling. The donor chambers may have stoppered, threaded, or luer joints, or be occluded.



CELL-GUIDE-10/19-01



-1-

# Horizontal Diffusion Cell or Side-Bi-Side Cell:

A blown glass diffusion cell which locates the membrane vertically between the donor chamber and receptor chamber, both of which are stirred and closed to the air. The standard Side-Bi-Side Cell uses a large clamp which surrounds both cell halves to secure the membrane and prevent leaks. A variation known as









Side-Bi-Side Cells are used when the donor material is a liquid and must be agitated. They are most common in testing the diffusion coefficient of membranes.



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#### A flow-thru cell or In-Line Cell:

A polychlorotrifluoroethylene (CTFE) flow type diffusion cell which locates the membrane horizontally over a very small receptor chamber, and is almost always used in an automated sampling system which supplies a constant flow of receptor media through the cell.



## **Key Considerations:**

There are other items which need to be considered when trying to decide which is the proper diffusion cell for an application.

**Orifice Diameter:** The orifice diameter is what determines the surface area the product will have available to diffuse through the membrane into the receptor chamber. Orifice diameters are a factor for all the diffusion cells. The most common orifice sizes are 9 mm, 11.28 mm, and 15 mm, which correspond to areas of 0.636, 1.0 and 1.767 cm2. Depending on the type of cell, other orifice diameters are available.

#### Reasons to select a smaller orifice diameter.

- Small amount of product available for testing. As diffusion testing works by spreading the dose over the entire surface area, a smaller orifice means less product needs to be used.
- Product has a very high rate of release, and will require less post sample processing (e.g. dilutions) with a smaller surface area which limits the amount diffusing.
- Skin is being used, and a smaller orifice allows for more cells to be used for testing while consuming less skin. As skin can be prohibitively expensive in some cases, using a smaller amount for testing allows for cost savings.

#### Reasons to select a larger orifice diameter.

- Product has a very low diffusion rate, a larger surface area would allow the receptor chamber to more easily reach detectable concentrations.
- Patches are to be tested and the orifice diameter should be similar to the patch diameter. Reservoir patches and some other designs cannot be cut to size, so a larger orifice area allows for testing without damage.

**Receptor Chamber Volume:** The receptor volume applies to Franz Cells and Side-Bi-Side Cells. The receptor chamber should hold enough media to ensure suitable sink conditions. The most common receptor chamber volumes for glass diffusion cells range from 5 mL to 20 mL.

The key to diffusion is ensuring that good sink conditions exist. This means that the drug should be nowhere close to saturating the receptor solution. Typically sink conditions for diffusion are considered to be when the volume of receptor media in the diffusion cell is capable of holding 10x the anticipated amount of the product released at the end of the test.

Reasons to select a smaller receptor chamber volume:

• Product is difficult to detect, and higher concentrations will make it easier to detect.

Reasons to select a larger receptor chamber volume:

• Product requires more receptor volume to attain proper sink conditions.

# Jacketed Franz Cell Unjacketed Franz Cell





Reasons to select a jacketed diffusion cell:

- Temperature control will be required.
- A V-Series Stirrer will be used with Franz Cells.
- A circulating water bath is required.

#### Reasons to select an unjacketed diffusion cell:

- Temperature control is not required.
- Cell will be immersed in a circulating water bath.
- Cell will be placed in an incubator for temperature control.

### **Other Considerations:**

For certain cases other options may need to be considered as well:

**Amber Glass**: Franz Cells and Side-Bi-Side are available in amber glass. These should be ordered when the product being tested is light sensitive.

**Specialized Joints**: There are different joints available for Franz diffusion cells which may aid specific studies:



*O-ring Joint 00*: This joint has an o-ring in place which can help sealing the cell if the membrane is unusually stiff, also these tend to tear skin.

*Flat Ground Joint 01 and Flat Ground Joint 02*: This are the most common joints used and are considered general purpose. They should work with most membranes, both synthetic and natural (up to ~ 4mm thick for joint-01 and ~ 10mm thick for joint-02). The flat ground joint-01 uses a spring clamp, while the flat flange joint-02 uses a horseshoe clamp with two screws.

Spherical Joint 03: This joint is designed for ophthalmic and corneal studies. It is not recommended for general purpose use, as it is designed specifically for clamping the cornea in place.

Sampling Arm: For Franz diffusion cells there are two types of arms available.

*Standard Sampling Arm*: This is a long thin arm, typical of the Franz cell design. Sampling is performed by removing a 200 μL to 500 μL by pipette or syringe. This arm is considered general purpose and can be suitable for release testing or permeation testing.

Dump Cell Arm: This arm has a larger diameter and is used to dump the entire contents of the diffusion cells in a 20mL collection vial. This is often used with permeation studies (IVPT). Dump cell part number includes suffix of DC (e.g. 6G-01-00-05-05-DC)

#### Cell Customization:

-6-

Typical diffusion cells may not be appropriate for every application. PermeGear can develop custom cells and donor chambers to be an ideal fit for a particular study. This can include, but is not limited to, flow ports, additional sampling ports, custom orifice sizes, and custom receptor volumes.

For more information contact PermeGear at support@permegear.com