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Forsmark site investigation

Drill hole KFM02A: Extensometer measurement of the coefficient of thermal expansion of rock

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May 2004

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Abstract

The coefficient of thermal expansion and the wet density have been determined on fifteen specimens from drill hole KFM02A. The specimens were sampled on three levels in the drill hole at a depth of approximately 335 m, 530 m and 710 m. The investigated rock type is mapped as a medium grained metagranite-granodiorite. The coefficient of thermal expansion has been determined within the temperature interval 20-80 ºC. The results indicated that the thermal expansion was almost linear and the coefficient of thermal expansion range between 6 and 10 x 10^{-6} mm/mm ˚C.

Contents

1 Introduction

This document reports the data collected within the activity “Undersökningar i Forsmarksområdet. KFM02A. Bergmekaniska och tekniska laboratoriebestämningar”, which is one of the activities performed as part of the site investigation at Forsmark. The work was carried out in accordance with activity plan AP PF 400-04-19 (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 KFM02A in the Forsmark area (Figure 1-1). They were sampled 17 June 2003 by Thomas Janson, Tyréns AB, and Urban Åkesson, The Swedish National Testing and Research Institute (SP). Specimens were taken from three levels at depths of approximately 300 m, 500 m and 700 m. The rock cores were transported by SP from Forsmark and arrived at SP 18 June 2003. The testing was performed during March and May 2004 (see Appendix 1).

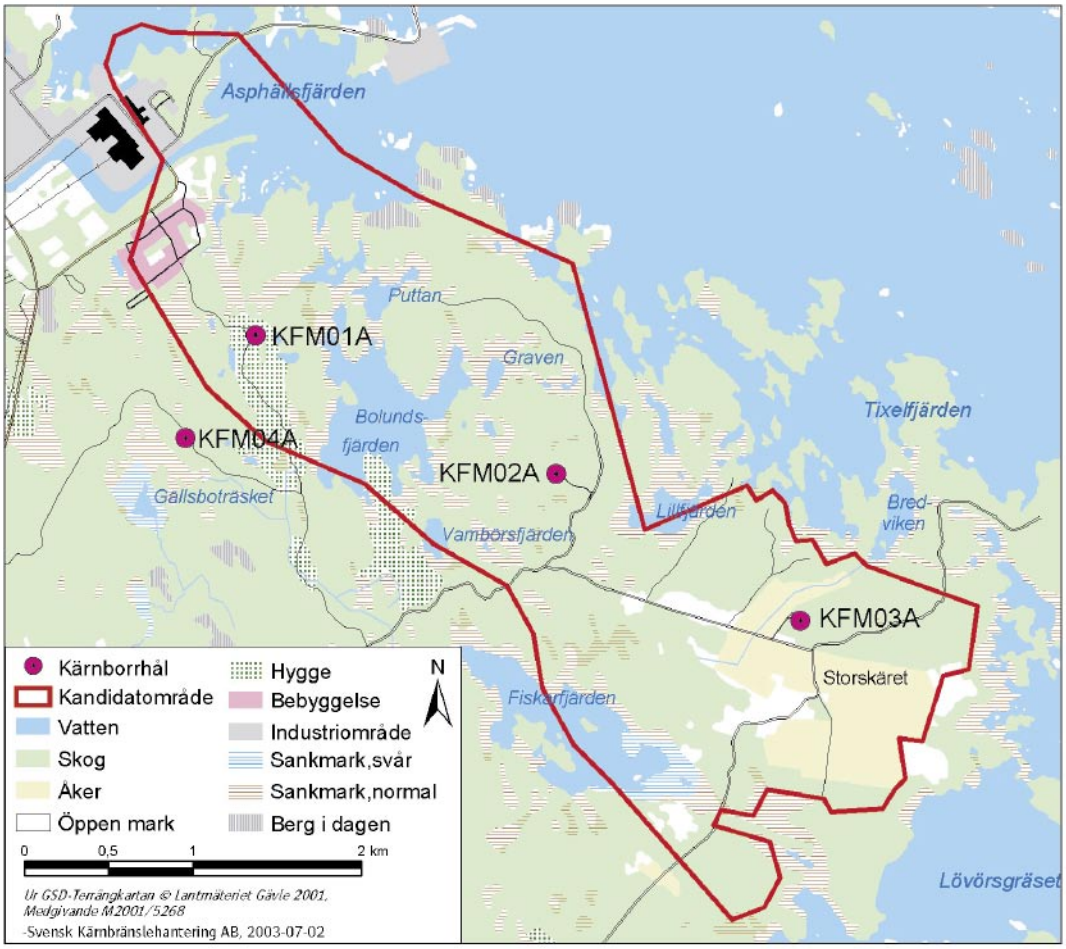


Figure 1-1. *Location of drill hole KFM02A at the Forsmark investigation area.*

2 Objective and scope

The purpose is to determine the linear coefficient of thermal expansion for rock cores at water-saturated conditions between +20-80 ºC.

These parameters will be included in site descriptive model of rock mechanics for the Forsmark area, performed by SKB. The specimens and the results will be presented in tables, diagrams and spreadsheets.

3 Equipment

The following equipment has 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 level (see Appendix 2). The uncertainty of the extensometer is ± 3.97 x 10^{-6} mm/mm (strain) which for these samples equals an uncertainty of a single measurement of the coefficient of thermal expansion of ± 0.4 x 10^{-6} mm/mm ^{o}C for a temperature difference of 20 degrees C.
- Reference bar in invar steel for calibration of the extensometer.
- Heating chamber (inv no 102284) with an accuracy of ± 0.7 ºC at 80 ºC 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

In the Forsmark area, specimens were sampled from one level in drill hole KFM02A. The core drilled part of the borehole starts at a depth of 100 m, and the sampled levels were selected at the approximate depths of 300 m, 500 m and 700 m. Fifteen specimens, with a length of 240 mm and a diameter of 50 mm, were sampled. The sampled rock type is a medium grained metagranite-granodiorite. Table 4-1 shows the rock type and identification marks of the specimens.

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

Identification	Sampling depth, according to the marks on the drill-core boxes (Sec low)	Rock type
KFM02A-90L-1	335.45	Metagranite-granodiorite
KFM02A-90L-2	339.20	Metagranite-granodiorite
KFM02A-90L-3	339.47	Metagranite-granodiorite
KFM02A-90L-4	339.47	Metagranite-granodiorite
KFM02A-90L-5	340.00	Metagranite-granodiorite
KFM02A-90L-7	529.33	Metagranite-granodiorite
KFM02A-90L-8	532.70	Metagranite-granodiorite
KFM02A-90L-9	533.28	Metagranite-granodiorite
KFM02A-90L-10	536.96	Metagranite-granodiorite
KFM02A-90L-11	538.03	Metagranite-granodiorite
KFM02A-90L-13	704.09	Metagranite-granodiorite
KFM02A-90L-14	707.10	Metagranite-granodiorite
KFM02A-90L-15	707.39	Metagranite-granodiorite
KFM02A-90L-16	707.66	Metagranite-granodiorite
KFM02A-90L-17	709.12	Metagranite-granodiorite

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 documents) and the following steps were performed:

Item	Activity
1	The specimens were cut according to the marks on the rock cores.
2	Two studs were glued with a distance of 200 mm on the specimens.
	At specimens KFM02A-90L-1, KFM02A-90L-8 and KFM02A-90L-17 three pairs of studs were glued for the purpose to measure possibly bending of the specimens.
3	The specimens were photographed in JPEG-format.
4	The specimens were water saturated for seven days.
5	The wet density was determined (See Appendix 3)
6	The coefficient of thermal expansion was determined. The thermal expansion was measured at 20, 40, 60 and 80 ºC. On each temperature level three to five measurements were done with 24 h intervals in order to ensure that the expansion was completed for each temperature level (See Appendix 2). The coefficient of thermal expansion was determined between 20-80 ºC.

5 Results

The results of the extensometer measurements on drill core samples from borehole KFM04A at Forsmark are stored in the database SICADA under field note no Forsmark 142.

5.1 Description of the specimens and presentation of the results

The temperature of water for water saturation was 18.8 ºC and the density of the water was 998 kg/m^3. The coefficient of thermal expansion was determined between +20-80 ˚C.

Figure 5-1 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40, 60, 80 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-1 was measured to be 7.3 x 10^{-6} mm/mm ˚C and the specimen had a wet density of 2660 kg/m^3.

At specimen KFM02A-90L-1 three pairs of studs were glued for the purpose of measuring possibly bending of the specimens.

KFM02A-90L-1 (335.45)

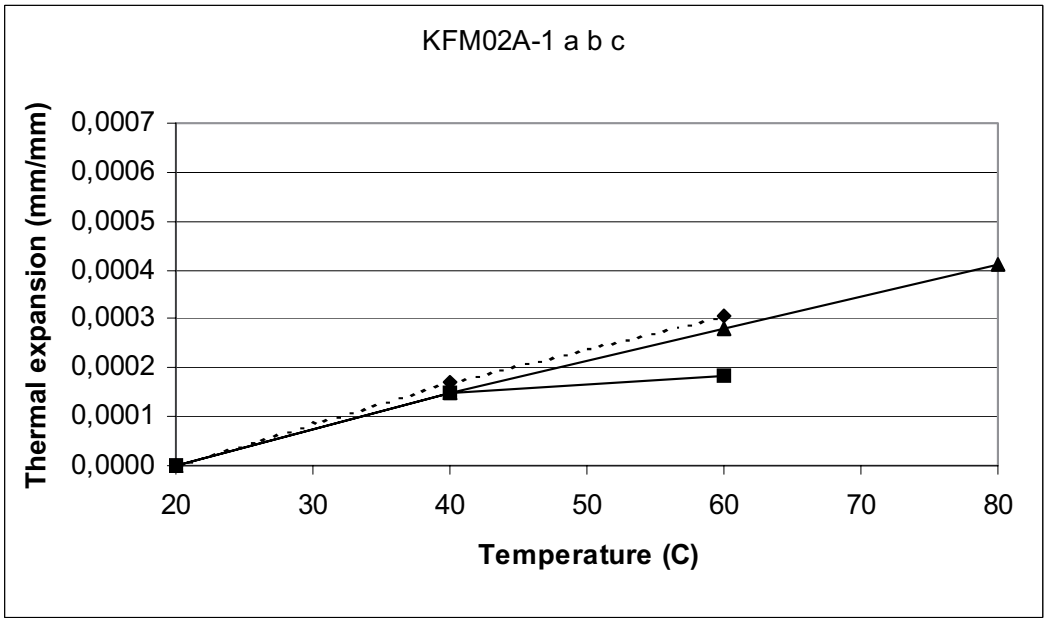


Figure 5-1. *Specimen KFM02A-90L-1.*

Figure 5-2 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40, 60, 80 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-2 was measured to be 6.0 x 10^{-6} mm/mm ˚C and the specimen had a wet density of 2650 kg/m^3.

