DESIGN OF FIRE RESISTANT INSTALLATION SYSTEMS

From Tests to new EAD

Ömer Cagirgan
Head of Business Unit Installation Systems
Hilti Corporation

Fire Safety Academy
Milan, June 3rd 2019

WE OFFER SAFE SOLUTIONS FOR FIRE AND SEISMIC APPLICATIONS

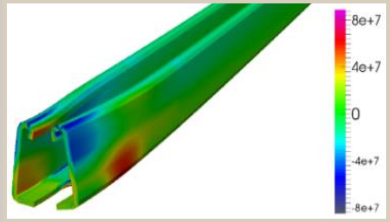
Fire Safe

Active Fire Protection

Support for the design of **seismic-resistant fire systems**

ETA Fire-resistant installation

Solutions for the design of **fire-resistant Modular Support Systems**



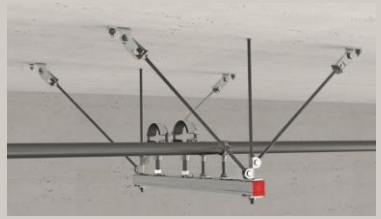
Seismic passive Fire Protection

Solutions for **passive protection** by **compartmentation** from design to construction site

Seismic Safe

Seismic Installation

Support for **seismic-resistant design** of Mo**dular Support Systems**



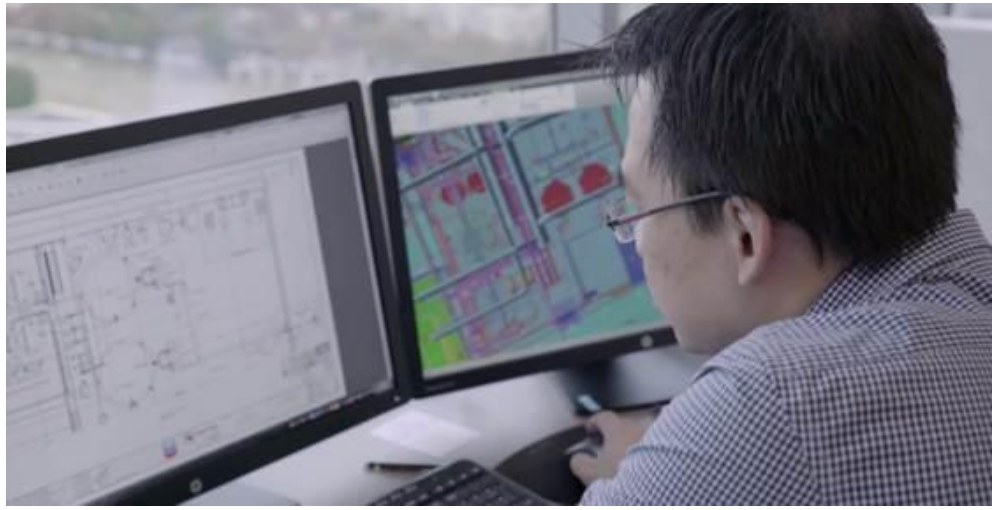
IN CASE OF FIRE, YOU NEED A SAFE WAY TO EXIT AND RESCUE THE BUILDING

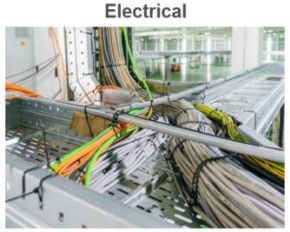
According to the Fire Prevention Code, an **escape route** is an unhindered path to the outflow belonging to the escape system, which allows occupants to reach a safe place from where they are.

Associated with the escape route is the RSET (required safe escape time), the time interval calculated between the firing of the fire and the moment in which the occupants of the activity reach a safe place.

In **hospitals**, RSET is longer compared to other buildings due to the presence of patients who may present mobility difficulties.

