

-180 C to +177 C   -238 F to +350 F

# FL

Walk-in Integral and Modular Rooms  
Temperature, Humidity, and Altitude

## Description:

Select the optimum solution for your walk-in environmental chamber testing, processing, or storage needs from Bemco, the nation's most respected supplier of precisely controlled integral and modular walk-in temperature, humidity, and altitude facilities.

Choose a factory pre-assembled and welded integral structure or a prefabricated modular room.

Our professional staff is ready to help you pick the best configuration for your application.

Bemco walk-in chambers are offered with work-spaces barely big enough to stand in all the way up to multistory building sized facilities capable of housing complete aircraft, automobiles, or spacecraft.

Why settle for the appearance of testing when you can have a system that actually works?

With over 60 years of experience, Bemco, the true experts in large scale environmental facilities.

*Environmental Test and Space Simulation Systems*



Walk-in integral (one piece welded) Temperature, Humidity, and Altitude Test Facility with man access door and full opening front door in the process of installation.



**Bemco Inc.**  
Focused on Excellence

**Contact us for a free quotation or additional information.**

**Bemco Inc, since 1951**

# Walk-in Chambers

## Integral and Modular Rooms



Bemco FL Series Walk-in Environmental System Options								
Construction Type	Cooling Method	Heating Method	Gas Inside	Temperature Range Maximum	Environments <sup>(1)</sup>			
					T	RH	A	
Integral Welded	Refrigeration, Single Stage	Electric	Air	-35 C to +175 C	Yes	Yes	Yes	
Integral Welded	Refrigeration, Cascade	Electric	Air	-70 C to +175 C	Yes	Yes	Yes	
Integral Welded	LN2 Heat Exchanger	Electric	Air	-150 C to +175 C	Yes	No	Yes	
Integral Welded	LN2 Direct Injection	Electric	GN2	-180 C to +175 C	Yes	No	No	
Integral Welded	Fluid "Brine" System	Electric	Air	-50 C to 150 C	Yes	Yes	Yes	
Prefabricated	Refrigeration, Single Stage	Electric	Air	-35 C to +90 C	Yes	Yes	No	
Prefabricated	Refrigeration, Cascade	Electric	Air	-70 C to +90 C	Yes	Yes	No	
Prefabricated	LN2 Heat Exchanger	Electric	Air	-70 C to +90 C	Yes	No	No	
Prefabricated	LN2 Direct Injection	Electric	GN2	-70 C to +90 C	Yes	No	No	
Prefabricated	Fluid "Brine" System	Electric	Air	-50 C to +90 C	Yes	Yes	No	

(1) For Environments, T=Temperature, RH=Humidity, A=Altitude. Environments can be combined as noted.

### The Right Choice for Your Application

It's easy to see why most companies that have actually purchased a Bemco FL Series Walk-in or Drive-in temperature, humidity or altitude test facility prefer our products to any other.

Innovative engineering, state of the art conditioning systems, advanced digital controls, matched components selected for their reliability, thorough testing, and careful final assembly are all Bemco trademarks.

We manufacture a complete line of both welded factory pre-assembled integral chambers and prefabricated chambers assembled from sectional panels.

Integral chambers are made in one to six pieces for permanent assembly at your facility. Typically,

individual piece size is limited by USA over-road shipping constraints although, very large systems can be fabricated on site.

We offer integral chambers to meet all of the specifications presented in our technical bulletins on our standard F, FNR, FHC (Temperature), FW (Temperature/Humidity), and A, AF, AFW (Temperature/Humidity/Altitude) series of environmental chambers. Custom and unusual combinations of environments are also available.

Prefabricated rooms are offered in any size ranging from the very small to the extremely large. They are often a first choice when there is limited access to the final assembly location or when lower first cost is an important consideration.



Request a free quotation or analysis of your testing needs. Our experienced engineers are ready to help you.

#### We Deliver

Bemco chambers really simulate the environments expected. We take your specifications and requirements literally. Our equipment does what we promise and you specify. We are truly focused on Excellence.

# Walk-in Chambers

## Integral and Modular Rooms



Walk-in integral (one piece welded) liquid nitrogen cooled chamber with a range of -180 C to +150 C equipped with a nitrogen atmosphere door interlock.



Access ports furnished with a flexible diaphragm to compensate for inner liner movement at -180 C.

prefabricated chamber. When rapid temperature cycling is needed, we generally recommend an integrally welded system.

