TYPE	CHARACTERISTICS	PICTURE	HYSTERESIS DIAGRAM

"MIONICA"

CHARACTERISTICS

TECHNICAL CHARACTERISTICS

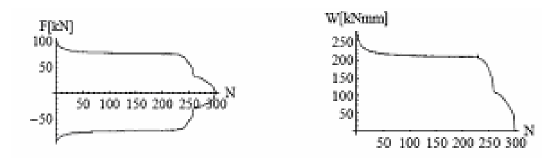
V=110kN, D=48.3/3mm, L=400 mm.

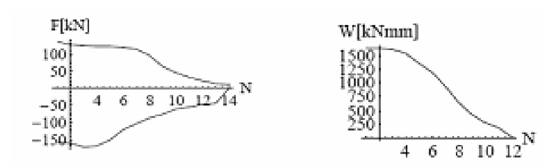
F (cm^2)	**ΔF** (cm^2)	**ε_y**	**f_y** (N/mm^2)	**f_y(F-ΔF)** (kN)	**f_u (F-ΔF)** (kN)	**Δ** (mm)
4.14	**0.72**	**0,003**	**260**	**88,92**	**123,12**	**1-5**

DESCRIPTION

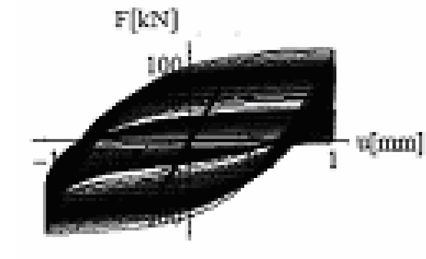
Type Mionica + is applied on brick layed buildings damaged by earthquake. This type of dumpers was widely applied in the Kolubara region, especially in Mionica.

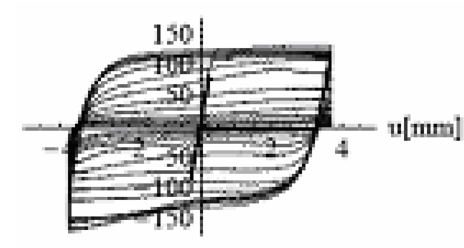
PICTURE





HYSTERESIS DIAGRAM





"X-1"

CHARACTERISTICS

TECHNICAL CHARACTERISTICS

V=65 KN, D=20 mm, L/B=200/200 mm

F (cm^2)	**ΔF** (cm^2)	**ε_y**	**f_y** (N/mm^2)	**f_y(F-ΔF)** (kN)	**f_u (F-ΔF)** (kN)	**Δ** (mm)
3,14	**0,5**	**0,003**	**260**	**63,00**	**113,4**	**1-8**

DESCRIPTION

Type X1 was developed as the first model for two-axial operation of the Institute IMS, and for overbuilding in the Knezevac city, Serbia.

PICTURE

HYSTERESIS CHARACTERISTICS

TYPE	CHARACTERISTICS	PICTURE	HYSTERESIS DIAGRAM

"KRUSEVAC"

TECHNICAL CHARACTERISTICS

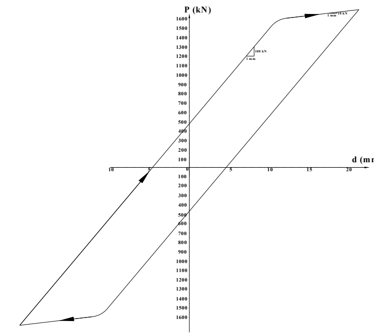
V=1.600kN, D=216*10mm, L=600 mm.

F (cm^2)	ΔF (cm^2)	ε_y	f_y (N/mm^2)	f_y(F-ΔF) (kN)	f_u (F-ΔF) (kN)	Δ (mm)
78.41	**12.50**	**0,003**	**239**	**1581.89**	**2310,34**	**1-21**

DESCRIPTION

Damper applied in Krushevac city departement store's RC frame structure.