NOT PROPERLY DESIGNED SUPPORT SYSTEMS POSE A SERIOUS SAFETY RISK IN HOSPITAL





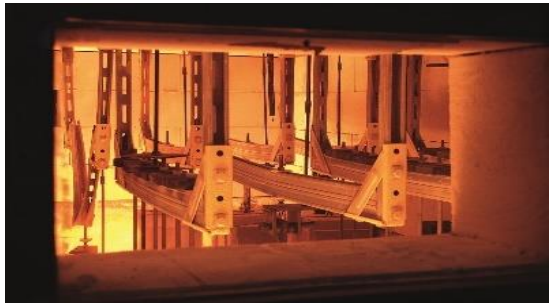
HOW TO CREATE FIRE SAFE SUPPORT SYSTEMS IN RESCUE AND ESCAPE ROUTES ?

FOR FIRE DESIGN OF MODULAR SUPPORT SYSTEMS, TODAY SOME PROJECT APPROACH ARE STILL BASED ON EUROCODE 3

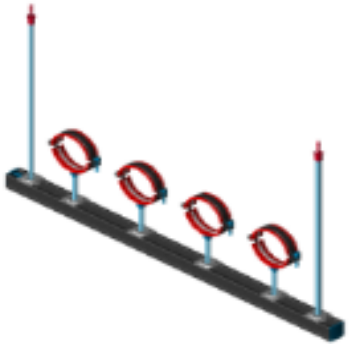
Context: e.g. Hospital project

Application: e.g. MEP supports in escape routes

Challenge: e.g. F60 fire resistance



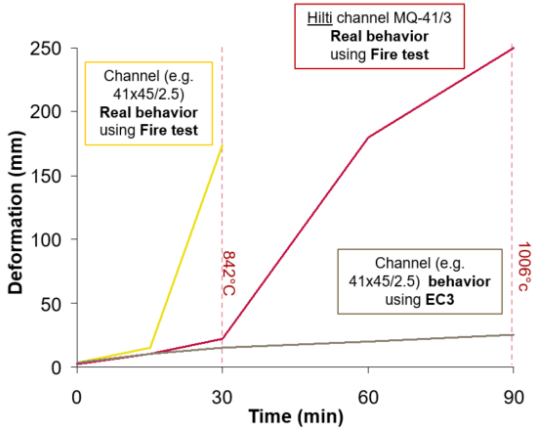
Design of Fire-resistant support systems



Fire design based on Eurocode 3

EUROCODES
BUILDING THE FUTURE
EUROCODE 3

EC3 not applicable for low material thickness



IT HAS BEEN PROVED BY MFPA LEIPZIG INSTITUTE THAT EC3 IS NOT SUITABLE FOR DEFORMATION PREDICTION OF CHANNELS

MFPA Leipzig GmbH

Geschäftsbereich II: Baulicher Brandschutz

Hilti Corporation
Business Unit Installation
Feldkirchenstrasse 100
9494 Schaan
Liechtenstein

Ihre Zeichen | Ihre Nachricht vom | Unsere Zeichen | Datum
0.3.2/15-291-1 | 11. September 2015

