

## **Oskarshamn site investigation**

### **Drill hole: KSH01A**

#### **Extensometer measurement of the coefficient of thermal expansion of rock**

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Swedish National Testing and Research Institute

March 2004

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*Keywords:* Rock mechanics, Coefficient of thermal expansion, Temperature change, Density, Porosity.

This report concerns a study which was conducted for SKB. The conclusions and viewpoints presented in the report are those of the author and do not necessarily coincide with those of the client.

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## Abstract

The coefficient of thermal expansion and the wet density has been determined on 21 specimens from drill hole KSH01A. The specimens were sampled on four levels in the drill hole: 300, 400, 480 and 700 m. The investigated rock types are mapped as quartz monzodiorite (300 and 700 m) and fine-grained dioritoid (400 and 480 m). The coefficient of thermal expansion has been determined between the temperature interval 20–80°C. The results indicated that the thermal expansion was almost linear and the coefficient of thermal expansion was greatest for the quartz monzodiorite, where the coefficient of thermal expansion range between 5.8 and 11.2 x 10<sup>-6</sup> mm/mm°C. For the dioritoid, the coefficient of thermal expansion was measured to range between 3.6 and 7.8 x 10<sup>-6</sup> mm/mm°C.

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# 1 Introduction

This document reports the data collected by Simpevarp, which is one of the activities performed as part of the site investigation at Oskarshamn. The work was carried out in accordance with activity plan AP PS 400-03-066 (SKB internal controlling document).

The principle of the measurements is to determine the coefficient of thermal expansion at different temperatures.

The cores are sampled from borehole KSH01A in the Simpevarp area (Figure 1-1). It was sampled 13 May 2003 by Rolf Christiansson, Swedish Nuclear & Waste Management Co (SKB) and Urban Åkesson, The Swedish National Testing and Research Institute (SP). Specimens were taken from four levels in the rock core: level 1 between 297 and 303 m, level 2 between 399 and 412 m, level 3 between 480 and 492 m, and level 4 between 701 and 713. The samples were selected based on the preliminary core logging, and with the strategy to primarily investigate the properties of the dominant rock properties. The rock cores were transported by SP from Simpevarp and arrived to SP 14 May 2003. The testing was performed during December 2003 and January 2004.



*Figure 1-1. Map of Oskarshamn site.*

## **2 Objective and scope**

The purpose is to determine the linear coefficient of thermal expansion for rock cores in water-saturated condition between +20–80°C.

These parameters will be included in rock mechanical model for the Simpvarp area, performed by SKB. The specimens and the results will be presented in tables, diagrams and spreadsheets.

### 3 Equipment

Following equipment have been used for the analyses:

- Extensometer (DEMEC inv no 102266) for measurements of the thermal expansion. Calibration of the instrument was done before the measurements on every new temperature (see Appendix 2). The uncertainty of the extensometer is  $\pm 3.97 \times 10^{-6}$  mm/mm (strain) which for these samples equals an uncertainty of a single measurement of the coefficient of thermal expansion of  $\pm 0.2 \times 10^{-6}$  mm/mm°C for temperature difference of 20°C.
- Reference bar in invar steel for calibrate the extensometer.
- Heating chamber (inv no 102284) with an accuracy of  $\pm 0.7^\circ\text{C}$  at 80°C for heating up the specimens.
- A covered plastic box filled with water for keeping the specimens water saturated.

## 4 Execution

Determination of the coefficient of thermal expansion was made in accordance with SKB's method description SKB MD 191.002-version 1.9 (SKB internal controlling document). The department of Building Technology and Mechanics (BM) at SP performed the test.

### 4.1 Description of the samples

From the Simpevarp area, specimens were sampled from four levels in drill hole KSH01A. The drill hole starts at a depth of 100 m. Level 1 range between 297 and 303 m, level 2 between 399 and 412 m, level 3 between 480 and 492 m, and level 4 between 701 and 713 m. Six specimens, with a length of 250 mm and a diameter of 50 mm were sampled from each level. The sampled rock types are Quartz monzodiorite and Fine-grained dioritoid. Detailed geological description of the rock is given in SKB's BOREMAP of KSH01A. Table 4-1 show the rock type and identification marks of the specimens.

**Table 4-1. Rock type and identification marks (Rock-type classification according to Boremap).**

Rock type	Identification	Sampling depth, according to the marks on the drill-core boxes (Sec up)
Quartz monzodiorite	KSH01A-90L-1	297.59
Quartz monzodiorite	KSH01A-90L-2	297.86
Quartz monzodiorite	KSH01A-90L-3	300.75
Quartz monzodiorite	KSH01A-90L-4	301.39
Quartz monzodiorite	KSH01A-90L-5	302.19
Quartz monzodiorite	KSH01A-90L-6	303.19
Fine-grained dioritoid	KSH01A-90L-7	399.00
Fine-grained dioritoid	KSH01A-90L-8	400.10
Fine-grained dioritoid	KSH01A-90L-9	400.37
Fine-grained dioritoid	KSH01A-90L-10	400.64
Fine-grained dioritoid	KSH01A-90L-11	401.21
Fine-grained dioritoid	KSH01A-90L-12	412.05
Fine-grained dioritoid	KSH01A-90L-13	480.32
Fine-grained dioritoid	KSH01A-90L-14	483.88
Fine-grained dioritoid	KSH01A-90L-15	484.21
Fine-grained dioritoid	KSH01A-90L-16	486.37
Fine-grained dioritoid	KSH01A-90L-17	488.60
Fine-grained dioritoid	KSH01A-90L-18	492.25
Quartz monzodiorite	KSH01A-90L-19	701.04
Quartz monzodiorite	KSH01A-90L-20	703.70
Quartz monzodiorite	KSH01A-90L-21	704.10
Quartz monzodiorite	KSH01A-90L-22	706.56
Quartz monzodiorite	KSH01A-90L-23	709.70
Quartz monzodiorite	KSH01A-90L-24	713.43



## 4.2 Testing

The execution procedure followed the prescription in SKB MD 191.002-version 1.9 and SKB MD 160.002-version 1.9. (SKB internal controlling document) and the following steps were performed:

Item	Activity
1	The specimens were cut according to the marks on the rock cores.
2	Two measuring points with a distance of 200 mm were glued on the specimens.
3	The specimens were photographed in JPEG-format.
5	The specimens were water saturated for seven days.
6	The wet density was determined (see Appendix 3).
7	The coefficient of thermal expansion was determined. The thermal expansion was measured at 20, 40, 60 and 80°C. On each temperature level was three to five measurements done with 24 h intervals in order to know that the expansion was completed for each temperature level (see Appendix 2). The coefficient of thermal expansion was determined between 20–80°C. The uncertainty in the measurement is $\pm 3.97 \times 10^{-6}$ mm/mm (strain) which for these measurements equals an uncertainty of the coefficient of thermal expansion of $\pm 0.2 \times 10^{-6}$ mm/mm°C. Calibration of the instrument was done before the measurements on every new temperature (see Appendix 2).

## 5 Results

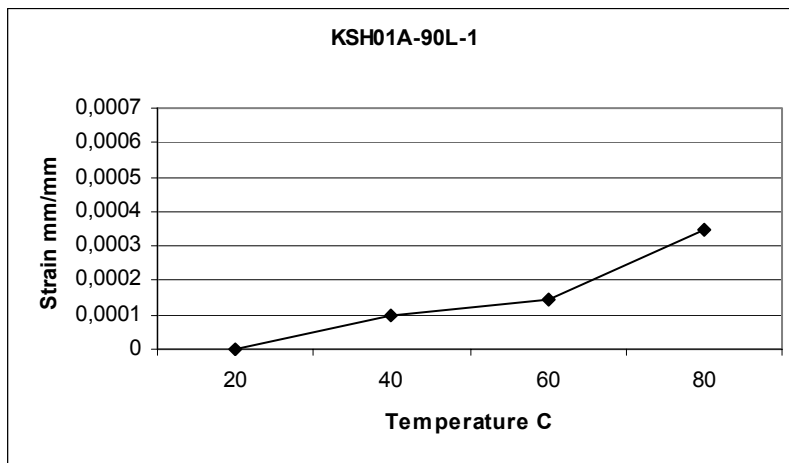
The main results of the site investigation of KSH01A could be found in the database SICADA FN96.

### 5.1 Description of the specimen and presentation of test results

The temperature of water for water saturation was 21.6°C and the density of the water was 998 kg/m<sup>3</sup>. The coefficient of thermal expansion was determined between +20 and 80°C.

#### 5.1.1 Level 1, 297–313 m, Specimen KSH01A-90L-1 to KSH01A-90L-6

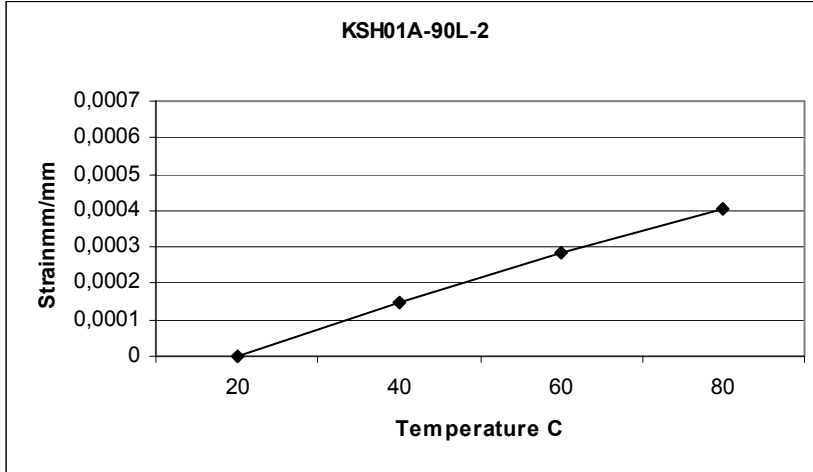
##### KSH01A-90L-1 (297.59)



**Figure 5-1.** Specimen KSH01A-90L-1.

The coefficient of thermal expansion for specimen KFM01A-90L-1 was measured to be  $5.8 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to 2720 Kg/m<sup>3</sup>.

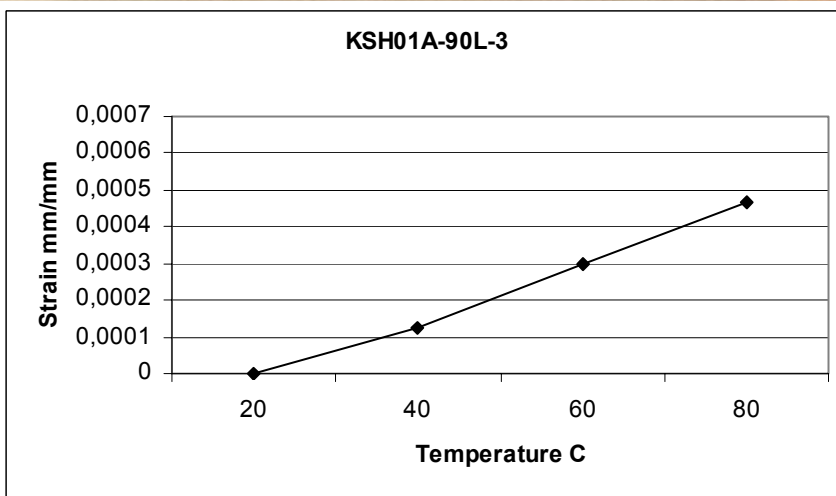
**KSH01A-90L-2 (297.86)**



**Figure 5-2. Specimen KSH01A-90L-2.**

The coefficient of thermal expansion for specimen KSH01A-90L-2 was measured to be  $6.7 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to  $2760 \text{ Kg/m}^3$ .

