ENCLOSURE 4

MFN 06-053

Supplement 1

Correspondence Referenced in the

Quality Oversight for the SBWR Test Program

Non Proprietary Content

Giraffe References

→ cc ASR Personals

→ MD 1995 pls MFN

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 4, 1994

RECEIVED
MAY - 9 1994
P.W. MARRIOTT

MFN-074-94

Docket Nos. 52-004 and 99900403

Mr. Patrick W. Marriott, Manager
Advanced Plant Technologies
GE Nuclear Energy
175 Curtner Avenue
San Jose, California 95125

Dear Mr. Marriott:

SUBJECT: CONFIRMATION OF NRC INSPECTION REGARDING GE NUCLEAR ENERGY (GE) SIMPLIFIED BOILING WATER REACTOR (SBWR) TESTING ACTIVITIES AT THE TOSHIBA NUCLEAR ENGINEERING LABORATORY

The Office of Nuclear Reactor Regulation staff will be conducting an inspection of the GIRAFFE test program at the Toshiba Nuclear Engineering Laboratory in Kawasaki City, Japan on August 8 through 12, 1994. The inspection team will tentatively consist of Messrs. Richard P. McIntyre (Team Leader), Alan E. Levin, Billy H. Rogers, Tim M. Lee, Chris L. Hoxie, and Joseph L. Staudenmeier. The inspection was originally discussed with you during a meeting with Dennis M. Crutchfield, Associate Director for Advanced Reactors and License Renewal, and Mr. Sterling Franks, U.S. Department of Energy on April 11, 1994. Alan Levin discussed the dates of the inspection with Mr. Terry McIntyre of your staff on April 26, 1994.

The inspection will review the quality assurance (QA) program and controls implemented during the design, procurement, construction, and testing associated with the GIRAFFE test program during approximately 1989 - 1992 and the development of related TRACG computer modeling. The adequacy of QA controls exercised during these activities is important to the staff since GE has used data from these tests to qualify the TRACG code for SBWR safety analysis applications.

The cooperation of your staff in notifying Toshiba of our plans and in providing the support needed to complete the inspection is appreciated. Should you have any questions concerning this inspection, please contact either Mr. McIntyre, at (301) 504-3215, or Ms. Melinda Malloy, at (301) 504-1178.

Sincerely,

R.W. Borchardt

R. W. Borchardt, Director
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of Nuclear Reactor Regulation

cc: See next page

Mr. Patrick W. Marriott
GE Nuclear Energy

Docket No. 52-004

cc: Mr. Laurence S. Gifford
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

June 8, 1994

RECEIVED
JUN 13 1994
P.W. MARRIOTT

Docket Nos. 52-004 and 99900403
MFN-083-94

Mr. Patrick W. Marriott, Manager
Advanced Plant Technologies
GE Nuclear Energy
175 Curtner Avenue
San Jose, California 95125

Dear Mr. Marriott:

SUBJECT: CONFIRMATION OF NRC INSPECTION AT GE NUCLEAR ENERGY (GE) REGARDING GE OVERSIGHT OF SIMPLIFIED BOILING WATER REACTOR (SBWR) GIRAFFE TEST ACTIVITIES AT THE TOSHIBA NUCLEAR ENGINEERING LABORATORY

The Office of Nuclear Reactor Regulation (NRR) staff will be conducting an inspection at the GE Nuclear Energy (GE) offices in San Jose, California on June 21 through 23, 1994, of SBWR GIRAFFE test activities. The inspection is being conducted to review GE records and activities that support the GE oversight of the GIRAFFE test program that was performed by Toshiba personnel at the Toshiba Nuclear Engineering Laboratory in Kawasaki City, Japan. This will be the first phase of the inspection of the GIRAFFE test program that will be continued in Japan at the Toshiba Nuclear Engineering Laboratory on August 8 through 12, 1994. The inspection team will consist of Messrs. Richard P. McIntyre (Team Leader) and Billy H. Rogers of NRR's Vendor Inspection Branch, Alan E. Levin of the Reactor Systems Branch, Joseph L. Staudenmeier of the Analytical Support Group, Chris L. Hoxie of the Containment Systems & Severe Accident Branch, Robert A. Gramm and Frederick R. Allenspach of the Performance and Quality Evaluation Branch, and Tim M. Lee of the Office of Nuclear Regulatory Research. Mr. McIntyre discussed the scope and dates of the inspection with Mr. Terry McIntyre and Mr. Ken Brayman of your staff on June 1 and June 2, 1994.

