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TSE DENEY ve KALİBRASYON MERKEZİ BAŞKANLIĞI

Makina ve Yapı Malzemeleri Grup Başkanlığı

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HEADSHIP OF TSE TEST and CALIBRATION CENTER
CONSTRUCTION MATERIALS FIRE AND ACOUSTICS LABORATORY DIRECTORATE

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Test
TS EN ISO/IEC 17025
AB-0001-T

AB-0001-T
339190
04-17

MUAYENE VE DENEY RAPORU
TEST REPORT

Deneyi Talep Eden (Adı,Adresi,Şehir vb.) *Customer (Name,Adress,City etc.)*	:	ISONEM YAPI KİMYASALLARI VE BOYA SAN.TİC.LTD.ŞTİ. (ISONEM YAPI KİMYASALLARI VE BOYA SAN.TİC.LTD.ŞTİ.: ITOB OSB 10001 SOK. NO:20 TEKELİ Menderes-İZMİR)
Deney Talep Tarihi/No *Order Date / No*	:	01.10.2015 / 137384
Numunenin Tanımı (Cins, Marka, Tip, Tür, Model vb.) *Sample Description(Type,Mark,Model etc.)*	:	ÇELİK YAPILAR İÇİN YANGINA DAYANIKLI KABARAN BOYA, ISONEM ANTIFIRE PAINT PLUS , , - , - , 6.00 adet *INTUMESCENT FIRE RESISTANCE PAINT FOR STEEL STRUCTURES,ISONEM ANTIFIRE PAINT PLUS,,,,6,00 item*
Numune Kabul Tarihi *Test Item Receipt Date*	:	01.10.2015 *Specimens were taken by client*
Deneylerin Yapıldığı Tarih *Date of Test*	:	01.03.2017 - 01.03.2017
Uygulanan Standard / Metod *Applied Standard/Method*	:	TS EN 13381-8:2013:2013-12 Yapı elemanlarının yangına dayanımına katkısının tayini için deney yöntemi - Bölüm 8:Çelik elemanlara uygulanmış reaktif koruma *TS EN 13381-8:2013:2013-12 Test methods for determining the contribution to the fire resistance of structural members - Part 8: Applied reactive protection to steel members*
Raporun Sayfa Sayısı *Number of pages of the report*	:	12 (40 sayfa ek)
Açıklamalar *Remarks*	:	

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The test and/or measurement results, the uncertainties (if applicable) with confidence probability and test methods are given on the following pages which are part of this report.
Bu rapor özel deney talebine istinaden düzenlenmiş olup, Standartlara Uygunluk Belgesi niteliğinde değildir. Partiyi temsil etmez, ayrıca ilan, reklam ve ihalelerde uygunluk belgesi niteliğinde kullanılamaz.
This test report was prepared upon customer's request, can not be used as certificate of conformity to standards, does not represent a batch and can not be used as conformity document for advertisements and procurements .

Mühür *Seal*	**Tarih** *Date*	**Deney Sorumlusu** *Person in charge of tests*	**Kontrol Eden** *Reviewer*	**Onaylayan** *Approved by*
TÜRK STANDARDLARI ENSTİTÜSÜ DENEY KALİBRASYON MERKEZİ BAŞKANLIĞI TSE 1954	20/04/2017	Ahmet Fazıl KARA Uzman Yardımcısı	Halil Alper YILDIRIM Mühendis	Metehan ÇALIŞ Laboratuvar Müdürü

CONTENT

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MUAYENE - DENEY SONUÇLARI *TEST RESULTS*

SUMMARY

ORDER /SPECIMEN NO	**137384/ 268220**
SPONSOR	ISONEM YAPI KİMYASALLARI VE BOYA SAN. TİC. LTD. ŞTİ.
PURPOSE	Fire resistance performance of intumescent painting as per TS EN 13381-8
TEST LABORATORY	TSE Construction Material Fire and Acoustic Laboratory Management
ADDRESS	Aydınlı Mah. Gülennur Sok. No:7/1 Tuzla / İSTANBUL

ABOUT TEST SPECIMEN

General:

''ISONEM ANTI FIRE PAINT PLUS'' intumescent paint manufactured by ISONEM YAPI KİMYASALLARI VE BOYA SAN. TİC. LTD. ŞTİ applied to steel sections were tested as per TS EN 13381-8 test method in 01.03.2017 in TSE Construction Material Fire and Acoustic Laboratory.

Application:

Primer, intumescent paint and top coat applied with roller.

Sampling:

Laboratory did not make sampling.

Conditioning:

Specimens were conditioned 28 days in laboratory conditions.

MUAYENE - DENEY SONUÇLARI *TEST RESULTS*

1. TEST SPECIMEN

1.1. GENERAL

''ISONEM ANTI FIRE PAINT PLUS'' intumescent paint manufactured by ISONEM YAPI KİMYASALLARI VE BOYA SAN. TİC. LTD. ŞTİ applied to steel sections with roller.

1.2. MATERIALS

Primer coat: Two component grey colour primer coat

Intumescent coat: Isonem Anti Fire Paint Plus

Top coat: Isonem Anti Fire Paint

Steel grade: S275JR

2. TEST EQUIPMENT

Furnace and test equipment are as per TS EN 1363-1

3. TEST CONDITIONS

3.1. GENERAL

The test conditions are as per TS EN 1363-1 and the test standard.

3.2. RESTARINT AND LOADING CONDITIONS

Loading beam restrained simply supported as per TS EN 13381-8 Figure-2. **(Annex-1)**

Short columns and reference beam hanged furnace roof were tested simultaneously with loading beam. Restraint conditions are as per TS EN 13381-8. **(Annex-2)**

3.3.LOADING

Loading were calculated as per 60% of design moment resistance as per steel certificate values and was performed by 2 point load as per TS EN 1365-3. **(Annex-3)**

4. TEST SPECIMENS

4.1. GENERAL

Short columns and reference beam hanged furnace roof were tested simultaneously with loading beam. Test specimen locations in furnace are given in **Annex-1.**

4.2. TEST SPECIMEN DIMENSIONS

Loading beam dimensions are given in **Annex-1** and are proper as per TS EN 13381-8 Figure 9.

Reference beam and loading beam section dimension are same and cut from same 12m profile.

Short columns are manufactured 1000 mm length as per standard. **(Annex-2)**

4.3. TEST SPECIMEN STEEL CONSTRUCTION

All manufactured steel sections are given in **Annex-1** and **Annex-2.**

4.4. STEEL SECTIONS

All steel sections grades are S275JR.

4.5. PROTECTION MATERIAL PROPERTIES

Intumescent paint thicknesses are given in **Annex-4** and are in tolerance as per TS EN 13381-8.

4.6. TEST SPECIMEN SELECTION

Test specimens are selected as per TS EN 13381-8 Table 1(Test package 3A) and Table 2 section factor range for one protection thickness.

5. INSTALLATION OF THE TEST SPECIMEN

5.1. LOADING BEAM

Loading beam top insulated with ceramic wool and 15 cm thick and 60 cm length and 500 kg/m^3 aerated concrete blocks.

5.2. REFERENCE BEAM

Loading beam top insulated with ceramic wool and 15 cm thick and 60 cm length and 500 kg/m^3 aerated concrete blocks and back and front side coated with ceramic wool.

5.3. SHORT COLUMNS

Short columns top and bottom side coat with ceramic wool as per standard.

5.4. TEST SPECIMEN INSTALLATION LAYOUT

Loading beam and reference beam installed parallel to same furnace.

Furnace dimensions are 4,05 m length, 3,70 m width and 2,05 m depth. Depth of the furnace increased 60-30 cm in order to close the loading beam.

Specimens located to furnace in order not to close the burners.

5.5.FURNACE LOAD

Furnace load details are given in **Annex-5.**

6. CONDITIONING

Specimens were conditioned 28 days in laboratory conditions.

7. APPLICATION OF INSTRUMENTATION

7.1. GENERAL

Temperature and pressure measurement equipment are as defined in TS EN 1363-1.

7.2. FURNACE TEMPERATURE CONTROL EQUIPMENT

Furnace temperature control is as defined in TS EN 1363-1.

7.3. EQUIPMENT FOR STEEL TEMPERATURE

Ceramic coated 1200 °C fire retardant 0,8 mm K type thermocouples were used for temperature measurement. Thermocouple locations for loading beam, reference beam and short column are given in **Annex-8.**

7.4. EQUIPMENT FOR PRESURE MEASUREMENT

1 pressure sensor is set 20 Pa under loading beam for furnace pressure measurement. Pressure is set 12,7 Pa (0,85mx8,5 Pa=7,225 Pa; 20 Pa-7,225 Pa= 12,7 Pa), because distance between

pressure sensor and 10 cm from beam bottom flange is 85 cm. Pressure in test is in limit as per TS EN 1363-1 and given in **Annex-9.**

7.5. EQUIPMENT FOR DISPLACEMENT MEASUREMENT

Displacement measurement were performed with lasers in two location in mid span of the loading beam as per TS EN 1363-1.

7.6. EQUIPMENTS FOR LOADING

Loading was performed with hydraulic system as per TS EN 1363-1 with two point load.

8. TEST PROCEDURE

8.1. GENERAL

Test specimens were selected as per TS EN 13381-8. Section detail are given in **Annex-10.**

8.2. FURNACE TEMPETARURE

Time-temperature graphics and deviation are given in **Annex-6 and Annex-7.**

Furnace temperature was controlled with 8 thermocouples located to loading beam 1/5, 2/5, 3/5 and 4/5 length distance. Time-temperature graphics are given in **Annex-6**

8.3. LOAD APPLICATION AND CONTROL

Load (242KN) calculation detail given in **Annex-3** is performed with hydraulic by two point load. When beam mean temperature come approximately 575 °C, rate of deflection exceeded $l^2/9000d = 4150^2/(9000*400) = 4{,}78$ mm in 33. Minutes. After that, load were decreased gradually. Loading graphic is given in **Annex-11.**

8.4. STEEL TEMPERATURES

Loading beam temperature graphics are given in **Annex-14.**

Reference beam temperature graphics are given in **Annex-15.**

Short column-IPE 100 temperature graphics are given in **Annex-16.**

Short column- HEA 200 temperature graphics are given in **Annex-17.**

Short column- HEB 240 temperature graphics are given in **Annex-18.**

Short column- HEM 240 temperature graphics are given in **Annex-19.**

8.5. DISPLACEMENT

Displacement values are given in **Annex-13.** Rate of deflection values are given in **Annex-12.**

8.6. OBSERVATIONS

Load was decreased gradually in 33.minute because rate of deflection exceeded limit.

After the test intumescent coating thicknesses were measured approximately 4 cm.

8.7. TERMINATION OF TEST

When all sections temperature exceeded 750 °C, the test was terminated.

9. TEST RESULTS

2 thermocouples for reference beam and 1 thermocouple for short column were detached. But, as per TS EN 13381-8, these detachments are in limit.

Test results and calculation steps are given in annexes.

MUAYENE - DENEY SONUÇLARI *TEST RESULTS*

10. MEASUREMENT OF PROPERTIES OF FIRE PROTCTION MATERIALS

Intumescent paint thicknesses are given in **Annex-4** and are in limit as per TS EN 13381-8.

11. FIXING OF THERMOCOUPLES TO STEEL WORK

Ceramic coated 1200 °C fire retardant 0,8 mm K type thermocouples were used and installed before application of paint for temperature measurement. Thermocouple locations for loading beam, reference beam and short column are given in **Annex-8.**

12. CORRECTION OF DATA

Data for correction and calculation steps are given in **Annex-20, Annex-21, Annex-22, Annex-23 and Annex-24.**

13. METHODS OF ASSESSMENT OF FIRE PROTECTION SYSTEM PERFORMANCE

Numerical regression analysis were used for assessment. Calculation methods regarding the calculation steps and criteria in TS EN 13381-8 are given in **Annex-25** Step-0, **Annex-26** Step-1, **Annex-27** Step-2&3, **Annex-28** Step-4, **Annex-29 (A, B, C, D, E, F)** Step-5&6.

14. PHOTOS

Figure 1. Furnace installation

Figure 2. Furnace installation

Figure 3. Furnace installation

Figure 4. Furnace installation

Figure 5. Furnace installation

Figure 6. Specimens during the test

Figure 7. Specimens after the test

MUAYENE - DENEY SONUÇLARI *TEST RESULTS*

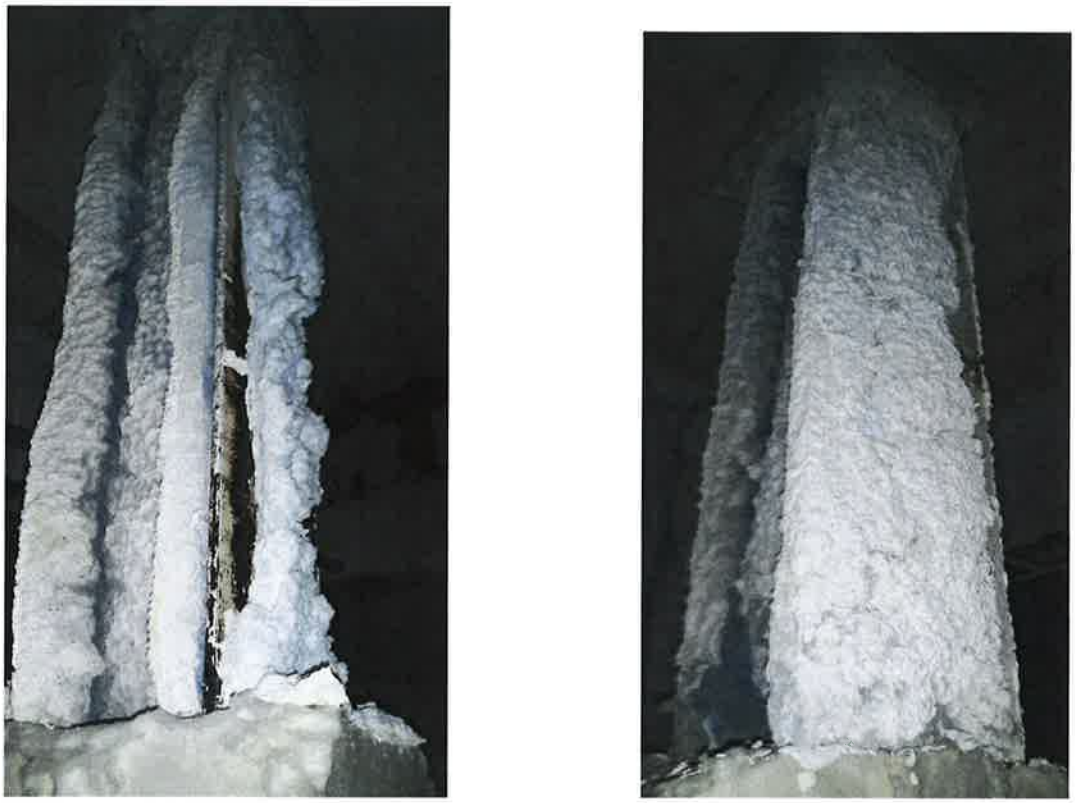


Figure 8. Specimens after the test

MUAYENE - DENEY SONUÇLARI *TEST RESULTS*

Figure 9. Specimens after the test

15. REFERENCE LIST

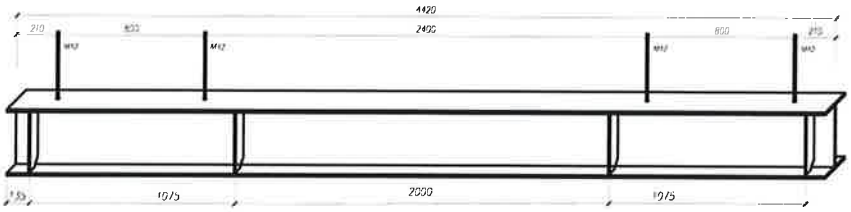
TS EN 1363-1: Fire resistance test - Part 1 – General requirements

