



SISTEM DC90

Research, Consulting, Engineering and Technology Transfer, EARETHQUAKE ENGINEERING INNOVATION CENTER BELGRADE,
E-mail: dc90@Eunet.yu www.dc90.co.yu, Smederevski put 67, tel/fax:381 11 8526663, 381 11 8526655, PIB 100132505, Matični broj:
17330314, Raiffeisenbank: 265-1100310000653-30.

DESTINATION :	CANADA HYDRO-QUEBEC Hidro Quebec Poste Mont-Royal, A/S J. Martineau 514- 232-2067, 3940 rue Jean-Talon Ouest Montreal QC CA, H3R 2G4 For clearance Mr. Jan Hebert A.W.W. Kyle Inc. 411, rue ds Recolets, RC Montreal (Quebek) H2Y 1W3 Tel (514) 289-2211, ext.3181 fax. (514) 288-9161, email. jhebert@affiliated.ca For informacion Catherine Maire 514-840-3000 poste 5409, email. cab_mtl@hydro.qc.ca
RGQ	6100169688
REQUEST OF PROPOSAL:	13843769

EXPORTER:	SISTEM DC 90, d.o.o. SMEDEREVSKI PUT STREET No 67 BELGRADE, SERBIA
COMMERCIAL NAME:	STEEL ANCOR- CONNECTOR
TECHNICAL NAME :	DAMPER - CONNECTOR DC 90 SET " CANADA HQM " TYPE
NUMBER pcs:	192
Btto:	345kg
Ntto	326kg

Documentation about quality assurance

Belgrade, 2011, december

Contents

C. Documentation about quality assurance:

1. Material Documentation
 - Attests for all built-in materials with mechanical characteristics including:
 - Metal pipes and
 - Welding electrodes
2. Documentation with proof of welder's qualification
 - Assurance of a valid completed welding exam-test
3. A statement from a responsible technical person about the control of all phases during manufacture.
4. Documentation about testing of the finished product with all the necessary diagrams and comments including:
 - -force-displacement diagram (histereses diagram)
5. Photo documentation

Trade name:

Metal Anchor-connector

Technical Name:

Damper-connector DC 90 sets („Canada HQ M“type)

CUSTOMER ORDER

The Customer (HYDRO-QUEBEC) ordered to conduct the dynamic loading test on type “Kanada HQM” damper (the absorber of seismic energy developed by “SYSTEM DC90”) according to the Test Program. The testing results of the delivered specimen should meet the quality requirements in the aspect of the energy damping.

TESTING PROCEDURE

The testing is performed by means of AFS Servo-controlled Hydraulic System, Figure 1. The edges of the testing specimen are fixed by the jaw clutches designed for the round specimens, thus the influence of the deformations virtually has no effect on the testing results.



Figure 1. AFS, Servo-controlled Hydraulic System

The maximum range of the system is $\pm 20\text{kN}$. The System works in the following modes:

- Force (energy) control mode,
- Strain control mode,
- Actuator step control mode.

The testing is performed in the displacement control mode (the deformation of the testing specimen). In advance defined testing mode was input in PDP PC program, while the sinuous alteration of dislocation is realized by function generator. The recorded data (the values of the force and actuator step) measured by AFS System are transmitted to PC through A/D converter.

Microsoft EXCEL software has been used to process the obtained measured data.

The testing started at 0.5 Hz frequency level, the data acquisition frequency was 100 samples per second.

1. Material Documentation

Attests for all built-in materials with mechanical characteristics including:
Metal pipes and
Welding electrodes



U.S.S. Steel BSRDA S.p.A.
Tržišnice, 51200 Smederevo
Republic of Serbia

INSPECTION CERTIFICATE 3.1 acc EN 10204:2004

- uverenje o ispitivanju -



06
0045

PURCHASER: ARCELORMITTAL DISTRIBUTIO
(kupac) NOVI BEOGRAD
MILUTINA MILANKOVICA 25B
CERTIFICATE No: 6804
(uverenje broj)
UGOVOR KUPCA
TRADING CO: ARCELORMITTAL DISTRIBUTIO
(izvoznik, primalac) NOVI BEOGRAD
MILUTINA MILANKOVICA 25B
CONTRACT No: 20-01/2011
(ugovor broj)
T: HR+CE
PRODUCT: HOT ROLLED SHEET
(proizvod) - EN 10051 CLASS A
DIMENSIONS: 3,000 X 1500 X 3000
(dimenzije, mm) PAGE No: 3
(strana br)
QUALITY: S235JR / EN 10025-2/2004
(kvalitet) DATE OF ISSUE 01/02/2011
(datum izdavanja)
Net Weight (kg): 21910
Transport: PO401751
DELIVERY CONDITIONS: AR
(STANJE ISPORUKE)

MECHANICAL PROPERTIES - MEH. TEH. OSOBINE													
COIL No. / Heat No.	Y	T	R _m	R _{p0.2}	R _{p0.01}	A	Impact test	Bend	Hardness	Weld	Heat	Hardness	Weld
PACK No.	Y	T	R _m	R _{p0.2}	R _{p0.01}	A	Hv	test	(tvrdoća)	test	test	(tvrdoća)	test
PARCEL No.	Y	T	R _m	R _{p0.2}	R _{p0.01}	A	(Elavost)	test	test	test	test	test	test
	Y	T	R _m	R _{p0.2}	R _{p0.01}	A	(mg, Sr, Vr, f, l, z, j, s, i)	test	test	test	test	test	test
	Y	T	R _m	R _{p0.2}	R _{p0.01}	A	MPa, MPa, f, l, z, j, s, i	test	test	test	test	test	test
	Y	T	R _m	R _{p0.2}	R _{p0.01}	A	MPa, MPa, f, l, z, j, s, i	test	test	test	test	test	test
N52806	124207	310	400	277	43								Y
N52807	124207	310	400	277	43								Y

CHEMICAL COMPOSITION - HEMIJSKI SASTAV (%)													
HEAT No.	C	Mn	Si	P	S	Al	Cu	Cr	Ni	Mo	Ti	V	Nb
Serija	C	Mn	Si	P	S	Al	Cu	Cr	Ni	Mo	Ti	V	Nb
br	X 100	X 100	X 100	X 100	X 100	X 100	X 100	X 100	X 100	X 100	X 100	X 100	X 100
124207	0.46	0.08	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
124207	0.46	0.08	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

We hereby declare that above mentioned products were manufactured in accordance with specifications and contract requirements.

U. S. S. Serbia, d.o.o.
QA - Odeljenje za ateste
AQ - 06
11300 Smederevo

QUALITY ASSURANCE
OBEZBEDJENJE KVALITETA



Radnas, 11000 Smederevo

Serbia

Tel: +381-26-226 116

+381-26-221 510

INJECTION CERTIFICATE (ukr.) (ukr.) (ukr.)

(ukr.) (ukr.) (ukr.)

PURCHASER: ANONIMIZIRAN DISTRIBUTIO
(ukr.) (ukr.)

NOVI BEGRAD

MILUTINA MILANOVICA 75R

TRADING CO: ANONIMIZIRAN DISTRIBUTIO

(ukr.) (ukr.) (ukr.) NOVI BEGRAD

MILUTINA MILANOVICA 75R

PRODUCT: HOT ROLL SHEET

(ukr.) (ukr.)

DIMENSIONS: 6,000 X 1500 X 0,000

(ukr.) (ukr.) (ukr.)

QUALITY: S235JR

(ukr.) (ukr.)

Net Weight (kg): 17,290

DELIVERY CONDITIONS: A6

(ukr.) (ukr.)

CERTIFICATE No: 1007

(ukr.) (ukr.)

ISSUED BY: UKRMIL KUPCA

CONTRACT No: 143-03/011

(ukr.) (ukr.)

To: UKRMIL

- EN 10029 CLASS A

PAGE No: 1

(ukr.) (ukr.)

DATE OF ISSUE: 24/03/2011

(ukr.) (ukr.)

Transpor: 01/08/2011

MECHANICAL PROPERTIES - MEH. TEH. OSOBINE													
HEAT No.	Heat No.					Impact test		Bend	Hardness	Tensile			
PACK No.	Heat No.	Re	ReL	ReH	RA	Kv	Charpy	Test	(HRC)	Rm	Ym	TS	TS
(ukr.) (ukr.)	(ukr.) (ukr.)	MPa	MPa	MPa	%	J	(J/cm²)			MPa	MPa	MPa	MPa
N63698	N64578	287	430	467	39								Y
N63699	N64578	287	430	467	39								Y

CHEMICAL COMPOSITION - HEMIJSKI SASTAV (%)													
HEAT No.	Heat No.	C	Mn	Si	P	S	Al	Ca	Cr	Ni	Mo	Ti	V
(ukr.) (ukr.)	(ukr.) (ukr.)	%	%	%	%	%	%	%	%	%	%	%	%
N64578	N64578	13	82	10	13	12	43	5	3	2	2	1	2
N64578	N64578	13	82	10	13	12	43	5	3	2	2	1	2

We hereby declare that above mentioned products were manufactured in accordance with specifications and contract requirements.