The inspection will review the quality assurance (QA) program and controls implemented during the design, procurement and testing associated with the GIRAFFE test program during approximately 1989 - 1992 timeframe and the development of related TRACG computer modeling. The adequacy of QA controls exercised during these activities is important to the staff since GE has used data from these tests to qualify the TRACG code for SBWR safety analysis applications. Also, we will be reviewing the implementation of your corrective actions for the findings identified during the inspection of the Gravity-Driven Cooling System Integrated Systems Test (GIST) test program, documented in NRC Inspection Report 99900403/93-01.

The cooperation of your staff in providing the support needed to complete the inspection is appreciated. Should you have any questions concerning this inspection, please contact either Mr. McIntyre, at (301) 504-3215, or Ms. Melinda Malloy, at (301) 504-1178.

Sincerely,

R.W. Borchardt

R.W. Borchardt, Director
Standardization Project Directorate
Associate Directorate for Advanced Reactors
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Office of Nuclear Reactor Regulation

cc: See next page

Mr. Patrick W. Marriott
GE Nuclear Energy

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MFN No. 087-94
Docket No. STN 52-004

July 1, 1994

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: R.W. Borchardt, Director
Standardization Project Directorate

Subject: Use of GIRAFFE Test Data in the SBWR

This letter is written to document the use of the GIRAFFE test data in the SBWR certification program.

PANDA and PANTHERS are the principal tests to be used as design basis tests for the SBWR Passive Containment Cooling System. As was demonstrated at the recent SBWR QA Program Review June 21 through 23, 1994, GIRAFFE was a development test conducted in a disciplined, professional manner, but not explicitly under the requirements of NQA-1. It is our intention to use GIRAFFE data to substantiate the results of PANDA and PANTHERS at another scale. We believe that this use of GIRAFFE data is consistent with its status as a development test.

Sincerely,

P. W. Marriott, Manager
Advanced Plant Technologies
M/C 781, (408) 925-6948

cc: M. Malloy, Project Manager
F. W. Hasselberg, Project Manager

GE Nuclear Energy

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September 26, 1994

MFN No. 113-94,
Docket STN 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Richard W. Borchardt, Director
Standardization Project Directorate

Subject: Responses to the Referenced Letters

References:

1) Letter, M. Malloy (NRC) to P. W. Marriott (GE), *SCHEDULE FOR REVIEW OF TEST AND ANALYSIS PROGRAM DESCRIPTION (NEDC-32391P) FOR THE GE NUCLEAR ENERGY (GE) SIMPLIFIED BOILING WATER REACTOR (SBWR) AND INITIAL REQUESTS FOR ADDITIONAL INFORMATION (Q900.65-Q900.81 AND PURDUE UNIVERSITY QUESTIONS - SET 5)*, dated September 12, 1994.

2. Letter, M. Malloy (NRC) to P. W. Marriott (GE), *REQUESTS FOR ADDITIONAL INFORMATION REGARDING THE TEST PROGRAM FOR THE GE NUCLEAR ENERGY (GE) SIMPLIFIED BOILING WATER REACTOR (SBWR) (Q900.82-Q900.95)*, dated September 16, 1994.

The Enclosures to this letter contain responses to Requests for Additional Information (RAIs) 900.65 - 900.81, Purdue University Questions - Set 5 (Questions 1, 2, and 3), and 900.83, 900.87, 900.91, 900.93, and 900.94, which were enclosures to the Referenced letters.

Sincerely,

TR McIntyre

T. R. McIntyre, Acting Manager
Advanced Plant Technologies

Enclosures: 1. Responses to Reference 1.
2. Responses to Reference 2.

cc: P. A. Boehnert (ACRS)
R. W. Hasselberg (NRC)
M. Malloy (NRC)

GE Nuclear Energy

MFN No. 113-94

bcc:

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R. Srinivasan	(EPRI)	
G. A. Wingate		
GE Master File	M/C 462	
SBWR Project File	M/C 781	

Enclosure 1 to MFN 113-94

RAI Number 300.65

Question:

Resubmit NEDC-32391P, "SBWR Test and Analysis Program Description," with clear identification of the proprietary information on each page sought to be withheld, along with the reasons for withholding the information. Consistent with the staff's April 7, 1994, letter from D. Crutchfield to P. Marriott regarding the quality of the SBWR application, submit a non-proprietary version of the report within a reasonable period of time of the proprietary version, if the versions are not submitted simultaneously. Both versions of the report should be resubmitted as Revision 0 in lieu of a draft.

In the letter(s) transmitting the report, provide a page-by-page summary of any additions and corrections made to the report since the August 10, 1994, version was submitted to the staff for review.