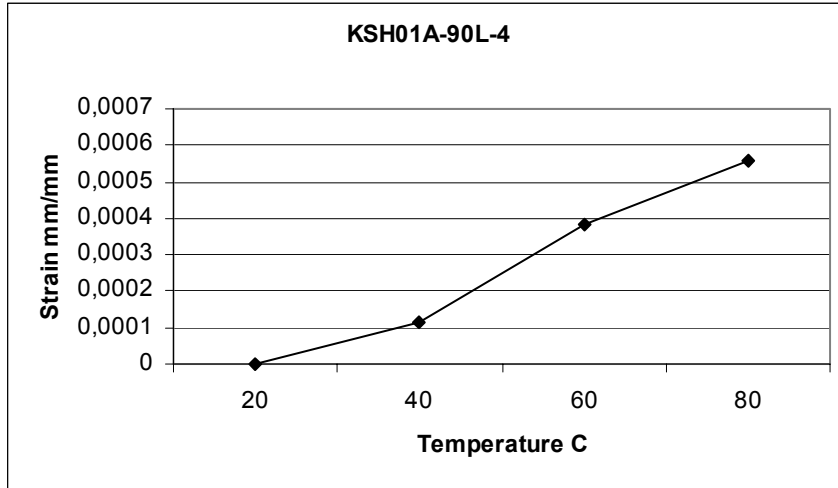
**KSH01A-90L-3 (300.75)**



**Figure 5-3. Specimen KSH01A-90L-3.**

The coefficient of thermal expansion for specimen KSH01A-90L-3 was measured to be  $7.7 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to  $2780 \text{ Kg/m}^3$ .

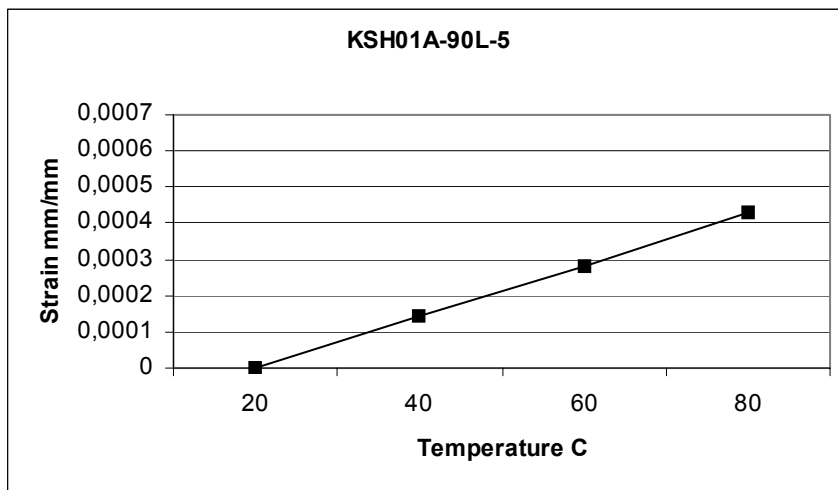
**KSH01A-90L-4 (301.39)**



**Figure 5-4.** Specimen KSH01A-90L-4.

The coefficient of thermal expansion for specimen KSH01A-90L-4 was measured to be  $9.3 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to  $2770 \text{ Kg/m}^3$ .

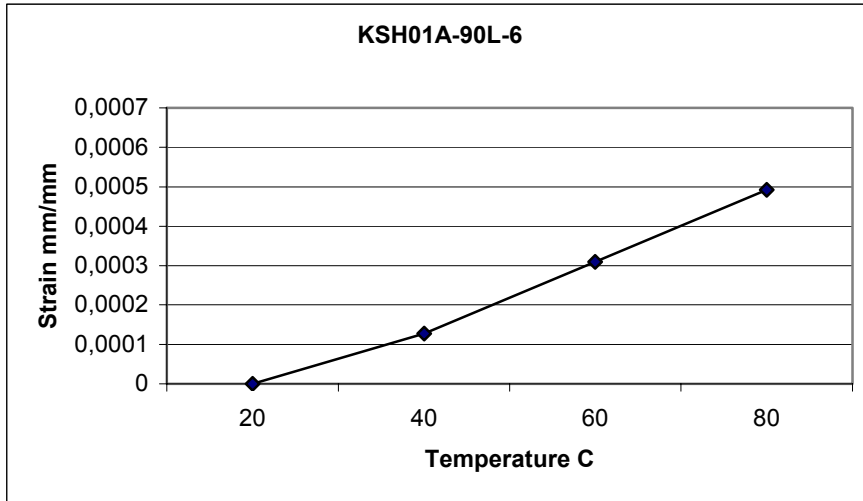
**KSH01A-90L-5 (302.19)**



**Figure 5-5.** Specimen KSH01A-90L-5.

The coefficient of thermal expansion for specimen KSH01A-90L-5 was measured to be  $7.1 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to  $2760 \text{ Kg/m}^3$ .

**KSH01A-90L-6 (303.19)**



**Figure 5-6.** Specimen KSH01A-90L-6.

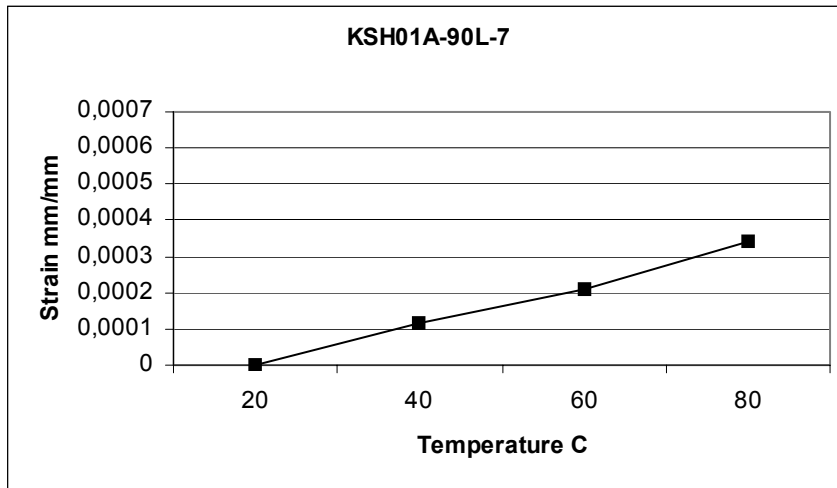
The coefficient of thermal expansion for specimen KSH01A-90L-6 was measured to be  $8.2 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to 2770 Kg/m<sup>3</sup>.

**Table 5-1. Summary of the results for the coefficient of thermal expansion and wet density of the specimens from level 1, 297–313 m.**

Specimen	Coefficient of thermal expansion between 20 and 80°C (mm/mm°C)	Wet density (Kg/m <sup>3</sup> )
KSH01A-90L-1	$5.8 \times 10^{-6}$	2720
KSH01A-90L-2	$6.7 \times 10^{-6}$	2760
KSH01A-90L-3	$7.7 \times 10^{-6}$	2780
KSH01A-90L-4	$9.3 \times 10^{-6}$	2770
KSH01A-90L-5	$7.1 \times 10^{-6}$	2760
KSH01A-90L-6	$8.2 \times 10^{-6}$	2770

5.1.2 Level 2, 399–412 m, Specimen KSH01A-90L-7 to KSH01A-90L-12

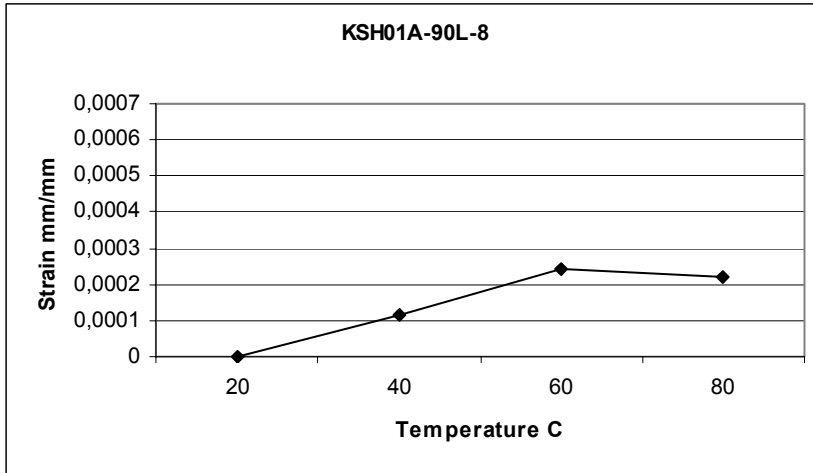
KSH01A-90L-7 (399.00)



**Figure 5-7.** Specimen KSH01A-90L-7.

The coefficient of thermal expansion for specimen KSH01A-90L-7 was measured to be  $5.7 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to 2770 Kg/m<sup>3</sup>.

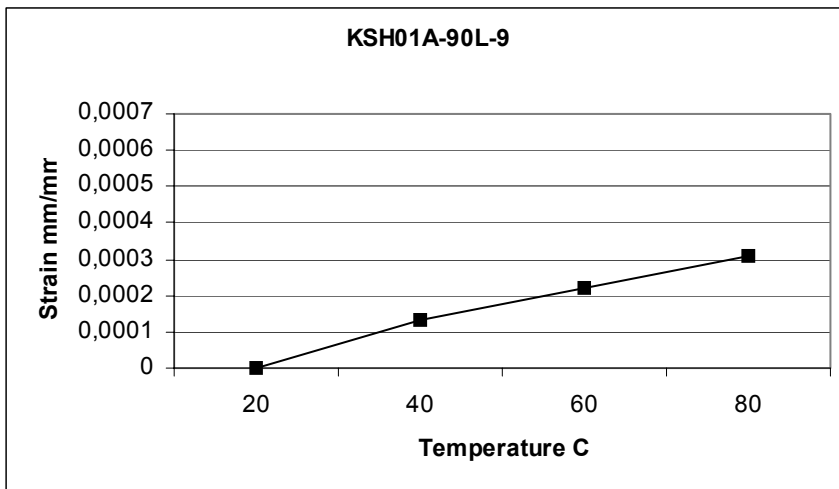
**KSH01A-90L-8 (400.10)**



**Figure 5-8.** Specimen KSH01A-90L-8.

The coefficient of thermal expansion for specimen KSH01A-90L-8 was measured to be  $3.6 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to 2770 Kg/m<sup>3</sup>. The result at 80°C is questionable, see Chapter 5.3.