QUALITY ASSURANCE
OSIGURANJE KVALITETA

FERROMORAVIA, s.r.o

Tovární 1688, 686 02, Staré Město

DIČ: CZ63480085 IČO: 63480085

OR: Krajský soud v Brně, spis.zn. C 20789 dne 29.9.1995

Inspekční certifikát**Inspection certificate 3.1**

ČSN EN 10204/3.1

Číslo: /No.:

137264



Předmět / Object	COLD-DRAWN ROUND STEEL BAR 014.00	
Rozměr / Dimensions	014.00 h9 3000+100-0	
Jakost / Quality	S355J2G3C	
Dle norem / Standart	EN 10278	N 10277-2
Objednávka / Order No.	41099220/00302	
Zakázka č. / Internal Order No.	9920022236	
Dodací list č. / Advice note	809001020	5908003123
Auto / Truck No.	CZ 4T30970 2T38668	
Množství / Total	0,000	
Váha / Totalweight	1,020	T

Mechanické vlastnosti / Mechanical values		(1MPa=1 N/mm ²)	
Vzorek č. / Probe No.	2071550		Hodnota / Value
Rp02 (MPa)	Yield point		524,0000
Rm (MPa)	Tensile strenght		672,0000
A5(%)	Allongation		13,0000

Chemické složení / Chemical Composition		
Tavba č. / Cast No.	30318	Hodnota / Value
(Tavbová analýza - Cast Analysis)		
C%		0,1600
P%		0,0150
S%		0,0090
Mn%		1,3200
Si%		0,3600
Cu%		0,0900
Al%		0,0240
Ti %		0,0027
CEQ %		0,4000

Vyřízení zakázky vyhovuje stanoveným požadavkům.

Dodržena radioizotopická aktivita taveb. vzorku - max. 100 BQ/KG.

We hereby certify that material describe above complies with the terms of the contract.

The radioisotopic activity of melting sample is compliance - max. 100 BQ/KG.

Staré Město

08.09.2008

FERROMORAVIA s.r.o.
Tovární 1688
686 02 Staré Město**FORRO**

atestace





U. S. Steel Serbia, d.o.o.
Goranska 12, 11000 Smederevo
Serbia
Tel.: +381-26-226 116
+381-26-221 619

INSPECTION CERTIFICATE 3.1 acc EN 10204:2004
- uverenje o ispitivanju -

CERTIFICATE No: 89643
(uverenje broj)

CONTRACT No. 63/03-2007
(ugovor broj.)

T: CR
- EN 10131 /1992

PAGE No: 2
(strana br)

DATE OF ISSUE 26/04/2007
(dat. izdavanja)

Transport: PA983393130PA

PRODUCT: COLD ROLLED COILS

(proizvod)

DIMENSIONS: 1,250 X 1880 X

(dimenzije, mm)

QUALITY: DC 01

/ EN 10130/91+A1/98

(kvalitet)

Net Weight (kg): 8310

		MECHANICAL PROPERTIES - MEH. TEH. OSOJINE											
COIL No,	HEAT No											r	n
PACK No,	Marka br.												
(otpor br.		Re	Rm	Re/	A	Elong	test	izv.	Hardness			nađ.	pro.
paket br)				Rm/gati	8	on			(tyrdopa)				
		2	2										
		N/mm	N/mm		%	180	mm	HRB	HRC	HR30T			
464769	828928	253	334	0,75	42								Y


		CHEMICAL COMPOSITION - HEMIJSKI SASTAV (%)													
HEAT No	Marka	C	Mn	Si	P	S	Al	Cu	Cr	Ni	Mo	Ti	V	Nb	N
br		X 100			X 1000			X 100				X 1000			
828928	B	38	7	7	6	34	2	1	1	<1	<1	<1	<1	4	2

We hereby declare that above mentioned products were manufactured in accordance with specifications and contract requirements.

QUALITY ASSURANCE
OBEZBEDJENJE KVALITETA

100-10013

11664

 IGM-TRADE lija i dr.DOO Profile and Pipe factory Industrijska 2 1430 Kavadarci R.Macedonia	Сертификат 2.2	ФМ 7.2/02
	Certificate 2.2	EN 10204:2004
	Нарачка број/Order No.	Пратка број/Delivery No 1112*63
	Купувач/ Buyer JEEP COMMERCE BEOGRAD, SRBIJA	
DATE:26.08.2008 1430 KAVADARCI, R.MACEDONIA		DATE:09.04.2010 1430 KAVADARCI, R.MACEDONIA
Опис на производот/Product description CFR(C)HS, Cold formed	Обележување/Marking	Стандард/Standard EN10219 ; EN 10217
Маркирање на производот/Product marking S235JR. EN 10219/1+2 ; EN 10217	Материјал/Material S235JR	

Испорака/Delivery:

Ознака Marking	Димензии(mm) Dimensions(mm)	Кол./теж. Lot/Weight	Материјал Base material	Стандард Standard	Шаржа Heat No.
	120x120x5. / 12000mm	32pcs/4915kg	S235JR	EN10219	266558
	Fi 21.3x2.3 / 6000mm	271pcs/1760kg	S235JR	EN10217	355518
	Fi 21.3x2.5 / 6000mm	424pcs/3145kg.	S235JR	EN10219	146470
	Fi 26x2.8 / 6000mm	97pcs/1305kg.	S235JR	EN10217	145626
	Fi 26.9x2.8 / 6000mm	79pcs/900kg	S235JR	EN10217	145626
	Fi 33.7x3.0 / 6000mm	169pcs/2200kg.	S235JR	EN10217	723856
	Fi 48x2.5 / 6000mm	91pcs/1575kg	S235JR	EN10217	146470
	120x60x5.0 / 6000mm	24pcs/2160kg.	S235JR	EN10219	721886
	120x80x5.0 / 6000mm	20pcs/1720kg	S235JR	EN10219	721886
	Zp 1004x1.8/6000mm	240pcs/4135kg	S235JR	EN10219	986819
	18x18x1.5/6000mm	300pcs/1305kg	S235JR	EN10219	917910

Хемиски состав/Chemical composition %

Шаржа. Heat No.	10 ⁻² C	10 ⁻² Si	10 ⁻² Mn	10 ⁻³ P	10 ⁻³ S	10 ⁻³ Al	10 ⁻³ N	10 ⁻² Cr	10 ⁻³ Ti	10 ⁻² Ni
266558	13	2	45	12	8	35	4			
355518	15	2	43	10	12	46	7			
146470	14	2	44	14	14	32	5			
145626	13	2	47	13	11	44	5			
723856	13	2	53	20	10	40	8			
713643	12	2	50	11	11	46	7			
986819	10	2	42	20	12	43	6.8			
917910	9.5	3	43	15	8	48	6.6			

Механичко/технолошки карактеристики/ Mechanical/technological properties:

Test na isteganje/Tensile test						
Ознака/Marking	Шаржа Heat No.	R _{eh} [N/mm ²]	R _m [N/mm ²]	A [%]	Бр. на тест	
	266558	286	409	31.3	1	
	355518	307	443	31.0	1	
	146470	280	406	31.5	1	
	145626	295	417	32.5	1	
	723856	298	412	30.0	1	
	713643	288	412	32.0	1	
	986819	298	414	30	2	
	917910	340	408	30	1	



TEM DC 90
 rando za laboratorijske, kontrolne
 i testne tehnologije

elektrode-jesenice

ELEKTRODE JESENICE, d.o.o.
 Često telefonirajte: 01-4276 Jesenica
 Tel: +386 (0)4 584 19 02
 Fax: +386 (0)4 584 14 42
 e-mail: elektrode@elektrode.si
 www.elektrode.si

Kupac / Buyer / Purchaser
 HUVEX BMD
 PLE KOVACIJA P/H
 11000 BEOGRAD
 SRBIJA

Potrdilo o kvalitati / Werkszeugnis / Test report

Redni broj / No. 71-09-00589

ISO 10204 2.2 Datum / Datum / Date 28.04.09

Naredba / Bestellung / Order No.

