TÜRKAK

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TÜRKAK
Test
TS EN ISO/IEC 17025
AB-0556-T

EFECTIS ERA AVRASYA TEST VE BELGELENDİRME A.Ş.

Dilovası OSB, 5. Kısım, Fırat Caddesi No:18, Dilovası, KOCAELİ/TÜRKİYE

AB-0556-T
20.05.2019
RFTR19112

DENEY RAPORU

TEST REPORT

Müşterinin adı/adresi *Customer name/address*	:	ISONEM BOYA VE YALITIM TEKNOLOJİLERİ İNŞ. SAN. TİC. A.Ş. İTOSB OSB, 10001 Sk. No:20, Tekeli, Menderes, İZMİR, TURKEY
İstek numarası *Order No.*	:	EEA-18-000393
Numunenin adı ve tarifi *Name and identity of test sample*	:	Fire Resistance Intumescent Paint For Structural Steels **"ISONEM Anti-Fire Paint Plus"** – (Short columns)
Numunenin kabul tarihi *The date of receipt of sample*	:	13.11.2018
Açıklamalar *Remarks*	:	
Deneyin yapıldığı tarih *Date of test*	:	16.04.2019
Raporun sayfa sayısı *Number of pages of the Report*	:	13 (25 pages including appendixes)

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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

Mühür *Seal*	**Tarih** *Date*	**Deney Sorumlusu** *Person in charge of test*	**Laboratuvar Müdürü** *Head of Testing Laboratory*
Efectis	20.05.2019	Mustafa Emre ÖZBEY	Ali BAYRAKTAR

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1. SCOPE

Fire resistance test, in conformity with the general requirements of standards EN 1363-1:2012, with substitute or additional methods of standard EN 1363-2:1999 and with the particular requirements of standard EN 13381-8:2013 "Test methods for determining the contribution to the fire resistance of structural members - Part 8: Applied reactive protection to steel members".

2. TEST LABORATORY

Name : Efectis Era Avrasya Test ve Belgelendirme A.S.

Address : Dilovası OSB, 5. Kısım, Fırat Caddesi No:18, Dilovası, KOCAELI/TURKEY

3. DESCRIPTION OF THE TEST SPECIMEN

3.1. General

Product identification : Fire Resistance Intumescent Paint For Structural Steels "**ISONEM Anti-Fire Paint Plus**" – (Short columns)

Manufacturer of paint : ISONEM BOYA VE YALITIM TEKNOLOJİLERİ İNŞ. SAN. TİC. A.Ş.
İTOSB OSB, 10001 Sk. No:20, Tekeli, Menderes, İZMİR, TÜRKİYE

Sponsor of test : ISONEM BOYA VE YALITIM TEKNOLOJİLERİ İNŞ. SAN. TİC. A.Ş.
İTOSB OSB, 10001 Sk. No:20, Tekeli, Menderes, İZMİR, TÜRKİYE

3.2. Preparation of Test Specimens

3.2.1. Steel Profiles

The steel profiles were supplied by the test laboratory include HEA 140 and IPE 80 profiles. The specimens were described below in the Table 1.

Table 1: Test specimens

Test specimen	Steel Symbol	Type of steel section	Length (mm)	Protection thickness (µm)
Unloaded Short Column	SC-1	HEA 140	1000	1500
Unloaded Short Column	SC-2	HEA 140	1000	7500
Unloaded Short Column	SC-3	HEA 140	1000	5100
Unloaded Short Column	SC-4	IPE 80	1000	5100
Unloaded Short Column	SC-5	IPE 80	1000	7500
Unloaded Short Column	SC-6	IPE 80	1000	3300
Unloaded Short Column	SC-7	HEA 140	1000	3300

Table 2: Details of profiles

No.	Symbol	Section type	Heating	Profile	Measured values						
					h [mm]	b [mm]	t_f [mm]	t_w [mm]	P [mm]	A [mm²]	**Section factor [m⁻¹]**
1	**SC-1**	**open**	**4 sides**	HEA 140	133	142	8,6	6,1	819	3139	**261**
2	**SC-2**	**open**	**4 sides**	HEA 140	134	140	8,6	6,1	816	3109	**263**
3	**SC-3**	**open**	**4 sides**	HEA 140	133	141	8,6	6,1	819	3133	**261**
4	**SC-4**	**open**	**4 sides**	IPE 80	80	45	4,6	4,0	334	703	**475**
5	**SC-5**	**open**	**4 sides**	IPE 80	80	45	5	4,0	333	695	**479**
6	**SC-6**	**open**	**4 sides**	IPE 80	80	45	4,6	4,0	333	697	**478**
7	**SC-7**	**open**	**4 sides**	HEA 140	133	141	8,6	6,1	817	3123	**261**

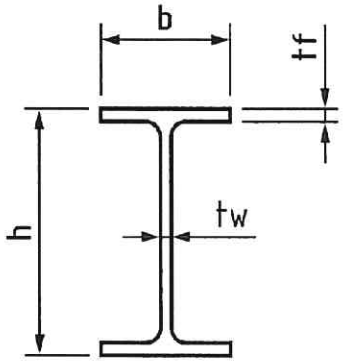


Figure 1: Profile details

3.2.2. The fire protection system

The fire protection system consists of Fire Resistance Intumescent Paint For Structural Steels "**ISONEM Anti-Fire Paint Plus**"

Table 3: Measured points of the HEA 140 (1500 µm)

Results	MEAN	MIN	MAX	MEAN -20%	MEAN +20%	MEAN -30%	MEAN +30%	MEAN -45%	MEAN +45%	% of readings within limit ±20%	±30%	±45%	Result
	1584	**1340**	**1745**	**1267**	**1901**	**1109**	**2060**	**871**	**2297**	**100%**	**100%**	**100%**	**PASS**
	Deviation =		**15,4%**					Requirements		68%	95%	100%	

	Measurement no.:	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	% of readings within limit ±20%	±30%	±45%
Measuring points	1. Position 1 temperature measurement station	1567	1580	1574	1658	1541	1420	1638	1740	1745	1465	**100%**	**100%**	**100%**
	2. Position 2 temperature measurement station	1340	1538	1540	1630	1640	1504	1630	1632	1675	1630	**100%**	**100%**	**100%**
										Requirements		68%	95%	100%

All measurements in [µm]

Table 4: Measured points of the HEA 140 (7500 µm)

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
	8199	**7442**	**8614**	**6559**	**9839**	**5739**	**10659**	**4510**	**11889**	**100%**	**100%**	**100%**	**PASS**
	Deviation =		**9,2 %**					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	8614	8439	8585	8412	8205	7578	7649	8343	8550	8128	**100%**	**100%**	**100%**
	2. Position 2 temperature measurement station	8349	8256	7565	8238	7442	8556	7944	8311	8225	8593	**100%**	**100%**	**100%**
										Requirements		68%	95%	100%

All measurements in [µm]

Table 5: Measured points of the HEA 140 (5100 µm)

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
	5480	**5200**	**5885**	**4384**	**6576**	**3836**	**7124**	**3014**	**7946**	**100%**	**100%**	**100%**	**PASS**
	Deviation =		**7,4 %**					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	5522	5379	5672	5402	5379	5429	5320	5220	5200	5250	**100%**	**100%**	**100%**
	2. Position 2 temperature measurement station	5365	5447	5796	5885	5347	5693	5700	5630	5409	5553	**100%**	**100%**	**100%**
										Requirements		68%	95%	100%

All measurements in [µm]

Table 6: Measured points of the IPE 80 (5100 µm)