GE Response:

NEDC-32391P, "SBWR Test and Analysis Program Description," Revision A, with clear identification of the proprietary information on each page sought to be withheld was transmitted by MFN 109-94, dated September 15, 1994. The letter transmitting the report provided a page-by-page summary of additions and corrections made to the report. A non-proprietary version entitled "SBWR Test and Analysis Program Description," NEDO-32391, was transmitted by MFN 110-94, dated September 15, 1994.

RAI Number 900.66

Question:

Provide a point-by-point response to the staff's March 7, 1994, letter from D. Crutchfield to P. Marriott regarding concerns about the SBWR testing program. Alternatively, provide a road map that identifies where in NEDC-32391P, "SBWR Test and Analysis Program Description," each of the concerns of the March 7, 1994, letter are explicitly addressed.

GE Response:

Issue
Acceptability of the Gravity Driven Cooling System (GDCS) Integral Systems Test (GIST) program data as the sole integral experimental basis for SBWR in view of the differences in configuration compared to the current SBWR design.

Response
While the physical configuration of GIST is representative of the 1988 SBWR design, GE considers that GIST provides GDCS performance data suitable for TRACG qualification. The basis for this statement is given below.

The principal difference between GIST and the current SBWR design is that the GDCS pool is a separate entity in the drywell instead of being a part of the suppression pool. This difference notwithstanding, the test captures the interactions between multiple regions represented by the reactor vessel, drywell and wetwell. The interactions between RPV depressurization and the GDCS are properly represented. The scaling study in Appendix B of NEDC-32391P demonstrates that the major parameters governing depressurization rate and driving heads for GDCS flow are preserved even though there are differences in the configuration of GIST from the current SBWR design

Testing in GIST is intended to simulate the late blowdown/early GDCS phase of the LOCA transient (Fig. 5.3.1 of NEDC-32391P), and thereby provide data for TRACG qualification of GDCS performance. The parameters of primary interest are: System pressure response which determines the timing of GDCS initiation, GDCS flow and RPV level response.

No scaling distortions have been identified in the significant phenomena which would preclude the use of the GIST data for their intended application

It should also be noted that the GIST data are supplemented by data from other BWR LOCA integral test facilities (TLTA, FIST) for the early part of the blowdown.

Issue
Absence of components/systems that could interact (IC, PCCS)

Response
GIST simulates the limiting LOCA transient without credit for the IC. No credit is taken in LOCA analysis for the IC.

Analysis shows (NEDC-32391P, Appendix C) that the IC increases the minimum water level for the limiting breaks (bottom break and GDCS line break). For the steam line and feedwater line breaks, the minimum water level is lowered due to void collapse. However, for these breaks the minimum water level is several meters above the top of the core and the impact is not significant to safety. Furthermore, postulated interactions between the IC and DPV resulting in flow reversal in the IC and subsequent reduction in the depressurization rate are shown not to be possible (NEDC-32391P, Appendix C). Thus, the overall impact of the IC is to increase the margins for the limiting breaks.

Because a relatively small fraction of the drywell to wetwell flow passes through the PCCS in the blowdown period, the PCCS has a minimal effect on the drywell pressure and GDCS flow(NEDC-32391P, Appendix C). The absence of a PCCS in the GIST tests has little or no effect on the vessel transient.

Interactions between the PCCS and GDCS are important in the containment during the GDCS phase of the transient in that they can result in vacuum breaker opening. This leads to a return of the noncondensibles to the drywell and subsequent recycling through the PCCS. Tests are planned in PANDA Phase 2 to address these interactions.

Issue
Insufficient characterization of GIST facility thermal hydraulic behavior

Response
GE agrees that calibration data on pressure drops and heat losses would be desirable. However, the data are adequate for the intended application.
For the TRACG calculations, the pipes, valves, elbows and orifices were treated as standard hydraulic components. The pressure drops and pressure distributions were calculated based on handbook published loss coefficients (Idelchik, Crane). Based on these assumptions, TRACG calculated the GIST transient response satisfactorily. This confirms the previous good experience with this approach.

Critical flow through the SRVs and the break is based on the minimum flow area. The TRACG model for critical flow, which has been qualified over a wide range of data (NEDC-32391P, Table 5.1-1) was employed for the calculation of critical flow.

Heat losses were calculated based on reasonable analytical values for the natural convection heat transfer coefficient. A sensitivity study on the heat transfer coefficient (variation of heat loss by a factor of 2) showed very little sensitivity to this parameter.

