CAN WE ADD THIS EQUIPMENT WITHOUT AFFECTING THE LABORATORY?

Diagnostic Guide
GD-018

A technical diagnostic guide to thermal load, exhaust, utilities, airflow disturbance, maintenance access, and impact on containment

A practical guide to evaluating whether new equipment can be integrated into an existing containment facility without compromising airflow, utilities, access, decontamination, or lifecycle performance.

DIAGNOSTIC GUIDE

HOW TO USE THIS GUIDE

NEW EQUIPMENT IS A SYSTEM CHANGE, EVEN IF IT FITS THROUGH THE DOOR.

This guide was created for laboratories where a new analyzer, freezer, centrifuge, cabinet, incubator, imaging system, or other instrument is being added to a room that was designed and commissioned for a different equipment load.

Why we developed it

Equipment decisions are often treated as purchasing decisions: confirm dimensions, electrical service, and price. In containment laboratories, installation may alter thermal load, supply/exhaust balance, room pressure, local airflow, electrical demand, emergency power, drainage, maintenance routes, and decontamination capability.

Some consequences appear only after installation: the room begins operating hotter, a new exhaust branch consumes capacity from adjacent spaces, technicians discover there is no service clearance, or the equipment blocks the intended airflow pattern.

The purpose of this guide is to evaluate the equipment as a new system dependency before it becomes part of the operating baseline.

Who can use it

The guide is intended for facility managers, laboratory users, HVAC and electrical engineers, biosafety personnel, architects, commissioning teams, maintenance personnel, and procurement/project teams.

It may be used for equipment planning, replacement, relocation, or renovation, acceptance testing, or retrospective review when a new installation creates room-performance problems.

HOW TO USE IT IN PRACTICE

Begin with the equipment's actual operating requirements, not only the sales brochure. Identify heat rejection, exhaust, electrical demand, utilities, dimensions, clearances, weight, drainage, vibration, maintenance access, and operating states. Then trace each requirement to the laboratory systems and define what must be reverified after installation.

The objective is not to prevent equipment from being added. It is to integrate it without forcing the existing containment system to absorb consequences for which it was never designed.

01 DEFINE

02 TRACE

03 INTEGRATE

04 VERIFY

HOW THIS GUIDE MAY BE USED — AND WHAT IT DOES NOT AUTHORIZE

This guide is a general diagnostic-orientation tool. It is designed to help structure technical questions, organize evidence, and define what requires more specific evaluation.

Acceptable use

It may be used to:

- structure preliminary technical investigations;
- prepare internal reviews and multidisciplinary discussions;
- identify missing information, measurements, and documentation;
- support definition of the scope of a subsequent evaluation;
- serve as educational and internal technical reference material.

It does not constitute

This guide does not constitute installation approval, integration design, a site-specific thermal-load or utility calculation, acceptance criterion, certification, compliance determination, authorization to modify or operate, or a site-specific recommendation.

Technical and operational decisions

No decision regarding equipment installation, relocation, or commissioning, airflow modification, electrical or utility connections, exhaust changes, continued operation, or return to service should be based solely on this guide.

Applicable technical basis

The content should be interpreted together with the risk assessment, current manufacturer documentation, Basis of Design, HVAC and electrical calculations, available system capacity, institutional change control, commissioning criteria, regulatory requirements, and other site-specific documentation.

Competent personnel

The addition of equipment that may affect containment-critical functions should be evaluated, designed, installed, and verified by appropriately qualified personnel, with review of system dependencies and the new operating condition.

Responsibility

BioLab Solutions assumes no responsibility for decisions, modifications, interventions, or actions carried out outside a site-specific evaluation and without review by competent personnel.

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01 Build the equipment requirements profile

Do not begin with location. Begin with what the equipment actually needs and produces.

Physical

- dimensions;
- weight;
- door/route clearance;
- service clearances;
- floor loading;
- anchorage.

Thermal

- sensible heat rejection;
- latent load, where applicable;
- continuous versus cyclic load;
- maximum operating state.

Air / exhaust

- direct-exhaust requirement;
- effect on room exhaust;
- discharge location;
- air inlet/discharge geometry.

Electrical

- voltage/phase;
- operating load;
- starting/inrush;
- UPS/emergency-power need;
- dedicated circuit.

Utilities

- water;
- drainage;
- gases;
- vacuum;
- compressed air;
- network/data.

Lifecycle

- maintenance frequency;
- filter/consumable access;
- replacement route;
- decontamination compatibility;
- waste generation.

> **Procurement question:** do we have the technical data needed to design the installation, or only enough information to order the equipment?

02 Quantify the thermal load before installation

Equipment heat can become an HVAC problem even when the electrical service is adequate.

