

General Ventilation Design

Air Quality Method

Designing for acceptable indoor air quality requires that we address:

- Outdoor air quality
- Design of the ventilation systems
- Sources of contaminants
- Proper air filtration
- System operation and maintenance

Determine the number of people occupying the respective building spaces. Find the CFM/person requirements in Ventilation Rates for Acceptable Indoor Air Quality, page 42. Calculate the required outdoor air volume as follows:

$$\text{People} = \text{Occupancy}/1000 \times \text{Floor Area (ft}^2\text{)}$$

$$\text{CFM} = \text{People} \times \text{Outdoor Air Requirement (CFM/person)}$$

Outdoor air quantities can be reduced to lower levels if proper particulate and gaseous air filtration equipment is utilized.

Air Change Method

Find total volume of space to be ventilated. Determine the required number of air changes per hour.

$$\text{CFM} = \text{Bldg. Volume (ft}^3\text{)} / \text{Air Change Frequency}$$

Consult local codes for air change requirements or, in absence of code, refer to “Suggested Air Changes”, page 41.

Heat Removal Method

When the temperature of a space is higher than the ambient outdoor temperature, general ventilation may be utilized to provide “free cooling”. Knowing the desired indoor and the design outdoor dry bulb temperatures, and the amount of heat removal required (BTU/Hr):

$$\text{CFM} = \text{Heat Removal (BTU/Hr)} / (1.10 \times \text{Temp diff})$$

General Ventilation Design

Suggested Air Changes

Type of Space	Air Change Frequency (minutes)
Assembly Halls	3-10
Auditoriums	4-15
Bakeries	1-3
Boiler Rooms	2-4
Bowling Alleys	2-8
Dry Cleaners	1-5
Engine Rooms	1-1.5
Factories (General)	1-5
Forges	1-2
Foundries	1-4
Garages	2-10
Generating Rooms	2-5
Glass Plants	1-2
Gymnasiums	2-10
Heat Treat Rooms	0.5-1
Kitchens	1-3
Laundries	2-5
Locker Rooms	2-5
Machine Shops	3-5
Mills (Paper)	2-3
Mills (Textile)	5-15
Packing Houses	2-15
Recreation Rooms	2-8
Residences	2-5
Restaurants	5-10
Retail Stores	3-10
Shops (General)	3-10
Theaters	3-8
Toilets	2-5
Transformer Rooms	1-5
Turbine Rooms	2-6
Warehouses	2-10

General Ventilation Design

Ventilation Rates for Acceptable Indoor Air Quality†

Space	Outdoor Air Required (CFM/person)	Occupancy (People/1000 ft ²)
Auditoriums	15	150
Ballrooms/Discos	25	100
Bars	30	100
Beauty Shops	25	25
Classrooms	15	50
Conference Rooms	20	50
Correctional Facility Cells	20	20
Dormitory Sleeping Rooms	15	20
Dry Cleaners	30	30
Gambling Casinos	30	120
Game Rooms	25	70
Hardware Stores	15	8
Hospital Operating Rooms	30	20
Hospital Patient Rooms	25	10
Laboratories	20	30
Libraries	15	20
Medical Procedure Rooms	15	20
Office Spaces	20	7
Pharmacies	15	20
Photo Studios	15	10
Physical Therapy	15	20
Restaurant Dining Areas	20	70
Retail Facilities	15	20
Smoking Lounges	60	70
Sporting Spectator Areas	15	150
Supermarkets	15	8
Theaters	15	150

†Adapted from ASHRAE Standard 62-1989 "Ventilation for Acceptable Indoor Air Quality".