Issue
Lack of a quantitative scaling study

Response
A quantitative scaling study has been performed and is provided in NEDC-32391P, Appendix B, Attachment B1.

Issue
Requirement for additional data from PANDA to be included as part of the testing for design certification. Details of the test matrix and facility scaling to be provided to the NRC.

Response
GE agrees that PANDA data will be used as primary data for TRACG qualification. The test/qualification matrix and facility scaling are provided in NEDC-32391P.

Issue
Requirement for Isolation Condenser performance data from PANTHERS to be included as part of the testing for design certification, if credit is taken for the IC.

Response
GE agrees that PANTHERS thermal hydraulic performance data will be used for TRACG qualification. The test/qualification matrix and facility scaling are provided in NEDC-32391P. While no credit is taken for ICs in LOCA analysis, interaction studies have shown no deleterious effects if ICs were to operate (NEDC-32391P Appendix C).

Issue
Requirement for data demonstrating PCCS performance in the presence of light noncondensible gases in an integral system test.

Response
A combination of tests and analysis addresses the effects of light noncondensibles (hydrogen) on the PCCS performance and containment pressure.

One of the major concerns underlying the light noncondensible gas issue is the capability of the PCCS to restart after the drywell and PCCS have been filled up with noncondensibles. A Noncondensible Blanketing Test (M7) is planned in PANDA Phase 2 to address this issue. Whether the noncondensible gas is lighter or heavier than steam does not make any difference for this demonstration, because it shows that the PCCS can purge the noncondensibles.

At a component level, tests will be performed at PANTHERS to determine the effect of helium buildup in the full scale PCC units. With the vent blocked, the helium will accumulate in the PCCS, and the distribution of helium and the effect on heat removal capacity can be determined.

A helium system response test program in GIRAFFE has been added as described in the response to RAI 900.67.

The effect of the hydrogen resulting from 100% metal-water reaction on the integral system response can be bounded through calculations.

Issue
Availability of experimental and facility data for tests run by others for GE (GIRAFFE, PANDA, PANTHERS).

Response
GE will continue to provide the requested information or provide NRC access to the test facilities and/or test performers.

Issue
Requirement for documentation of testing program in conformance with 10CFR52.47 in Section 1.5 of SSAR.

Response
GE agrees to include a summary of the testing program in SSAR Section 1.5 and/or a reference to NEDO-32391.

Issue
Need for additional test in properly scaled integral test facility.

Response
A systematic study of test and analysis needs has been performed in NEDC-32391P. A need for additional testing has been identified in PANDA for specific interactions between the GDCS and PCCS in the GDCS phase resulting in vacuum breaker openings, for interactions with ICs, and to demonstrate PCCS restart when filled with noncondensible.

(Tests M5 - M9). These tests have been added to PANDA Phase 2 testing. Scaling of PANDA is judged to be adequate for its intended purpose and is addressed in Appendix B of NEDC-32391P.

The GIST tests are adequate for validating vessel performance during the late blowdown/early GDCS phase. Here there are few uncertainties and large margins to core heatup. The overall coverage of the LOCA transient by the integral tests is shown in Figure 5.3-1 of NEDC-32391P.

RAI Number 900.67

Question:

GE's July 1, 1994, letter (MFN No. 087-94) states that GIRAFFE tests were development tests and GE intends to use GIRAFFE data to substantiate the results of PANDA and PANTHERS at another scale. Contrary to this position, NEDC-32391P, "SBWR Test and Analysis Program Description," indicates that the helium test data from GIRAFFE are to be used as part of the TRACG qualification effort. GE needs to clarify the use of helium test data from GIRAFFE vis-à-vis the position on GIRAFFE data stated in MFN No. 087-94, in particular:

(a) Is the GIRAFFE helium test the only one, or are there plans for other helium tests, in GIRAFFE or in another test facility?

(b) If helium test data from GIRAFFE only is to be used, how will GE resolve the quality assurance concerns raised by the staff on other GIRAFFE tests during its June 21-23, 1994, inspection?

(c) The recently conducted GIRAFFE helium test contained only helium. Explain whether future tests will be more typical of post-accident conditions, include a combination of helium and nitrogen. In addition, the test duration should be based on observing at least one purge and transient back to steady state operation of the Passive Containment Cooling System (PCCS).