Electrical energy used by laboratory equipment generally becomes heat within or near the room unless it is removed through a dedicated cooling or exhaust path. For refrigeration equipment, total heat rejection to the surrounding environment may include both the electrical power consumed and the heat removed from the refrigerated volume.

Confirm

- manufacturer heat rejection;
- operating versus standby load;
- duty cycle;
- maximum simultaneous equipment use;
- existing room thermal load;
- current supply-air temperature and airflow;
- available cooling capacity.

Containment consequence

If additional cooling requires more supply air, the exhaust system may also need greater capacity to preserve the negative-pressure relationship.

A local thermal problem can therefore become a whole-room airflow problem.

THE EQUIPMENT MAY BE ELECTRICALLY COMPATIBLE AND STILL THERMALLY OVERLOAD THE ROOM.

03 Evaluate direct exhaust as a change to the room balance

Any new exhaust connection changes both the room and the shared system.

Question	Why it matters
How much exhaust does the equipment require?	It becomes part of total room exhaust and may change the offset between supply and exhaust.
Is the exhaust continuous or variable?	A cycling demand may require dynamic pressure-control response.
Where does it connect?	A shared branch may not have sufficient capacity or static pressure for the new load.
What contaminants enter the exhaust?	This may affect material compatibility, filtration, discharge location, and maintenance strategy.
What happens if exhaust is lost?	The equipment may require shutdown/interlock rather than continued operation.
Does the system have reserve?	Current pressure performance does not demonstrate that sufficient remaining capacity exists for the new branch.

> Do not connect a new exhaust demand expecting TAB to “find” the airflow afterward. Confirm system capacity before adding the branch.

04 Review whether the equipment alters room airflow

Large equipment can modify local air movement without changing total room CFM.

Supply obstruction

Tall equipment may obstruct wall- or ceiling-supply patterns and create stagnant zones.

Exhaust obstruction

Equipment positioned near low-level or wall exhausts may reduce effective capture or create recirculation.

Thermal plume

Hot equipment can generate upward airflow that changes local mixing and sensor behavior.

Internal fans

Equipment air discharges may create turbulence or interfere with local containment devices.

BSC interaction

Strong supply-air currents or equipment-generated airflow may disturb BSC inflow if location is inappropriate.

Door / circulation route

New equipment may force personnel or carts through airflow-sensitive zones or restrict recovery after door opening.

AIRFLOW PERFORMANCE DEPENDS ON WHERE THE EQUIPMENT IS LOCATED, NOT ONLY ON HOW MUCH AIR THE ROOM RECEIVES.

05 Review electrical demand beyond the receptacle

Having the correct voltage does not demonstrate electrical integration. Where applicable, normal power, emergency power, UPS requirements, starting/inrush demand, heat rejection, and the consequence of an unplanned shutdown should also be reviewed.

Review

- connected load;
- circuit capacity;
- breaker size;
- starting/inrush;
- harmonics or power-quality sensitivity;
- grounding requirements;
- UPS need;
- emergency-power need.

Emergency-power question

Does the equipment need to continue operating during a power loss, shut down safely, or simply retain data/control power?

Adding a large load to the emergency system may affect generator capacity and the priority of mechanical systems critical to containment.

NOT EVERY IMPORTANT PIECE OF LABORATORY EQUIPMENT SHOULD AUTOMATICALLY BE ADDED TO THE EMERGENCY PANEL.

06 Trace utilities and penetrations through the containment envelope

Each new utility can create a new envelope interface.

Water / drainage

Where do new pipes cross the envelope, and what drainage or effluent controls apply?

Gases

Confirm cylinder/manifold location, regulators, shutoff, pressure rating, and emergency response.

Vacuum / compressed air

Evaluate contamination potential across the envelope and the required protective devices.

Data / communications

New cable penetrations require controlled routes and sealing.

Exhaust duct

Penetration, material, isolation, testability, and discharge strategy require coordinated design.

Future removal

Plan how utility penetrations will be safely closed when the equipment is replaced or removed.

> An apparently simple connection should be treated as a containment-envelope modification when it passes through that envelope and should be evaluated according to the function of that barrier.

SPACE AND MAINTAINABILITY

WILL WE BE ABLE TO MAINTAIN IT AFTER IT IS INSTALLED?

Manufacturer clearance

Required side, rear, top, and front clearances should be preserved in the actual room layout.

Filter / consumable access

Can routine service be performed without moving adjacent equipment or opening a containment envelope?

Technician position

Is there sufficient safe working space for the maintenance task and required PPE?

Replacement route

Can the equipment—or its largest service component—later be removed without dismantling walls or critical systems?

Decontamination access

Can surfaces behind and around the equipment be cleaned or decontaminated?

Utility isolation

Are shutoffs, disconnects, and valves accessible without entering unsafe or contaminated positions?