Integral chambers are available with all of the optional equipment offered on our standard F, FNR, FHC (Temperature), FW (Temperature/Humidity), and A, AF, AFW (Temperature/Humidity/Altitude) series of environmental chambers.

In addition, secondary man access doors, air lock compartments, interior lighting systems, sprinkler provisions, ramps, and sliding doors are available. Please see the available accessories list at the end of this bulletin.

### Integral Chamber Construction

Bemco integral chambers include a heliarc welded, 300 series stainless steel inner liner, fiberglass insulation, and a structural steel supported carbon steel outer case normally finished in Bemco blue. No asbestos is used in chamber construction.

Altitude chambers add pressure reinforcement to either the inner or outer enclosure in accordance with Section VIII (Unfired Pressure Vessels) of the ASME Code.

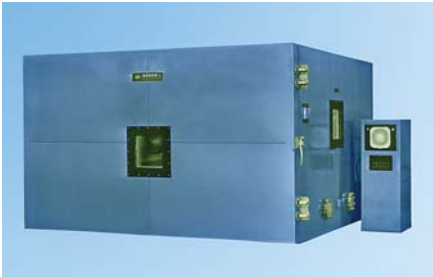
Hyperbaric chambers (altitude above local atmospheric pressure) include special latches and hinges on all doors and pressure interlocks

to prevent opening under positive pressure.

Interior chamber baffles are made from 300 series stainless steel attached to welded supports and interior structures. Access ports are continuously welded to the inner liner and vapor sealed.

When temperatures below -70 C or above +90 C are required, integral construction is needed to withstand the high stresses imposed by interior expansion and contraction.

An integral chamber is always stronger and more rigid than a



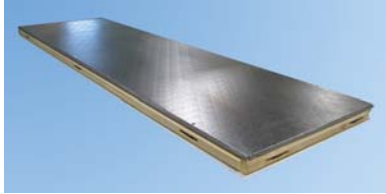
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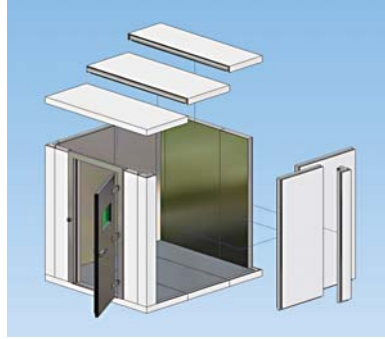
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# Walk-in Chambers

## Integral and Modular Rooms



Bemco prefabricated panels feature gaskets, tongue and groove interlocking urethane foam insulation, and cam type locks.



from heavier gauge materials, can be made from:

- Galvanized steel
- Smooth aluminum
- 300 series stainless steel

Insulation is offered in 3", 4", 5" and 6" thicknesses of foamed in place urethane foam. We normally select the most suitable thickness unless you specify a preference.

### Prefabricated Panel Chamber Construction

Bemco prefabricated chambers are assembled from modular sectional panels using metal inner and outer skins bonded to a core of rigid polyurethane insulation. At least three heavy duty cam-action locks are provided on each side panel.

Chamber size is unlimited, however, exact room dimensions must conform with the sectional panel sizes offered. These panels come in 11-1/2", 23", and 46" standard widths in various heights. Rooms can be constructed as large as needed and

can include partitions and ante-chambers.

Standard chamber access doors include a heated frame, a window, and an in-fitting or flush main door to positively seal the workspace.

Large equipment loading doors are constructed by Bemco using integral welded chamber construction techniques to maintain alignment and structural rigidity.

Chamber wall interior and exterior surfaces can be made in any combination (one per side) from:

- Bright galvanized steel.
- Stucco embossed aluminum.
- 300 series stainless steel.
- White baked enamel on steel.

Chamber floors are reinforced to withstand a minimum of 500 pounds per square foot. Higher ratings are available. Floors, made

Conditioning systems, including the air circulation, local refrigeration equipment, heat exchangers, heaters, electrical apparatus, baffles and process controls are normally factory pre-assembled to one or more of the chamber's wall panels and shipped as a convenient, ready to install on site assembly.

These chambers can be erected by a local industrial air conditioning contractor you select or by Bemco's skilled field installation and service technicians.



Prefabricated chamber under test, with a stainless steel exterior, paper wrapped to protect the surface for shipping.



Large prefabricated chamber conditioning system packed and ready for shipment.