Results	MEAN	MIN	MAX	MEAN -20%	MEAN +20%	MEAN -30%	MEAN +30%	MEAN -45%	MEAN +45%	% of readings within limit			Result
										±20%	±30%	±45%	
	5330	**5109**	**5580**	**4264**	**6396**	**3731**	**6929**	**2932**	**7729**	**100%**	**100%**	**100%**	**PASS**
	Deviation =		**4,7%**					Requirements		68%	95%	100%	

												% of readings within limit		
	Measurement no.:	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	±20%	±30%	±45%
Measuring points	1. Position 1 temperature measurement station	5218	5319	5322	5469	5337	5445	5193	5468	5245	5421	**100%**	**100%**	**100%**
	2. Position 2 temperature measurement station	5326	5109	5337	5109	5261	5567	5266	5419	5580	5193	**100%**	**100%**	**100%**
										Requirements		68%	95%	100%

All measurements in [µm]

Table 7: Measured points of the IPE 80 (7500 µm)

Results	MEAN	MIN	MAX	MEAN -20%	MEAN +20%	MEAN -30%	MEAN +30%	MEAN -45%	MEAN +45%	% of readings within limit			Result
										±20%	±30%	±45%	
	7877	**7411**	**8148**	**6302**	**9453**	**5514**	**10240**	**4332**	**11422**	**100%**	**100%**	**100%**	**PASS**
	Deviation =		**5,9%**					Requirements		68%	95%	100%	

												% of readings within limit		
	Measurement no.:	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	±20%	±30%	±45%
Measuring points	1. Position 1 temperature measurement station	8093	7694	7955	7994	7858	7415	7976	8057	7583	8055	**100%**	**100%**	**100%**
	2. Position 2 temperature measurement station	7411	7818	7844	7955	8065	8126	7590	7969	8148	7937	**100%**	**100%**	**100%**
										Requirements		68%	95%	100%

All measurements in [µm]

Table 8: Measured points of the IPE 80 (3300 µm)

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
	3480	**3319**	**3679**	**2784**	**4176**	**2436**	**4524**	**1914**	**5046**	**100%**	**100%**	**100%**	**PASS**
	Deviation =		**5,7%**					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	3378	3669	3495	3512	3472	3415	3569	3562	3520	3349	**100%**	**100%**	**100%**
	2. Position 2 temperature measurement station	3350	3377	3491	3319	3495	3462	3509	3679	3492	3482	**100%**	**100%**	**100%**
										Requirements		68%	95%	100%

All measurements in [µm]

Table 9: Measured points of the HEA 140 (3300 µm)

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
	3503	**3069**	**3792**	**2802**	**4204**	**2452**	**4554**	**1927**	**5079**	**100%**	**100%**	**100%**	**PASS**
	Deviation =		**12,4%**					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	3666	3291	3440	3423	3370	3685	3394	3708	3550	3575	**100%**	**100%**	**100%**
	2. Position 2 temperature measurement station	3471	3311	3405	3069	3537	3567	3792	3743	3481	3582	**100%**	**100%**	**100%**
										Requirements		68%	95%	100%

All measurements in [µm]

- Type: Steel Fire Protection Paint is a water base acrylic coating fire retardant. This coat is specially designed as passive fire protection for steel constructions. Coat can be applied for structural steel exposed and internal environments.

- Thickness: Thickness measurements were reached by applying 400 µm per a day. 24 hours drying internal is waited between application of each layer.

- Paint : Water based fire retardant intumescent paint
  - Nominal density : 1150±0.05 kg/m³
  - Measured density: 1288.32 kg/m³
  - Nominal thickness: 1.5-7.5 µm

3.2.2. *Application*

"ISONEM Anti-Fire Paint Plus" paint was applied on the surface with the spray machine that work with the air. The paint was applied by brush for strips and small areas. The epoxy based prime paint that has 50 µm thicknesses was applied on the columns before the test to protect from corrosion

**Brand, type, quantity and dimension information of the components, when it is not possible to be verified by the laboratory, are given according to the sponsor's declaration.*

4. PRE-TEST PROCESSES

4.1. Verification of specimen

Efectis Era Avrasya A.S. verified the used materials and parts against the supplied data and drawings during installation of the test specimen and not involved in the selection of test specimen.

The test specimen was assembled by sub-contractor of the test sponsor with the witness of manufacturer.

4.2. Thickness measurement

Thickness measurement was checked and documented on the test specimens by the laboratory.

4.3 Conditioning

The construction was stored in the laboratory of Efectis Era Avrasya A.S. under the following conditions:

- Ambient temperature : 13,8 ± 1,5 °C.
- Relative humidity : 55,0 ± 4,0 %.
- Conditioning time : 31 days

5. TEST PROCESS

5.1. Method

The fire test was conducted according to the EN 13381-8:2013.
The heating of the furnace followed the standard fire curve, as specified in the EN 1363-1:2012

The target overpressure in the furnace was 20 Pa 100 mm below the furnace ceiling

5.2. Measurements

Following test data were measured during the test:

- During the heating, the following data was measured and registered:
- Gas temperatures inside the furnace with ten plate thermocouples (TC1 to TC3 and TC8 to TC9), evenly distributed over the directly heated surface (see figure A1).
- The pressure in the furnace, measured at a height of 2,9 meter above the furnace floor level (see figure A3).
- Ambient temperature in the laboratory (see figure A4).
- The steel temperatures (TC 1 to TC 9) (see figure B2-B8).
- There is no need to use roving thermocouple.
- The positions of the thermocouples measurement are given in figure (B1).

6. OBSERVATIONS

Table 9: Observations during the test.

0	Heating started.
18	**F-** Cracked occurred at the surface of the columns.
78	SC-6 temperature increased at Thermocouple Avr., **ΔT ≥ 750 °C.**
86	SC-4 temperature increased at Thermocouple Avr., **ΔT ≥ 750 °C.**
103	SC-1 temperature increased at Thermocouple Avr., **ΔT ≥ 750 °C.**
114	SC-7 temperature increased at Thermocouple Avr., **ΔT ≥ 750 °C.**
122	SC-3 temperature increased at Thermocouple Avr., **ΔT ≥ 750 °C.**
149	SC-5 temperature increased at Thermocouple Avr., **ΔT ≥ 750 °C.**
187	SC-2 temperature increased at Thermocouple Avr., **ΔT ≥ 750 °C.**
189	Test was terminated due to failure of design temperature.

7. TEST RESULTS

7.1 Results

The results are given in table 10 and appendixes B and C.

During the heating the temperature in the laboratory complied with the standard EN 1363-1:2012.

7.2 Uncertainty of measurements

Due to the nature of fire resistance testing, in which several non-linear effects are present in both the test configuration and the test specimen, which influence each other, it is at this moment not yet possible to give a stated degree of uncertainty of measurement.