Betreff: Verformungsberechnung Montageschienen im Brandfall

Sehr geehrte Damen und Herren,

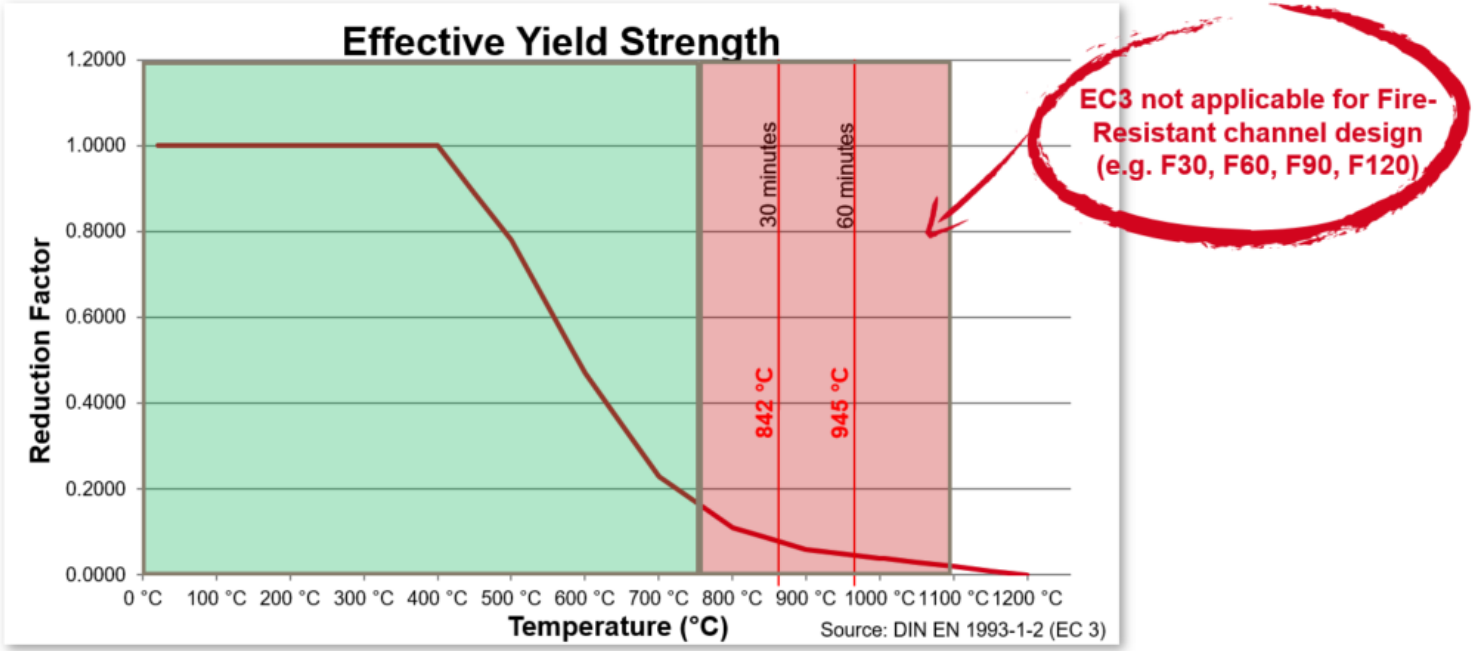
in §40 der MBO [1] wird festgestellt, dass Leitungsanlagen über notwendigen Fluren nur zulässig sind, wenn die Nutzung des Rettungswegs im Brandfall ausreichend lange gewährleistet ist. In Abschnitt 3.5.3 der MLAR wird für die Einhaltung dieses Schutzziels gefordert:

... die besonderen Anforderungen hinsichtlich der brandsicheren Befestigung im Bereich zwischen den Geschossdecken und Unterdecken verlegten Leitungen sind zu beachten.

Für den Brandfall im Unterdeckenbereich muss dementsprechend sichergestellt werden, dass Rohrbefestigungen/Tragsysteme sich nicht soweit verformen, dass die sich darunter befindende Unterdecke mechanisch beschädigt wird.

Der Nachweis der begrenzten Verformung kann durch Brandprüfungen mit Brandbeanspruchung nach DIN EN 1363-1 [2] sichergestellt werden. Alternativ werden aktuell die Verformungen der Stahlbauteile mithilfe der Spannungs-Dehnungsbeziehung nach DIN EN 1993-1-2 [3] (kurz: EC3-1-2) berechnet.

Hierzu muss aber angemerkt werden, dass rechnerisch nicht ohne weiteres sichergestellt werden kann, dass darunterliegende Bauteile wie Unterdecken im Brandfall mechanisch unbeschädigt bleiben. Ausführende Erläuterung zur Abweichung zwischen rechnerisch und experimentell ermittelten Verformungen von Rohrbefestigungen/Tragsystemen können Anlage 1 entnommen werden. Es zeigt sich, dass mit einer Verformungsberechnung gemäß EC3-1-2 nicht sichergestellt werden kann, dass brandschutztechnisch wirksame Unterdecken ausreichend



Eurocode 3 was developed for the design of steel structures of buildings and other engineering structures.
For installation system design beyond 750°C, the material model needs additional validation.

