

## SEISMIC PROTECTION AND VIBRATION ISOLATION SPECIFICATION

### A. GENERAL

All products and services in this section are intended to protect the mechanical installations and equipment of the project against a possible earthquake and to keep it running after the earthquake.

All products and services to be provided will be supplied by the single manufacturer of the seismic protection and vibration isolation material

The material manufacturer is responsible for reporting as a result of field discoveries, projecting services and controls with supervisory services during implementation, along with product supply and selection. The calculations and documentation during the project design works will be made and signed by the expert engineer of the firm of the seismic protection material manufacturer.

### B. STANDARD AND REGULATIONS

During the project design, the published latest versions of the regulations and standards listed below will be referenced.

- T.C. Çevre ve Şehircilik Bakanlığı, Deprem Bölgelerinde Yapılacak Binalar Hakkında Yönetmelik
- T.C. Binaların Yangından Korunması Hakkında Yönetmelik
- IBC 2012 (International Building Code)
- ASCE-7 ( American Society of Civil Engineers)
- NFPA-13 (Installation of Fire Sprinkler Systems)
- FEMA (Federal Emergency Management Agency)
- FEMA Seismic Protection Application Guide
  - a. FEMA 412: Mechanical Equipment
  - b. FEMA 413: Electrical Equipment
  - c. FEMA 414: Duct and Pipe
- ASHRAE (Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.)
- SMACNA (Sheet Metal and Air-Conditioning Contractors' National Association)

### C. APPROVAL

The scope of the file to be submitted for product approvals is given below.

- Product Information: Data sheets containing size, material and performance information of all materials to be used for seismic protection and vibration isolation will be submitted for approval.

- Manufacturer Approval: The manufacturer's recommendations will be taken into account in the selection of vibration and seismic restrictions. All selection will only be approved by the manufacturer.

- Certification and Test Reports: Certification and test reports of the products to be used will be submitted for approval. All products offered must have a test report from international and independent laboratories. In addition, the companies that have given certification should be independent organizations operating in the region where these products are used.

- Sample: Sample set (s) prepared with selected seismic protection and vibration isolation materials will be submitted for approval.

A professional engineer with minimum 5 years experience in providing engineering services in the field of seismic and vibration isolation; will provide material, design and supervision services in accordance with the criteria of the project.

The scope of the file to be submitted for project approvals is given below.

a. Design Calculations: It will be stated which standard or regulation the calculations made in the selection of the products are made. Explanations of the coefficients used in the calculations will be made. All calculations will be prepared and signed by the expert engineer of the seismic restraining material manufacturer.

b. Application Projects: All points where seismic protection is required will be marked on the installation plans.

c. Application Details: Seismic protection details will be drawn to 1 by 1 scale and all necessary dimensions and sections will be specified. The quantities, dimensions, connection details to the structure to be determined according to the seismic load calculations of the products, the diameter of the dowel selected and the depth in the concrete will be shown. If vibration isolation is to be made along with seismic protection, the amount of vibration absorbing material selected, installation details and collapse values will be specified.

#### D. DESCRIPTION OF SEISMIC SYSTEM

General Requirements: The requirements for seismic protection measures described in this section will apply to the systems and mechanical equipment listed below.

##### 1. Mechanical Systems

a. Fire protection systems

b. Ventilation and smoke ducts

c. Other piping.

a. Fire protection systems:

Regarding by NFPA-13 and FM criteria, all lines will be restrained regardless of the diameter while seismic protection is made in fire installations.

Galvanized coated RSB type rigid seismic sway braces designed to meet tensile and compression loads which approved by FM will be used.

b. Air Ducts:

All air and smoke ducts, will be restrained by determined calculations against earthquake loads unless stated otherwise or exceptional circumstances.