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# Walk-in Chambers

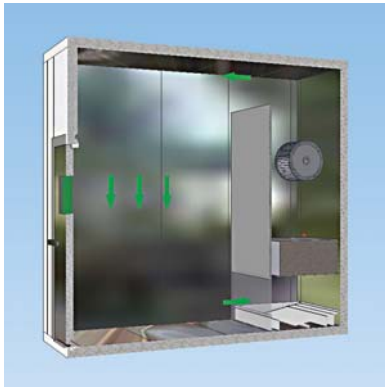
## Integral and Modular Rooms

FL

### Bemco FL Series Walk-in Air Flow Pattern Options

Air Flow Pattern	Air Flow Type	Primary Advantages As an Air Circulation System	Primary Disadvantages As an Air Circulation System
Side Plenum	Circular	Lowest Cost, most compact package	Blocked by large load, uniformity
Ceiling Split	Dual Circular	Lower Cost, relatively compact	Blocked by tall load, ceiling dripping
Diagonal	Diagonal Circular	Large loads do not block airflow	Flow eddies in upper corner
Ceiling Plenum	Vertical Circular	Lower velocity air flow, quieter	Uniform heat transfer on small loads.
Horizontal	Horizontal Laminar	Test load flexibility, smooth flow	Cost, more floor space needed
Vertical	Vertical Laminar	Computer floor, smooth flow	Cost, floor recess required for door

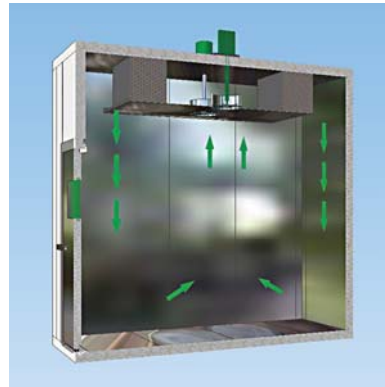
Environmental Test and Space Simulation Systems



#### Side Plenum Flow

Together with Ceiling Split Flow, the least expensive air flow pattern. Air leaves the conditioning system, located on one wall of the chamber at the top near the ceiling and returns to the conditioning system near the floor on the same wall.

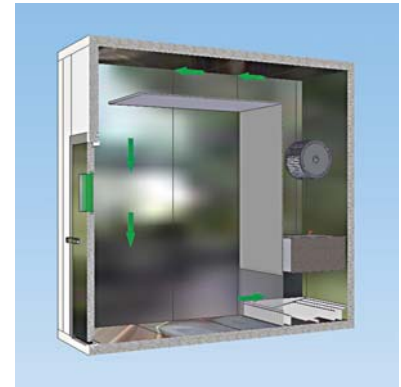
An economical configuration for general purpose use, air circulation systems of this type are limited in their ability to move air over great distances and generate slightly higher noise levels than other alternatives, with the exception of Ceiling Split Flow.



#### Ceiling Split Flow

The smallest floor space requirement of all conditioning system patterns, this type of circulation is best suited to processes where the load sits in a central location on the floor of the workspace.

Generating the highest noise level of all systems, taller loads near the walls have a tendency to cause short cycling on one or both sides of the air loop. Drain pans for cooling coils must be carefully designed to prevent dripping from the roof. Not recommended for humidity systems.



#### Diagonal Flow

Similar to Side Plenum Flow except a ceiling duct is provided so that air leaves the conditioning system near the top on the wall opposite the conditioning system.

A good solution when taller or larger loads are present in the workspace that might block and short circuit the flow pattern on a Side Plenum System.

An alternate to Side Plenum Flow that compensates for long air paths. Recommended when the selected chamber is longer than 15 feet.

Excellence



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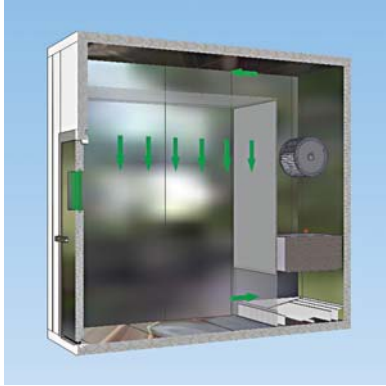
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# Walk-in Chambers

## Integral and Modular Rooms

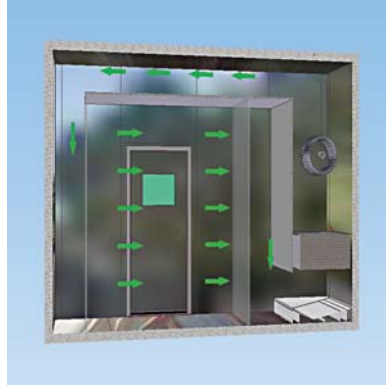


### Ceiling Plenum Flow

Similar to Side Plenum Flow except a pressurized, perforated air distribution plenum is provided to evenly distribute air discharge from the chamber ceiling.