8. SUMMARY

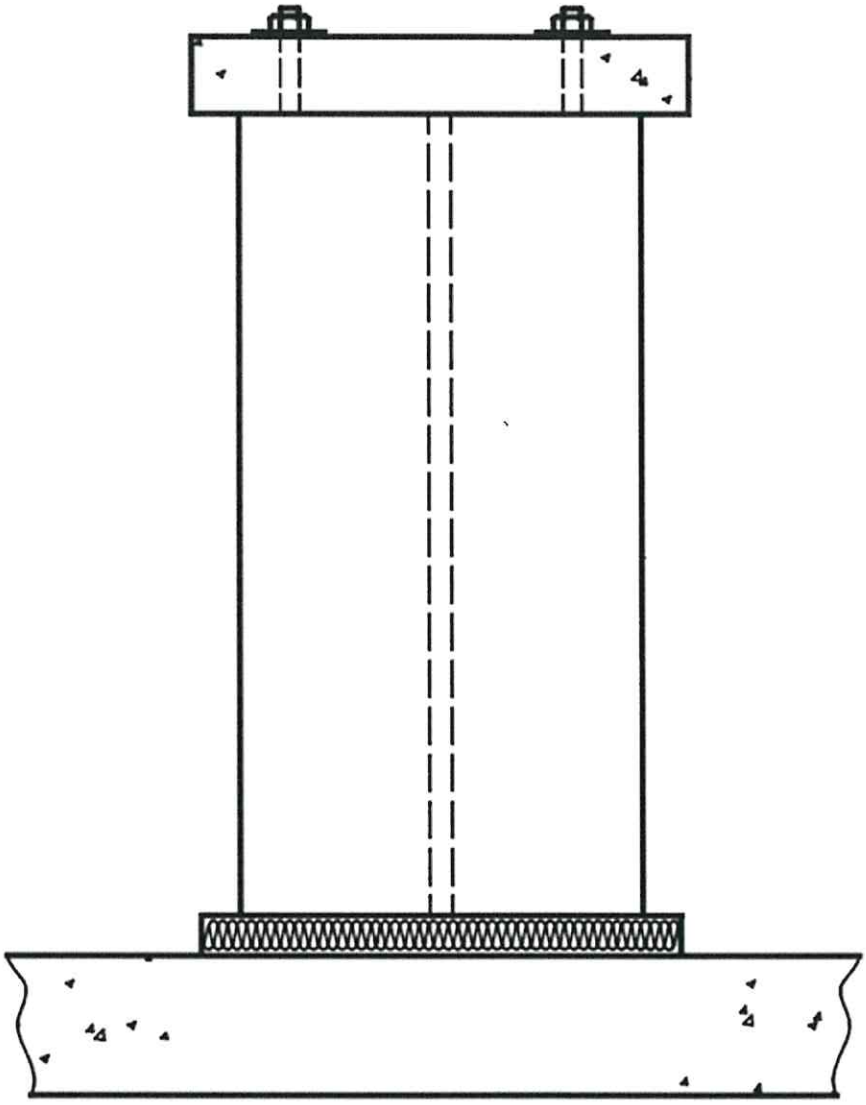
The most important results of the examination are given in table 10.

Table 10: Summary of test results of the loaded beam

Insulation:, [I] – Average temperature	(SIC-6) 78. minute (750°C). (SIC-4) 86. minute (750°C). (SIC-1)103. minute (750°C). (SIC-7)114. minute (750°C). (SIC-3)122. minute (750°C). (SIC-5)149. minute (750°C). (SIC-2)187. minute (750°C).
The heating was terminated at 189th minute after failure	

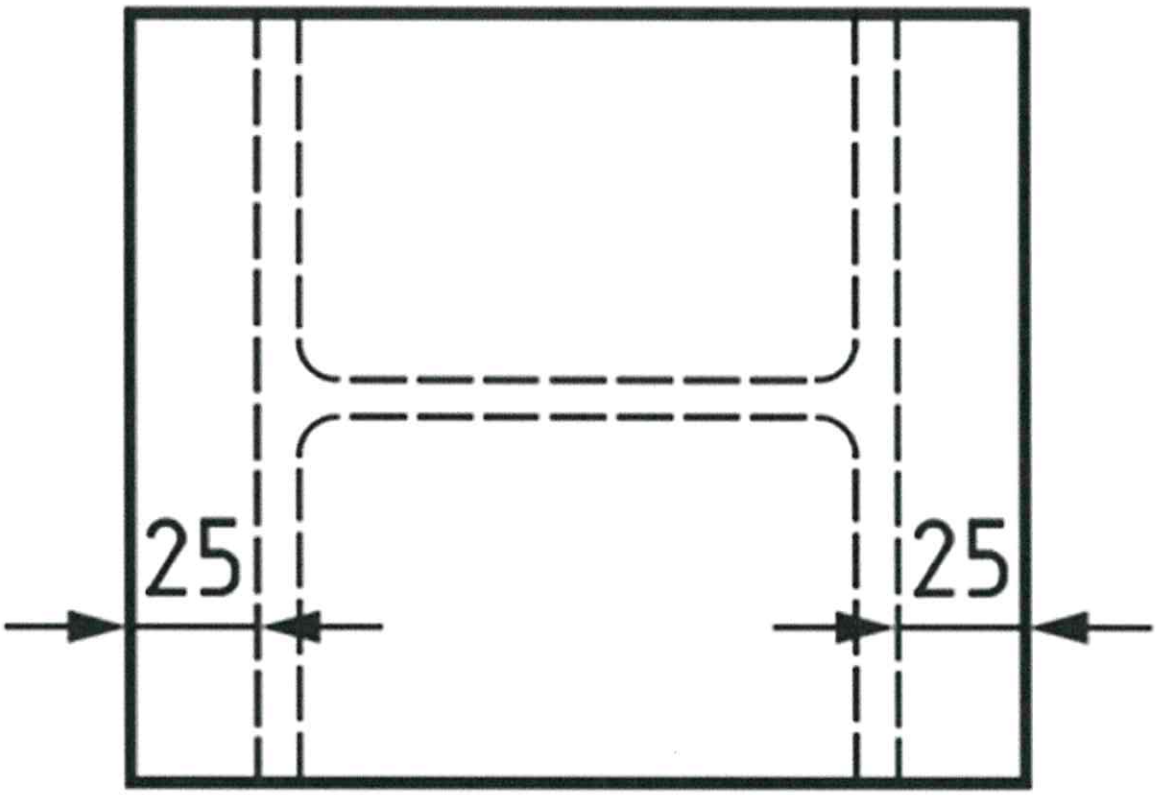
This report provides the constructional details, the test conditions, the results obtained and the interpolated data obtained when the specified fire protection system described herein was tested following the procedures of EN 13381-8. Any deviation with respect to thickness and density of fire protection material and constructional details, loads, stresses, edge or end conditions other than those allowed under the field of application could invalidate the test result.

9. DRAWINGS



Column elevation

Figure 2: Section view of the column



I or H column plan

Figure 2: Cross section details of the column

APPENDIXES:

Appendix A: Furnace and laboratory conditions

Appendix B: Test results

Appendix C: Photos

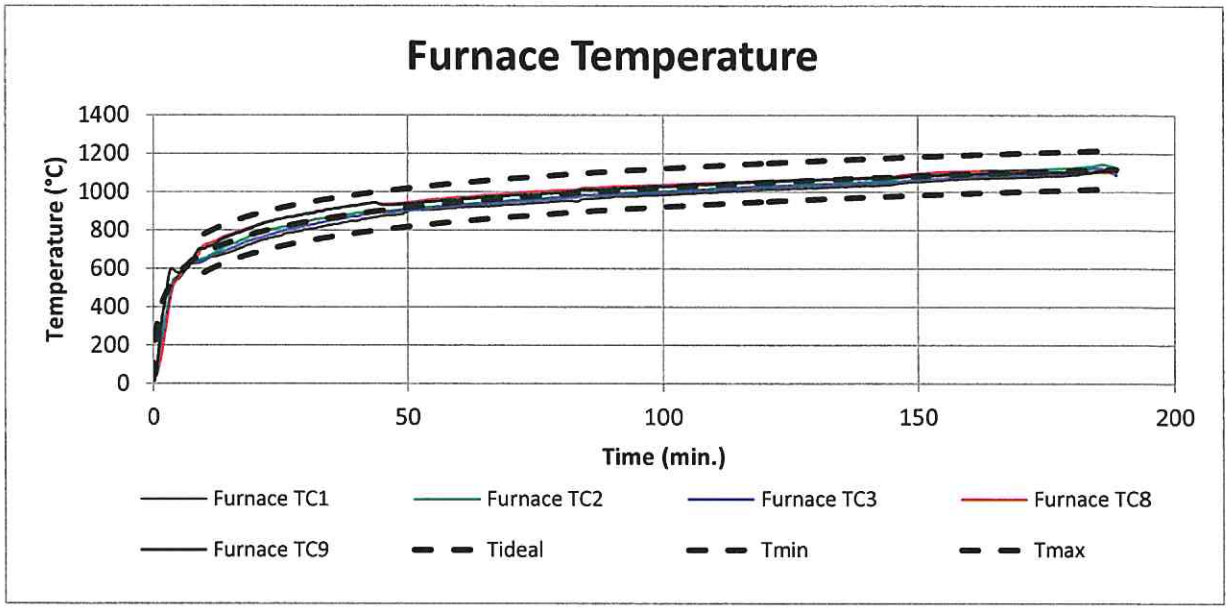


Figure A1: Furnace Temperatures

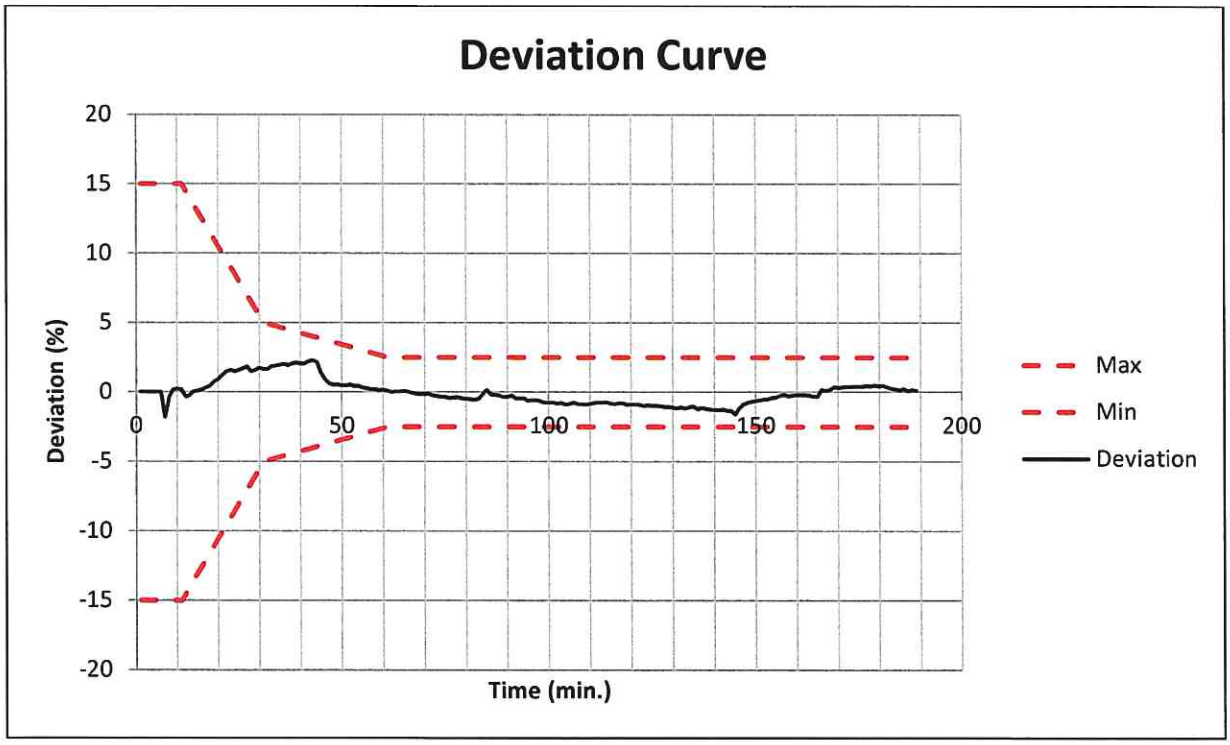


Figure A2: Deviation of furnace temperature

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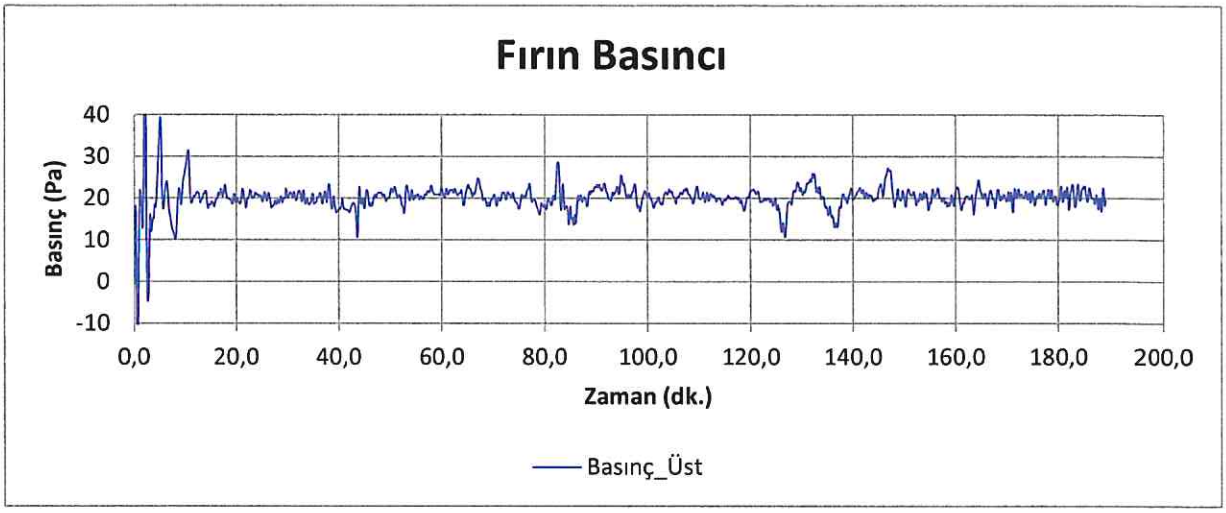


Figure A3: Pressure in the furnace

- *The sudden peaks caused by the parts of the specimen fallen inside to the furnace.*