Količina / Quantity

Specifikacija / Specification

Opis / Description / Delivery Note

Opis / Description / Delivery Note

71-09-00589

Mehanička ispitivanja / Mechanical Eigenschaften / Mechanical properties

GLATKA VARA

Dr. št. / Sample No.	Tip / Design	Profil / Profile	Debljina / Thickness	Čvrstoća / Strength	Čvrstoća / Strength	Čvrstoća / Strength	Čvrstoća / Strength	Čvrstoća / Strength	Čvrstoća / Strength
779210	2.556.3	VAC 40	0.50	54.8	130-150	122	147	147	147
779211	2.100.4	VAC 40	0.50	54.8	130-150	122	147	147	147
601857	2.100.5	VAC 40	0.50	54.8	130-150	122	147	147	147
779212	1.080.0	VAC 40	0.80	54.8	130-150	122	147	147	147

Kemijska analiza / Chemische Zusammensetzung / Chemical Composition

Dr. št. / Sample No.	Tip / Design	Profil / Profile	Debljina / Thickness	Čvrstoća / Strength	Čvrstoća / Strength	Čvrstoća / Strength	Čvrstoća / Strength	Čvrstoća / Strength	Čvrstoća / Strength
779210	VAC 40	0.50	0.50	3.50	14.821	13.021			
779211	VAC 40	0.50	0.50	3.50	14.821	13.021			
601857	VAC 40	0.50	0.50	3.50	14.821	13.021			
779212	VAC 40	0.80	0.80	3.50	14.821	13.021			

SI

10



ZAVOD ZA ZAVARIVANJE, A.D.
INSTITUT DE SOUDURE - WELDING INSTITUTE



11050 BEOGRAD, Grčica Milenka 67

tel: 011/2851-079,

fax: 2850-648,

e-mail: office@zzz.co.rs,

www.zzz.co.rs

IZVEŠTAJ O ISPITIVANJU PENETRANTIMA
PENETRANT TEST REPORT

Izdaje: ZAVOD ZA ZAVARIVANJE - LABORATORIJA
Issued by: WELDING INSTITUTE - LABORATORY

Datum izdavanja: 22.11.2011.
Date of issue:

Broj:
No.: 113.166

Strana: 1 od 1
Page: of

Naručilac:

Customer:

Zahtev naručioca:

Order No.:

Predmet ispitivanja:

Object to be tested:

SISTEM DC 90 Co.Ltd. INNOVATION CENTER BELGRADE - Beograd, Palmira Toljatija br. 19/13

od 03.11.2011.

Mesto ispitivanja:

Testing place:

Zavod za zavarivanje

- Beograd

Radni nalog br.:

Job order No.:

1.1.026

ISPITIVANJE UZORKA br. 20 UREDAJA KANADA HQL

PODACI O DELU KOJI SE ISPITUJE / DETAILS OF THE TEST ITEM

Oznaka / fabr. br.:	br. 20	Datum prijema uzorka:	18.11.2011.	Interna oznaka:	/
Identifikacija:		Date of receipt:		Internal designation:	
Materijal/Standard:	/	Mere (mm):	/	Crtež broj:	/
Material/Standard:		Dimensions (mm):		Drawing No.:	
Stanje izrade:	/	Postupak zavarivanja:	/	Termička obrada:	/
Fabrication state:		Welding process:		Heat treatment:	
Radna temperatura:	/	Radni pritisak:	/	Vreme eksploatacije:	novo
Working temperature:		Working pressure:		Service period:	

PODACI O POSTUPKU ISPITIVANJA / TEST PROCEDURE

Datum ispitivanja:	18.11.2011.	Metoda ispitivanja:	SRPS EN	Obim ispitivanja:	100%
Test date:		Test method:	571 - 1 : 2005	Scope of testing:	
Priprema površine:	čeličnom četkom	Pribor:	/	Ispitna strana:	spoljašnja
Surface preparation:		Accessories:		Outside/Inside surface:	
Temp. površ./okoline:	15°C	Vreme penetriranja:	20 min.	Odstranjiv, viška penetr.:	vodom, čistačem
Surface/Ambient temp.:		Penetration time:		Excess penetrant removal	
Vreme emulgovanja:	/	Sušenje:	na vazduhu	Vreme razvijanja:	15 min.
Emulsifying time:		Drying:		Development time:	
Osvetljenje:	prirodno	Uslovi posmatranja:	okom	Naknadno čišćenje:	/
Illumination:		Viewing conditions:		Postcleaning:	
Napomena:	/				
Note:					

PENETRANTSKI SISTEM / PENETRANT SYSTEM

Penetrant	Tip	Oznaka	Proizvođač	Način nanošenja
Penetrant	tip III	MR 68C	"MR - CHEMIE" - Nemačka	sprej boca
Odstranjivač	metoda "C"	MR 79	"MR - CHEMIE" - Nemačka	sprej boca
Remover				
Razvijatelj	vrsta "d"	MR 70	"MR - CHEMIE" - Nemačka	sprej boca
Developer				

KRITERIJUM PRIHVATLJIVOSTI / ACCEPTANCE CRITERIA

Nivo kvaliteta: SRPS EN ISO 5817
Quality level:

Nivo prihvatljivosti:

Acceptance level:

SRPS EN 1289

REZULTATI ISPITIVANJA / RESULTS OF EXAMINATION

Ispitano Tested	Vrsta spoja Weld type	Zavarivač Welder No.	Nalaz broj Indication No.	Parametri nalaza/Indication parameters					Zadovoljava Acceptable	Ne zadovoljava Not accepted	Napomena Note
				Indikacija Indication	Pozicija Position	Dužina Length	Dubina Depth	Položaj Location			
br. 20	FW	/	1	pore Ø 2 mm; loš nastavak; zajedni	/	/	/	MŠ	X		

*) OM - osnovni materijal/parent material; MŠ - metal šava/weld metal; ZUT - zona uticaja toplote/heat-affected zone; K - koreni zavar/root run; SZ - stranica zljeba/fusion face; N - navareni sloj/surfaced layer

Napomena / Note:

MIŠLJENJA I TUMAČENJA / OPINIONS AND INTERPRETATIONS

Ispitao / Operator

Miroslav Crnokrak, dipl.ing.

Ovećio / Verified by

Željko Reljić, dipl.ing.

Odobrio / Approved by

Vladimir Vuković, dipl.ing. EWE, IWI-C

Rezultati ispitivanja se odnose samo na ispitani uzorak. Ovaj izveštaj se ne sme reprodukovati, izuzet u celosti, bez pismene saglasnosti laboratorije Zavod za zavarivanje. The results relate only to the items tested. The test report shall not be reproduced except in full, without written approval of the laboratory of Zavod za zavarivanje.

OB-LAB-18 Rev 1



INTERNATIONAL INSTITUTE OF WELDING
A world of joining experience

16.12.11
17.



ZAVOD ZA ZAVARIVANJE, A.D.
INSTITUT DE SOUDURE - WELDING INSTITUTE



11050 BEOGRAD, Grčiča Milenka 67

tel: 011/2851-079,

fax: 2850-648,

e-mail: office@zzz.co.rs,

www.zzz.co.rs

IZVEŠTAJ O METALOGRAFSKOM ISPITIVANJU

METALOGRAPHY TEST REPORT

Izdaje: ZAVOD ZA ZAVARIVANJE – LABORATORIJA
Issued by: WELDING INSTITUTE – LABORATORY

Datum izdavanja: 16.12.2011.
Date of issue:

Broj: 122.108

Strana: 1 od 2
Page: of

Naručilac:
Customer:

„SISTEM DC 90” - Beograd

Zahtev naručioca:
Order No.:

zahtev od 03.11.2011.

Mesto ispitivanja:
Testing place:



Radni nalog br.:

1.2.025

Predmet ispitivanja:
Object to be tested:

UZORAK ZA PROVERU MAKROSTRUKTURE UGAONOG SPOJA

PODACI O PREDMETU ISPITIVANJA / DETAILS OF THE TEST ITEM

Oznaka / fabr. br.:	/	Interna oznaka:	823
Identification:	/	Internal designation:	/
Osnovni materijal:	/	Dodatni materijal:	/
Parent material:	/	Filler material:	/
Datum prijema uzorka:	08.12.2011.	Mere (mm):	/
Date of receipt:	/	Dimensions (mm):	/
Postupak zavarivanja:	/	Položaj zavarivanja:	/
Welding process:	/	Welding position:	/
Termička obrada:	/	Vreme eksploatacije:	/
Heat treatment:	/	Service period:	/
		Crtež br.:	/
		Drawing No.:	/
		Vrsta spoja:	FW
		Weld type:	/
		Radna temp. / pritisak:	/
		Working temp. / pressure:	/

PODACI O POSTUPKU ISPITIVANJA / TEST PROCEDURE

Datum ispitivanja:	14.12.2011.	Vrsta ispitivanja:	makro	Metoda:	SRPS EN 1321:2007
Test date:	/	Type of examination:	/	Procedure:	/
Uzorkovanje:	prema zahtevu	Priprema površine:	brušenje	Ispitna strana:	poprečni presek
Sampling:	Naručioca	Surface preparation:	/	Testing surface:	/
Nagrizanje:	nital	Vreme nagrizanja:	15"	Uvećanje:	/
Etching:	/	Etching time:	/	Magnification:	/

TEHNIČKI PODACI / TECHNICAL DATA

Uređaj:	Lupa: x 12,5	Pribor:	oprema za metalografsku pripremu
Device:	/	Accessories:	/

REZULTATI ISPITIVANJA / EXAMINATION RESULTS

MAKROSTRUKTURNA ANALIZA

UZORAK BR. 823

Na fot.1 i fot.2 i fot.3 prikazana je makrostruktura ugaono zavarenog spoja. Uvarivanje u osnovni materijal cevi i lima je zadovoljavajuće, s tim da je na preseku III sa jedne strane ugaonog spoja konstatovan preveliki provar u materijal cevi, fot.3. Debljina ugaonog šava se kreće u granicama $a = 1,5 \text{ mm}$ do $a = 2,0 \text{ mm}$. Nisu uočene makro greške tipa prslina i uključaka.