KFM02A-90L-2 (339.20)

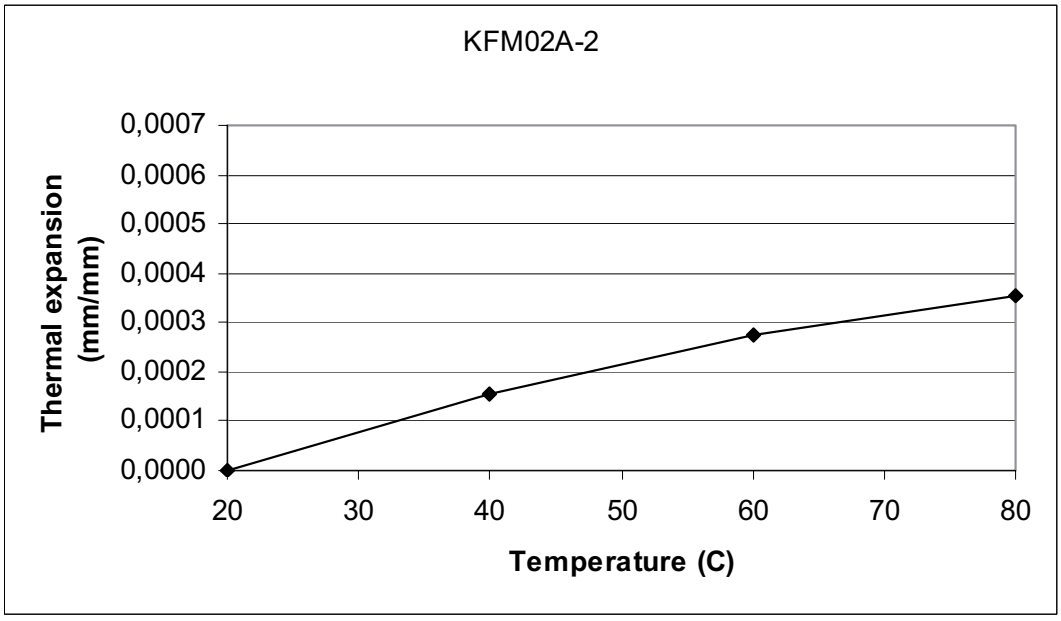


Figure 5-2. *Specimen KFM02A-90L-2.*

Figure 5-3 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40, 60 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-3 was not measured, due to that the studs fell off at 80 degrees. The specimen had a wet density of 2650 kg/m^3.

KFM02A-90L-3 (339.47)

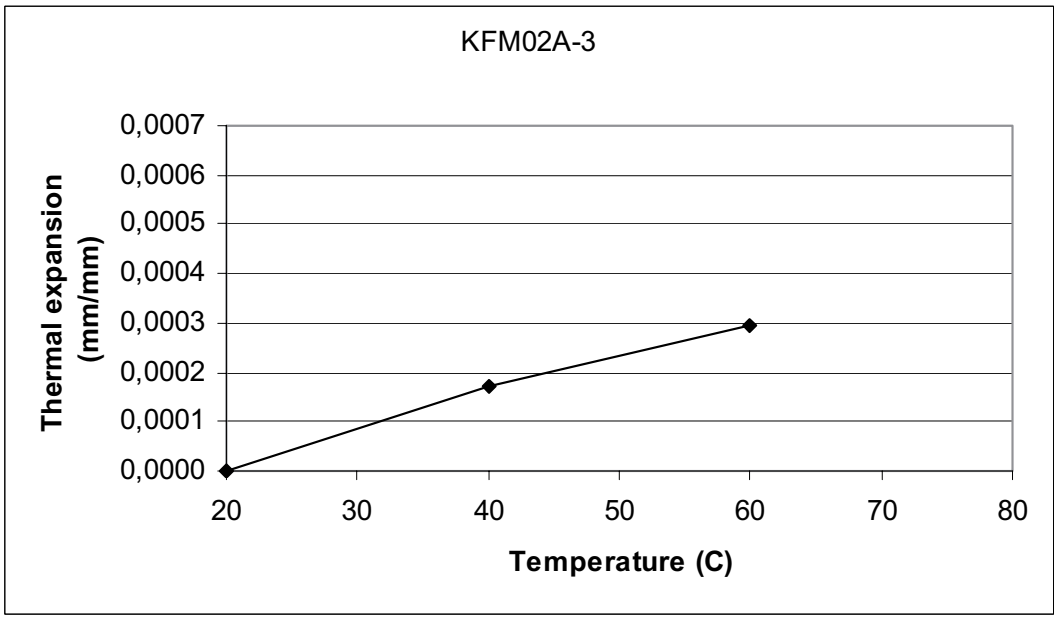
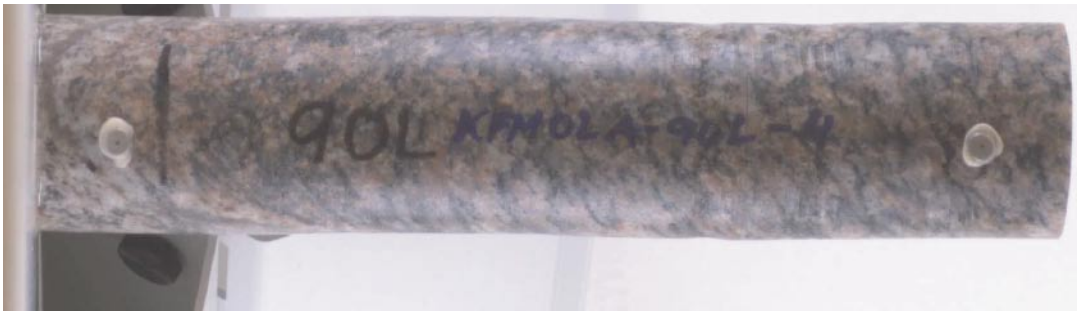


Figure 5-3. *Specimen KFM02A-90L-3.*

Figure 5-4 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40, 60, 80 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-4 was measured to be 7.7 x 10^{-6} mm/mm ˚C and the specimen had a wet density of 2650 kg/m^3.

KFM02A-90L-4 (339.74)



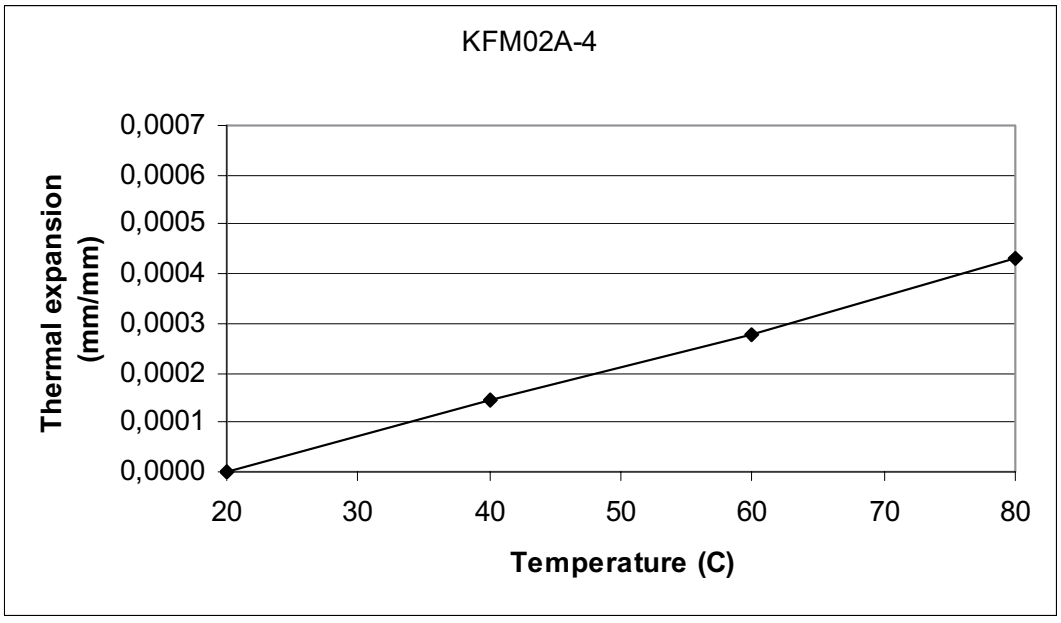


Figure 5-4. *Specimen KFM02A-90L-4.*

Figure 5-5 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40, 60, 80 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-5 was measured to be 6.3 x 10^{-6} mm/mm ˚C and the specimen had a wet density of 2660 kg/m^3.

KFM02A-90L-5 (340.00)

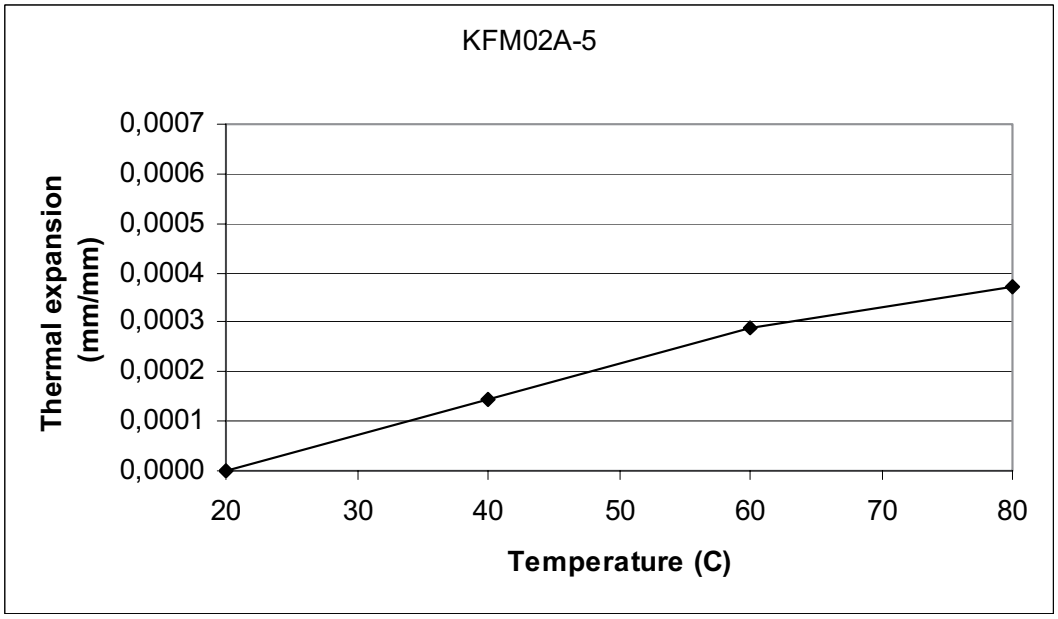


Figure 5-5. *Specimen KFM02A-90L-5.*

Figure 5-6 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40, 60, 80 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-7 was measured to be 9.7 x 10^{-6} mm/mm ˚C and the specimen had a wet density of 2650 kg/m^3.