HYSTERESIS CHARACTERISTICS



"ALŽIR"

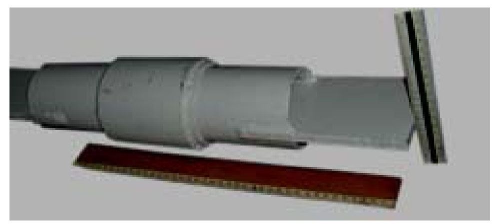
TECHNICAL CHARACTERISTICS

V=350kN, D=67.7*7.1mm, L=600 mm.

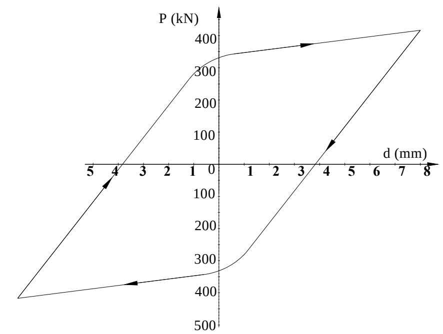
F (cm^2)	ΔF (cm^2)	ε_y	f_y (N/mm^2)	f_y(F-ΔF) (kN)	f_u (F-ΔF) (kN)	Δ (mm)
16.82	**2.84**	**0,003**	**240**	**335.48**	**490,01**	**1 – 8**

DESCRIPTION

Damper devloped for Algierian market. (for the Residency of Finish Ambassadory). It's characteristics are used from testing diagram



HYSTERESIS CHARACTERISTICS



"IRAN"

TECHNICAL CHARACTERISTICS

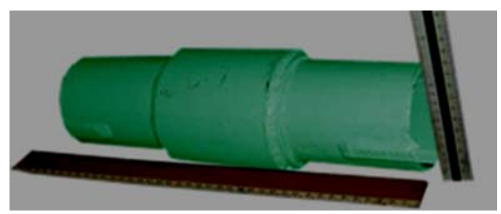
V=750kN, D=127*10mm, L=600 mm.

F (cm^2)	ΔF (cm^2)	ε_y	f_y (N/mm^2)	f_y(F-ΔF) (kN)	f_u (F-ΔF) (kN)	Δ (mm)
36.76	**6.00**	**0,003**	**240**	**738.16**	**1105,00**	**1-13**

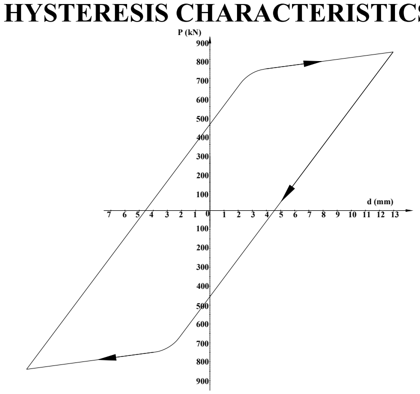
DESCRIPTION

Type of Iran was developed for the rehabilitation of unbaked clay buildings damaged by earthquake in the city of Bam in Iran.

The product was donated.



HYSTERESIS CHARACTERISTICS



TYPE	CHARACTERISTICS	PICTURE	HYSTERESIS DIAGRAM

"BAKU 1-9"

TECHNICAL CHARACTERISTICS

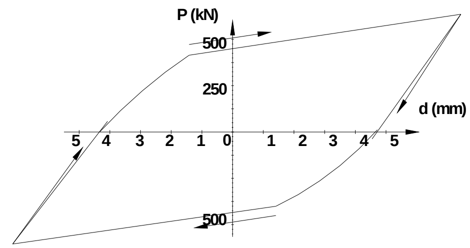
V= D=20/20 mm L=410

F (cm^2)	ΔF (cm^2)	ε_y	f_y (N/mm^2)	f_y(F-ΔF) (kN)	f_u (F-ΔF) (kN)	Δ (mm)
4,0	**1,0**	**0,003**	**260**	**78,0**	**108,0**	**1-5**

type DAMPERS	thickness	width	debilitation
BAKU t/b-s	t (mm)	b (mm)	s (mm)
20/20-15	20	20	15
20/30/22	20	30	22
20/40-30	20	40	30
30/30-22	30	30	22
30/40-30	30	40	30
30/50-38	30	50	38
30/60-46	30	60	46
30/70-54	30	70	54
40/60-46	40	60	46

