

## GENERAL EXEMPTIONS AND REQUIREMENTS

### D2.9 – 4.1 Introduction:

The National Building Code of Canada has limited exemptions for MEP components written in to it. The SMACNA Seismic Restraint Manual – Guidelines for Mechanical Systems, 2<sup>nd</sup> Edition with Addendum No. 1, 1998; is not directly referenced in the NBCC. Therefore, it is safe to assume that any exemptions in the SMACNA manual that have been previously taken are no longer allowed.

There are, however, some general exemptions for MEP components which will be covered in this section. Along with the exemptions, this section will the requirements for flexible/flexibly connected (isolated) components, direction of seismic design force application, structural connections, deflections, transfer of seismic forces to the building structure, and hanger rods for MEP components.

### D2.9 – 4.2 General Acceleration Based Exemption for MEP Components [Sentences 4.1.8.1, and 4.1.8.17.(2)]<sup>1</sup>

Sentence 4.1.8.1 is a general exemption for building, and also applies to those buildings that have been assigned to the Importance Category classified as Post Disaster. The deflections and loads due to earthquake motion as specified in Sentence 4.1.8.17, do not apply to MEP Components when  $S_{a(0.2)} \leq 0.12$ . Under this condition seismic restraints will not be required for MEP components.

The next general exemption is found in Sentence 4.1.8.17.(2) and applies to buildings that have been assigned to Importance Categories Low, Normal, and High. Section 2.9 – 3.0 of this guide

<sup>1</sup> References in brackets [Sentence 4.1.8.17.(2)] apply to sections, tables, and/or equations in the National Building Code of Canada 2005.

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covered the seismic design forces specified by the NBCC. The basic acceleration term multiplying the weight (mass) of the MEP component is  $I_E F_a S_{a(0.2)}$ . This term includes the importance of the building, the effects of the ground upon which the project is being built, and the expected horizontal acceleration produced by the design earthquake for the project location. This general exemption for MEP components is based on the value of this term. If  $I_E F_a S_{a(0.2)} < 0.35$ , then MEP components that fall into categories 7 through 21 in Table 3-2 of this guide do not require seismic restraint for buildings assigned to Importance Categories Low, Normal, and High.

## D2.9 – 4.3 “Chandelier” Exemption [Sentence 4.1.8.17.(13)]

This exemption does not read exactly as the companion exemption in the International Building Code (IBC); see Kinetic’s Guide to Understanding IBC Seismic for MEP, Section D2.1 – 4.5. So, for clarity it will be directly quoted below.

Isolated suspended equipment and components, such as pendant lights, may be designed as a pendulum system provided that adequate chains or cables capable of supporting 2.0 times the weight of the suspended component are provided and the deflection requirements of Sentence 4.1.8.17.(11) are satisfied.

## D2.9 – 4.4 Isolated vs. Rigidly Connected Components [Sentence 4.1.8.17.(4)]:

The NBCC basically says that MEP components that can be defined by Categories 11 and 12 in Table 3-2 of this Guide are to be treated as flexible/flexibly connected (isolated) components. If, however, the fundamental period of the component and its connections to the building structure can be shown to be less than or equal to 0.06 second, it may be treated as though it were a rigid or rigidly connected component.

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## D2.9 – 4.5 Design Horizontal Seismic Load Application [Sentence 4.1.8.17.(7)]:

The design horizontal seismic loads are to be applied in the direction the results in the most critical loading for the MEP component and its attachment to the structure. This will ensure that the most conservative design and selection of seismic restraints for the MEP component has been made.

## D2.9 – 4.6 Connection of MEP Components to the Building Structure [Sentence 4.1.8.17.(8)]:

Connections for the MEP components to the building structure must be designed to resist gravity loads, meet the requirements of Sentence 4.1.8.1 of the NBCC, and also satisfy the following additional requirements.

1. Friction due to gravity loads may not be used to resist seismic forces.
2. The  $R_p$  value for non-ductile fasteners such as adhesives, powder shot pins, and other power actuated fasteners must be taken as 1.0.
3. Shallow embedment anchors, shallow expansion, chemical, epoxy, or cast-in-place, are those whose embedment depth to nominal diameter ratio is less than 8:1. For these types of anchors the value for  $R_p$  shall be taken as 1.5.
4. Drop in anchors and power actuated fasteners, such as powder shot pins, are not to be used in tensile applications.

## D2.9 – 4.7 Lateral Deflections of MEP Components [Sentence 4.1.8.17.(10)]:

The lateral deflections based on design horizontal seismic force specified the Sentence 4.1.8.17.(1), see Section D2.9 – 3.0 of this guide, need to be multiplied by a factor of  $R_p/I_E$  to yield more realistic values for the anticipated deflections. The values of  $R_p$  and  $I_E$  are used to

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artificially inflate the loads to ensure the selection of seismic restraints and attachments that will meet the Post-Disaster criteria.

## **D2.9 – 4.8 Transfer of Seismic Restraint Forces [Sentence 4.1.8.17.(11)]:**

This provision is intended to engender co-operation between the MEP design professionals and the structural engineering professionals. It is basically saying that the MEP components and their attachments to the building structure must be designed in such away that they do not transfer any loads to the structure that were not anticipated by the structural engineer. This means that the MEP design professionals must inform the structural engineer of the anticipated dead loads and seismic restraint forces at the restraint attachment points as soon as the MEP component selections have been finalized. Conversely, the structural engineer needs to make him or her self available to the MEP design professionals to work out issues surrounding the seismic loads and the attachment points for the seismic restraints used for the MEP components.

## **D2.9 – 4.9 Seismic Restraints for Suspended MEP Components & Hanger Rods [Sentence 4.1.8.17.(12)]:**

The seismic restraints for suspended MEP equipment, pipes, ducts, electrical cable trays, bus ducts, and so on, must meet the force and displacement conditions of Sentence 4.1.8.17, and be designed in such away that they do not place the hanger rods in bending.

## **D2.9 – 4.13 Summary:**

The exemptions and requirements outlined in this section are intended to assist the MEP design professionals and contractors in planning their project contribution efficiently. Also, they help define the limits of responsibility for each MEP design profession and trade.

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