GE Response:

(a) Since the submittal of NEDC-32319P in mid-August, GE has been pursuing negotiations with Toshiba Corporation regarding additional helium testing in GIRAFFE. These negotiations have recently been concluded. As a result of this agreement, reference to the existing GIRAFFE helium test will be removed from NEDC-32391P, and a new test program will be performed in GIRAFFE specifically to address the staff's concerns relative to lighter-than-steam non-condensable gasses in the SBWR. Facility configuration and instrumentation will be similar to the GIRAFFE Phase 2 Main Steam Line Break tests. The test objectives of the GIRAFFE Helium Test Program are:

  1. Provide data that demonstrate the effective operation of the passive containment cooling system with the presence of a lighter-than-steam non-condensable gas, and

  2. Provide data for qualification of containment response predictions by TRACG in the presence of lighter-than-steam non-condensable gases.

Four test conditions will be included. Test Condition H1 will be a base case with nominal initial conditions the same as in PANDA tests M3 and M4, e.g., near SBWR SSAR LOCA conditions one hour into the accident scenario. The drywell will contain a mixture of steam and nitrogen at a total pressure of approximately 300 kPa. Test H2 will be a nominal repeat of test H1, but with a helium replacing the total volume of nitrogen in the drywell and PCCS. Test H3 will have the same total initial drywell pressure as tests H1 and H2, but with the initial non-condensable fraction consisting of helium / nitrogen mixture having the same proportions that would result from a 100% SBWR metal water reaction. Test H4 will start with the same initial conditions as test H1, (nitrogen and steam in the drywell), and will have constant helium injection to the drywell. The helium addition rate will be such that the helium is injected over a period of one hour, and the test will be terminated when the total mass of helium added is equal to the initial drywell helium mass in Test H3. The test will be continued to observe the venting of any residual helium from the drywell following termination of helium injection.

System response from the four tests will be compared with each other to establish the effects of lighter than steam, or a mixture of lighter-than-steam and heavier-than-steam non-condensables, on the effectiveness of heat rejection by the PCC heat exchanger. Specific test conditions are currently being finalized. No other helium testing in a facility other than GIRAFFE is planned

(b) The new GIRAFFE HELIUM tests described in response to item (a), above, will be performed by Toshiba in accordance with Japanese National Standard JEAG-4101 (1990 Rev.) GE has reviewed this standard, and concluded that in all important aspects, it meets the intent of 10CFR50 Appendix B and ANSI/ASME NQA-1 (1983). GE requests that the staff review this standard for this application, and concur that tests performed under it are acceptable for the application of this data to the SBWR. GE effort supporting the new GIRAFFE testing will be performed under our own, NRC accepted, QA program.

In addition to the four GIRAFFE Helium tests described in Response (a), Toshiba will also be performing a repeat of the GIRAFFE Phase 2 Main Steam Line Test, one of the two tests described as GIRAFFE Data Group G2 in NEDC-32391P. This test will be performed using the above quality assurance requirements, and will be performed in order to reinforce ("tie-back") the validity of previous GIRAFFE testing with the NRC staff.

(c) We believe the GIRAFFE Helium test program as defined in the response to item (a) is responsive to the staff's comments as elucidated in this item.

RAI Number 900.68

Question:

Both the staff (during a meeting with GE on August 18, 1994) and the ACRS Thermal-Hydraulic Phenomena Subcommittee (during a meeting on August 24, 1994) have expressed concerns regarding test instrumentation. In general, GE seems to place dependence on a limited number of pressure-temperature measurements, and then back-calculate any local conditions of interest. Specifically, the staff is concerned with:

(a) lack of direct local heat fluxes in the PCCS heat exchangers,

(b) lack of direct measurements of the pressure and/or noncondensable gas distribution along the PCCS heat exchanger tubes,

(c) lack of direct measurements of local concentration of noncondensable gases.

Address the above concerns regarding adequacy of test instrumentation for PANDA and PANTHERS.

GE Response:

(a) SIET Document 00157ST92 Rev 1, transmitted to the NRC by MFN No. 086-94 dated June 30, 1994, in response to RAI 950.24, addresses the instrumentation specifically added to the PANTHERS PCC heat exchanger in order to address the ACRS concerns on local heat flux measurement. Figure A.2.1 of the SIET document shows the location and type of instrumentation for local heat flux measurement.

Briefly, 72 thermocouples were added to the PANTHERS test instrumentation to address the ACRS concern. Four PCCS tubes, located at differing locations within the tube bundle, have been instrumented at nine elevations each. Thermocouples are located on the inside and the outside of the tubes, so that local heat fluxes may be calculated from the temperature difference across the tube wall. The algorithm to be used in data analysis is given in SIET document 00098PP91 Rev. 1, transmitted to the NRC by MFN No. 098-95 dated August 16, 1994.

