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Temperature buffer test

Dismantling operation

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Summary

The Temperature Buffer Test (TBT) is a joint project between SKB/ANDRA and supported by ENRESA (modelling) and DBE (instrumentation), which aims at improving the understanding and to model the thermo-hydro-mechanical behavior of buffers made of swelling clay submitted to high temperatures (over 100°C) during the water saturation process.

The test has been carried out in a KBS-3 deposition hole at Äspö HRL. It was installed during the spring of 2003. Two heaters (3 m long, 0.6 m diameter) and two buffer arrangements have been investigated: the lower heater was surrounded by bentonite in the usual way, whereas the upper heater was surrounded by a ring of sand. The test was dismantled and sampled during a period from the end of October 2009 to the end of April 2010, and this report describes this operation.

Different types of samples have been obtained during this operation. A large number of Ø50 mm bentonite cores have been taken for analysis of water content and density. Large pieces, so-called big sectors, have been taken for hydro-mechanical and chemical characterizations. Finally, there has been an interest to obtain different types of interface samples in which bentonite were in contact with sand, iron or concrete.

One goal has been to investigate the retrievability of the upper heater, given the possibility to remove the surrounding sand shield, and a retrieval test has therefore been performed. The sand in the shield was first removed with an industrial vacuum cleaner after loosening the material through mechanical means (with hammer drill and core machine). A front loader was subsequently used for applying a sufficient lifting force to release the heater from the bentonite underneath.

The experiment has been documented in different aspects: measurements of the coordinate (height or radius) of different interfaces (between bentonite blocks and between bentonite and sand); verification of sensor positions and retrieval of sensors for subsequent function control; and through documentation of the operation through photography.

Significant fallout of material from the bentonite rings in the upper package took place soon after the retrieval test. This appears to be a consequence of the removal of the sand shield which implied a radial unloading of the blocks. Traces of another mechanical event were found on the top surface of Ring 12 and the bottom surface of Cylinder 3. Together with results from levelling, these traces suggest that the Ring 12 was pressed against and sheared the outer parts of the Cylinder 3. Finally it can be noted that it was fairly easy to separate large pieces of bentonite from the block surface underneath. The joints between the different blocks therefore only displayed a marginal attachment, even though some of the bentonite blocks were fully water saturated.

Contents

1 Introduction

1.1 Background

The Temperature Buffer Test (TBT) is a joint project between SKB/ANDRA and supported by ENRESA (modelling) and DBE (instrumentation), which aims at improving the understanding and to model the thermo-hydro-mechanical behavior of buffers made of swelling clay submitted to high temperatures (over 100°C) during the water saturation process.

The test has been carried out at the 420 m level in Äspö HRL in a 8 meters deep and 1.75 m diameter deposition hole, with two heaters (3 m long, 0.6 m diameter), surrounded by a MX-80 bentonite buffer and a confining plug on top anchored with 9 rods (Figure 1-1). It was installed during the spring of 2003. Two buffer arrangements have been investigated: the lower heater was surrounded by bentonite in the usual way, whereas the upper heater was surrounded by a ring of sand. The latter has acted as a thermal protection for the bentonite, and as an important component for the retrievability.

The canisters were heated with 1,500 W power from day 15 to day 1,171, when the power was raised to 1,600 W. Around day 1,700 the power was raised by steps to 2,000 W in the lower heater and reduced to 1,000 W in the upper heater. The heating was terminated around day 2,300 in August 2009.

The test was dismantled and sampled during a period from the end of October 2009 to the end of April 2010, and this report describes this operation.

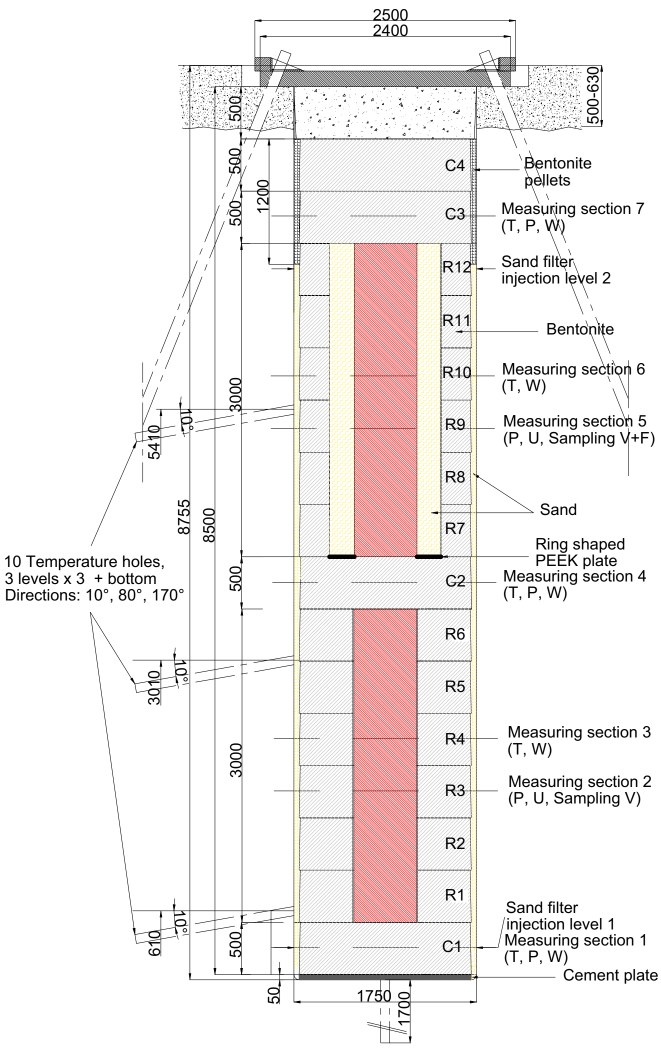

Figure 1-1. Design of the TBT experiment.

Other activities in TBT are described concurrently in a number of other reports: The different parts of the test design and the installation is described by Johannesson et al. (2010). The operation conditions and the sensors data is reported by Goudarzi et al. (2010), which includes the results from the function control performed on the sensors that was retrieved during the dismantling operation. The analyses of density and water content in bentonite core samples obtained during the dismantling and the results from this program are presented by Johannesson (2010). The hydro-mechanical and chemical/mineralogical characterization programs and the results from these analyses are described by Åkesson et al. (2012a). The final THM modelling of TBT is presented by Åkesson et al. (2012b). This report also includes different evaluations of the data from the analyses of the core samples obtained during the dismantling operation. Finally, a summary of the entire project is given by Åkesson (2012).

1.2 Goals of dismantling

There were different goals and interests with the dismantling operation.

One important goal was to obtain different types of samples for the various subsequent analyses. Bentonite cores were devoted for the so-called base program, in which the bentonite was analysed for water content and density. Large pieces of bentonite, so-called big sectors, were devoted for the HM & C (hydro-mechanical and chemical) program. Finally, there was an interest to obtain different types of interface samples in which bentonite were in contact with sand, iron or concrete.

A second goal was to investigate the retrievability of the upper heater, given the possibility to remove the surrounding sand shield.

Finally the experiment was documented in different aspects: measurements of the coordinate (height or radius) of different interfaces (between bentonite blocks and between bentonite and sand); verification of sensor positions and retrieval of sensors for subsequent function control; and by documentation of the operation through photography.

1.3 Organisation

The final phase of the TBT project has been organized in 13 different activities:

1. Termination of heating and filter hydration.
2. Preparatory work.
3. Plug removal.
4. Sampling and removal of bentonite cylinder C4 and C3.
5. Sampling and removal of sand shield in upper part of TBT.
6. Heater removal.
7. Sampling and removal of bentonite rings R12 to R7.
8. Sensor function control.
9. Water content and density.
10. HM & C program.
11. Sampling and removal of bentonite blocks C2 to C1(including R6 to R1).
12. Heater removal – II.
13. Water content and density – II.

The actual dismantling operation was covered by the activities 3–7 and 11–12, and was performed by a number of persons at SKB, Skanska, Geosigma and Clay Technology. This report describes the implementation and the results from these activities.

1.4 Method

The main method to sample and partition the bentonite blocks was with the use of handheld coring machines (Figure 1-2). Two machines were used in parallel. The inner and the outer diameter of the coring machine were 50 and 66 mm, respectively. The plan was to take cores that spanned over the entire height of the bentonite blocks, i.e. approximately 500 mm.

For each block a coring scheme was specified according to which cores were to be taken in four directions at 50 mm intervals. A plywood template was produced to specify these coring positions in the field (Figure 1-2). The same directions were aimed for in all blocks: 32, 122, 212 and 302°[1]. One reason for choosing these angles was that they would coincide with the orientation of the lid of the lower heater and the cables from this (see Figure 2-22). It was also found that these angles were generally free from instruments, and also that it would be beneficial to keep the same angles in all blocks for simplicity.

In addition to the sampling of cores, the plan was to "cut" out two so-called *big sectors* from each block representing the entire radial distribution in two directions: 32 and 212°. These were on one side defined be the arrays of holes from the coring in these directions, and on the other side released through a straight stitch drill, giving the piece a width of at least 100 mm (see Figure 2-3 and 2-5).

Figure 1-2. *Coring machine used for sampling and partitioning of bentonite blocks.*

[1] Directions (or azimuths) were defined as counterclockwise with zero in the direction of the end of the TASD tunnel.

In order to obtain samples close to the rock wall and the lower heater, so called *end sectors* were taken, either through stitch drilling, or through cutting bigger pieces with hand saw. In the lower part of the experiment, it was found to be beneficial to make a circular stitch drill around the heater which enabled the sampling of suitable pieces close to the heater.

All samples were packaged in evacuated aluminium laminate foil bags (Figure 1-3). The top surface of the bentonite was covered with a rubber mat during all nights, weekends and holydays throughout the dismantling operation.

1.5 Outline of report

A large amount of data and photographs has been obtained during this dismantling operation. And in order to simplify the preparation and the editing of this report, different types of information are presented in different chapters. An overall description of dismantling operation is presented in Chapter 2. Lists of all obtained samples are given in tables in Chapter 3. A description and an evaluation of the gas sampling of Heater 1 are given in Chapter 4. Tables from the identification and the positioning of the sensors are presented in Chapter 5. Compilations of the results from the measurements of interfaces and levels, from the dismantling as well as the installation, are given in Chapter 6. Finally, a summary of the daily logs, thereby representing a brief diary of the operation, is presented in Chapter 7.

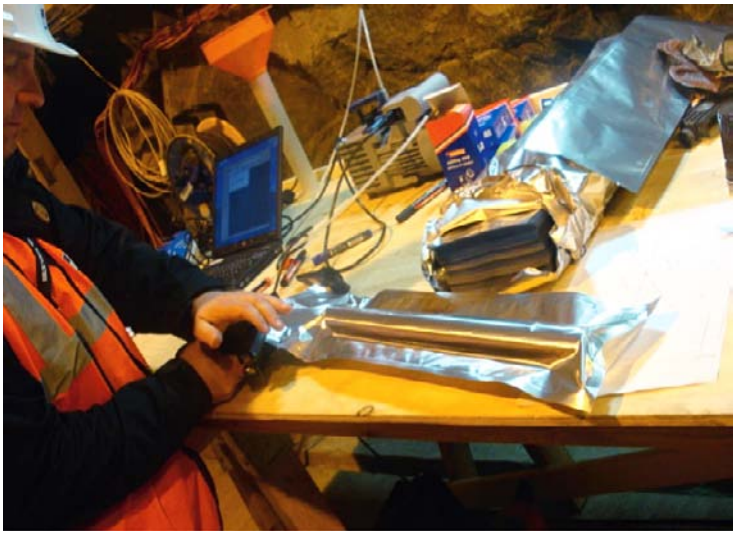

Figure 1-3. *Packaging of core in evacuated aluminum laminate foil bag.*

2 Dismantling operation

2.1 Plug

The actual dismantling operation began with the removal of the plug. The first thing to do was to level the plug and to get the final readings of the Glötzl cells. This was made on October 27th.

The plan was to unload the cables through releasing three cables at a time with approximately 6 mm in an iterative scheme using hydraulic jacks. This was however found to be difficult, since there was not enough room between the anchors and the tension nut. Instead the cables were released completely one at a time according to scheme Rod 6, 3, 9, 8, 5, 2, 4, 1 and 7, respectively.

A new leveling was made immediately after the unloading, i.e. on October 30th. This showed that the plug had moved approximately 14 mm upwards during the unloading. After the unloading, the steel ring, the lid and the concrete plug (Figure 2-1) was lifted from the deposition hole.

Before the work with the bentonite could begin, the anchor cables were cut using a special tool (Figure 2-2).

During the course of this activity it became apparent that the used cable type (VSL 6-12) was not the one that has stated previously (i.e. VSL 5-19), which means that the failure load for each cable was 3,180 kN instead of 3,530 kN, i.e approximately 10% lower than stated.

Figure 2-1. *Lifting of concrete plug.*

Figure 2-2. Cutting of anchor cables.

2.2 Cylinders 3 and 4

The top surface of Cylinder 4 was uncovered and levelled on November 5th. The sampling began on the same day. It was found that the block had risen above the lower edge of the mould, which implied the rock wall was hidden at this level. The templates were aligned so that the centre coincided with the original centre mark of the block. In general, the sampling followed the plan (Figure 2-3), and in total 65 cores and 2 big sectors were sampled (Figure 2-4 and 2-5).

Coming down to Cylinder 3, the top surface was levelled on November 13th. This top surface was largely covered by the filter mat which thereby had to be removed in order to identify, specify the positions and remove the sensors in this block. It was observed that the surface and the filter mat was broken at some locations in the outer parts between 120° and 270° with protruding areas (Figure 2-6). The templates were aligned so that the centre coincided with the centre of the deposition hole, given by the intersection of lines drawn between the 0 and the 180° directions, and the 90 and the 270° directions, respectively.

The sampling was performed according to the plans with cores and big sectors (Figure 2-7), but also with a cylindrical centre piece which was created through circular stitch drilling above the lid of Heater II (Figure 2-8). This was only a rehearsal for the real sampling on top of Heater I. It was found that the height of the central piece would have to be reduced in order to lift it safely.

During the course of the core sampling it was found that some cores, taken in the outer parts of the block, separated approximately 0.05 m above the expected end of the block. And that the surfaces of these interfaces shown sign of block compaction, which indicated that the lower surface was located approximately 0.05 m higher than expected. Later on, this was found to correspond to other observations that have been interpreted as traces of a large shearing process (see below).

A number of observations could be made at the top of Ring 12 when the material from Cylinder 3 had been removed: a significant piece had loosened from the bottom side of Cylinder 3 and fallen down into the sand shield at approximately 270° (Figure 2-9); two "shelves" with approximately 0.05 m high inclined lateral sides were found at around 0° and between 160 and 270° (Figure 2-10); the six thermocouples in the sand shield and the ground cable to Heater II had been torn off. The inclination of the lateral side at the shelf in the 350° direction was measured to approximately 65° in relation to the horizontal plane. The corresponding inclination in the 200° direction was measured to approximately 72°. Heater II was levelled on November 24th, whereas the top surface of Ring 12 was levelled on November 25th and 26th.

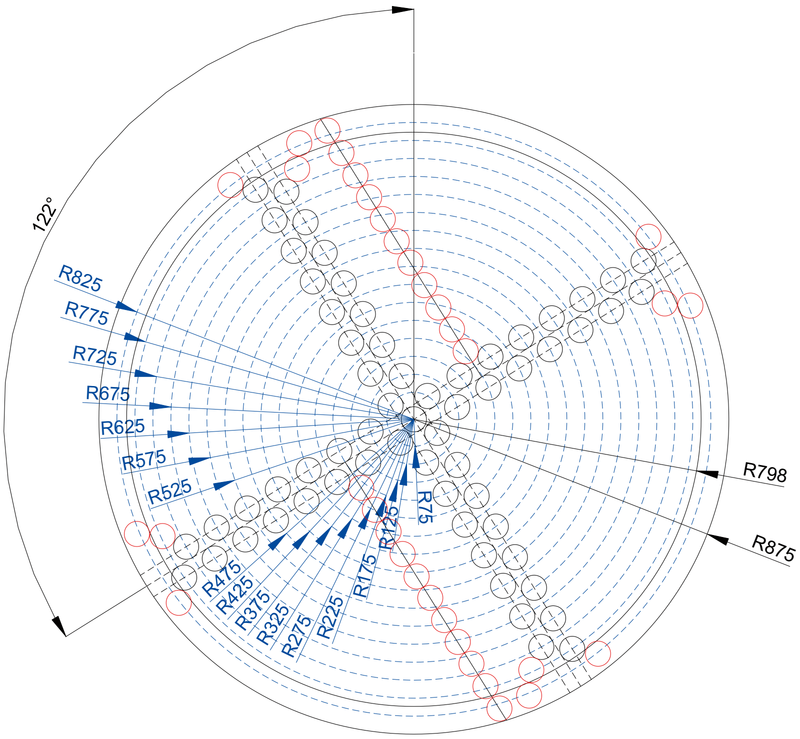

Figure 2-3. *Sampling scheme Cylinder 4.*

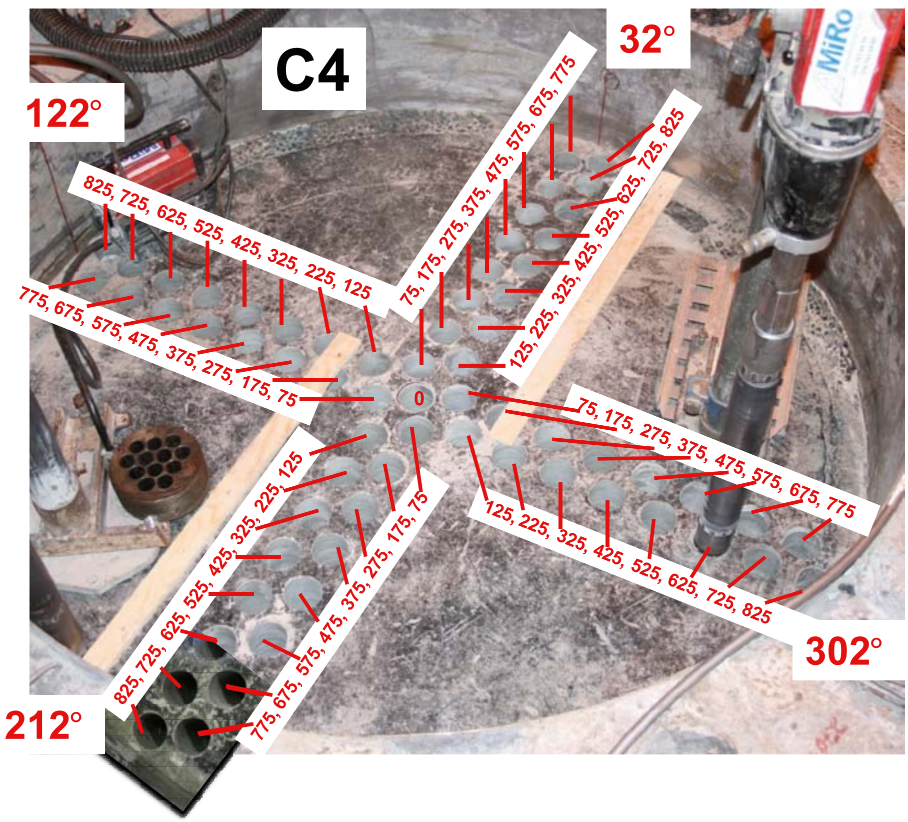

Figure 2-4. *Cores of Cylinder 4.*

Results from the levelling are compiled in Figure 6-1 and 2-44. These suggest that the upward swelling of Ring 12 had sheared the outer parts of Cylinder 3. These damages, together with the marginal attachment of the joints between the blocks may very well explain the leakage from the shield during the pressurization of the shield. The direction of the observed shelves between 160 and 270° coincide with the slots in which the leakage was observed (slots at 204.5 and at 242°).