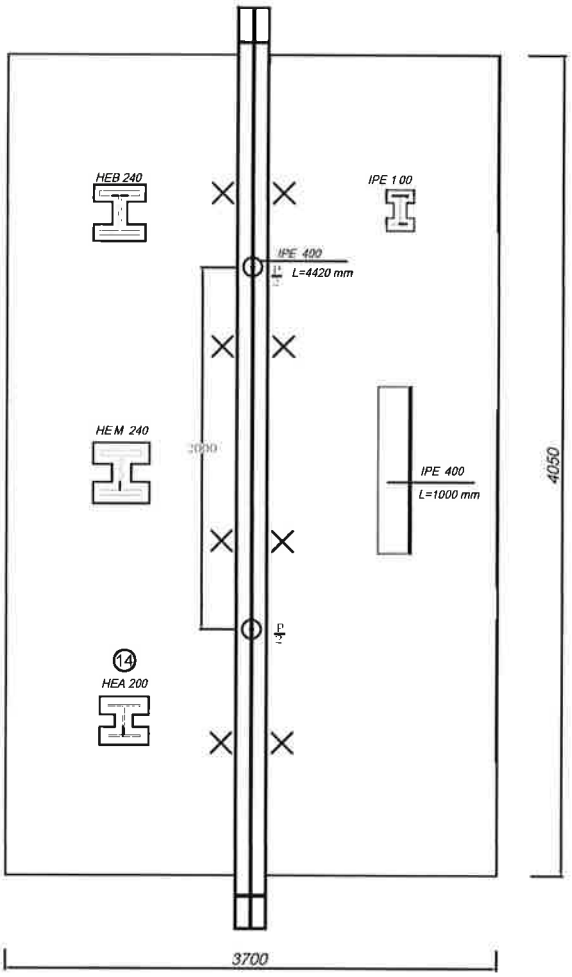
TS EN 13381-8: Test methods for determining the contribution to the fire resistance of structural members - Part 8: Applied reactive protection to steel members

TS EN 13501-2: Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services

LAB-D-17-FR-006: Fire resistance raw data form

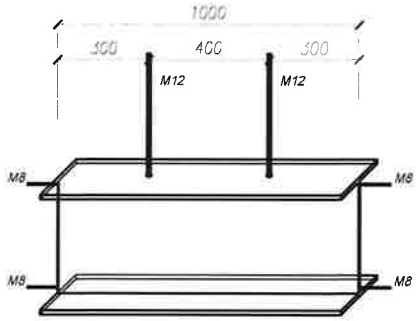
EK 1-YÜKLEMELİ KİRİŞ DETAYI VE FIRIN NUMUNE LOKASYONU
ANNEX 1-LOAD BEARING BEAM DETAIL AND FURNACE SPECIMEN LOCATION





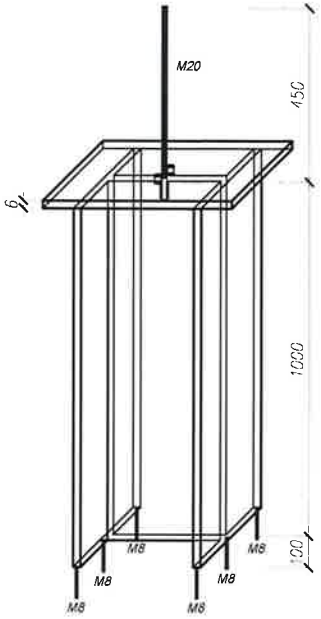
Talep no: 137334

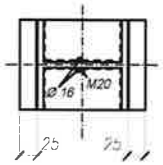
EK 2-REFERANS KİRİŞ VE KISA KOLON DETAYI
ANNEX 2-REFERENCE BEAM AND SHORT COLUMN DETAIL



RERERANS KİRİŞ

RERERENCE BEAM





KISA KOLON

SHORT COLUMN

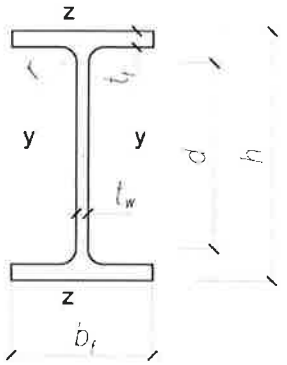
BEAM (open section) - LOAD CALCULATION (in accord. EN 1991-1-1)

1. Static

L_{sup}	4150	[mm]
P_{dist}	2000	[mm]
P_{sup}	1075	[mm]
P distance is OK		

2. Cross-section parameters and steel grade

IPE 400			Actual steel yield strength				275	[MPa]
h	400,0	[mm]	$I_{y,c}$	23130	[cm^4]	$W_{el,y,c}$	1160	[cm^3]
b	180,0	[mm]	$I_{z,c}$	1318	[cm^4]	$W_{el,z,c}$		[cm^3]
t_w	8,6	[mm]	$I_{w,c}$	490000	[cm^6]	$W_{pl,y,c}$	1307	[cm^3]
t_f	13,5	[mm]	$I_{T,c}$	51,1	[cm^4]	$W_{pl,z,c}$		[cm^3]
r	21,0	[mm]	i_y	16,6	[cm]	A_c	84,5	[cm^2]
d	331,0	[mm]	i_z	3,95	[cm]	U		[cm]



3. Dead load calculation

Fire protection material parameters	- shape*	c	
	- density	500	[kg/m^3]
	- thickness	1,50	[mm]

* type: "b" for box, "c" for contour

Concrete topping parameters	- density	500	[kg/m^3]
	- width	60	[cm]
	- thickness	15	[cm]

Beam self-weigth	**66,3**	[kg/m]
Concrete topping	**45,0**	[kg/m]

Fire protection material	**1,0**	[kg/m]
Additional linear load	**0,0**	[kg/m]

4. Moment resistance

Cross section class
1

t_{max}	13,5	[mm]
ε	0,924	[-]

web c/t	38,5 ≤72ε = 66,6
flange c/t	4,8 ≤9ε = 8,3

$M_{c,y,Rd}$	**359,4**	[kNm]	- plastic

E	210000	N/mm^2
G	80770	N/mm^2

5. Critical moment for lateral torsional buckling

k	1,0	[-]	- since the compression flange is free to rotate about the weak axis of the cross-section
k_w	1,0	[-]	- since there is no device to prevent the warping at the ends of the beam

C_1	1,127	[-]
C_2	0,454	[-]

z_g	200	[mm]

$$M_{cr} = C_1 \frac{\pi^2 E I_z}{(kL)^2} \left\{ \sqrt{\left(\frac{k}{k_w}\right)^2 \frac{I_\omega}{I_z} + \frac{(kL)^2 G I_T}{\pi^2 E I_z} + (C_2 z_g)^2} - C_2 z_g \right\}$$

M_{cr}	**315,5**	[kNm]

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Order No:

6. Non-dimensional slenderness and reduction factor

λ_{LT}	1,067	[-]
$\lambda_{LT,0}$	0,4	[-]
β	0,75	[-]
λ_{LT}	>	$\lambda_{LT,0}$

h/b	2,222	[-]
h/b_{limit}	2,0	[-]
h/b	>	h/b_{limit}

k_c	0,94	[-]

f	0,974	[-]

curve c			
α_{LT}	0,49	[-]	
Φ_{LT}	1,091	[-]	
χ_{LT}	0,599	[-]	before checks
χ_{LT}	0,599	[-]	after checks
$\chi_{LT,mod}$	0,615	[-]	

7. Design buckling resistance moment

$M_{c,y,Rd}$	220,9	[kNm]
$V_{c,z,Rd}$	678,4	[kN]

No M-V interaction has to be considered since the maximum moment is obtained at mid-span and the maximum shear force is obtained at supports

8. Force in the test

60% $M_{c,y,Rd}$	132,6	[kNm]	=	"P" force momentum	130,1	[kNm]
—						
Dead load momentum	2,5	[kNm]				

Load required to be applied in the fire test (in addition to the dead load)	***P***	**242,0**	**[kN]**

Note: One hydraulic ram applies half of the value P !!!

Talep no : 137 384
Order no

THICKNESS OF FIRE PROTECTION MATERIAL - LOADED BEAM (OPEN SECTION)

Basic information		
Order No.	137384	**LB-1**
Name of the company	ISONEM	
Fire protection system	**Isonem Antifire Paint Plus**	IPE 400
Layers	Intumescent	

Results	MEAN	MIN	MAX	MEAN -20%	MEAN +20%	MEAN -30%	MEAN +30%	MEAN -45%	MEAN +45%	% of readings within limit ±20%	% of readings within limit ±30%	% of readings within limit ±45%	Result
	1620	**1239**	**1989**	**1296**	**1944**	**1134**	**2106**	**891**	**2349**	**98%**	**100%**	**100%**	**PASS**
	Deviation =		**23,5%**					Requirements		68%	95%	100%	

	Measurement no.:	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*			% of readings within limit ±20%	% of readings within limit ±30%	% of readings within limit ±45%
Measuring points	1. Position 1 temperature measurement station	1591	1871	1528	1485	1579	1517	1331	1422			**88%**	**100%**	**100%**
	2. Position 2 temperature measurement station	1643	1653	1641	1616	1555	1776	1614	1701			**100%**	**100%**	**100%**
	3. Position 3 temperature measurement station	1529	1700	1638	1777	1741	1806	1579	1506			**100%**	**100%**	**100%**
	4. Position A temperature measurement station	1437	1596	1605	1437	1596	1605	1596	1605			**100%**	**100%**	**100%**
	5. Position B temperature measurement station	1408	1304	1429	1408	1304	1429	1429	1408			**100%**	**100%**	**100%**
	6. Halfway between Position 1 and Position A	1676	1702	1728	1459	1617	1696	1673	1671			**100%**	**100%**	**100%**
	7. Halfway between Position A and Position 2	1778	1528	1518	1658	1678	1778	1658	1778			**100%**	**100%**	**100%**
	8. Halfway between Position 2 and Position B	1338	1518	1628	1758	1628	1758	1628	1758			**100%**	**100%**	**100%**
	9. Halfway between Position B and Position 3	1577	1663	1618	1239	1603	1509	1297	1513			**100%**	**100%**	**100%**
	10. Halfway between Position 1 and beam's end	1691	1876	1759	1662	1695	1511	1658	1692			**100%**	**100%**	**100%**
	11. Halfway between Position 3 and beam's end	1834	1899	1860	1989	1925	1909	1747	1849			**100%**	**100%**	**100%**
										Requirements		68%	95%	100%

All measurements in [µm]

THICKNESS OF FIRE PROTECTION MATERIAL - UNLOADED BEAM (OPEN SECTION)

Basic information		
	Order No.	137384
	Name of the company	ISONEM
	Fire protection system	**Isonem Antifire Paint Plus**
	Layers	Intumescent

SIB-1

IPE 400

Results	MEAN	MIN	MAX	MEAN -20%	MEAN +20%	MEAN -30%	MEAN +30%	MEAN -45%	MEAN +45%	% of readings within limit ±20%	% of readings within limit ±30%	% of readings within limit ±45%	Result
	1769	**1006**	**2288**	**1416**	**2123**	**1239**	**2300**	**973**	**2566**	**75%**	**96%**	**100%**	**PASS**
	Deviation =		**43,1%**					Requirements		68%	95%	100%	

	Measurement no.:	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*			% of readings within limit ±20%	% of readings within limit ±30%	% of readings within limit ±45%
Measuring points	1. Position 1 temperature measurement station	1677	1369	1702	1873	1634	1946	1943	1733			**88%**	**100%**	**100%**
	2. Position 2 temperature measurement station	1941	1006	2154	1866	2288	1954	1794	1454			**75%**	**88%**	**100%**
	3. Position 3 temperature measurement station	1550	1324	1762	2000	1757	2218	1720	1801			**75%**	**100%**	**100%**
										Requirements		68%	95%	100%

All measurements in [µm]

THICKNESS OF FIRE PROTECTION MATERIAL - UNLOADED COLUMN (OPEN SECTION)

Basic information		
	Order No.	137384
	Name of the company	ISONEM
	Fire protection system	**Isonem Antifire Paint Plus**
	Layers	Intumescent

SIC-1

IPE100

Results	MEAN	MIN	MAX	MEAN -20%	MEAN +20%	MEAN -30%	MEAN +30%	MEAN -45%	MEAN +45%	% of readings within limit ±20%	% of readings within limit ±30%	% of readings within limit ±45%	Result
	1496	**1184**	**1970**	**1197**	**1796**	**1047**	**1945**	**823**	**2170**	**80%**	**95%**	**100%**	**PASS**
	Deviation =		**31,7%**					Requirements		68%	95%	100%	

	Measurement no.:	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	% of readings within limit ±20%	% of readings within limit ±30%	% of readings within limit ±45%
Measuring points	1. Position 1 temperature measurement station	1184	1441	1557	1644	1645	1310	1272	1770	1909	1218	**80%**	**100%**	**100%**
	2. Position 2 temperature measurement station	1882	1970	1746	1373	1499	1383	1321	1242	1274	1286	**80%**	**90%**	**100%**
										Requirements		68%	95%	100%

All measurements in [µm]

THICKNESS OF FIRE PROTECTION MATERIAL - UNLOADED COLUMN (OPEN SECTION)

Basic information		
	Order No.	137384
	Name of the company	ISONEM
	Fire protection system	**Isonem Antifire Paint Plus**
	Layers	Intumescent

SIC-4

HEM 240

Results	MEAN	MIN	MAX	MEAN -20%	MEAN +20%	MEAN -30%	MEAN +30%	MEAN -45%	MEAN +45%	% of readings within limit ±20%	% of readings within limit ±30%	% of readings within limit ±45%	Result
	1531	**1295**	**2219**	**1225**	**1837**	**1071**	**1990**	**842**	**2219**	**90%**	**95%**	**100%**	**PASS**
	Deviation =		**45,0%**					Requirements		68%	95%	100%	