KFM02A-90L-7 (529.33)

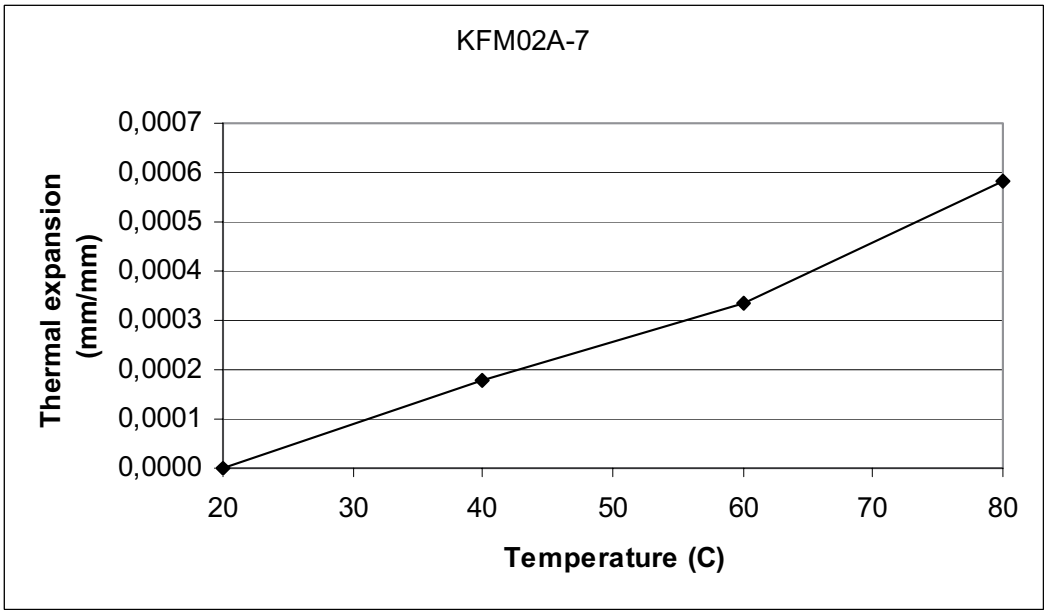


Figure 5-6. *Specimen KFM02A-90L-7.*

Figure 5-7 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40, 60, 80 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-8 was measured to be 6.0 x 10^{-6} mm/mm ˚C and the specimen had a wet density of 2650 kg/m^3.

At specimen KFM02A-90L-8 three pairs of studs were glued for the purpose of measuring possibly bending of the specimens.

KFM02A-90L-8 (532.70)

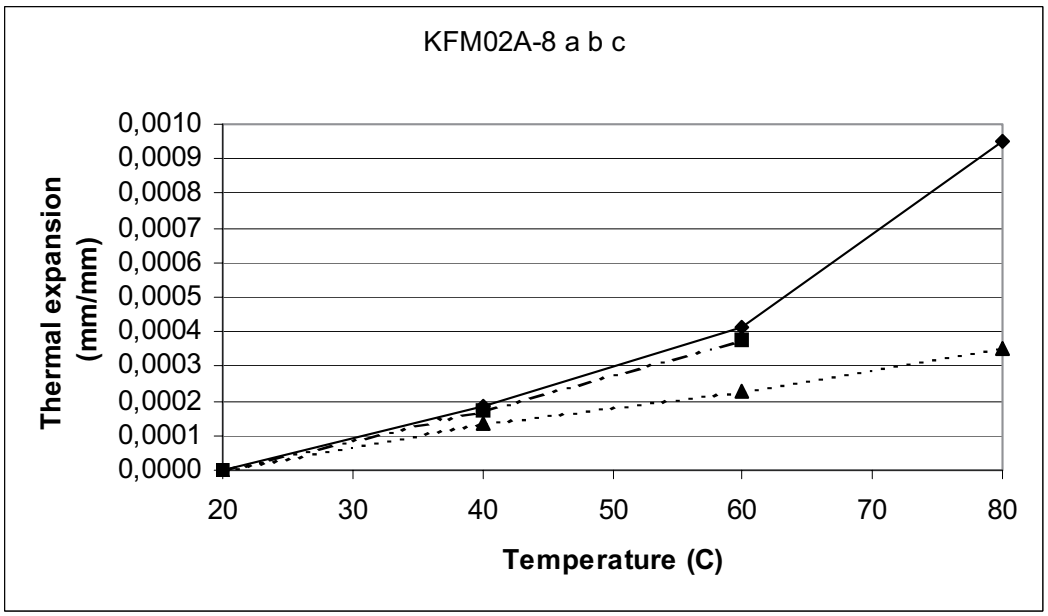


Figure 5-7. *Specimen KFM02A-90L-8.*

Figure 5-8 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40, 60, 80 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-9 was measured to be 10 x 10^{-6} mm/mm ˚C and the specimen had a wet density of 2640 kg/m^3.

KFM02A-90L-9 (533.28)

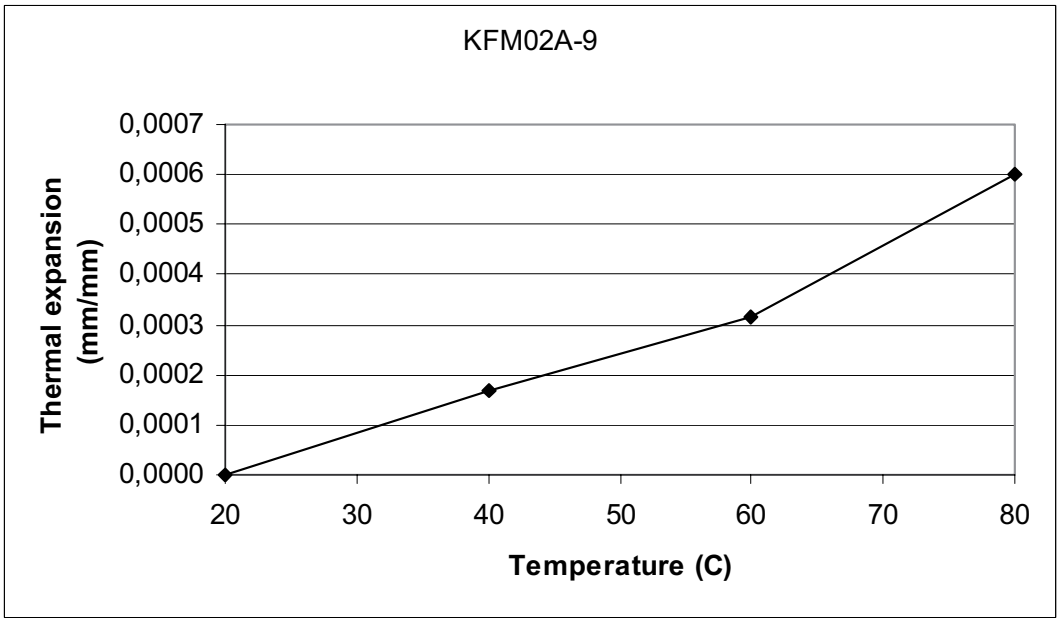


Figure 5-8. *Specimen KFM02A-90L-9.*

Figure 5-9 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40, 60 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-10 was not measured, because the studs fell off at 80 degrees. The specimen had a wet density of 2640 kg/m^3.

KFM02A-90L-10 (536.96)

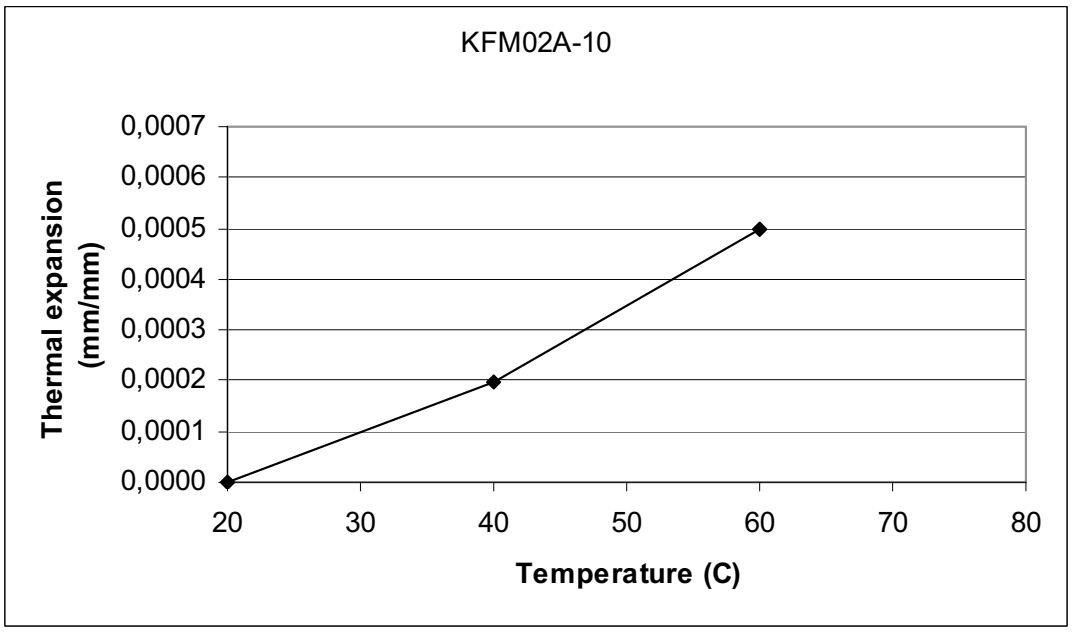


Figure 5-9. *Specimen KFM02A-90L-10.*

Figure 5-10 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40, 60, 80 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-11 was measured to be 9.3 x 10^{-6} mm/mm ˚C and the specimen had a wet density of 2620 kg/m^3.