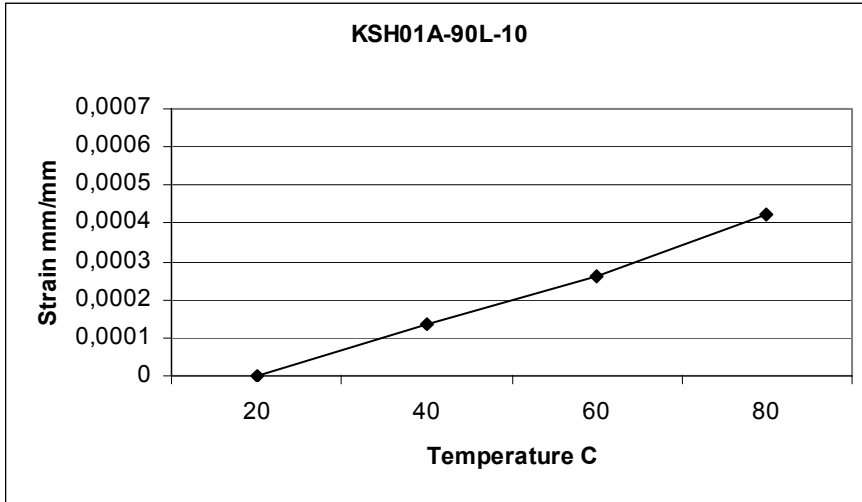
**KSH01A-90L-9 (400.37)**



**Figure 5-9.** Specimen KSH01A-90L-9.

The coefficient of thermal expansion for specimen KSH01A-90L-9 was measured to be  $5.2 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to 2750 Kg/m<sup>3</sup>.

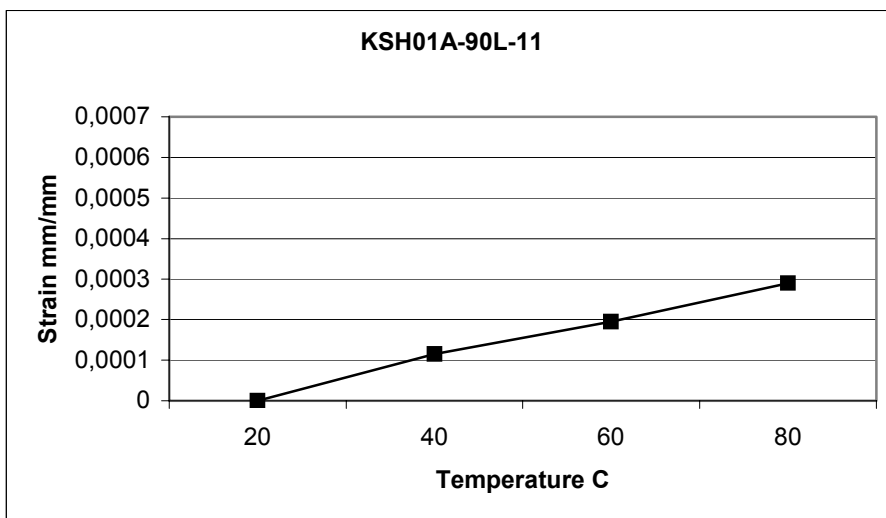
**KSH01A-90L-10 (400.64)**



**Figure 5-10. Specimen KSH01A-90L-10.**

The coefficient of thermal expansion for specimen KSH01A-90L-10 was measured to be  $7.0 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to 2780 Kg/m<sup>3</sup>.

**KSH01A-90L-11 (401.21)**

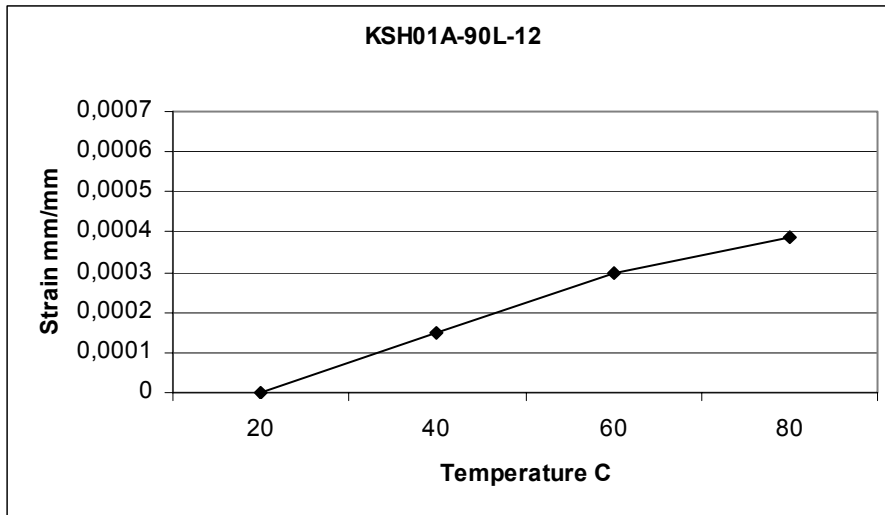


**Figure 5-11. Specimen KSH01A-90L-11.**

The coefficient of thermal expansion for specimen KSH01A-90L-11 was measured to be  $4.8 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to 2780 Kg/m<sup>3</sup>.



**KSH01A-90L-12 (412.05)**



**Figure 5-12.** Specimen KSH01A-90L-12.

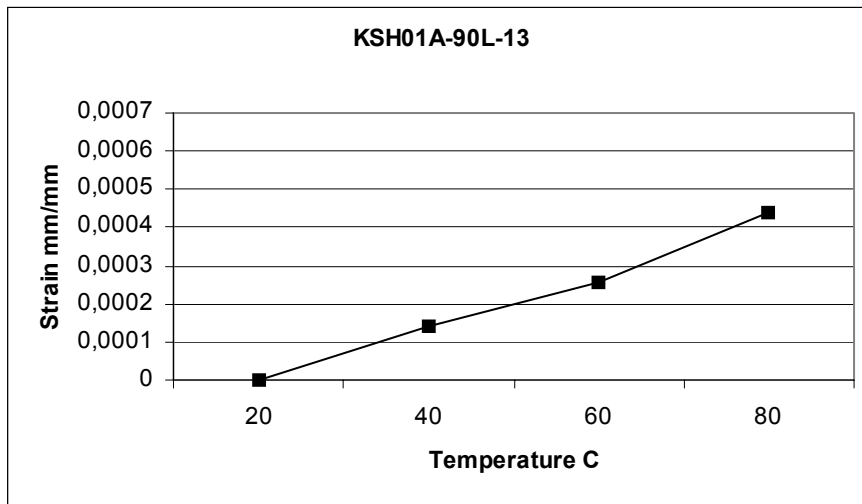
The coefficient of thermal expansion for specimen KSH01A-90L-12 was measured to be  $6.5 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to  $2760 \text{ Kg/m}^3$ .

**Table 5-2. Summary of the results for the coefficient of thermal expansion and wet density of the specimens from level 2, 399–412 m.**

Specimen	Coefficient of thermal expansion between 20 and 80°C (mm/mm°C)	Wet density (Kg/m <sup>3</sup> )
KSH01A-90L-7	$5.7 \times 10^{-6}$	2770
KSH01A-90L-8	–	2770
KSH01A-90L-9	$5.2 \times 10^{-6}$	2750
KSH01A-90L-10	$7.0 \times 10^{-6}$	2780
KSH01A-90L-11	$4.8 \times 10^{-6}$	2780
KSH01A-90L-12	$6.5 \times 10^{-6}$	2760

5.1.3 Level 3, 480–492 m, Specimen KSH01A-90L-13 to KSH01A-90L-18

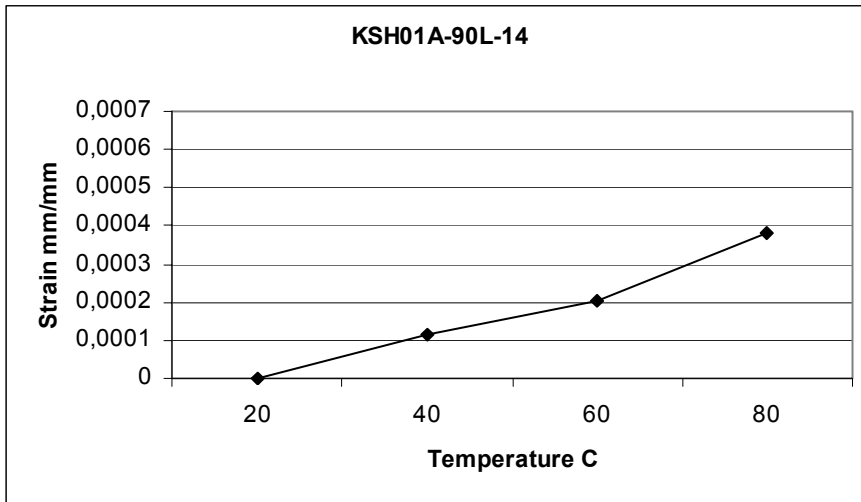
KSH01A-90L-13 (480.32)



*Figure 5-13. Specimen KSH01A-90L-13.*

The coefficient of thermal expansion for specimen KSH01A-90L-13 was measured to be  $7.3 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to 2770 Kg/m<sup>3</sup>.

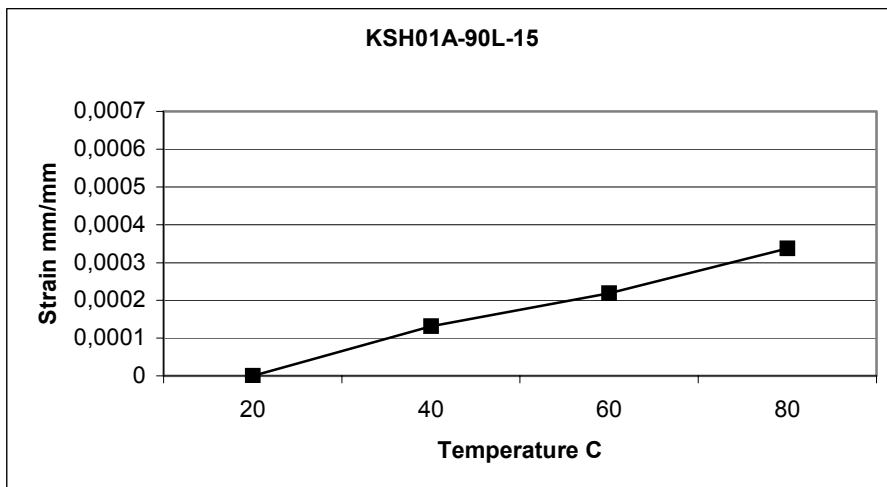
**KSH01A-90L-14 (483.88)**



*Figure 5-14. Specimen KSH01A-90L-14.*

The coefficient of thermal expansion for specimen KSH01A-90L-14 was measured to be  $6.4 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to 2780 Kg/m<sup>3</sup>.