STB steel ropes will be used that have been tested in accordance with UL, ANSI / ASHRAE or equivalent, and approved by an international organization. These ropes should be pre-tensioned, galvanized and failure strength as seismic protection product

Air ducts will be restrained when the distance between the upper level of the channel and the structure is 30 cm or more, the weight is more than 23 kg (kg / mt), and the cross-sectional area of more than 0.56 m<sup>2</sup>

G section rod support profiles and RDK type terminals are used to prevent the torsion and breakage of the hanger rods when it is necessary to be used with calculations,

HYET steel spring hanger type insulators whose collapse quantity and capacity are specified in color codes by the manufacturer will be used as a product of vibration isolation;

Vibration isolation will be provided with HYET hanger type / FAN floor type insulators within minimum minimum 15 meters after the equipment exit.

The smoke ducts will be protected by STB steel seismic ropes regardless of their weight and cross-section.

c. Other piping

On single lines which is 2 ½" and above will be protected seismically. In trapezoidal hangers consisting of two or more pipes will be protected with seismic ropes when the weight of more than 15 kg in the meter and distance is more than 30 cm between the junction point of the hanger and the ceiling.

2. Mechanical Equipment:

Mechanical equipment with power over 560 W (0.75 HP) will be connected to the structure with vibration isolators.

Unless otherwise stated and / or does not have an exceptional condition, all equipment will be protected against overturning and slipping against seismic loads.

a. Air Handling Unit, Roof-Top, Cell Type Aspirators, Boiler.

b. Chiller, Cooling Towers.

c. Pump Groups.

d. Floor type and Hanging type all fans.

e. Exhaust fans.

a. Air Handling Unit, Roof-Top, Cell Type Aspirators, Boiler:

SLT or LNKY Elastomer Vibration Absorber Pad materials will be used for the vibration isolation of equipment such as High Frequency Air Handling Unit, Roof-top, Cell Type Aspirator and Boiler. The thickness and dimensions will be determined by the material manufacturer according to the place of use and vibration isolation efficiency. In order to distribute the load homogenously, galvanized steel plates of minimum 5mm thickness and pad size can be placed on the pad.

For Seismic Protection, SLD seismic snubber or SLZ seismic snubber that can overcome both horizontal and vertical loads should be used, either directly connected to the building by welding or bolts, or by the equipment itself or chassis. The contact surfaces of the snubber should be covered with flexible elastomer to prevent damage to the equipment during seismic motion. Connection details of the snubbers should be made by the expert engineer of the firm that provides seismic restraint service.

b. Chiller, Cooling Towers

SLOT (Closed type) Steel Spring Seismic Vibration isolators will be used for the vibration isolation and seismic protection of equipment such as low frequency operating Chiller and Cooling Tower. The spring collapse amount and load capacity will be determined by the material manufacturer according to the place of use and vibration isolation efficiency. When the isolator is exposed to vibration, the contact surfaces should be covered with elastomer material. The baseplate shall be perforated for dowel connection and suitable to welded mounting . Equipment will be balanced with height adjustment bolt.

c. Pump Groups

SLOT (Closed type) Spring Seismic Vibration isolators will be used for the vibration isolation and seismic protection of low frequency centrifugal pumps. The spring collapse amount and load capacity will be determined by the material manufacturer according to the place of use and vibration isolation efficiency. When the isolator is exposed to seismic load, the contact surfaces will be covered with elastomer material, the base plate will be perforated for the dowel connection and suitable for welded mounting. Equipment will be balanced with height adjustment bolt. An inertial mass to be made of steel or concrete will be placed under the pump if the engineer of the material manufacturer, which provides seismic projecting services based on the location of the device in the building seems necessary.

d. Floor type and Hanging type all fans:

Suspended fans will be hang with HYET spring suspended type vibration isolators or LNT elastomer suspended type vibration isolators. For floor type fans, SVA spring vibration isolators or SLT elastomer vibration isolators will be used. The amount of collapse and load capacity will be determined by the material manufacturer according to the place of use and vibration isolation efficiency.