KFM02A-90L-11 (538.03)

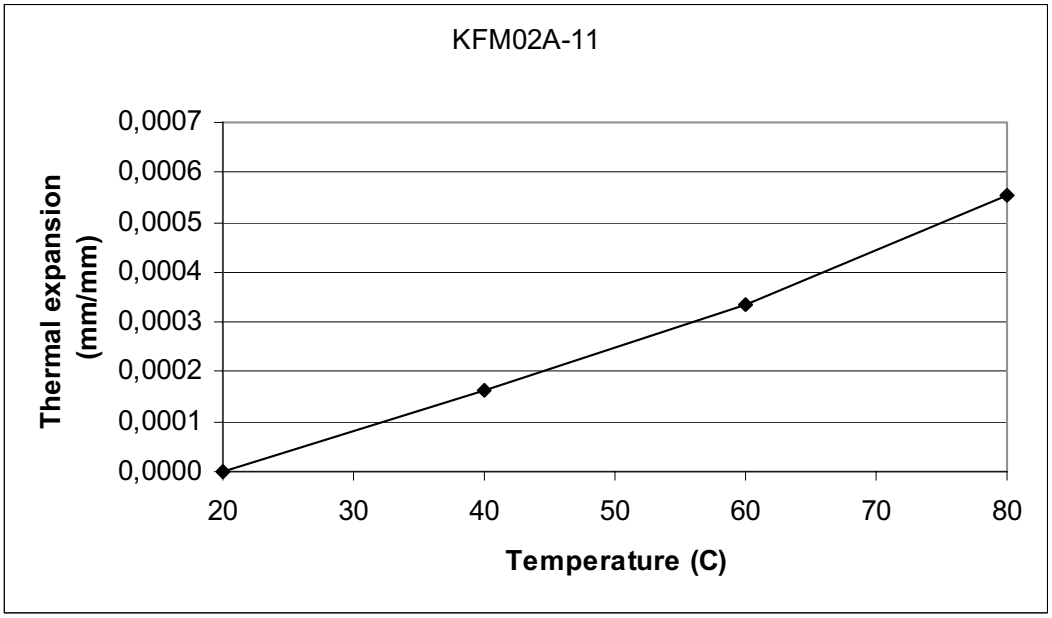


Figure 5-10. *Specimen KFM02A-90L-11.*

Figure 5-11 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40, 60, 80 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-13 was measured to be 7.7 x 10^{-6} mm/mm ˚C and the specimen had a wet density of 2650 kg/m^3.

KFM02A-90L-13 (704.09)

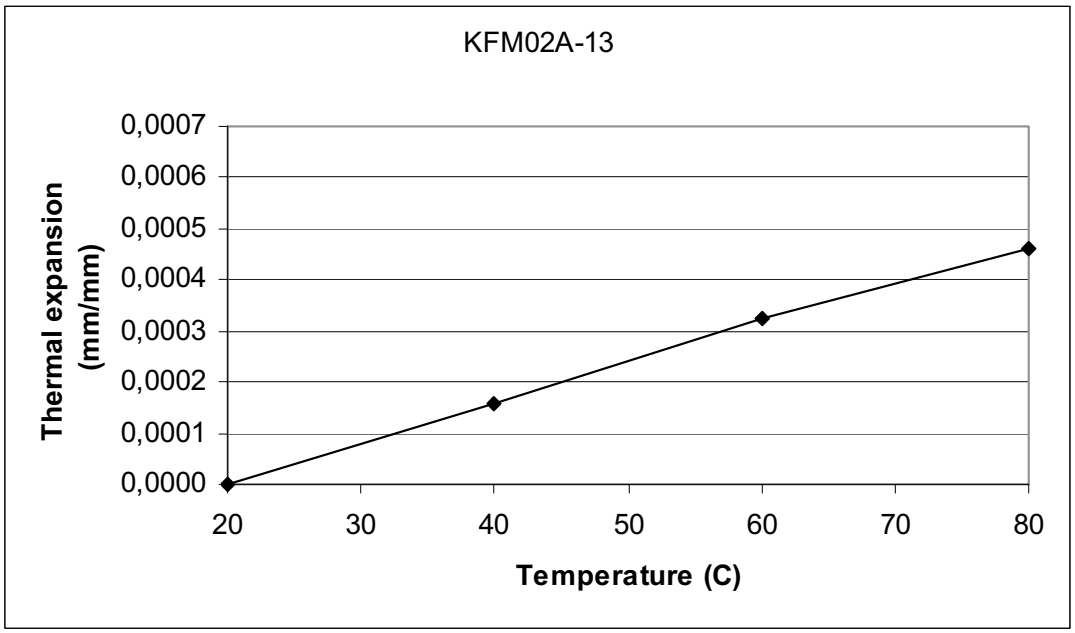


Figure 5-11. *Specimen KFM02A-90L-13.*

Figure 5-12 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40, 60, 80 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-14 was measured to be 9.7 x 10^{-6} mm/mm ˚C and the specimen had a wet density of 2660 kg/m^3.

KFM02A-90L-14 (707.10)

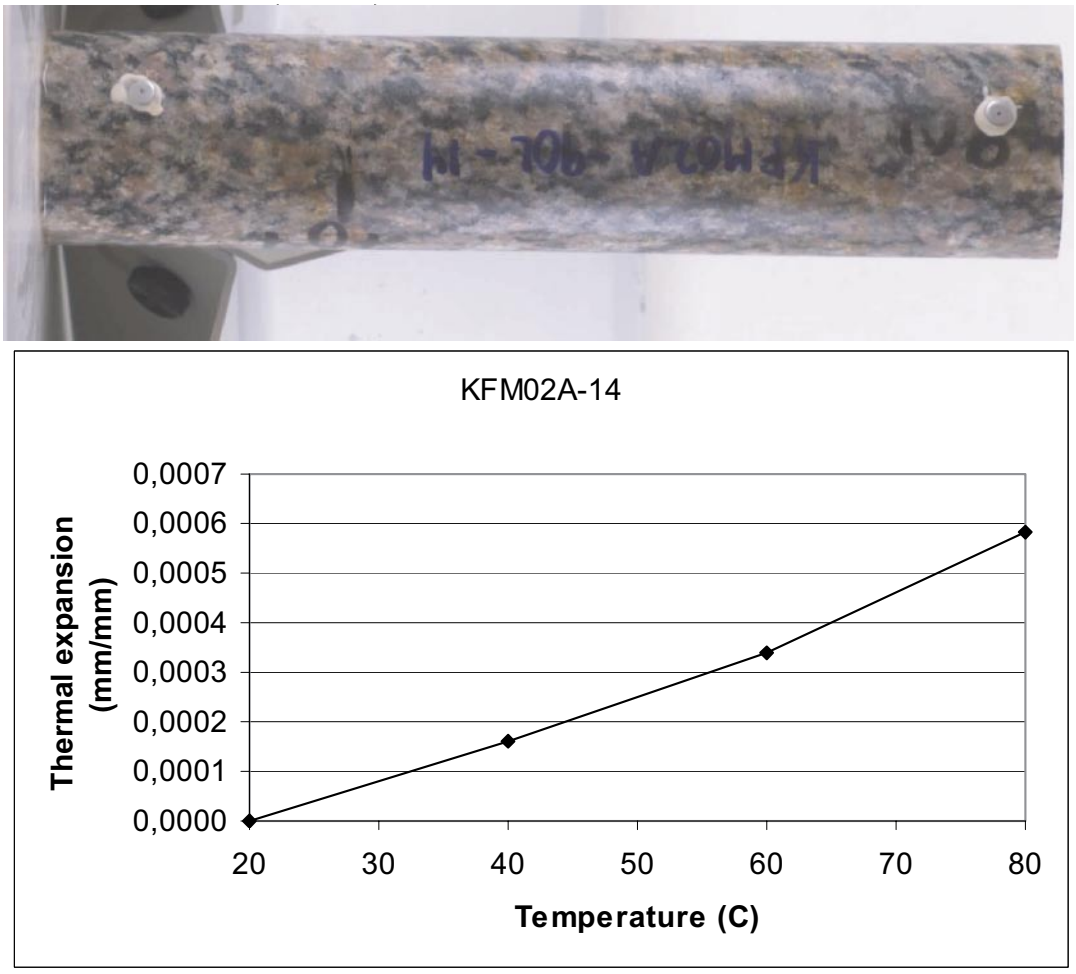


Figure 5-12. *Specimen KFM02A-90L-14.*

Figure 5-13 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40, 60 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-15 was not measured, because the studs fell of at 80 degrees. The specimen had a wet density of 2660 kg/m^3.

KFM02A-90L-15 (707,39)

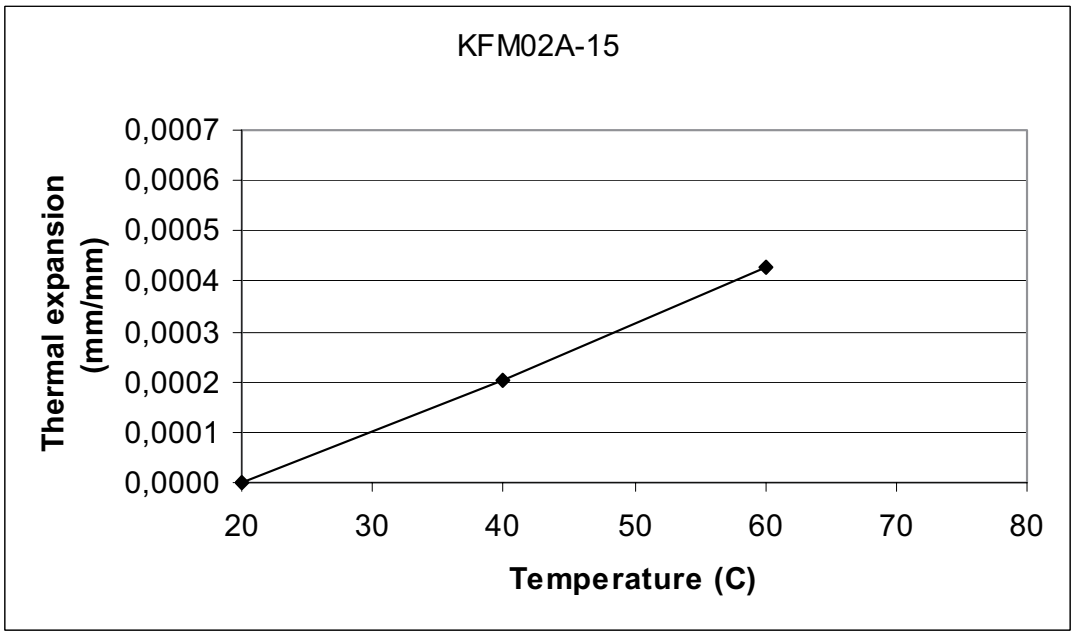


Figure 5-13. *Specimen KFM02A-90L-15.*

Figure 5-14 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-16 was not measured, because the studs fell of at 60 degrees. The specimen had a wet density of 2660 kg/m^3.