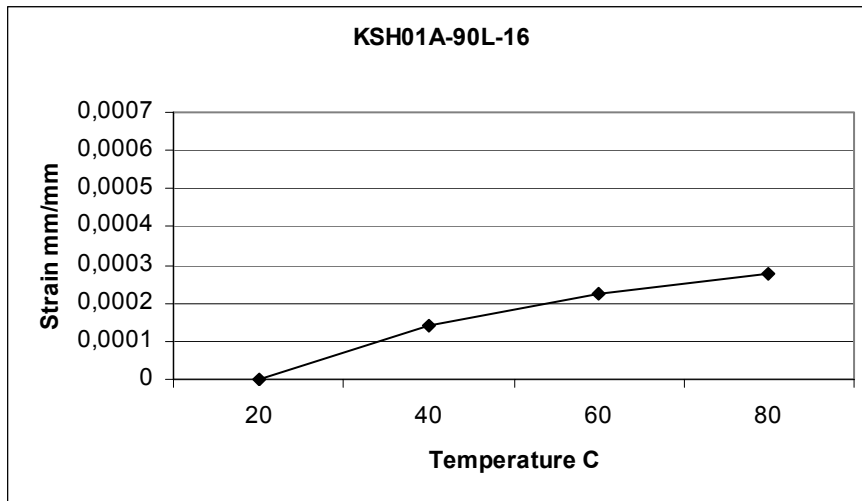
**KSH01A-90L-15 (484.21)**



*Figure 5-15. Specimen KSH01A-90L-15.*

The coefficient of thermal expansion for specimen KSH01A-90L-15 was measured to be  $5.6 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to 2730 Kg/m<sup>3</sup>.

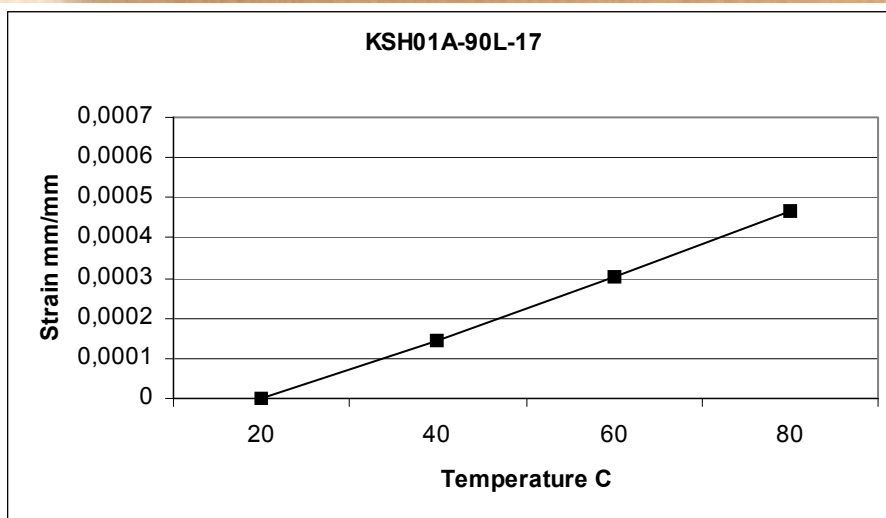
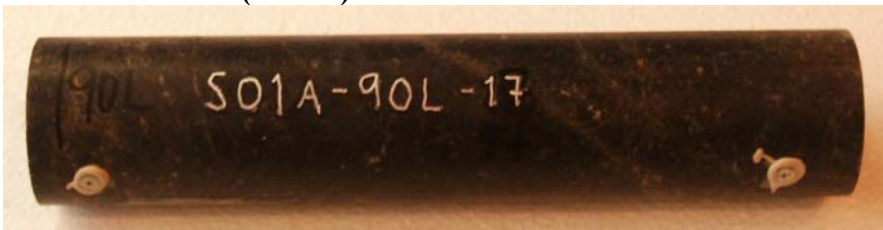
**KSH01A-90L-16 (486.37)**



**Figure 5-16.** Specimen KSH01A-90L-16.

The coefficient of thermal expansion for specimen KSH01A-90L-16 was measured to be  $4.6 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to  $2810 \text{ Kg/m}^3$ .

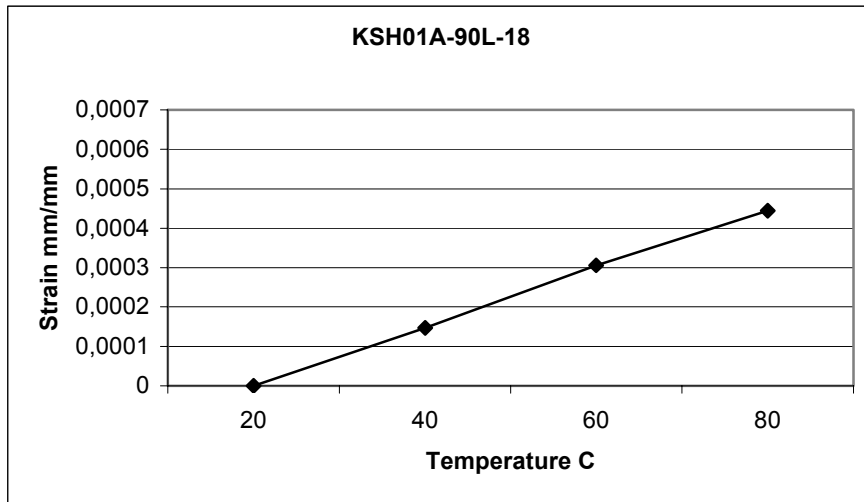
**KSH01A-90L-17 (488.60)**



**Figure 5-17.** Specimen KSH01A-90L-17.

The coefficient of thermal expansion for specimen KSH01A-90L-17 was measured to be  $7.8 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to  $2800 \text{ Kg/m}^3$ .

**KSH01A-90L-18 (492.25)**



**Figure 5-18.** Specimen KSH01A-90L-18.

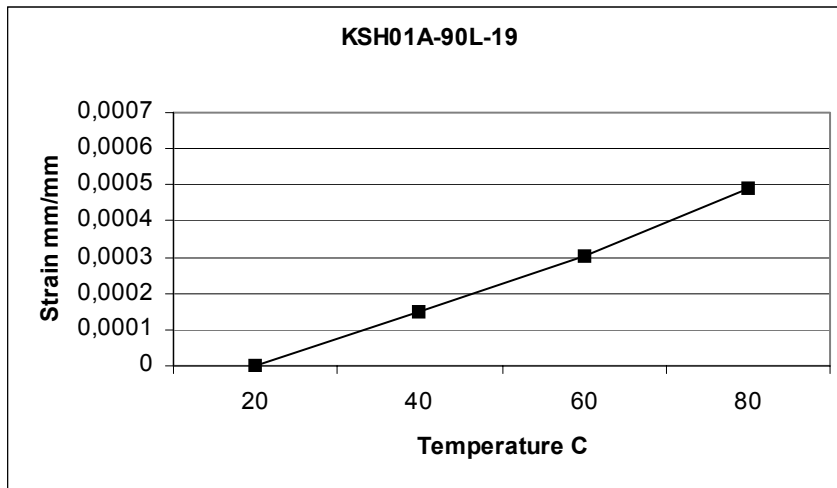
The coefficient of thermal expansion for specimen KSH01A-90L-18 was measured to be  $7.4 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to 2790 Kg/m<sup>3</sup>.

**Table 5-3. Summary of the results for the coefficient of thermal expansion and wet density of the specimens from level 3, 480–492 m.**

Specimen	Coefficient of thermal expansion between 20 and 80°C (mm/mm°C)	Wet density (Kg/m <sup>3</sup> )
KSH01A-90L-13	$7.3 \times 10^{-6}$	2770
KSH01A-90L-14	$6.4 \times 10^{-6}$	2780
KSH01A-90L-15	$5.6 \times 10^{-6}$	2730
KSH01A-90L-16	$4.6 \times 10^{-6}$	2810
KSH01A-90L-17	$7.8 \times 10^{-6}$	2800
KSH01A-90L-18	$7.4 \times 10^{-6}$	2790

5.1.4 Level 4, 701–713 m, Specimen KSH01A-90L-19 to KSH01A-90L-24

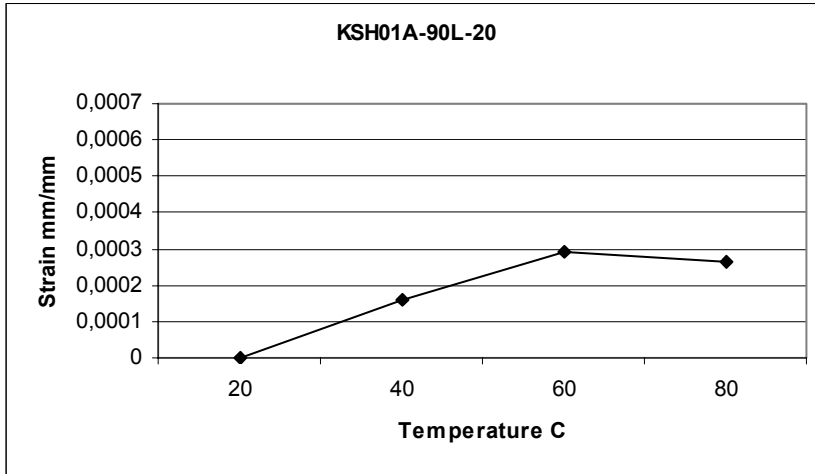
KSH01A-90L-19 (701.04)



*Figure 5-19. Specimen KSH01A-90L-19.*

The coefficient of thermal expansion for specimen KSH01A-90L-19 was measured to be  $8.1 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to 2810 Kg/m<sup>3</sup>.

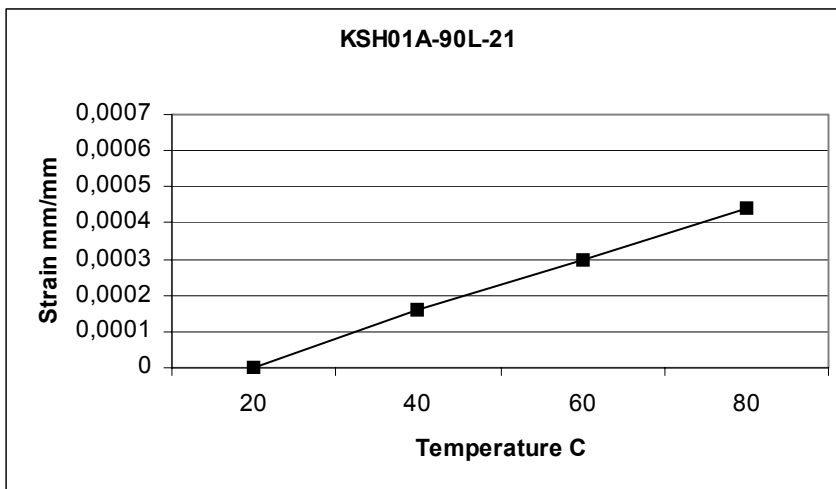
**KSH01A-90L-20 (703.70)**



**Figure 5-20.** Specimen KSH01A-90L-20.

The coefficient of thermal expansion for specimen KSH01A-90L-20 was measured to be  $4.4 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to  $2810 \text{ Kg/m}^3$ . The result at 80°C is questionable, see Chapter 5.3.