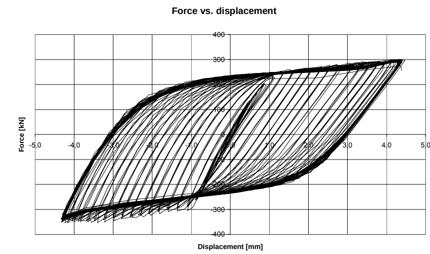
DESCRIPTION

Baku Types 1-8 represent a series of dAmpers for improved protection of valuable historical buildings. These types were developed for the rehabilitation of Presidential residence in Azerbaijan.



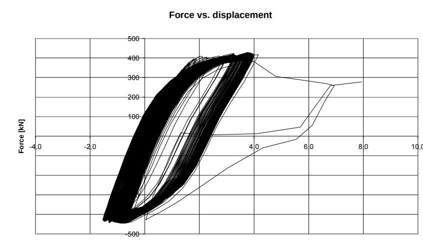
HYSTERESIS CHARACTERISTICS

BAKU 30, F-u 0-87 cik.

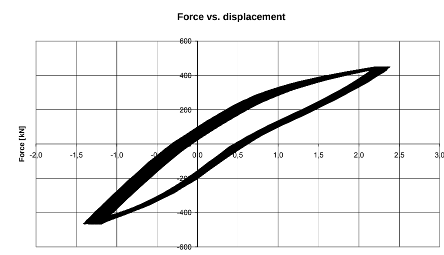


BAKU 30, F-u 88-277 cik.

BAKU50, F-u



BAKU 70



TYPE	CHARACTERISTICS	PICTURE	HYSTERESIS DIAGRAM

"CANADA HQL,HQM"

TECHNICAL CHARACTERISTICS

Canada HQ M type

V=9.4 kN, , 5x190x215, Tube - Ø 16x133mm .

F (cm^2)	ΔF (cm^2)	ε_y	f_y (N/mm^2)	f_y(F-ΔF) (kN)	f_u (F-ΔF) (kN)	Δ (mm)
0,5	**0,25**	**0,003**	**220**	**5,5**	**9,0**	**1-4**

Kanada HQ-L type

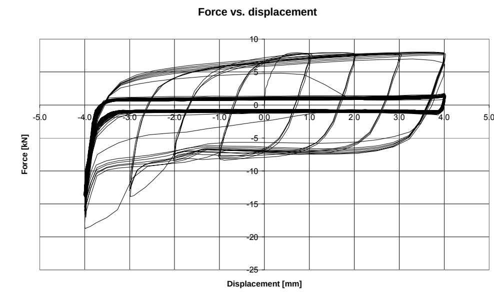
V=14.4 kN, , 5x190x215, Tube - Ø 16x133mm .

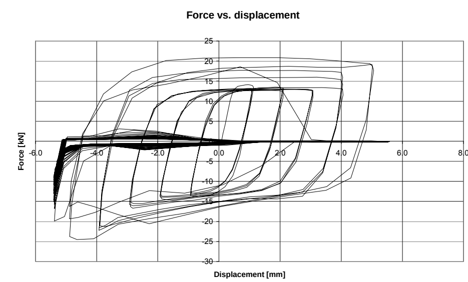
F (cm^2)	ΔF (cm^2)	ε_y	f_y (N/mm^2)	f_y(F-ΔF) (kN)	f_u (F-ΔF) (kN)	Δ (mm)
0,5	**0,125**	**0,003**	**250**	**9,9**	**13**	**1-5**

DESCRIPTION

These types were developed in cooperation with Canadian experts for strengthening of mechanical building walls.