(b) It is true that there are no direct measurements of the pressure or non-condensable gas concentration along the PCC heat exchanger tubes. We have evaluated this situation, and determined that such measurements are not necessary to determine the location within the tubes where condensation is taking place. Temperature measurements along the PCCS tubes were used successfully in GIRAFFE to determine the location of the condensation process within the PCC heat exchanger tubes, and review of initial PANTHERS data likewise has confirmed this capability. Pressure difference measurements between the upper and lower headers of the PANTHERS PCCS have indicated very low pressure drop through the units.

(c) In PANTHERS, which is a steady state experiment, both the air and steam flow to the heat exchangers are measured, and controlled as an independent condition of the experiment. GE has also committed to provide local non-condensable measurements in the PANDA drywell. Our current plan is to determine the non-condensable concentration distribution by use of a combination of temperature measurements and oxygen sensors located at several locations in the PANDA drywell.

RAI Number 900.69

Question:

Adequacy of scaling, phenomena level versus systems interaction: During a meeting regarding the SBWR test and analysis program on August 24, 1994, the ACRS Thermal-Hydraulic Phenomena Subcommittee expressed concerns about whether preserving parameters like gravity head and local friction losses is sufficient to model an integral system behavior. For example, having a "tall and skinny" test facility may affect the 3-dimensional distribution of noncondensable gases. Another example is that inappropriate modeling of global inertia terms may distort the integral system responses, like pressure and water level oscillations. In the scaling analyses, did GE include these "integral" or "global" effects?

GE Response:

GE has included these effects, as noted below:

Scaling of the Global Inertia Terms in the Momentum Equation

In the top-down scaling analysis presented in NEDC-32288 (Section 2.3), the transfers of mass driven by pressure differences were considered using the momentum equation integrated over a segment (piping) length. A rigorous analysis led to Eq. (2.31) of NEDC-32288 where a number of non-dimensional groups appeared. The non-dimensional number multiplying the rate of change of the velocity is Π_{in} (Eq. 2.32 of NEDC-32288),

$$\Pi_{in} = \frac{\rho^{o} L_{I} u_{r}^{o} / \tau_{tp}^{o}}{\Delta p^{o}}$$

which scales the inertial pressure drop with respect to the reference pressure drop. Considering the transit time of the fluid in the piping, P_{in} can be replaced by an alternative form, Eq. (2.37) of NEDC-32288,

$$\Pi_{in} = \frac{\rho^{o} u_{r}^{o2}}{\Delta p^{o}}$$

and the ratio of the equivalent inertia to volume lengths, L_I/L_V, Eq. (2.42).

$$\frac{L_I}{L_V} = \frac{\sum \frac{a_r}{a_n} l_n}{\sum \frac{a_n}{a_r} l_n}$$

The inertia number and the ratio L_I/L_V were considered in Appendix B of NEDC-32391P on Scaling Applicability (Tables B1-9 to B1-11 for GIST; B1-22 to B1-27 for GIRAFFE; B1-39 to B1-46 for PANDA). The L_I/L_V ratios of the prototype and of the various experimental facilities are matched reasonably well. Although the experimental facility components often have different Π_{in} values than the ones of the prototype (due to differences in the flow velocities in these components), this is a very minor scaling distortion, since the relative importance of the inertial pressure drops with respect to the system response is very small. Inertial pressure drops can reach significant magnitudes only during rapid system transients when velocities change abrupty; this is not the case during SBWR transients, except during the very first moments of depressurization. (Rapid velocity changes may take place during certain specific phenomena such as chugging; the scaling of such particular effects is considered in the bottom-up analysis. Inexact scaling of *local* phenomena such as chugging is not expected to affect overall system behavior.)

Moreover, the scaling analysis of NEDC-32288 produced three time scales, (τ^o, τ^o_{in}, and τ^o_{tr}), which scale the rates of volume fill, of inertial effects, and of pipe transfers, respectively (Section 2.4). Clearly, the systems considered here are made of large volumes connected by piping of much lesser volumetric capacity. The inertia and transit times, which are of the same order of magnitude, are much smaller than the volume fill times:

$$\tau^o >> \tau^o_{in} \approx \tau^o_{tr}$$

as shown in the NEDC-32391P tables mentioned above. It was concluded that the time scale that is controlling system behavior and therefore must be considered in scaling the system is τ^o. The other two time scales (controlled by the geometric characteristics L_I and L_V of the piping) are clearly of minor importance.