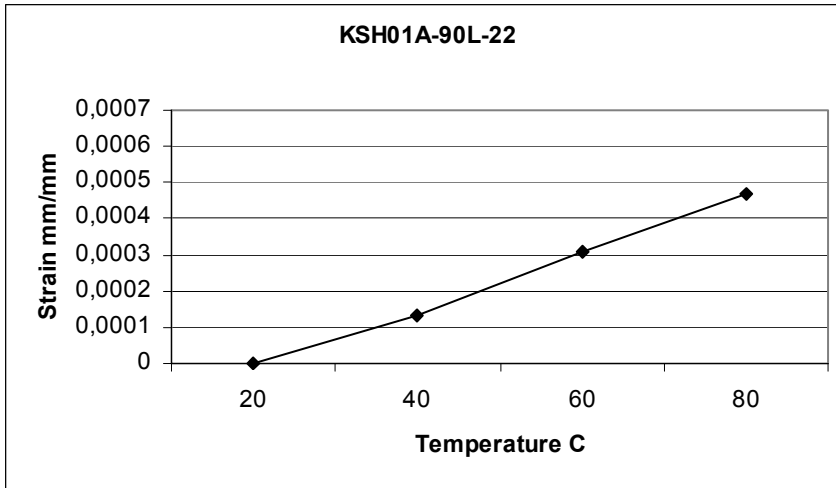
**KSH01A-90L-21 (704.10)**



**Figure 5-21.** Specimen KSH01A-90L-21.

The coefficient of thermal expansion for specimen KSH01A-90L-21 was measured to be  $7.3 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to  $2830 \text{ Kg/m}^3$ .

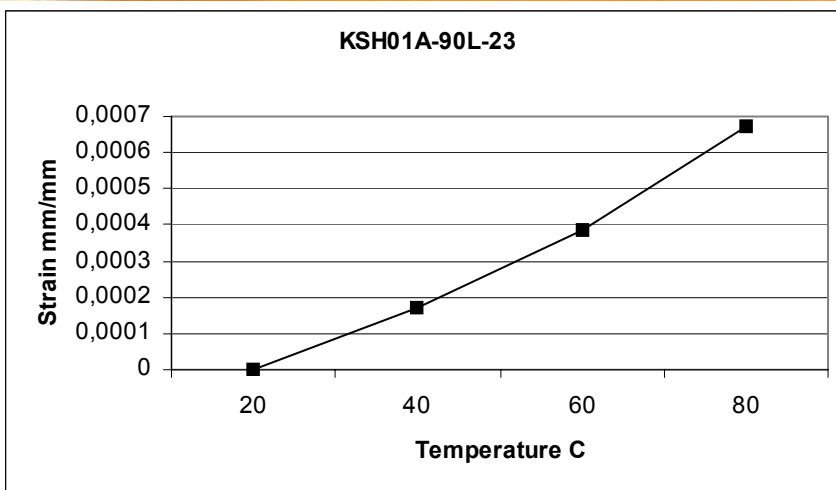
**KSH01A-90L-22 (706.56)**



**Figure 5-22.** Specimen KSH01A-90L-22.

The coefficient of thermal expansion for specimen KSH01A-90L-22 was measured to be  $7.8 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to  $2870 \text{ Kg/m}^3$ .

**KSH01A-90L-23 (709.70)**

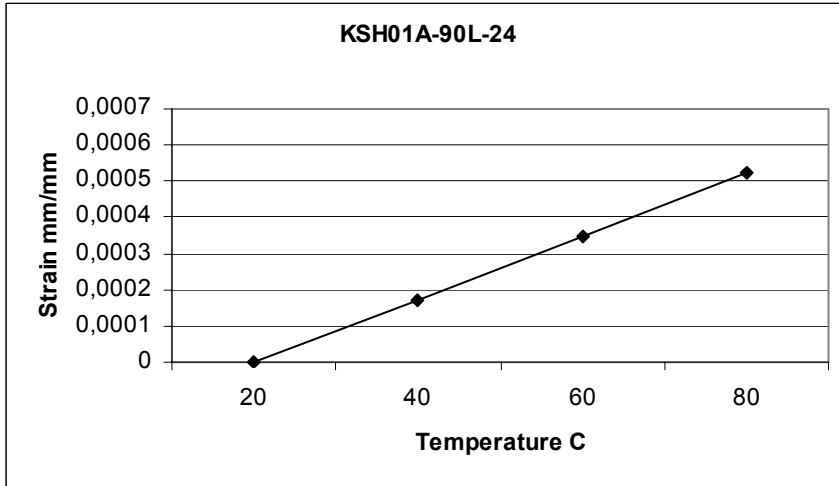


**Figure 5-23.** Specimen KSH01A-90L-23.

The coefficient of thermal expansion for specimen KSH01A-90L-23 was measured to be  $11.2 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to  $2840 \text{ Kg/m}^3$ .



**KSH01A-90L-24 (713.43)**



**Figure 5-24.** Specimen KSH01A-90L-24.

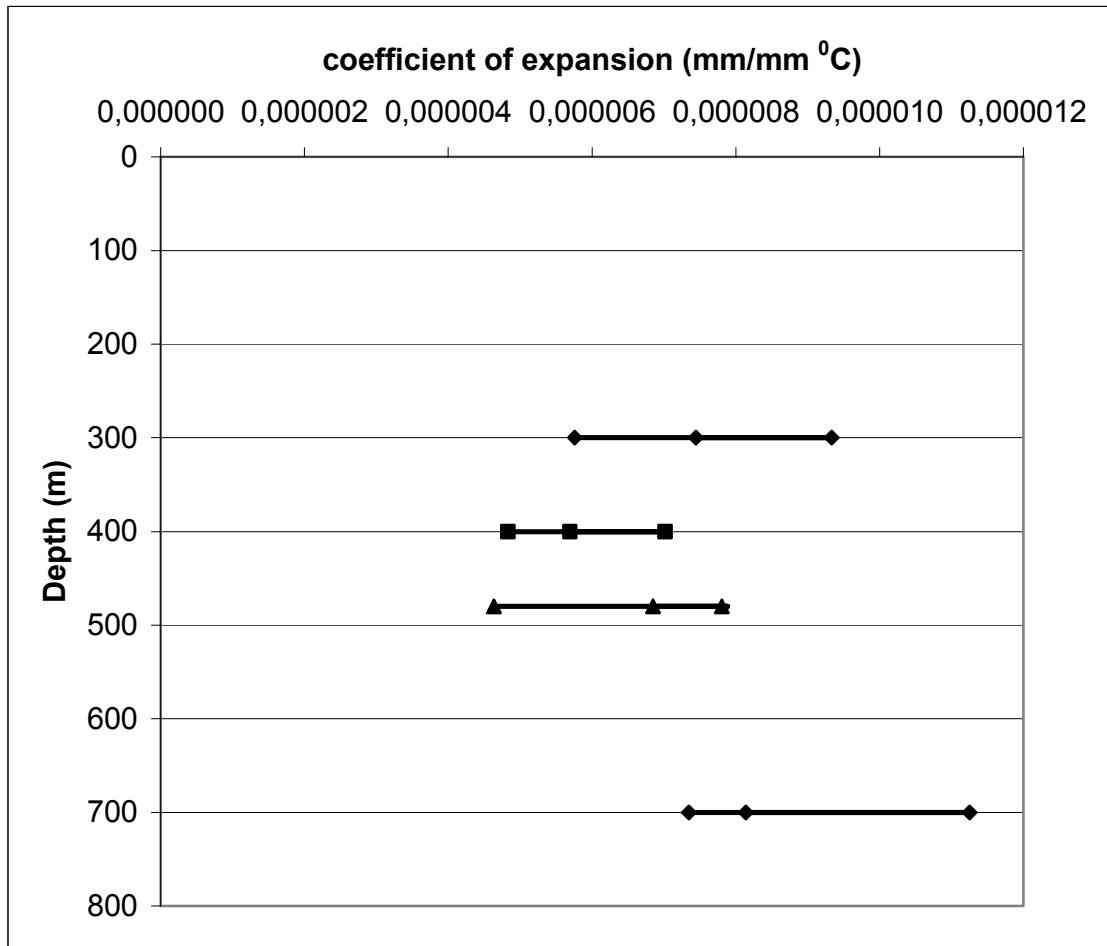
The coefficient of thermal expansion for specimen KSH01A-90L-24 was measured to be  $8.7 \times 10^{-6}$  mm/mm°C and the specimen had a wet density to 2860 Kg/m<sup>3</sup>.

**Table 5-4. Summary of the results for the coefficient of thermal expansion and wet density of the specimens from level 4, 701–713 m.**

Specimen	Coefficient of thermal expansion between 20 and 80°C (mm/mm°C)	Wet density (Kg/m <sup>3</sup> )
KSH01A-90L-19	$8.1 \times 10^{-6}$	2810
KSH01A-90L-20	–	2810
KSH01A-90L-21	$7.3 \times 10^{-6}$	2830
KSH01A-90L-22	$7.8 \times 10^{-6}$	2870
KSH01A-90L-23	$11.2 \times 10^{-6}$	2840
KSH01A-90L-24	$8.7 \times 10^{-6}$	2860

## 5.2 Results for the entire test series

Figure 5-25 and table 5-5 show the coefficient of thermal expansion plotted against the depth in the borehole. The results indicate that the coefficient of thermal expansion is greatest for the specimens consisting of Quartz monzodiorite, and the specimen KSH01A-90L-23 on the depth of 709.70 m shows the greatest expansion ( $11.2 \times 10^{-6}$  mm/mm°C).



**Figure 5-25.** Coefficient of thermal expansion plotted against the depth in the drill hole. The plot show the minimum, maximum and median values for the specimens on each level. The samples KSH01A-90L-8 and KSH01A-90L-20 are excluded.

**Table 5-5. Summary of the results for the coefficient of thermal expansion and wet density at different levels. The samples KSH01A-90L-8 and KSH01A-90L-20 are excluded.**

Depth (m)	Coefficient of variation (mm/mm°C)		
	Min value	Median value	Max value
300	$5.8 \times 10^{-6}$	$7.4 \times 10^{-6}$	$9.3 \times 10^{-6}$
400	$4.8 \times 10^{-6}$	$5.7 \times 10^{-6}$	$7.0 \times 10^{-6}$
480	$4.6 \times 10^{-6}$	$6.8 \times 10^{-6}$	$7.8 \times 10^{-6}$
700	$7.3 \times 10^{-6}$	$8.1 \times 10^{-6}$	$11.2 \times 10^{-6}$

### **5.3 Discussion**

The results from samples KSH01A-90L-8 (400.10) and KSH01A-90L-20 (703.70) deviate from the results from testing the other samples. No reason for this could be found in the documentation of the test. The results from these tests should however be handled with care.