On larger chambers, dampers or screens are provided to allow flow balancing to compensate for distance from the conditioning system.

A good medium cost solution for a fully or tightly loaded chamber. Because discharge velocities are lower, this system is relatively quiet.

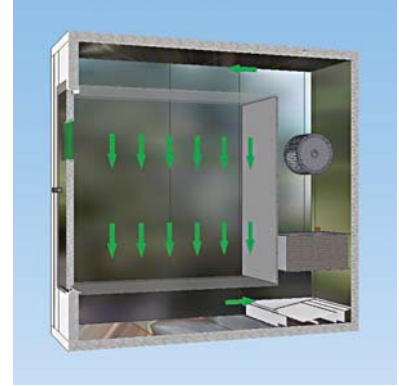


### Horizontal Flow

The most expensive solution using the largest amount of floor space, this system has both a pressurized perforated air distribution plenum on the opposite wall from the conditioning system and another perforated air suction plenum on the same side as the conditioning equipment.

This configuration gives excellent air flow uniformity and balanced air velocity in the test area.

It is not a good selection if test objects are placed to block air flow.



### Vertical Flow

A moderately expensive solution, this system has both a pressurized ceiling plenum and a perforated floor. Not shown in the illustration, the floor panels are reinforced for loading and are removable.

This pattern also provides excellent air flow uniformity and balanced air velocity in the test area.

It allows wiring or piping to be run under the floor. Its primary disadvantage is the requirement for a raised door. Typically, the chamber is recessed into the floor.

## Heat Transfer Versus Air Flow Design Factors

How effectively a product tracks internal chamber conditions is a function of air temperature uniformity, air flow volume, air velocity uniformity, and test item configuration.

The heat transfer rate on the surface of a test object varies with the temperature difference between the air and the object, the ambient air or

nitrogen pressure, and the average flow rate over the surface of the object.

A product's exposed surface area, size, shape, mass, and material of construction determine how well it responds to a forcing temperature change. For every application, Bemco analyzes your test object and recommends the best combination

of air flow pattern, conditioning systems, and controls. Often, the ideal solution involves not only a well matched air flow pattern but an advanced, PLC or multi-channel digital process control system as well as an adjustable flow air system. Bemco offers variable speed drive axial fans and blowers integrated with the air systems described above as a standard option.



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# Walk-in Chambers

## Integral and Modular Rooms



### Bemco FL Series Walk-in Cooling System Options

Cooling System	Lowest Temperature	Primary Advantages As a Cooling System	Primary Disadvantages As a Cooling System
Refrigeration, Single Stage DX	-35 C	Utilities cost, reliable operation	Medium first cost, space required
Refrigeration, Cascade DX <sup>(1)</sup>	-70 C	Utilities cost, reliable operation	Higher first cost, space required
Liquid Nitrogen Heat Exchanger	-150 C	Temperature, air atmosphere <sup>(2)</sup>	Cost of LN2, too cold for RH use
Liquid Nitrogen Injection	-180 C	Non oxidizing, lower first cost <sup>(2)</sup>	Cost of LN2, nitrogen in chamber
Fluid Chiller, Reciprocating <sup>(5)(6)</sup>	-30 C	Uniformity in heat exchanger <sup>(3)</sup>	High first cost, maintenance
Fluid Chiller, Screw Machine <sup>(5)(6)</sup>	-40 C	Required greater than 200 hp <sup>(3)(4)</sup>	Highest first cost, maintenance

<sup>(1)</sup> DX = Direct Expansion inside the refrigeration cooling heat exchanger, recommended up to 100 hp per stage.  
<sup>(2)</sup> Can be combined with refrigeration systems to boost capacity or to extend low temperature operating range.  
<sup>(3)</sup> Greater than 200 hp heat exchangers require circulating fluid to evenly distribute the heat exchange medium.  
<sup>(4)</sup> Screw machine chillers are available with single stage refrigeration to -30 C and compound refrigeration to -40 C.  
<sup>(5)</sup> The most common chiller fluids Bemco recommends are Dowtherm J (-40 C) and Propylene Glycol (-20 C).  
<sup>(6)</sup> Please request a Bemco PCL Fluid Chiller System brochure for additional fluid and circulating system options.