HYSTERESIS CHARACTERISTICS





"KULA"

TECHNICAL CHARACTERISTICS

V=900kN, D=70/50 mm, L=500mm.

F (cm^2)	ΔF (cm^2)	ε_y	f_y (N/mm^2)	f_y(F-ΔF) (kN)	f_u (F-ΔF) k(N)	Δ (mm)
35,0	**7,5**	**0,003**	**260**	**715**	**990**	**20**

DESCRIPTION

It is assembled verticaly and it concts foundation socket with foundation slab of high rise buildings. It is used to receive large banding moment of the support on bad soil.

HYSTERESIS CHARACTERISTICS

"VOGZAL"

TECHNICAL CHARACTERISTICS

V=600 kN, D= 300/5mm, L= 450+1500 mm.

F (cm^2)	ΔF (cm^2)	ε_y	f_y (N/mm^2)	f_y(F-ΔF) (kN)	f_u (F-ΔF) (kN)	Δ (mm)
47,1	**12,0**	**0,003**	**240**	**842**	**1263**	**20**

DESCRIPTION

Type Vogzal was developed for the construction of a large shopping center (70,000 m^2) in Baku, the reinforced concrete structure without beams, with spans of 8.00x8.00 m and 6.00 m of floor height.

HYSTERESIS CHARACTERISTICS

TYPE	CHARACTERISTICS	PICTURE	HYSTERESIS DIAGRAM

"GROCKA"

TECHNICAL CHARACTERISTICS

V=120-250 kN kN, D=mm, L= mm.

F (cm^2)	ΔF (cm^2)	ε_y	f_y (N/m m^2)	f_y(F-ΔF) (KN)	f_u (F-ΔF) (KN)	Δ (mm)
4.14	**0.72**	**0,003**	**260**	**88,92**	**123,12**	**1-5**

DESCRIPTION

Type Grocka (120-250 kN) is applied in masonry structures. Structures stiffened like this don't need RC walls and can be combined with frame structures.Unstiffened masonry structures can not be combined with frame structures because of the different horizontal stiffness of these two types of structures.

HYSTERESIS CHARACTERISTICS

"MOST"

TECHNICAL CHARACTERISTICS

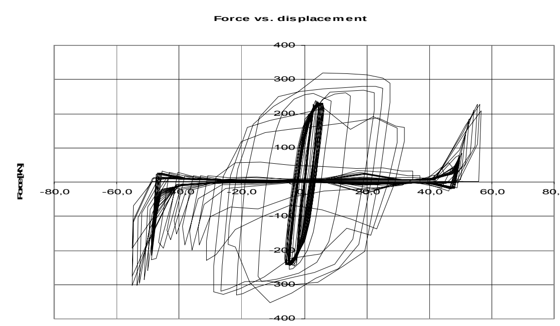
V=250-320 kN, D=100/4 mm, L=1000 mm.

F (cm^2)	ΔF (cm^2)	ε_y	f_y (N/mm^2)	f_y(F-ΔF) (kN)	f_u (F-ΔF) (kN)	Δ (mm)
12,56	**2,56**	**0,003**	**260**	**260**	**320**	**0-120**

DESCRIPTION

Type bridge is developed for connection of columns and main beams of bridge structures. This damper can allow up to 120 mm of controlled displacements.

HYSTERESIS CHARACTERISTICS



1. The facts defining damper:

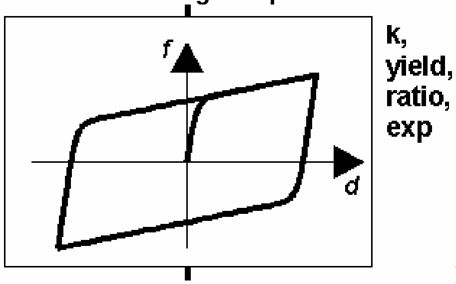


Fig1 .

