Ene07

Energy efficient laboratory systems

Actions:

i. Determine occupant requirements and define laboratory performance criteria
ii. Design, specify and install laboratory plant and systems to promote energy efficiency
iii. Use calculations or modelling to show a reduction in energy consumption

Note: This credit only applies to buildings with laboratory areas

Laboratory areas:

Laboratory areas are defined as highly serviced (temperature, ventilation, humidity or containment controlled) spaces where physical, biological or chemical processing or testing is carried out. Such areas will have inherently high energy demands.

In order to maintain controlled conditions to enable experiments and to comply with health and safety standards, typically laboratories:

- Contain various exhaust and containment devices (such as fume cupboards and microbiological safety cabinets)
- Are heavily serviced to circulate air and to supply heating, cooling, humidity, and clean air
- Often require 24-hour access and failsafe redundant backup systems and uninterrupted power supply or emergency power to enable irreplaceable experiments.

Therefore, for the purpose of assessing this BREEAM issue, the definition of laboratory areas excludes any laboratory support areas such as:

- Write up or offices
- Meeting rooms
- Storage
- Ancillary and other support areas with lower servicing requirements.

i. Design specification

During RIBA Stage 1, the client should determine occupant requirements and define laboratory performance criteria, including:

- Description of purpose
- Occupant or process activities
- Containment requirements and standards
- Interaction between systems

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- Flexibility and adaptability of laboratory facilities.
- Any other specific requirements (for example, requirements relevant to ventilation, heating or cooling).

The service system equipment should also be sized correctly.

The minimised energy demand of the laboratory facilities resulting from the achievement of the defined design performance criteria should be demonstrated.

Does the project have laboratory containment devices and containment areas?

If so, for the ducted fume cupboards specified:

- Demonstrate that the average design air flow rate is no greater than 0.16m³/s per linear metre (internal width) of fume cupboard workspace
- Measure the volume flow rate in the exhaust duct (at the boundary of the laboratory) to take account of reductions in (inward) volume flow rate from fume cupboard leakage
- Demonstrate that a reduction in air flow does not compromise the defined performance criteria and does not increase the health and safety risk to future building occupants.
- The guidance within G9 Fume Cupboards in Schools (Building Bulletin 88 can be used for assessments in Northern Ireland) should be followed as an applicable standard.

ii. Energy efficiency measures

If the laboratory area accounts for at least 10% of the total building floor area, energy efficiency measures need to be promoted within the design, specification and installation of the laboratory plant and systems.

Two credits are available where laboratory areas account for at least 10% (but less than 25%) of the total building floor area.

Four credits are available where laboratory areas account for 25% or more of the total building floor area.

The number of credits are achieved based on the implementation of best practice energy efficient measures as detailed in the table below.

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Best practice energy efficient measures in laboratories:

Item description	Credits
Fume cupboard volume flow rates (further reduction)	
An average design air flow rate of < 0.12m³/s per linear metre (internal width) of fume cupboard workspace.	0.5
Grouping or isolation of high filtration or ventilation activities	
Minimisation of room air change rates and overall facility ventilation flows by grouping together or isolating activities and equipment with high filtration or ventilation requirements.	0.5
Energy recovery - heat	
Heat recovery from exhaust air (where there is no risk of cross-contamination) or via refrigerant or water-cooling systems.	0.5
Energy recovery - cooling	
Cooling recovery via exhaust air heat exchangers (where there is no risk of cross-contamination) or via refrigerant or water-cooling systems.	0.5
Grouping of cooling loads	
Grouping of cooling loads to enable supply efficiencies and thermal transfer.	0.5
Free cooling	
Specification of free cooling coils in chillers or dry air coolers related to laboratory-specific activities.	0.5
Load responsiveness	
Effective matching of supply with demand through modularity, variable speed drives and pumps, and other mechanisms.	0.5
Clean rooms	
Specification of particle monitoring systems, linked to airflow controls.	0.5
Diversity	
Achievement of high levels of diversity in central plant sizing and laboratory duct sizing, where compatible with safety.	0.5
Room air changes rates	
Reducing air change rates by matching ventilation airflows to environmental needs and demands of containment devices.	0.5
Fan power	
Specification and achievement of best practice fan power figures (as shown below) for all air handling units, laboratory extract systems, local extract ventilation, containment area extracts (where applicable) and fume cupboard extracts (where applicable).	1

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Item description	Credits
Laboratory system	Best practice specific fan power (W/(L/s))
General laboratory supply air handling unit (AHU) with heating and cooling	1.5
General laboratory extract systems	1.2
Laboratory local extract ventilation – ducted	1.0
Containment area extract, without high efficiency particulate absorption (HEPA) filtration	1.5
Containment area extract, with HEPA filtration	2.5
Fume cupboard extract	1.5
Only whole credits can be awarded in BREEAM. Therefore, to achieve a credit for items with partial credits, the laboratory must comply with at least two of the items. In an instance where, for example, three and half credits are achieved this would need to be rounded down to three credits.	

iii. Calculations or modelling of energy consumption

After assessing appropriate energy efficient measures, it should be demonstrated by calculations or modelling that the chosen measures have a reasonably significant effect on the total energy consumption of the laboratory, i.e. 2% reduction or greater.

It should also be demonstrated that the energy efficient measures specified do not compromise the defined performance criteria, and do not increase the health and safety risk to future building occupants.

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