

Whitepaper FDM

Climate Chambers for Pharma Testing: Volume Selection Guide

Introduction

Selecting the appropriate climate chamber volume is a critical decision for pharmaceutical testing facilities. The right size ensures optimal use of laboratory space, maintains testing efficiency, and provides significant cost benefits over the chamber's lifecycle. This guide outlines a structured approach to determine the ideal chamber volume for your specific pharmaceutical testing needs.

Key Factors in Volume Selection

1. Sample Characteristics

The physical dimensions and quantity of your pharmaceutical samples directly impact required chamber volume:

- **Individual sample size:** consider both the sample itself and any containers or fixtures.
- **Total sample quantity:** account for both current testing needs and anticipated future requirements.
- **Sample arrangement:** different products require varying spacing for proper air circulation.

2. Testing Requirements

Your specific testing protocols significantly influence chamber volume needs:

- **Test duration:** longer stability studies may require larger chambers to accommodate multiple batches simultaneously.
- **Sample accessibility:** frequent access necessitates adequate spacing for easy retrieval without disturbing other samples.
- **Regulatory compliance:** ICH guidelines and other regulatory requirements may dictate specific spacing parameters.

3. Laboratory Constraints

Physical laboratory limitations must be considered:

- **Available floor space:** account for door clearance, service access, and operational space around the chamber.
- **Ceiling height:** especially relevant for walk-in chambers.
- **Building infrastructure:** HVAC capacity, electrical requirements, and load-bearing capabilities.

Volume Calculation Methodology

Step-by-Step Process

1. **Calculate total sample volume:**
 - **Measure individual sample dimensions (L × W × H).**

- Multiply by total number of samples.
- Add 20% buffer for packaging/containers.

2. Apply spacing factor:

- Minimum 30% additional space for proper air circulation.
- Increase to 50% for temperature-sensitive products.
- Consider 70% for high-humidity testing environments.

3. Account for accessories:

- Add space for shelving systems (typically 10-15% of chamber volume).
- Include room for monitoring equipment and fixtures.
- Consider growth factor (typically 25%) for future expansion.

Sample Volume Calculation Example

For a tablet stability study with 50 batches in standard HDPE bottles:

- Individual sample volume: $10\text{cm} \times 5\text{cm} \times 15\text{cm} = 750\text{cm}^3$
- Total sample volume: $750\text{cm}^3 \times 50 = 37,500\text{cm}^3$
- Container buffer (20%): $37,500\text{cm}^3 \times 1.2 = 45,000\text{cm}^3$
- Air circulation factor (30%): $45,000\text{cm}^3 \times 1.3 = 58,500\text{cm}^3$
- Shelving (15%): $58,500\text{cm}^3 \times 1.15 = 67,275\text{cm}^3$
- Future expansion (25%): $67,275\text{cm}^3 \times 1.25 = 84,094\text{cm}^3$ (84L)

Chamber Size Comparison Chart

Application Type	Small (100-400L)	Medium (400-800L)	Large (800-1500L)	Walk-in (>1500L)
R&D Testing	✓✓	✓✓✓	✓✓✓✓	✓✓✓✓✓
Stability Testing	✓✓	✓✓✓	✓✓✓✓	✓✓✓✓✓
Photo Stability	✓✓	✓✓✓	✓✓✓✓	-
ICH Compliance	✓✓✓	✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓
Large Production	-	✓✓✓	✓✓✓✓✓	✓✓✓✓✓

Optimizing Chamber Utilization

To maximize return on investment:

- **Modular approach:** consider multiple smaller chambers instead of one large unit for flexibility.
- **Maintenance access:** ensure adequate space for service and calibration.
- **Energy efficiency:** right-sized chambers consume less energy per sample.
- **Capacity planning:** balance immediate needs with 3-5 year growth projections.

Conclusion

Proper climate chamber volume selection balances sample requirements, testing protocols, and facility constraints. Our calculation methodology provides a systematic approach to determining optimal chamber size, ensuring compliance with regulatory standards while maximizing operational efficiency and cost-effectiveness.

For personalized volume recommendations based on your specific pharmaceutical testing requirements, use our online calculator tool or download our comprehensive sizing guide PDF.

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