	Measurement no.:	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	% of readings within limit ±20%	% of readings within limit ±30%	% of readings within limit ±45%
Measuring points	1. Position 1 temperature measurement station	1458	1945	2219	1450	1501	1295	1415	1355	1458	1756	**80%**	**90%**	**100%**
	2. Position 2 temperature measurement station	1553	1335	1412	1363	1450	1542	1412	1773	1505	1416	**90%**	**100%**	**100%**
										Requirements		68%	95%	100%

All measurements in [µm]

THICKNESS OF FIRE PROTECTION MATERIAL - UNLOADED COLUMN (OPEN SECTION)

Basic information		
	Order No.	137384
	Name of the company	ISONEM
	Fire protection system	**Isonem Antifire Paint Plus**
	Layers	Intumescent

SIC-3

HEB 240

Results	MEAN	MIN	MAX	MEAN -20%	MEAN +20%	MEAN -30%	MEAN +30%	MEAN -45%	MEAN +45%	% of readings within limit ±20%	% of readings within limit ±30%	% of readings within limit ±45%	Result
	1531	**1034**	**1947**	**1224**	**1837**	**1071**	**1990**	**842**	**2219**	**80%**	**95%**	**100%**	**PASS**
	Deviation =		**32,4%**					Requirements		68%	95%	100%	

	Measurement no.:	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	% of readings within limit ±20%	% of readings within limit ±30%	% of readings within limit ±45%
Measuring points	1. Position 1 temperature measurement station	1298	1868	1407	1897	1947	1639	1306	1583	1229	1392	**70%**	**100%**	**100%**
	2. Position 2 temperature measurement station	1309	1474	1034	1350	1645	1510	1824	1579	1808	1512	**70%**	**90%**	**100%**
										Requirements		68%	95%	100%

All measurements in [µm]

THICKNESS OF FIRE PROTECTION MATERIAL - UNLOADED COLUMN (OPEN SECTION)

Basic information		
	Order No.	137384
	Name of the company	ISONEM
	Fire protection system	**Isonem Antifire Paint Plus**
	Layers	Intumescent

SIC-2

HEA 200

Results	MEAN	MIN	MAX	MEAN -20%	MEAN +20%	MEAN -30%	MEAN +30%	MEAN -45%	MEAN +45%	% of readings within limit ±20%	% of readings within limit ±30%	% of readings within limit ±45%	Result
	1605	**1134**	**2054**	**1284**	**1926**	**1124**	**2087**	**883**	**2328**	**80%**	**100%**	**100%**	**PASS**
	Deviation =		**29,4%**					Requirements		68%	95%	100%	

	Measurement no.:	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	% of readings within limit ±20%	% of readings within limit ±30%	% of readings within limit ±45%
Measuring points	1. Position 1 temperature measurement station	1682	1750	1676	1663	1714	1690	1661	1650	1666	1373	**100%**	**100%**	**100%**
	2. Position 2 temperature measurement station	1273	1599	1592	1961	1487	1672	1317	1134	1494	2054	**70%**	**90%**	**100%**
										Requirements		68%	95%	100%

All measurements in [µm]

EK- 5 FIRIN YÜKÜ /ANNEX- 5 FURNACE LOAD

Furnace size/Fırın boyutları		
Depth:	2,9	[m]
Width	3	[m]
Lenght	4	[m]
Volume	34,8	[m^3]

Furnace load/Fırın yükü		
Furnace load	18,7	[kg/m^3]
Max furnace load	45,0	[kg/m^3]
41,5%		

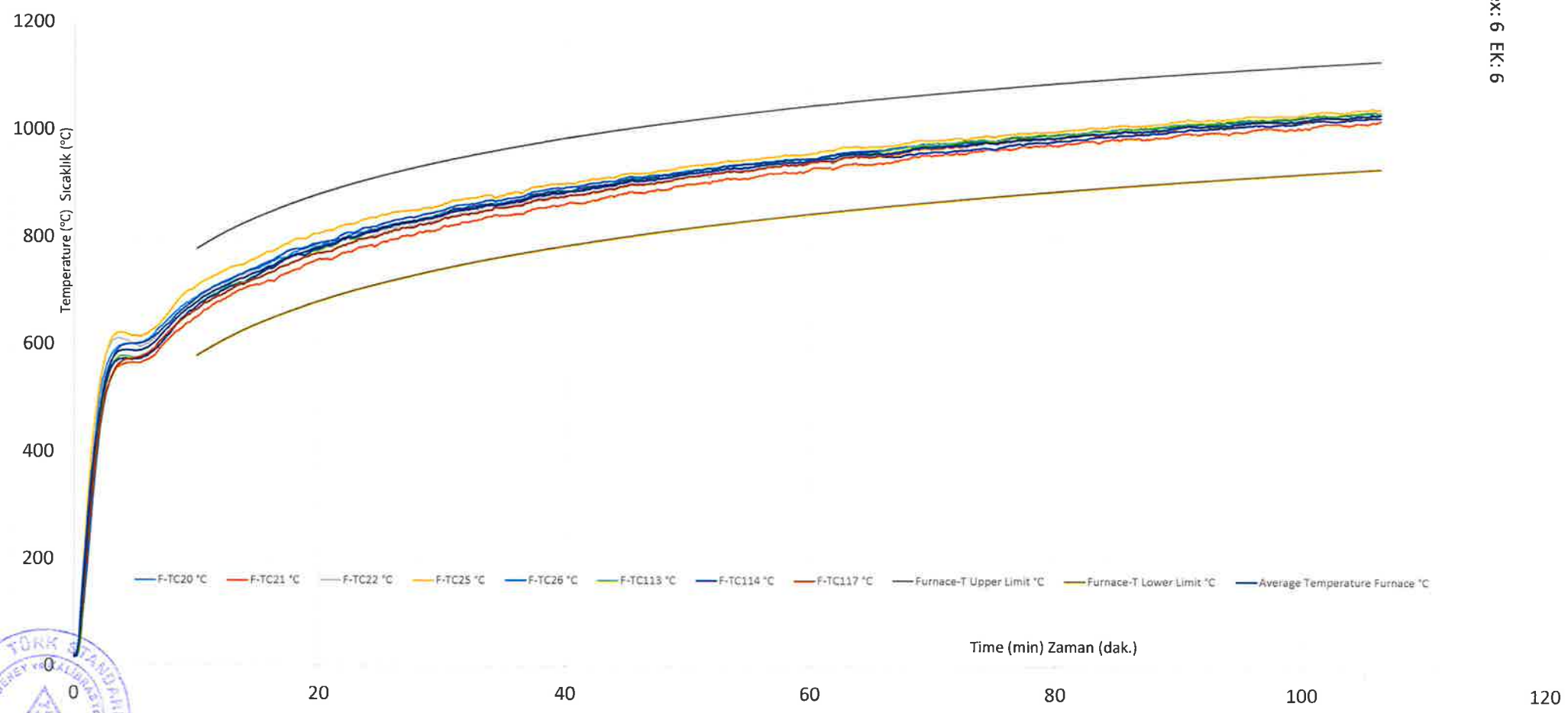
OK - FURNACE LOAD WITHIN LIMIT

Test specimens/Test numuneleri					
No.	Symbol	Section	Lenght [m]	Weight [kg/m]	Load [kg]
1	SIC-1	IPE 400	4,42	66,3	293,0
2	SIC-2	IPE 400	1,00	66,3	66,3
3	SIC-3	IPE 100	1,00	8,1	8,1
4	SIC-4	HEM 240	1,00	157,0	157,0
5	SIC-5	HEA 200	1,00	42,3	42,3
6	SIC-6	HEB 200	1,00	83,2	83,2
7					
8					
9					
10					
11					
12					
13					
14					
15					
				Total load	649,9

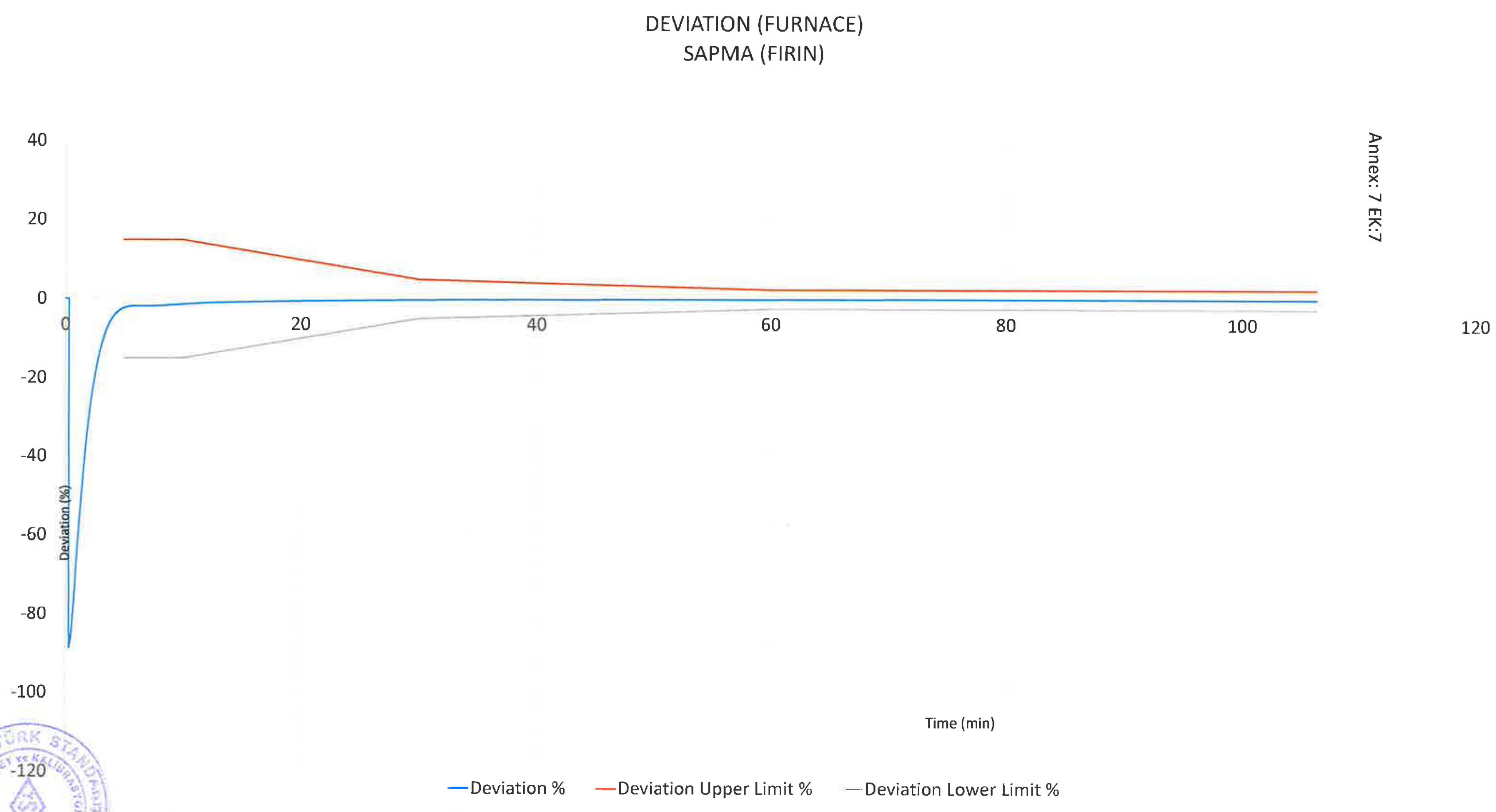
Talep no: 137384
Order no:

Annex: 6 EK: 6

FURNACE THERMOCOUPLES
FIRIN ISILÇİFTLERİ



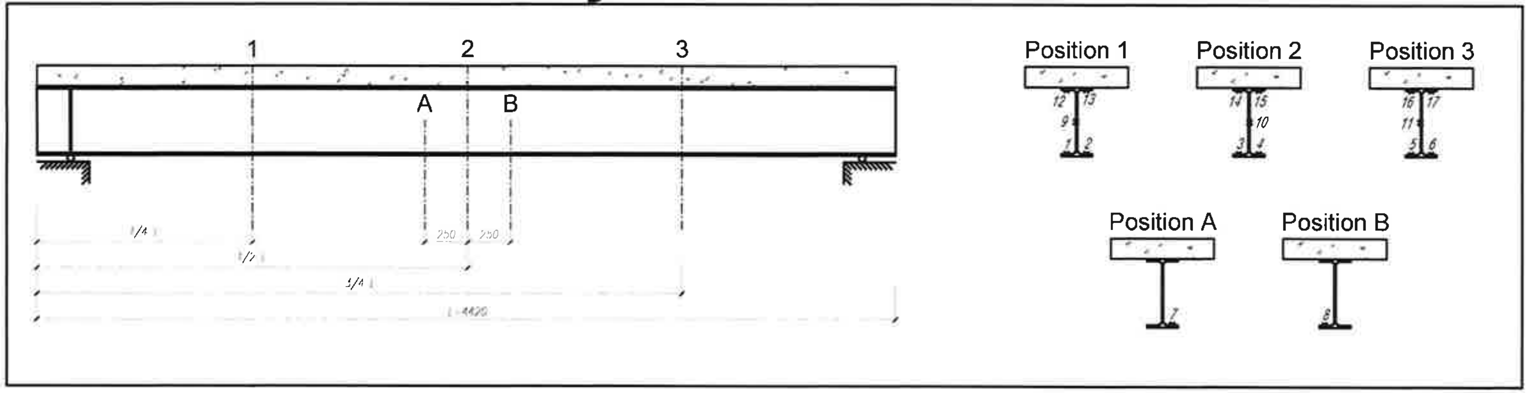
Annex: 7 EK:7



Talep no / Order no : 137384

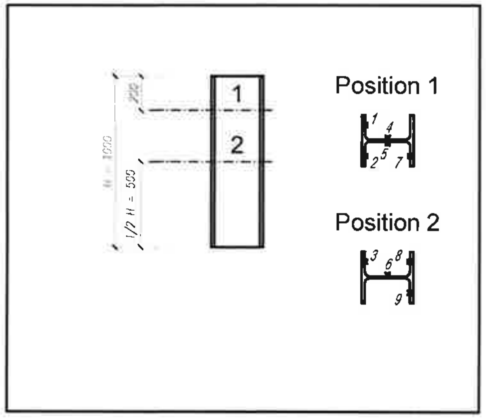
EK-8 TERMOKUPL YERLEŞİMİ
ANNEX-8 THERMOCOUPLE PLACEMENT

YÜKLEMELİ KİRİŞ- LOADED BEAM



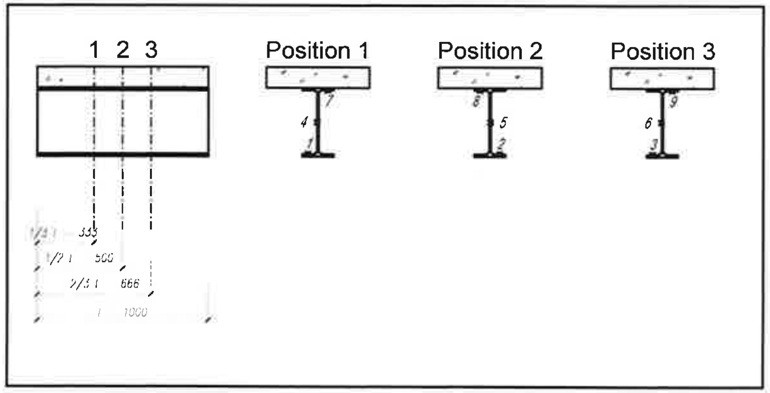
KISA KOLON

SHORT COLUMN



REFERANS KİRİŞ

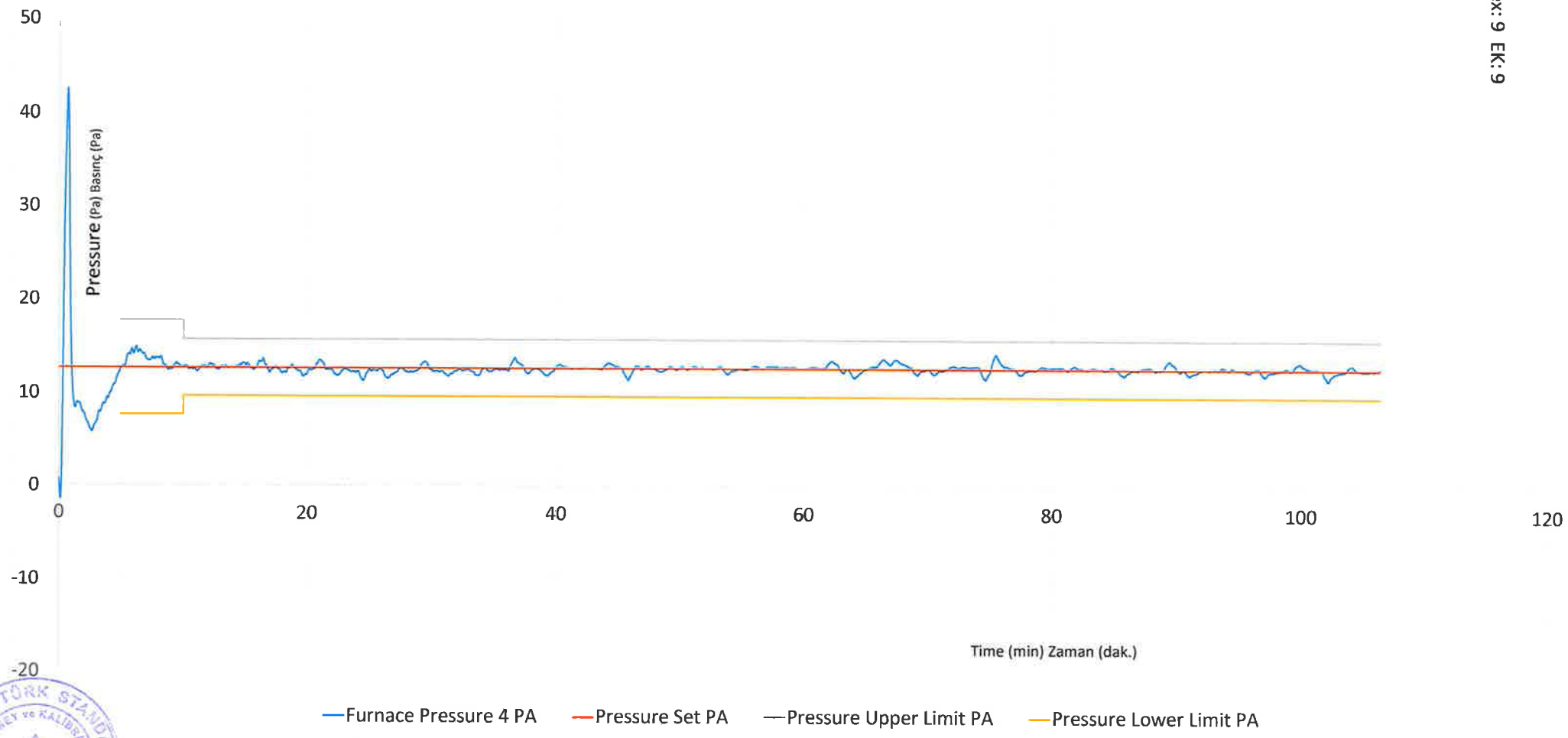
REFRENCE BEAM



Talep no: / order no: 137384

Annex: 9 EK: 9

FURNACE PRESSURE
FIRIN BASINCI



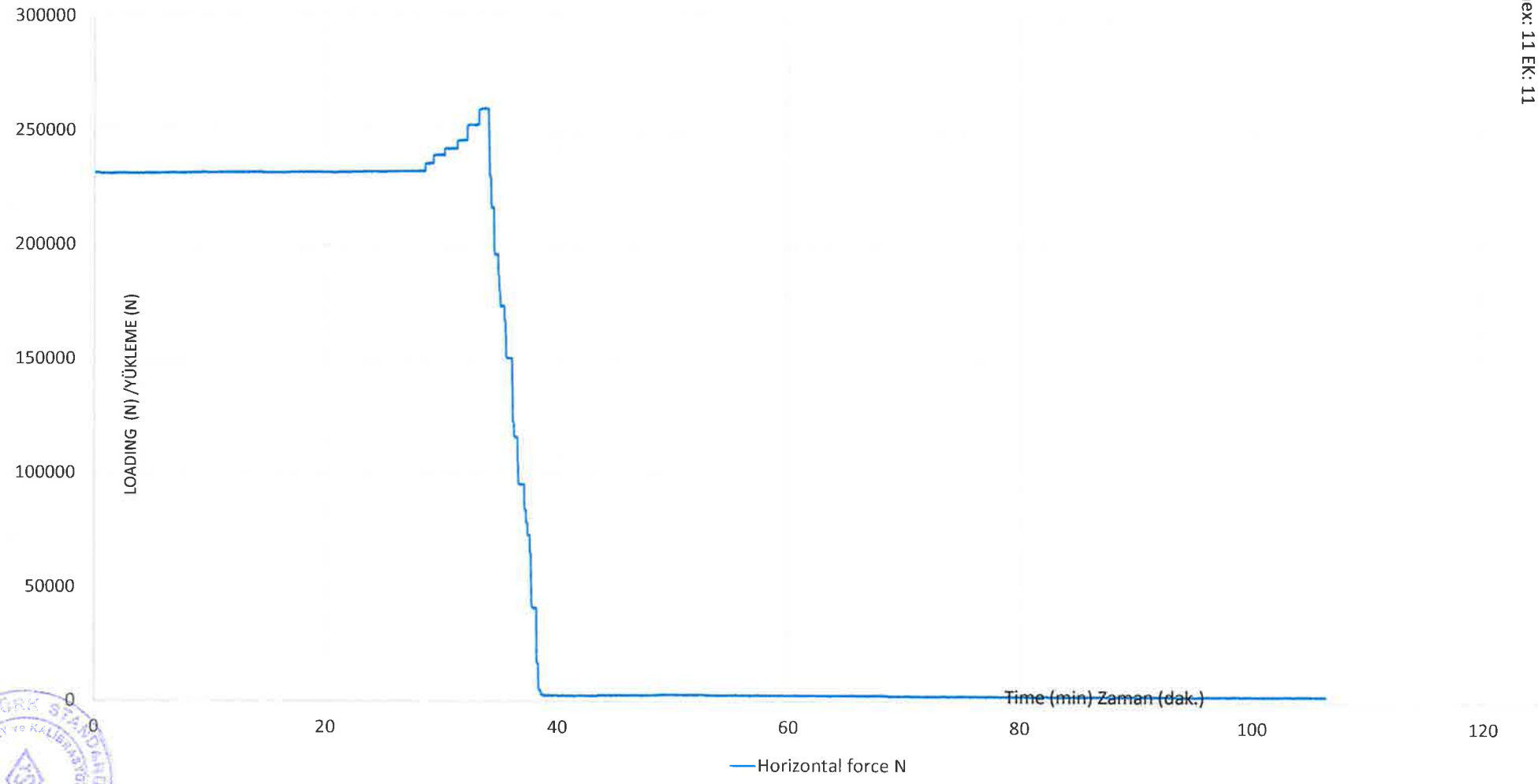
Tarih: 13.2.24

EK-10 KESİT DETAYLARI / ANNEX-10 SECTION DETAIL

No.	Symbol	Section type/ Kesit tipi	Heating/ Isıtma	Profile/Profil	Measured values/Ölçülmüş değerler						
					h [mm]	b [mm]	t_f [mm]	t_w [mm]	P [mm]	A [mm^2]	**Section factor /Kesit faktörü [m^{-1}]**
1	**SIC-1**	**open/açık**	**4 sides/taraf**	IPE 100	100	55	5,8	4,1	412	1000	**412**
2	**SIC-2**	**open/açık**	**4 sides/taraf**	HEA 200	190	200	10,4	6,5	1167	5260	**222**
3	**SIC-3**	**open/açık**	**4 sides/taraf**	HEB 240	232	242	16,0	11,2	1410	9998	**141**
4	**SIC-4**	**open/açık**	**4 sides/taraf**	HEM 240	270	243	30,5	18,2	1476	18616	**79**
5	**SIB-1**	**open/açık**	**3 sides/taraf**	IPE 400	400	180	13,5	9,6	1321	8441	**156**
6	**LB-1**	**open/açık**	**3 sides/taraf**	IPE 400	400	180	13,5	9,6	1321	8441	**156**

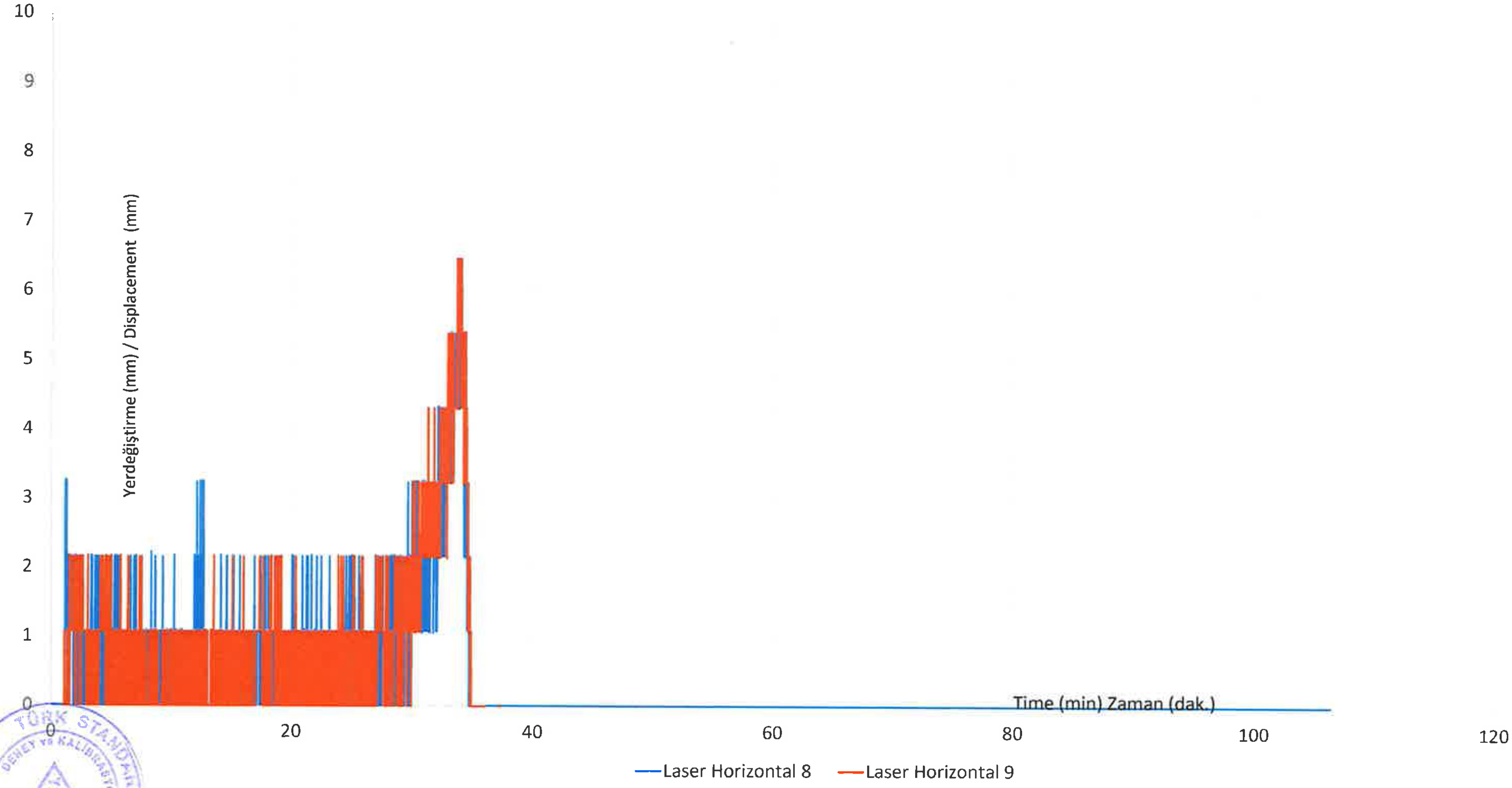
Annex: 11 EK: 11

YÜKLEME DEĞERLERİ /LOADING VALUES (N)