For suspended fans, STB steel ropes with pre-tensioning, galvanized and failure strength approved by UL, TÜV or equivalent standard will be used as seismic protection material. For floor type fans, SVA (Closed type) spring vibration isolator or SLD / SLZ seismic isolator will be used.

## EXCEPTIONS FROM SEISMIC APPLICATION OF MECHANICAL INSTALLATIONS AND MECHANICAL EQUIPMENT

All installation equipments that comply with the following items can be exempted from seismic application.

- On single lines smaller than DN65 located in the building (If the project will be made according to NFPA-13 in the case of fire installation, seismic protection will be applied to all main line pipes regardless of the diameter for fire installation pipes. Also branch lines will be limited only against lateral earthquake loads. )
- All pipes, ducts and equipment whose distance between the upper level of the pipe, duct or hanging equipment and the structure to which it is connected is less than 30 cm (this value is 15 cm for fire installation pipes according to NFPA 13)
- Trapezoidal hangers with a total weight of the pipes on the pipe bundle less than 15 kg / m
- All rectangular ducts with a cross-sectional area of less than 0.56m<sup>2</sup> except smoke - exhaust ducts
- All round ducts with a diameter of less than 842 mm except smoke - exhaust ducts
- The duct line weighing 35 kg or less which is connected to fans
- Ceiling or wall hanging equipment which is Importance factor ( $I_p = 1.0$ ) with vibration isolation weighing 9 kg or less.

### E. PRODUCTS

#### 1. Rigid Seismic Sway Brace Clamp (FM Approved)

Electro galvanized rigid seismic bracing clamp with lateral and longitudinal design loads determined by FM. Installing by 1 "or 1 1/4" SCH 40 type pipe rigid connection and also with a bolt head capable of breaking when it reaches sufficient tightening value.

Place of Use: Fire Installation

Reference Model: LINK – RSBC

#### 2. Rigid Seismic Sway Brace Structure Attachment (UL-FM Approved)

Electro galvanized, made of cast material for mounting seismic brace to the reinforced concrete floor with a design load of 11.200 N approved by FM , with also the bolt head capable of breaking when it reaches sufficient tightening value. Seismic structure fastener designed to allow mounting at 30 - 90 degrees angles, which can be used for both transverse and longitudinal seismic sway braces.

Place of Use: Fire Installation

Reference Model: LINK – RSBA

### 3. Rigid Seismic Structure Attachment for Steel Construction 1 " & 1 1/4 " (UL-FM Approved)

Electro galvanized, made of cast material for mounting the rigid seismic suspension sets with a design load of 6670 N approved on the FM side to the steel construction, assembled with a bolt head capable of breaking when it reaches sufficient tightening value. Seismic structure fastener designed to allow mounting at 30 - 90 degrees angles, which can be used for both transverse and longitudinal seismic hangers.

Place of Use: Fire Installation

Reference Model: LINK – RSBI

### 4. Seismic Wire Rope – 1

Tensile strength of 270 kgf, local and international organizations under the supervision of independent tests performed, the preliminary stretching from the elasticity, and ease of installation to galvanized thimble or yellow color-coded seismic wire rope clips available to bind with. Ceiling and the system used and the strength of the connection tests performed under the supervision of local and international organizations approved steel based material, corner pieces, and seismic loads with adequate tensile and shear strength of steel seismic anchors.

Place of Use: Pipes, Ducts, Suspended Fans, VRV Units

Reference Model: LINK - STB11

### 5. Seismic Wire Rope – 2

Tensile strength of 540 kgf, local and international organizations under the supervision of independent tests performed, the preliminary stretching from the elasticity, and ease of installation to galvanized thimble or red color-coded seismic wire rope clips available to bind with. Ceiling and the system used and the strength of the connection tests performed under the supervision of local and international organizations approved steel based material, corner pieces, and seismic loads with adequate tensile and shear strength of steel seismic anchors.