KFM02A-90L-16 (707.66)

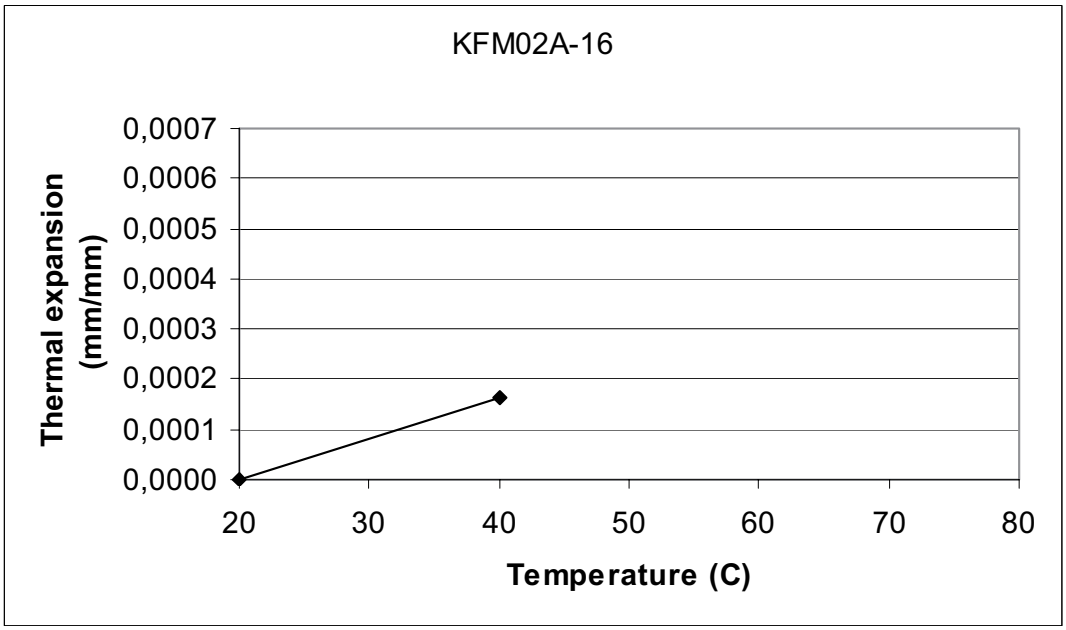


Figure 5-14. *Specimen KFM02A-90L-16.*

Figure 5-15 shows a picture of the specimen and a diagram for the thermal expansion in the interval 20, 40, 60, 80 ˚C. The coefficient of thermal expansion for specimen KFM02A-90L-17 was measured to be 6.3 x 10^{-6} mm/mm ˚C and the specimen had a wet density of 2650 kg/m^3.

At specimen KFM02A-90L-17 three pairs of studs were glued for the purpose of measuring possibly bending of the specimens.

KFM02A-90L-17 (709.12)

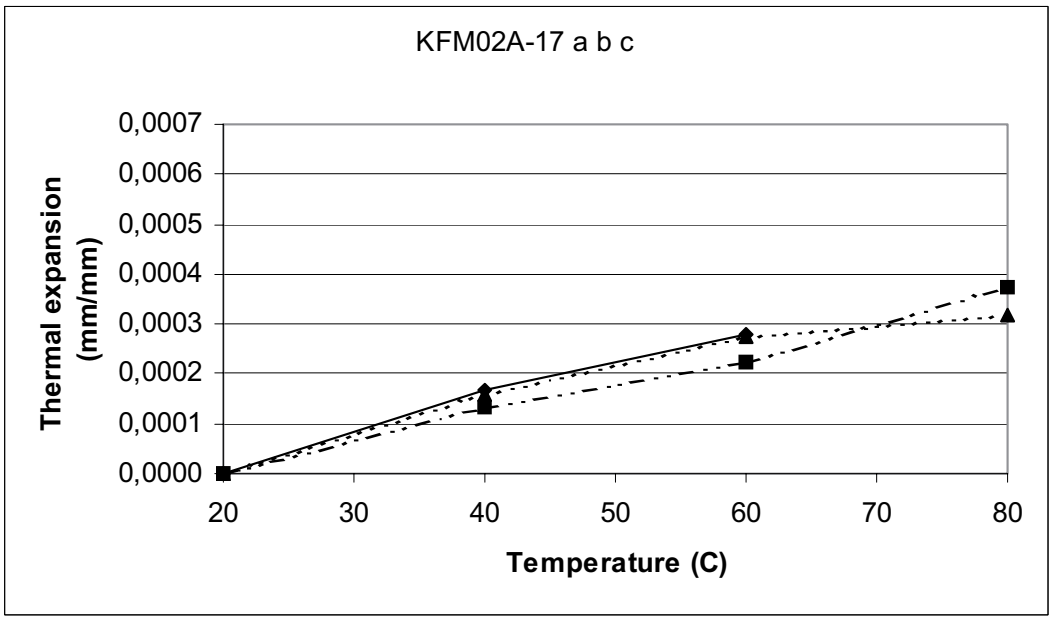


Figure 5-15. *Specimen KFM02A-90L-17.*

5.2 Results for the entire test series

Table 5-1. Summary of the results for the coefficient of thermal expansion and wet density of the tested specimens, level 1 (335-340 m).

Specimen	Coefficient of thermal expansion between 20 and 80 ˚C (mm/mm ˚C)	Wet density (Kg/m^3)
KFM02A-90L-1		2660
Line a	-	
Line b	-	
Line c	7.3 x 10^{-6}	
KFM02A-90L-2	6.0 x 10^{-6}	2650
KFM02A-90L-3	-	2650
KFM02A-90L-4	7.7 x 10^{-6}	2650
KFM02A-90L-5	6.3 x 10^{-6}	2660
Median	6.8 x 10^{-6}	
Maximum value	7.7 x 10^{-6}	
Minimum value	6.0 x 10^{-6}	

Table 5-2. Summary of the results for the coefficient of thermal expansion and wet density of the tested specimens, level 2 (529-538 m).

Specimen	Coefficient of thermal expansion between 20 and 80 ˚C (mm/mm ˚C)	Wet density (Kg/m^3)
KFM02A-90L-7	9.7 x 10^{-6}	2650
KFM02A-90L-8		2650
Line a	(16 x 10^{-6})	
Line b	-	
Line c	6.0 x 10^{-6}	
KFM02A-90L-9	10 x 10^{-6}	2650
KFM02A-90L-10	-	2640
KFM02A-90L-11	9.3 x 10^{-6}	2620
Median	9.5 x 10^{-6}	
Maximum value	10 x 10^{-6}	
Minimum value	6.0 x 10^{-6}	

Table 5-3. Summary of the results for the coefficient of thermal expansion and wet density of the tested specimens, level 3 (704-709 m).

Specimen	Coefficient of thermal expansion between 20 and 80 ˚C (mm/mm ˚C)	Wet density (Kg/m^3)
KFM02A-90L-13	7.7 x 10^{-6}	2650
KFM02A-90L-14	9.7 x 10^{-6}	2660
KFM02A-90L-15	-	2660
KFM02A-90L-16	-	2660
KFM02A-90L-17		2650
Line a	-	
Line b	6.3 x 10^{-6}	
Line c	(5.3 x 10^{-6})	
Median	7.7 x 10^{-6}	
Maximum value	9.7 x 10^{-6}	
Minimum value	6.3 x 10^{-6}	

Results in brackets are not reported as results, because they are regarded as uncertain.

5.3 Nonconformities

On four specimens the studs fell off at 80 and 60 degrees, KFM02A-90L-3, KFM02A-90L-10, KFM02A-90L-15 and KFM02A-90L-16.

At specimens KFM02A-90L-1, KFM02A-90L-8 and KFM02A-90L-17 three pairs of studs were glued for the purpose of measuring possibly bending of the specimens.

5.4 Discussion

The variation between the samples is app. 4 x 10^{-6} mm/mm ˚C which is more than 10 times the uncertainty of the measurement (0,4 x 10^{-6} mm/mm ˚C).

Appendix 1

Protokoll Checklista längdutvidgning

Kvalitetsdokument **Blankett** **BMm-QR 51**
Version 1,0
Utfärdat 2003-12-19
Författare Lotta Carlsson
Godkännare Matz Sandström
Sida 1(1)

Bygg och Mekanik
Checklista längdutvidgning

Fyll i datum och signatur i rutorna.

Appendix 1 KFM02A thermal expansion
Sida 1 av 1

Instrument (inventarienr): 102266

Prov id	Foto	Provberedning & limning mätdubbar	Vattenmättning startad	Vattenmättnadsdensitet	Provning startad	Retur i lådor
KFMO2A 90L-1	04-03-30	04-03-16	04-04-15	04-05-21	04-04-28	04 -05-26
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	03-30 03-30	04-03-16 04-03-16				

Utskrivet dokument är ostyrt, dvs inte säkert gällande.

Appendix 2

Beräkning av längdutvidgningskoefficient och Provningsprotokoll för längdutvidgningskoefficient

Provningsprotokoll längdutvidgningskoefficient								
Borrhål/nivå								
KFMO2A								
Mättemperatur		**20,4**						
Kalibrering extensometer (datum)		**03-05-05**						
Prov ID	Skalvärde/datum		Skalvärde/datum		Skalvärde/datum		Skalvärde/datum	
1a	-7	28-apr	-7	29	-7	30		
1b	53		55		52			
1c	17		17		16			
2	19		19		20			
3	42		42		42			
4	19		18		18			
5	10		11		11			
7	8		10		8			
8a	4		4		3			
8b	24		24		24			
8c	36		38		36			
9	0		0		-1			
10	16		16		15			
11	-14		-14		-15			
13	7		8		6			
14	31		30		28			
15	-3		-4		-4			
16	43		42		42			
17a	34		35		32			
17b	14		13		12			
17c	39		38		38			

Provningsprotokoll längdutvidgningskoefficient

Borrhål/nivå								
Mättemperatur		**39,7**						
Kalibrering extensometer (datum)								
Prov ID	Skalvärde/datum		Skalvärde/datum		Skalvärde/datum		Skalvärde/datum	
1a	41	05-maj	36	6	36	7	36	10
1b	95		87		90		89	
1c	58		53		54		52	
2	66		59		60		59	
3	87		85		86		85	
4	61		54		55		53	
5	52		49		46		46	
7	60		55		51		51	
8a	56		49		49		49	
8b	72		68		67		67	
8c	78		70		70		70	
9	47		41		42		41	
10	66		70		63		63	
11	23		28		26		26	
13	42		46		46		46	
14	68		70		69		69	
15	56		48		46		45	
16	88		83		83		82	
17a	81		73		75		73	
17b	53		45		46		45	
17c	83		78		77		76	

Provningsprotokoll längdutvidgningskoefficient

Borrhål/nivå								
Mättemperatur 59,6								
Kalibrering extensometer (datum) (				2003-05-06				
Prov ID	Skalvärde/datum		Skalvärde/datum		Skalvärde/datum		Skalvärde/datum	
1a	70	11-maj	73	12	68	13	71	14
1b	107		89		97		99	
1c	84		87		87		86	
2	88		90		89		91	
3	117		118		115		116	
4	85		89		88		88	
5	82		87		83		84	
7	89		94		92		92	
8a	97		112		107		107	
8b	113		121		117		121	
8c	96		98		88		90	
9	77		79		76		80	
10	128		127		155		154	
11	62		61		76		76	
13	86		79		90		89	
14	108		106		118		118	
15	98		106		104		103	
16	117		118		122			
17a	102		106		102		103	
17b	70		72		58		67	
17c	107		112		102		108	