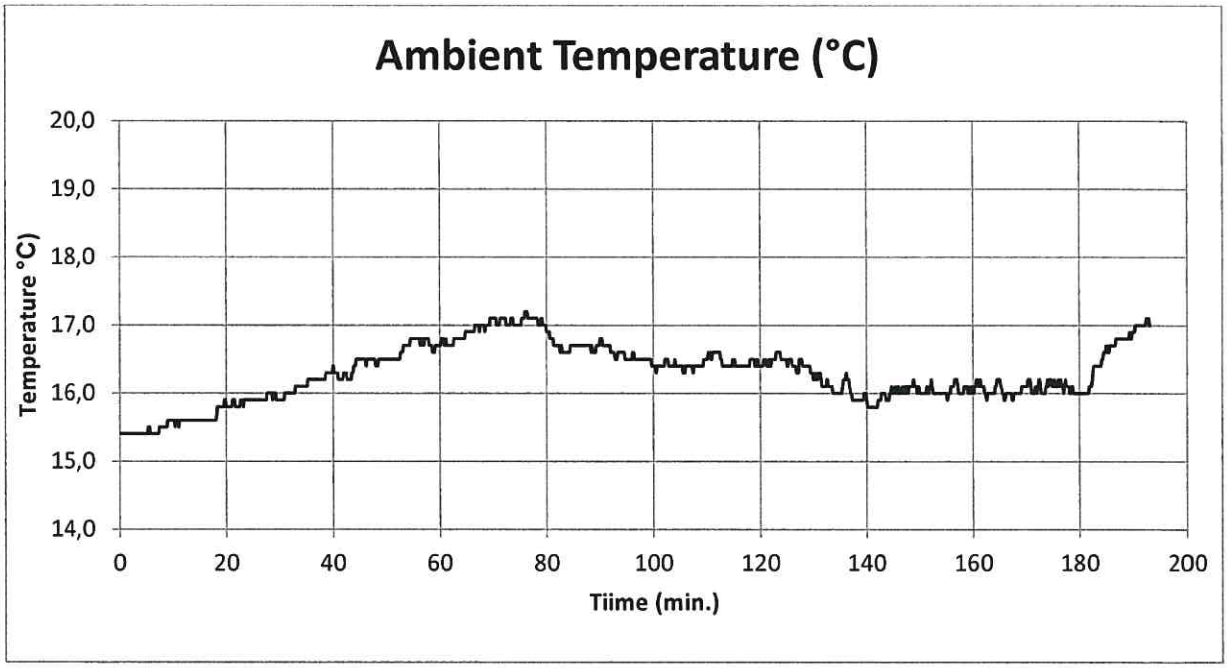
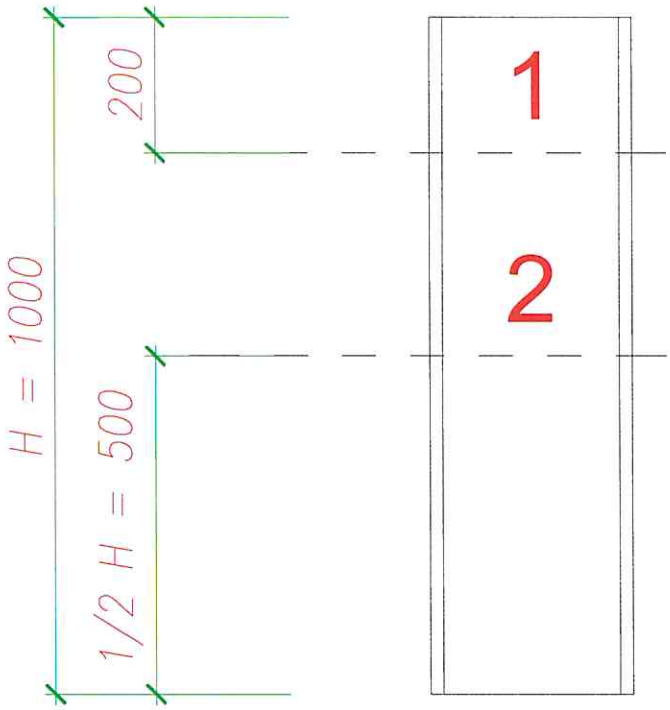
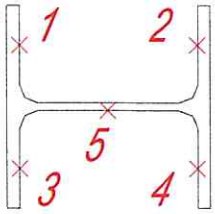


Figure A4: Ambient temperature at laboratory



Position 1



Position 2

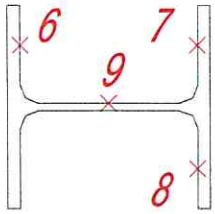


Figure B1: Locations of thermocouples of columns

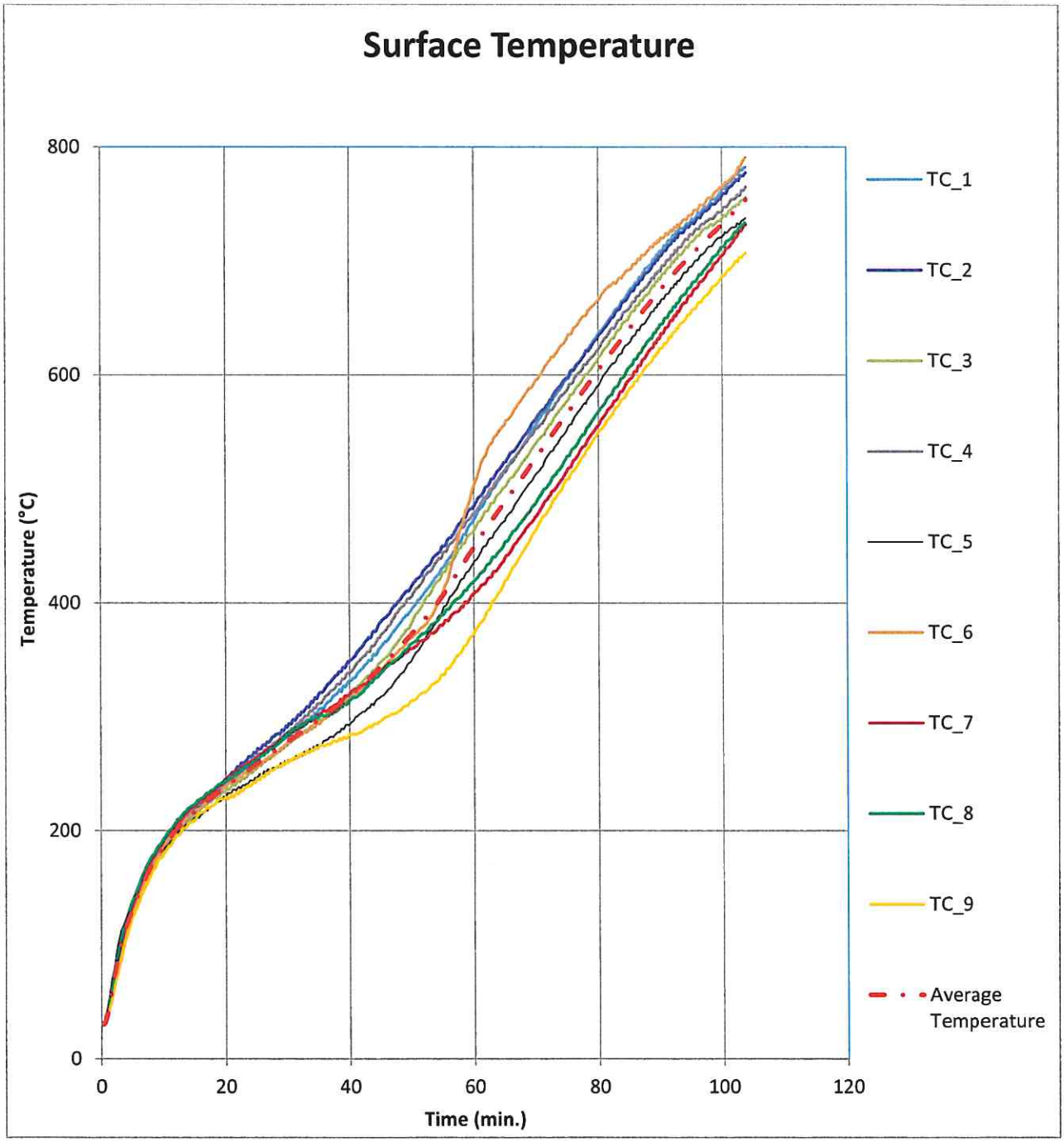


Figure B2: Surface temperatures of SC1 (TC1 –TC9 and Web Avr. Temp)