Three-Dimensional Effects

It is evident that 3D effects cannot be simulated exactly in experiments where the aspect ratio of the system is necessarily distorted (to preserve the important heights) *and* the complex SBWR volume geometries are replaced by cylindrical vessels. Mixing and stratification phenomena in the various SBWR containment volumes are discussed in Section 3.2 of NEDC-32288, where it is shown that appropriate simulation of the discharge areas of components such as vents and vacuum breakers can preserve similarity of the phenomena.

The Grashof numbers of containment volumes controlling natural circulation are considered in Section B1-2.2.2 of NEDC-32391P. For facility components that are full-height, the Grashof numbers calculated with height as the length scale match very well. Examples are shown in Tables B1-12, B1-28, and B1-47 of numbers based on these cannot be matched, but study of 3D effects was not within the scope of these tests. The horizontal dimensions of the PANDA facility approach those of the SBWR. Moreover, representation in PANDA of the Drywell and Suppression Chamber volumes by two large vessels interconnected by very large diameter pipes essentially provides two horizontal reference lengths: for example, the diameter of one SC vessel is close to the width of the annular SBWR SC pool, while the distance between the opposing ends of the two SC vessels approaches that of the SBWR SC perimeter. Thus both length scales will be present in the PANDA model.

RAI Number 900.70

Question:

GE has identified several sources of data that may be included in the SBWR design certification database, e.g., Dodewaard startup, boron mixing tests, and CRIEPI stability tests. For all of these sources (not just those cited here), provide detailed documentation about the tests, such as facility design, scaling, and instrumentation; test specifications and test matrices; and test data and analyses. Also, document specifically how GE will use these data within the test and analysis program.

GE Response:

Section A.3.1.6 of NEDC-32391P "SBWR Test and Analysis Program Description" lists six specific sets of existing test data for which TRACG analyses are being planned. Typically, this is non NQA-1 data, much of it several years old, but that can be used to illustrate TRACG capability to correctly predict a specific parameter; PSTF containment data for as containment main vent clearing during blowdown for example. We intend to use this data to illustrate the breadth of TRACG prediction capability and to corroborate the main body of SBWR data. The specific tests included are:

1/6 Scale Boron Mixing Test
CREIPI Natural Circulation Test
Dodewaard Plant Startup
PSTF Mark III
Mark II - 4T
Suppressions Pool Stratification - Mark III

These data are from tests in SBWR-like, but not necessarily SBWR unique or scaled geometries. Since, in general, these are not SBWR unique tests, specific scaling to the SBWR configuration has not been performed, and were it to be performed, it would result in the obvious; that these are not SBWR scaled tests. We do not plan to perform any additional scaling analyses for these data sets.

Typically, the phenomena addressed are very specific, and were added to the analysis plan for additional confidence in TRACG's predictive capability. In each of the six cases identified, NEDC-32391 is very specific with regard to runs to be analyzed, and the specific purpose of each of the specific comparisons to be made.

References to specific test documentation and the specific data use are given in NEDC-32391P. The following are GE's comments on each of the six addition data sets:

1/6 Scale Boron Mixing:

This data was submitted to the NRC on the ABWR docket. The report includes scaling, facility design, test matrices, and instrumentation used.

Specific runs to be analyzed are still being defined. GE will have a detailed plan for these analyses by December 1, 1994.

CRIEPI Natural Circulation Test:

We recognize that additional information will be required by the staff. GE will prepare a data transmittal on this facility and the results to be used by December 1, 1994.

Dodewaard Plant Startup:

GE will provide the NRC staff with the test reports from the Dodewaard startup, referenced in NEDC-32391P by October 15, 1994. Reactor description and instrumentation is included in the reports. Scaling and test matrix information is not applicable in this situation.

PSTF Mark III:

The test report referenced in NEDC-32391P was submitted to the NRC as part of the GESSAR docket in 1973. Scaling (to the BWR-6 design), test facility design, instrumentation, and test matrices are included in the report.

Mark II-4T:

The test report referenced in NEDC-32391P was provided to the NRC under the Mark II Containment Program in 1976. Scaling (to several Mark II containment configurations), test facility design, instrumentation, and test matrices are included in the report.

Suppression Pool Stratification - PSTF:

The two reports referenced in NEDC-32391P were provided to the staff in 1977 and 1978 under the GESSAR docket. These reports are specifically data analysis reports from PSTF Mark III testing.

RAI Number 900.71

Question:

Explain the rationale for excluding shutdown events and beyond-design-basis events from the SBWR design certification test program. Shutdown events must be evaluated for the SBWR, and presumably will be analyzed using the same computer code(s) used for design-basis analyses. As far as beyond-design-basis accidents are concerned, the staff must determine the robustness of the passive safety systems to deal with events nominally beyond the design basis (e.g., multiple failures) and the possibility of reliance on active, non-safety systems to deal with the consequences of these events. Note: "Beyond-design-basis" in this context is not equivalent to severe accidents.