Provningsprotokoll längdutvidgningskoefficient

Borrhål/nivå								
KFMO2A								
Mättemperatur 80,8								
Kalibrering extensiometer (datum)03-05-05								
						19		
Prov ID	Skalvärde/datum		Skalvärde/datum		Skalvärde/datum		Skalvärde/datum	
1a	120	17		18		19-jan		20
1b								
1c	115		112		130		124	
2	110		88		109		110	
3	68		72					
4	122		107		137		132	
5	105		105		106		105	
7	159		160		149		150	
8a	243		244		242		240	
8b	181		172					
8c	127		124		125		124	
9	154		155		147		141	
10								
11	119		127		124		126	
13	126		125		119		117	
14	174		178		175		175	
15	141							
16								
17a	72							
17b	107		105		104		108	
17c	118		119		116		119	

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	Skalvärde vid mätning	Differens skaldelar	strain	Delta l	l	Längdutvidgningskoeff	Längdutv
	20 C	2004-05-05 40C		(mm/mm)			mm/mm per grader C	mm/mm
KFM02A-1a	-7	41	48	0,00019056	0,038112	200,0	0,00000953	0,000191
KFM02A-1b	52	95	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KFM02A-1c	16	58	42	0,00016674	0,033348	200,0	0,00000834	0,000167
KFM02A-2	20	66	46	0,00018262	0,036524	200,0	0,00000913	0,000183
KFM02A-3	42	87	45	0,00017865	0,03573	200,0	0,00000893	0,000179
KFM02A-4	18	61	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KFM02A-5	11	52	41	0,00016277	0,032554	200,0	0,00000814	0,000163
KFM02A-7	8	60	52	0,00020644	0,041288	200,0	0,00001032	0,000206
KFM02A-8a	3	56	53	0,00021041	0,042082	200,0	0,00001052	0,000210
KFM02A-8b	24	72	48	0,00019056	0,038112	200,0	0,00000953	0,000191
KFM02A-8c	36	78	42	0,00016674	0,033348	200,0	0,00000834	0,000167
KFM02A-9	-1	47	48	0,00019056	0,038112	200,0	0,00000953	0,000191
KFM02A-10	15	66	51	0,00020247	0,040494	200,0	0,00001012	0,000202
KFM02A-11	-15	23	38	0,00015086	0,030172	200,0	0,00000754	0,000151
KFM02A-13	6	42	36	0,00014292	0,028584	200,0	0,00000715	0,000143
KFM02A-14	28	68	40	0,0001588	0,03176	200,0	0,00000794	0,000159
KFM02A-15	-4	56	60	0,0002382	0,04764	200,0	0,00001191	0,000238
KFM02A-16	42	88	46	0,00018262	0,036524	200,0	0,00000913	0,000183
KFM02A-17a	32	81	49	0,00019453	0,038906	200,0	0,00000973	0,000195
KFM02A-17b	12	53	41	0,00016277	0,032554	200,0	0,00000814	0,000163
KFM02A-17c	38	83	45	0,00017865	0,03573	200,0	0,00000893	0,000179
		2004-05-06 40C	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	#VÄRDEFEL!
KFM02A-1a	-7	36	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KFM02A-1b	52	87	35	0,00013895	0,02779	200,0	0,00000695	0,000139
KFM02A-1c	16	53	37	0,00014689	0,029378	200,0	0,00000734	0,000147
KFM02A-2	20	59	39	0,00015483	0,030966	200,0	0,00000774	0,000155
KFM02A-3	42	85	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KFM02A-4	18	54	36	0,00014292	0,028584	200,0	0,00000715	0,000143
KFM02A-5	11	49	38	0,00015086	0,030172	200,0	0,00000754	0,000151
KFM02A-7	8	55	47	0,00018659	0,037318	200,0	0,00000933	0,000187
KFM02A-8a	3	49	46	0,00018262	0,036524	200,0	0,00000913	0,000183
KFM02A-8b	24	68	44	0,00017468	0,034936	200,0	0,00000873	0,000175
KFM02A-8c	36	70	34	0,00013498	0,026996	200,0	0,00000675	0,000135
KFM02A-9	-1	41	42	0,00016674	0,033348	200,0	0,00000834	0,000167
KFM02A-10	15	70	55	0,00021835	0,04367	200,0	0,00001092	0,000218
KFM02A-11	-15	28	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KFM02A-13	6	46	40	0,0001588	0,03176	200,0	0,00000794	0,000159
KFM02A-14	28	70	42	0,00016674	0,033348	200,0	0,00000834	0,000167
KFM02A-15	-4	48	52	0,00020644	0,041288	200,0	0,00001032	0,000206
KFM02A-16	42	83	41	0,00016277	0,032554	200,0	0,00000814	0,000163
KFM02A-17a	32	73	41	0,00016277	0,032554	200,0	0,00000814	0,000163
KFM02A-17b	12	45	33	0,00013101	0,026202	200,0	0,00000655	0,000131
KFM02A-17c	38	78	40	0,0001588	0,03176	200,0	0,00000794	0,000159
		2005-05-07 40C	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	#VÄRDEFEL!
KFM02A-1a	-7	36	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KFM02A-1b	52	90	38	0,00015086	0,030172	200,0	0,00000754	0,000151
KFM02A-1c	16	54	38	0,00015086	0,030172	200,0	0,00000754	0,000151
KFM02A-2	20	60	40	0,0001588	0,03176	200,0	0,00000794	0,000159
KFM02A-3	42	86	44	0,00017468	0,034936	200,0	0,00000873	0,000175
KFM02A-4	18	55	37	0,00014689	0,029378	200,0	0,00000734	0,000147
KFM02A-5	11	46	35	0,00013895	0,02779	200,0	0,00000695	0,000139
KFM02A-7	8	51	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KFM02A-8a	3	49	46	0,00018262	0,036524	200,0	0,00000913	0,000183
KFM02A-8b	24	67	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KFM02A-8c	36	70	34	0,00013498	0,026996	200,0	0,00000675	0,000135
KFM02A-9	-1	42	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KFM02A-10	15	63	48	0,00019056	0,038112	200,0	0,00000953	0,000191
KFM02A-11	-15	26	41	0,00016277	0,032554	200,0	0,00000814	0,000163
KFM02A-13	6	46	40	0,0001588	0,03176	200,0	0,00000794	0,000159
KFM02A-14	28	69	41	0,00016277	0,032554	200,0	0,00000814	0,000163
KFM02A-15	-4	46	50	0,0001985	0,0397	200,0	0,00000993	0,000199
KFM02A-16	42	83	41	0,00016277	0,032554	200,0	0,00000814	0,000163
KFM02A-17a	32	75	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KFM02A-17b	12	46	34	0,00013498	0,026996	200,0	0,00000675	0,000135
KFM02A-17c	38	77	39	0,00015483	0,030966	200,0	0,00000774	0,000155
		2005-05-10 40C	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	#VÄRDEFEL!
KFM02A-1a	-7	36	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KFM02A-1b	52	89	37	0,00014689	0,029378	200,0	0,00000734	0,000147
KFM02A-1c	16	52	36	0,00014292	0,028584	200,0	0,00000715	0,000143

KFM02A-2	20	59	39	0,00015483	0,030966	200,0	0,00000774	0,000155
KFM02A-3	42	85	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KFM02A-4	18	53	35	0,00013895	0,02779	200,0	0,00000695	0,000139
KFM02A-5	11	46	35	0,00013895	0,02779	200,0	0,00000695	0,000139
KFM02A-7	8	51	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KFM02A-8a	3	49	46	0,00018262	0,036524	200,0	0,00000913	0,000183
KFM02A-8b	24	67	43	0,00017071	0,034142	200,0	0,00000854	0,000171
KFM02A-8c	36	70	34	0,00013498	0,026996	200,0	0,00000675	0,000135
KFM02A-9	-1	41	42	0,00016674	0,033348	200,0	0,00000834	0,000167
KFM02A-10	15	63	48	0,00019056	0,038112	200,0	0,00000953	0,000191
KFM02A-11	-15	26	41	0,00016277	0,032554	200,0	0,00000814	0,000163
KFM02A-13	6	46	40	0,0001588	0,03176	200,0	0,00000794	0,000159
KFM02A-14	28	69	41	0,00016277	0,032554	200,0	0,00000814	0,000163
KFM02A-15	-4	45	49	0,00019453	0,038906	200,0	0,00000973	0,000195
KFM02A-16	42	82	40	0,0001588	0,03176	200,0	0,00000794	0,000159
KFM02A-17a	32	73	41	0,00016277	0,032554	200,0	0,00000814	0,000163
KFM02A-17b	12	45	33	0,00013101	0,026202	200,0	0,00000655	0,000131
KFM02A-17c	38	76	38	0,00015086	0,030172	200,0	0,00000754	0,000151