> **EQUIPMENT THAT CAN BE INSTALLED BUT NOT MAINTAINED HAS NOT BEEN PROPERLY INTEGRATED.**

07 Review weight, vibration, and structural effects

Mechanical fit does not guarantee structural or operational compatibility.

Review where applicable

- equipment dead load;
- point loads;
- floor capacity;
- anchorage;
- seismic restraint;
- dynamic/vibration load;
- rotating-equipment forces;
- leveling requirements.

Vibration can affect more than the equipment itself

High-speed centrifuges, compressors, and other dynamic equipment can transmit vibration to adjacent instruments, partitions, ceiling systems, or sensitive control devices.

Where equipment characteristics justify it, structural and vibration review should be completed before installation.

THE FLOOR PLAN SHOWS AREA. IT DOES NOT SHOW LOAD, VIBRATION, OR SERVICE FORCES.

COMMON INTEGRATION FAILURES

WHAT OFTEN GOES WRONG

“There is room to put it there.”

Footprint alone ignores service clearances, airflow, utility access, and replacement route.

“The receptacle has the right voltage.”

Electrical integration still requires review of capacity, load, protection, and continuity.

“It only adds a little heat.”

Small loads accumulate, and some instruments reject several thousand BTU/h into compact rooms.

“We can connect it to the exhaust.”

Shared-system capacity and room balance should be established before connection.

“TAB can fix the pressure afterward.”

TAB cannot create exhaust or cooling capacity that does not exist.

“Maintenance can move it if necessary.”

Moving large equipment later may disturb utilities, seals, validated alignments, or containment interfaces.

THE INSTALLATION PROBLEM SHOULD BE SOLVED BEFORE THE EQUIPMENT ARRIVES.

08 Define verification before installation

The equipment should not simply be energized and considered integrated.

Change introduced	Possible verification
Thermal load	Temperature trending under representative operation; supply-air/cooling performance.
Direct exhaust	Airflow measurement, room balance, pressure cascade, alarm/interlock function.
Airflow obstruction	Review of room airflow, smoke visualization where appropriate, and check of interaction with BSCs.
Electrical load	Circuit verification, impact on emergency power, and starting behavior where applicable.
New penetration	Inspection of sealing and envelope verification appropriate to the installation.
Utility / drainage	Leak testing, isolation function, and applicable backflow/effluent controls.
Workflow / risk change	Updated SOP, risk assessment, training, and operational-readiness review.

> The verification scope should follow the dependencies altered by the installation rather than being limited to the manufacturer's startup checklist.

INSTALLATION IS NOT COMPLETE UNTIL THE EQUIPMENT CAN BE SERVICED WITHOUT CREATING AN UNMANAGED CONTAINMENT PATH

New equipment introduces a maintenance lifecycle in addition to an operating load. The service strategy should be reviewed before the equipment becomes part of routine containment operations.

Review the service condition

- which panels or components must be opened;
- whether contaminated internal surfaces may be exposed;
- decontamination required before service;
- entry requirements for vendor or contractor personnel;
- movement of parts and tools through the envelope;
- waste or replaced components leaving the room;
- clearance required to remove major components;
- replacement route for the complete unit.

Representative integration testing

Acceptance should consider the modes that materially affect the room: startup, normal operation, maximum heat rejection, direct-exhaust operation, shutdown, and any service condition affecting doors, airflow, or utilities.

Successful power-up does not demonstrate that the equipment has been integrated into the containment system.

When the equipment enables a new activity, the operational risk assessment and containment assumptions should be reviewed together with the physical installation.

DIAGNOSTIC SEQUENCE

CAN THIS EQUIPMENT BE ADDED SAFELY?

01

Are the equipment's actual operating and service requirements known?

No → obtain current technical data before selecting the location.
Yes → continue.

02

Can the room absorb the thermal, airflow, electrical, and utility loads?

No → modify the infrastructure or reconsider the location/equipment before installation.
Yes → continue.

03

Does the installation create new envelope penetrations or exhaust dependencies?

Yes → review them as containment modifications.
No → continue.

04

Can the equipment be operated, cleaned, and maintained without compromising access or airflow?

No → revise the layout or service strategy.
Yes → continue.

05

Does the equipment change the hazard, process, throughput, or workflow?

Yes → update the risk and operating basis.
No → continue.

06

Has the affected laboratory system been reverified after installation?

No → integration remains incomplete.
Yes → document the new accepted baseline.

WHAT SHOULD BE AVAILABLE?

Equipment data

- dimensions/weight;
- clearances;
- heat rejection;
- exhaust;
- electrical load;
- utilities;
- maintenance needs.

Facility data

- room airflow;
- pressure cascade;
- cooling capacity;
- electrical capacity;
- emergency power;
- structural limits;
- available utilities.