Figure 2-5. *Big sectors of Cylinder 4.*

Figure 2-6. *Top surface of Cylinder 3. Note the protruding areas.*

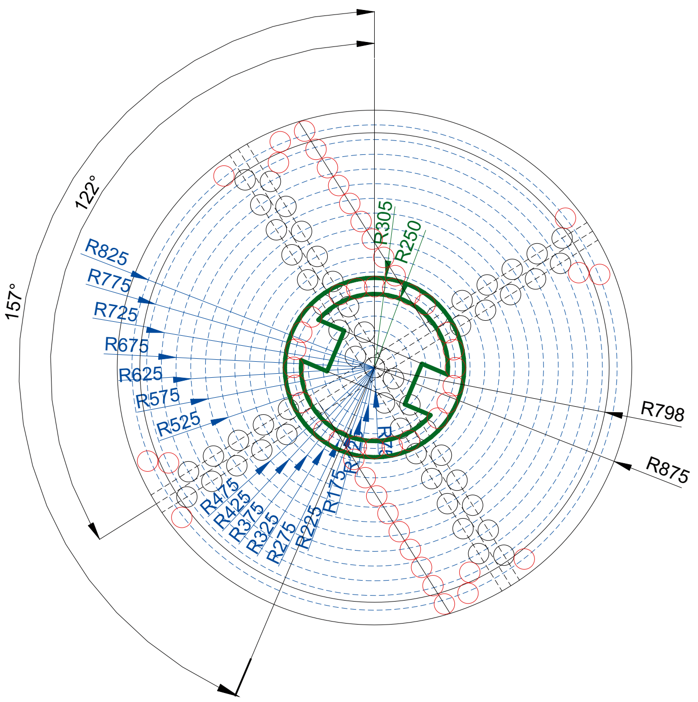

Figure 2-7. *Sampling scheme Cylinder 3.*

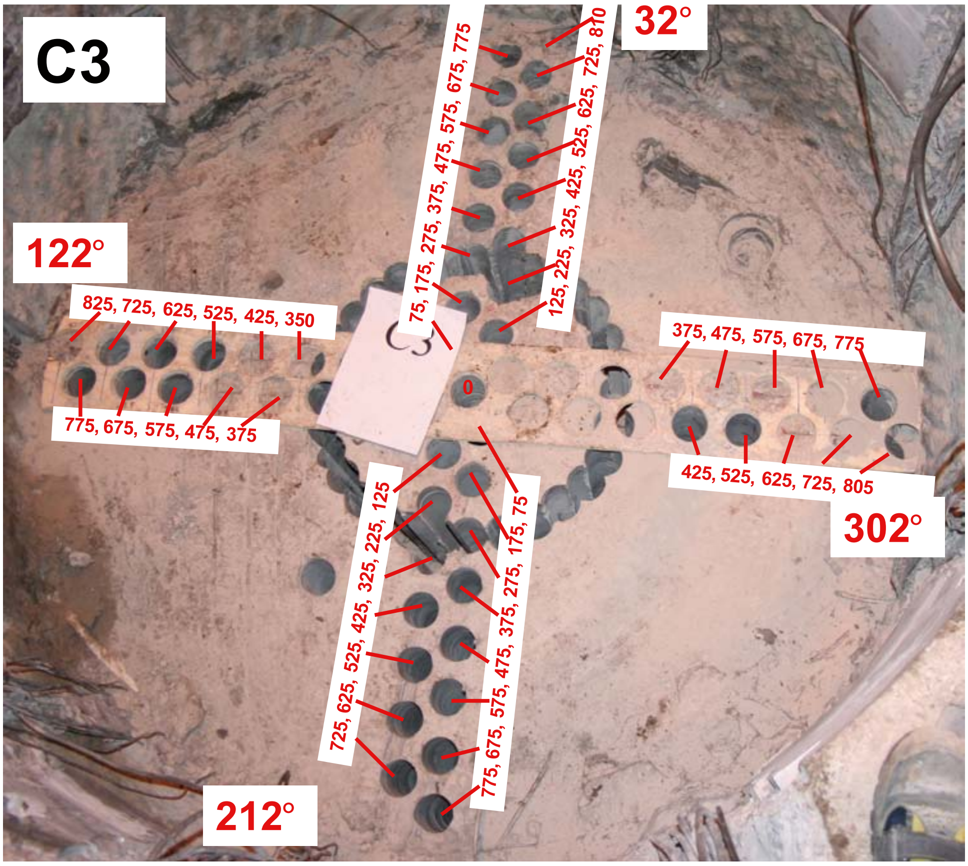

Figure 2-8. *Cores of Cylinder 3.*

Figure 2-9. *Center piece of Cylinder 3 and top surface of Ring 12.*

Figure 2-10. *Shelfs of top surface of Ring 12 indicating shearing. Left: in 350° direction inclination approximately 65° in relation to the horizontal plane; right: in 200° direction inclination approximately 72° in relation to the horizontal plane.*

2.3 Sampling of sand shield and retrieval test

Before the removal of the sand shield, attempts were made to take samples of the interface between the sand in the shield and the bentonite. This was however found to be unfeasible since the sand tended to loosen during coring. Still, some samples were obtained which showed bentonite with attached sand on its surface (Figure 2-11). An array of sand samples was also taken from the shield.

The plan was to remove the sand in the shield with an industrial vacuum cleaner (Figure 2-12). It was found that the sand had to be loosened before it could be removed. This was first achieved with a hammer drill (Hilti), and later on (deep down) with the core machine. During the course of the sand removal, a water table was encountered (not surprisingly due to the performed hydration of the shield). This water was partly removed through pumping.

The difficulties of removing the sand increased with depth, and during the first attempt to lift the heater there were therefore a few decimeters of sand remaining in the bottom of the shield. This attempt was made with the gantry crane and also with a hydraulic jack between the heater and the inside of Ring 12. Due to the inability to move the heater, this attempt was however given up and instead an additional campaign of removing the sand was performed, after which approximately 0.05 m of sand remained. At this stage a front loader was used to rock the heater sideways and in this way it eventually was possible to release the heater (Figure 2-13). The reason why the heater was stuck was partly due to the compressive stresses from the surrounding bentonite and sand even though it was only a few decimeters. In addition, it was also due to the bentonite beneath the heater in Cylinder 2 exerting a sucking action on the bottom surface.

This phase of dismantling showed that the sand could be fairly easily removed with a proper loosening action, and also that the canister could be loosened from the grip of the swelling bentonite without too much difficulty.

Figure 2-11. *Sample from attempt to obtain an sand-bentonite interface.*

Figure 2-12. *Sand removal with industrial vacuum cleaner.*

Figure 2-13. *Lifting of Heater II.*

2.4 Rings 7–12

Soon after the sand and the heater had been removed, it was noticed that some material from the bentonite rings fell out. This fallout became more severe with time (especially in Ring 10 – Ring 7) which complicated the core sampling in this rings. A steel plate (1,000×1,000 mm×20 mm) was used in order to work with the coring machine with the empty space on the inside of the rings. During the core sampling it was noticed that the remaining holes from the coring tended to deform with time, which indicates that there was high stresses in the bentonite.

The fallout of material also complicated the measurements of the radial position of the interfaces. These dimensions were measured as half the diameter across the entire circle, both for inner and outer radii. Due to the fallout of material, these measurements had to be limited to a few directions with intact blocks.

The positions of the core samples were selected in order to provide representative profiles of the rings, and six cores could in general be taken in each direction (Figure 2-14 to 2-20). However, due to the fallout of material, these profiles were is some cases modified in angle and also limited to a lesser numbers of cores. The sampling of big sectors was also affected by the fallout.

The sampling and the removal of bentonite was fairly rapid due to the fallout and the ambition to complete the dismantling of upper package before the holydays. This is reflected by the date of levelling the individual blocks. Ring 11, 10, 9, 8, 7 and the peek plate were levelled on December 8, 9, 11, 15, 17 and 22 respectively.

The sensors in Ring 9 and 10 were identified, positioned and removed. It was found that the total pressure sensor PB226 was not installed at the level of Ring 9 as specified earlier, but rather at the level of Ring 7. The injection points in the sand shield CS202 and CS203 were of interest since these points have shown very high flow resistance. It was found that these points were surrounded by bentonite (Figure 2-21).

All bentonite and sand down to Cylinder 2 was removed on December 23rd. At this time the peek-plate was also removed, after which the Cylinder 2 was covered with a rubber mat.

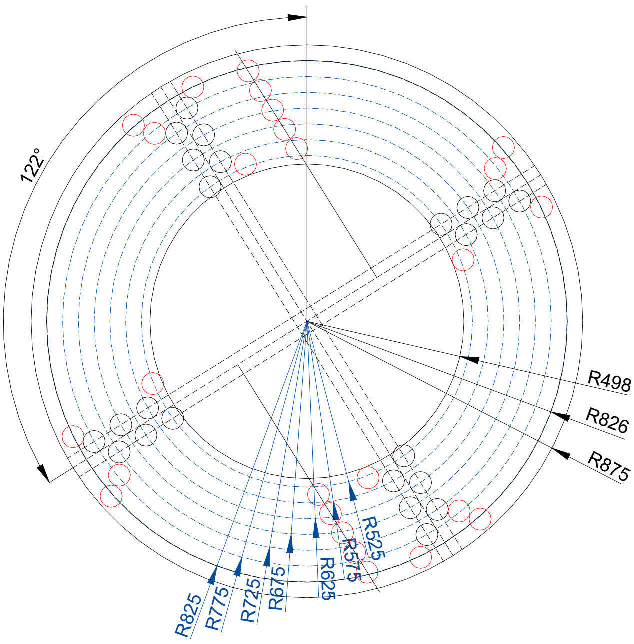

Figure 2-14. *Sampling scheme Ring 12 to Ring 7.*

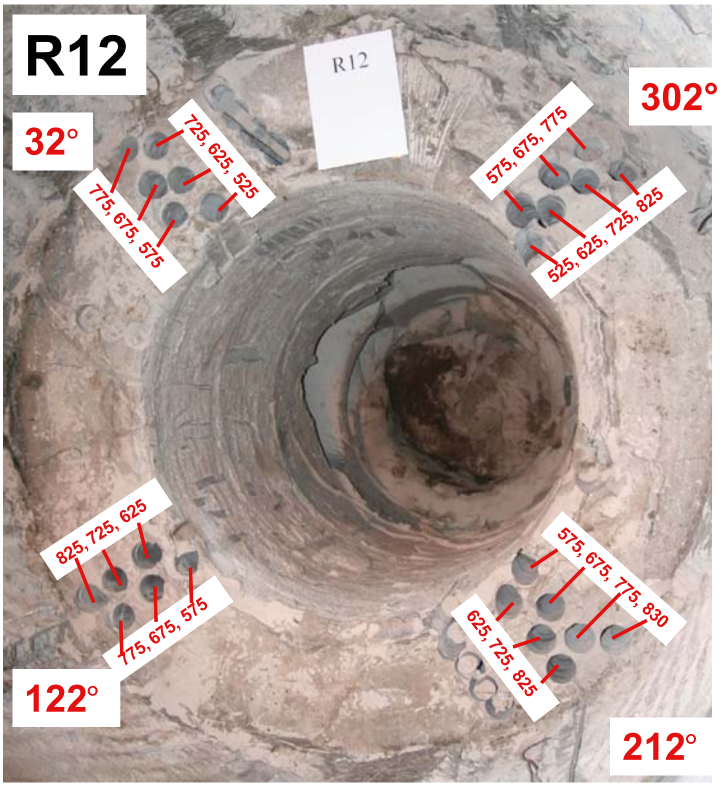

Figure 2-15. *Cores of Ring 12.*

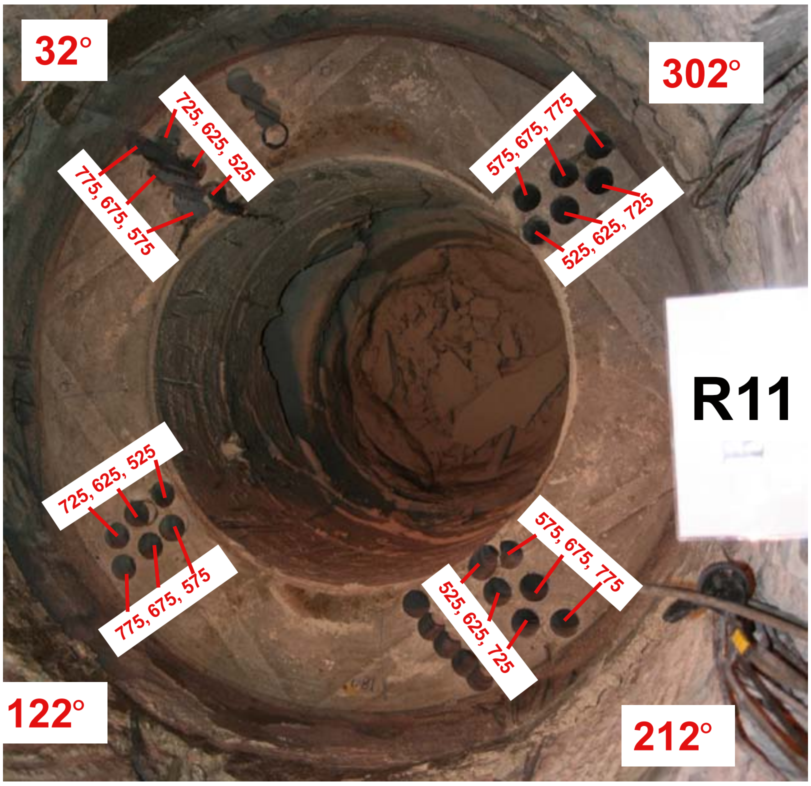

Figure 2-16. *Cores of Ring 11.*

Figure 2-17. Cores of Ring 10.

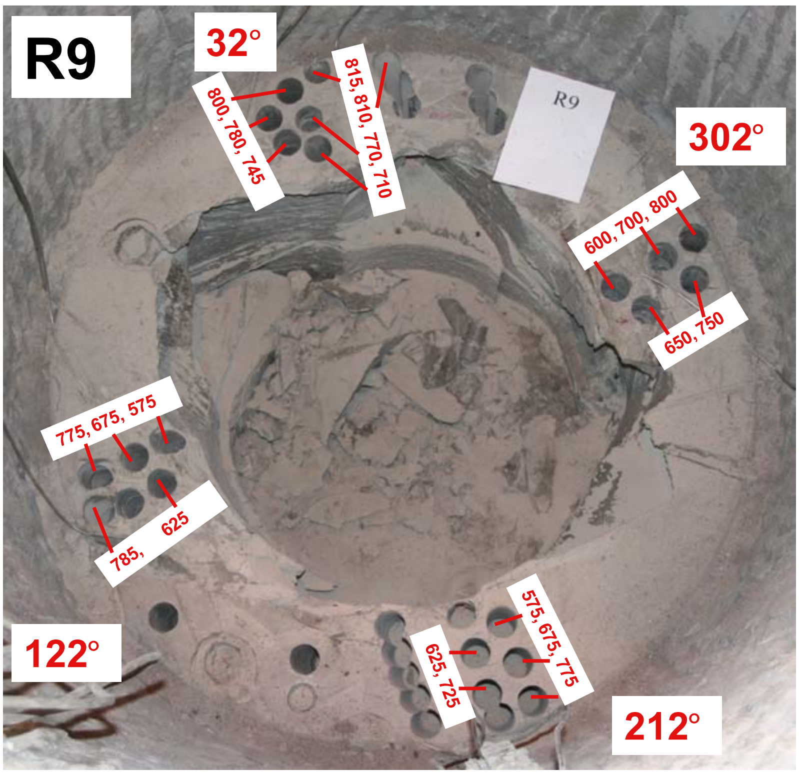

Figure 2-18. Cores of Ring 9.

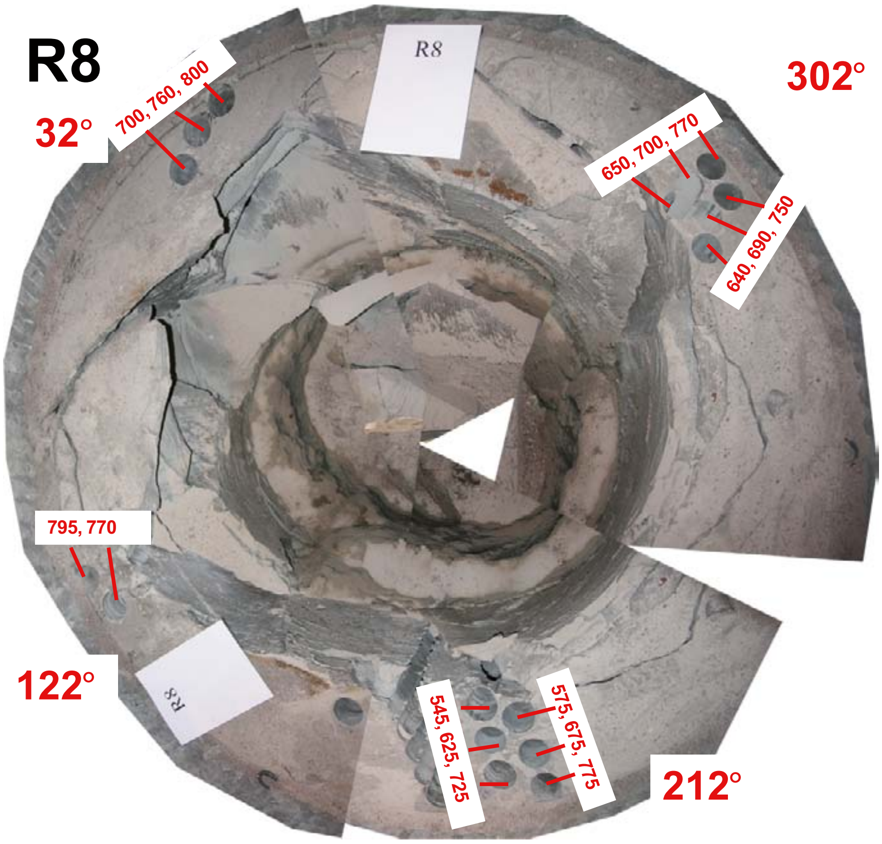

Figure 2-19. *Cores of Ring 8.*

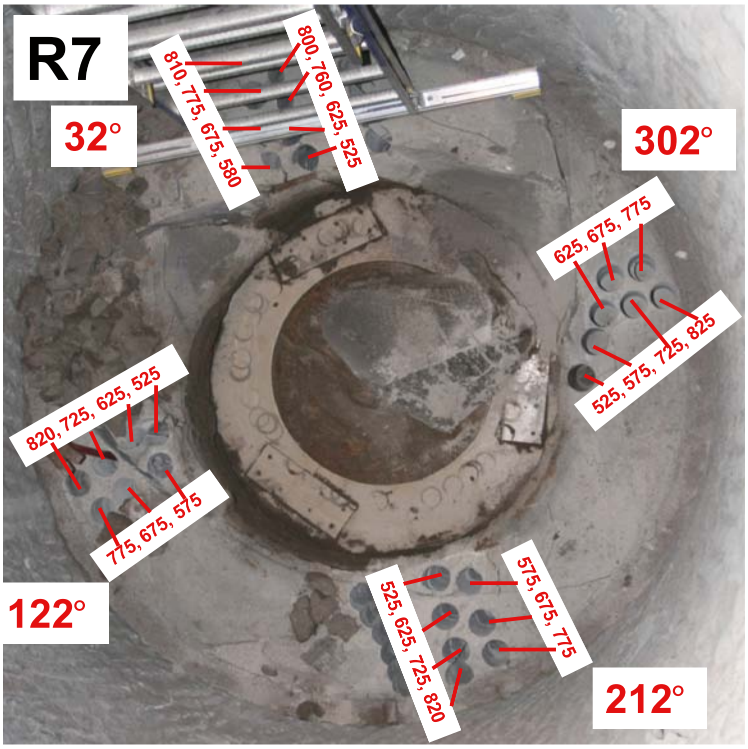

Figure 2-20. *Cores of Ring 7.*

Figure 2-21. *Injection points CS 202 (right) and CS 203 (left) at top surface of Ring 9. Upper photos taken during installation.*

2.5 Cylinder 2

The top surface of Cylinder 2 was uncovered and levelled on January 19. The plan was to take a 200 mm high undisturbed centre sample on top of the lid of Heater I. This operation followed a fairly complex scheme which consisted of several steps (Figure 2-22) and took approximately eight working days to complete.