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	Skalvärde vid mätning	Differens skaldelar	strain	Delta l	l	Längdutvidgningskoeff	Längdutv
KFM02a	20 C	2004-05-11 60C		(mm/mm)			mm/mm per grader C	mm/mm
1a	-7	70	77	0,00030569	0,061138	200,0	0,00000764	0,000306
1b	52	107	55	0,00021835	0,04367	200,0	0,00000546	0,000218
1c	16	84	68	0,00026996	0,053992	200,0	0,00000675	0,000270
2	20	88	68	0,00026996	0,053992	200,0	0,00000675	0,000270
3	42	117	75	0,00029775	0,05955	200,0	0,00000744	0,000298
4	18	85	67	0,00026599	0,053198	200,0	0,00000665	0,000266
5	11	82	71	0,00028187	0,056374	200,0	0,00000705	0,000282
7	8	89	81	0,00032157	0,064314	200,0	0,00000804	0,000322
8a	3	97	94	0,00037318	0,074636	200,0	0,00000933	0,000373
8b	24	113	89	0,00035333	0,070666	200,0	0,00000883	0,000353
8c	36	96	60	0,0002382	0,04764	200,0	0,00000596	0,000238
9	-1	77	78	0,00030966	0,061932	200,0	0,00000774	0,000310
10	15	128	113	0,00044861	0,089722	200,0	0,00001122	0,000449
11	-15	62	77	0,00030569	0,061138	200,0	0,00000764	0,000306
13	6	86	80	0,0003176	0,06352	200,0	0,00000794	0,000318
14	28	108	80	0,0003176	0,06352	200,0	0,00000794	0,000318
15	-4	98	102	0,00040494	0,080988	200,0	0,00001012	0,000405
16	42	117	75	0,00029775	0,05955	200,0	0,00000744	0,000298
17a	32	102	70	0,0002779	0,05558	200,0	0,00000695	0,000278
17b	12	70	58	0,00023026	0,046052	200,0	0,00000576	0,000230
17c	38	107	69	0,00027393	0,054786	200,0	0,00000685	0,000274
		2004-05-12 60C	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
1a	-7	73	80	0,0003176	0,06352	200,0	0,00000794	0,000318
1b	52	89	37	0,00014689	0,029378	200,0	0,00000367	0,000147
1c	16	87	71	0,00028187	0,056374	200,0	0,00000705	0,000282
2	20	90	70	0,0002779	0,05558	200,0	0,00000695	0,000278
3	42	118	76	0,00030172	0,060344	200,0	0,00000754	0,000302
4	18	89	71	0,00028187	0,056374	200,0	0,00000705	0,000282
5	11	87	76	0,00030172	0,060344	200,0	0,00000754	0,000302
7	8	94	86	0,00034142	0,068284	200,0	0,00000854	0,000341
8a	3	112	109	0,00043273	0,086546	200,0	0,00001082	0,000433
8b	24	121	97	0,00038509	0,077018	200,0	0,00000963	0,000385
8c	36	98	62	0,00024614	0,049228	200,0	0,00000615	0,000246
9	-1	79	80	0,0003176	0,06352	200,0	0,00000794	0,000318
10	15	127	112	0,00044464	0,088928	200,0	0,00001112	0,000445
11	-15	61	76	0,00030172	0,060344	200,0	0,00000754	0,000302
13	6	79	73	0,00028981	0,057962	200,0	0,00000725	0,000290
14	28	106	78	0,00030966	0,061932	200,0	0,00000774	0,000310
15	-4	106	110	0,0004367	0,08734	200,0	0,00001092	0,000437
16	42	118	76	0,00030172	0,060344	200,0	0,00000754	0,000302
17a	32	106	74	0,00029378	0,058756	200,0	0,00000734	0,000294
17b	12	72	60	0,0002382	0,04764	200,0	0,00000596	0,000238
17c	38	112	74	0,00029378	0,058756	200,0	0,00000734	0,000294
		2004-05-13 60C	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
1a	-7	68	75	0,00029775	0,05955	200,0	0,00000744	0,000298
1b	52	97	45	0,00017865	0,03573	200,0	0,00000447	0,000179
1c	16	87	71	0,00028187	0,056374	200,0	0,00000705	0,000282
2	20	89	69	0,00027393	0,054786	200,0	0,00000685	0,000274
3	42	115	73	0,00028981	0,057962	200,0	0,00000725	0,000290
4	18	88	70	0,0002779	0,05558	200,0	0,00000695	0,000278
5	11	83	72	0,00028584	0,057168	200,0	0,00000715	0,000286
7	8	92	84	0,00033348	0,066696	200,0	0,00000834	0,000333
8a	3	107	104	0,00041288	0,082576	200,0	0,00001032	0,000413
8b	24	117	93	0,00036921	0,073842	200,0	0,00000923	0,000369
8c	36	88	52	0,00020644	0,041288	200,0	0,00000516	0,000206
9	-1	76	77	0,00030569	0,061138	200,0	0,00000764	0,000306
10	15	155	140	0,0005558	0,11116	200,0	0,00001390	0,000556
11	-15	76	91	0,00036127	0,072254	200,0	0,00000903	0,000361
13	6	90	84	0,00033348	0,066696	200,0	0,00000834	0,000333
14	28	118	90	0,0003573	0,07146	200,0	0,00000893	0,000357
15	-4	104	108	0,00042876	0,085752	200,0	0,00001072	0,000429
16	42	122	80	0,0003176	0,06352	200,0	0,00000794	0,000318
17a	32	102	70	0,0002779	0,05558	200,0	0,00000695	0,000278
17b	12	58	46	0,00018262	0,036524	200,0	0,00000457	0,000183
17c	38	102	64	0,00025408	0,050816	200,0	0,00000635	0,000254
		2005-05-14 60 c	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
1a	-7	71	78	0,00030966	0,061932	200,0	0,00000774	0,000310
1b	52	99	47	0,00018659	0,037318	200,0	0,00000466	0,000187

1c	16		86	70	0,0002779	0,05558	200,0	0,00000695	0,000278
2	20		91	71	0,00028187	0,056374	200,0	0,00000705	0,000282
3	42		116	74	0,00029378	0,058756	200,0	0,00000734	0,000294
4	18		88	70	0,0002779	0,05558	200,0	0,00000695	0,000278
5	11		84	73	0,00028981	0,057962	200,0	0,00000725	0,000290
7	8		92	84	0,00033348	0,066696	200,0	0,00000834	0,000333
8a	3		107	104	0,00041288	0,082576	200,0	0,00001032	0,000413
8b	24		121	97	0,00038509	0,077018	200,0	0,00000963	0,000385
8c	36		90	54	0,00021438	0,042876	200,0	0,00000536	0,000214
9	-1		80	81	0,00032157	0,064314	200,0	0,00000804	0,000322
10	15		154	139	0,00055183	0,110366	200,0	0,00001380	0,000552
11	-15		76	91	0,00036127	0,072254	200,0	0,00000903	0,000361
13	6		89	83	0,00032951	0,065902	200,0	0,00000824	0,000330
14	28		118	90	0,0003573	0,07146	200,0	0,00000893	0,000357
15	-4		103	107	0,00042479	0,084958	200,0	0,00001062	0,000425
16	42	dubb lossat		#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
17a	32		103	71	0,00028187	0,056374	200,0	0,00000705	0,000282
17b	12		67	55	0,00021835	0,04367	200,0	0,00000546	0,000218
17c	38		108	70	0,0002779	0,05558	200,0	0,00000695	0,000278

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	Skalvärde vid mätning	Differens skaldelar	strain	Delta l	l	Längdutvidgningskoeff	Längdutv
	20 C	2004-05-17 80C		(mm/mm)			mm/mm per grader C	mm/mm
1a	-7	120	127	0,00050419	0,100838	200,0	0,00000840	0,000504
1b	52	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
1c	16	115	99	0,00039303	0,078606	200,0	0,00000655	0,000393
2	20	110	90	0,0003573	0,07146	200,0	0,00000596	0,000357
3	42	68	26	0,00010322	0,020644	200,0	0,00000172	0,000103
4	18	122	104	0,00041288	0,082576	200,0	0,00000688	0,000413
5	11	105	94	0,00037318	0,074636	200,0	0,00000622	0,000373
7	8	159	151	0,00059947	0,119894	200,0	0,00000999	0,000599
8a	3	243	240	0,0009528	0,19056	200,0	0,00001588	0,000953
8b	24	181	157	0,00062329	0,124658	200,0	0,00001039	0,000623
8c	36	127	91	0,00036127	0,072254	200,0	0,00000602	0,000361
9	-1	154	155	0,00061535	0,12307	200,0	0,00001026	0,000615
10	15	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
11	-15	119	134	0,00053198	0,106396	200,0	0,00000887	0,000532
13	6	126	120	0,0004764	0,09528	200,0	0,00000794	0,000476
14	28	174	146	0,00057962	0,115924	200,0	0,00000966	0,000580
15	-4	141	145	0,00057565	0,11513	200,0	0,00000959	0,000576
16	42	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
17a	32	72	40	0,0001588	0,03176	200,0	0,00000265	0,000159
17b	12	107	95	0,00037715	0,07543	200,0	0,00000629	0,000377
17c	38	118	80	0,0003176	0,06352	200,0	0,00000529	0,000318
0	0	**2004-05-18 80C**	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
1a	-7	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
1b	52	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
1c	16	112	96	0,00038112	0,076224	200,0	0,00000635	0,000381
2	20	88	68	0,00026996	0,053992	200,0	0,00000450	0,000270
3	42	72	30	0,0001191	0,02382	200,0	0,00000199	0,000119
4	18	107	89	0,00035333	0,070666	200,0	0,00000589	0,000353
5	11	105	94	0,00037318	0,074636	200,0	0,00000622	0,000373
7	8	160	152	0,00060344	0,120688	200,0	0,00001006	0,000603
8a	3	244	241	0,00095677	0,191354	200,0	0,00001595	0,000957
8b	24	172	148	0,00058756	0,117512	200,0	0,00000979	0,000588
8c	36	124	88	0,00034936	0,069872	200,0	0,00000582	0,000349
9	-1	155	156	0,00061932	0,123864	200,0	0,00001032	0,000619
10	15	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
11	-15	127	142	0,00056374	0,112748	200,0	0,00000940	0,000564
13	6	125	119	0,00047243	0,094486	200,0	0,00000787	0,000472
14	28	178	150	0,0005955	0,1191	200,0	0,00000993	0,000596
15	-4	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
16	42	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
17a	32	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
17b	12	105	93	0,00036921	0,073842	200,0	0,00000615	0,000369
17c	38	119	81	0,00032157	0,064314	200,0	0,00000536	0,000322
0	0	**2005-05-19 80C**	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
1a	-7	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
1b	52	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
1c	16	130	114	0,00045258	0,090516	200,0	0,00000754	0,000453
2	20	109	89	0,00035333	0,070666	200,0	0,00000589	0,000353
3	42	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
4	18	137	119	0,00047243	0,094486	200,0	0,00000787	0,000472
5	11	106	95	0,00037715	0,07543	200,0	0,00000629	0,000377
7	8	149	141	0,00055977	0,111954	200,0	0,00000933	0,000560
8a	3	242	239	0,00094883	0,189766	200,0	0,00001581	0,000949
8b	24	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
8c	36	125	89	0,00035333	0,070666	200,0	0,00000589	0,000353
9	-1	147	148	0,00058756	0,117512	200,0	0,00000979	0,000588
10	15	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
11	-15	124	139	0,00055183	0,110366	200,0	0,00000920	0,000552
13	6	119	113	0,00044861	0,089722	200,0	0,00000748	0,000449
14	28	175	147	0,00058359	0,116718	200,0	0,00000973	0,000584
15	-4	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
16	42	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
17a	32	dubb släppt	#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
17b	12	104	92	0,00036524	0,073048	200,0	0,00000609	0,000365