Ispitao / Operator

Vladan Jerečić, dipl. ing. IWE



Odobrio / Approved by

Vladimir Vuković, dipl. ing. EWE, IWI-C

Rezultati ispitivanja se odnose samo na ispitani uzorak. Ovaj izveštaj se ne sme reprodukovati, izuzev u celosti, bez pismene saglasnosti laboratorije Zavoda za zavarivanje.
The results relate only to the items tested. The test report shall not be reproduced except in full, without written approval of the laboratory of Zavod za zavarivanje.

OB-LAB-10 Rev 1



INTERNATIONAL INSTITUTE OF WELDING
A world of joining experience

16.12.2011.
D.2.



ZAVOD ZA ZAVARIVANJE, A.D.
INSTITUT DE SOUDURE - WELDING INSTITUTE



11050 BEOGRAD, Grčica Milenka 67

tel: 011/2851-079,

fax: 2850-648,

e-mail: office@zzz.co.rs,

www.zzz.co.rs

IZVEŠTAJ O METALOGRAFSKOM ISPITIVANJU
METALOGRAPHY TEST REPORT

Izdaje: ZAVOD ZA ZAVARIVANJE - LABORATORIJA
Issued by: WELDING INSTITUTE - LABORATORY

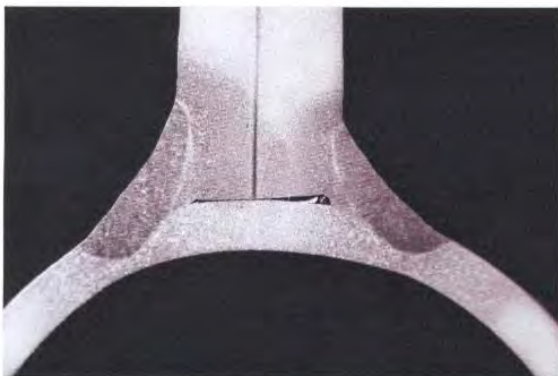
Datum izdavanja: 16.12.2011.
Date of issue:

Broj: 122.108
No.:

Strana: 2 od 2
Page: of

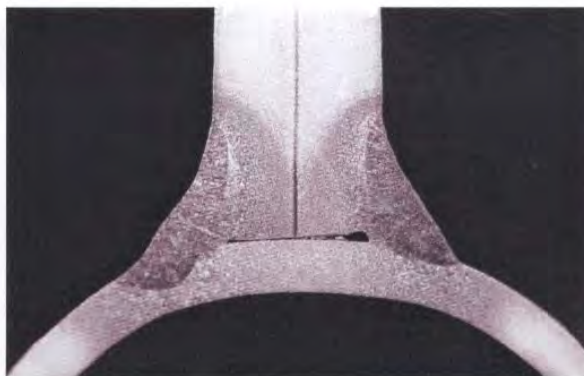
UZORAK BR. 823

presek I



fot.1

presek II



fot.2

presek III



fot.3





ZAVOD ZA ZAVARIVANJE, A.D.
INSTITUT DE SOUDURE - WELDING INSTITUTE



11050 BEOGRAD, Grčica Milenka 67

tel: 011/2851-079,

fax: 2850-648,

e-mail: office@zzz.co.rs,

www.zzz.co.rs

IZVEŠTAJ O VIZUELNOM PREGLEDU
VISUAL TEST REPORT

Izdaje: ZAVOD ZA ZAVARIVANJE - LABORATORIJA
Issued by: WELDING INSTITUTE - LABORATORY

Datum izdavanja: 22.11.2011.
Date of issue:

Broj: 111.384
No.:
Strana: 1 od 1
Page: of

Naručilac:

Customer:

Zahtev naručioca:

Order No.:

Predmet ispitivanja:

Object to be tested:

SISTEM DC 90 Co.Ltd. INNOVATION CENTER BELGRADE - Beograd, Palmira Toljatija br. 19/13

od 03.11.2011.

Mesto ispitivanja: Zavod za zavarivanje
Testing place: - Beograd

Radni nalog br.: 1.1.026
Job order No.:

VIZUELNI PREGLED 20 UZORAKA UREDAJA KANADA HQL

PODACI O PREDMETU ISPITIVANJA / DETAILS OF THE TEST ITEM

Oznaka / fabr. br.: Identification:	od br. 1 do br. 20	Datum prijema uzorka: Date of receipt:	18.11.2011.	Interna oznaka: Internal designation:	/
Materijal/Standard: Material/Standard:	/	Mere (mm): Dimensions (mm):	/	Crtež broj: Drawing No.:	/
Stanje izrade: Fabrication state:	/	Izolacija: Insulation:	/	Termička obrada: Heat treatment:	/
Postupak zavarivanja: Welding process:	/	Vrsta spoja: Weld type:	FW	Položaj zavarivanja: Welding position:	/
Dodatak na koroziju: Corrosion allowance:	/	Vreme eksploatacije: Service period:	novo	Radna temp. / pritisak: Working temp. / pressure:	/

PODACI O ISPITIVANJU / TEST PROCEDURE

Datum ispitivanja: Test date:	18.11.2011.	Ispitna strana: Outside/Inside surface:	spoljašnja	Osvetljenje: Illumination:	dnevno
Metoda: Procedure:	SRPS EN 970 : 2003	Priprema površine: Surface preparation:	čeličnom četkom	Korišćena oprema: Equipment used:	/
Obim ispitivanja: Scope of testing:	100%	Pribor: Accessories:	/	Napomena: Note:	/

REZULTATI ISPITIVANJA / RESULTS OF EXAMINATION

Na ugaono zavarenim spojevima na komadima označenim sa brojem 1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14 i 18 nisu konstatovani nalazi.
Na komadu br. 2 konstatovane su dve pore Ø 1 mm.
Na komadu br. 20 konstatovane su dve pore Ø 2 mm, loš nastavak i zajed.
Na komadu br. 9 konstatovano je neravnomerno lice šava i zajed.
Na komadu br. 15 konstatovan je loš nastavak i zajed.
Na komadu br. 16 konstatovan je loš nastavak i zajed.
Na komadu br. 17 konstatovani su zajed.

MIŠLJENJA I TUMAČENJA / OPINIONS AND INTERPRETATIONS

Ispitao / Operator
Miroslav Cmokrak, dipl.ing.

Overio / Verified by
Željko Reljic, dipl.ing.



Odobrio / Approved by
Vladimir Vuković, dipl.ing. EWE, IWI-C

Rezultati ispitivanja se odnose samo na ispitani uzorak. Ovaj izveštaj se ne sme reprodukovati, izuzev u celosti, bez pismene saglasnosti laboratorije Zavod za zavarivanje.
The results relate only to the items tested. The test report shall not be reproduced except in full, without written approval of the laboratory of Zavod za zavarivanje.