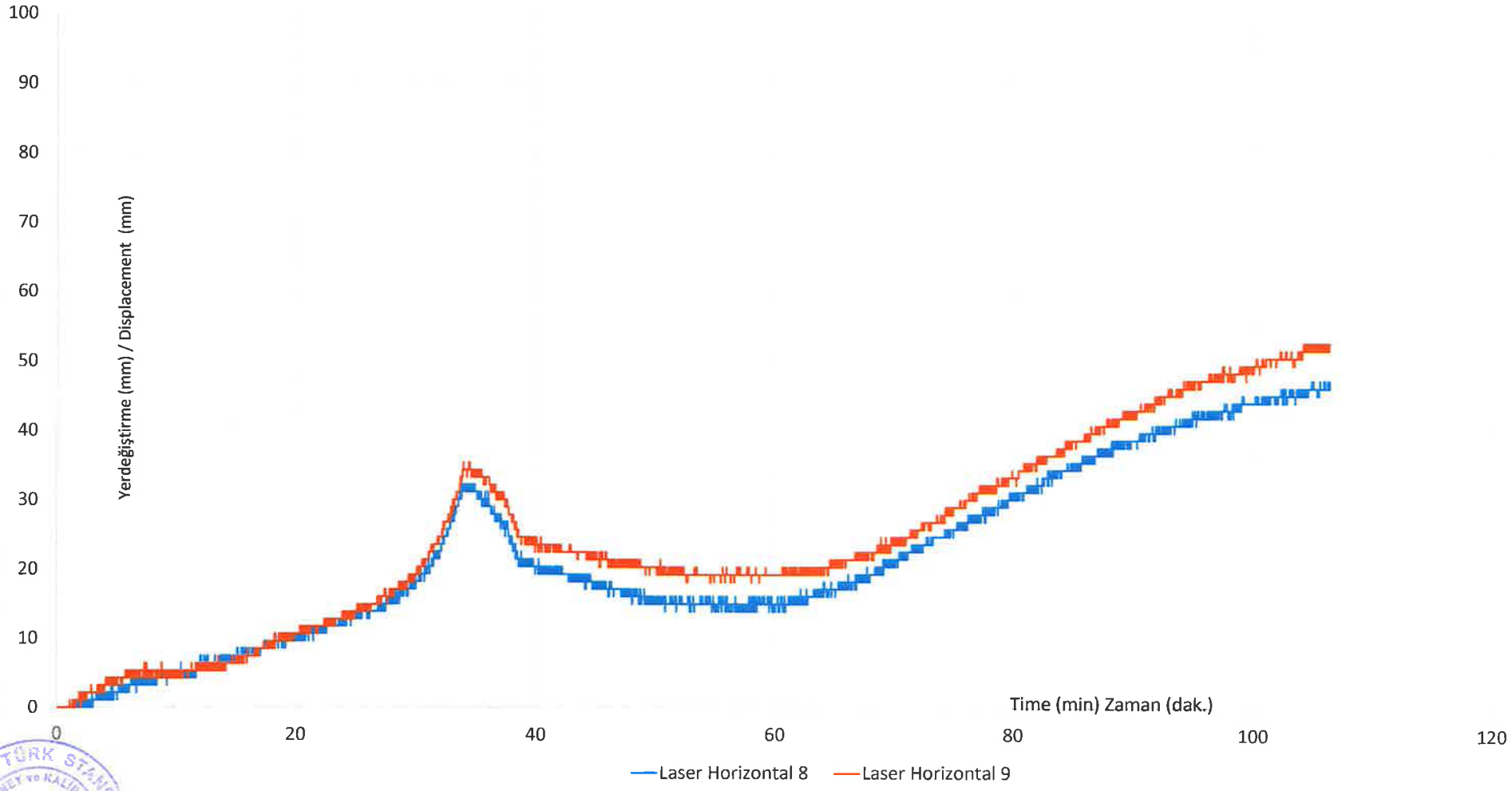
Annex: 12 EK: 12

YERDEĞİŞTİRME HIZI DEĞERLERİ /DISPLACEMENT RATE VALUES (mm)



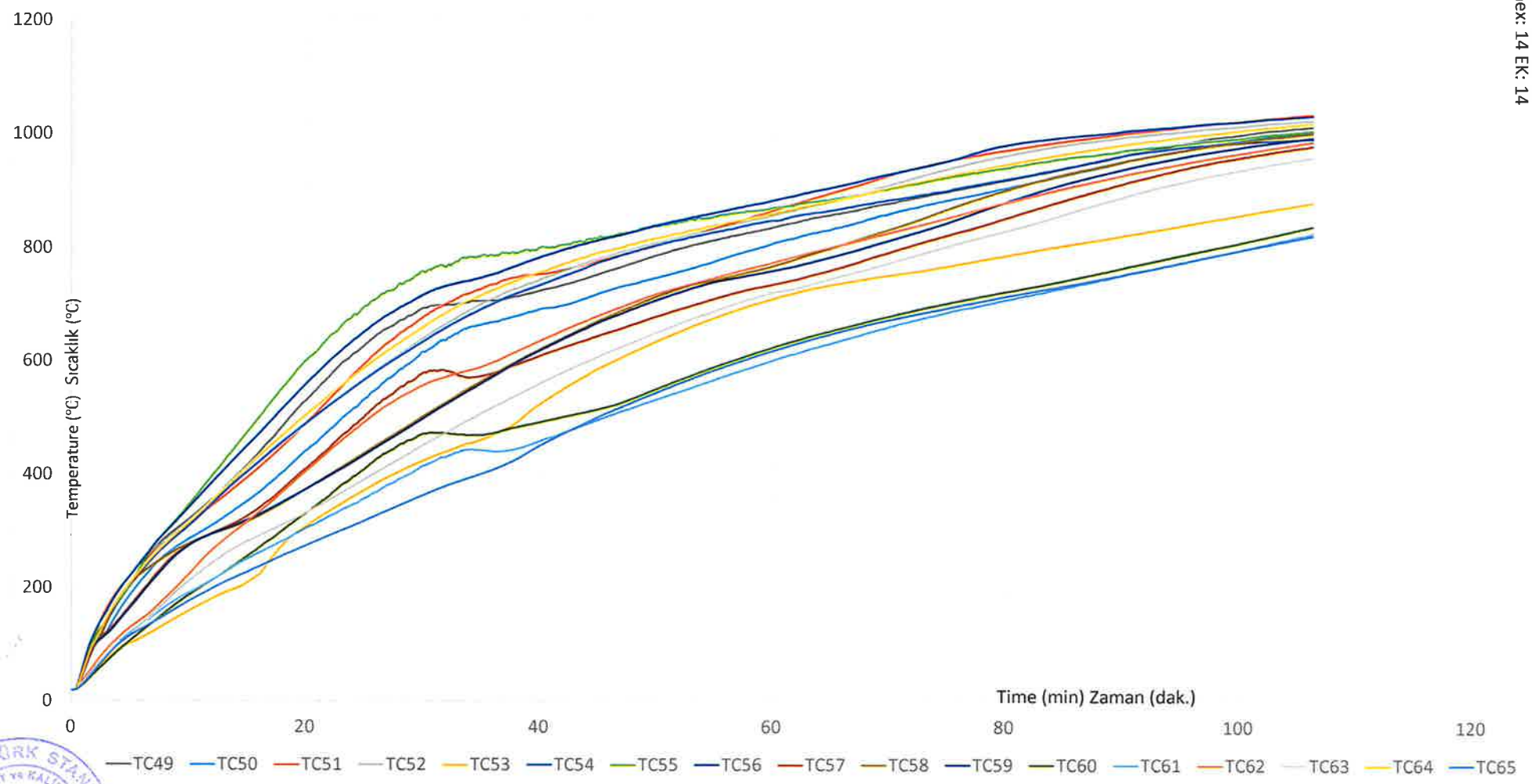
Annex: 13 EK: 13

YERDEĞİŞTİRME DEĞERLERİ /DISPLACEMENT VALUES (mm)