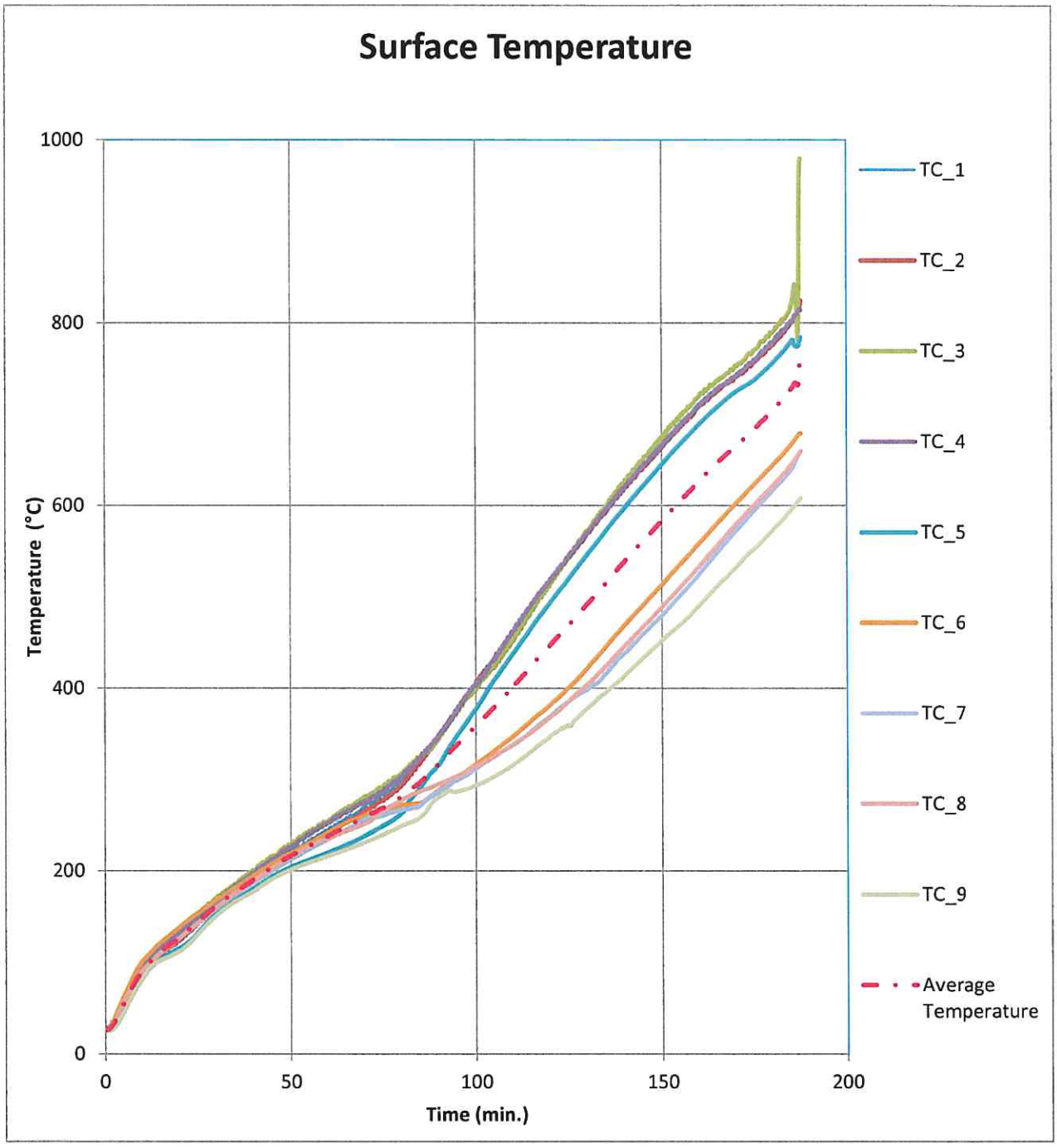


Figure B3: Surface temperatures of SC2 (TC1 –TC9 and Web Avr. Temp)

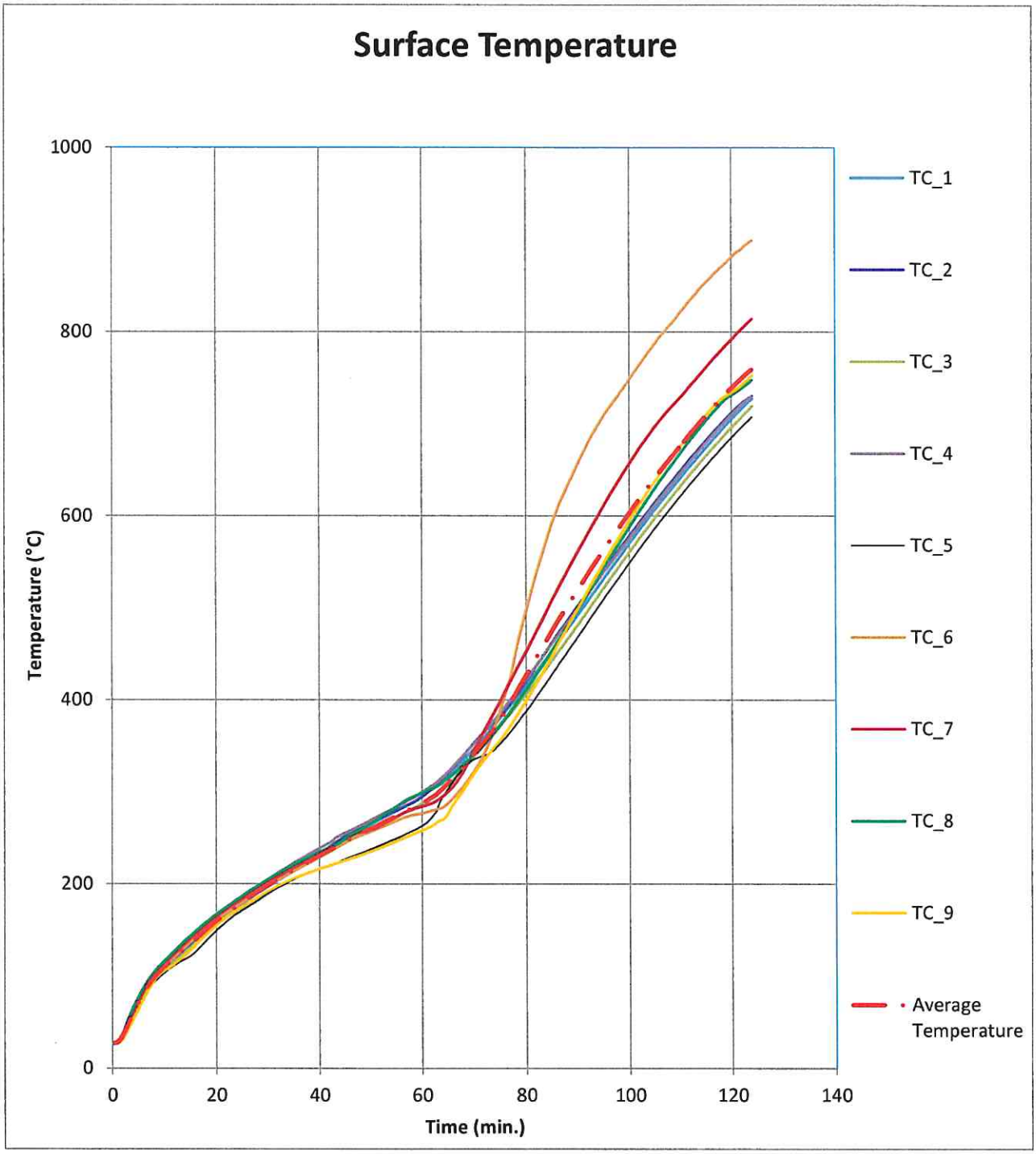


Figure B4: Surface temperatures of SC3 (TC1 –TC9 and Web Avr. Temp)

