

INTRODUCTION

VIBRATION ISOLATION

To isolate unwanted fan vibration, it was once sufficient to mount the offending equipment on a piece of cork or felt. But today, with greater knowledge and higher expected standards, this traditional solution is usually inadequate, both in large building structures and in the general industrial environment.

In building construction, improved design allows lighter but inherently more flexible structures to be used. At the same time, increasingly powerful equipment is needed and may often be installed in upper level plantrooms. Fan vibration, therefore, can be a major problem in such structures.

IMPORTANCE OF STATIC DEFLECTION

Isolation of vibration is accomplished by supporting the equipment on resilient mounting elements such as springs or rubber, which compress under the equipment's weight. The degree of isolation achieved is directly related to the amount of compression (i.e. static deflection) of the mounting.

The greater the static deflection which can be achieved (without compressing to solid) the better the resulting vibration isolation.

When determining the level of isolation efficiency which might be acceptable in any situation, consideration must be given to the following:-

- Fan type and operating weight.
- Magnitude and nature of the vibrating forces.
- Restrictions on fan motion.
- Location of the fan in the building structure.

For example, an isolation efficiency of 80% is normally satisfactory for a 5kW machine located in the basement but totally inadequate for a 100kW machine installed on a flexible upper level floor, particularly when adjacent to valuable office or residential accommodation. In this case an isolation efficiency close to 97% would be recommended.

USING VIBRATION MOUNTINGS

Some simple guidelines for successful vibration control:

1. Mounting support points and load ratings should be selected so that the static deflections of all mountings are as uniform as possible.
2. Unrestricted movement of resiliently mounted equipment is essential for effective isolation.
 - a) Ensure that adequate clearance is maintained around the installed equipment, particularly underneath it, to permit free movement - especially where high deflection mountings are used.
 - b) All connections to resiliently supported equipment should themselves be flexible. As well as restricting equipment motion, any fixed connection can offer a direct path for transmission of vibration to the surrounding structure, bypassing the isolation system.
3. Top-heavy machinery, especially when mounted on a narrow base, can become unstable if mountings are located too close to each other beneath the equipment. Such instability can be avoided by use of outrigger brackets which space the mountings further apart and raise the mounting location points closer to the vertical centre of gravity of the equipment.
4. A rigid base is essential for resiliently supported equipment to avoid misalignment of drive components. Any flexibility in the machine base should be eliminated by the addition of steel stiffeners or use of a concrete inertia base.
5. Ductwork and ancillary equipment should not impose dead loads on the resiliently mounted equipment (such as attenuators). Where this is not possible, their weight should be separately supported or allowed for when calculating the total weight.

STATIC DEFLECTION GUIDE

The table provides a guide to the isolator type and necessary static deflection for given values of operating speed and isolation efficiency. It also suggests appropriate levels of isolation efficiency for various operating locations.

To use the table, read the minimum static deflection directly against machine disturbing frequency (operating speed) and required isolation efficiency.

Two static deflection figures appear, one for basement or on-grade installations; the other for upper level installations where some allowance is made for flexibility of the supporting structure. Select the appropriate figure.

	Disturbing Frequency rps (Hz)	Isolation Efficiency, 80%		Isolation Efficiency, 90%		Isolation Efficiency, 95%		Isolation Efficiency, 98%	
		Ground Floor	Upper Floor	Ground Floor	Upper Floor	Ground Floor	Upper Floor	Ground Floor	Upper Floor
		Isolator Static Deflection, mm							
High Defl. Springs	5.0	60	90	110	150	-	-	-	-
	8.5	-	35	40	50	70	90	-	-
	12	-	-	-	-	40	50	100	120
	17	-	-	-	-	-	-	50	60
25mm Defl. Springs	12	11	18	20	25	-	-	-	-
	17	-	10	10	15	18	25	-	-
	25	-	-	-	-	-	11	20	25
Rubber Mountings	25	3	5	5	8*	8*	-	-	-
	33	2	4	4	5	6	8*	-	-
	50	1	1.5	1.5	3	4	5	7*	10*
		Non-critical Areas		General Areas		Critical Areas		Critical Areas	
		Factories, Workshops, Garages, Warehouses, Laundries, Basements.		Schools, Dept. stores, Super-markets, Telephone exchanges, Hotels.		Multi-storey buildings, Offices, Hospitals - service area Churches, Schools, Restaurants.		Multi-storey buildings, Hospitals - ward areas, Broadcasting studios, Theatres, Auditoriums, Libraries	

Note: These figures are to be used as a guide only.

* Double deflection rubber mount required.

ISOLATION EFFICIENCY CHART

This chart illustrates the theoretical relationship between isolation efficiency, disturbing frequency and static deflection for a simple isolation system on a rigid foundation. It is also grouped into zones suggesting isolation efficiency ranges appropriate to different applications.

To use the chart, determine the lowest rotational speed of the equipment and consider this to be the disturbing frequency. Move vertically to intersect the diagonal line corresponding to the percentage isolation required; then move horizontally left and read the static deflection required of the mounting.

