STRUCTURAL DESIGN REQUIREMENTS
FOR MULTI-SECTION DAMPER ASSEMBLIES

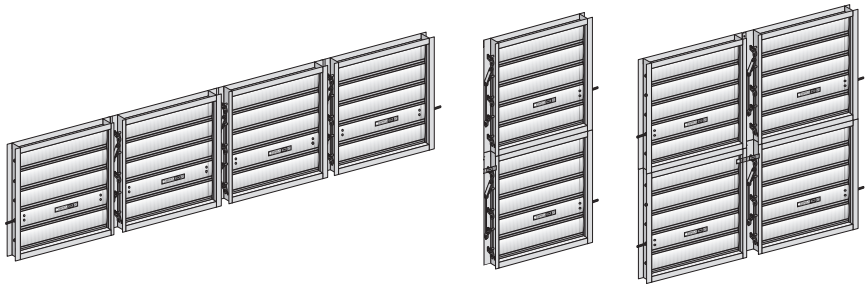
REQUIREMENTS:

- Intermediate structural support is required to resist applied pressure loads for dampers that consist of two or more sections in both height and width. (See below.)
- Tubular steel structural support may be required for large multi-sectioned dampers.
- A non-insulated TAMCO damper weighs approximately 5 lbs/ft². An insulated TAMCO dampers weighs approximately 6 lbs/ft².

MAXIMUM DEFLECTION:

- The structure providing intermediate support must be designed to resist the highest pressure load, with deflection of less than **L/320**. This applies whether the pressure load is created by the mechanical system, by wind load, or if the damper is mounted on the exterior of the building.

Intermediate, field-supplied, structural support is required when installing in both the vertical and horizontal planes.



STRUCTURAL SUPPORT DESIGN FOR TAMCO DAMPERS

Example:

Design the structural support required to carry TAMCO dampers at the 17th story of a building in Ottawa, Ontario, Canada. (Assuming that the maximum internal pressure, as a result of the mechanical systems, is 2 inches of water, 10.4 psf or 500 Pa.)

Assumptions:

The subject building is 17 floors high and has plan dimension of 120' by 120' (36.6 m by 36.6 m). The dampers will be mounted on vertical framing members spanning from the 17th floor to the roof slab level.

Analysis:

Net wind pressure on damper = exterior pressure or suction + interior pressure in the mechanical plenum (as specified by the mechanical engineer)

$$p = qC_eC_gC_{p\ external} + 10.4\ psf \quad 1997\ OCB\ 4.1.8$$

Where: p = *the specific external pressure acting statically and in a direction normal to the surface, either as a pressure directed towards the surface or as a suction directed away from the surface.*

q = *the reference velocity pressure based on a 1 in 30 probability of being exceeded in any one year for design of structural members for strength.* $q_{1/30} = 7.72$ *psf (0.37 kPa in Ottawa, Ontario).*

C_e = *exposure factor based on the height of the building (1.4 for a 170 ft. high building).*

C_g = *gust factor (2.5 for cladding elements and small structural components).*

C_p = *external pressure coefficient (1.0 for high local suction).*

$$p = qC_eC_gC_{p\ external} + 10.4\ psf$$

$$p = 7.72\ psf\ (1.4)\ (2.5)\ (1.0) + 10.4\ psf$$

$$p = 37.4\ psf$$

Total net factored pressure:

$$p_f = 1.5\ (live\ wind\ load)$$

$$p_f = 1.5 \bullet (37.4)$$

$$p_f = 56.1\ psf \quad (2.7\ kPa)$$

Factored distributed load over vertical support framing member:

$$w_f = 56.1\ psf\ (5')$$

$$w_f = 281\ lb./ft.$$

Factored maximum moment:

$$M_f = w_f l^2/8$$

$$M_f = 281 \bullet (10)^2/8$$

$$M_f = 3513\ lb./ft. \quad (4.8\ kN \bullet m)$$

Resisting moment:

M_r *has to be equal to or greater than* M_f *for an unsupported length of 10' (3.05 m)*

Acceptable vertical support member:

C4 x 6.0 - *4" structural steel channel (metric designation C100 x 9)*
$M_r = 3980$ *lb.ft. for an unsupported length (Lu) = 13'.*
($M_r = 5.4$ *kNm at Lu = 4m)*

Check deflection criteria:

Maximum allowable deflection is L/320 = 10'/320 = 0.375" (9.5 mm)
Maximum deflection at mid-height of the channel:

$$\Delta = \frac{5\ w\ l^4}{384\ E\ I}$$

For deflection, the reference velocity pressure, q, *is based on a 1 in 10 probability of being exceeded in any one year.* $q_{1/10} = 6.27$ *psf (0.30 kPa in Ottawa, Ontario).*

$$p = qC_eC_gC_{p\ external} + 10.4\ psf$$

$$p = 6.27\ psf\ (1.4)\ (2.5)\ (1.0) + 10.4\ psf$$

$$p = 32.3\ psf$$

$$w = 32.3\ psf\ (5')$$

$$w = 162\ lb./ft.$$

$$\Delta = \frac{5\ (162\ lb./ft.)\ (10')^4}{384\ (29{,}000\ ksi)\ (4.25\ in^4)}$$

$$\Delta = \frac{5\ (13.5\ lb./ft.)\ (120")^4}{384\ (29 \bullet 10^6\ psi)\ (4.25\ in^4)} = 0.30 \quad (7.6\ mm)$$

Therefore, an acceptable vertical support member for this example is a ***C4 x 6.0*** *(metric designation C100 x 9).*