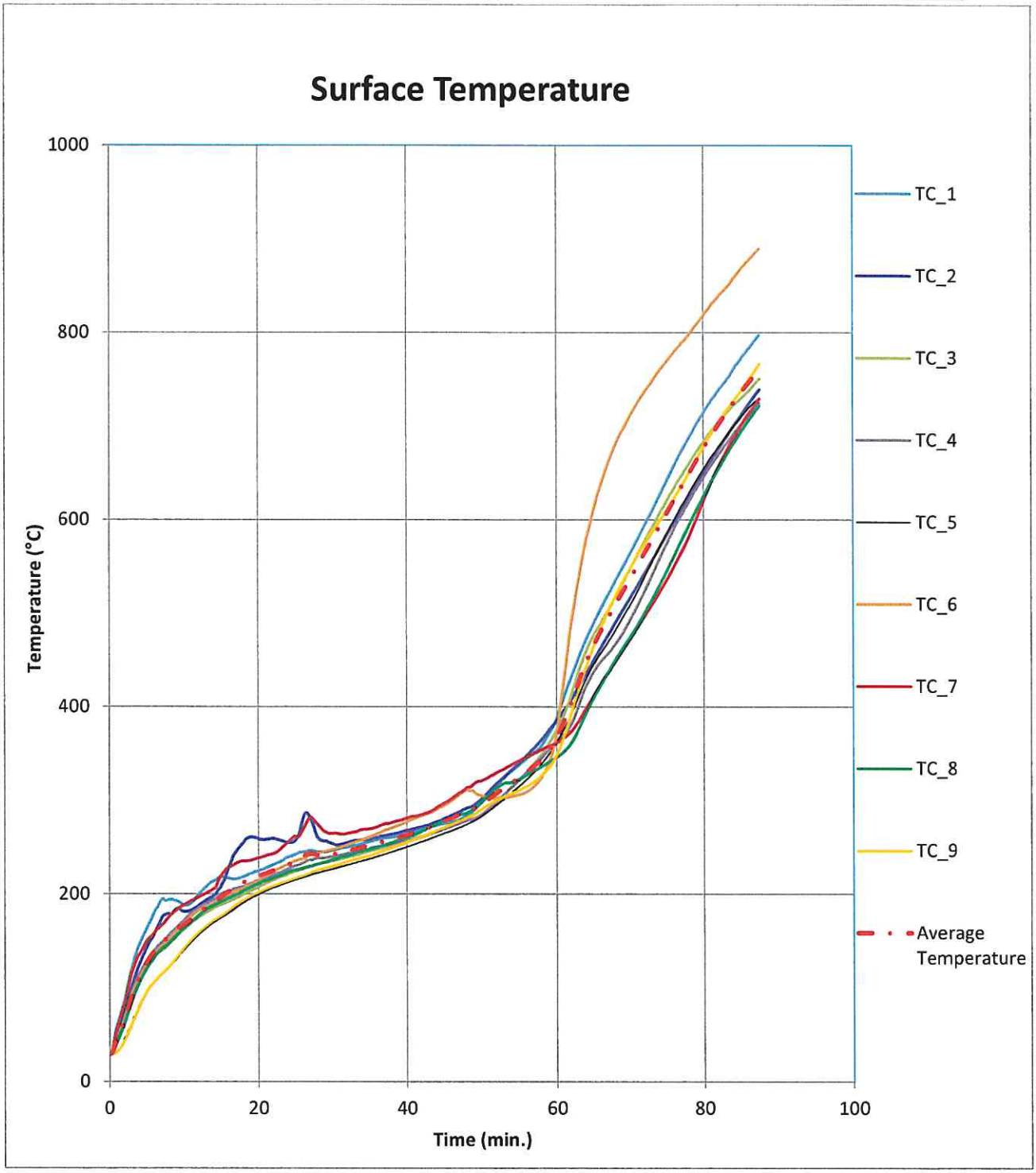


Figure B5: Surface temperatures of SC4 (TC1 –TC9 and Web Avr. Temp)

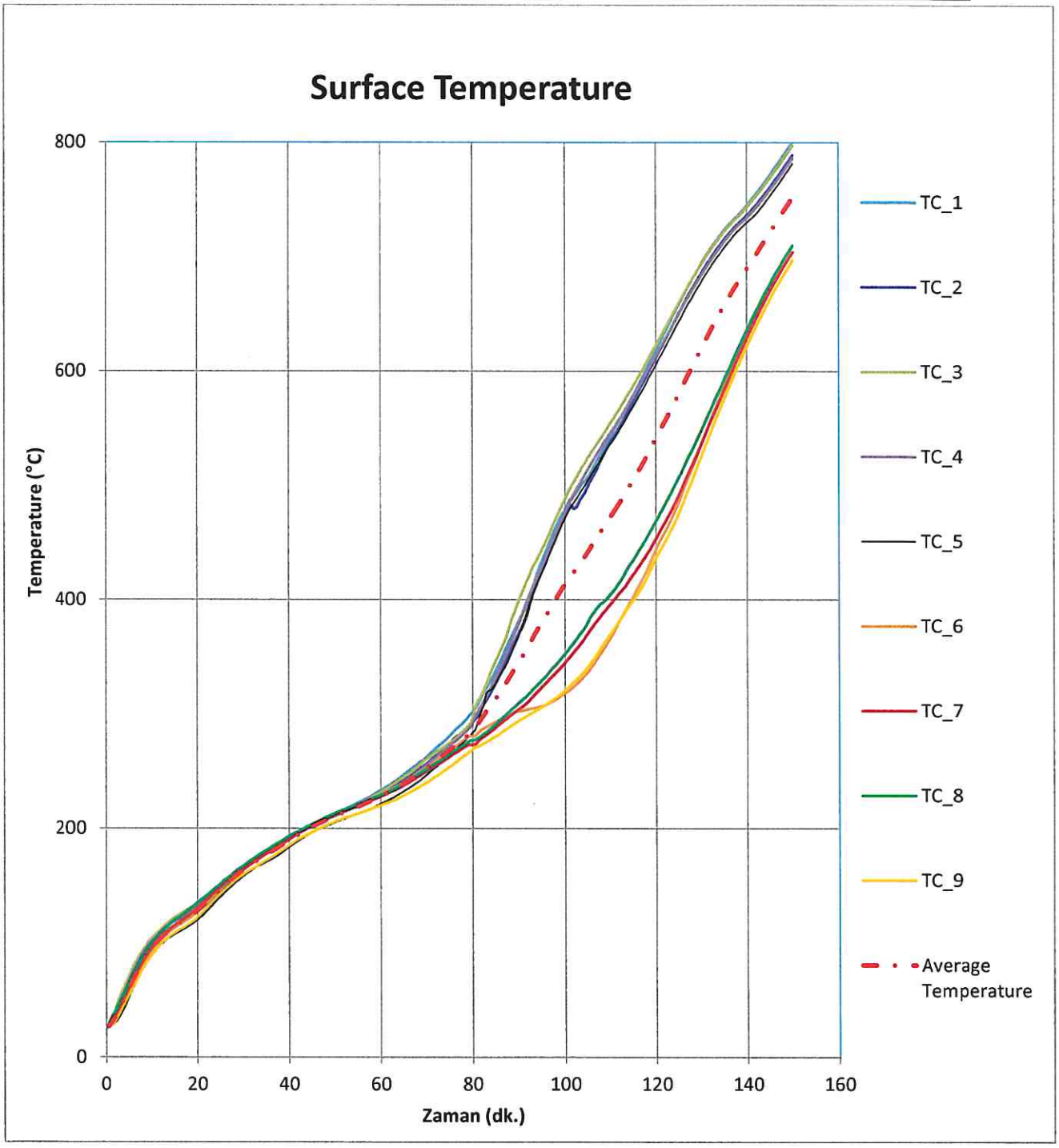


Figure B6: Surface temperatures of SC5 (TC1 –TC9 and Web Avr. Temp)