FIRE TESTS CONFIRM EC3 INVALIDITY AND SHOW THEIR REAL BEHAVIOR BUT LEAD TO NOT FLEXIBLE DESIGN

AS A SOLUTION, A NEW EUROPEAN DESIGN GUIDELINE DEFINES HOW TO CALCULATE FIRE RESISTANT INSTALLATION SYSTEMS

What are the benefits?

- ✓ Empowered by EOTA, European Commission, DIBt and notified bodies: **Technical reliability**
- ✓ Appropriate for wide range of applications: Allows **customized design**
- ✓ Optimized for **economical material usage**
- ✓ Rules for **validated safe design**

Safe, flexible and cost effective solution

CPD/CPR LAID THE FRAMEWORK AND DEFINED ROLES & RESPONSIBILITIES OF DIFFERENT ORGANISATIONS

CEN: European Committee for Standardization

- in charge to develop **European Standards** (**ENs**) in many areas, (not only construction products) in particular the **Eurocodes**.

Design Standards

EOTA: European Organisation for Technical Assessment (all TABs)

- in charge to develop **European Assessment Documents (EADs)** in the area of construction products.

Product Assessment Criteria

TABs: Technical Assessment Bodies (e.g. DIBt, CSTB)

- in charge of the **European Technical Assessment (ETAs)** of construction products.

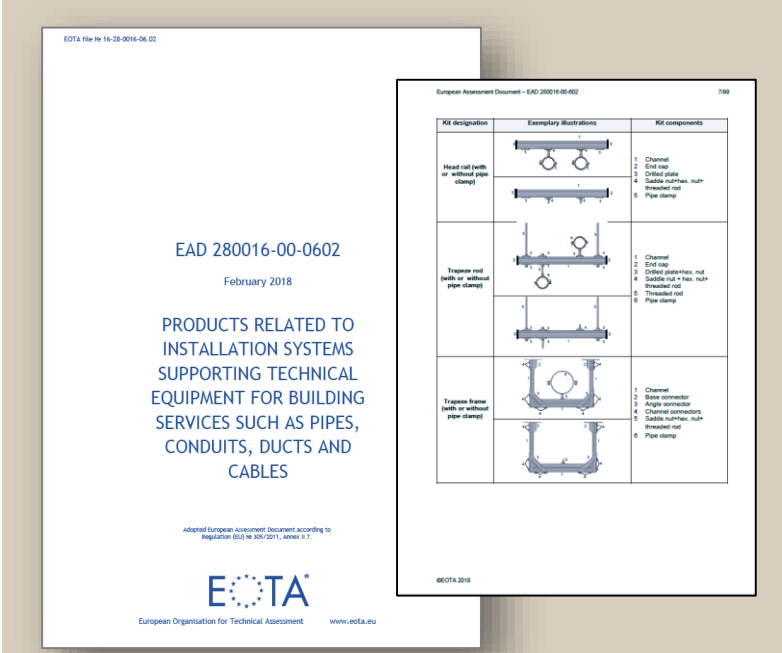
Product Assessment

FIRST EVER EAD & ETA'S FOR MODULAR SUPPORT SYSTEMS THAT ALLOW HARMONIZED FIRE-RESISTANT DESIGN

CEN: European Committee for Standardization

- in charge to develop **European Standards** (**ENs**) in many areas, (not only construction products) in particular the **Eurocodes**.