The variation between the samples is approximately  $5 \text{ mm/mm}^\circ\text{C}$  which is more than 10 times the uncertainty of the measurement ( $0,2 \times 10^{-6} \text{ mm/mm}^\circ\text{C}$ ).

## References

**NT BUILD 479.** Natural Building stones: Coefficient of thermal expansion.

## Checklist – measurements

Kvalitetsmanual  
BMm  
Protokoll – Checklista längdutvidgning

BTm-QR 51  
Utgåva 0  
Utfärdad 2003-05-06

## Checklista prover till längdutvidgning

Datum och sign i rutan.

Instrument (inventariernr): 102266

Prov id	Provberedning	Limning mät-dubbar	Vattenmätning	Vattenmättnads densitet	Provning
KSH01A-1	03-11-25	03-11-28	03-12-10	03-12-17	03-12-17
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

### Checklista prover till längdutvidgning

Datum och sign i rutan.

Instrument (inventariernr): 102266

Prov id	Provberedning	Limning mättdubbar	Vattenmättnings	Vattenmättnads densitet	Provning
KSH01A 15	03-K-25	03-11-28	03-12-10	03-12-12	03-12-17
16					
17					
18					
19					
20					
21					
22					
23					
24	Ly	Ly	Ly	Ly	Ly

## Determination of the linear coefficient of thermal expansion

## Längdutvidgningskoefficient

Provningsmetod:

NT BUILD 479

Vattenmättad temperaturintervall 20-80 C

Borrhål/nivå:

1 skaldel motsvarar 3,97 mikrostrain = 3,97x10-6 strain

Delta l = längdförändringen i mm = strain x l

Prov id	Skalvärde start 20 C	Skalvärde vid mätning 2003-12-18 40C	Differens skaldelar	strain (mm/mm)	Delta l	l	Längdutvidgningskoeff mm/mm per grader C	Längduttv mm/mm
KSH01A-90L-1	67	95	28	0,0001116	0,022232	200,0	0,00000556	0,000111
KSH01A-90L-2	23	59	36	0,00014292	0,028584	200,0	0,00000715	0,000143
KSH01A-90L-3	5	36	31	0,00012307	0,024614	200,0	0,00000615	0,000123
KSH01A-90L-4	34	60	26	0,00010322	0,020644	200,0	0,00000516	0,000103
KSH01A-90L-5	47	78	31	0,00012307	0,024614	200,0	0,00000615	0,000123
KSH01A-90L-6	104	136	32	0,00012704	0,025408	200,0	0,00000635	0,000127
KSH01A-90L-7	148	179	31	0,00012307	0,024614	200,0	0,00000615	0,000123
KSH01A-90L-8	5	30	25	0,00009925	0,01985	200,0	0,00000496	0,000099
KSH01A-90L-9	602	626	24	0,00009528	0,019056	200,0	0,00000476	0,000095
KSH01A-90L-10	8	43	35	0,00013895	0,02779	200,0	0,00000695	0,000139
KSH01A-90L-11	-11	20	31	0,00012307	0,024614	200,0	0,00000615	0,000123
KSH01A-90L-12	-18	17	35	0,00013895	0,02779	200,0	0,00000695	0,000139
KSH01A-90L-13	-35	-1	34	0,00013498	0,026996	200,0	0,00000675	0,000135
KSH01A-90L-14	-202	-173	29	0,00011513	0,023026	200,0	0,00000576	0,000115
KSH01A-90L-15	551	584	33	0,00013101	0,026202	200,0	0,00000655	0,000131
KSH01A-90L-16	6	41	35	0,00013895	0,02779	200,0	0,00000695	0,000139
KSH01A-90L-17	118	152	34	0,00013498	0,026996	200,0	0,00000675	0,000135
KSH01A-90L-18	684	720	36	0,00014292	0,028584	200,0	0,00000715	0,000143
KSH01A-90L-19	40	77	37	0,00014689	0,029378	200,0	0,00000734	0,000147
KSH01A-90L-20	12	48	36	0,00014292	0,028584	200,0	0,00000715	0,000143
KSH01A-90L-21	-7	22	29	0,00011513	0,023026	200,0	0,00000576	0,000115
KSH01A-90L-22	112	145	33	0,00013101	0,026202	200,0	0,00000655	0,000131
KSH01A-90L-23	-90	-47	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KSH01A-90L-24	36	81	45	0,00017865	0,03573	200,0	0,00000893	0,000179

# Längdutvidgningskoefficient

Provningsmetod:

NT BUILD 479

Vattenmättad temperaturintervall 20-80 C

Borrhål/nivå:

1 skaldel motsvarar 3,97 mikrostrain = 3,97x10<sup>-6</sup> strain

Delta l = längdförändringen i mm = strain x l

Prov id	Skalvärde start 20 C	Skalvärde vid mätning 2003-12-19 40C	Differens skaldelar	strain (mm/mm)	Delta l	l	Längdutvidgningskoeff mm/mm per grader C	Längduttv mm/mm
KSH01A-90L-1	67	92	25	0,00009925	0,01985	200,0	0,0000496	0,000099
KSH01A-90L-2	23	60	37	0,00014689	0,029378	200,0	0,0000734	0,000147
KSH01A-90L-3	5	37	32	0,00012704	0,025408	200,0	0,0000635	0,000127
KSH01A-90L-4	34	63	29	0,00011513	0,023026	200,0	0,0000576	0,000115
KSH01A-90L-5	47	83	36	0,00014292	0,028584	200,0	0,0000715	0,000143
KSH01A-90L-6	104	136	32	0,00012704	0,025408	200,0	0,0000635	0,000127
KSH01A-90L-7	148	177	29	0,00011513	0,023026	200,0	0,0000576	0,000115
KSH01A-90L-8	5	34	29	0,00011513	0,023026	200,0	0,0000576	0,000115
KSH01A-90L-9	602	636	34	0,00013498	0,026996	200,0	0,0000675	0,000135
KSH01A-90L-10	8	42	34	0,00013498	0,026996	200,0	0,0000675	0,000135
KSH01A-90L-11	-11	18	29	0,00011513	0,023026	200,0	0,0000576	0,000115
KSH01A-90L-12	-18	20	38	0,00015086	0,030172	200,0	0,0000754	0,000151
KSH01A-90L-13	-35	2	37	0,00014689	0,029378	200,0	0,0000734	0,000147
KSH01A-90L-14	-202	-171	31	0,00012307	0,024614	200,0	0,0000615	0,000123
KSH01A-90L-15	551	586	35	0,00013895	0,02779	200,0	0,0000695	0,000139
KSH01A-90L-16	6	40	34	0,00013498	0,026996	200,0	0,0000675	0,000135
KSH01A-90L-17	118	154	36	0,00014292	0,028584	200,0	0,0000715	0,000143
KSH01A-90L-18	684	723	39	0,00015483	0,030966	200,0	0,0000774	0,000155
KSH01A-90L-19	40	78	38	0,00015086	0,030172	200,0	0,0000754	0,000151
KSH01A-90L-20	12	54	42	0,00016674	0,033348	200,0	0,0000834	0,000167
KSH01A-90L-21	-7	33	40	0,0001588	0,03176	200,0	0,0000794	0,000159
KSH01A-90L-22	112	144	32	0,00012704	0,025408	200,0	0,0000635	0,000127
KSH01A-90L-23	-90	-48	42	0,00016674	0,033348	200,0	0,0000834	0,000167
KSH01A-90L-24	36	79	43	0,00017071	0,034142	200,0	0,0000854	0,000171



## Längdutvidgningskoefficient

Provningsmetod:

NT BUILD 479

Vattenmättad temperaturintervall 20-80 C

Borrhål/nivå:

1 skaldel motsvarar 3,97 mikrostrain = 3,97x10<sup>-6</sup> strain

Delta l = längdförändringen i mm = strain x l

Prov id	Skalvärde start 20 C	Skalvärde vid mätning 2003-12-22 40C	Differens skaldelar	strain (mm/mm)	Delta l	l	Längdutvidgningskoeff mm/mm per grader C	Längduttv mm/mm
KSH01A-90L-1	67	91	24	0,00009528	0,019056	200,0	0,00000476	0,000095
KSH01A-90L-2	23	61	38	0,00015086	0,030172	200,0	0,00000754	0,000151
KSH01A-90L-3	5	38	33	0,00013101	0,026202	200,0	0,00000655	0,000131
KSH01A-90L-4	34	65	31	0,00012307	0,024614	200,0	0,00000615	0,000123
KSH01A-90L-5	47	88	41	0,00016277	0,032554	200,0	0,00000814	0,000163
KSH01A-90L-6	104	139	35	0,00013895	0,02779	200,0	0,00000695	0,000139
KSH01A-90L-7	148	177	29	0,00011513	0,023026	200,0	0,00000576	0,000115
KSH01A-90L-8	5	36	31	0,00012307	0,024614	200,0	0,00000615	0,000123
KSH01A-90L-9	602	641	39	0,00015483	0,030966	200,0	0,00000774	0,000155
KSH01A-90L-10	8	42	34	0,00013498	0,026996	200,0	0,00000675	0,000135
KSH01A-90L-11	-11	18	29	0,00011513	0,023026	200,0	0,00000576	0,000115
KSH01A-90L-12	-18	24	42	0,00016674	0,033348	200,0	0,00000834	0,000167
KSH01A-90L-13	-35	0	35	0,00013895	0,02779	200,0	0,00000695	0,000139
KSH01A-90L-14	-202	-173	29	0,00011513	0,023026	200,0	0,00000576	0,000115
KSH01A-90L-15	551	584	33	0,00013101	0,026202	200,0	0,00000655	0,000131
KSH01A-90L-16	6	41	35	0,00013895	0,02779	200,0	0,00000695	0,000139
KSH01A-90L-17	118	154	36	0,00014292	0,028584	200,0	0,00000715	0,000143
KSH01A-90L-18	684	721	37	0,00014689	0,029378	200,0	0,00000734	0,000147
KSH01A-90L-19	40	79	39	0,00015483	0,030966	200,0	0,00000774	0,000155
KSH01A-90L-20	12	52	40	0,0001588	0,03176	200,0	0,00000794	0,000159
KSH01A-90L-21	-7	34	41	0,00016277	0,032554	200,0	0,00000814	0,000163
KSH01A-90L-22	112	145	33	0,00013101	0,026202	200,0	0,00000655	0,000131
KSH01A-90L-23	-90	-46	44	0,00017468	0,034936	200,0	0,00000873	0,000175
KSH01A-90L-24	36	79	43	0,00017071	0,034142	200,0	0,00000854	0,000171