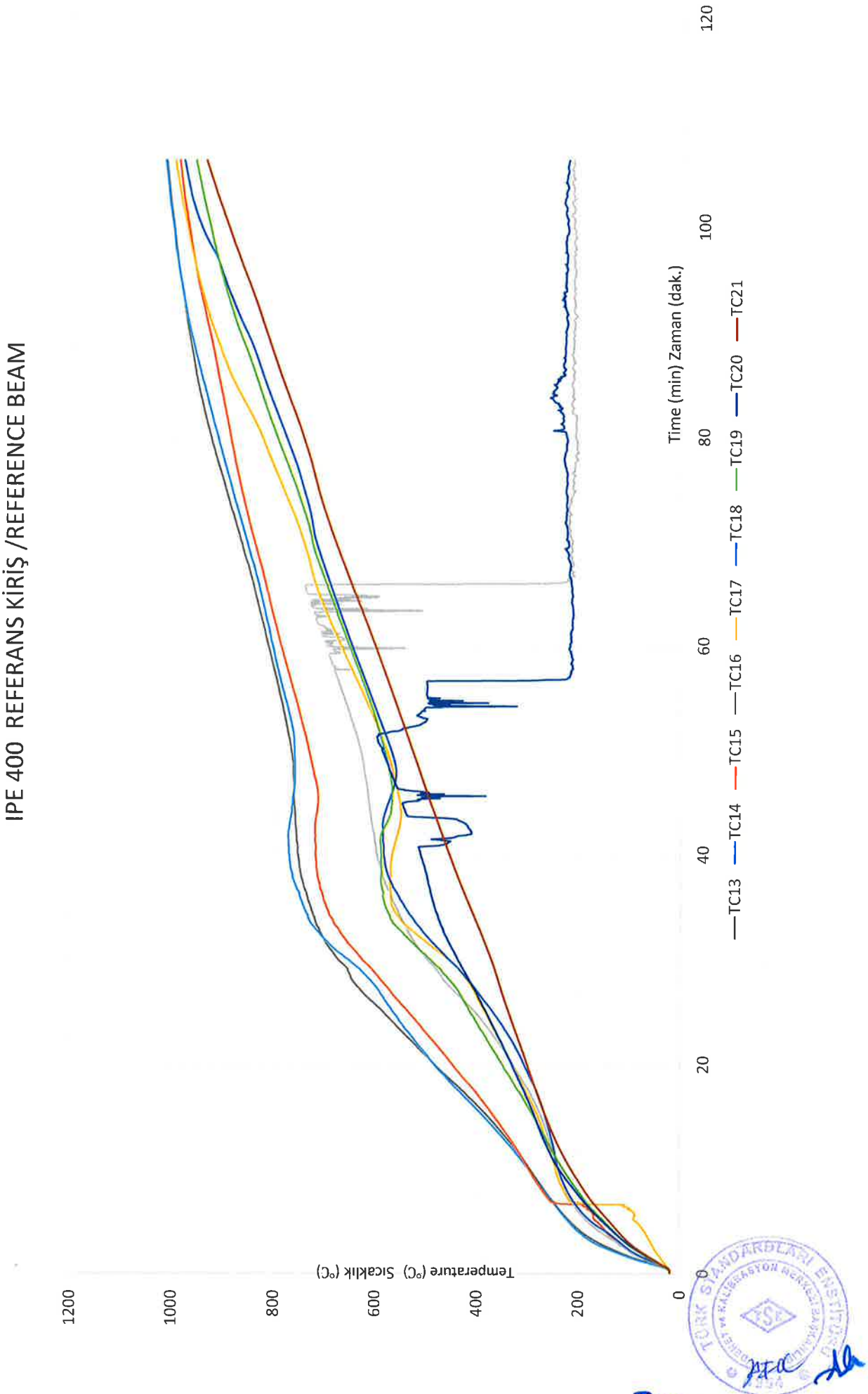


Annex: 14 EK: 14

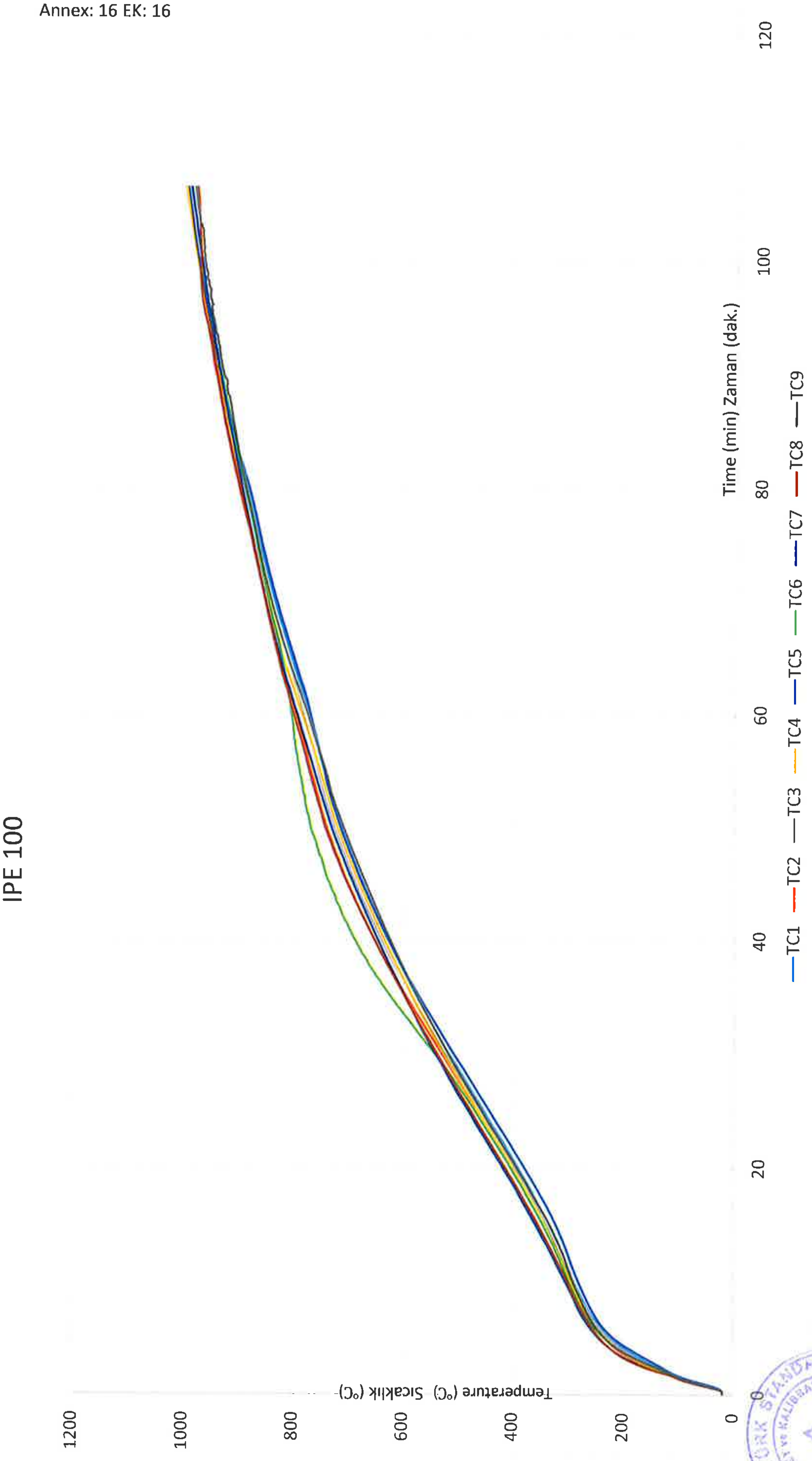
LOADED BEAM IPE 400



Annex: 15EK: 15

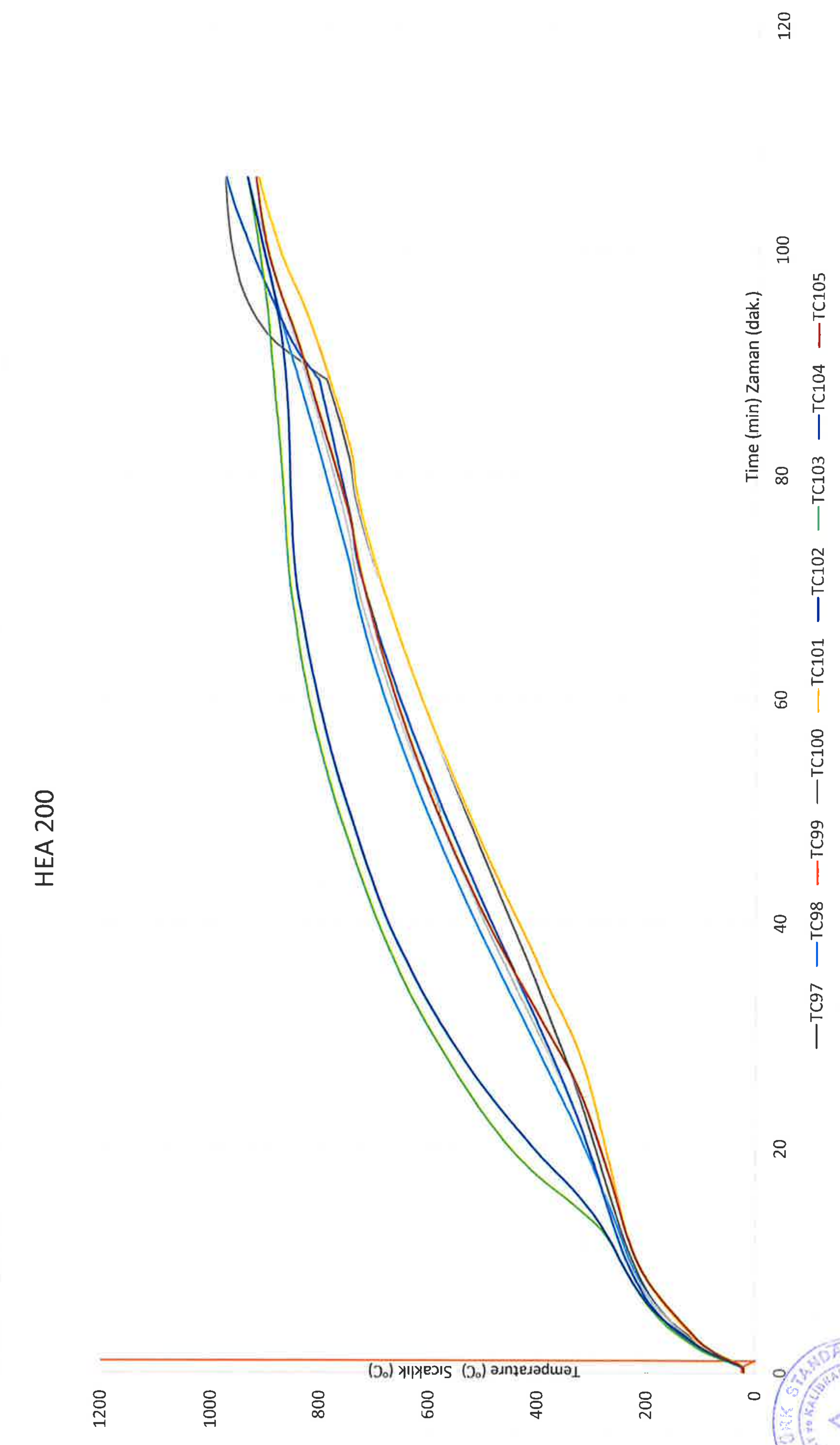


Annex: 16 EK: 16



Talep no:
Order no: 137324

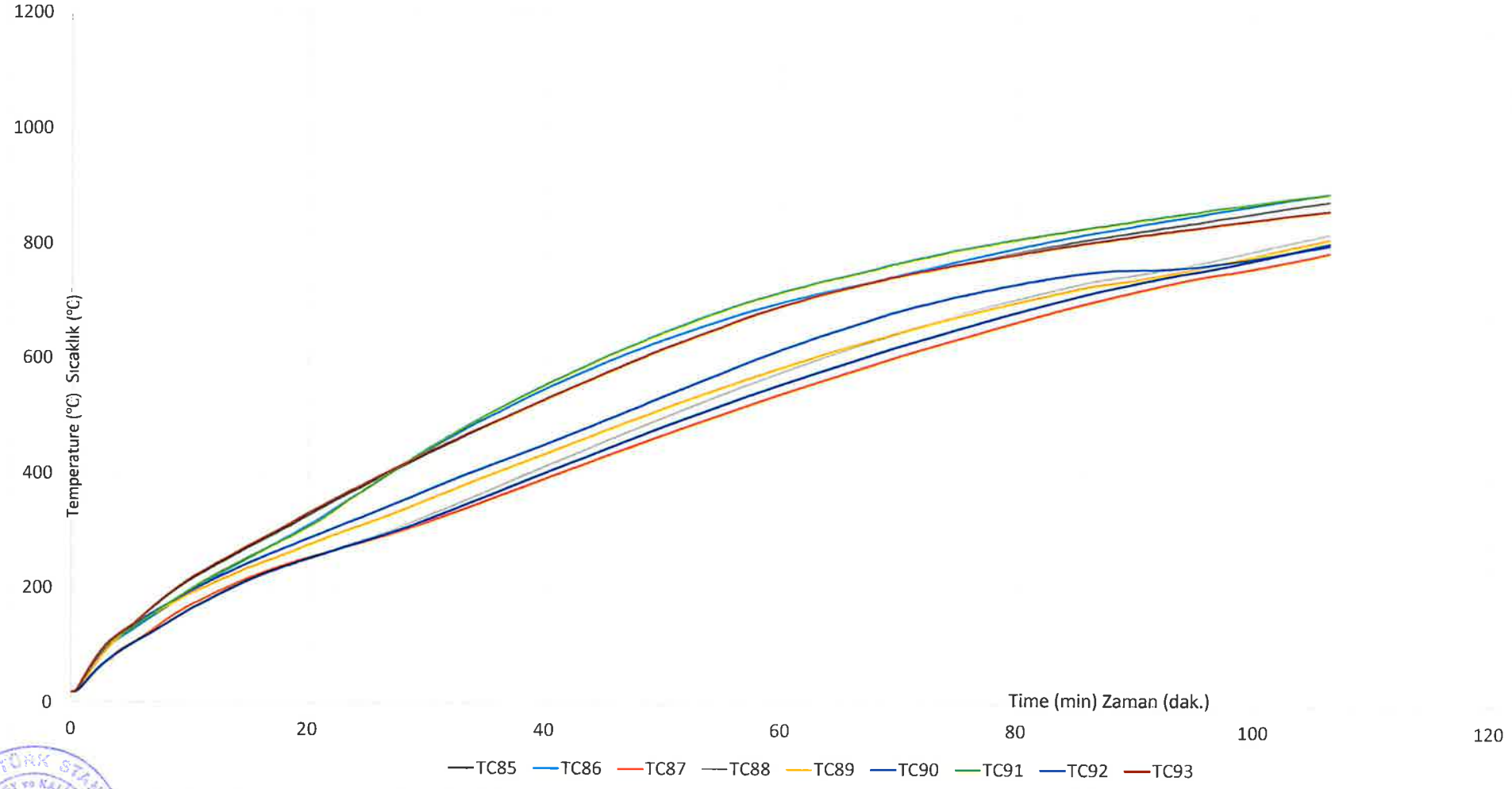
Annex: 17 EK: 17



Talep no: / Order no: 137384

Annex: 18 EK: 18

HEB 240

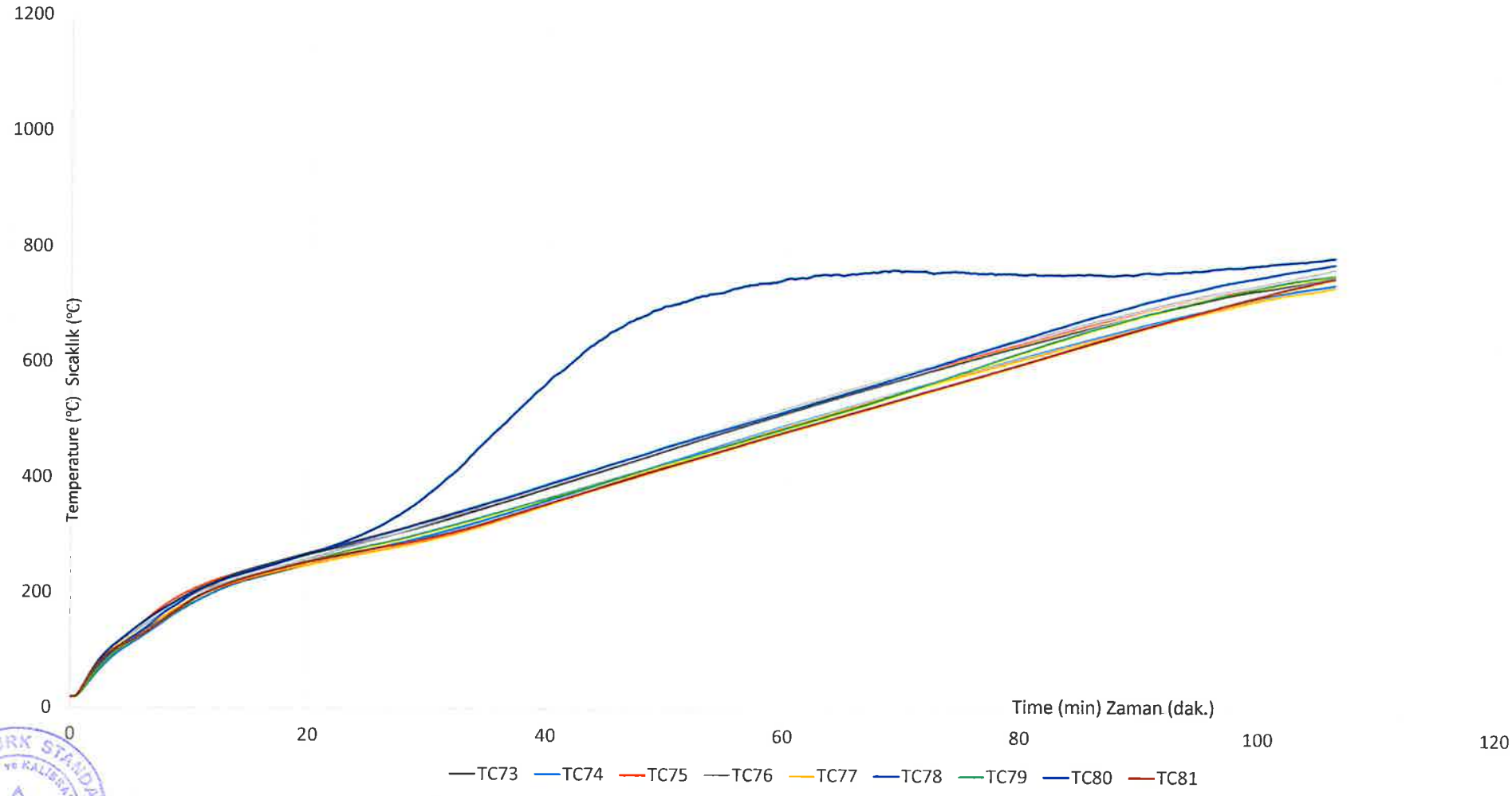


Talep tarihi: 13.03.24

TÜRK STANDARDLARI ENSTİTÜSÜ DENEY VE KALİBRASYON DAİRESİ BAŞKANLIĞI

Annex: 19 EK: 19

HEM 240



EK-20 VERİLERİN DOĞRULANMASI / ANNEX-20 DATA CORRECTION

Element	Section/ Kesit	Length/ Boy [mm]	Protection shape/Koruma şekli	Nominal protection thickness Nominal koruma kalınlığı dp [mm]	Real protection thickness/Gerçek koruma kalınlığı [mm]	Nominal section factor/Nominal kesit faktörü Am/V [m-1]	Real section factor/Gerçek kesit faktörü [m-1]
TEST 1							
SIC-1	IPE 100	1000	Contour/Tüm çevre	1,500	1,496	416	412
SIC-2	HEA 200	1000	Contour/Tüm çevre	1,500	1,605	229	222
SIC-3	HEB 240	1000	Contour/Tüm çevre	1,500	1,531	139	141
SIC-4	HEM 240	1000	Contour/Tüm çevre	1,500	1,531	76	79
SIB-1	IPE 400	1000	Contour/Tüm çevre	1,500	1,769	164	156
LB-1	IPE 400	4420	Contour/Tüm çevre	1,500	1,620	164	156

TÜRK STANDARDLARI ENSTİTÜSÜ DENEY ve KALİBRASYON HİZMETLERİ MÜDÜRLÜĞÜ TSE

Talep no/ Order no: 137384

EK-21 DOĞRULAMA FAKTÖRÜ / ANNEX-21 CORRECTION FACTOR

Section Type / Parameter	Thickness/ Kalınlık [mm]	Section Factor/Kesit Faktörü [m^{-1}]	Time (characteristic) to reach design temperature [min]/Dizayn sıcaklığına ulaşılan zaman [dak]										Failure time/Kalma zamanı (EN 1363-1) [min]
			300	350	400	450	500	550	600	650	700	750	
Loaded Element MIN	1,620	156	9,8	12,4	14,9	17,3	19,8	22,6	25,6	29,7	37,6	46,4	32,88333
Reference Element MIN	1,769	156	11,8	15,2	18,3	21,4	24,4	27,3	30,4	33,4	51,0	59,7	
$t_c(d_{min})$	1,620		10,8	13,9	16,7	19,6	22,3	25,0	27,9	30,6	46,7	54,6	
k_{min}	1,620		**0,91**	**0,89**	**0,89**	**0,89**	**0,89**	**0,91**	**0,92**	**0,97**	**0,80**	**0,85**	

Talep no: 137334

EK-22 DOĞRULAMA TABLOSU / ANNEX-22 CORRECTION FACTOR TABLE

Correction factor/Düzeltme faktörü k_i													
Test	Element	Section factor/Kesit faktörü	Thickness/ Kalınlık	300	350	400	450	500	550	600	650	700	750
Test 1	SIC-1	412	1,496	0,91	0,89	0,89	0,89	0,89	0,89	0,89	0,89	0,89	0,89
	SIC-2	222	1,605	0,91	0,89	0,89	0,89	0,89	0,89	0,89	0,89	0,89	0,89
	SIC-3	141	1,531	0,91	0,89	0,89	0,89	0,89	0,89	0,89	0,89	0,89	0,89
	SIC-4	79	1,531	0,91	0,89	0,89	0,89	0,89	0,89	0,89	0,89	0,89	0,89

