



MECHANICAL SYSTEMS

Frequently Asked Questions for Mechanical Systems

1. Do I need to have a separate A/C unit for my data server room?

If the data stored on your server is critical to your company’s success then it makes sense to add a separate A/C unit that is run off of emergency power.

2. What are the mechanical requirements for my new class clean room?

The requirements for clean rooms depend on the classification and use. Clean rooms in the microelectronic business are somewhat different than those in the pharmaceutical business. The following table identifies the basic requirements for a typical microelectronic facility.

Criteria	Class 10	Class 100	Class 1000	Class 10K	Class 100K
Air Changes per hr/min	600/10	480/8 to 300/5	180/3	60/1	36/0.6
HEPA Filter Coverage (%)	100	70 to 40	20 to 30	7 to 15	4 to 5
CFM per Sq. Ft.	90	65 to 36	32 to 18	16 to 9	8 to 5
Typ. Filter Efficiency	99.9997	99.997	99.997	99.997	99.97
Typ. Ceiling Type	Gel Seal	2" Tbar/Gskt.	1" Tbar/Gskt.	1" Tbar/Gskt.	1" Tbar/Gskt.
Typ. Return Air System	Raised floor	Low Wall	Low Wall	Low Wall Or Ceiling	Low Wall or Ceiling
Very Generic Cost Range					
Class 10	\$600/sf to \$750/sf				
Class 100	\$450/sf to \$650/sf				
Class 1000	\$160/sf to \$260/sf				
Class 10K	\$60/sf to \$70/sf				
Class 100K	\$40/sf to \$50/sf				

3. What can I do to minimize sound problems caused by the mechanical equipment, if possible?

- Install mechanical equipment over un-occupied areas such as restrooms and storage areas.
- Make sure mechanical isolation and flex connectors are provided for all mechanical equipment.
- Use spiral ducting to eliminate “rumble” low-frequency noise.
- For larger A/C units use horizontal airflow discharge.
- Locate shafts on adjoining walls to restrooms and storage areas when possible.

4. What type of floor to floor clear heights should I plan to design into my new building to accommodate mechanical systems for various types of buildings?

1. Typical office buildings: 12’ to 14’
2. Typical electronic R&D facility: 14’ to 16’
3. Typical microelectronic clean room facility without raised floor:..... 20’
4. Typical microelectronic clean room facility with raised floor:..... 22’
5. Typical biotech R&D facility: 16’ to 17’
6. Typical biotech/pharmaceutical manufacturing facility without large vessels:.....20’ to 22’

5. What is the difference between Plan and Spec vs. Design Build construction strategies? What are the advantages and disadvantages?

Descriptions Definition	Plan and Specification Approach A design consultant programs, designs, specifies, and draws all aspects of the MEP scope. These “plans and specs” are then bid out to multiple MEP contractors to establish the lowest initial price.	Design Build Approach A contractor with in-house design capabilities is selected to program, design, specify, and draw all aspects of the MEP scope. Price is usually negotiated during the pre-construction process.
Descriptions Typical Project Organization	Plan and Specification Approach The Architect works for the owner/developer. All design consultants work for the Architect. The general contractor works for the owner/developer and all subcontractors work for the general contractor.	Design Build Approach The Architect works for the owner/developer. The general contractor works for the owner/developer and all design build subcontractors work for the general contractor. This creates a TEAM atmosphere conducive to a quality project.
Descriptions Advantages	Plan and Specification Approach 1. Longer design time allows for more thorough programming and more complete plans and specifications. 2. Better initial cost control due to bidding process. 3. Engineering firms are not involved with construction costs, therefore no cost oversight is typically required.	Design Build Approach 1. Speed of project delivery. Design build projects reach completion 20% to 50% faster than conventional plan and spec strategies. 2. Single source responsibility for system performance. Design engineer IS directly responsible for final product. 3. Design build contractors understand the actual cost of designing and building a variety of facilities. 4. No change orders for items that the engineer accidentally left out of the plans and specifications. 5. Value Engineering occurs during the pre-construction process to make sure that the project maintains budget goals.
Descriptions Disadvantages	Plan and Specification Approach 1. Process takes longer than design build due to RFI process, bidding process, series approach to project schedule. 2. Typically more expensive than design build in overall project costs. 3. No functional ownership for final product.	Design Build Approach 1. Some DB contractors do not have adequate engineering depth to fully design the job. 2. Contractor must be focused on balancing owner budget with functional requirements. This requires a trusting relationship with the DB contractor team.

6. What should I plan for my mechanical roof loads (lbs./ sq. ft.) based on building type?

1. For a typical office building: *3 pounds per square foot.*
2. Typical electronic R&D facility: *Actual weight of equipment.*
3. Typical microelectronic clean room facility: *With interstitial level design load @ 150 pounds per square foot, and 20 pounds per square foot for roof design load.*
4. Typical microelectronic clean room facility: *With interstitial level design load @ 150 pounds per square foot, and 20 pounds per square foot for roof design load.*
5. Typical biotech R&D facility: *20 pounds per square foot live load, 10 pounds per square foot for mechanical equipment, plus other mechanical load, and any dead load structural framing.*
6. Typical biotech/pharmaceutical manufacturing facility: *20 pounds per square foot live load, 10 pounds per square foot for mechanical equipment, plus other mechanical load, and any dead load structural framing.*

7. What is the suggested minimum preventative maintenance schedule for various mechanical systems based on building usage? Preventive maintenance service frequencies are generally dictated by the type of system and how critical it is to the company's operation.