OB-LAB-15 Rev 1



INTERNATIONAL INSTITUTE OF WELDING
A world of joining experience

16.12.11
10

2.Documentation with proof of welder's qualification
Assurance of a valid completed welding exam-test



ZAVOD ZA ZAVARIVANJE A.D.
INSTITUT DE SOUDURE - WELDING INSTITUTE

11127 BEOGRAD, Grčica Milenka 67, tel: 011/2851-079, fax: 2850-648, e-mail: office@zzz.co.rs www.zzz.co.rs

UVERENJE O STRUČNOJ OSPOSOBLJENOSTI ZAVARIVAČA
Welder Approval Test Certificate

Oznaka: EN 287-1:2008 141 T BW 6 S t4.0 D108 H-L045 ss nb
Designation: EN 287-1:2008 111 T BW 6 B t6.0 D108 H-L045 ss mb

Proizvođačka WPS (ako je primenjiva):

Manufacturer's WPS (if applicable):

Ime i prezime zavarivača: **MILAN (Dobrivoje) GRUJČIĆ**

Welder's name:

Identifikacija: **1612977771012**

Identification:

Datum i mesto rođenja: **16.12.1977. Valjevo**

Date and place of birth:

Poslodavac: **Lično**

Employer:

Pravilo / standard: **SRPS EN 287-1:2008**

Code / Testing Standard:

Poznavanje struke: **Nije ispitano**

Job knowledge: **Not tested**

Broj: **1071/10**

Number:

Žig zavarivača:

Welder's brand:

Isprava identifikacije: **JMBG**

Method of identification:

Fotografija
(ako se zahteva)
Photograph
(if required)

	Podaci o ispitnom uzorku Weld test details	Područje odobrenja Range of approval
Postupak zavarivanja / Welding process	141 T 111	141 T,P 111
Uim ili cev / Plate or pipe	BW	BW,FW
Tip spoja / Joint type	6	1.1,1.2,1.3,1.4,2,3,4,5,6,7,9,11
Grupa(e) osnovnog materijala / Parent metal group(s)	S B	S,M A,B,RA,RB,RC,RR,R
Dodatni materijal/Oznaka / Filler metal type/Designation	EN439-11	EN439-11
Zaštitni gas / Shielding gas		
Pomoćni materijal / Auxiliaries		
Debljina materijala (mm) / Test piece thickness (mm)	4 6	3 mm do 8 mm ** 3 mm do 12 mm **
Spoljni prečnik cevi (mm) / Pipe outside diameter (mm)	108	>= 54 mm
Položaj zavarivanja / Welding position	H-L045	H-L045,PA,PC,PF,PE,PB,PD
Žljebljenje/podloška // Gouging / backing	ss , nb ss , mb	ss nb,ss mb,bs ss mb,bs FW:sl,ml

** Područje odobrenja za kombinaciju / Range of approval for combination 141/ 111 t= 10.00 3 mm do 20 mm

Vrsta ispitivanja Type of test	IZVRŠENO I PRIHVATLJIVO Performed and acceptable	NE ZAHTJEVA SE Not required
Vizuelno / Visual	X	-
Radiografijom / Radiography	X	-
MP - PT / MT - PT	-	X
Makrostrukturno / Macro	-	X
Prelomom / Fracture	-	X
Savijanjem / Bend	-	X
Dodatna ispitivanja* / Additional tests*	-	X

*) Priložiti poseban list, ako je potrebno / Append separate sheet if require

Ispitno telo: Zavod za zavarivanje a.d. Beograd
Examination body:

Ispitivač / Examiner: **Overava / Approved**

(Signature) *(Signature)*
Z. Tasić dipl.ing. IWE B. Sofronić dipl.ing. EWE, IWI

Datum izdavanja: **02.11.2010.**

Date of issue:

Mesto: **Beograd**

Location:

Uverenje važi do: **25.10.2012.**

Validity of approval until:

Produženje uverenja od strane poslodavca/koordinatora za 6 mes.

Prolongation for approval by employer/coordinator for the following 6 months:

Datum Date	Potpis Signature	Funkcija Position or title

Produženje uverenja od strane ispitnog tela za 2 godine.

Prolongation for approval by examiner or examination body for following 2 years.

Datum Date	Potpis Signature	Funkcija Position or title



ČLAN MEĐUNARODNOG INSTITUTA ZA ZAVARIVANJE
MEMBRE DE L'INSTITUT INTERNATIONAL DE SOUDURE
MEMBER OF THE INTERNATIONAL INSTITUTE OF WELDING

3. A statement from a responsible technical person about the control of all phases during manufacture.

Descriptions for manufacturing processes of Damper type **HQM**

1. Aquisition and transportation of all materials; steel tubes and tin, lead, paints, packaging polystirl etc.
2. Marking, measuring, and cutting the material to fit the dimensions within the required tolerance for each element separately in accordance with technical specifications and normatives.
3. Cleaning, degreasing, removing of corrosion and precise machine processing of parts and surfaces up to the required tolerances and geometry.
4. Placing of element assembly in tools. Geomerty control.
5. Placing of element assembly in tools. Geometry control. Connecting and securing of elements. Repeated control of geometry via modern electronic measuring devices with 0.01 mm precision.
6. Welding by CO₂ process.
7. Thermic processing of weld by regime. Gradual heating of materials followed by release. Whole process lasts 6,00 hours.
8. Painting of elements with coatings, thoroughly and finally with a total of 3 layers.
9. Packing and labeling into smaller packages and then into packages for aerial transport.
10. Delivery to the Nikola Tesla airport-Belgrade

I hereby state that I have performed the integral control of.

-materials,
-processes,
-geometry and
-final control

Sistem DC 90-Radijus Mionica, Serbia

CEO

Radivojević Slobodan, mechanical.eng.

4. Documentation about testing of the finished product with all the necessary diagrams and comments including:
- force-displacement diagram (histereses diagram)

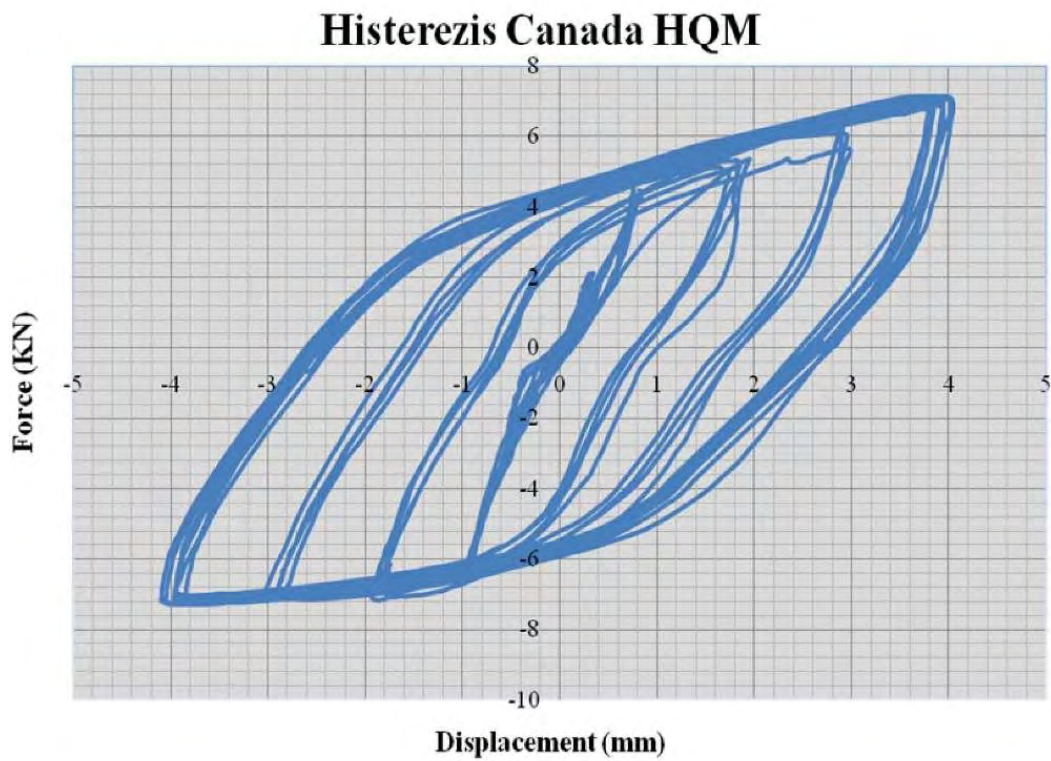


Figure 2. Force vs. displacement (hysteresis), all cycles

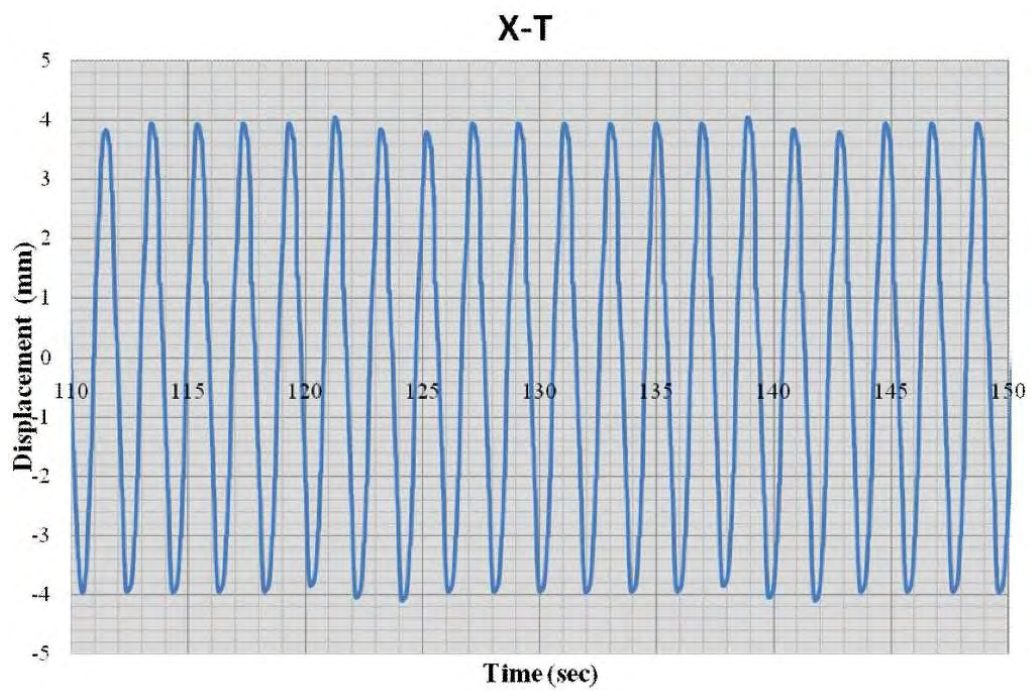


Figure 3. displacement vs. time twenty cycles (max $x = \pm 5$ mm.)