Change analysis

- risk/workflow impact;
- new penetrations;
- demand on shared systems;
- airflow obstruction;
- waste streams;
- maintenance route.

Verification

- startup;
- TAB where affected;
- pressure testing;
- temperature trending;
- alarm/interlock testing;
- envelope verification;
- updated records.

Review objective: demonstrate that the equipment, room, and supporting infrastructure can operate together without consuming unrecognized containment margin.

IF THE EQUIPMENT IS ALREADY INSTALLED

RETROSPECTIVE INTEGRATION IS STILL POSSIBLE

An undocumented installation should be brought back under technical control rather than simply accepted because the equipment has been operating.

Reconstruct

- what changed;
- when it was installed;
- thermal/electrical/exhaust load;
- new utilities and penetrations;
- room performance before and after;
- alarms or temperature complaints;
- maintenance experience.

Then reconcile

Measure current room airflow and pressure, review thermal performance, inspect penetrations and service clearances, confirm electrical/utilities systems, and determine what verification was omitted.

Correct deficiencies, verify the affected functions, and once the resulting condition has been technically accepted, establish it as a new documented baseline.

> **“IT HAS BEEN OPERATING FOR MONTHS” IS OPERATING HISTORY, NOT TECHNICAL ACCEPTANCE.**

BEFORE INSTALLATION, CONFIRM THAT THE LABORATORY CAN SUPPORT THE EQUIPMENT THROUGHOUT ITS FULL LIFECYCLE

Use this checklist as diagnostic support. A checked item does not constitute acceptance; each element must be interpreted against the risk basis, facility configuration, and applicable criteria.

□ Define equipment dimensions, operating and service clearances, weight, vibration, and replacement route.

□ Quantify sensible/latent thermal load and confirm that the room can control temperature under representative operating conditions.

□ Identify direct exhaust, local airflow disturbances, or discharge patterns that may affect room airflow or containment devices.

□ Review normal power, emergency power, UPS need, starting/inrush demand, and the consequence of an unplanned shutdown.

□ Identify water, drainage, gases, vacuum, data, and other utilities, including new penetrations through the containment envelope.

□ Review equipment location relative to supply diffusers, exhaust grilles, doors, cabinets, and intended personnel/material routes.

□ Define cleaning and decontamination requirements, including access to potentially contaminated surfaces and internal components.

□ Plan vendor service access, movement of tools/parts, waste handling, and removal of replaced components through the envelope.

□ Determine whether the equipment enables a new activity that changes the operational risk assessment or containment assumptions.

□ Define and perform post-installation verification for the affected containment functions, utilities, and environmental conditions.

Technical-use note: This review checklist is a diagnostic-support tool. It does not establish site-specific acceptance criteria, replace risk assessment or professional judgment, constitute certification, or authorize operation or return to service.

If the review identifies a condition requiring site-specific evaluation, BioLab Solutions can support technical assessment, verification, and definition of the required evidence.

RELATED BIOLAB RESOURCES

EXPLORE CHANGE CONTROL, AIRFLOW, CAPACITY, AND LIFECYCLE PERFORMANCE IN GREATER DEPTH

NT-010–017
Directional airflow, pressure, ACH, HVAC integration, exhaust authority, and controls

NT-021–024
Envelope continuity and leak tightness

NT-032–035
Commissioning, functional testing, authority, and documentation

NT-037
Maintenance as a containment-risk domain

NT-039
Lifecycle drift in containment systems

NT-040
Risk assessment as a design input

GD-003
Can we safely modify this containment laboratory?

GD-015
Do we have enough exhaust capacity remaining?

BIOLAB DIAGNOSTIC GUIDES

Short technical resources organized around real containment problems rather than individual disciplines.

Series concept: symptom → system → evidence → restoration.

CLOSING DIAGNOSTIC PRINCIPLE

THE EQUIPMENT BECOMES PART OF THE LABORATORY SYSTEM THE MOMENT IT CHANGES WHAT THE ROOM HAS TO DO.

New equipment is rarely just an object placed in available space.

It introduces heat, electrical demand, utilities, airflow patterns, maintenance needs, physical obstruction, process changes, and, in some cases, new exhaust or containment interfaces. Those dependencies may be modest individually and still combine into a significant change in laboratory performance.

Good integration makes those consequences visible before purchase and verifies the affected systems after installation. The result is not simply a machine that works: it is a laboratory that continues to function as a containment system with the machine inside it.

BIOLAB SOLUTIONS

Independent technical support for planning, design, commissioning, assessment, and lifecycle management of high-containment laboratories.

For site-specific evaluation, BioLab Solutions can support technical review, verification, and definition of evidence requirements.

NEW EQUIPMENT → NEW LOADS → SYSTEM DEPENDENCIES → REVERIFICATION