Place of Use: Pipes, Ducts, Suspended Fans

Reference Model: LINK – STB12

### 6. Seismic Wire Rope – 3

Tensile strength of 1005 kgf, local and international organizations under the supervision of independent tests performed, the preliminary stretching from the elasticity, and ease of installation to galvanized thimble or blue color-coded seismic wire rope clips available to bind with. Ceiling and

the system used and the strength of the connection tests performed under the supervision of local and international organizations approved steel based material, corner pieces, and seismic loads with adequate tensile and shear strength of steel seismic anchors.

Place of Use: Pipes, Ducts, Suspended Fans

Reference Model: LINK – STB13

#### 7. Seismic Wire Rope – 4

Tensile strength of 2250 kgf, local and international organizations under the supervision of independent tests performed, the preliminary stretching from the elasticity, and ease of installation to galvanized thimble or white color-coded seismic wire rope clips available to bind with. Ceiling and the system used and the strength of the connection tests performed under the supervision of local and international organizations approved steel based material, corner pieces, and seismic loads with adequate tensile and shear strength of steel seismic anchors.

Place of Use: Pipes, Ducts, Suspended Fans

Reference Model: LINK – STB15

#### 8. Swaging Tools

It will be used to tighten ferrule material used in rope assembly and tensioning the rope.

TM-14: used for crimping ferrules on STB11, STB12 and STB 13 type ropes.

TM-24: used for crimping ferrules on STB11, STB12, STB 13 and STB15 type ropes.

Place of Use: All seismic protection places with steel wire rope

Reference Model: LINK – TM

#### 9. Seismic Vibration Isolator

Capable of both vibration isolation and seismic protection, the amount of deflection and load capacity according to the place of use and efficiency of vibration isolation material to be determined by the manufacturer, vertical and horizontal movement is limited, the spring constant horizontal / vertical ratio is 1, PVC-coated steel spring. When subjected to seismic loads of material contact surfaces are covered with the elastomer, base plate and welded mounting holes for anchor connection is suitable thickness. Height adjustment screw will be balanced with the equipment.

Place of Use: Pumps, Chillers, Cooling Towers

Reference Model: LINK – SLOT2 or SLOTV2 and SLOT2AC, SLOT4AP

#### 10. Vibration Hanger

The amount of deflection and the load capacity and vibration isolation efficiency of material by the place of use will be determined by the manufacturer, vertical and horizontal movement is limited, the spring constant horizontal / vertical ratio is 1, PVC-covered steel spring vibration isolator. Suitable anchor or rod connecting the spring to the ceiling box and will be resistant to seismic loads.

Place of Use: Fancoils, Suspended Fans

Reference Model: LINK – HYET

#### 11. Seismic Snubber

Equipment shall be restrained against excessive movement during a seismic event by the use of 3-axis resilient snubbers, designed to withstand the project required seismic forces. A minimum of two (2) snubbers are to be used at each equipment installation, oriented to effectively restrain the isolated equipment in all three directions, and additional snubbers shall be used as required by seismic design conditions.

Place of Use: Air Handling Unit, Exhaust Fans, Boiler

Reference Model: LINK – SLD / SLZ

#### 12. Vibration Isolator Pads

Thickness and size according to the place of use and efficiency of vibration isolation to be determined by the manufacturer of the material to be used for the isolation of high-frequency vibration rubber - cork base pad-type isolator. Homogeneously distribute the load on behalf of the minimum 5mm thick pad, the pad will be put to the extent galvanized steel plates.

Place of Use: Air Handling Unit, Exhaust Fans, Boiler

Reference Model: LINK – SLT / LNKY

#### 13. Seismic Anchor

C2 certified LTS type anchor will be used when installing all seismic products at cracked and uncracked concrete.

#### 14. Project and Supervision

In accordance with this specification, all project design services, calculations, shop drawings, preparation of approval files, drawing of application projects, accompanying the assembly of sample applications belonging to type details during assembly, inspection of the assembly done in the field in certain periods and all reporting works are the service fee.