CORRECTION FACTOR TABLE

Teklif No: 137384

TÜRK STANDARDLARI ENSTİTÜSÜ DENEY VE KALİBRASYON LABORATUVARLARI

EK-23 SICAKLIK-ZAMAN DEĞERLERİ / ANNEX-23 TIME TO REACH

				Time to reach design temperature [min] Dziayn sıcaklığına ulaşılan zaman (dak)									
Test	Element	Section factor/Kesit faktörü	Thickness/ Kalınlık	300	350	400	450	500	550	600	650	700	750
Test 1	SIC-1	412	1,496	10,7166667	15,85	20,0166667	23,9333333	27,8333333	31,7	35,8	40,3666667	45,7666667	52,85
	SIC-2	222	1,605	17,9333333	23,55	28,6666667	33,4166667	38,3833333	43,7	49,5	55,8333333	63,1666667	72,41667
	SIC-3	141	1,531	21,3166667	26,7166667	32,1166667	37,7	43,5333333	49,5666667	56,0833333	63,4166667	72,2	82,63333
	SIC-4	79	1,531	27,1666667	34,6166667	41,2833333	48,3	56,1333333	64,5166667	73,2666667	82,25	91,7666667	103,0667

BASED ON TEST DATA (BEFORE CORRECTION) (DÜZELTMEDEN ÖNCE)

Talep no:
order no: 137354

EK-24 SICAKLIK-ZAMAN DEĞERLERİ (DOĞRULANMIŞ) / ANNEX-24 TIME TO REACH (CORRECTED)

Time to reach design temperature [min] Dizayn sıcaklığına ulaşılan zaman (dak)													
Test	Element	n factor/Kesit	ickness/ Kalı	300	350	400	450	500	550	600	650	700	750
Test 1	SIC-1	412	1,496	9,74	14,06	17,83	21,20	24,69	28,21	31,86	35,93	40,73	47,04
	SIC-2	222	1,605	16,30	20,89	25,53	29,60	34,05	38,89	44,06	49,69	56,22	64,45
	SIC-3	141	1,531	19,37	23,70	28,61	33,40	38,62	44,11	49,91	56,44	64,26	73,54
	SIC-4	79	1,531	24,69	30,71	36,77	42,79	49,80	57,42	65,21	73,20	81,67	91,73

AFTER CORRECTION (DÜZLETMEDEN SONRA)

EK-25 ADIM 0 /ANNEX-25 STEP 0

INPUT DATA

No	Element	Am/V [m-1]	dp [mm]	Time to reach design temperature (corrected) [°C]									
				300	350	400	450	500	550	600	650	700	750
1	SIC-1	412	1,5	9,74	14,06	17,83	21,20	24,69	28,21	31,86	35,93	40,73	47,04
2	SIC-2	222	1,5	16,30	20,89	25,53	29,60	34,05	38,89	44,06	49,69	56,22	64,45
3	SIC-3	141	1,5	19,37	23,70	28,61	33,40	38,62	44,11	49,91	56,44	64,26	73,54
4	SIC-4	79	1,5	24,69	30,71	36,77	42,79	49,80	57,42	65,21	73,20	81,67	91,73

Talep no:
order no: 137384

EK-26 ADIM 1 /ANNEX-26 STEP 1

Element	AmV	dp	temp	dp	dp/AmV	temp	dp*temp	dp*(temp/AmV)	temp/AmV	1/AmV	time
SIC-1	412	1,5	300	1,5	0,003640777	300	450	1,09223301	0,72815534	0,002427184	9,74
SIC-1	412	1,5	350	1,5	0,003640777	350	525	1,274271845	0,849514563	0,002427184	14,06
SIC-1	412	1,5	400	1,5	0,003640777	400	600	1,45631068	0,970873786	0,002427184	17,83
SIC-1	412	1,5	450	1,5	0,003640777	450	675	1,638349515	1,09223301	0,002427184	21,70
SIC-1	412	1,5	500	1,5	0,003640777	500	750	1,82038835	1,213592233	0,002427184	24,69
SIC-1	412	1,5	550	1,5	0,003640777	550	825	2,002427184	1,334951456	0,002427184	28,21
SIC-1	412	1,5	600	1,5	0,003640777	600	900	2,184466019	1,45631068	0,002427184	31,86
SIC-1	412	1,5	650	1,5	0,003640777	650	975	2,366504854	1,577669903	0,002427184	35,93
SIC-1	412	1,5	700	1,5	0,003640777	700	1050	2,548543689	1,699029126	0,002427184	40,73
SIC-1	412	1,5	750	1,5	0,003640777	750	1125	2,730582524	1,82038835	0,002427184	47,04
SIC-2	222	1,5	300	1,5	0,006756757	300	450	2,027027027	1,351351351	0,004504505	16,30
SIC-2	222	1,5	350	1,5	0,006756757	350	525	2,364864865	1,576576577	0,004504505	20,89
SIC-2	222	1,5	400	1,5	0,006756757	400	600	2,702702703	1,801801802	0,004504505	25,53
SIC-2	222	1,5	450	1,5	0,006756757	450	675	3,040540541	2,027027027	0,004504505	29,60
SIC-2	222	1,5	500	1,5	0,006756757	500	750	3,378378378	2,252252252	0,004504505	34,05
SIC-2	222	1,5	550	1,5	0,006756757	550	825	3,716216216	2,477477477	0,004504505	38,89
SIC-2	222	1,5	600	1,5	0,006756757	600	900	4,054054054	2,702702703	0,004504505	44,06
SIC-2	222	1,5	650	1,5	0,006756757	650	975	4,391891892	2,927927928	0,004504505	49,69
SIC-2	222	1,5	700	1,5	0,006756757	700	1050	4,72972973	3,153153153	0,004504505	56,22
SIC-2	222	1,5	750	1,5	0,006756757	750	1125	5,067567568	3,378378378	0,004504505	64,45
SIC-3	141	1,5	300	1,5	0,010638298	300	450	3,191489362	2,127659574	0,007092199	19,37
SIC-3	141	1,5	350	1,5	0,010638298	350	525	3,723404255	2,482269504	0,007092199	23,70
SIC-3	141	1,5	400	1,5	0,010638298	400	600	4,255319149	2,836879433	0,007092199	28,61
SIC-3	141	1,5	450	1,5	0,010638298	450	675	4,787234043	3,191489362	0,007092199	33,40
SIC-3	141	1,5	500	1,5	0,010638298	500	750	5,319148936	3,546099291	0,007092199	38,62
SIC-3	141	1,5	550	1,5	0,010638298	550	825	5,85106383	3,90070922	0,007092199	44,11
SIC-3	141	1,5	600	1,5	0,010638298	600	900	6,382978723	4,255319149	0,007092199	49,91
SIC-3	141	1,5	650	1,5	0,010638298	650	975	6,914893617	4,609929078	0,007092199	56,44
SIC-3	141	1,5	700	1,5	0,010638298	700	1050	7,446808511	4,964539007	0,007092199	64,26
SIC-3	141	1,5	750	1,5	0,010638298	750	1125	7,978723404	5,319148936	0,007092199	73,54
SIC-4	79	1,5	300	1,5	0,018987342	300	450	5,696202532	3,797468354	0,012658228	24,69
SIC-4	79	1,5	350	1,5	0,018987342	350	525	6,64556962	4,430379747	0,012658228	30,71
SIC-4	79	1,5	400	1,5	0,018987342	400	600	7,594936709	5,063291139	0,012658228	36,77
SIC-4	79	1,5	450	1,5	0,018987342	450	675	8,544303797	5,696202532	0,012658228	42,79
SIC-4	79	1,5	500	1,5	0,018987342	500	750	9,493670886	6,329113924	0,012658228	49,80
SIC-4	79	1,5	550	1,5	0,018987342	550	825	10,44303797	6,962025316	0,012658228	57,42
SIC-4	79	1,5	600	1,5	0,018987342	600	900	11,39240506	7,594936709	0,012658228	65,21
SIC-4	79	1,5	650	1,5	0,018987342	650	975	12,34177215	8,227848101	0,012658228	73,20
SIC-4	79	1,5	700	1,5	0,018987342	700	1050	13,29113924	8,860759494	0,012658228	81,67
SIC-4	79	1,5	750	1,5	0,018987342	750	1125	14,24050633	9,493670886	0,012658228	91,73

REGRESSION CONSTANTS (Step 1)

A7	A6	A5	A4	A3	A2	A1	A0
0	0	4,270291	0,045875	0	-510,009	0	-12,5317
0	0	0,541493	0,004166	0	294,7786	0	3,400897
0,980857	2,826857	#YOK	#YOK	#YOK	#YOK	#YOK	#YOK
614,1933	36	#YOK	#YOK	#YOK	#YOK	#YOK	#YOK
14724,28	287,6804	#YOK	#YOK	#YOK	#YOK	#YOK	#YOK
0							
0							
0							

R2-->

A7	A6	A5	A4	A3	A2	A1	A0
0	0	4,270291	0,045875	0	-510,009	0	-12,5317

Talepno: order no: 13384

INPUT DATA (from Step 0)

No	Element	Am/V [m-1]	dp [mm]	Time to reach design temperature CORRECTED [°C]									
				300	350	400	450	500	550	600	650	700	750
1	SIC-1	412	1,5	9,7	14,1	17,8	21,2	24,7	28,2	31,9	35,9	40,7	47,0
2	SIC-2	222	1,5	16,3	20,9	25,5	29,6	34,1	38,9	44,1	49,7	56,2	64,5
3	SIC-3	141	1,5	19,4	23,7	28,6	33,4	38,6	44,1	49,9	56,4	64,3	73,5
4	SIC-4	79	1,5	24,7	30,7	36,8	42,8	49,8	57,4	65,2	73,2	81,7	91,7

PREDICTED TIMES (Step 2)

No	Element	Am/V [m-1]	dp [mm]	Time to reach design temperature PREDICTED [°C]									
				300	350	400	450	500	550	600	650	700	750
1	SIC-1	412	1,5	10,9	15,1	19,4	23,6	27,8	32,0	36,2	40,4	44,7	48,9
2	SIC-2	222	1,5	13,3	18,2	23,1	28,0	32,9	37,7	42,6	47,5	52,4	57,3
3	SIC-3	141	1,5	16,3	22,0	27,7	33,5	39,2	44,9	50,6	56,3	62,0	67,7
4	SIC-4	79	1,5	22,8	30,2	37,7	45,2	52,7	60,2	67,7	75,2	82,7	90,2

DIFFERENCES (Step 3) (in minutes)

1	SIC-1	412	1,5	1,2	1,1	1,5	2,4	3,1	3,8	4,4	4,5	3,9	1,8
2	SIC-2	222	1,5	-3,0	-2,7	-2,4	-1,6	-1,2	-1,2	-1,4	-2,2	-3,8	-7,2
3	SIC-3	141	1,5	-3,1	-1,7	-0,9	0,1	0,5	0,8	0,7	-0,1	-2,2	-5,8
4	SIC-4	79	1,5	-1,9	-0,5	1,0	2,5	2,9	2,8	2,5	2,0	1,0	-1,5
											AVG. DIFF.	0,0000	

DIFFERENCES (Step 3) (in %)

1	SIC-1	412	1,5	12,12%	7,04%	8,56%	11,19%	12,55%	13,49%	13,70%	12,58%	9,65%	3,92%
2	SIC-2	222	1,5	-18,25%	-12,87%	-9,38%	-5,91%	-3,82%	-3,07%	-3,25%	-4,40%	-6,81%	-11,14%
3	SIC-3	141	1,5	-15,77%	-7,07%	-3,03%	0,16%	1,40%	1,72%	1,35%	-0,25%	-3,50%	-7,91%
4	SIC-4	79	1,5	-7,83%	-1,52%	2,64%	5,73%	5,88%	4,99%	3,85%	2,75%	1,27%	-1,66%
											AVG. DIFF.	0,25%	

ACCEPTABILITY OF ANALYSIS

Criterion	Description	Value	Test
13.5 a)	predicted time for each element ≤15% larger than corrected time	0	PASSED
13.5 b)	mean value of all percentage differences < 0%	0,25%	FAILED
13.5 c)	maximum of 30% of values >0%	52,50%	FAILED

Tarihi: 01.03.2024

INPUT DATA (from Step 0)

No	Element	Am/V [m-1]	dp [mm]	Time to reach design temperature CORRECTED [°C]									
				300	350	400	450	500	550	600	650	700	750
1	SIC-1	412	1,5	9,7	14,1	17,8	21,2	24,7	28,2	31,9	35,9	40,7	47,0
2	SIC-2	222	1,5	16,3	20,9	25,5	29,6	34,1	38,9	44,1	49,7	56,2	64,5
3	SIC-3	141	1,5	19,4	23,7	28,6	33,4	38,6	44,1	49,9	56,4	64,3	73,5
4	SIC-4	79	1,5	24,7	30,7	36,8	42,8	49,8	57,4	65,2	73,2	81,7	91,7

MODIFIED PREDICTED TIMES (Step 4)

No	Element	Am/V [m-1]	dp [mm]	Time to reach design temperature MODIFIED & PREDICTED [°C]									
				300	350	400	450	500	550	600	650	700	750
1	SIC-1	412	1,5	10,5	14,6	18,6	22,7	26,7	30,8	34,9	38,9	43,0	47,0
2	SIC-2	222	1,5	12,8	17,5	22,2	26,9	31,6	36,3	41,0	45,7	50,4	55,1
3	SIC-3	141	1,5	15,7	21,2	26,7	32,2	37,7	43,2	48,7	54,2	59,7	65,2
4	SIC-4	79	1,5	21,9	29,1	36,3	43,5	50,7	57,9	65,2	72,4	79,6	86,8

DIFFERENCES (Step 4) (in minutes)

1	SIC-1	412	1,5	0,8	0,5	0,8	1,5	2,0	2,6	3,0	3,0	2,2	0,0
2	SIC-2	222	1,5	-3,5	-3,4	-3,3	-2,7	-2,4	-2,6	-3,0	-4,0	-5,8	-9,3
3	SIC-3	141	1,5	-3,7	-2,5	-1,9	-1,2	-0,9	-0,9	-1,2	-2,3	-4,6	-8,4
4	SIC-4	79	1,5	-2,8	-1,6	-0,5	0,7	0,9	0,5	0,0	-0,8	-2,1	-4,9
											AVG. DIFF.	-1,5469	

DIFFERENCES (Step 4) (in %)

1	SIC-1	412	1,5	7,85%	3,57%	4,46%	6,98%	8,29%	8,12%	8,40%	8,32%	5,50%	-0,01%
2	SIC-2	222	1,5	-21,34%	-16,18%	-13,00%	-9,08%	-7,17%	-6,64%	-6,91%	-8,01%	-10,36%	-14,50%
3	SIC-3	141	1,5	-18,96%	-10,59%	-6,70%	-3,62%	-2,43%	-2,12%	-2,44%	-4,02%	-7,14%	-11,40%
4	SIC-4	79	1,5	-11,32%	-5,24%	-1,24%	1,73%	1,80%	0,82%	0,07%	-1,13%	-2,56%	-5,36%
											AVG. DIFF.	-3,54%	

REGRESSION CONSTANTS (from Step 1)