First, a circular stitch drill was made down to 300 mm depth. Secondly, cores were taken on the outside of the circle down to 500 mm depth in the usual directions, as well as the associated stitch drills for the big sectors. In addition, cores were taken on the inside of the circle down to 300 mm depth in the 32 and 212° directions. Thirdly, the material on the inside of the circle was cleared down to 300 mm depth (Figure 2-23). After this, the circular stitch drill was made deeper all the way down to the heater, although leaving some attachment to the samples on the outside of the ring in some places. With a cluster of cores, the material above the locations for the lifting device on the heater lid was removed. After this, the material on the outside of the circle was removed, finally leaving only the central sample on top of the heater lid. The sample was strapped to the lid and successfully lifted from the deposition hole (Figure 2-24). Later on, it was placed in an evacuated aluminium laminate foil bag which in turn was placed in a special fabricated container. The lid of the heater was levelled on January 29.

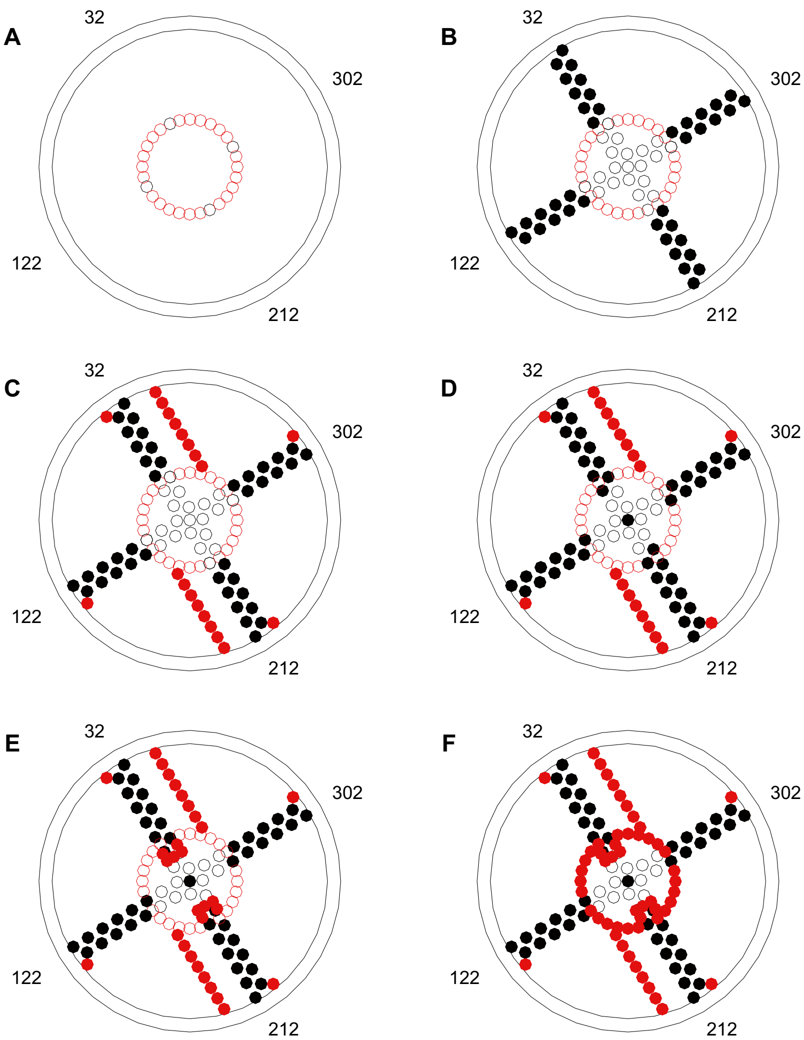

Figure 2-22. *Sampling scheme Cylinder 2. A: Core and stitch drilling in ring down to 300 mm depth. Middle line at radius 275 mm. Four cores included in base programme. B: Core sampling in four main directions: outside ring down to 500 mm depth and inside ring down to 300 mm depth. The centre sample belongs to the 32° direction. C: Stitch drilling outside ring down to 500 mm depth. D: Removal and sampling of remaining material inside ring. 7 cores taken from and inside the ring down to 500 mm depth. The central core was not taken in order to protect the interface sample. E: Clearing of slot at holes for fastening equipment. F: Stitch drilling for releasing the central sample.*

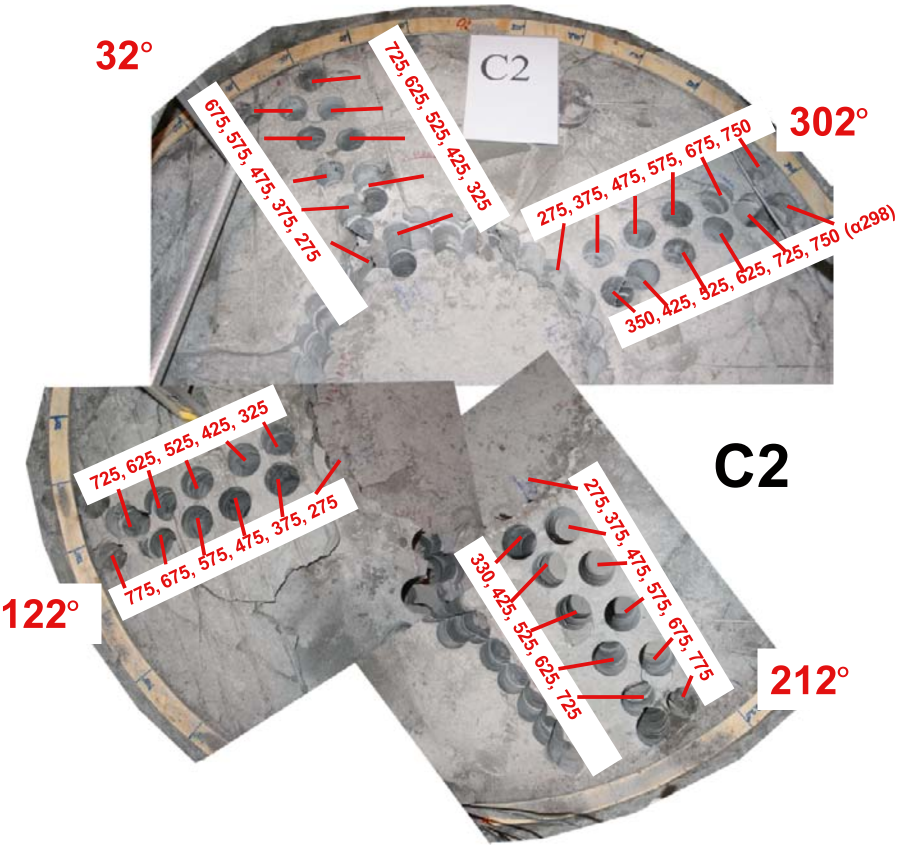

Figure 2-23. *Cores of Cylinder 2.*

Figure 2-24. *Undisturbed bentonite iron interface sample from Cylinder 2. The sample is resting on the lid from Heater I.*

2.6 Rings 1–6

Coming down to Ring 6, the top surface was levelled on January 29th. The coring proceeded as planned, although it became apparent that the sampling in the 122° direction was interfered by the presence of the power cables (Figure 2-25 and 2-26). All material of Ring 6 had been removed on February 10th at which time the top surface of Ring 5 was levelled.

One important observation that was made during the removal of the material in Ring 6 was the fact that the material was very restrained by the swelling pressure, and it was therefore difficult to remove material without damage. This was especially disadvantageous for the sampling of the end sectors close to the heater, where the material tended to fracture and fall apart. It was also notices that some bentonite was stuck to the heater, possibly associated with the welding at the top end.

As a response against this condition, a circular stitch drill approximately 150 mm from the heater was made in all rings from Ring 5 downwards (Figure 2-27 to 2-31). This made it easier to loosen and remove the big sectors and the remaining material without damage.

Additional sampling from the inside of the circular stitch drill was carried out during the removal of material in Ring 4 and Ring 3 (Figure 2-32). During this operation, the samples were put in evacuated aluminum laminate foil bags as well as in plastic barrels which were flushed with nitrogen gas before they were closed. In the case of the these samples taken from Ring 3, the evacuation of the bags was made in the deposition hole in order to minimize the exposure to atmospheric oxygen.

The sampling and the material removal in the required more time than in the upper package. This is reflected by the date of levelling the individual blocks. Ring 5, 4, 3, 2 and 1 were levelled on February 10, 18, March 3, 12, and 22 respectively.

Coming down to Ring 1 a second attempt to take undisturbed bentonite iron interface sample was made. This was performed with a circular stitch drill, similar to the ones used at the rings above. No cores were however taken on the inside of the circle. The cylindrical bentonite piece attached to the heater was reinforced with mounted wooden planks and straps (Figure 2-33 and 2-34).

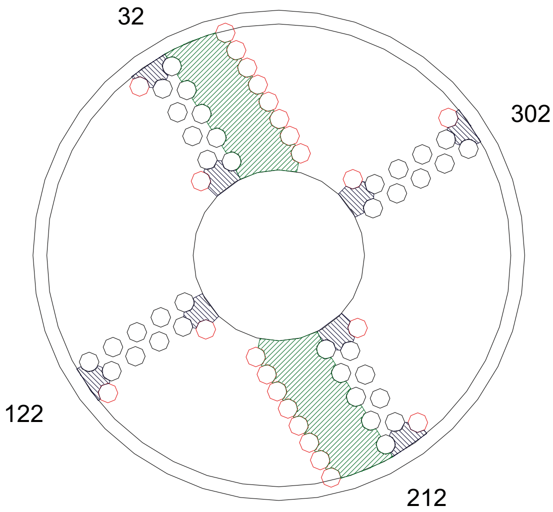

Figure 2-25. *Sampling scheme Ring 6.*

Figure 2-26. *Cores of Ring 6.*

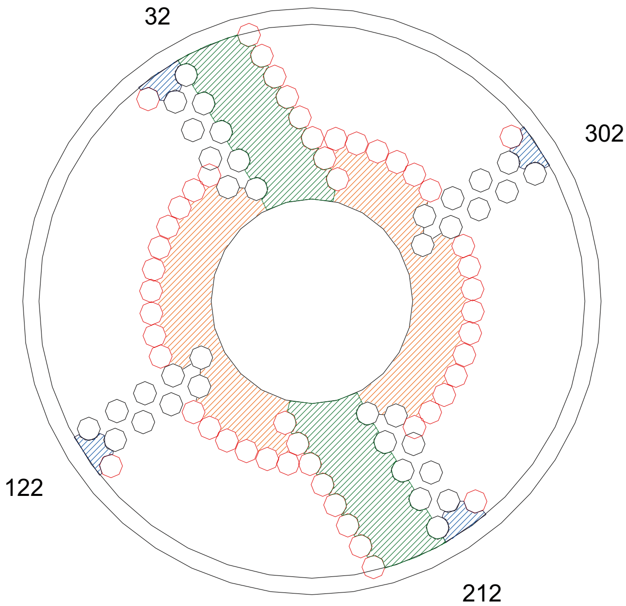

Figure 2-27. *Sampling scheme Ring 5 to Ring 2.*

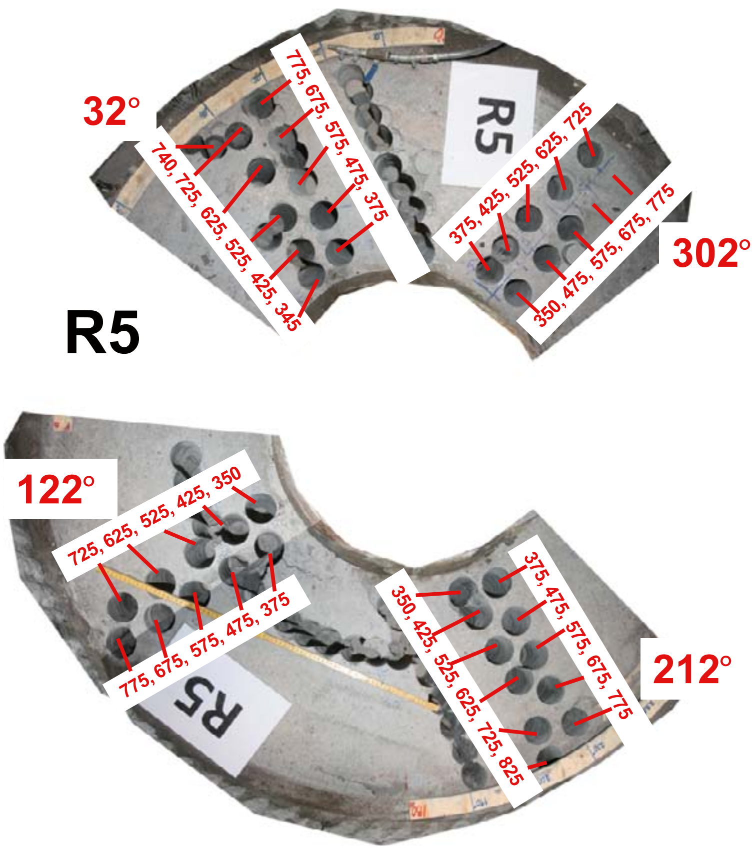

Figure 2-28. *Cores of Ring 5.*

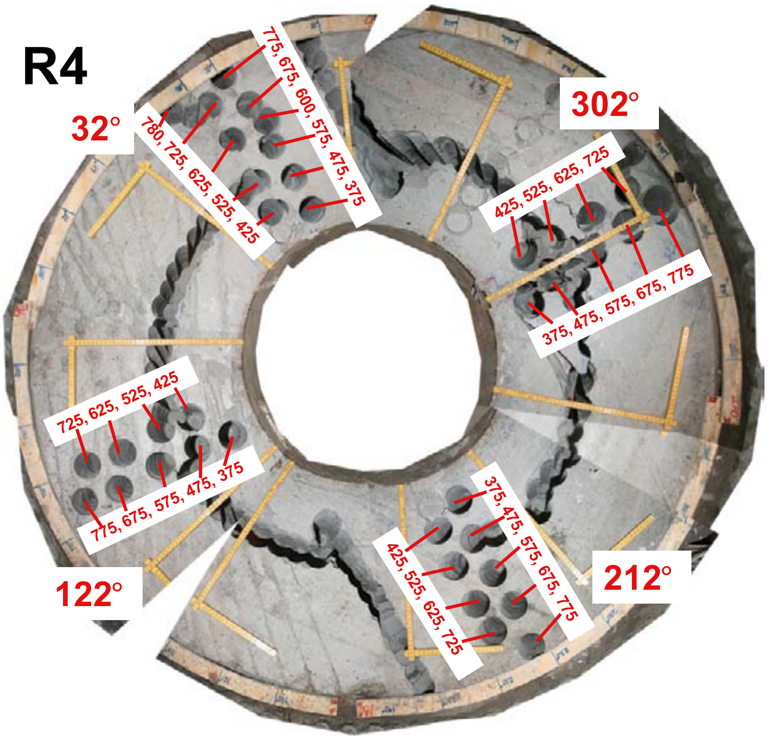

Figure 2-29. Cores of Ring 4.

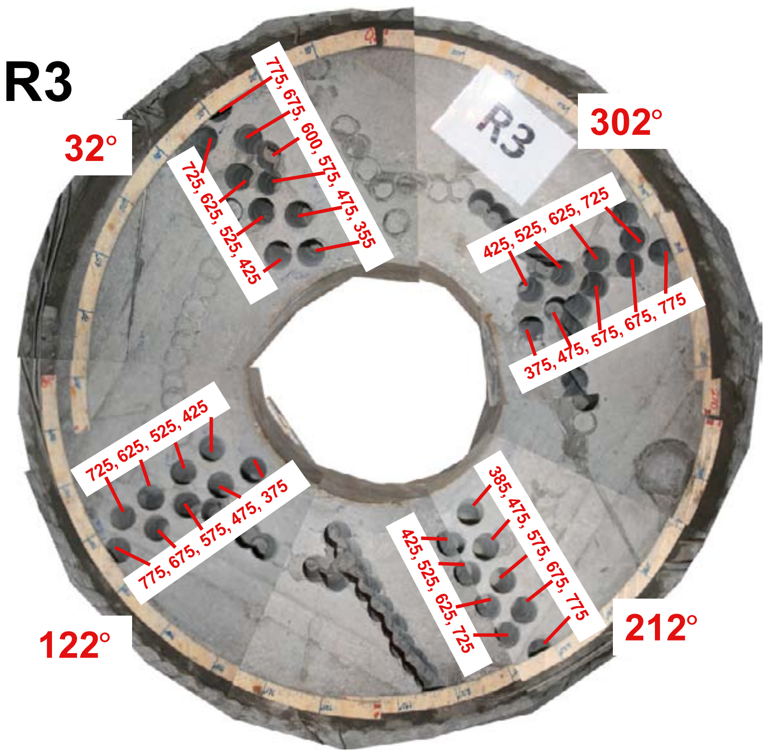

Figure 2-30. Cores of Ring 3.