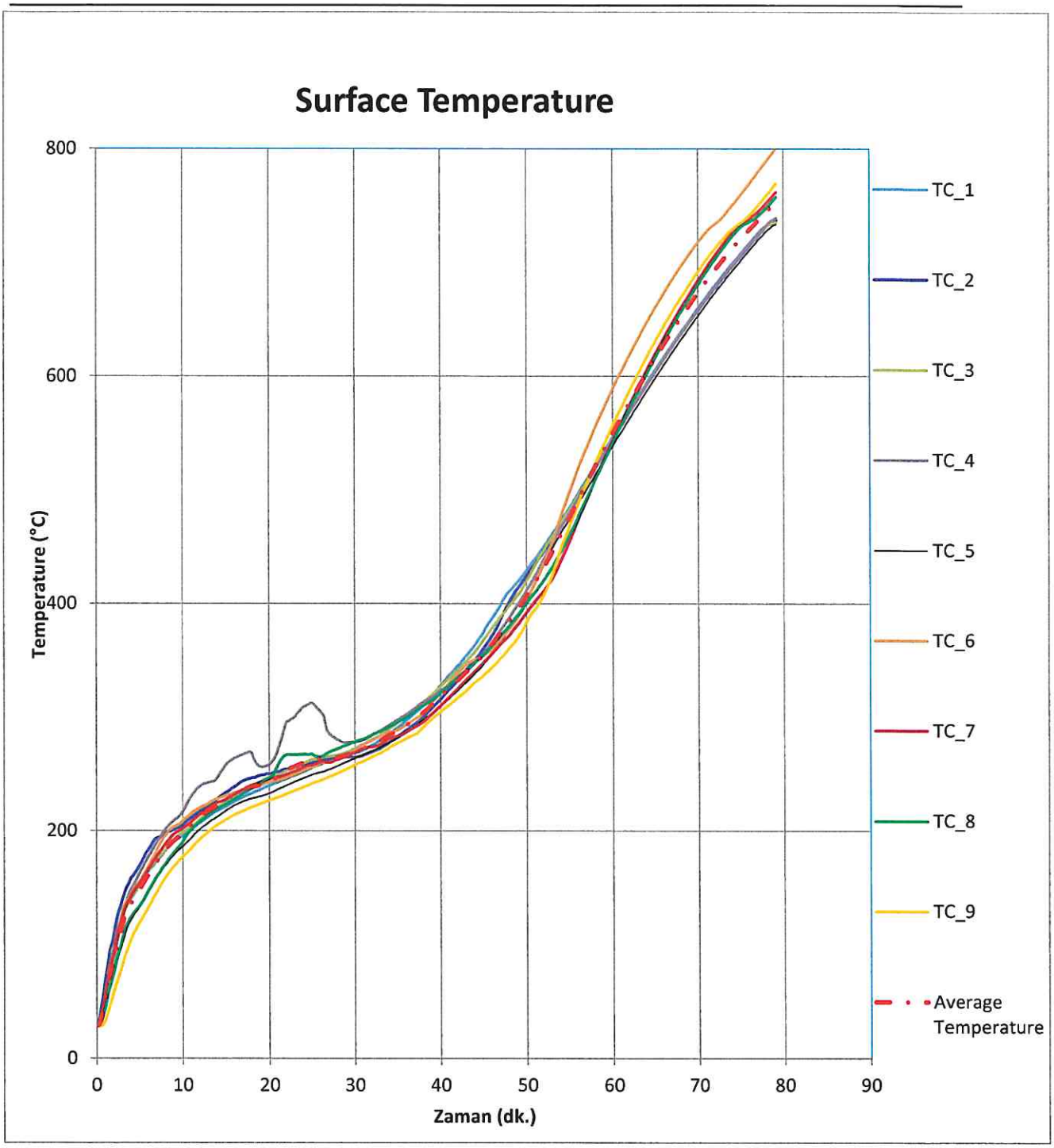


Figure B7: Surface temperatures of SC6 (TC1 –TC9 and Web Avr. Temp)

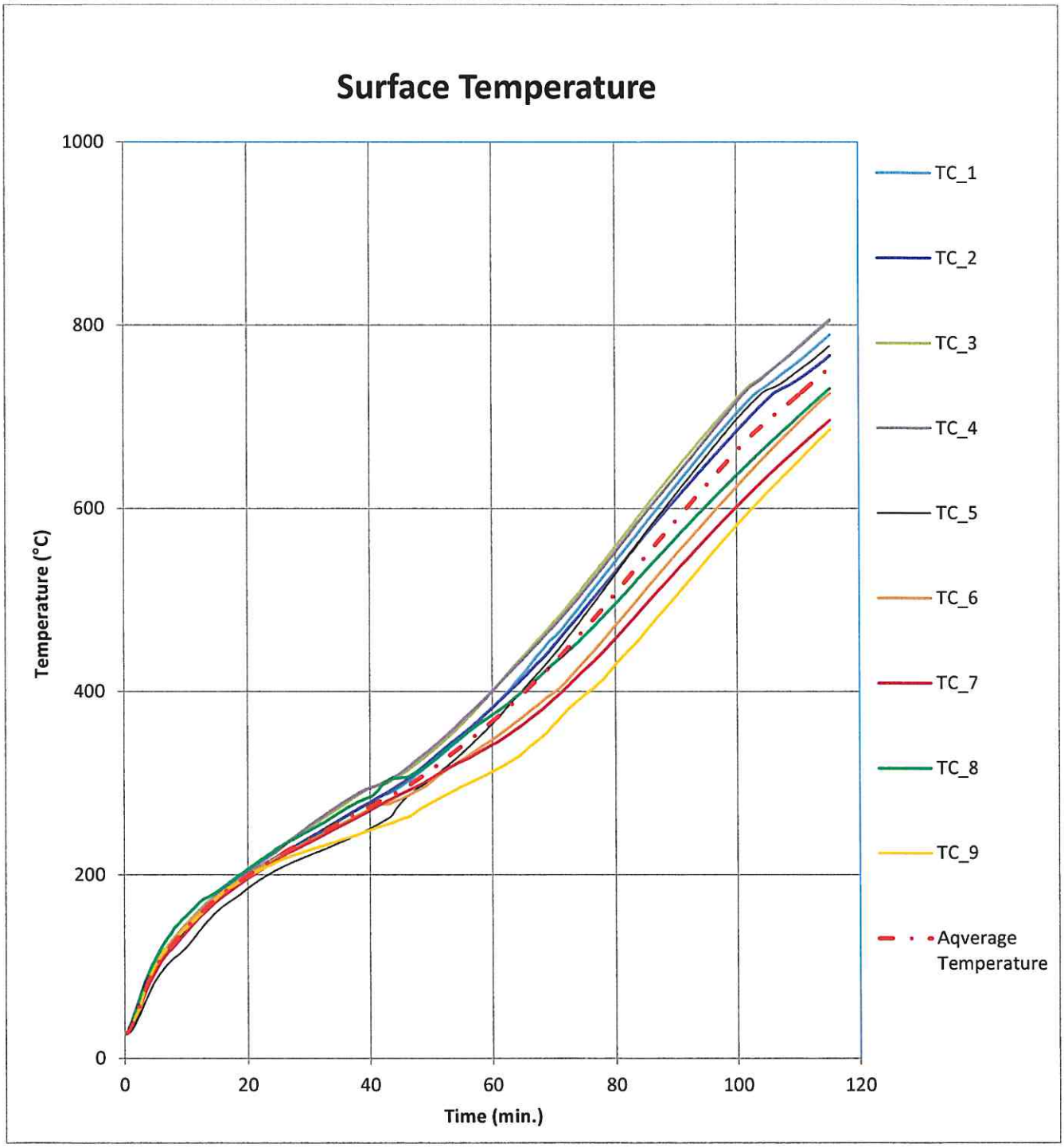


Figure B8: Surface temperatures of SC7 (TC1 –TC9 and Web Avr. Temp)

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Photo C1: The aspect of columns before the test

Photo C2: The aspect of columns after the test

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