Design Standards

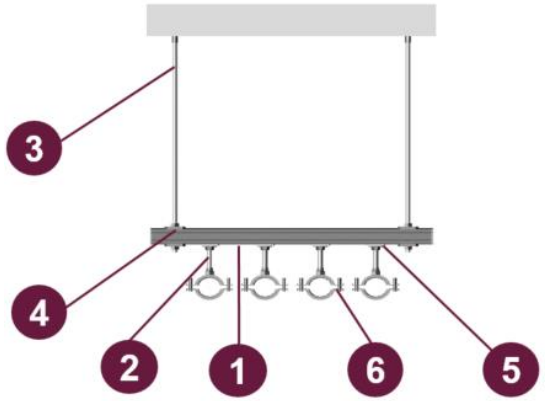


EAD

ETAs

EAD ASSESS FLEXIBLY REAL CHANNEL SYSTEM RESISTANCE & DEFORMATION AND CHECK THE CRITICAL CHARACTERISTICS

Trapeze rod Configuration



1 Finite Element Method (FEM)

Bending resistance and deformation of the channel

2 Analytical calculation

Elongation of the pipe clamp threaded rod

3 Fire test & Analytical calculation

Bending resistance and elongation of the suspended threaded rod

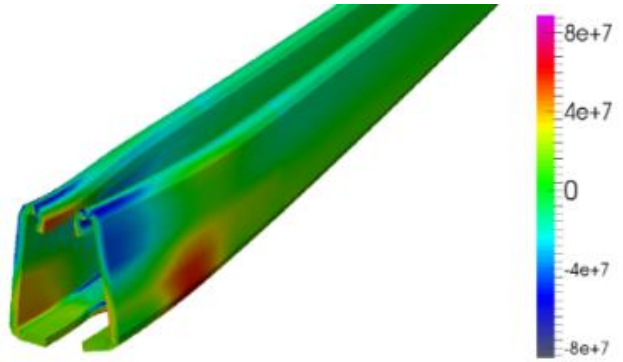
Fire test

4 Pull-out resistance of bored plate

5 Pull-out resistance of saddle nut or repeat step 4 for through bolting connection

6 Resistance and deformation of the Pipe clamp

Channel FEM Model



Saddle nut pull-out test

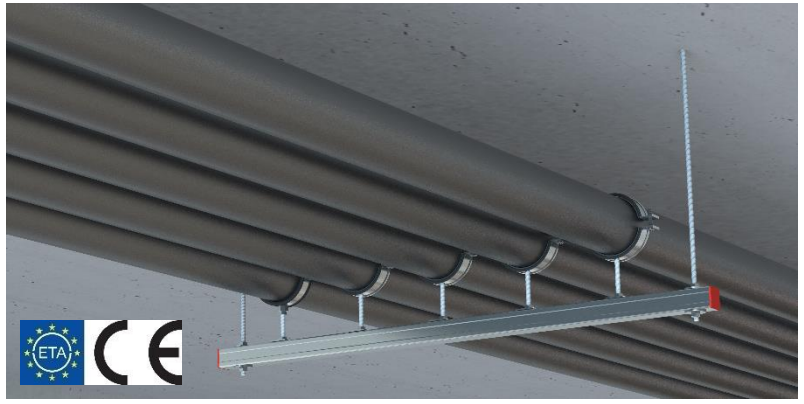
EAD FOCUS ON 6 KEY CONFIGURATIONS WHICH COVER THE MAIN FIRE RELEVANT APPLICATIONS