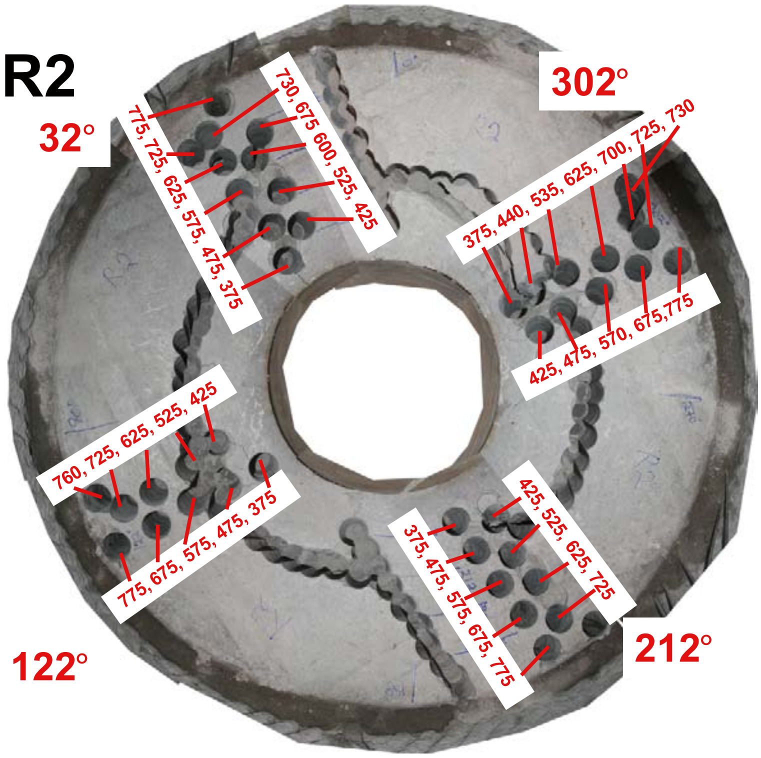

Figure 2-31. *Cores of Ring 2.*

Figure 2-32. *Inner piece from Ring 4.*

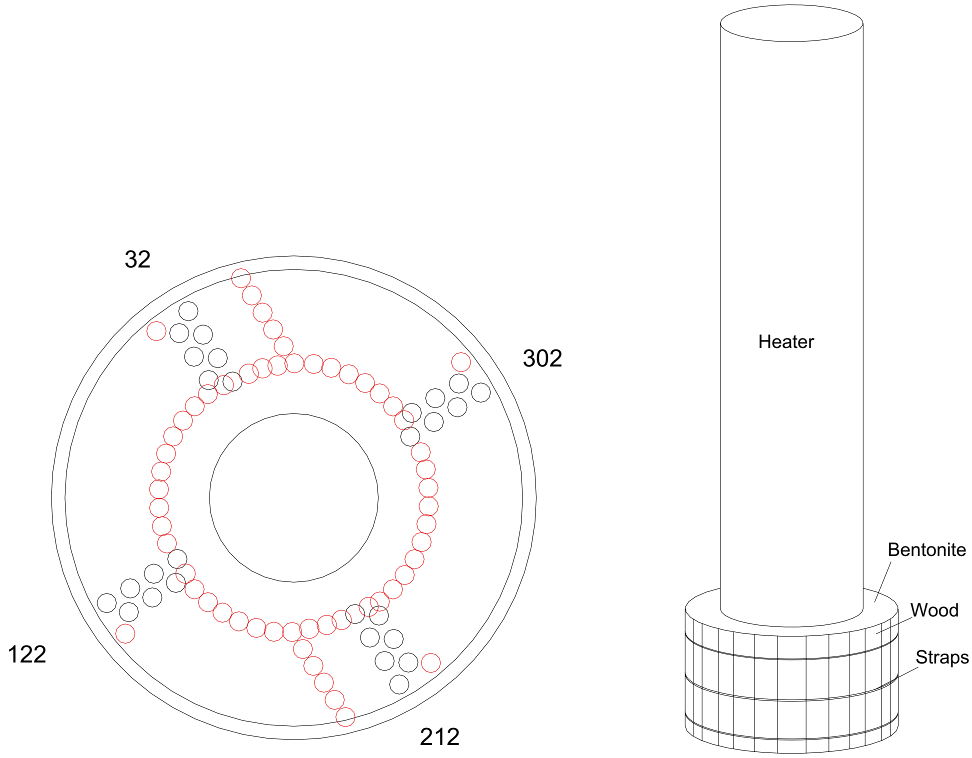

***Figure 2-33.** Sampling scheme Ring 1.*

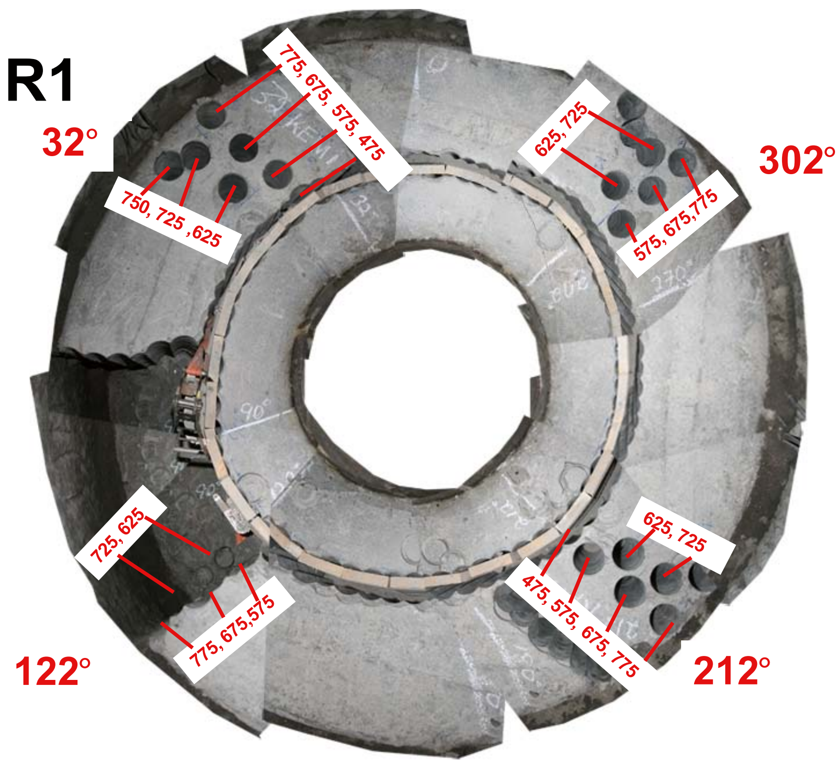

***Figure 2-34.** Cores of Ring 1.*

2.7 Heater I

A special manufactured lifting lid was mounted on Heater I before the completion of the sampling in Ring 1. The lid was connected to the gantry crane and the first attempt to lift the heater on March 25th showed to be successful. Later on the heater was lifted out of the deposition hole and was placed on beams on top of the deposition hole. The attached bentonite was covered with plastic foil, and subsequently put in a cradle (see Figure 2-35).

Approximately three weeks later the bentonite was uncovered and partitioned so that approximately 80° in the 122° direction remained on top of the heater (Figure 2-36 and 2-37). The partitioning was performed with hand saw. After this the remaining bentonite was covered with plastic foil.

Figure 2-35. *Lifting of Heater I .*

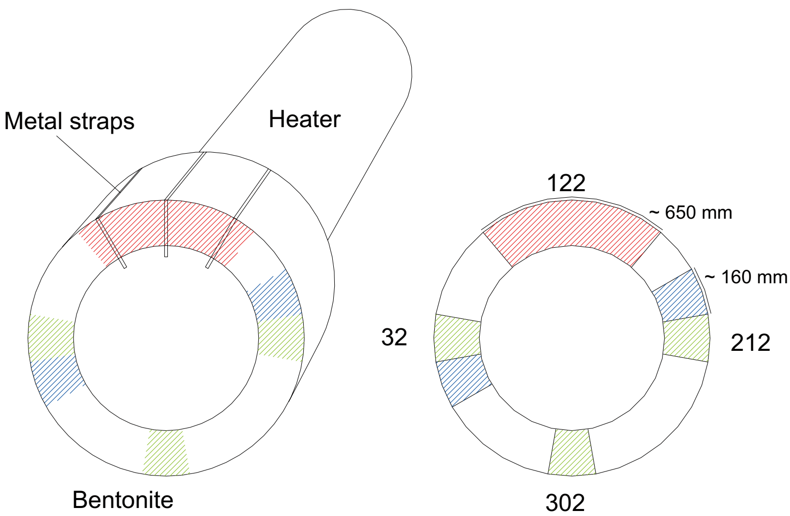

Figure 2-36. *Scheme for partitioning of inner piece of Ring 1. Areas marked green devoted for water content and density analyses; blue areas: for HM & C program; red area: for iron bentonite sample.*

Figure 2-37. *Top part of inner piece of Ring 1 after partitioning.*

The plan was to cut the heater in order to obtain a manageable iron bentonite sample. Before this cutting operation took place, a gas sample was taken from the interior of the heater.

For this purpose, a special tool was developed (Figure 2-38). The top surface of the heater was equipped with a threaded hole with a one-way valve on the backside and a screw on the front side. The first observation was that there was no overpressure in the heater, and this was therefore pressurized with nitrogen gas and left overnight. The next day samples were taken which were sent for analysis. A description of the operation, with information on the nitrogen dilution and the concentration of different gases, is given in Chapter 4. The original volumetric concentration of hydrogen was found to be in the order of 8–9%. The content of the heater was therefore flushed repeatedly with nitrogen before the heater was considered to be safe for sawing. The operation was performed with the saw for canister components at the Canister Laboratory in Oskarshamn. The heater was cut perpendicular to the heater axis approximately 0.2 m from the attached bentonite piece (Figure 2-39).

Figure 2-38. *Equipment for gas sampling of Heater I.*

***Figure 2-39.** Cutting of Heater I. Note the bentonite sample in upper right corner.*

2.8 Cylinder 1

The sampling of the Cylinder 1 was commenced immediately after the lifting of Heater I, and the top surface was levelled on March 31st. The sampling and the removal of the bentonite proceeded as planned (Figure 2-40 and 2-41).

Special samples of bentonite-concrete interfaces were taken at the end of the operation. These were taken with a 76 mm diameter coring machine at an inclination of approximately 30°. Four such interface samples were taken (Figure 2-42).

All bentonite material was removed on April 20th. The concrete bottom foundation was levelled the subsequent day (Figure 2-43).

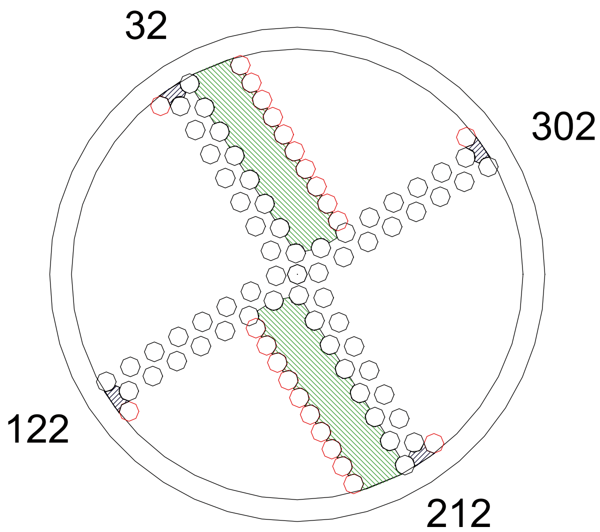

***Figure 2-40.** Sampling scheme Cylinder 1.*

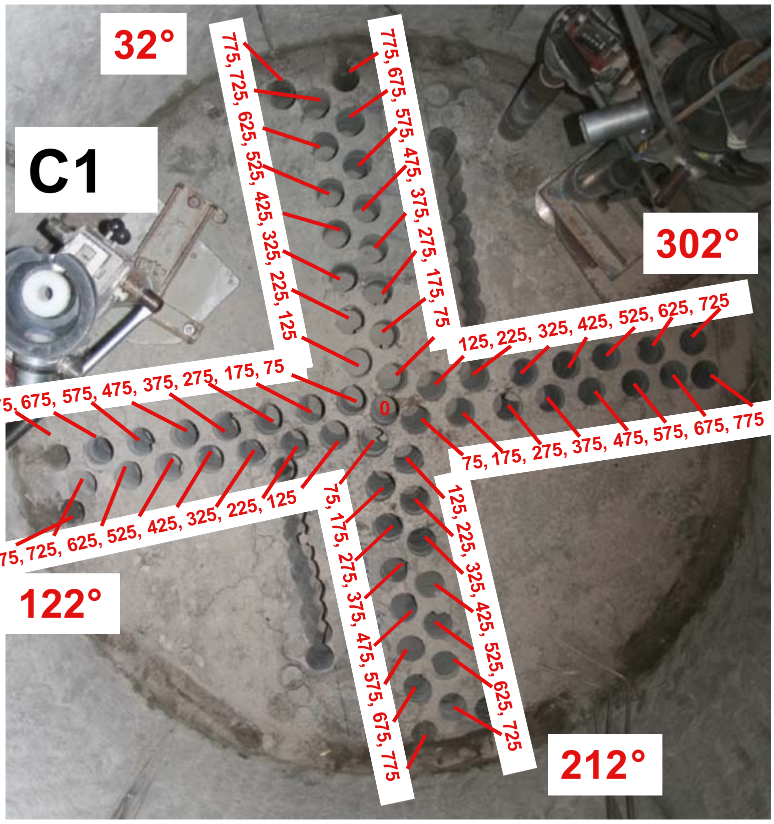

Figure 2-41. *Cores of Cylinder 1.*

Figure 2-42. *Bentonite concrete interface sample taken from bottom of Cylinder 1.*

Figure 2-43. *Concrete bottom plate.*

2.9 General observations

Results from measurements of interfaces at the dismantling are compiled in Table 6-1 to Table 6-3. These are defined as outer, and in some cases inner, radii of each bentonite block in different directions. The width of the outer slot is also given in these tables. It should be noted that these measurements could only be made at the top surface of each block. Due to the initial slightly conical shape of the blocks, it can be assumed that the outer radii were slightly larger at the bottom end of each block. This was also supported by the occasionally observed bentonite sand “skin” with remaining sand after the bentonite block had been removed. Measurements of the diameter between such skins were a few centimetres larger than the corresponding diameter at the top surface. Corresponding interfaces at the installation are compiled in Table 6-4 and Table 6-5. These measurements included the radii at the top surface as well as the lower surface.

Results from levelling of top surfaces of bentonite blocks, heaters, peek plate and concrete bottom plate at the dismantling are compiled in Table 6-6 to 6-8 and Figure 6-1. Corresponding levels at the installation are compiled in Table 6-9.

Graphical representations of all these measurements are shown in Figure 2-44 to 2-46. These pictures also illustrate the traces of shearing of Ring 12 and Cylinder 3 mentioned above. The upper block radii in these graphs are set by the average value of all available measurements for the block in question. Correspondingly, the lower radii are given as the upper radii with an addition of 10 mm. The data on the upper levels of each block are taken from the measurements on the 0 and 180° directions. In Figure 2-44 and 2-45, the axial displacement of the top surface of each block is given in mm and marked with red, whereas the relative change in the block thickness is given in % and marked with blue. In Figure 2-46, the radial displacements are given in mm and marked with red.

The joints between the different blocks only displayed a marginal attachment, even though some of the bentonite blocks were fully water saturated.The removal of remaining material after the sampling of each block followed the original interfaces. Large quadratic shapes can be seen in Figure 2-16 and 2-30, which were taken on top of Ring 11 and 3, respectively. These shapes are “negative” marks of the grooves on the bottom face of the blocks above which were made in order to facilitate the removal of the lifting straps used during the installation of the blocks.

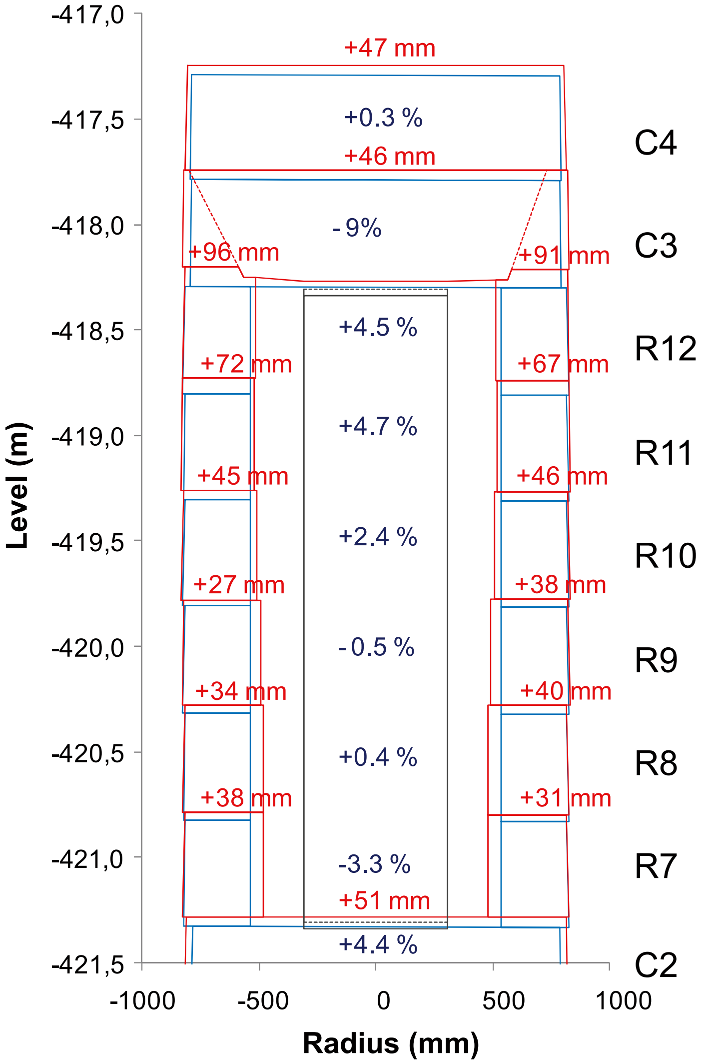

Figure 2-44. *Absolute changes in height (red), and relative changes in thickness (blue) of blocks in upper package. The left and the right side correspond to the 0° and 180° direction, respectively.*

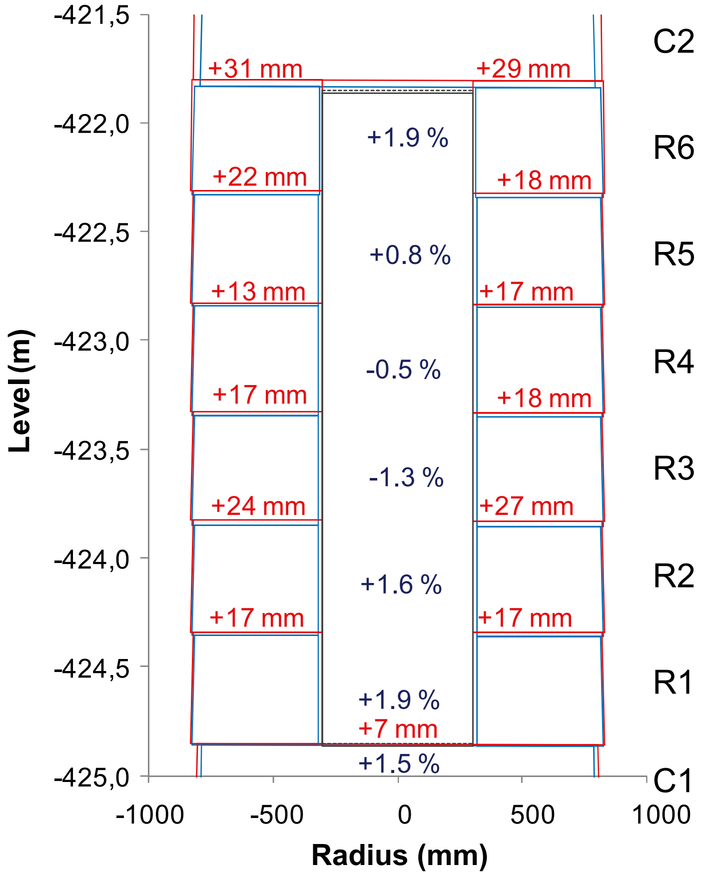

Figure 2-45. *Absolute changes in height (red), and relative changes in thickness (blue) of blocks in lower package. The left and the right side correspond to the 0° and 180° direction, respectively.*

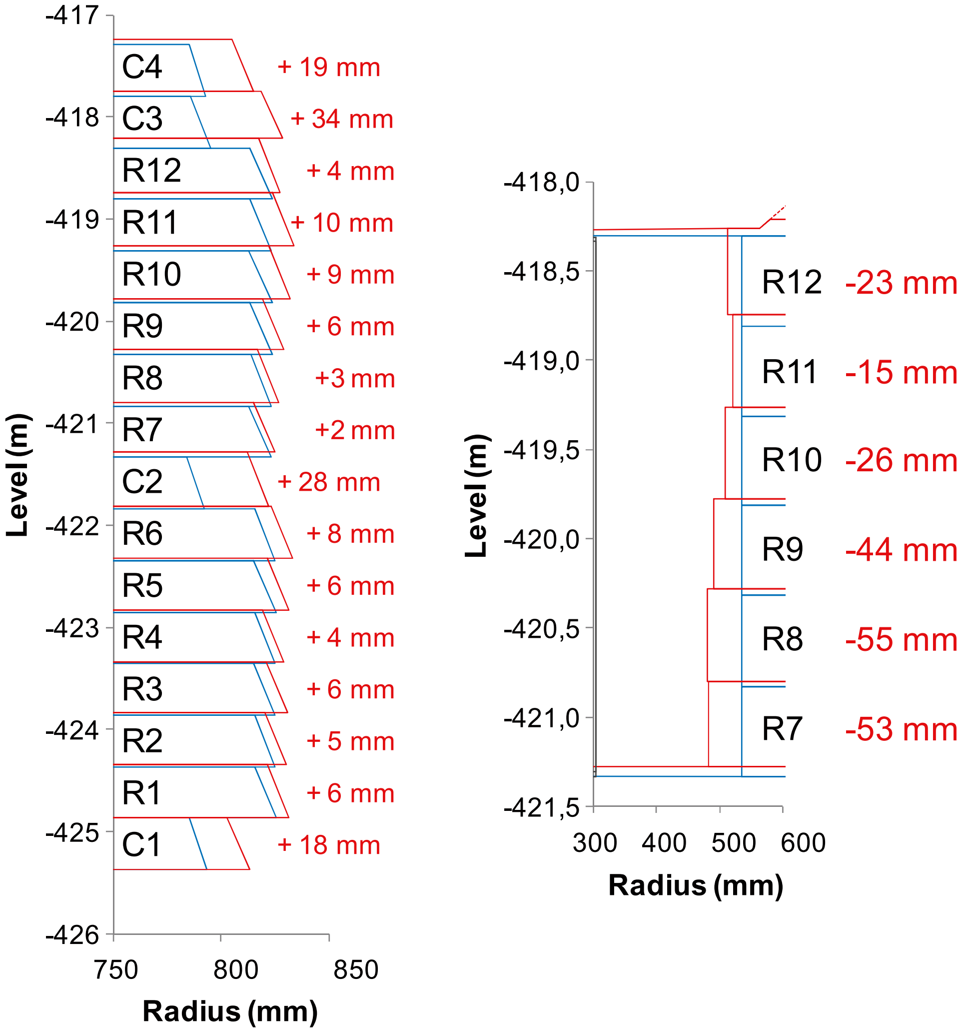

Figure 2-46. *Changes in outer radius for each block (left), and inner radius for rings in upper package (right).*

Fairly horizontal fractures were observed in virtually all blocks in the lower package, i.e. from Cylinder 2 and downwards. This affected the sampling so that the cores in almost all cases came up as two or three pieces. Attempts to map these with measurements of the depth to the fracture in the coring holes were made on two occasions: in Cylinder 2 and Cylinder 1 (see Figure 2-47 and 2-48).