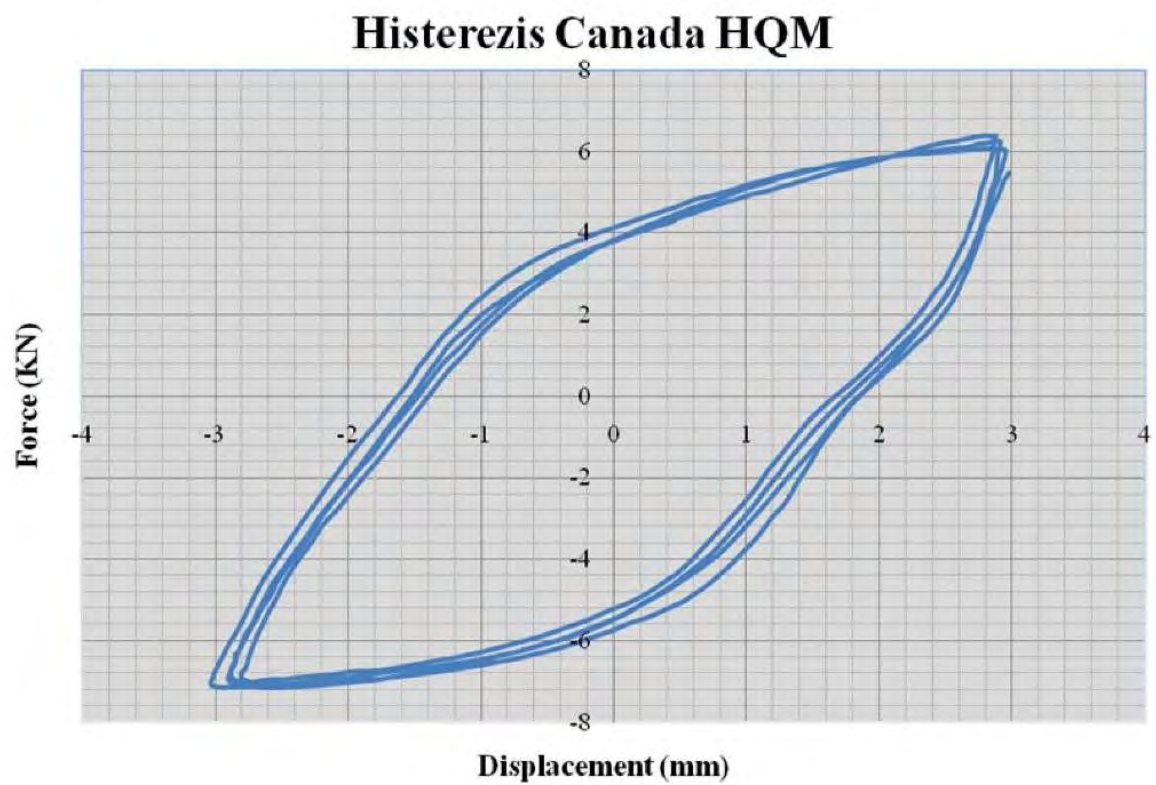


Figure 4. Force vs. displacement (hysteresis), four cycles (max $x = \pm 2.0$ mm)

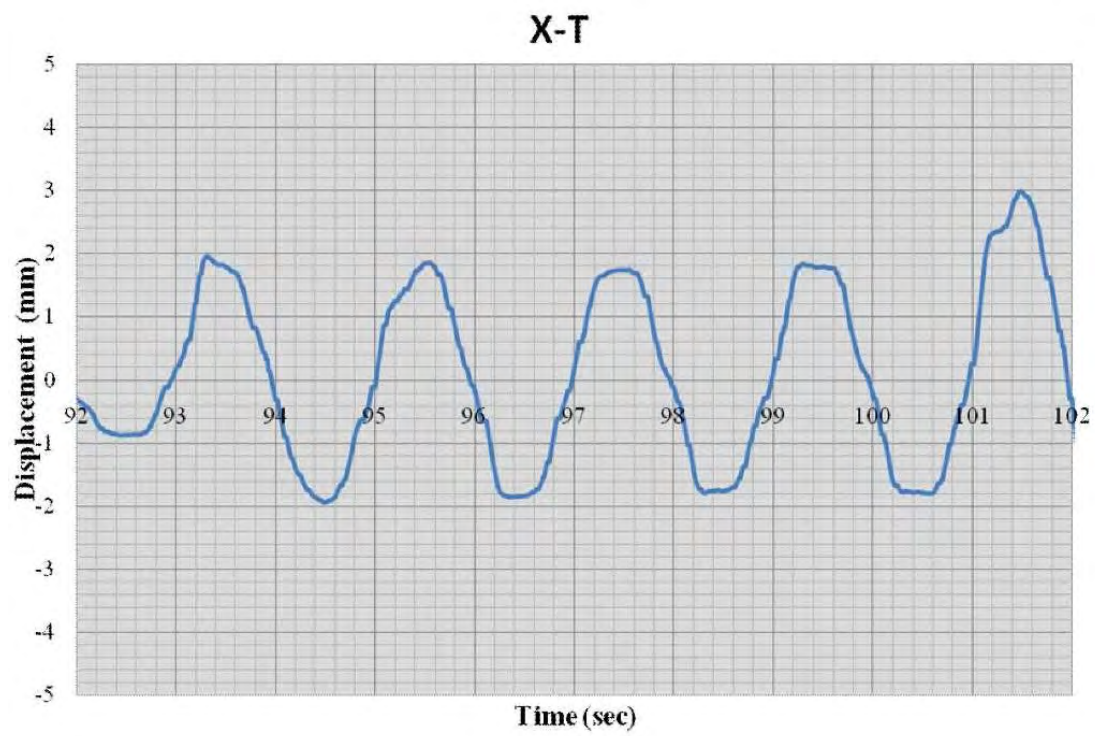


Figure 5. displacement vs. time four cycles (max $x = \pm 2.0$ mm)