# Längdutvidgningskoefficient

Provningsmetod:

NT BUILD 479

Vattenmättad temperaturintervall 20-80 C

Borrhål/nivå:

1 skaldel motsvarar 3,97 mikrostrain = 3,97x10<sup>-6</sup> strain

Delta l = längdförändringen i mm = strain x l

Prov id	Skalvärde start 20 C	Skalvärde vid mätning 2003-12-23 60C	Differens skaldelar	strain (mm/mm)	Delta l	l	Längdutvidgningskoeff mm/mm per grader C	Längduttv mm/mm
KSH01A-90L-1	67	120	53	0,00021041	0,042082	200,0	0,00000526	0,000210
KSH01A-90L-2	23	94	71	0,00028187	0,056374	200,0	0,00000705	0,000282
KSH01A-90L-3	5	70	65	0,00025805	0,05161	200,0	0,00000645	0,000258
KSH01A-90L-4	34	108	74	0,00029378	0,058756	200,0	0,00000734	0,000294
KSH01A-90L-5	47	118	71	0,00028187	0,056374	200,0	0,00000705	0,000282
KSH01A-90L-6	104	170	66	0,00026202	0,052404	200,0	0,00000655	0,000262
KSH01A-90L-7	148	205	57	0,00022629	0,045258	200,0	0,00000566	0,000226
KSH01A-90L-8	5	66	61	0,00024217	0,048434	200,0	0,00000605	0,000242
KSH01A-90L-9	602	673	71	0,00028187	0,056374	200,0	0,00000705	0,000282
KSH01A-90L-10	8	74	66	0,00026202	0,052404	200,0	0,00000655	0,000262
KSH01A-90L-11	-11	51	62	0,00024614	0,049228	200,0	0,00000615	0,000246
KSH01A-90L-12	-18	57	75	0,00029775	0,05955	200,0	0,00000744	0,000298
KSH01A-90L-13	-35	35	70	0,0002779	0,05558	200,0	0,00000695	0,000278
KSH01A-90L-14	-202	-137	65	0,00025805	0,05161	200,0	0,00000645	0,000258
KSH01A-90L-15	551	618	67	0,00026599	0,053198	200,0	0,00000665	0,000266
KSH01A-90L-16	6	70	64	0,00025408	0,050816	200,0	0,00000635	0,000254
KSH01A-90L-17	118	187	69	0,00027393	0,054786	200,0	0,00000685	0,000274
KSH01A-90L-18	684	761	77	0,00030569	0,061138	200,0	0,00000764	0,000306
KSH01A-90L-19	40	115	75	0,00029775	0,05955	200,0	0,00000744	0,000298
KSH01A-90L-20	12	86	74	0,00029378	0,058756	200,0	0,00000734	0,000294
KSH01A-90L-21	-7	72	79	0,00031363	0,062726	200,0	0,00000784	0,000314
KSH01A-90L-22	112	188	76	0,00030172	0,060344	200,0	0,00000754	0,000302
KSH01A-90L-23	-90	-2	88	0,00034936	0,069872	200,0	0,00000873	0,000349
KSH01A-90L-24	36	121	85	0,00033745	0,06749	200,0	0,00000844	0,000337

## Längdutvidgningskoefficient

Provningsmetod:

NT BUILD 479

Vattenmättad temperaturintervall 20-80 C

Borrhål/nivå:

1 skaldel motsvarar 3,97 mikrostrain = 3,97x10<sup>-6</sup> strain

Delta l = längdförändringen i mm = strain x l

Prov id	Skalvärde start 20 C	Skalvärde vid mätning 2003-12-30 60C	Differens skaldelar	strain (mm/mm)	Delta l	l	Längdutvidgningskoeff mm/mm per grader C	Längduttv mm/mm
KSH01A-90L-1	67	103	36	0,00014292	0,028584	200,0	0,00000357	0,000143
KSH01A-90L-2	23	91	68	0,00026996	0,053992	200,0	0,00000675	0,000270
KSH01A-90L-3	5	80	75	0,00029775	0,05955	200,0	0,00000744	0,000298
KSH01A-90L-4	34	130	96	0,00038112	0,076224	200,0	0,00000953	0,000381
KSH01A-90L-5	47	124	77	0,00030569	0,061138	200,0	0,00000764	0,000306
KSH01A-90L-6	104	182	78	0,00030966	0,061932	200,0	0,00000774	0,000310
KSH01A-90L-7	148	201	53	0,00021041	0,042082	200,0	0,00000526	0,000210
KSH01A-90L-8	5	67	62	0,00024614	0,049228	200,0	0,00000615	0,000246
KSH01A-90L-9	602	658	56	0,00022232	0,044464	200,0	0,00000556	0,000222
KSH01A-90L-10	8	73	65	0,00025805	0,05161	200,0	0,00000645	0,000258
KSH01A-90L-11	-11	24	35	0,00013895	0,02779	200,0	0,00000347	0,000139
KSH01A-90L-12	-18	59	77	0,00030569	0,061138	200,0	0,00000764	0,000306
KSH01A-90L-13	-35	25	60	0,0002382	0,04764	200,0	0,00000596	0,000238
KSH01A-90L-14	-202	-152	50	0,0001985	0,0397	200,0	0,00000496	0,000199
KSH01A-90L-15	551	606	55	0,00021835	0,04367	200,0	0,00000546	0,000218
KSH01A-90L-16	6	62	56	0,00022232	0,044464	200,0	0,00000556	0,000222
KSH01A-90L-17	118	194	76	0,00030172	0,060344	200,0	0,00000754	0,000302
KSH01A-90L-18	684	759	75	0,00029775	0,05955	200,0	0,00000744	0,000298
KSH01A-90L-19	40	116	76	0,00030172	0,060344	200,0	0,00000754	0,000302
KSH01A-90L-20	12	90	78	0,00030966	0,061932	200,0	0,00000774	0,000310
KSH01A-90L-21	-7	63	70	0,0002779	0,05558	200,0	0,00000695	0,000278
KSH01A-90L-22	112	190	78	0,00030966	0,061932	200,0	0,00000774	0,000310
KSH01A-90L-23	-90	7	97	0,00038509	0,077018	200,0	0,00000963	0,000385
KSH01A-90L-24	36	124	88	0,00034936	0,069872	200,0	0,00000873	0,000349

# Längdutvidgningskoefficient

Provningsmetod: NT BUILD 479

Vattenmättad temperaturintervall 20-80 C

Borrhål/nivå:

1 skadel mot svarar 3,97 mikrostrain = 3,97x10<sup>-6</sup> strain

Delta l = längdförändringen i mm = strain x l

Prov id	Skalvärde start	Skalvärde vid mätning 2004-01-07 60C	Differens skadelar	strain (mm/mm)	Delta l	l	Längdutvidgningskoeff mm/mm per grader C	Längdutt mm/mm
	20 C							
KSH01A-90L-1	67	97	30	0,0001191	0,02382	200,0	0,00000298	0,000119
KSH01A-90L-2	23	94	71	0,00028187	0,056374	200,0	0,00000705	0,000282
KSH01A-90L-3	5	86	81	0,00032157	0,064314	200,0	0,00000804	0,000322
KSH01A-90L-4	34	130	96	0,00038112	0,076224	200,0	0,00000953	0,000381
KSH01A-90L-5	47	112	65	0,00025805	0,05161	200,0	0,00000645	0,000258
KSH01A-90L-6	104	183	79	0,00031363	0,062726	200,0	0,00000784	0,000314
KSH01A-90L-7	148	189	41	0,00016277	0,032554	200,0	0,00000407	0,000163
KSH01A-90L-8	5	58	53	0,00021041	0,042082	200,0	0,00000526	0,000210
KSH01A-90L-9	602	654	52	0,00020644	0,041288	200,0	0,00000516	0,000206
KSH01A-90L-10	8	77	69	0,00027393	0,054786	200,0	0,00000685	0,000274
KSH01A-90L-11	-11	38	49	0,00019453	0,038906	200,0	0,00000486	0,000195
KSH01A-90L-12	-18	55	73	0,00028981	0,057962	200,0	0,00000725	0,000290
KSH01A-90L-13	-35	29	64	0,00025408	0,050816	200,0	0,00000635	0,000254
KSH01A-90L-14	-202	-151	51	0,00020247	0,040494	200,0	0,00000506	0,000202
KSH01A-90L-15	551	605	54	0,00021438	0,042876	200,0	0,00000536	0,000214
KSH01A-90L-16	6	61	55	0,00021835	0,04367	200,0	0,00000546	0,000218
KSH01A-90L-17	118	196	78	0,00030966	0,061932	200,0	0,00000774	0,000310
KSH01A-90L-18	684	761	77	0,00030569	0,061138	200,0	0,00000764	0,000306
KSH01A-90L-19	40	116	76	0,00030172	0,060344	200,0	0,00000754	0,000302
KSH01A-90L-20	12	73	61	0,00024217	0,048434	200,0	0,00000605	0,000242
KSH01A-90L-21	-7	68	75	0,00029775	0,05955	200,0	0,00000744	0,000298
KSH01A-90L-22	112	191	79	0,00031363	0,062726	200,0	0,00000784	0,000314
KSH01A-90L-23	-90	27	117	0,00046449	0,092898	200,0	0,00001161	0,000464
KSH01A-90L-24	36	130	94	0,00037318	0,074636	200,0	0,00000933	0,000373

## Längdutvidgningskoefficient

Provningmetod:

NT BUILD 479

Vattenmättad temperaturintervall 20-80 C

Borrhål/nivå:

1 skaldel motsvarar 3,97 mikrostrain = 3,97x10<sup>-6</sup> strain

Delta l = längdförändringen i mm = strain x l

Prov id	Skalvärde start 20 C	Skalvärde vid mätning 2004-01-12 80C	Differens skaldelar	strain (mm/mm)	Delta l	l	Längdutvidgningskoeff mm/mm per grader C	Längduttv mm/mm
KSH01A-90L-1	67	146	79	0,00031363	0,062726	200,0	0,00000523	0,000314
KSH01A-90L-2	23	127	104	0,00041288	0,082576	200,0	0,00000688	0,000413
KSH01A-90L-3	5	124	119	0,00047243	0,094486	200,0	0,00000787	0,000472
KSH01A-90L-4	34	172	138	0,00054786	0,109572	200,0	0,00000913	0,000548
KSH01A-90L-5	47	152	105	0,00041685	0,08337	200,0	0,00000695	0,000417
KSH01A-90L-6	104	221	117	0,00046449	0,092898	200,0	0,00000774	0,000464
KSH01A-90L-7	148	227	79	0,00031363	0,062726	200,0	0,00000523	0,000314
KSH01A-90L-8	5	58	53	0,00021041	0,042082	200,0	0,00000351	0,000210
KSH01A-90L-9	602	680	78	0,00030966	0,061932	200,0	0,00000516	0,000310
KSH01A-90L-10	8	114	106	0,00042082	0,084164	200,0	0,00000701	0,000421
KSH01A-90L-11	-11	66	77	0,00030569	0,061138	200,0	0,00000509	0,000306
KSH01A-90L-12	-18	82	100	0,000397	0,0794	200,0	0,00000662	0,000397
KSH01A-90L-13	-35	76	111	0,00044067	0,088134	200,0	0,00000734	0,000441
KSH01A-90L-14	-202	-106	96	0,00038112	0,076224	200,0	0,00000635	0,000381
KSH01A-90L-15	551	636	85	0,00033745	0,06749	200,0	0,00000562	0,000337
KSH01A-90L-16	6	85	79	0,00031363	0,062726	200,0	0,00000523	0,000314
KSH01A-90L-17	118	237	119	0,00047243	0,094486	200,0	0,00000787	0,000472
KSH01A-90L-18	684	799	115	0,00045655	0,09131	200,0	0,00000761	0,000457
KSH01A-90L-19	40	162	122	0,00048434	0,096868	200,0	0,00000807	0,000484
KSH01A-90L-20	12	81	69	0,00027393	0,054786	200,0	0,00000457	0,000274
KSH01A-90L-21	-7	101	108	0,00042876	0,085752	200,0	0,00000715	0,000429
KSH01A-90L-22	112	231	119	0,00047243	0,094486	200,0	0,00000787	0,000472
KSH01A-90L-23	-90	81	171	0,00067887	0,135774	200,0	0,00001131	0,000679
KSH01A-90L-24	36	171	135	0,00053595	0,10719	200,0	0,00000893	0,000536