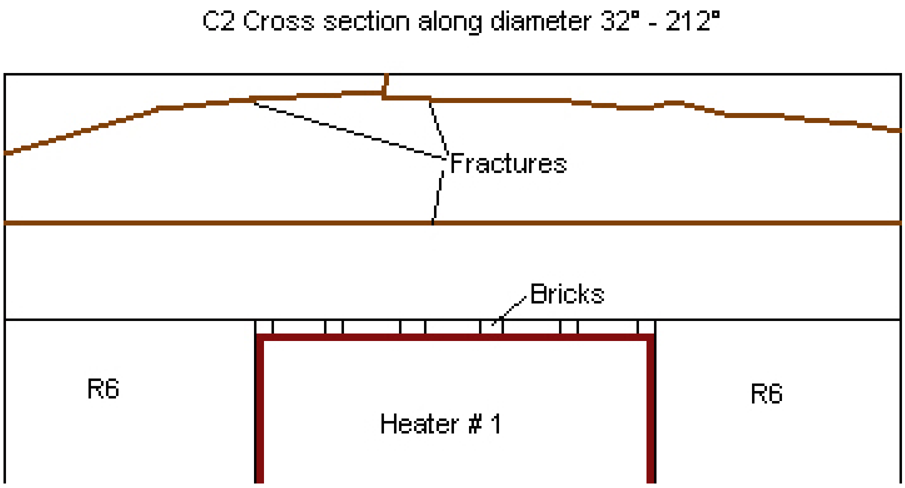

Figure 2-47. Fractures in Cylinder 2.

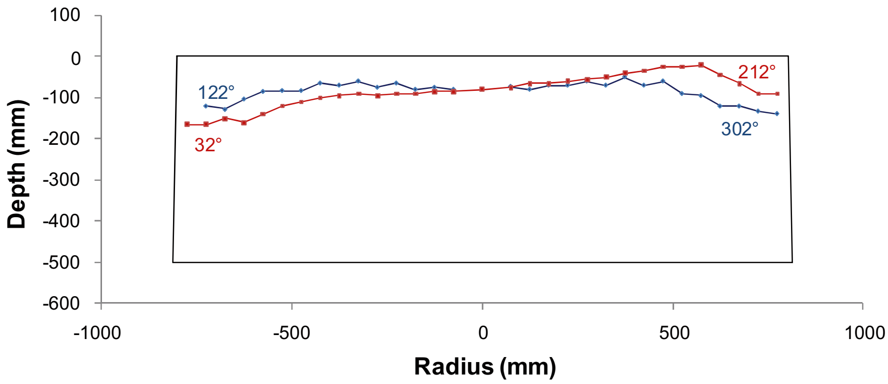

Figure 2-48. Fractures in Cylinder 1.

3 Samples from dismantling

In this chapter, all obtained samples are listed in tables (Table 3-1 to Table 3-19). The name of the individual sample is given together with the date when the sample was taken. Occasional inconsistencies and assumptions have been noted as footnotes in the bottom end of the tables.

The names of the samples include Swedish words in some cases. These words have however not been changed, and instead a small dictionary has been added at the end of the chapter.

Table 3-1. Samples taken from Cylinder 4.

C4:302:R775	05-nov	C4:32:R825	10-nov
C4:302:R675	05-nov	C4:212:R475	10-nov
C4:302:R575	05-nov	C4:212:R575	10-nov
C4:302:R475	06-nov	C4:212: R675	10-nov
C4:302:R375	06-nov	C4:32:R675	10-nov
C4:302:R275	06-nov	C4:32:R575	10-nov
C4:302:R175	06-nov	C4:32:R425	10-nov
C4:302:R75	06-nov	C4:32:R375	10-nov
C4:302:R0	06-nov	C4:32:R275	10-nov
C4:122:R125	06-nov	C4:32:R175	10-nov
C4:302:R625	09-nov	C4:32:R75	10-nov
C4:122:R225	09-nov	C4:212:R125	10-nov
C4:122:R325	09-nov	C4:212:R525	10-nov
C4:122:R425	09-nov	C4:32:R325	10-nov
C4:122:R525	09-nov	C4:212:R225	10-nov
C4:122R:625	09-nov	C4:212:R325	10-nov
C4:122R:725	09-nov	C4:212:R425	10-nov
C4:122R:775	09-nov	C4:212:R625	10-nov
C4:122R:675	09-nov	C4:212:R725	10-nov
C4:122R:575	09-nov	C4:32:R125	10-nov
C4:122:R275	09-nov	C4:32:R225	10-nov
C4:122:R175	09-nov	C4:212:R175	11-nov
C4:122:R75	09-nov	C4:212:R75	11-nov
C4:302:R725	09-nov	C4:212:R275	11-nov
C4:122:R375	09-nov	C4:212:R375	11-nov
C4:122:R475	09-nov	C4:32:R475	11-nov
C4:302:R525	09-nov	C4:32:R525	11-nov
C4:302:R425	09-nov	C4:32:R625	11-nov
C4:302:R325	09-nov	C4:32:R725	11-nov
C4:302:R225	09-nov	C4:302 Interface Bit block å pellets	12-nov
C4:302:R125	09-nov	C4:32:0–875	12-nov
C4:122:R825	10-nov	C4:32:Interface Bit block å pellets	12-nov
C4:302: R825	10-nov	C4:122: Interface Bit pellets	12-nov
C4:32:R775	10-nov	C4:118: Interface Bit pellets	12-nov
C4:212:R825	10-nov	C4:212:0–875	13-nov
C4:212:R775	10-nov	C4:212:Pellets	13-nov

Table 3-2. Samples taken from Cylinder 3.

C3:0:Mot PB 227	17-nov	C3:302:R525	20-nov
C3:0:Mot PB 229	17-nov	C3:122:R675	20-nov
C3:0:Mot PB 228	17-nov	C3:122:R725	20-nov
C3:212:R375	17-nov	C3:122:R775	20-nov
C3:32:R375	17-nov	C3:122:R575	20-nov
C3:212:R475	17-nov	C3:122:R525	20-nov
C3:32:R475	17-nov	C3:122:R625	20-nov
C3:32:R575	18-nov	C3:122:R475	23-nov
C3:32:R675	18-nov	C3:122:R425	23-nov
C3:32:R775	18-nov	C3:122:R375	23-nov
C3:32:R325	18-nov	C3:302:R675	23-nov
C3:32:R425	18-nov	C3:302:R725	23-nov
C3:32:R525	18-nov	C3:302:R625	23-nov
C3:32:R625	18-nov	C3:302:R575	23-nov
C3:32:R725	18-nov	C3:302:R375	23-nov
C3:212:R325	18-nov	C3:302:R475	23-nov
C3:32:R125	18-nov	C3:10R650	23-nov
C3:32:R225	18-nov	C3:10R400	23-nov
C3:212:R75	18-nov	C3:10R490	23-nov
C3:212:R175 *	18-nov	C3:10R440	23-nov
C3:32:R0	18-nov	C3:205R:710	23-nov
C3:32:R175	19-nov	C3:122:R825	23-nov
C3:32:R275	19-nov	C3:122:R350	23-nov
C3:WB 231	19-nov	C3:32:R810	23-nov
C3:212:R675	19-nov	C3:130R825	23-nov
C3:212:R575	19-nov	C3:60:R410	23-nov
C3:212:R275	19-nov	C3:60:R360	23-nov
C3:32:R75	19-nov	C3:60:R780	23-nov
C3:212:R175 *	19-nov	C3:60:R510	23-nov
C3:302:R805	19-nov	C3:60:R560	23-nov
C3:212:R225	19-nov	C3:60:R460	23-nov
C3:302:R775	19-nov	C3:Mot WB 232	24-nov
C3:212:R425	19-nov	C3:220:R600	24-nov
C3:212:R525	19-nov	C3:WB 233	24-nov
C3:212:R625	19-nov	C3:250 mot pellets	24-nov
C3:212:R725	19-nov	C3:302 mot pellets	24-nov
C3:275:R275	20-nov	C3:WB234	24-nov
C3:270:R275	20-nov	C3:WB235	24-nov
C3:130:R275	20-nov	C3:270 Botten	24-nov
C3:135:R275	20-nov	C3:290 Botten	24-nov
C3:90:R275	20-nov	C3:122:Pellets	24-nov
C3:225:R275	20-nov	C3:212:Pellets	25-nov
C3:60:R275	20-nov	C3:32:Pellets	25-nov
C3:EXTRA:R275	20-nov	C3:212:Kemiprov	25-nov
C3:212:R775	20-nov	C3:32:Kemiprov	25-nov
C3:302:R425	20-nov	C3:0:Överkapsel	25-nov

* Two C3:212:R175 but no C3:212:R125.

Table 3-3. Sand samples.

C3:212: Sandprov	25-nov	211:sandprov –2,75 m	01-dec
C3:32: Sandprov	25-nov	sandprov på kapsel	02-dec
C3:302:B tunga i sand	25-nov	sandprov invid kapsel	02-dec
C3:0:sand Överkapsel	25-nov	R10:180: sandprov	03-dec
R12:230: sandbentonitprov	25-nov	R9:90: sandprov	03-dec
R12:225: sandbentonitprov	25-nov	R10:270: sandprov	03-dec
R12:227: sandbentonitprov	25-nov	R10:185: sandprov	03-dec
R12:32: sandbentonitprov	26-nov	R11:170: sandprov	03-dec
R12:32: R300 sandprov	26-nov	R9:0: sandprov	03-dec
R12:32: R320 sandprov	26-nov	R9:212: sandprov	03-dec
R12:32: R350 sandprov	26-nov	R8:40: Sandprov	03-dec
R12:32: R380 sandprov	26-nov	C2:0:Bentonit sand	03-dec
R12:32: R410 sandprov	26-nov	R9: Bentonitsand skinn	15-dec
R12:32: R47 sandprov	26-nov	R8:sandprov:90	17-dec
R12:32: R490 sandprov	26-nov	R8:40: skinnsandspalt	17-dec
R11:290:R400 sandprov	26-nov	R8:180: Sandprov	17-dec
R10:270: Rsandprov	26-nov	R8:0: Sandprov	17-dec
R10:90: sandprov	26-nov	R8:212: Sandprov	17-dec
–2,2 m:0:sandprov	30-nov	R8:180: skinn mot spalt	17-dec
:32:sandprov	30-nov	R7: sandprov insida 122 grader	22-dec
–2 m:20:sandprov	30-nov	R7: sandprov insida 32 grader	22-dec
–1,8 m:35:sandprov	30-nov	R7: sandprov insida 212 grader	22-dec
Sandprov	30-nov	R7: sandprov insida 302 grader	22-dec
90:sandprov –2,9 m	01-dec	Sand-bentonit taget under Värmare 2 (toppC2)	22-dec
180:sandprov –2,3 m	01-dec	R7: Sandprov från spalt mot berg	04-jan
130:sandprov –2,3 m	01-dec		

Table 3-4. Samples taken from Ring 12.

R12:32:R525	07-dec	R12:302:R725	07-dec
R12:32:R625	07-dec	R12:302:R675	07-dec
R12:32:R725	07-dec	R12:122R825	07-dec
R12:32:R575	07-dec	R12:122R575	07-dec
R12:32:R675	07-dec	R12:122R775	07-dec
R12:32:R775	07-dec	R12:122R675	07-dec
R12:212:R830	07-dec	R12:122R725	07-dec
R12:212:R825	07-dec	R12:122R625	07-dec
R12:212:R725	07-dec	R12:302R775	07-dec
R12:212:R675	07-dec	R12:20R600	07-dec
R12:212:R775	07-dec	R12:20R650	07-dec
R12:212:R625	07-dec	R12:302:R825	07-dec
R12:212:R575	07-dec	R12:212R850 (bit)	07-dec
R12:302:R625	07-dec	R12:32 Kemi (bit)	07-dec
R12:302:R575	07-dec	R12:212 Kemi (bit)	07-dec
R12:302:R525	07-dec		

Table 3-5. Samples taken from Ring 11.

R11:212R775	08-dec	R11:122R525	08-dec
R11:212R575	08-dec	R11:122:R775B	08-dec†
R11:212R625	08-dec	R11:122:R775 *	08-dec
R11:212R675	08-dec	R11:122R625	08-dec
R11:212R725	08-dec	R11:122R675	08-dec
R11:32R775	08-dec	R11:122R775 *	08-dec
R11:32R575	08-dec	R11:122R575	08-dec
R11:32R675	08-dec	R11:302R575	08-dec
R11:32R725	08-dec	R11:302R525	08-dec
R11:32R625	08-dec	R11:302R675	08-dec
R11:32R525	08-dec	R11:302R725	08-dec
R11:20:R700	08-dec	R11:302R625	08-dec
R11:20:R750	08-dec	R11:302R775	08-dec
R11:15:R650	08-dec	R11:32:KEMI	08-dec
R11:212R525	08-dec	R11:212:KEMI	08-dec

* Two R11:122:R775 but no R11:122 725.
† Assumed.

Table 3-6. Samples taken from Ring 10.

R10:32:R775	09-dec	R10:122R675	10-dec
R10:32:R675	09-dec	R10:115R785	10-dec
R10:32:R625	09-dec	R10:302:R725	10-dec
R10:32:R725	09-dec	R10:302:R675	10-dec
R10:212:R625	09-dec	R10:302:R625	10-dec
R10:212:R675	09-dec	R10:302:R775	10-dec
R10:212:R525	09-dec	R10:302:R525	10-dec
R10:212:R725	09-dec	R10:302:R575	10-dec
R10:212:R575	09-dec	R10:300:R780	10-dec
R10:212:R775	09-dec	R10:122:R775	10-dec
R10:200R660 x-tra	09-dec	R10:122:R525	10-dec
R10:200R780 x-tra	09-dec	R10:WB 224	10-dec
R10:200R710 x-tra	09-dec	R10:WB 227	11-dec
R10:15R550 x-tra	09-dec	R10:WB 228	11-dec
R10:32:R600	09-dec	R10:surface 302	11-dec
R10:32:R575	09-dec	R10:WB 226	11-dec
R10:15R600	09-dec	R10:surface 212	11-dec
R10:15:R650	09-dec	R10:KEMI 212	11-dec
R10:20:R775	09-dec	R10:KEMI 32	11-dec
R10:20R700	09-dec	R10:WB 230	11-dec
R10:122:R575	10-dec	R10:122 surface	11-dec
R10:122:R625	10-dec	R10:WB 229	11-dec
R10:122:R725	10-dec		

Table 3-7. Samples taken from Ring 9.

R9:180:Referensprov	03-dec	R9:0R680	14-dec
R9:10R750	14-dec	R9:10R730	14-dec
R9:PB 223	14-dec	R9:122R785	14-dec
R9:Peek kopp 125	14-dec	R9:10R650	14-dec
R9:PB 221	14-dec	R9:0R780	14-dec
R9:PB 218	14-dec	R9:175R650	14-dec
R9:212R575	14-dec	R9:302R700	14-dec
R9:212R625	14-dec	R9:302R750	14-dec
R9:212R675	14-dec	R9:302R800	14-dec
R9:212R775	14-dec	R9:302R650	14-dec
R9:212R725	14-dec	R9:302R600	14-dec
R9:34R780	14-dec	R9:PB 222	15-dec
R9:34R745	14-dec	R9:122:Surface	15-dec
R9:34R770	14-dec	R9:UB207	15-dec
R9:32R815	14-dec	R9:PB 224	15-dec
R9:30R810	14-dec	R9:PB 219	15-dec
R9:34R800	14-dec	R9:PB 220	15-dec
R9:34R710	14-dec	R9:PB 206	15-dec
R9:195R785	14-dec	R9:302:Surface	15-dec
R9:190R550	14-dec	R9:212:Surface	15-dec
R9:122R575	14-dec	R9:PB 225	15-dec
R9:122R675	14-dec	R9:UB 208	15-dec
R9:122R625	14-dec	R9:212:KEMI	15-dec
R9:122R775	14-dec	R9:0–10:KEMI	15-dec
R9:150R770	14-dec	R9 bentonit (skin) från utkant ring mot spalt taget i olika riktningar	15-dec

Table 3-8. Samples taken from Ring 8.

R8:40:Bentonit skjuvad	03-dec	R8:190:600	16-dec
R8:41:Bentonit skjuvad	03-dec	R8:212:545	16-dec
R8:42:Bentonit	03-dec	R8:302:640	16-dec
R8:212:725	16-dec	R8:302:650	16-dec
R8:32:800	16-dec	R8:302:690	16-dec
R8:32:760	16-dec	R8:302:700	16-dec
R8:32:700	16-dec	R8:212:775	16-dec†
R8:212:675	16-dec	R8:302:750	16-dec
R8:212:625	16-dec	R8:302:770	16-dec
R8:212:575	16-dec	R8:180:615	16-dec
R8:190:790	16-dec	R8:112:795	16-dec
R8:190:525	16-dec	R8:112:770	16-dec
R8:190:690	16-dec	R8:100:surface	17-dec
R8:190:550	16-dec	R8:212 KEMI	17-dec

† Assumed.

Table 3-9. Samples taken from Ring 7.

R7:32:525	18-dec	R7:122R575	21-dec
R7:32:R800	18-dec	R7:122R625	21-dec
R7:10:R750	18-dec	R7:122R675	21-dec
R7:5:R600	18-dec	R7:122R725	21-dec
R7:0:540	18-dec	R7:122R775	21-dec
R7:32:675	18-dec	R7:122R820	21-dec
R7:32:580	18-dec	R7:302R825	22-dec
R7:32:760	18-dec	R7:302R775	22-dec
R7:32:625	18-dec	R7:302R725	22-dec
R7:32:810	18-dec	R7:302R675	22-dec
R7:32:775	18-dec	R7:302R625	22-dec
R7:212R525	21-dec	R7:285R575	22-dec
R7:212R575	21-dec	R7:275R525	22-dec
R7:212R625	21-dec	R7:Kemiprov 212 grader	22-dec
R7:212R675	21-dec	R:7 Ändprov 212grader	22-dec
R7:212R725	21-dec	R:7 Ändprov 122grader	22-dec
R7:212R775	21-dec	R:7 Ändprov 302grader	22-dec
R7:212R820	21-dec	R:7 10 KEMI	22-dec
R7:122R525	21-dec	R:7 Ändprov 32grader	23-dec

Table 3-10. Samples taken from Cylinder 2.

C2:302:R275	20-jan	C2:212:R425	21-jan
C2:212:275	20-jan	C2:212:R475	21-jan
C2:122:R275	20-jan	C2:32:R525	21-jan
C2:32:R275	20-jan	C2:32:R475	21-jan
C2:230R275	20-jan	C2:32:R425	21-jan
C2:240R275	20-jan	C2:32:R375	21-jan
C2:160R275	20-jan	C2:212:R775 *	21-jan
C2:320R275	20-jan	C2:212:R675 *	21-jan
C2:255R275	20-jan	C2:32:R0	21-jan
C2:195R275	20-jan	C2:212:R75	21-jan
C2:290R275	20-jan	C2:212:R125	21-jan
C2:280R275	20-jan	C2:212:R175	21-jan
C2:115R275	20-jan	C2:212:R225	21-jan
C2:180R275	20-jan	C2:32:R75	21-jan
C2:270R275	20-jan	C2:32:R175	21-jan
C2:145R275	20-jan	C2:32:R225	21-jan
C2:95:R275	20-jan	C2:32:R125	21-jan
C2:165R275	20-jan	C2:32:R675	22-jan
C2:50R275	20-jan	C2:32:R575	22-jan
C2:20:R275	20-jan	C2:180R350	22-jan
C2:40R275	20-jan	C2:170R340	22-jan
C2:335:R275	20-jan	C2:40R625	22-jan
C2:350:R275	20-jan	C2:32:R625	22-jan
C2:80R275	20-jan	C2:175R545	22-jan
C2:60R276	20-jan	C2:175R485	22-jan
C2:70R275	20-jan	C2:195R600	22-jan
C2:212:R375	21-jan	C2:195R655	22-jan
C2:212:R725 *	21-jan	C2:32:R725	22-jan
C2:212:R625 *	21-jan	C2:32:R325	25-jan

* Two C2:212:R625/675/725/775 but no C2:122:R625/675/725/775.