Histerezis Canada HQM

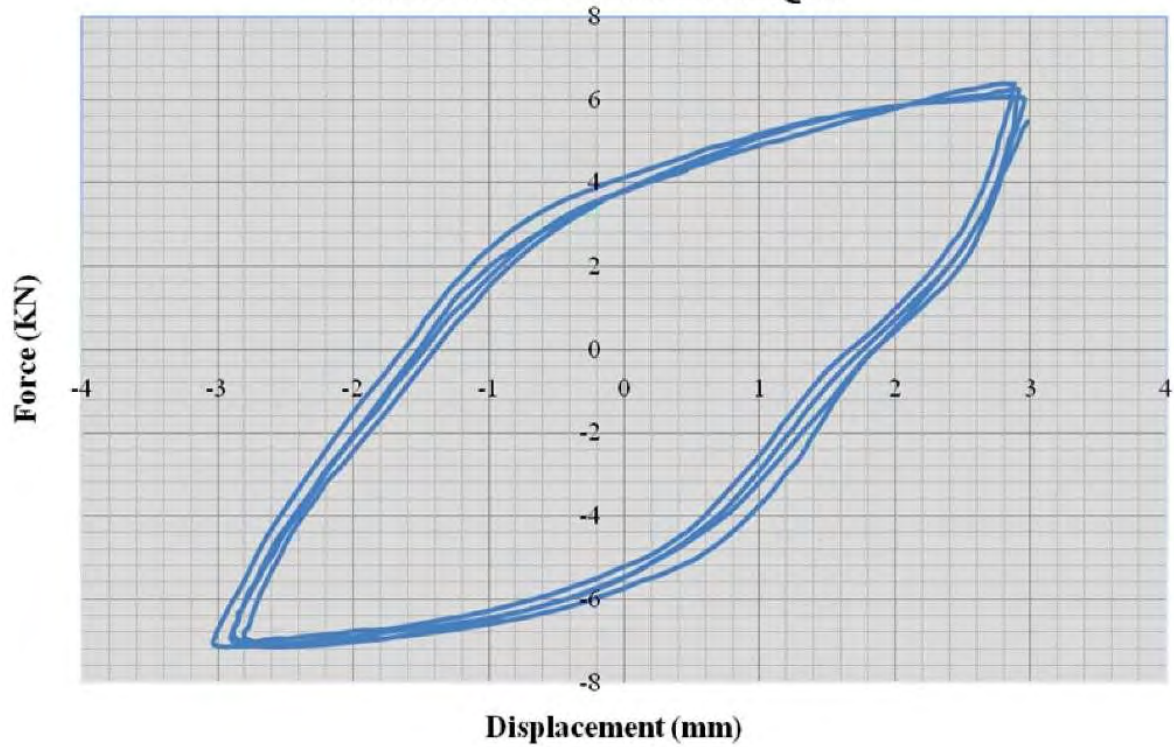


Figure 6. Force vs. displacement (hysteresis), four cycles (max $x = \pm 3.0$ mm)

X-T

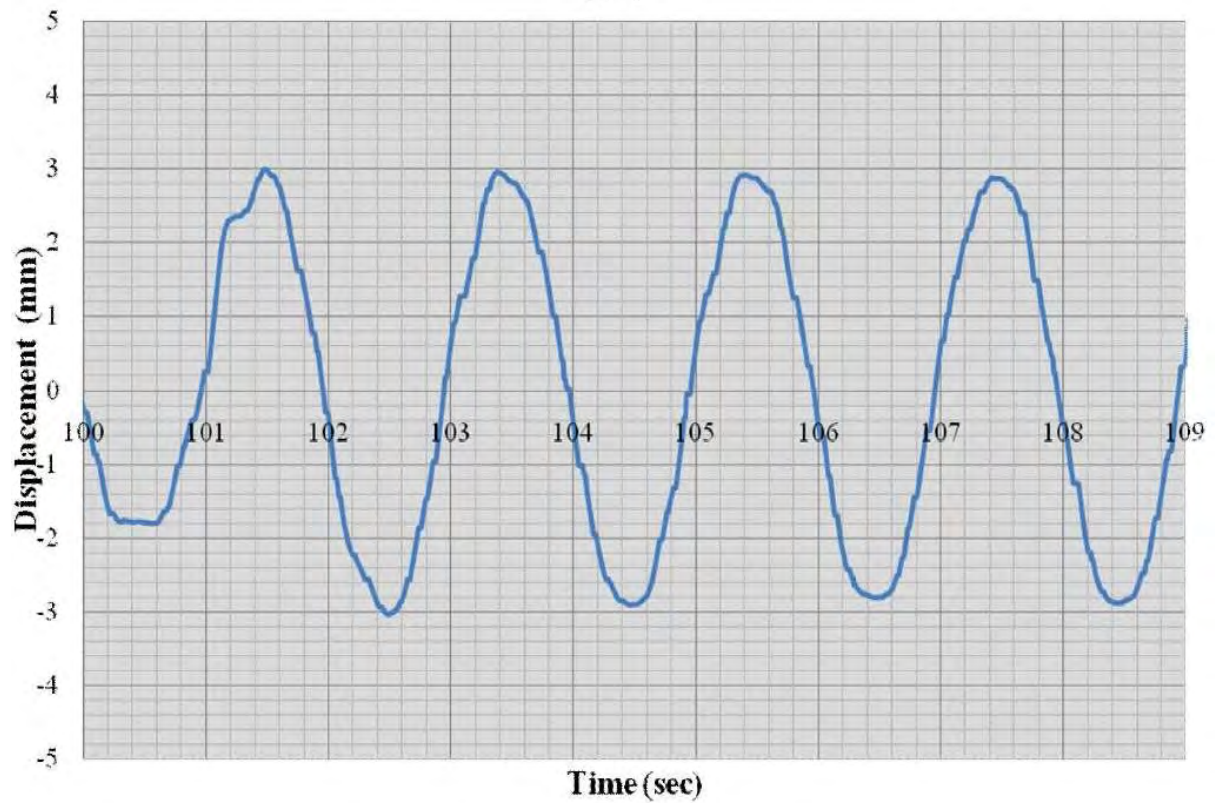


Figure 7. displacement vs. time four cycles (max $x = \pm 3.0$ mm)