### The Right Cooling System for Your Application

Bemco offers a number of choices for chamber cooling.

#### Single Stage DX

Single stage refrigeration systems utilize hermetic or semi-hermetic, industrial grade mechanical refrigeration compressors running with modern, environmentally friendly refrigerants. These systems are either water or air condensed and include proportional process controls as well as automatic hot gas bypass and suction cooling unloading.

DX refers to direct expansion of the refrigerant in the heat exchanger coil.

Up to 100 horsepower, integral systems normally have the refrigeration systems mounted locally as part of the refrigeration package.

Larger compressors and prefabricated chambers are furnished with remote mounted systems in separate packages.

#### Cascade DX

Similar to single stage except two refrigeration systems are provided, one cooling, the other to reach lower temperatures. Cascade packages up to 60 x 60 horsepower, actually dual 30 x 30 systems, are locally mounted on both integral and prefabricated chambers. Above 60 x 60 horsepower, they are furnished for installation by Bemco factory trained technicians.

#### Liquid Nitrogen

Can be used for chamber cooling or boost cooling. Direct injection

systems require the installation of a nitrogen gas sensing safety system by a Bemco approved vendor.

#### Fluid Chiller

Systems are recommended when the required cooling system becomes very large. They utilize industry standard circulating fluids to maintain chamber conditions.



Fluid chiller conditioned stainless steel thermal shroud inside an octagonal prefabricated Bemco chamber under construction.



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# Walk-in Chambers

## Integral and Modular Rooms

FL



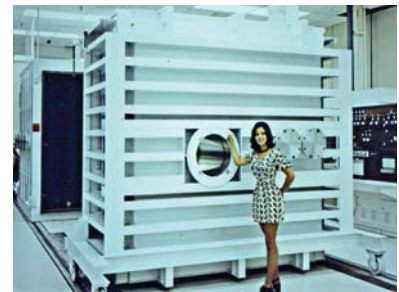
### Optional Accessories

All of the optional systems normally available on Bemco F, FNR, FHC (Temperature), FW (Temperature/Humidity), and A, AF, AFW (Temperature/Humidity/Altitude) series environmental chambers can be installed on Bemco Integral and Prefabricated Walk-in Chambers (please request a copy of the applicable Bulletin from your Bemco representative).

A partial list of additional options that are available on both integral and prefabricated chambers include:

- Internal lights with both interior and exterior vapor proof switches. Fluorescent lights are available for operation between -20 C and +70 C.

- A secondary man access door or an entry airlock.
- Very large windows for viewing chamber contents. Maximum size available varies with environmental conditions.
- Ramps for loading the chamber with carts.
- Solar simulation light banks and ceiling mounted arrays.
- Cantilever adjustable stainless steel or aluminum shelving.
- Door interior or exterior kick plates and wall protection rails to limit damage from carts.
- Floor grates of galvanized, aluminum, or stainless steel diamond plate to resist high point loads.
- Outside air injection systems for man rated chamber systems including dehumidification processing where applicable.
- Inside electrical outlets and electrical, pneumatic, vacuum line, or fluid fixturing.
- Sprinkler system provisions for sprinkler equipment installation by others.
- Gas, oxygen, and contaminate instrument sensing and alarm systems for operator or process safety.
- Filtration, including pre-filters and HEPA filters in the circulating air.
- Backup refrigeration systems with automatic switch-over.
- Test instrumentation consoles including power supplies, high power or instrumentation connectors, load boards, monitoring apparatus or system sequencing equipment.
- Very high volume air circulation systems and nozzles for wind speed simulation.
- Chamber personnel, airflow, humidity, pressure, temperature, outside air, and process alarms.
- Programmable logic control of test processes. Bemco recommends Allen Bradley (ABB) PLC's and software.
- Touchscreen HMI's (human machine interfaces).
- For systems with temperature ranges between -20 and 94 C, glass doors on one or more walls with shelf standards or card cage rails directly behind the doors. See Bemco's KD brochure for additional details.



High Vacuum, thermal vacuum and space simulator walk-ins are also available. Please request a Bemco AH Series Bulletin.



**Bemco Inc.**

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### Combined Environments

Temperature, Humidity, Altitude, Vibration, Vacuum, Rain, Sunshine, Salt Spray, Sand and Dust, and Gasses. Space simulation systems, walk-in chambers, drive-in rooms, PAO fluid chillers, and Air Servos.