Table 3-11. Samples taken from Cylinder 2 (cont.)

C2:350:R330	25-jan	C2:210:R250	27-jan
C2:355:R380	25-jan	C2:212R200	27-jan
C2:0:R430	25-jan	C2:212R260	27-jan
C2:5:R480	25-jan	C2:60:R275	27-jan
C2:8:R530	25-jan	C2:71:R275	27-jan
C2:195:R700	25-jan	C2:80:R275	27-jan
C2:175:R485	25-jan	C2:95:R275	27-jan
C2:195:R750	25-jan	C2:20:R275	27-jan
C2:212:R575	25-jan	C2:355:R276	27-jan
C2:212:R525	25-jan	C2:12:R275	27-jan
C2:302:R575	25-jan	C2:350:R275	27-jan
C2:302:R525	25-jan	C2:340:R275	27-jan
C2:302:R475	25-jan	C2:335:R275	27-jan
C2:212:R725 *	25-jan	C2:302R275	27-jan
C2:212:R675 *	25-jan	C2:300:R276	27-jan
C2:212:R775 *	25-jan	C2:260:R275	27-jan
C2:212R775 x-tra	26-jan	C2:240:R275	27-jan
C2:195:R775 x-tra	26-jan	C2:250:R276	27-jan
C2:302R425	26-jan	Bit från fyllning mellan C2 och värmare 1	27-jan
C2:302R725	26-jan	C2:122R275	27-jan
C2:302R675	26-jan	C2:123:R275	27-jan
C2:212R625 *	26-jan	C2:140:R275	27-jan
C2:302R625	26-jan	Bit från fyllning mellan C2 och värmare 1	27-jan
C2:10:R725	26-jan	C2:150:R275	27-jan
C2:10:R800	26-jan	C2: okänd radie och riktning	27-jan
C2:Centrumbit över kapsel 0–300 mm ner	26-jan	Bitar från fyllning mellan C2 och värmare	27-jan
C2:212:kemi 300–500 mm	26-jan	C2: bit från underkant	27-jan
C2:122:R525	26-jan	C2 bit från fyllning mellan fyllningen och värmare 1	27-jan
C2:122:R575	26-jan	C2:PB 216	27-jan
C2:122:R475	26-jan	C2:122:surface	27-jan
C2:122:R325	26-jan	C2:PB 214	27-jan
C2:122:R375	26-jan	C2:PB 215	27-jan
C2:122:R425	26-jan	C2:32 KEMI	27-jan
C2:302R750	26-jan	C2:302:surface	27-jan
C2:302R375	26-jan	C2:212:surface	27-jan
C2:302R350	26-jan	C2:32:surface	27-jan
C2:212R330	26-jan	C2:212 kemi	27-jan
C2:298:R750	26-jan	C2:32 kemi	28-jan
C2:32R275	27-jan	C2:32:surface 300–500 mm	28-jan
C2:32R210	27-jan	C2:302:surface 300–500 mm	28-jan
C2:32R255	27-jan	C2:122:surface 300–500 mm	28-jan
C2:30:R210	27-jan	C2:212:surface 300–500 mm	28-dec
C2:210:R200	27-jan	Bitar från fyllning mellan C2 och värmare 1	28-jan

* Two C2:212:R625/675/725/775 but no C2:122:R625/675/725/775.

Table 3-12. Samples taken from Ring 6.

R6:212R425	03-feb	R6:192R650	04-feb
R6:212R725	03-feb	R6:190R525	04-feb
R6:212R475	03-feb	R6:190R575	04-feb
R6:212R525	03-feb	R6:12R775	04-feb
R6:212R625	03-feb	R6:0R500	04-feb
R6:32R375	03-feb	R6:3R550	04-feb
R6:32R475	03-feb	R6:5R625	04-feb
R6:32R575	03-feb	R6:302R725	05-feb
R6:32R675	03-feb	R6:302R525	05-feb
R6:32R725	03-feb	R6:302R625	05-feb
R6:32R625	03-feb	R6:302R475	05-feb
R6:212R375	03-feb	R6:302R425	05-feb
R6:212R775	03-feb	R6:302R575	05-feb
R6:212R675	03-feb	R6:302R775	08-feb
R6:212R575	03-feb	R6:302R675	08-feb
R6:32R775	03-feb	R6:122R375	08-feb
R6:32R425	03-feb	R6:122R425	08-feb
R6:32R525	03-feb	R6:122R675	08-feb
R6:38R725	03-feb	R6:122R475	08-feb
R6:40R760	03-feb	R6:122R625	08-feb
R6:195R775	03-feb	R6:122R525	08-feb
R6:180R375	04-feb	R6:122R575	08-feb
R6:11R725	04-feb	R6:122R775	08-feb
R6:9R685	04-feb	R6:32 grader surface mot spalt	09-feb
R6:185R400	04-feb	R6:212 surface mot sandspalt	10-feb
R6:185R450	04-feb	R6:212 surface mot Kapsel ner mot R5	10-feb
R6:220R775	04-feb	R6:212 surface mot Kapsel ner mot R5 Kemi mitt	10-feb
R6:195R725	04-feb	R6:212 surface Kemi	10-feb
R6:215R725	04-feb		

Table 3-13. Samples taken from Ring 5.

R5:32:R675	11-feb	R5:32:R425	11-feb
R5:32:R475	11-feb	R5:180R470	12-feb
R5:32R375	11-feb	R5:185R525	12-feb
R5:32R575	11-feb	R5:165R365	12-feb
R5:212R375	11-feb	R5:172R415	12-feb
R5:212R425	11-feb	R5:122R350	12-feb
R5:212R475	11-feb	R5:195R770	12-feb
R5:212R525	11-feb	R5:195R710	12-feb
R5:212R350	11-feb	R5:195R650	12-feb
R5:212R575	11-feb	R5:190R585	12-feb
R5:212R625	11-feb	R5:122R425	15-feb
R5:212R675	11-feb	R5:122R375	15-feb
R5:212R725	11-feb	R5:122R475	15-feb
R5:212R775	11-feb	R5:122R525	15-feb
R5:212R825	11-feb	R5:122R625	15-feb
R5:32:R345	11-feb	R5:122R575	15-feb
R5:34R775	11-feb	R5:122R725	15-feb
R5:32R725	11-feb	R5:122R675	15-feb
R5:32:R740	11-feb	R5:122R775	15-feb
R5:32:R775	11-feb	R5:302R725	15-feb
R5:32:R525	11-feb	R5:302R625	15-feb
R5:32R625	11-feb	R5:302R525	15-feb

Table 3-14. Samples taken from Ring 5 (cont.)

R5:302R475	15-feb	R5: surface 40–90 bit mot kapsel	16-feb
R5:302R425	15-feb	R5: surface 40–90 Övrebit mot kapsel	16-feb
R5:302R575	15-feb	R5:surface 270–302 Övre bit mot kapsel	17-feb
R5:302R375	15-feb	R5:surface 270–302 Mitt bit mot kapsel	17-feb
R5:302R350	15-feb	R5:surface 270–302 Nedre bit mot kapsel	17-feb
R5:302R775	16-feb	R5:surface 212–260 Övre bit mot kapsel	17-feb
R5:302R675	16-feb	R5:surface 212–300 Nedre bit mot kapsel	17-feb
R5:122–180 Övrebit mot kapsel	16-feb	R5:302 surface mot sandspalt	17-feb
R5 bit2: 122–180 Övrebit mot kapsel	16-feb	R5:32 surface mot sandspalt	17-feb
R5 bit2: 122–180 Mittrebit mot kapsel	16-feb	R5:212 surface mot sandspalt	17-feb
R5:bit2: 122–180 Nedrebit mot kapsel	16-feb	R5:Surface Kemi 212	17-feb
R5:90–122 Kemi bit mot kapsel	16-feb	R5:surface Kemi 32	18-feb

Table 3-15. Samples taken from Ring 4.

R4:212:R775	22-feb	R4:122:R675	25-feb
R4:32:R575	22-feb	R4:122:R625	25-feb
R4:32:R475	22-feb	R4:122:R575	25-feb
R4:32:R675	22-feb	R4:122:R475	25-feb
R4:212:R725	22-feb	R4:122:R525	25-feb
R4:212:R625	22-feb	R4:32–122 Övre	01-mar
R4:212:R575	22-feb	R4:32–122 Mittre	01-mar
R4:32:R625	22-feb	R4:32–122 Botten	01-mar
R4:32:R775	22-feb	R4:32–122 Mittre	01-mar
R4:32:R525	22-feb	R4:122–167 Botten	01-mar
R4:32:R725	22-feb	R4:122–270 Mittre	01-mar
R4:32:R600	23-feb	R4:122:Järn Mittre	01-mar
R4:32:R425	23-feb	R4:250:mot kapsel Mittre	01-mar
R4:32:R375	23-feb	R4:212–302:mot kapsel Övredel	01-mar
R4:212:R375	23-feb	R4:212–302:mot kapsel Nedre del	01-mar
R4:212:R475	23-feb	R4:212–302:mot kapsel Nedre del	01-mar
R4:212:R525	23-feb	R4:0–302:mot kapsel Övre del	01-mar
R4:212:R425	23-feb	R4:0–302:mot kapsel Botten del	01-mar
R4:190:R775	23-feb	R4:0–302:mot kapsel Mittdel:2	01-mar
R4:32:R780	23-feb	R4:0–302:mot kapsel Mittdel:1	01-mar
R4:302:R525	24-feb	R4:0–302:mot kapsel Bitar	01-mar
R4:302:R725	24-feb	R4:212:KEMI Botten	01-mar
R4:302:R775	24-feb	R4:212:Surface	01-mar
R4:302:R375 *	24-feb	R4:212:KEMI 0–370 mm	01-mar
R4:302:R425	24-feb	R4:212:KEMI 0–370 mm mot kapsel	01-mar
R4:302:R7675 †	24-feb	R4:122:Surface	01-mar
R4:302:R7625 †	24-feb	R4:32:Surface	01-mar
R4:302:R575	24-feb	R4:WB 209	02-mar
R4:302:R375 *	24-feb	R4:302 surface	02-mar
R4:122:R375	24-feb	R4:325 WB211	02-mar
R4:122:R425	24-feb	R4:315 WB 210	02-mar
R4:212:R675	24-feb	R4:32 Kemi Prov	02-mar
R4:122:R775	25-feb	R4:WB 213	02-mar
R4:122:R725	25-feb		

* Two R4:302:R375 but no R4:302:R475.
† Radii erroneous but interpretable.

Table 3-16. Samples taken from Ring 3.

R3:32:R575	03-mar	R3:302:R525	05-mar
R3:32:R600	03-mar	R3:302:R375	05-mar
R3:32:R425	03-mar	R3:302:R725	05-mar
R3:32:R525	03-mar	R3:302:R775	05-mar
R3:32:R355	03-mar	R3:302:R575	05-mar
R3:32:R475	03-mar	R3:302:R475	05-mar
R3:212:R775	03-mar	R3:302:R675	05-mar
R3:212:R425 *	03-mar	R3:Surface:0–302	10-mar
R3:212:R525	03-mar	R3:Surface:0–302 70–500 mm	10-mar
R3:212:R575	03-mar	R3:Surface mot kapsel 212–302 del 1	10-mar
R3:212:R625	03-mar	R3:Surface mot kapsel 212–302 del 2	10-mar
R3:212:R725	03-mar	R3:Surface:mot kapsel 212–302 del 3	10-mar
R3:212:R675	03-mar	R3:PB 204	10-mar
R3:212:R425 *	04-mar	R3:Surface:kapsel 122–212 del 1	10-mar
R3:212:R385	04-mar	R3:Surface:kapsel 122–212 del 2	10-mar
R3:32:R775	04-mar	R3:Surface:kapsel 122 0–500 mm	10-mar
R3:32:R675	04-mar	R3:PB 210	10-mar
R3:32:R725	04-mar	R3:PB 211	10-mar
R3:32:R625	04-mar	R3:Surface 122 mot sand	10-mar
R3:PB 208	04-mar	R3:Surface32 mot Kapsel	10-mar
R3:122:R575	04-mar	R3:Surface 212–302 del 1	10-mar
R3:122:R625	04-mar	R3:Surface 212–302 del 2	10-mar
R3:122:R775	04-mar	R3:Surface 60–90 0–200 mm	10-mar
R3:122:R675	04-mar	R3:Surface 60–90 200–500 mm	10-mar
R3:122:R525	04-mar	R3:Sand 90	10-mar
R3:122:R475	04-mar	R3:PB 207	10-mar
R3:122:R725	04-mar	R3:Surface:32	10-mar
R3:122:R425	04-mar	R3:surface 302	11-mar
R3:122:R375	04-mar	R3:32 KEMI-PROV	11-mar
R3:302:R625	04-mar	R3:212 KEMI-PROV	11-mar
R3:302:R425	04-mar		

Two R3:212:R425 but no R3:212:R475.

Table 3-17. Samples taken from Ring 2.

R2:212:R475	15-mar	R2:302:R375	16-mar
R2:32:R675	15-mar	R2:302:R775	16-mar
R2:32:R775	15-mar	R2:302:R675	16-mar
R2:32:R725	15-mar	R2:302:R730	16-mar
R2:32:R625	15-mar	R2:302:R700	16-mar
R2:32:R425	15-mar	R2:302:R625	16-mar
R2:32:R525	15-mar	R2:302:R725	16-mar
R2:32:R475	15-mar	R2:122:R775	16-mar
R2:32:R375	15-mar	R2:122:R725	16-mar
R2:32:R575	15-mar	R2:122:R575	16-mar
R2:212:R425	15-mar	R2:122:R525	16-mar
R2:212:R625	15-mar	R2:122:R625	16-mar
R2:212:R525	15-mar	R2:122:R675	16-mar
R2:212:R725	15-mar	R2:122:R425	16-mar
R2:212:R375	15-mar	R2:118:R760	17-mar
R2:212:R575	15-mar	R2:Surface:302–0	18-mar
R2:212:R775	15-mar	R2:Surface:302	18-mar
R2:212:R675	15-mar	R2:Surface:212–302	18-mar
R2:230:R775	15-mar	R2:Surface:212	18-mar
R2:32:R730	15-mar	R2:Surface:105	18-mar
R2:32:R600	15-mar	R2:Surface:32–85	18-mar
R2:122:R475	16-mar	R2:Surface:32–122	18-mar
R2:122:R375	16-mar	R2:Surface:122	19-mar
R2:302:R570	16-mar	R2:Surface:32	19-mar
R2:302:R440	16-mar	R2:sandprov	19-mar
R2:302:R475	16-mar	R2:212 KEMI	19-mar
R2:302:R535	16-mar	R2:32 KEMI	19-mar
R2:302:R425	16-mar		

Table 3-18. Samples taken from Ring 1.

R1:32:R475	22-mar	R1:302:R575	24-mar
R1:212:R475	22-mar	R1:302:R675	25-mar
R1:32:R675	24-mar	R1:302:R725	25-mar
R1:32:R750	24-mar	R1:302:R775	25-mar
R1:32:R725	24-mar	R1:32:Surface	30-mar
R1:32:R575	24-mar	R1:32:KEMI	30-mar
R1:32:R625	24-mar	R1:302:Surface	30-mar
R1:32:R775	24-mar	R1:212:Surface	30-mar
R1:103:R780	24-mar	R1:212:KEMI	30-mar
R1:122:R725	24-mar	R1:302:Skinn	30-mar
R1:122:R625	24-mar	R1:Sand	30-mar
R1:122:R575	24-mar	R1:180–200 Mot kapsel	22-apr
R1:122:R675	24-mar	R1:60–80 Mot kapsel	22-apr
R1:122:R775	24-mar	R1:190–200 Mot kapsel (liten bit i botten)	22-apr
R1:122:Surface	24-mar	R1:20–30 Mot kapsel (småbitar mot botten)	22-apr
R1:212:R575	24-mar	R1:302 Mot kapsel (mot botten)	22-apr
R1:212:R675	24-mar	R1:32 Mot kapsel (mot botten)	22-apr
R1:212:R625	24-mar	R1:200–230 Mot kapsel (mot botten)	22-apr
R1:212:R775	24-mar	R1:302 Liten bit mot kapsel (mot botten), 1	22-apr
R1:212:R725	24-mar	R1:302 Liten bit mot kapsel (mot botten), 2	22-apr
R1:302:R625	24-mar	R1:32 Bit mot kapsel	22-apr

Table 3-19. Samples taken from Cylinder 1.

C1:32:R225	06-apr	C1:122:R125	08-apr
C1:32:R375	06-apr	C1:122:R225	08-apr
C1:32:R175	06-apr	C1:122:R75	08-apr
C1:32:R75	06-apr	C1:122:R425	08-apr
C1:32:R475	06-apr	C1:122:R775	08-apr
C1:32:R275	06-apr	C1:122:R525	08-apr
C1:32:RO	06-apr	C1:122:R725	08-apr
C1:212:R75	06-apr	C1:122:R625	08-apr
C1:212:R175	06-apr	C1:302:R675	08-apr
C1:212:R275	06-apr	C1:302:R275	08-apr
C1:212:R375	06-apr	C1:302:R575	08-apr
C1:212:R575	07-apr	C1:302:R725	08-apr
C1:212:R625	07-apr	C1:302:R75	12-apr
C1:212:R725	07-apr	C1:302:R125	12-apr
C1:212:R775	07-apr	C1:302:R175	12-apr
C1:212:R675	07-apr	C1:212:R750	12-apr
C1:212:R475	07-apr	C1:302:R225	12-apr
C1:32:R725	07-apr	C1:122:R575	12-apr
C1:32:R125	07-apr	C1:122:R475	12-apr
C1:32:R425	07-apr	C1:122:R375	12-apr
C1:32:R525	07-apr	C1:122:R675	12-apr
C1:32:R225	06-apr	C1:122:R275	12-apr
C1:32:R375	06-apr	C1:302:R765	12-apr
C1:32:R175	06-apr	C1:130:R775	12-apr
C1:32:R75	06-apr	C1:302:R775	12-apr
C1:32:R475	06-apr	C1:38:R775	12-apr
C1:32:R275	06-apr	C1:32:surface mot sand	13-apr
C1:32:RO	06-apr	C1:302:surface mot sand	13-apr
C1:212:R75	06-apr	C1:212:surface mot sand	13-apr
C1:212:R175	06-apr	C1:122:surface mot sand	13-apr
C1:212:R275	06-apr	C1:270:Extra Bentonit-betong	14-apr
C1:212:R375	06-apr	C1:50:Extra Bentonit-betong	16-apr
C1:212:R575	07-apr	C1:350:Extra Bentonit-betong	16-apr
C1:212:R625	07-apr	C1:0:Extra Bentonit-betong	16-apr
C1:212:R725	07-apr	C1:PB201+PB202	20-apr
C1:212:R775	07-apr	C1:212:Kemi	20-apr
C1:212:R675	07-apr	C1:32:Kemi	20-apr
C1:302:R325	08-apr	SANDPROV C1-BERG	21-apr
C1:122:R175	08-apr	C1:WB204	21-apr

Small dictionary for sample names:

bentonit = bentonite; berg = rock; betong = concrete; bit = piece; botten = bottom; centrum = centre; från = from; fyllning = filling; grader = degrees; i = in; insida = inside; invid = at; kapsel = canister; kemi = chemistry; kopp = cup; liten = small; mellan = between; mitt = middle; mittre = middle; mot = towards; ner = down; nedre = lower part; och = and; okänd = unknown; olika = different; prov = sample; på = on; referens = reference; riktning(ar) = direction(s); sand = sand; skinn = skin; skjuvad = sheared; spalt = slot; taget = taken; tunga = tong; under = under; underkant = lower part; utkant = periphery; värmare = heater; x-tra = extra; å (in this case a short form) = and; över = over; övre = upper.

4 Gas sampling of Heater I

The gas inside Heater I was sampled and analyzed in order to determine the content of hydrogen and other gases. A significant content of hydrogen gas could be hazardous for the preparation of the undisturbed iron bentonite sample (see section 2.7).

Before the gas sampling, the heater was pressurized in order to build up an overpressure. The pressure in both the heater and the nitrogen gas tube was measured before and after the pressurization (Figure 4-1). However, the initial pressure in the heater was below atmospheric and could therefore only be evaluated from the other measurements and the volumes.