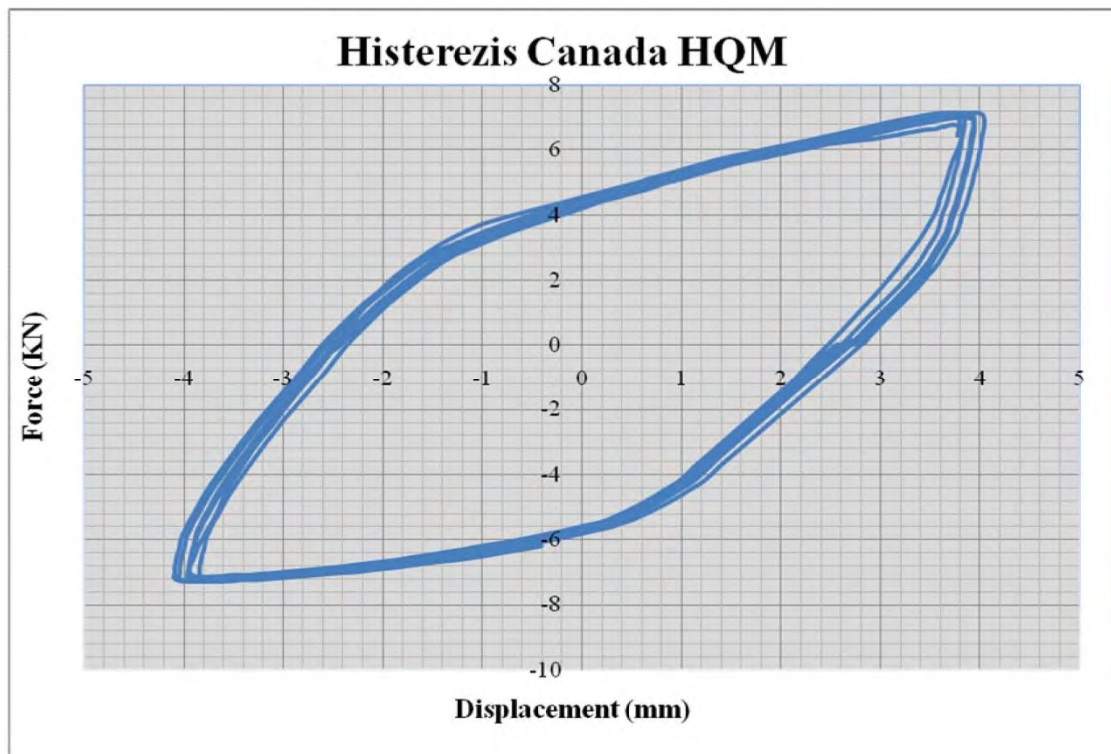


Figure 8. Force vs. displacement (hysteresis), finish cycles

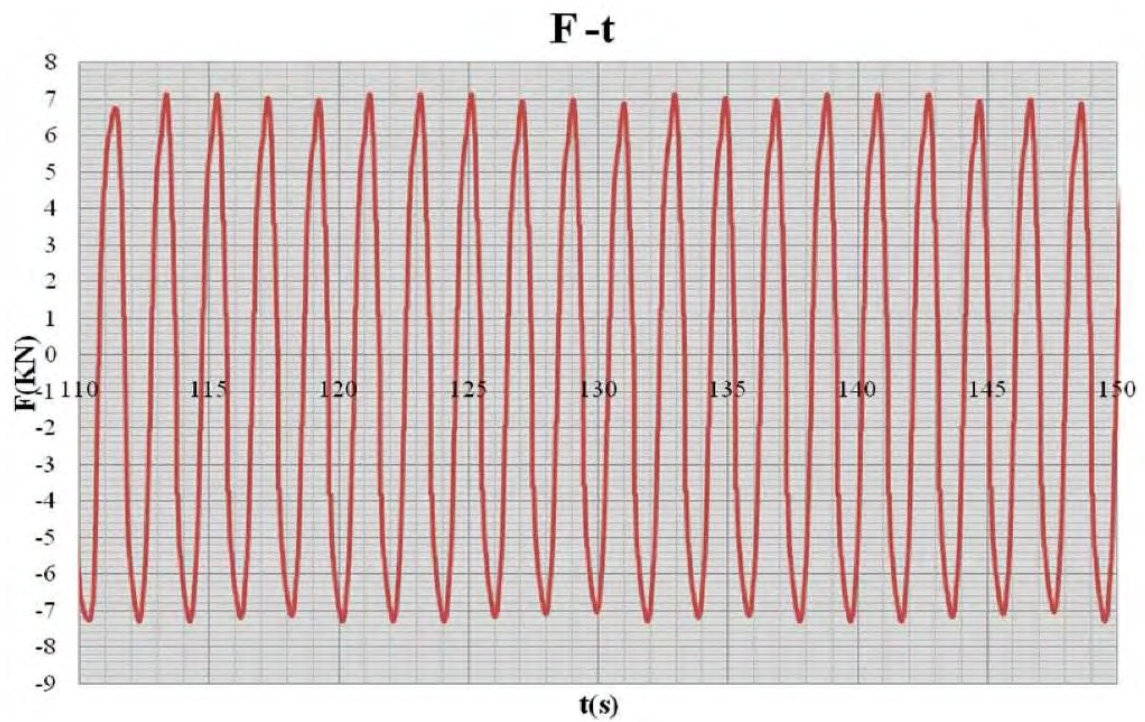


Figure 9. Force vs. time, finish cycles

TESTING RESULTS

The testing results are represented on the following Figures:

- Figure 2. Force vs. displacement (hysteresis), all cycles
- Figure 3. displacement vs. time twenty cycles (max x=+-4mm.)
- Figure 4. Force vs. displacement (hysteresis), five cycles (max x=+-2.0mm)
- Figure 5. displacement vs. time five cycles (max x=+-2.0mm)
- Figure 6. Force vs. displacement (hysteresis), five cycles (max x=+-3.0mm)
- Figure 7. displacement vs. time five cycles (max x=+-3.0mm)
- Figure 8. Force vs. displacement (hysteresis), finish cycles
- Figure 9. Force vs. time, finish cycles

At deformation levels of $\pm 2\text{mm}$, $\pm 3\text{mm}$, $\pm 4\text{mm}$, force is about 4-7kN (see Figure 2).

Figure 4 and Figure 6 indicates work for displacement $\pm 2\text{ mm}$ and $\pm 3\text{ mm}$, and Forces between 6 to 7 kN in plastic area.

Figure 8. and 9 indicates forces and displacement in finish cycles. The slope of the input curve is 4.5 KN/mm. In finish cycles decreases to 0.87 KN/mm.

Testing of damper was made in side of Inovation Laboratory of Sistem DC90, com.ltd., Belgrade.

Technical characteristics of Dampers kanada HQM.

Fabrication and delivery of Damper-connector DC 90 sets (,Canada HQ M“type) including the total custom export duties and formalities and air freight or carriage costs paid to Buyer address in Montreal.

Each set includes the following:

- Damper,
- Steel plate,
- Connector: 16mm diameter, 2mm tread.

(All the members are joined by welding and appear as integrality).

Damper-connector DC 90 (,Canada HQ M“type) is fabricated according to the following technical specifications:

- Initial force of plastic (non-elastic) work is about 3.8 kN.
- Plastic work zone is $\pm 4\text{ mm}$.
- Maksimum force – Damper-connector capacity is about 4-7 kN.

Accumulated dilatation

Δl_u	$ \Delta \varepsilon_u $	n_{cyc}	$\Sigma \Delta \varepsilon_u $
<i>mm</i>			
± 0.5	0.02	2	0.04
± 1	0.04	4	0.16
± 2	0.08	4	0.32
± 3	0.12	4	0.48
± 4	0.16	20	3.20
	Σ	34	4.20

$$|\Delta \varepsilon_i| = \left| \frac{\Delta l_i}{l} \right| - \text{accumulated dilatation during a semi-cycle}$$

Where a cycle,

l – is the length of the test specimen of 100 mm and
 n_{cyc} – is the number of cycles.

Total accumulated dilatation is 4,20 during **34 loading cycles** on a length of 100 mm on a dog bone Damper DC 90 type HQM. Post-collapse capacity)even after the construction degradation, when it can no longer take pull loading. More **than 200 cycles** with control deformation.

DELIVERED SPECIMEN

To conduct a test the customer delivered the type “Canada” damper (the absorber of seismic energy developed by “SYSTEM DC90”).

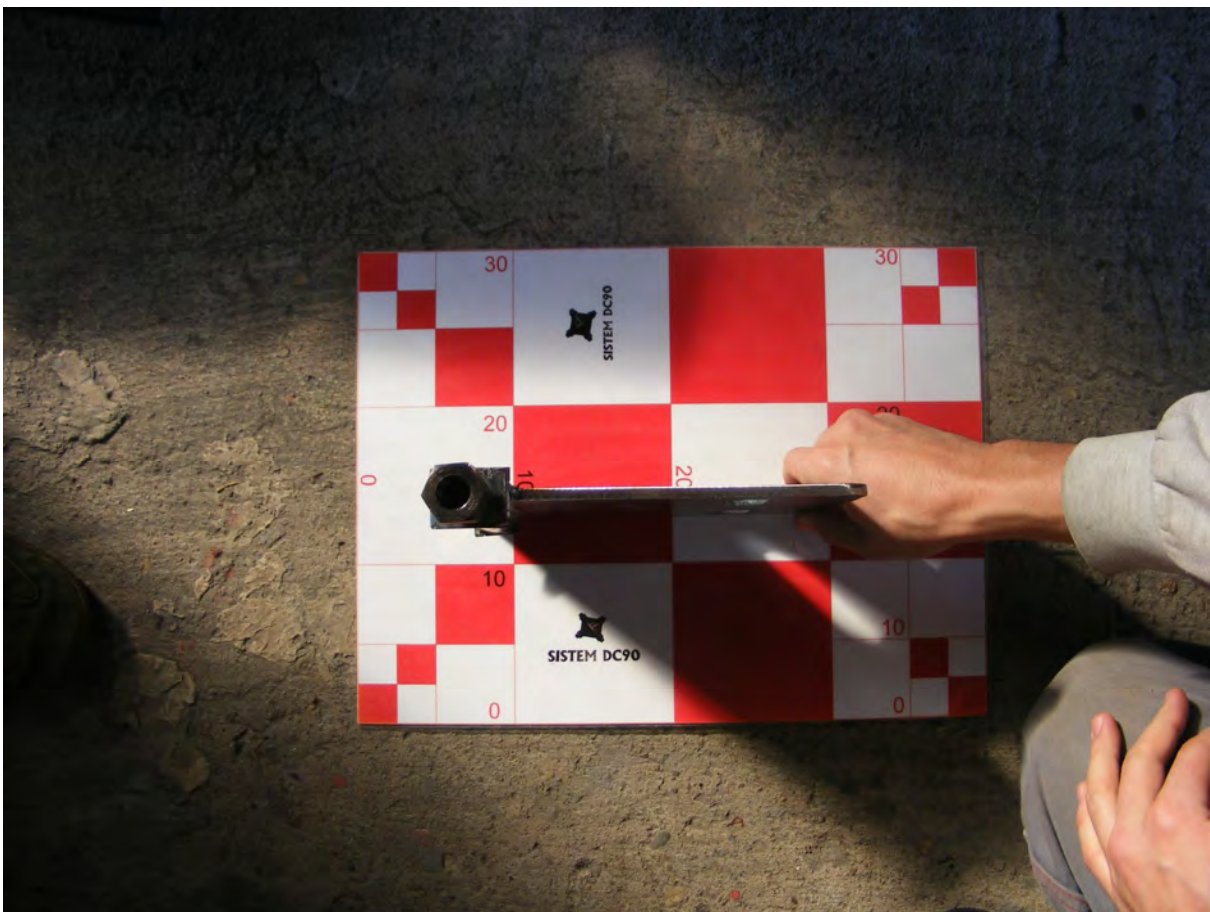
The view of the delivered damper specimen (the absorber of seismic energy) is represented on Figure 10.



Figure 10. View of Damper type “Canada” (absorber of seismic energy).

5. Photo documentation







5. CONCLUSION

The objective of the testing was to investigate the quality of the specimen in aspect of energy damping as well as to check the calculated domain of usage of the damper.

Recomended area of use of the tested damper is to ± 4 mm.

It is also important that this damper have a high material plasticity reserve (post-collapse capacity) even after the construction degradation, when it can no longer take pull loading. More than 200 cycles.
Belgrade, 2011, december

Report is prepared by



Zoran Petrašković, B.Sc.C.E.



ON BEHALF OF Sistem DC90, c.ltd.
DIRECTOR

Dragana Obrenović