Headrail

Suspended cantilever

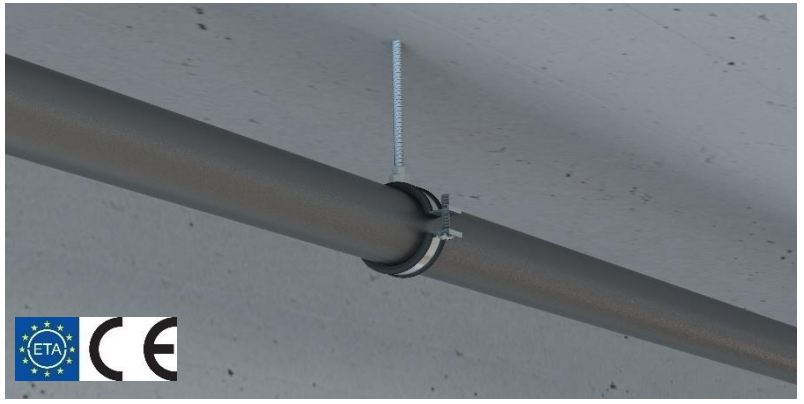
Trapeze Frame

Trapeze rod

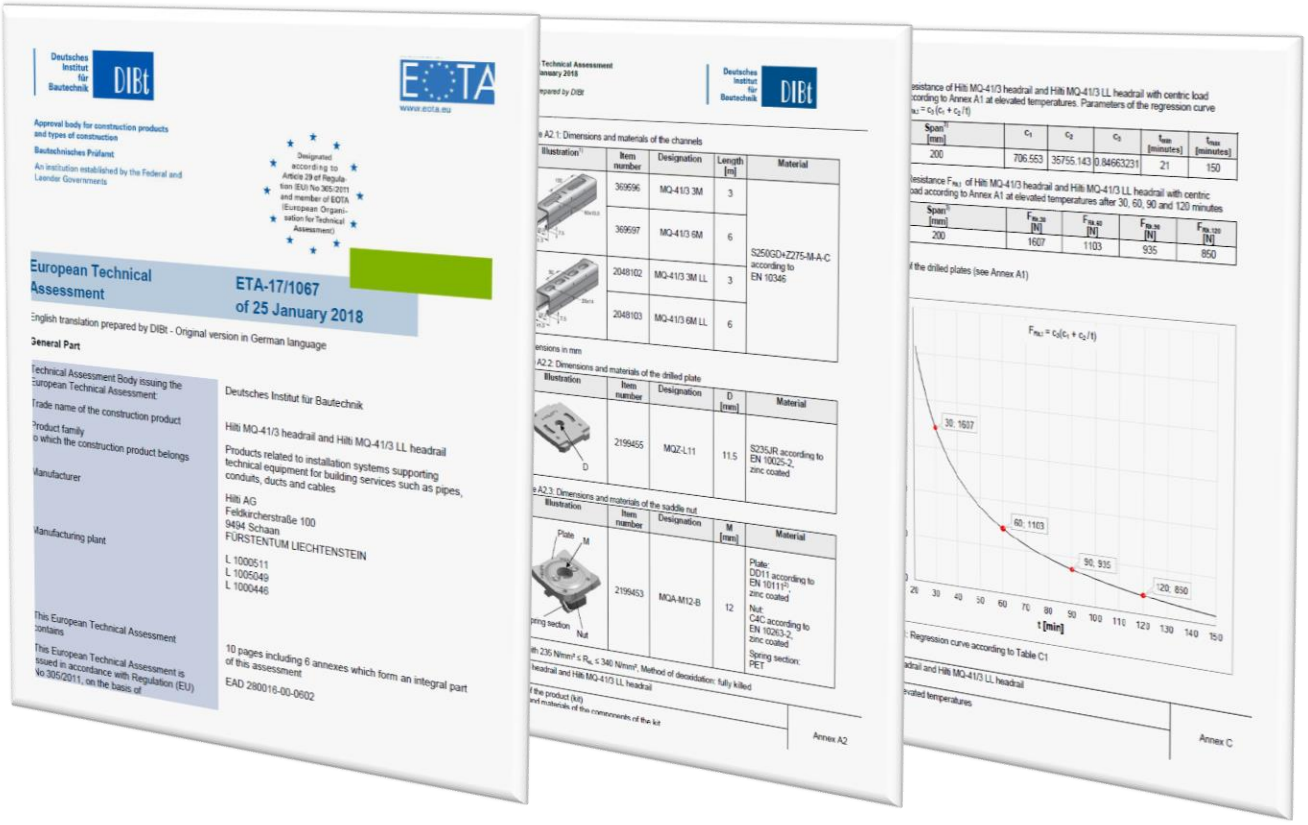


Non-suspended cantilever

Single pipe clamps



TO DESIGN THESE CONFIGURATIONS ALL RELEVANT TECHNICAL DATA ARE AVAILABLE IN THE ETA'S




MPA Braunschweig