The volume of the heater and the nitrogen gas tube was 546 and 20 litres, respectively. The pressure in gas tube reduced from 200 to 155 bar during the pressurization. The pressure in the heater was at the same time 2.4 bar (abs). This would imply that the original pressure in the heater was 0.75 bar, and that the extent of dissolution would in that case be 3.2 (Figure 4-2).

During the course of the pressurization, an intermediate measurement was made at which the pressures in the tube and the heater was 170 and 1.7 bar respectively. This is slightly below the evaluated pressure evolution in Figure 4-3.

The results from the gas analysis are shown in Table 4-1. If the nitrogen and the oxygen are assumed to be added during the pressurization then the extent of dissolution would be 3.4. The analysis shows that the final concentration of hydrogen was 2.6%. With an extent of dissolution of 3.2–3.4 then the original hydrogen concentration would be approximately 8–9%.

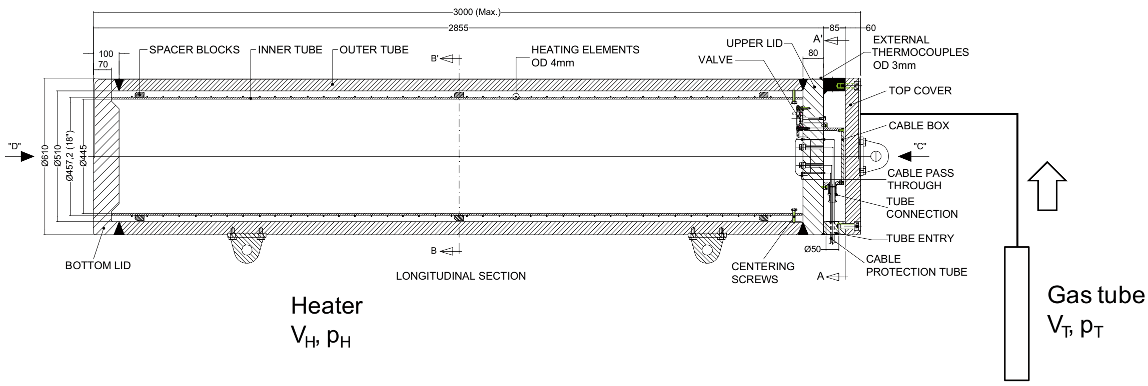

Figure 4-1. *Pressurization of Heater I.*

Volume of heater:

Diameter (m): $d_H := 0.510$

Length (m): $l_H := 2.855 - 0.1 - 0.08$

Volume (m^3): $V_H := \pi \cdot \left(\frac{d_H}{2}\right)^2 \cdot l_H$ $\quad \boxed{V_H = 0.546}$

Initial pressure tube (bar): $p_{Ti} := 200$

Final pressure tube (bar): $p_{Tf} := 155$

Final pressure heater (bar): $p_{Hf} := 2.4$

Initial pressure heater (bar): $p_{Hi} := p_{Hf} - \frac{V_T}{V_H} \cdot (p_{Ti} - p_{Tf})$ $\quad \boxed{p_{Hi} = 0.753}$

Extent of dissolution (-): $\boxed{\frac{p_{Hf}}{p_{Hi}} = 3.187}$

Volume of gas tube:

Volume (m^3): $\boxed{V_T := 0.020}$

Figure 4-2. *Evaluation of inital heater gas pressure and extent of dissolution.*

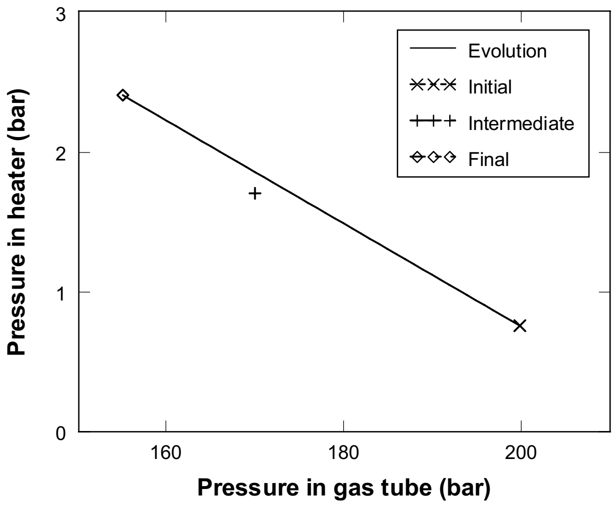

Figure 4-3. *Evolution of pressures in gas tube and heater during pressurization.*

Table 4-1. Results from gas analysis.

Gas		Gas (ppm)
Hydrogen	(H_2)	26,000
Helium	(He)	269,000
Argon	(Ar)	4,700
Oxygen	(O_2)	5,260
Nitrogen	(N_2)	725,000
Carbon monoxide	(CO)	128
Carbon dioxide	(CO_2)	687
Methane	(CH_4)	24.0
Ethane	(C_2H_6)	1.42
Ethylene	(C_2H_4)	13.8
Ethylene	(C_2H_2)	< 0.40
Propane	(C_3H_8)	9.14
Propylene	(C_3H_6)	< 0.40
Propyne	(C_3H_3)	<0.40
	Σ	1,030,000

5 Identification of instruments

In this chapter, the identification and positioning of the sensors are listed in tables (Table 5-1 to 5-7).

Positions are given as the azimuth and the radius. Corresponding axial coordinates would require that individual levelling results would be taken into account and this has not been done. Still, no inconsistencies have in general been found concerning the axial coordinate, except in one case: PB226 in Ring 9 which was found to be located approximately 1 m below the previously stated level, i.e. it was actually located on the outside of Ring 7. It should also be mentioned that six thermocouples in Cylinder 2 were not included in the documentation during the dismantling (see Table 5-4) and the positions of these have therefore not been checked.

Table 5-1. Sensors of Cylinder 3.

Mark	Block	Instrument position at installation α degree	r mm	Z mm	Fabricate	Measured position at dismantling α degree	r mm
TB276	Cyl. 3	90	150	7,524	Pentronic	85	150
TB277	Cyl. 3	95	360	7,524	Pentronic	95	365
TB278	Cyl. 3	85	400	7,524	Pentronic	85	405
TB279	Cyl. 3	95	440	7,524	Pentronic	95	445
TB280	Cyl. 3	85	480	7,524	Pentronic	85	490
TB281	Cyl. 3	95	520	7,524	Pentronic	95	530
TB282	Cyl. 3	85	560	7,524	Pentronic	85	525
TB283	Cyl. 3	95	600	7,524	Pentronic	95	610
TB284	Cyl. 3	85	640	7,524	Pentronic	85	655
TB285	Cyl. 3	95	680	7,524	Pentronic	95	694
TB286	Cyl. 3	85	720	7,524	Pentronic	85	
TB287	Cyl. 3	95	760	7,524	Pentronic	95	775
TB288	Cyl. 3	85	800	7,524	Pentronic	85	825
TB289	Cyl. 3	95	825	7,524	Pentronic	95	825
PB227	Cyl. 3	340	635	7,574	Geokon	340	635
PB228	Cyl. 3	0	635	7,524	Geokon	0	635
PB229	Cyl. 3	20	635	7,524	Geokon	20	635
WB231	Cyl.3	180	420	7,374	Rotronic	180	450
WB232	Cyl.3	225	635	7,374	Vaisala	225	693
WB233	Cyl.3	235	635	7,374	Wescor	235	685
WB234	Cyl.3	270	785	7,374	Rotronic	270	805
WB235	Cyl.3	280	785	7,374	Wescor	280	780

Table 5-2. Sensors of Ring 10 and 9.

Mark	Block	Instrument position at installation			Fabricate	Measured position at dismantling	
		α degree	r mm	Z mm		α degree	r mm
TB254	R10	~90	343	6,056	Pentronic	90	343
TB255	R10	~90	400	6,056	Pentronic	90	400
TB256	R10	~90	463	6,056	Pentronic	90	463
TB257	R10	97.5	540	6,006	Pentronic	97.5	540
TB258	R10	92.5	555	6,006	Pentronic	92.5	555
TB259	R10	87.5	570	6,006	Pentronic	87.5	570
TB260	R10	82.5	585	6,006	Pentronic	82.5	585
TB261	R10	97.5	600	6,006	Pentronic	97.5	600
TB262	R10	92.5	615	6,006	Pentronic	92.5	615
TB263	R10	87.5	630	6,006	Pentronic	87.5	630
TB264	R10	82.5	645	6,006	Pentronic	82.5	645
TB265	R10	97.5	660	6,006	Pentronic	97.5	660
TB266	R10	92.5	675	6,006	Pentronic	92.5	675
TB267	R10	87.5	690	6,006	Pentronic	87.5	690
TB268	R10	82.5	705	6,006	Pentronic	82.5	705
TB269	R10	97.5	720	6,006	Pentronic	97.5	720
TB270	R10	92.5	735	6,006	Pentronic	92.5	735
TB271	R10	87.5	750	6,006	Pentronic	87.5	750
TB272	R10	82.5	765	6,006	Pentronic	82.5	765
TB273	R10	97.5	780	6,006	Pentronic	97.5	780
TB274	R10	92.5	795	6,006	Pentronic	92.5	795
TB275	R10	87.5	810	6,006	Pentronic	87.5	810
WS222	R10	135	525	5,806	Vaisala	135	525
WB223	R10	180	585	5,806	Rotronic	180	585
WB224	R10	225	635	5,806	Vaisala	225	635
WB225	R10	270	685	5,806	Rotronic	270	685
WB226	R10	280	685	5,806	Wescor	280	685
WB227	R10	315	735	5,806	Vaisala	315	735
WB228	R10	325	735	5,806	Wescor	325	735
WB229	R10	0	785	5,806	Rotronic	0	785
WB230	R10	10	785	5,806	Wescor	10	785
PB217	R9	270	535	5,319	Geokon	270	535
PB218	R9	340	635	5,554	Geokon	340	635
PB219	R9	0	635	5,504	Geokon	0	635
PB220	R9	20	635	5,504	Geokon	20	635
PB221	R9	70	710	5,554	Geokon	70	710
PB222	R9	110	710	5,504	Geokon	120	710
PB223	R9	160	745	5,554	Geokon	160	745
PB224	R9	180	770	5,504	Geokon	180	770
PB225	R9	200	740	5,504	Geokon	220	740
PB226	R9	270	875	5,450	Geokon	270	875
PB231	R9	180	535	5,504	DBE	180	535

Table 5-3. Sensors of Ring 9.

Mark	Block	Instrument position at installation α degree	r mm	Z mm	Fabricate	Measured position at dismantling α degree	r mm
US205	R9	270	510	5,304	Geokon	270	510
UB206	R9	315	635	5,304	Geokon	320	640
UB207	R9	90	710	5,304	Geokon	90	710
UB208	R9	225	785	5,304	Geokon	225	785
UB210	R9	150	510	5,304	DBE	150	510
CS202	R9	328	505	5,304	CT	328	505
CS203	R9	135	505	5,304	CT	135	505
CB204	R9	45	625	5,474	CT	45	630
CB205	R9	45	715	5,474	CT	45	720
CB206	R9	135	770	5,504	CT	135	775
WS221	R9	135	525	5,304	Vaisala	135	525

Table 5-4. Sensors of Cylinder 2*.

Mark	Block	Instrument position in block α degree	r mm	Z mm	Fabricate	Measured position at dismantling α degree	r mm
TB240	Cyl. 2	90	150	3,983	Pentronic	90	150
TB241	Cyl. 2	95	360	3,983	Pentronic	90	365
TB242	Cyl. 2	85	400	3,983	Pentronic	85	400
TB243	Cyl. 2	95	440	3,983	Pentronic	95	440
TB244	Cyl. 2	85	480	3,983	Pentronic	85	480
TB245	Cyl. 2	95	520	3,983	Pentronic	95	525
TB246	Cyl. 2	85	560	3,983	Pentronic	n.d.	n.d.
TB247	Cyl. 2	95	600	3,983	Pentronic	n.d.	n.d.
TB248	Cyl. 2	85	640	3,983	Pentronic	n.d.	n.d.
TB249	Cyl. 2	95	680	3,983	Pentronic	n.d.	n.d.
TB250	Cyl. 2	85	720	3,983	Pentronic	n.d.	n.d.
TB251	Cyl. 2	95	760	3,983	Pentronic	n.d.	n.d.
TB252	Cyl. 2	85	800	3,983	Pentronic	85	800
TB253	Cyl. 2	95	825	3,983	Pentronic	95	825
WB216	Cyl.2	180	420	3,783	Rotronic	180	420
WB217	Cyl.2	225	635	3,783	Vaisala	225	635
WB218	Cyl.2	235	635	3,783	Wescor	235	635
WB219	Cyl.2	270	785	3,783	Rotronic	270	785
WB220	Cyl.2	280	785	3,783	Wescor	280	785
PB214	Cyl. 2	340	635	4,033	Geokon	340	635
PB215	Cyl. 2	0	635	3,983	Geokon	0	600
PB216	Cyl. 2	20	635	3,983	Geokon	20	635

* Positions marked “n.d.” (no data) were not measured during dismantling.

Table 5-5. Sensors of Ring 4.

Mark	Block	Instrument position at installation			Fabricate	Measured position at dismantling	
		α	r	Z		α	r
		degree	mm	mm		degree	mm
TB215	R4	97.5	320	2,469	Pentronic	97	320
TB216	R4	82.5	360	2,469	Pentronic	82.5	360
TB217	R4	97.5	390	2,469	Pentronic	97.5	390
TB218	R4	92.5	420	2,469	Pentronic	92.5	420
TB219	R4	87.5	435	2,469	Pentronic	87.5	435
TB220	R4	82.5	450	2,469	Pentronic	82.5	450
TB221	R4	97.5	465	2,469	Pentronic	97.5	465
TB222	R4	92.5	480	2,469	Pentronic	92.5	480
TB223	R4	87.5	495	2,469	Pentronic	87.5	495
TB224	R4	82.5	510	2,469	Pentronic	82.5	510
TB225	R4	97.5	525	2,469	Pentronic	97.5	525
TB226	R4	92.5	540	2,469	Pentronic	92.5	540
TB227	R4	87.5	555	2,469	Pentronic	87.5	555
TB228	R4	82.5	570	2,469	Pentronic	82.5	570
TB229	R4	97.5	585	2,469	Pentronic	97	585
TB230	R4	92.5	600	2,469	Pentronic	92	600
TB231	R4	87.5	615	2,469	Pentronic	87	615
TB232	R4	82.5	630	2,469	Pentronic	82	630
TB233	R4	97.5	645	2,469	Pentronic	97	645
TB234	R4	92.5	660	2,469	Pentronic	92	660
TB235	R4	87.5	690	2,469	Pentronic	87	690
TB236	R4	92.5	720	2,469	Pentronic	92	720
TB237	R4	87.5	750	2,469	Pentronic	87	750
TB238	R4	92.5	780	2,469	Pentronic	92	780
TB239	R4	87.5	810	2,469	Pentronic	87	810
WB206	R4	135	360	2,269	Vaisala	135	360
WB207	R4	180	420	2,269	Rotronic	180	420
WB208	R4	225	485	2,269	Vaisala	225	485
WB209	R4	270	560	2,269	Rotronic	270	560
WB210	R4	315	635	2,269	Vaisala	315	635
WB211	R4	325	635	2,269	Wescor	325	635
WB212	R4	0	710	2,269	Rotronic	0	710
WB213	R4	10	710	2,269	Wescor	10	710
WB214	R4	45	785	2,269	Vaisala	45	785
WB215	R4	55	785	2,269	Wescor	55	785

Table 5-6. Sensors of Ring 3.

Mark	Block	Instrument position at installation α degree	r mm	Z mm	Fabricate	Measured position at dismantling α degree	r mm
PB204	R3	250	420	1,968	Geokon	250	420
PB205	R3	290	420	2,018	Geokon	290	430
PB206	R3	8	535	1,968	Geokon	10	535
PB207	R3	20	535	1,968	Geokon	20	535
PB208	R3	45	585	2,018	Geokon	45	585
PB209	R3	100	635	1,968	Geokon	100	635
PB210	R3	170	710	1,968	Geokon	170	710
PB211	R3	180	710	1,968	Geokon	180	710
PB212	R3	260	748	2,018	Geokon	260	748
PB213	R3	270	875	1,950	Geokon	280	875
PB230	R3	180	315	1,968	DBE	180	315
UB201	R3	270	420	1,768	Geokon	270	420
UB202	R3	350	535	1,768	Geokon	350	540
UB203	R3	90	635	1,768	Geokon	90	635
UB204	R3	280	785	1,768	Geokon	280	790
UB209	R3	200	315	1,968	DBE	200	315
CB201	R3	135	770	1,968	CT	135	770

Table 5-7. Sensors of Cylinder 1.

Mark	Block	Instrument position at installation α degree	r mm	Z mm	Fabricate	Measured position at dismantling α degree	r mm
TB201	Cyl. 1	90	150	452	Pentronic	90	150
TB202	Cyl. 1	95	360	452	Pentronic	95	360
TB203	Cyl. 1	85	400	452	Pentronic	85	400
TB204	Cyl. 1	95	440	452	Pentronic	95	440
TB205	Cyl. 1	85	480	452	Pentronic	85	480
TB206	Cyl. 1	95	520	452	Pentronic	95	520
TB207	Cyl. 1	85	560	452	Pentronic	85	560
TB208	Cyl. 1	95	600	452	Pentronic	95	600
TB209	Cyl. 1	85	640	452	Pentronic	85	640
TB210	Cyl. 1	95	680	452	Pentronic	95	680
TB211	Cyl. 1	85	720	452	Pentronic	85	720
TB212	Cyl. 1	95	760	452	Pentronic	95	760
TB213	Cyl. 1	85	800	452	Pentronic	85	800
TB214	Cyl. 1	95	840	452	Pentronic		
PB201	Cyl. 1	340	635	502	Geokon	330	635
PB202	Cyl. 1	0	635	452	Geokon	0	635
PB203	Cyl. 1	20	635	452	Geokon	20	635
WB201	Cyl.1	180	420	252	Rotronic	180	420
WB202	Cyl.1	225	635	252	Vaisala	225	635
WB203	Cyl.1	235	635	252	Wescor	250	635
WB204	Cyl.1	270	785	252	Rotronic	270	785
WB205	Cyl.1	280	785	252	Wescor	280	785

6 Levelling and measurements of interfaces

In this chapter, results from levelling and measurements of interfaces are listed in tables.

Interfaces measured during dismantling are given in Table 6-1 to 6-3, while corresponding tables from the installation are given in Table 6-4 and Table 6-5. In general, these results are given as inner and outer radii of the top surface of the different blocks, as well as the width of the outer slot. Some additional measurements of widths of blocks, of radii towards toward "skin" and other comments are given in footnotes.

Results from levelling of the lid at different times are given in Table 6-6. Results from levelling of blocks, heaters and plates during dismantling are given in Table 6-7. Results from additional levelling during dismantling, i.e. for different centre positions, different inner ring positions, beneath the PEEK plate and for one fracture are given Table 6-8. Plots of additional levelling on the top surface of Ring 12 are given in Figure 6-1. Results from levelling of blocks, heaters and plates during installation are given in Table 6-9.

Table 6-1. Results from measurements of interfaces at dismantling.

Block	Angle (°)	Inner radius (mm)	Outer radius (mm)	Slot width (mm)	Comments
C4	32		805		Measured on big sectors
	212		805		
C3	32		799		Measured on big sectors
	212		838		
R12	0	525	815		
	90	510	805		
	180	500	820		
	270	515	830		
R11	0	517.5	824	65	Two inner and two
	90	522.5	824	55	outer diameters
	180	517.5	824	37	
	270	522.5	824	45	
R10	0	508.5	822.5	55	Two inner and two
	90	509.5	821.5	60	outer diameters
	180	508.5	822.5	54	
	270	509.5	821.5	56	
R9	0		818	60	One inner diameter
	90	491.5	820.5	50	measured at 122°–302°
	180		818	46	Two outer diameters
	270	491.5	820.5	58	
R8	0		815	62	One inner diameter:
	90	480	819	68	measured at 122°–302°
	180		815	56	Two outer diameters
	270	480	819	50	See footnote also
R7	0	490.5	815.5	53	Two inner and two
	90	473.5	815	50	outer diameters
	180	490.5	815.5	55	
	270	473.5	815	60	See footnote also
C2	0		782	65	
	90		797	74	
	180		849	55	
	270		821	66	

Widths of blocks measured at R8 and R7:
R8: 180°: 317 mm; 212°: 315 mm; 270°: 330 mm.
R7: 32°: 335 mm; 90°: 361 mm; 180°: 334 mm; 270°: 322 mm; 302°: 337 mm.