A7	A6	A5	A4	A3	A2	A1	A0
0,000	0,000	4,270	0,046	0,000	-510,009	0,000	-12,532

MODIFIED REGRESSION CONSTANTS (Step 4)

Modification factor "x" (≤1,00)							0,9622 <-- modify here
A7	A6	A5	A4	A3	A2	A1	A0
0	0	4,1088738	0,0441405	0	-490,7305	0	-12,05796

ACCEPTABILITY OF ANALYSIS

Criterion	Description	Value	Test
13.5 a)	predicted time for each element ≤15% larger than corrected time	0	PASSED
13.5 b)	mean value of all percentage differences < 0%	-3,54%	PASSED
13.5 c)	maximum of 30% of values >0%	30,00%	PASSED

EK-29-A ADIM 5&6 /ANNEX-29-A STEP 5&6

15 Dakika

Fire Resistance Period / Yangına Daynım Periyodu **15** minutes/dakika										
Design Temperature/ Dizayn Sıcaklığı °C	300	350	400	450	500	550	600	650	700	750
Section factor/Kesit faktörü m^{-1}	Thickness (mm) of Fire Protection Material to Maintain Steel Temperature Below Design Temperature/Çeliği istenilen dizayn sıcaklığı altında tutmak için koruma malzemesi kalınlığı (mm)									
71	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
80	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
90	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
100	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
110	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
120	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
130	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
140	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
150	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
160	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
170	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
180	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
190	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
200	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
210	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
220	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
230	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
240	1,7	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
250	1,7	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
260	1,7	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
270	-	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
280	-	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
290	-	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
300	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
310	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
320	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
330	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
340	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
350	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
360	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
370	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
380	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
390	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
400	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
410	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
420	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
430	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
440	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
450	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
453	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4

Talep no: 137384

EK-29-B ADIM 5&6 /ANNEX-29-B STEP 5&6

20 Dakika

Fire Resistance Period / Yangına Daynım Periyodu **20** minutes/dakika										
Design Temperature/ Dizayn Sıcaklığı °C	300	350	400	450	500	550	600	650	700	750
Section factor/Kesit faktörü m^{-1}	Thickness (mm) of Fire Protection Material to Maintain Steel Temperature Below Design Temperature/Çeliği istenilen dizayn sıcaklığı altında tutmak için koruma malzemesi kalınlığı (mm)									
71	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
80	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
90	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
100	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
110	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
120	1,7	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
130	-	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
140	-	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
150	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
160	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
170	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
180	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
190	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
200	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
210	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
220	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
230	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
240	-	1,7	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
250	-	1,7	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
260	-	1,7	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
270	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
280	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
290	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
300	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
310	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
320	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
330	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
340	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
350	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
360	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
370	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
380	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
390	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4
400	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4
410	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4
420	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4
430	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4
440	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4
450	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4
453	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4

Talep no: 132334
Order no:

EK-29-C ADIM 5&6 /ANNEX-29-C STEP 5&6

30 Dakika

Fire Resistance Period / Yangına Daynım Periyodu **30** minutes/dakika										
Design Temperature/ Dizayn Sıcaklığı °C	300	350	400	450	500	550	600	650	700	750
Section factor/Kesit faktörü m^{-1}	Thickness (mm) of Fire Protection Material to Maintain Steel Temperature Below Design Temperature/Çeliği istenilen dizayn sıcaklığı altında tutmak için koruma malzemesi kalınlığı (mm)									
71	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
80	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
90	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
100	-	1,7	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
110	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
120	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4
130	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4
140	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4	1,4
150	-	-	1,7	1,5	1,4	1,4	1,4	1,4	1,4	1,4
160	-	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4
170	-	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4
180	-	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4
190	-	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4
200	-	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4
210	-	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4
220	-	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4
230	-	-	-	1,6	1,5	1,4	1,4	1,4	1,4	1,4
240	-	-	-	1,6	1,5	1,4	1,4	1,4	1,4	1,4
250	-	-	-	1,7	1,5	1,4	1,4	1,4	1,4	1,4
260	-	-	-	1,7	1,5	1,4	1,4	1,4	1,4	1,4
270	-	-	-	1,7	1,5	1,4	1,4	1,4	1,4	1,4
280	-	-	-	-	1,5	1,4	1,4	1,4	1,4	1,4
290	-	-	-	-	1,5	1,4	1,4	1,4	1,4	1,4
300	-	-	-	-	1,5	1,4	1,4	1,4	1,4	1,4
310	-	-	-	-	1,6	1,4	1,4	1,4	1,4	1,4
320	-	-	-	-	1,6	1,4	1,4	1,4	1,4	1,4
330	-	-	-	-	1,6	1,4	1,4	1,4	1,4	1,4
340	-	-	-	-	1,6	1,4	1,4	1,4	1,4	1,4
350	-	-	-	-	1,6	1,4	1,4	1,4	1,4	1,4
360	-	-	-	-	1,6	1,4	1,4	1,4	1,4	1,4
370	-	-	-	-	1,6	1,4	1,4	1,4	1,4	1,4
380	-	-	-	-	1,6	1,5	1,4	1,4	1,4	1,4
390	-	-	-	-	1,6	1,5	1,4	1,4	1,4	1,4
400	-	-	-	-	1,6	1,5	1,4	1,4	1,4	1,4
410	-	-	-	-	1,6	1,5	1,4	1,4	1,4	1,4
420	-	-	-	-	1,6	1,5	1,4	1,4	1,4	1,4
430	-	-	-	-	1,6	1,5	1,4	1,4	1,4	1,4
440	-	-	-	-	1,6	1,5	1,4	1,4	1,4	1,4
450	-	-	-	-	1,6	1,5	1,4	1,4	1,4	1,4
453	-	-	-	-	1,6	1,5	1,4	1,4	1,4	1,4

Talepno: Order no: 137384

EK-29-D ADIM 5&6 /ANNEX-29-D STEP 5&6

45 Dakika

Fire Resistance Period / Yangına Daynım Periyodu **45** minutes/dakika										
Design Temperature/ Dizayn Sıcaklığı °C	300	350	400	450	500	550	600	650	700	750
Section factor/Kesit faktörü m^{-1}	Thickness (mm) of Fire Protection Material to Maintain Steel Temperature Below Design Temperature/Çeliği istenilen dizayn sıcaklığı altında tutmak için koruma malzemesi kalınlığı (mm)									
71	-	-	1,7	1,5	1,4	1,4	1,4	1,4	1,4	1,4
80	-	-	-	1,5	1,4	1,4	1,4	1,4	1,4	1,4
90	-	-	-	1,6	1,4	1,4	1,4	1,4	1,4	1,4
100	-	-	-	-	1,5	1,4	1,4	1,4	1,4	1,4
110	-	-	-	-	1,6	1,4	1,4	1,4	1,4	1,4
120	-	-	-	-	1,6	1,5	1,4	1,4	1,4	1,4
130	-	-	-	-	1,7	1,5	1,4	1,4	1,4	1,4
140	-	-	-	-	-	1,5	1,4	1,4	1,4	1,4
150	-	-	-	-	-	1,6	1,4	1,4	1,4	1,4
160	-	-	-	-	-	1,6	1,5	1,4	1,4	1,4
170	-	-	-	-	-	1,6	1,5	1,4	1,4	1,4
180	-	-	-	-	-	1,7	1,5	1,4	1,4	1,4
190	-	-	-	-	-	-	1,5	1,4	1,4	1,4
200	-	-	-	-	-	-	1,6	1,4	1,4	1,4
210	-	-	-	-	-	-	1,6	1,5	1,4	1,4
220	-	-	-	-	-	-	1,6	1,5	1,4	1,4
230	-	-	-	-	-	-	1,6	1,5	1,4	1,4
240	-	-	-	-	-	-	1,6	1,5	1,4	1,4
250	-	-	-	-	-	-	1,7	1,5	1,4	1,4
260	-	-	-	-	-	-	1,7	1,5	1,4	1,4
270	-	-	-	-	-	-	1,7	1,6	1,4	1,4
280	-	-	-	-	-	-	-	1,6	1,4	1,4
290	-	-	-	-	-	-	-	1,6	1,5	1,4
300	-	-	-	-	-	-	-	1,6	1,5	1,4
310	-	-	-	-	-	-	-	1,6	1,5	1,4
320	-	-	-	-	-	-	-	1,6	1,5	1,4
330	-	-	-	-	-	-	-	1,6	1,5	1,4
340	-	-	-	-	-	-	-	1,6	1,5	1,4
350	-	-	-	-	-	-	-	1,6	1,5	1,4
360	-	-	-	-	-	-	-	1,6	1,5	1,4
370	-	-	-	-	-	-	-	1,6	1,5	1,4
380	-	-	-	-	-	-	-	1,7	1,5	1,4
390	-	-	-	-	-	-	-	1,7	1,5	1,4
400	-	-	-	-	-	-	-	1,7	1,5	1,4
410	-	-	-	-	-	-	-	1,7	1,6	1,4
420	-	-	-	-	-	-	-	1,7	1,6	1,5
430	-	-	-	-	-	-	-	-	1,6	1,5
440	-	-	-	-	-	-	-	-	1,6	1,5
450	-	-	-	-	-	-	-	-	1,6	1,5
453	-	-	-	-	-	-	-	-	1,6	1,5

Tadilat Orderi: 137384

EK-29-E ADIM 5&6 /ANNEX-29-E STEP 5&6

60 Dakika

Fire Resistance Period / Yangına Daynım Periyodu **60** minutes/dakika										
Design Temperature/ Dizayn Sıcaklığı °C	300	350	400	450	500	550	600	650	700	750
Section factor/Kesit faktörü m^{-1}	Thickness (mm) of Fire Protection Material to Maintain Steel Temperature Below Design Temperature/Çeliği istenilen dizayn sıcaklığı altında tutmak için koruma malzemesi kalınlığı (mm)									
71	-	-	-	-	1,6	1,5	1,4	1,4	1,4	1,4
80	-	-	-	-	-	1,6	1,4	1,4	1,4	1,4
90	-	-	-	-	-	1,6	1,5	1,4	1,4	1,4
100	-	-	-	-	-	-	1,6	1,4	1,4	1,4
110	-	-	-	-	-	-	1,6	1,5	1,4	1,4
120	-	-	-	-	-	-	1,7	1,5	1,4	1,4
130	-	-	-	-	-	-	-	1,6	1,5	1,4
140	-	-	-	-	-	-	-	1,6	1,5	1,4
150	-	-	-	-	-	-	-	1,7	1,5	1,4
160	-	-	-	-	-	-	-	-	1,6	1,5
170	-	-	-	-	-	-	-	-	1,6	1,5
180	-	-	-	-	-	-	-	-	1,6	1,5
190	-	-	-	-	-	-	-	-	1,7	1,5
200	-	-	-	-	-	-	-	-	1,7	1,6
210	-	-	-	-	-	-	-	-	-	1,6
220	-	-	-	-	-	-	-	-	-	1,6
230	-	-	-	-	-	-	-	-	-	1,6
240	-	-	-	-	-	-	-	-	-	1,6
250	-	-	-	-	-	-	-	-	-	1,7
260	-	-	-	-	-	-	-	-	-	1,7
270	-	-	-	-	-	-	-	-	-	1,7
280	-	-	-	-	-	-	-	-	-	-
290	-	-	-	-	-	-	-	-	-	-
300	-	-	-	-	-	-	-	-	-	-
310	-	-	-	-	-	-	-	-	-	-
320	-	-	-	-	-	-	-	-	-	-
330	-	-	-	-	-	-	-	-	-	-
340	-	-	-	-	-	-	-	-	-	-
350	-	-	-	-	-	-	-	-	-	-
360	-	-	-	-	-	-	-	-	-	-
370	-	-	-	-	-	-	-	-	-	-
380	-	-	-	-	-	-	-	-	-	-
390	-	-	-	-	-	-	-	-	-	-
400	-	-	-	-	-	-	-	-	-	-
410	-	-	-	-	-	-	-	-	-	-
420	-	-	-	-	-	-	-	-	-	-
430	-	-	-	-	-	-	-	-	-	-
440	-	-	-	-	-	-	-	-	-	-
450	-	-	-	-	-	-	-	-	-	
453	-	-	-	-	-	-	-	-	-	

EK-29-F ADIM 5&6 /ANNEX-29-F STEP 5&6

90 Dakika

Fire Resistance Period / Yangına Daynım Periyodu **90** minutes/dakika										
Design Temperature/ Dizayn Sıcaklığı °C	300	350	400	450	500	550	600	650	700	750
Section factor/Kesit faktörü m^{-1}	Thickness (mm) of Fire Protection Material to Maintain Steel Temperature Below Design Temperature/Çeliği istenilen dizayn sıcaklığı altında tutmak için koruma malzemesi kalınlığı (mm)									
71	-	-	-	-	-	-	-	-	1,6	1,5
80	-	-	-	-	-	-	-	-	1,7	1,6
90	-	-	-	-	-	-	-	-	-	1,6
100	-	-	-	-	-	-	-	-	-	-
110	-	-	-	-	-	-	-	-	-	-
120	-	-	-	-	-	-	-	-	-	-
130	-	-	-	-	-	-	-	-	-	-
140	-	-	-	-	-	-	-	-	-	-
150	-	-	-	-	-	-	-	-	-	-
160	-	-	-	-	-	-	-	-	-	-
170	-	-	-	-	-	-	-	-	-	-
180	-	-	-	-	-	-	-	-	-	-
190	-	-	-	-	-	-	-	-	-	-
200	-	-	-	-	-	-	-	-	-	-
210	-	-	-	-	-	-	-	-	-	-
220	-	-	-	-	-	-	-	-	-	-
230	-	-	-	-	-	-	-	-	-	-
240	-	-	-	-	-	-	-	-	-	-
250	-	-	-	-	-	-	-	-	-	-
260	-	-	-	-	-	-	-	-	-	-
270	-	-	-	-	-	-	-	-	-	-
280	-	-	-	-	-	-	-	-	-	-
290	-	-	-	-	-	-	-	-	-	-
300	-	-	-	-	-	-	-	-	-	-
310	-	-	-	-	-	-	-	-	-	-
320	-	-	-	-	-	-	-	-	-	-
330	-	-	-	-	-	-	-	-	-	-
340	-	-	-	-	-	-	-	-	-	-
350	-	-	-	-	-	-	-	-	-	-
360	-	-	-	-	-	-	-	-	-	-
370	-	-	-	-	-	-	-	-	-	-
380	-	-	-	-	-	-	-	-	-	-
390	-	-	-	-	-	-	-	-	-	-
400	-	-	-	-	-	-	-	-	-	-
410	-	-	-	-	-	-	-	-	-	-
420	-	-	-	-	-	-	-	-	-	-
430	-	-	-	-	-	-	-	-	-	-
440	-	-	-	-	-	-	-	-	-	-
450	-	-	-	-	-	-	-	-	-	
453	-	-	-	-	-	-	-	-	-	