17c		38	116	78	0,00030966	0,061932	200,0	0,00000516	0,000310
0			0	0	0	0	200,0	0,00000000	0,000000
		2005-05-20 80C		#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
1a		-7 dubb släppt		#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
1b		52 dubb släppt		#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
1c		16	124	108	0,00042876	0,085752	200,0	0,00000715	0,000429
	2	20	110	90	0,0003573	0,07146	200,0	0,00000596	0,000357
	3	42 dubb släppt		#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
	4	18	132	114	0,00045258	0,090516	200,0	0,00000754	0,000453
	5	11	105	94	0,00037318	0,074636	200,0	0,00000622	0,000373
	7	8	150	142	0,00056374	0,112748	200,0	0,00000940	0,000564
8a		3	240	237	0,00094089	0,188178	200,0	0,00001568	0,000941
8b		24 dubb släppt		#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
8c		36	124	88	0,00034936	0,069872	200,0	0,00000582	0,000349
	9	-1	141	142	0,00056374	0,112748	200,0	0,00000940	0,000564
	10	15 dubb släppt		#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
	11	-15	126	141	0,00055977	0,111954	200,0	0,00000933	0,000560
	13	6	117	111	0,00044067	0,088134	200,0	0,00000734	0,000441
	14	28	175	147	0,00058359	0,116718	200,0	0,00000973	0,000584
	15	-4 dubb släppt		#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
	16	42 dubb släppt		#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
17a		32 dubb släppt		#VÄRDEFEL!	##########	##########	200,0	#VÄRDEFEL!	##########
17b		12	108	96	0,00038112	0,076224	200,0	0,00000635	0,000381
17c		38	119	81	0,00032157	0,064314	200,0	0,00000536	0,000322

	20	40 C	40 C	40 C	40C	**40**	60C	60C	60C	60 c	**60**	80C	80C	80C	80C	**80**
#REFERENS!	0,00000	0,00019	0,00017	0,00017	0,00017	**0,00017**	0,00031	0,00032	0,00030	0,00031	**0,00031**	0,00050	########	########	########	**#########**
#REFERENS!	0,00000	0,00017	0,00014	0,00015	0,00015	**0,00015**	0,00022	0,00015	0,00018	0,00019	**0,00018**	########	########	########	########	**#########**
#REFERENS!	0,00000	0,00017	0,00015	0,00015	0,00014	**0,00015**	0,00027	0,00028	0,00028	0,00028	**0,00028**	0,00039	0,00038	0,00045	0,00043	**0,0004109**
#REFERENS!	0,00000	0,00018	0,00015	0,00016	0,00015	**0,00016**	0,00027	0,00028	0,00027	0,00028	**0,00028**	0,00036	0,00027	0,00035	0,00036	**0,0003553**
#REFERENS!	0,00000	0,00018	0,00017	0,00017	0,00017	**0,00017**	0,00030	0,00030	0,00029	0,00029	**0,00030**	0,00010	0,00012	########	########	**#########**
#REFERENS!	0,00000	0,00017	0,00014	0,00015	0,00014	**0,00014**	0,00027	0,00028	0,00028	0,00028	**0,00028**	0,00041	0,00035	0,00047	0,00045	**0,0004327**
#REFERENS!	0,00000	0,00016	0,00015	0,00014	0,00014	**0,00014**	0,00028	0,00030	0,00029	0,00029	**0,00029**	0,00037	0,00037	0,00038	0,00037	**0,0003732**
#REFERENS!	0,00000	0,00021	0,00019	0,00017	0,00017	**0,00018**	0,00032	0,00034	0,00033	0,00033	**0,00033**	0,00060	0,00060	0,00056	0,00056	**0,0005816**
#REFERENS!	0,00000	0,00021	0,00018	0,00018	0,00018	**0,00018**	0,00037	0,00043	0,00041	0,00041	**0,00041**	0,00095	0,00096	0,00095	0,00094	**0,0009508**
#REFERENS!	0,00000	0,00019	0,00017	0,00017	0,00017	**0,00017**	0,00035	0,00039	0,00037	0,00039	**0,00038**	0,00062	0,00059	########	########	**#########**
#REFERENS!	0,00000	0,00017	0,00013	0,00013	0,00013	**0,00013**	0,00024	0,00025	0,00021	0,00021	**0,00023**	0,00036	0,00035	0,00035	0,00035	**0,0003513**
#REFERENS!	0,00000	0,00019	0,00017	0,00017	0,00017	**0,00017**	0,00031	0,00032	0,00031	0,00032	**0,00031**	0,00062	0,00062	0,00059	0,00056	**0,0006015**
#REFERENS!	0,00000	0,00020	0,00022	0,00019	0,00019	**0,00020**	0,00045	0,00044	0,00056	0,00055	**0,00050**	########	########	########	########	**#########**
#REFERENS!	0,00000	0,00015	0,00017	0,00016	0,00016	**0,00016**	0,00031	0,00030	0,00036	0,00036	**0,00033**	0,00053	0,00056	0,00055	0,00056	**0,0005558**
#REFERENS!	0,00000	0,00014	0,00016	0,00016	0,00016	**0,00016**	0,00032	0,00029	0,00033	0,00033	**0,00032**	0,00048	0,00047	0,00045	0,00044	**0,0004605**
#REFERENS!	0,00000	0,00016	0,00017	0,00016	0,00016	**0,00016**	0,00032	0,00031	0,00036	0,00036	**0,00034**	0,00058	0,00060	0,00058	0,00058	**0,0005836**
#REFERENS!	0,00000	0,00024	0,00021	0,00020	0,00019	**0,00020**	0,00040	0,00044	0,00043	0,00042	**0,00043**	0,00058	########	########	########	**#########**
#REFERENS!	0,00000	0,00018	0,00016	0,00016	0,00016	**0,00016**	0,00030	0,00030	0,00032	########	**#########**	########	########	########	########	**#########**
#REFERENS!	0,00000	0,00019	0,00016	0,00017	0,00016	**0,00017**	0,00028	0,00029	0,00028	0,00028	**0,00028**	0,00016	########	########	########	**#########**
#REFERENS!	0,00000	0,00016	0,00013	0,00013	0,00013	**0,00013**	0,00023	0,00024	0,00018	0,00022	**0,00022**	0,00038	0,00037	0,00037	0,00038	**0,0003732**
#REFERENS!	0,00000	0,00018	0,00016	0,00015	0,00015	**0,00016**	0,00027	0,00029	0,00025	0,00028	**0,00028**	0,00032	0,00032	0,00031	0,00032	**0,0003196**

1a	8,40317E-06	########	########	#VÄRDEFEL!	**#VÄRDEFEL!**		
1b	#VÄRDEFEL!	########	########	#VÄRDEFEL!	**#VÄRDEFEL!**		
1c	6,5505E-06	0,000381	7,54E-06	0,000007146	**7,3E-06**		
2	0,000005955	0,00027	5,89E-06	0,000005955	**6,0E-06**		
3	1,72033E-06	0,000119	########	#VÄRDEFEL!	**#VÄRDEFEL!**	max	7,7E-06
4	6,88133E-06	0,000353	7,87E-06	0,000007543	**7,7E-06**	min	6,0E-06
5	6,21967E-06	0,000373	6,29E-06	6,21967E-06	**6,3E-06**	median	6,8E-06
7	9,99117E-06	0,000603	9,33E-06	9,39567E-06	**9,7E-06**		
8a	0,00001588	0,000957	1,58E-05	1,56815E-05	**1,6E-05**		
8b	1,03882E-05	0,000588	########	#VÄRDEFEL!	**#VÄRDEFEL!**		
8c	6,02117E-06	0,000349	5,89E-06	5,82267E-06	**6,0E-06**		
9	1,02558E-05	0,000619	9,79E-06	9,39567E-06	**1,00E-05**	max	1,0E-05
10	#VÄRDEFEL!	########	########	#VÄRDEFEL!	**#VÄRDEFEL!**	min	6,0E-06
11	8,86633E-06	0,000564	9,2E-06	9,3295E-06	**9,3E-06**	median	9,5E-06
13	0,00000794	0,000472	7,48E-06	7,3445E-06	**7,7E-06**		
14	9,66033E-06	0,000596	9,73E-06	9,7265E-06	**9,7E-06**		
15	9,59417E-06	########	########	#VÄRDEFEL!	**#VÄRDEFEL!**		
16	#VÄRDEFEL!	########	########	#VÄRDEFEL!	**#VÄRDEFEL!**		
17a	2,64667E-06	########	########	#VÄRDEFEL!	**#VÄRDEFEL!**	max	9,7E-06
17b	6,28583E-06	0,000369	6,09E-06	0,000006352	**6,3E-06**	min	6,3E-06
17c	5,29333E-06	0,000322	5,16E-06	5,3595E-06	**5,3E-06**	median	7,7E-06
				max	**1,6E-05**		
				min	**5,3E-06**		
				median	**7,7E-06**		

Appendix 3

Beräkning densitet

Vattenmättnadsdensitet

Uppdrags nr: P302604
Metod: EN 13755, ISRM (1973), avsnitt 3 samt SKB MD 160.002 version 1.0
Provad av: Lej
Datum: 2004-05-21

	Provmärkning:	Vikt i vatten, Msub (g)	Yttor vikt, Msat (g)	Yttorr vikt, Ms (g)	Bulk volume, V (cm3)	Pore volume, Vv (cm3)	Porosity, n (%)	Dry density, ρd (g/cm3)	Wet density (g/cm3)
1	KFMO2A-1	809,18	1294,53		486,13	1296,60	266,72	0,000	2,663
2	2	795,61	1275,29		480,45	1277,33	265,86	0,000	2,654
3	3	793,44	1272,89		480,22	1274,93	265,49	0,000	2,651
4	4	792,45	1271,52		479,84	1273,56	265,41	0,000	2,650
5	5	798,49	1279,15		481,43	1281,20	266,12	0,000	2,657
6	6				0,00	0,00	#DIVISION/0!	#DIVISION/0!	#DIVISION/0!
7	7	807,84	1296,1		489,04	1298,18	265,45	0,000	2,650
8	8	805,29	1292,09		487,58	1294,16	265,43	0,000	2,650
9	9	805,97	1292,29		487,10	1294,36	265,73	0,000	2,653
10	10	804,73	1294,49		490,54	1296,56	264,31	0,000	2,639
11	11	804,74	1301,66		497,72	1303,75	261,95	0,000	2,615
12	12				0,00	0,00	#DIVISION/0!	#DIVISION/0!	#DIVISION/0!
13	13	801,11	1284,61		484,27	1286,67	265,69	0,000	2,653
14	14	803,35	1287,1		484,53	1289,16	266,07	0,000	2,656
15	15	794,61	1273,24		479,40	1275,28	266,02	0,000	2,656
16	16	802,18	1284,55		483,14	1286,61	266,30	0,000	2,659
17	17	802,75	1287,16		485,19	1289,22	265,72	0,000	2,653
18	18				0,00	0,00	#DIVISION/0!	#DIVISION/0!	#DIVISION/0!
19					0,00	0,00	#DIVISION/0!	#DIVISION/0!	#DIVISION/0!
20					0,00	0,00	#DIVISION/0!	#DIVISION/0!	#DIVISION/0!
21					0,00	0,00	#DIVISION/0!	#DIVISION/0!	#DIVISION/0!

Vattnets temperatur (‘	18,8
Vattnets desitet (ºC):	0,9984

Våg, inv.nr:	102291
Termometer, inv.nr:	102080