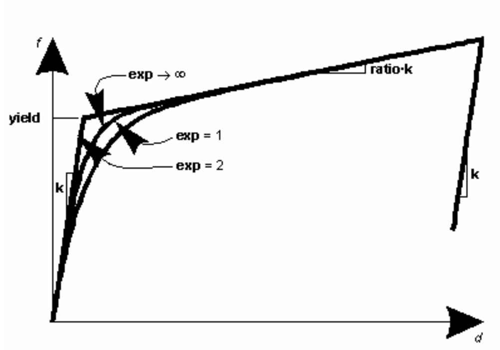


Fig . 2

- stiffness of elements - (on sketch upper right)
- limit of elasticity – yield (data na skici gore desno)
- relation of stiffness in elastic zone and after it – ratio k
- exponent by which the diagram is approximated – exp.
- (ε_{yield}, σ_{yield}) strain and stress in limit yield

Dumper type Mionica +:
k=128712.87 kN/m
yield=120 kN
ratiok=0.07769
exp=2

Fig.3. Testing at Military Institute-VTI Belgrade

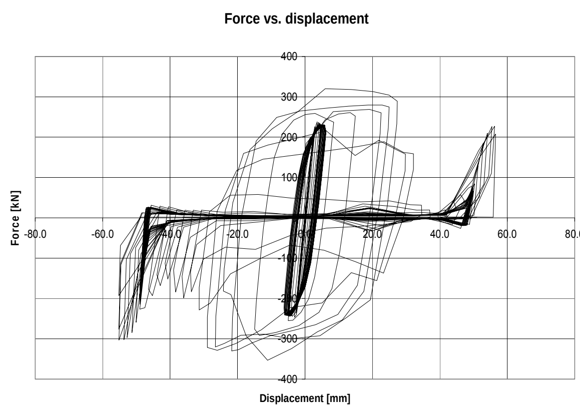


Fig.4. Force vs. displacement Diagram for DAMPERS “BRIDGE“ ℓ=1000mm . The new model of „Bridge“ type damper.

The Force vs. displacement diagram shows the two level work of the damper strengthened by +-55mm and provided with deformation control feature. Fig.6 shows the three level work of the damper in elasticity zone, in deformation control zone and in post-collapse zone with deformation and force control.

2. Dampers parameters are:
- Diametar (% reduction, minimum 20%)
- Length reduction (corresponding max strain 10%)
-Roughness of element “dog bone״
- Elements for local and gobal buckling (for work in compression, concrete, lead, aluminium plate, and element for sliding)
- C and γ –material and damper constants

The problem is how to describe histeresis loop with large displacements and in situation when the acting force is small, because the relation are not more applicable.
Hystereses loop is defined by: :
Manson-Coffine Law, (VERY LOW CYCLE FATIGUE)

- *Δεp* - the cyclic plastic strain range (accumulated strain) and
- *Nf* - the number of cycles to failure

and

- F (σ,ε), hystereses line

3. Step of dampers work:
1. $\sigma<\sigma y$ hige cycle fatige,
2. $\sigma y < \sigma < \sigma u$ love cycle fatige,
3. σ close to σu very love cycle fatige
4. ε> (5-10%) dampers work with control displacments and colaps dampers work
5. After damper colaps diagonal works in elastical area

Two line for histeresis loop diagram for dising, F (σ,ε)
1. fi(σ, ε) σ =b+k ε, (line) and (i=1…n)
2. fi(σ, ε) (σ- σ1)2+(ε- ε1)2=R2 (i=1…n)
and date for cycle fatigue (Δε, Np, ε)

SYMBOLS REGISTER

V- MAX FORCE

D-DAMPER DIAMETAR

L-LENGTH OD DAMPER

F-CROSS SECTIONAL AREA

ΔF-CROSS SECTIONAL AREA OF NECK

ε_y-YIELD STRAIN

f_y-STRESS YIELD

f_u-MAX STRESS (FAILURE)

Δ-MAX DISPLACEMENT