Outer radius measured at "skin" on top of sand-filled slot at R8:
828.5 mm in both 0–180° and 90–270° direction.

Table 6-2. Results from measurements of interfaces at dismantling (cont.).

Block	Angle (°)	Inner radius (mm)	Outer radius (mm)	Slot width (mm)	Comments
R6	0	305	820	57	
	32	305	817	58	
	90	305	817	44	
	122	305	827	29	
	180	305	827	30	
	212	305	836	35	
	270	305	822	55	
	302	305	820	66	
R5	0	305	822	65	
	32	305	818		
	90	305	821	45	
	122	305	832		
	180	305	821	37	
	212	305	821		
	270	305	817	65	
	302	305	819		
R4	0	305	817	57	
	32	305	815	45	
	90	305	816	46	
	122	305	822	42	
	180	305	821	45	
	212	305	818	54	
	270	305	821	60	
	302	305	822	62	
R3	0	305	817	60	
	32	305	822	52	
	90	305	822	42	
	122	305	821	45	
	180	305	821	51	
	212	305	822	50	
	270	305	820	52	
	302	305	822	59	
R2	0	305	819	44	
	32	305	820	42	
	90	305	817	51	
	122	305	822	53	
	180	305	820	58	
	212	305	822	60	
	270	305	822	62	
	302	305	820	57	

Table 6-3. Results from measurements of interfaces at dismantling (cont.).

Block	Angle (°)	Inner radius (mm)	Outer radius (mm)	Slot width (mm)	Comments
R1	0	305	821	42	
	32	305	816	44	
	90	305	818	47	
	122	305	826	58	
	180	305	825	60	
	212	305	820	65	
	270	305	824	50	
	302	305	821	46	
C1	0		811	61	
	32		802	65	
	90		797	75	
	122		800	73	
	180		802	79	
	212		804	72	
	270		802	72	
	302		807	67	

Table 6-4. Results from measurements of interfaces at installation.

Block	Angle (°)	Inner radius (mm)	Outer radius (mm)		Slot width (mm)
			Upper	Lower	
C4	0		785.5	793.1	80
	90		786.2	795.2	73
	180		785.5	793.1	77
	270		786.2	795.2	80
C3	0		785.8	795.0	95
	90		784.0	791.5	93
	180		785.8	795.0	90
	270		784.0	791.5	83
R12	0	535.7	813.5	824.0	70
	90	535.4	813.5	824.1	60
	180	535.7	813.5	824.0	52
	270	535.4	813.5	824.1	58
R11	0	535.2	813.2	823.4	70
	90	535.3	814.0	823.5	62
	180	535.2	813.2	823.4	47
	270	535.3	814.0	823.5	62
R10	0	535.2	813.0	823.9	64
	90	534.8	813.5	824.0	64
	180	535.2	813.0	823.9	60
	270	534.8	813.5	824.0	63
R9	0	535.7	813.5	824.2	61
	90	534.8	813.0	823.5	55
	180	535.7	813.5	824.2	55
	270	534.8	813.0	823.5	65
R8	0	535.0	814.0	823.6	61
	90	535.1	813.8	823.5	54
	180	535.0	814.0	823.6	56
	270	535.1	813.8	823.5	60
R7	0	535.3	813.0	823.6	58
	90	535.3	813.8	823.0	56
	180	535.3	813.0	823.6	65
	270	535.3	813.8	823.0	66
C2	0		784.5	792.5	85
	90		785.0	792.9	92
	180		784.5	792.5	92
	270		785.0	792.9	85

Table 6-5. Results from measurements of interfaces at installation (cont.).

Block	Angle (°)	Inner radius (mm)	Outer radius (mm)		Slot width (mm)
			Upper	Lower	
R6	0	315.1	815.7	825.0	72
	90	318.0	815.6	825.8	47
	180	315.1	815.7	825.0	48
	270	318.0	815.6	825.8	71
R5	0	318.6	815.2	825.9	76
	90	319.5	815.2	825.7	48
	180	318.6	815.2	825.9	42
	270	319.5	815.2	825.7	68
R4	0	318.0	815.5	825.3	60
	90	316.5	815.4	825.8	52
	180	318.0	815.5	825.3	56
	270	316.5	815.4	825.8	68
R3	0	319.5	815.4	825.2	63
	90	315.8	815.3	824.9	53
	180	319.5	815.4	825.2	66
	270	315.8	815.3	824.9	67
R2	0	318.6	815.6	825.3	52
	90	320.0	815.4	825.3	52
	180	318.6	815.6	825.3	65
	270	320.0	815.4	825.3	65
R1	0	318.5	815.5	825.4	48
	90	318.8	815.6	826.2	52
	180	318.5	815.5	825.4	69
	270	318.8	815.6	826.2	62
C1	0		785.2 *	793.5 *	87
	90		785.1 *	793.2 *	85
	180		785.2 *	793.5 *	90
	270		785.1 *	793.2 *	93

* Calculated as average diameters of C4, C3 and C2.

Table 6-6. Levelling of lid before and after unloading of cables.

Date	Sensor 1	Sensor 2	Sensor 3
2003-04-10	–416.572	–416.578	–416.571
2009-10-27	–416.555	–416.557	–416.551
2009-10-30	–416.541	–416.542	–416.537

Table 6-7. Levelling of blocks, heaters and plates during dismantling (levels given according to the Äspö 96 coordinate system).

Surface	Angle				Comment
	0°	90°	180°	270°	
C4	–417.246	–417.247	–417.246	–417.247	
C3	–417.745	–417.746	–417.744	–417.746	
Heater II	–418.304	–418.308	–418.309	–418.309	
R12	–418.201	–418.218	–418.211	–418.201	
R11	–418.729	–418.741	–418.741	–418.729	
R10	–419.26	–419.269	–419.266	–419.255	
R9	–419.78	–419.78	–419.777	–419.773	
R8	–420.28	–420.288	–420.281	–420.277	Outer part
R7	–420.784	–420.799	–420.799	–420.786	Outer part
PEEK	–421.276	–421.277	–421.277	–421.279	
C2	–421.28	–421.28	–421.28	–421.284	
Heater I	–421.851	–421.851	–421.855	–421.855	
R6	–421.801	–421.811	–421.811	–421.807	
R5	–422.312	–422.32	–422.324	–422.319	Outer part
R4	–422.829	–422.829	–422.833	–422.829	Outer part
R3	–423.326	–423.332	–423.334	–423.326	Outer part
R2	–423.826	–423.831	–423.829	–423.829	Outer part
R1	–424.339	–424.344	–424.344	–424.344	Outer part
C1	–424.851	–424.863	–424.856	–424.856	
Concrete	–425.366	–425.366	–425.366	–425.366	

Table 6-8. Additional levelling at some surfaces (levels given according to the Äspö 96 coordinate system).

Surface	Angle					
	0°	90°	180°	270°	Centre	Comment
Heater II	–	–	–	–	–418.308	Centre
C2	–421.261	–421.266	–421.271	–421.281	–421.252	Beneath PEEK plate
C2 Fracture	–421.572	–421.572	–421.572	–421.572	–421.572	Approximately 300 mm depth
R5	–422.32	–422.321	–422.324	–422.319	–	Inner part of block
R4	–422.833	–422.833	–422.834	–422.829	–	Inner part of block
R3	–423.328	–423.335	–423.335	–423.331	–	Inner part of block
R2	–423.826	–423.831	–423.829	–423.829	–	Inner part of block
R1	–424.34	–424.344	–424.346	–424.344	–	Inner part of block
C1	–	–	–	–	–424.851	Centre
Concrete	–	–	–	–	–425.366	Centre

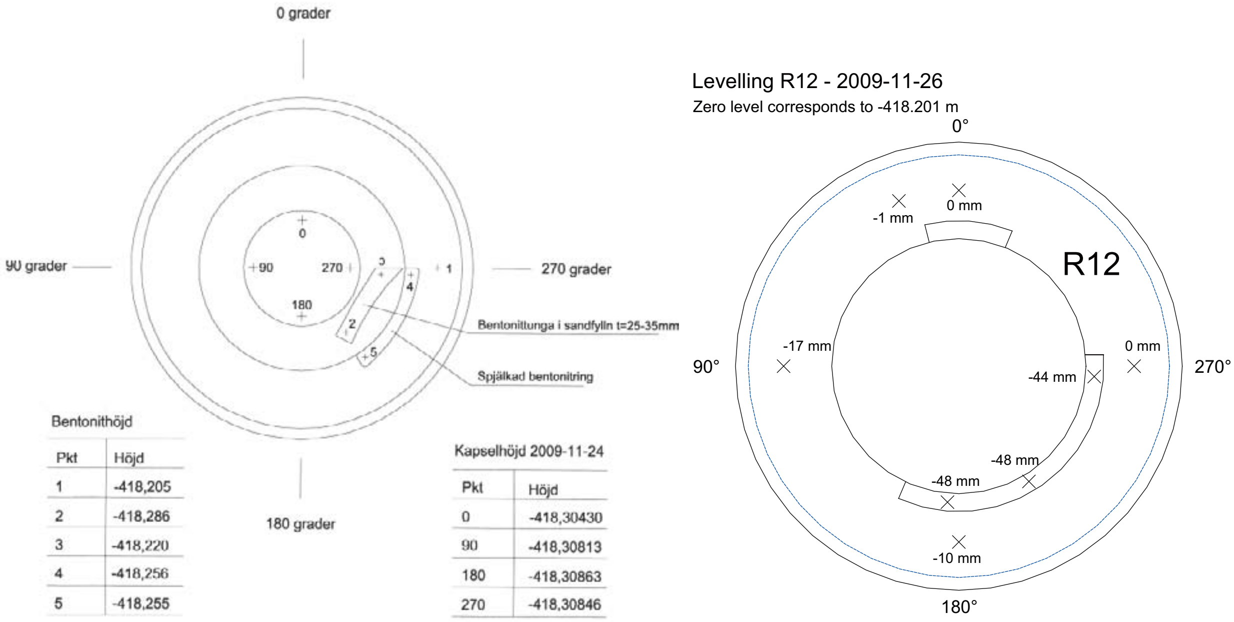

__Figure 6-1.__ Two plots with additional levelling at Ring 12 (levels given according to the Äspö 96 coordinate system).

Table 6-9. Levelling of blocks, heaters and plates during installation (levels given according to the Äspö 96 coordinate system).

Surface	Angle 0°	90°	180°	270°	Centre	Comment
C4	–417.291	–417.295	–417.296	–417.292	–417.294	
C3	–417.788	–417.794	–417.794	–417.788	–417.798	
Heater II	–418.334	–418.335	–418.338	–418.337	–418.336	
R12	–418.297	–418.303	–418.302	–418.296	–	
R11	–418.801	–418.805	–418.808	–418.803	–	
R10	–419.305	–419.310	–419.312	–419.306	–	
R9	–419.807	–419.813	–419.815	–419.809	–	
R8	–420.314	–420.320	–420.321	–420.316	–	Calculated from R9 levels and heights
R7	–420.822	–420.828	–420.830	–420.825	–	
PEEK	–421.322	–421.325	–421.328	–421.324	–	
C2	–421.329	–421.333	–421.335	–421.331	–421.332	
Heater I	–421.862	–421.864	–421.867	–421.864	–421.864	
R6	–421.832	–421.838	–421.840	–421.835	–	
R5	–422.334	–422.337	–422.342	–422.338	–	
R4	–422.842	–422.845	–422.850	–422.843	–	
R3	–423.343	–423.349	–423.352	–423.345	–	
R2	–423.850	–423.855	–423.856	–423.852	–	
R1	–424.356	–424.360	–424.361	–424.360	–	
C1	–424.861	–424.865	–424.865	–424.863	–424.864	
Conc.	–425.365	–425.365	–425.365	–425.365	–	Average of 13 measurments

7 Summary of daily logs

In this chapter, a summary of daily logs, i.e. the most important activities, are listed in a table (Table 7-1).

Table 7-1. Summary of daily logs.

2009-10-26	
2009-10-27	Plug – levelling and last Glötzl reading.
2009-10-28	Plug – attempt to unloading three wires at a time 6 mm.
2009-10-29	Plug – complete unloading of one wire at a time.
2009-10-30	Levelling, lifting of ring, lid and concrete plug.
2009-11-02	
2009-11-03	
2009-11-04	
2009-11-05	Levelling of C4. Sampling of C4 122–302°. 3 cores taken. Problem with compressor.
2009-11-06	Sampling of C4 122–302°. 7 cores taken.
2009-11-09	Sampling of C4 122–302°
2009-11-10	Sampling of C4 32–212°
2009-11-11	Sampling of C4 32–212° Removal of C4 material.
2009-11-12	Removal of C4 material.
2009-11-13	Removal of C4 material. Levelling C3.
2009-11-16	Removal of concrete in slots.
2009-11-17	Positioning and removal of sensors in C3. Sampling of C3 32–212°
2009-11-18	Sampling of C3 32–212°
2009-11-19	Sampling of C3 32–212° Problem with compressor.
2009-11-20	Sampling of C3 122–302° Change of compressor.
2009-11-23	Stitch drilling above lid on Heater II.
2009-11-24	Stitch drilling above lid on Heater II, Removal of C3 material, Levelling Heater II.
2009-11-25	Lifting of centre piece C3. Sampling sand/bentonite R12. Levelling R12. Sand removal.
2009-11-26	Sand removal. Levelling R12. Water detected.
2009-11-27	Sand removal.
2009-11-28	Measurement of water level in sand.
2009-11-29	Water removal in sand.
2009-11-30	Sand removal.
2009-12-01	Sand removal. Cutting of power cables. Removal of thermocouples.
2009-12-02	1st attempt to lift Heater II. Sand removal. 2nd successful lift Heater II, put in cradle.
2009-12-03	Sand removal and sampling.
2009-12-04	Mounting of safety handle. Attempt to remove water from hydration tubes.
2009-12-07	Sampling of R12 32–212° and 122–302°. Removal of R12 material.
2009-12-08	Levelling R11. Sampling of R11 32–212° and 122–302°. Removal of R11 material.
2009-12-09	Levelling R10. Positioning and removal of sensors in R10. Removal of filter sand Sampling. of R10 32–212°
2009-12-10	–
2009-12-11	Sampling of R10 122–302°. Removal of R10 material. Levelling R9.
2009-12-14	Sampling of R9. Deformations in block. Modified directions.
2009-12-15	Sampling of sand from Heater II. Removal of R9 material. Levelling R8.
2009-12-16	Sampling of R8. Deformations in block. Modified directions.
2009-12-17	Removal of R8 material. Levelling R7.
2009-12-18	–
2009-12-21	Sampling of R7.
2009-12-22	Sampling of R7. Removal of R7 material. Levelling of PEEK plate.
2009-12-23	Removal of sand and bentonite. Photography C2. Covering of C2.
2009-12-24	–
2009-12-25	–

Table 7-1. Summary of daily logs (cont).

2009-12-28	Handling of samples.
2009-12-29	Handling of samples.
2009-12-30	–
2009-12-31	–
2010-01-01	–
2010-01-04	–
2010-01-05	–
2010-01-06	–
2010-01-07	–
2010-01-08	–
2010-01-11	–
2010-01-12	–
2010-01-13	–
2010-01-14	–
2010-01-15	–
2010-01-18	–
2010-01-19	Levelling of C2.
2010-01-20	C2: 4 cores taken in 4 directions. Circular stich drill above heater. Levelling of fracture.
2010-01-21	Sampling of C2 32–212°. Photography.
2010-01-22	Sampling of C2 (difficulties to use core machine/ broken surface of block).
2010-01-25	Sampling of C2 32–212°.
2010-01-26	Sampling of C2 122–302° (difficulties with broken surface of block).
2010-01-27	Sampling of C2 in order to reduce the centre piece to 200 mm height.
2010-01-28	Sampling of C2 release of centre piece. Preparation for lifting.
2010-01-29	C2 Lifting of centre piece. Levelling of Heater 1 and R6.
2010-02-01	Photography R6.
2010-02-02	Removal of concrete in slots.
2010-02-03	Sampling of R6 32–212° and stitch drilling for big sectors.
2010-02-04	Sampling of R6 32–212°
2010-02-05	Sampling of R6 32–212° 122–302°
2010-02-08	Sampling of R6 122–302°. Interference with power cables in 122 direction.
2010-02-09	Removal of R6 material.
2010-02-10	Removal of R6 material. Lifting of big sectors. Levelling of R5.
2010-02-11	Sampling of R5 32–212° (23 cores).
2010-02-12	Sampling of R5 32–212°. Stitch drilling for big sector 212. Sampling of R5 122°
2010-02-15	Sampling of R5 122–302°. Circular stitch drill.
2010-02-16	Circular stitch drill R5. Sampling close to heater.
2010-02-17	Removal of R5 material.
2010-02-18	Removal of R5 material. Lifting of big sector 32°. Levelling R4. Control of thermocouples.
2010-02-19	Control of thermocouples.
2010-02-22	Sampling of R4 32–212°. Change of coring machine.
2010-02-23	Sampling of R4 32–212° and big sectors.
2010-02-24	Sampling of R4 122–302°. Circular stitch drill.
2010-02-25	Sampling of R4 122–302°. Circular stitch drill
2010-02-26	Circular stitch drill R4. Photography.
2010-03-01	Sampling inner pieces R4.
2010-03-02	Removal of R4 material.
2010-03-03	Levelling R3. Photography. Removal of total pressure sensors. Sampling of R3 32–212°
2010-03-04	Sampling of R3 32–212° and 122–302°.
2010-03-05	Sampling of R3 302°. Circular stitch drill.

Table 7-1. Summary of daily logs (cont).

2010-03-08	Circular stitch drill R3. Release of big sector 32°
2010-03-09	Circular stitch drill R3.
2010-03-10	Sampling inner pieces R3. Evacuation of sample bags in deposition hole.
2010-03-11	Lifting of big sectors R3 and removal of R3 material.
2010-03-12	Levelling R2.
2010-03-15	Sampling of R2 32–212°
2010-03-16	Sampling of R2 122–302°. Circular stitch drill.
2010-03-17	Release of big sectors R2.
2010-03-18	Lifting of big sectors and sampling of inner pieces R2.
2010-03-19	Removal of R2 material.
2010-03-22	Levelling R1. Circular stitch drill R1.
2010-03-23	Circular stitch drill R1. Wooden planks and straps mounted.
2010-03-24	Sampling of R1 32–212° and 122–302°. Removal of material 90°. Lifting lid on Heater 1.
2010-03-25	Sampling of R1 302°. Successful test of lifting Heater 1
2010-03-26	–
2010-03-29	Lifting of Heater 1. Standing on beams above hole, bentonite covered with plastic foil.
2010-03-30	Heater 1 (with bentonite) put in cradle. Lifting of big sectors R1. Removal of R1 material.
2010-03-31	Levelling C1. Thermocouples. Photography.
2010-04-01	Preparatory work.
2010-04-02	–
2010-04-05	–
2010-04-06	Sampling of C1 32–212°
2010-04-07	Sampling of C1 32–212°
2010-04-08	Sampling of C1 122–302°
2010-04-09	Sampling of C1 122–302°
2010-04-12	Stitch drilling for big sectors C1.
2010-04-13	Last ordinary sampling of C1.
2010-04-14	Sampling of bentonite/concrete interface.
2010-04-15	Sampling of bentonite/concrete interface.
2010-04-16	Sampling of bentonite/concrete interface.
2010-04-19	Removal of C1 material.
2010-04-20	Removal of C1 material.
2010-04-21	Sampling and removal of filter sand. Removal of sensors. Levelling. Photography.
2010-04-22	Partitioning of bentonite on Heater 1.
2010-04-23	Removal of concrete in slots. Removal of sensors and filter tips.
2010-04-26	Removal of concrete in slots and decommissioning.
2010-04-27	Removal of concrete in slots and decommissioning.
2010-04-28	Decommissioning.
2010-04-29	Decommissioning. Collection of thermocouples.
2010-04-30	Decommissioning.
2010-06-10	Pressurisation with nitrogen gas.
2010-06-11	Gas sampling.
2010-06-17	Cutting of Heater 1.

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