## Längdutvidgningskoefficient

Provningsmetod:

NT BUILD 479

Vattenmättad temperaturintervall 20-80 C

Borrhål/nivå:

1 skaldel motsvarar 3,97 mikrostrain = 3,97x10<sup>-6</sup> strain

Delta l = längdförändringen i mm = strain x l

Prov id	Skalvärde start	Skalvärde vid mätning 2004-01-13 80C	Differens skaldelar	strain (mm/mm)	Delta l	l	Längdutvidgningskoeff mm/mm per grader C	Längduttv mm/mm
	20 C							
KSH01A-90L-1	67	154	87	0,00034539	0,069078	200,0	0,00000576	0,000345
KSH01A-90L-2	23	125	102	0,00040494	0,080988	200,0	0,00000675	0,000405
KSH01A-90L-3	5	122	117	0,00046449	0,092898	200,0	0,00000774	0,000464
KSH01A-90L-4	34	176	142	0,00056374	0,112748	200,0	0,00000940	0,000564
KSH01A-90L-5	47	155	108	0,00042876	0,085752	200,0	0,00000715	0,000429
KSH01A-90L-6	104	230	126	0,00050022	0,100044	200,0	0,00000834	0,000500
KSH01A-90L-7	148	234	86	0,00034142	0,068284	200,0	0,00000569	0,000341
KSH01A-90L-8	5	60	55	0,00021835	0,04367	200,0	0,00000364	0,000218
KSH01A-90L-9	602	678	76	0,00030172	0,060344	200,0	0,00000503	0,000302
KSH01A-90L-10	8	114	106	0,00042082	0,084164	200,0	0,00000701	0,000421
KSH01A-90L-11	-11	61	72	0,00028584	0,057168	200,0	0,00000476	0,000286
KSH01A-90L-12	-18	80	98	0,00038906	0,077812	200,0	0,00000648	0,000389
KSH01A-90L-13	-35	76	111	0,00044067	0,088134	200,0	0,00000734	0,000441
KSH01A-90L-14	-202	-104	98	0,00038906	0,077812	200,0	0,00000648	0,000389
KSH01A-90L-15	551	638	87	0,00034539	0,069078	200,0	0,00000576	0,000345
KSH01A-90L-16	6	76	70	0,0002779	0,05558	200,0	0,00000463	0,000278
KSH01A-90L-17	118	236	118	0,00046846	0,093692	200,0	0,00000781	0,000468
KSH01A-90L-18	684	796	112	0,00044464	0,088928	200,0	0,00000741	0,000445
KSH01A-90L-19	40	163	123	0,00048831	0,097662	200,0	0,00000814	0,000488
KSH01A-90L-20	12	79	67	0,00026599	0,053198	200,0	0,00000443	0,000266
KSH01A-90L-21	-7	107	114	0,00045258	0,090516	200,0	0,00000754	0,000453
KSH01A-90L-22	112	229	117	0,00046449	0,092898	200,0	0,00000774	0,000464
KSH01A-90L-23	-90	79	169	0,00067093	0,134186	200,0	0,00001118	0,000671
KSH01A-90L-24	36	168	132	0,00052404	0,104808	200,0	0,00000873	0,000524

## Längdutvidgningskoefficient

Provningsmetod:

NT BUILD 479

Vattenmättad temperaturintervall 20-80 C

Borrhål/nivå:

1 skaldel motsvarar 3,97 mikrostrain = 3,97x10<sup>-6</sup> strain

Delta l = längdförändringen i mm = strain x l

Prov id	Skalvärde start 20 C	Skalvärde vid mätning 2004-01-15 80C	Differens skaldelar	strain (mm/mm)	Delta l	l	Längdutvidgningskoeff mm/mm per grader C	Längduttv mm/mm
KSH01A-90L-1	67	154	87	0,00034539	0,069078	200,0	0,00000576	0,000345
KSH01A-90L-2	23	125	102	0,00040494	0,080988	200,0	0,00000675	0,000405
KSH01A-90L-3	5	122	117	0,00046449	0,092898	200,0	0,00000774	0,000464
KSH01A-90L-4	34	175	141	0,00055977	0,111954	200,0	0,00000933	0,000560
KSH01A-90L-5	47	155	108	0,00042876	0,085752	200,0	0,00000715	0,000429
KSH01A-90L-6	104	228	124	0,00049228	0,098456	200,0	0,00000820	0,000492
KSH01A-90L-7	148	235	87	0,00034539	0,069078	200,0	0,00000576	0,000345
KSH01A-90L-8	5	61	56	0,00022232	0,044464	200,0	0,00000371	0,000222
KSH01A-90L-9	602	680	78	0,00030966	0,061932	200,0	0,00000516	0,000310
KSH01A-90L-10	8	114	106	0,00042082	0,084164	200,0	0,00000701	0,000421
KSH01A-90L-11	-11	62	73	0,00028981	0,057962	200,0	0,00000483	0,000290
KSH01A-90L-12	-18	79	97	0,00038509	0,077018	200,0	0,00000642	0,000385
KSH01A-90L-13	-35	77	112	0,00044464	0,088928	200,0	0,00000741	0,000445
KSH01A-90L-14	-202	-106	96	0,00038112	0,076224	200,0	0,00000635	0,000381
KSH01A-90L-15	551	635	84	0,00033348	0,066696	200,0	0,00000556	0,000333
KSH01A-90L-16	6	74	68	0,00026996	0,053992	200,0	0,00000450	0,000270
KSH01A-90L-17	118	235	117	0,00046449	0,092898	200,0	0,00000774	0,000464
KSH01A-90L-18	684	794	110	0,0004367	0,08734	200,0	0,00000728	0,000437
KSH01A-90L-19	40	163	123	0,00048831	0,097662	200,0	0,00000814	0,000488
KSH01A-90L-20	12	74	62	0,00024614	0,049228	200,0	0,00000410	0,000246
KSH01A-90L-21	-7	104	111	0,00044067	0,088134	200,0	0,00000734	0,000441
KSH01A-90L-22	112	230	118	0,00046846	0,093692	200,0	0,00000781	0,000468
KSH01A-90L-23	-90	80	170	0,0006749	0,13498	200,0	0,00001125	0,000675
KSH01A-90L-24	36	164	128	0,00050816	0,101632	200,0	0,00000847	0,000508





# Appendix 3

## Determination of wet density

### Densitet och porositet

Uppdrags nr: KSH01A

Metod:

Provad av: Lej

Datum: 2003-12-17

	Provmärkning:	Vikt i vatten, Msub (g)	Yttor vikt, Msat (g)	Torr vikt, Ms (g)	Bulk volym, V (cm3)	Por volym, Vv (cm3)	Porositet, n (%)	Torr densitet, pd (g/cm3)	Våt densitet (g/cm3)
1	KSH01A-90L-1	815,56	1289,05		474,39	1291,50	272,24	0,000	2,717
2	KSH01A-90L-2	835,65	1309,17		474,42	1311,66	276,48	0,000	2,760
3	KSH01A-90L-3	843,27	1317,07		474,70	1319,58	277,98	0,000	2,775
4	KSH01A-90L-4	839,77	1313,94		475,07	1316,44	277,10	0,000	2,766
5	KSH01A-90L-5	836,15	1309,65		474,40	1312,14	276,59	0,000	2,761
6	KSH01A-90L-6	841,67	1315,76		474,99	1318,26	277,53	0,000	2,770
7	KSH01A-90L-7	838,58	1309,83		472,15	1312,32	277,95	0,000	2,774
8	KSH01A-90L-8	835,92	1307,7		472,68	1310,19	277,18	0,000	2,767
9	KSH01A-90L-9	829,29	1301,13		472,74	1303,61	275,76	0,000	2,752
10	KSH01A-90L-10	841,1	1313,2		473,00	1315,70	278,16	0,000	2,776
11	KSH01A-90L-11	841,73	1314,54		473,71	1317,04	278,03	0,000	2,775
12	KSH01A-90L-12	809,52	1268,31		459,66	1270,72	276,45	0,000	2,759
13	KSH01A-90L-13	839,85	1312,02		473,07	1314,52	277,87	0,000	2,773
14	KSH01A-90L-14	841,36	1313,23		472,77	1315,73	278,30	0,000	2,778
15	KSH01A-90L-15	817,54	1289,62		472,98	1292,07	273,18	0,000	2,727
16	KSH01A-90L-16	857,6	1329,97		473,27	1332,50	281,55	0,000	2,810
17	KSH01A-90L-17	851,46	1323,82		473,26	1326,34	280,26	0,000	2,797
18	KSH01A-90L-18	847,23	1319,8		473,47	1322,31	279,28	0,000	2,788
19	KSH01A-90L-19	853,04	1324,29		472,15	1326,81	281,02	0,000	2,805
20	KSH01A-90L-20	853,17	1324,44		472,17	1326,96	281,04	0,000	2,805
21	KSH01A-90L-21	864,94	1336,05		472,01	1338,59	283,60	0,000	2,831
22	KSH01A-90L-22	883,54	1355,4		472,76	1357,98	287,25	0,000	2,867
23	KSH01A-90L-23	867,84	1339,17		472,23	1341,72	284,13	0,000	2,836
24	KSH01A-90L-24	879,98	1351,1		472,02	1353,67	286,78	0,000	2,862
25					0,00	0,00	#DIVISION/0!	#DIVISION/0!	

Vattnets temp. (°C): 20,5

Vattnets densitet (g/cm3): 0,9981

Våg, inv.nr.: 102291

Termometer, inv.nr.: 102080