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News to Use

Design Requirements Manual

The formulae $\frac{\partial \rho U_i}{\partial t}+\frac{\partial}{\partial x_j}(\rho U_j U_i)=-\frac{\partial P}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial U_i}{\partial x_j}\right)+g_i(\rho-\rho_0)$ for building $\frac{\partial}{\partial x_j}(\rho\overline{U_i}\overline{U_j})=-\frac{\partial P}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial \overline{U_i}}{\partial x_j}-\rho\overline{u_i u_j}\right)+g_i(\rho-\rho_0)$ state of the art $\frac{\partial}{\partial x_i}(\rho U_i H)=\frac{\partial}{\partial x_i}\left(\lambda\frac{\partial T}{\partial x_i}-\rho\overline{u_i H}\right)$ biomedical research facilities.

'Design Requirements Manual (DRM) News to Use' is a monthly ORF publication featuring salient technical information that should be applied to the design of NIH biomedical research laboratories and animal facilities. NIH Project Officers, A/E's and other consultants to the NIH, who develop intramural, extramural and American Recovery and Reinvestment Act (ARRA) projects will benefit from 'News to Use'.
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Clearance for Equipment Access and Service

When designing a laboratory, an important aspect that should not be overlooked is clearance for the servicing of equipment. Laboratory equipment can be complex and sensitive, and require regular service, including:

- Calibration
- Filter changes
- Scheduled maintenance
- Repairs
- Upgrades

Proper planning is required to provide service personnel with sufficient access to internal components to perform the required service quickly. Challenges associated with equipment service in laboratories include:

- Service activities may be disruptive to laboratory operations, particularly if adequate service clearances are not provided,
- requiring things to be moved to create clearance.
- Service activities may require a lab to be recertified if SOPs are violated.
- Equipment, equipment components or tools may have to be
- cleaned or specially prepared before entering the laboratory, and decontaminated before leaving.
- Service personnel may have to gown up or wear personal protective equipment (PPE) and follow lab protocols.

Laboratory equipment can be categorized as movable, fixed-in-place, or building infrastructure. Each category has its own requirements.

Movable Equipment

Movable equipment includes both small benchtop items and large floor mounted items, including refrigerators, freezers, centrifuges and incubators. Although they are movable, service is usually performed in the laboratory.

Locating equipment in a common equipment room or area, even if within the lab, can isolate service activities from more sensitive laboratory operations.

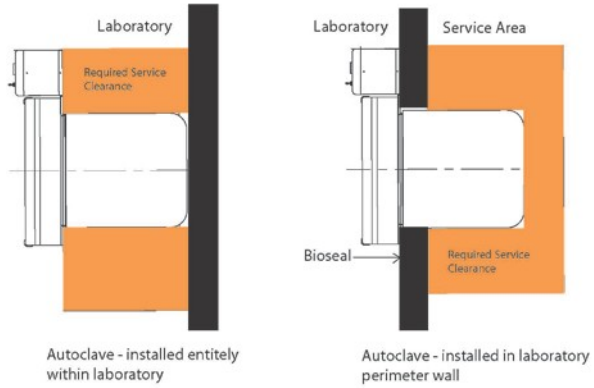
Most movable equipment serviceable components are housed within a cover that is wholly or partially removable for access. Clearance must be provided to fully open or remove the cover and for service personal to get in position to perform the required work. Most equipment is located against a wall, and service access can be from the front, sides or top. Some equipment, including refrigerators, must be pulled away from the wall. Some equipment, including robotic devices, must be located away from the wall to provide 360 degree service access.

Fixed-in-place Equipment

Fixed-in-place equipment includes larger items that are hard-connected to utilities and often permanently secured to the floor or walls. Items include fume hoods, large autoclaves and imaging equipment. Fixed-in-place equipment is often located in vivariums, containment labs and other spaces not conducive to service activities, but by its nature it must be serviced in-place.

It is ideal to locate the equipment so that items to be service can be accessed from areas outside of the lab (see Plans of autoclave installation configurations). It is often possible to recess equipment into a wall that forms the perimeter of the lab, allowing access to service personnel from adjacent areas without having to enter the lab. Autoclaves, for example, are often equipped with a bioseal that allows access to the chamber and controls from a containment lab, and concurrent access to mechanical and electrical components by service personnel from outside of the lab.

For equipment located wholly within a lab, service access should be provided so that service can be completed quickly and efficiently, without having to move adjacent items or otherwise disrupt lab activities. Regardless of equipment configuration, it is ideal to locate ancillary items that may require service (valves and dampers, for example) outside of the lab.



Plans of autoclave installation configurations

Building Infrastructure Equipment

Building infrastructure equipment is constructed on-site, and is integral with the building. Items include systems for pure water, animal watering, specialty ventilation or exhaust and piped utility services. These systems should be designed to locate valves, filters and other components requiring regular service outside of the lab. Ideal locations are in mechanical rooms, accessible chases or interstitial spaces. Less ideal locations are in accessible ceilings above corridors, office and other non-lab spaces.

A related issue is the engineering and utility systems that serve a laboratory, including heating, ventilation and air conditioning (HVAC) systems. These systems also require access for regular service and maintenance. For these systems there are a number of items to consider, including:

- Limiting the need for service personnel to enter the laboratory. This is especially important for containment labs, vivariums, clean rooms and other facilities with limited access or security requirements. In these cases, valves, filters, VAV boxes and other items needing service should be located in mechanical rooms or interstitial spaces accessed from outside of the laboratory.
- The mechanical rooms should be designed with adequate clearance to replace the largest piece of equipment. Aisle and door widths, turning radiuses, ceiling heights and elevator capacities in the equipment rigging path should all be considered.
- For interstitial floors and mechanical mezzanines, duct and piping layouts have to be carefully planned to ensure adequate ceiling height for safe and efficient working conditions. 3D visualization tools, including Revit, can be very beneficial.

Further details on this month's topic are available on the DRM website
http://orf.od.nih.gov/PoliciesAndGuidelines/BiomedicalandAnimalResearchFacilitiesDesignPoliciesandGuidelines/Pages/DesignRequirementsManualPDF.aspx
DRM Chapter 4, Section 4-5 Casework and Equipment