- Typical office buildings (VAV Systems):..... Bimonthly
VAV systems (office buildings – non-critical operations) should be serviced bimonthly. Quarterly service is acceptable if the buildings exposure to open areas, construction in progress, high traffic areas etc. is minimal and equipment is fairly new. Older equipment and high contamination areas (for filters) needs the 60 day frequency.
- Typical office buildings (Small Package Systems)..... Quarterly
Simple small package unit systems, serving non-critical operations, (2.0 to 20.0 Ton)
- Typical electronic R&D facility: Bimonthly
- Typical microelectronic clean room facility:..... Monthly
Cooling towers/ water treatment, scrubbers, DI/RO, chillers, steam boilers, CDA systems, and vacuum pumps, gas monitoring and all life safety systems always require monthly service.
- Typical biotech R&D facility: Bimonthly
- Typical biotech/pharmaceutical manufacturing facility (GMP) Monthly
- GMP facilities require monthly service (as well as a schedule of lesser frequencies on some equipment as specified by the manufacture's manual).
- Typical biotech/pharmaceutical manufacturing facility (GMP) Bimonthly
Non GMP biotech facilities require bimonthly service for simple systems ...monthly if towers, chillers, etc. are in use.
- If your mechanical systems include cooling towers, chillers, CDA Monthly
- *Air handler systems are serviced bimonthly unless they use 100% outside air. Then they are serviced monthly (for filter changing).*

8. What are some of the things that I need to be concerned with when planning to build out an existing facility or considering a new building which can affect my mechanical and plumbing systems?

- Identify existing vs. new utility requirements, i.e., water, sewer, and gas main sizes. This information should be evaluated as early as possible in a project due to the extreme cost and possible delays that can be caused when upgrading them.
- Determine if you have to get a permit from Bay Area Air Quality Management District (BAAQMD) for any process exhaust systems. This process can range from 2 weeks to 6 months in duration based on the application.
- Do you have any hazardous materials that will be used in the new site? Put together a Hazardous Material Inventory Statement (HMIS) early in the project programming to give to your consultants early visibility to possible code and occupancy issues.
- Do you share any utilities with an adjoining tenant? Do they need to be split to meet code or be billed correctly?

9. What is the best control system to use for comfort control in my building?

Most of the major control system manufacturers have similar features and are priced competitively. Pneumatic systems are finally being replaced by DDC systems for the same price. Like any other service, it's the people doing the work rather than the product. Look for a system that has been around for awhile and well supported by more than one contractor. Avoid using products that are "sole sourced" or you may be stuck with a product or company that is too high priced or just won't service

you well with no other alternatives. Get references, review work scope, and review submittals on everything from points lists to graphic layouts before issuing a contract.

10. What sound level from the HVAC equipment should I expect in my building spaces?

- Low end open office space: -40
- High end private office space:..... 30-40
- High end open office space:..... 35-40
- High end conference space: 25-30
- Class 100,000 clean room space: 45-50
- Class 10,000 clean room space: 55-60
- Class 1,000/100/10 clean room space: 60-65
- Biology Lab space:..... 55-60
- Chemistry Lab space:..... 55-60
- Engineering Lab space: 45-55
- ISO 9000+ manufacturing space:..... 55-60

11. What procedures for installation, start up, commissioning and validation does your company employ to insure the highest quality of mechanical installation?

Qualified contractors will have available for your review SOP's (Standard Operating Procedures). These documents will establish a minimum standard for planning, organizing, and auditing the quality assurance program. They will define and limit the work to be performed under the heading of start up, commissioning and validation. These standards will become the basis of the organization structure for the ongoing maintenance of your facility.

12. Will there be a maintenance program established by the building contractor to assure warranty and consistent operational standards?

The constructing contractor is the best qualified to maintain your mechanical system after start up and during the one year warranty. This contractor knows the project intimately and can most effectively resolve problems which may arise from mechanical system failures or just nuisance.

13. What considerations should be made during the design and construction process to enhance serviceability and longevity of the systems?

- Provide sufficient service access, both for routine maintenance service, and for repair service. Pay particular attention to space requirements for replacing large components or long parts, such as shafts.
- Position equipment and access so as to avoid or minimize interruption to normal access.
- Never position equipment above owner's equipment which makes access difficult or impossible. Strictly avoid equipment overhead which might result in damage to products or equipment below.
- Provide for isolation capability which will facilitate normal repairs or service without interrupting normal operation.

14. What kind of payback can I expect from utilizing gas humidifiers in lieu of electric humidifiers?

The payback time frame is depending on operating hours, size of the humidifier and design conditions. However, with 24 hour operation and 45 ± 55 design requirement you can expect a 1-2 year payback.

15. Does it make sense to evaluate the impact of energy consumption and energy cost on my mechanical system?

Yes. The cost of energy can be a significant percentage of your operating expenses. Energy efficient mechanical systems will have a higher up front cost but the payback in energy savings can make them very attractive. A qualified contractor can assist you in making your decision.

16. Are there alternative ways to finance energy efficient systems?

Many electrical energy suppliers will offer rebates based on energy savings. These cost rebates will reduce up-front costs and reduce payback time. In addition, there are many companies that will finance your system. They will supply the energy and finance the equipment. You will make a Monthly payment over a number of years. These types of arrangements can be very cost effective.

The foregoing information is to be used only as a general reference guide.

Please refer to the appropriate trade contractor for completeness, accuracy and workload.

UPDATE 2003