GE Response:

Beyond-design basis and shutdown events were not explicitly considered for the study that led to the definition of the Test and Analysis Program. In response to this RAI 900.71, these scenarios have been considered and GE concludes that they are covered by the defined programs.

a) Beyond-design basis events:

GE takes this set of events to mean those event and equipment failure combinations which are defined by the PRA success criteria (Attachment 19AA to the SSAR). In these events, core uncovery occurs but cladding temperature remains below 2200 F. The dominant phenomena introduced in these events (beyond the design basis events) relates to core uncovery for a period of time followed by recovery as cooling systems are restored. These phenomena are already included in the PIRT tables (e.g., C11, C13, C14, C15, C24, C25). Tests which cover these phenomena include the TLTA boiloff test, and small and large break tests in TLTA and FIST. All these tests were performed with a simulated full scale BWR fuel bundle and cladding heatup occurred over a range of temperatures and system pressures. TRACG has been qualified against these tests with excellent results (NEDE-32177P). No additional tests or analyses are needed to cover these events.

b) Shutdown events

Plant shutdown to the hot standby condition is accomplished by bypassing steam to the main condenser and through the use of the RWCU/SDC system for decay heat removal. The ICs can also be used for decay heat removal during this phase of the transient. No new phenomena are introduced in this transient, beyond those already considered. Cold shutdown is achieved through decay heat removal by the RWCU/SDC system. If these systems are not available, other core injection systems (e.g. FAPCS), can be used for decay heat removal. One train of the RWCU/SDC system is sufficient to remove the decay heat, but two trains are engaged for the first 8 days to keep the cold leg temperature of the RCCW at 95°F. Again, no new phenomena are introduced.

RAI Number 900.72

Question:

Explain how GE can rely solely upon analysis to resolve the issues of systems interactions during the early phases of transients and accidents, when there are essentially no integral systems test data either existing or planned that cover such conditions during that time. Note that PANDA is not scaled to represent the early phase of SBWR accidents, and is incapable of representing the "worst-case" sequences for the SBWR, that is, bottom drain line and Gravity-Driven Cooling System line breaks.

GE Response:

GE is not relying solely on analysis to resolve systems interaction issues in the early phases of the LOCA transient. Figure 5.3-1 of NEDC-32391P illustrates the coverage of various portions of the transient by different integral systems tests. Section 5.3 of NEDC-3239:P discusses this figure. The systems interaction analysis was performed to identify the needs for tests where systems interactions might be important, where possible adverse interactions might occur and where there could be uncertainties in the analysis. This led to the definition of the PANDA Phase 2 tests. It is true that PANDA does not have the power supply capability to simulate the decay power at 10 minutes into the transient, and that the GDCS tanks do not have sufficient capacity to simulate the full capacity in the SBWR. However, test procedures will be developed to minimize the impact of these parameters on the system transient response. This is addressed further in response to RAI 900.73. It should be recognized that the purpose of these tests is to provide representative data for code validation of the key phenomena and interactions. Thus, in the early GDCS period of the transient, the emphasis is on the interactions between the heat removal by the PCCS combined with the effects of steam condensation within the reactor and drywell. The key phenomena related to drywell depressurization, vacuum breaker opening, recycling of noncondensibles, PCCS purging and restoration of PCCS performance will all be maintained even if there are scaling distortions in some of the parameters.

Incidentally, the bottom drain line break and GDCS line break are limiting for the minimum water level in the reactor vessel. In the PANDA tests, the focus is on the containment performance and the large steam line break is the limiting break.

RAI Number 900.73

Question:

Specify as precisely as possible at what time in the accident sequence the PANDA tests that are to represent the "early" phases of main steam line breaks will begin.

GE Response:

Although the detailed procedures for the PANDA Integral Systems Tests with an early start have not been completed, it appears that these tests (M7 and M8) can simulate the SBWR containment response to a steam line break as early as 10 minutes into the transient.

At approximately 10 minutes into a main steam line break accident, the RPV pressure is calculated to have dropped to approximately 300 kPa and is nearly equal to the drywell and wetwell pressures. The PANDA vessels and connecting piping have the capability to model this transient directly from this time on except for the decay heat and the GDCS inventory addition to the RPV.

The PANDA power supply is capable of providing 1.5 MW to the electrical heaters in the RPV. The SBWR scaled decay heat at one hour after scram is approximately 1 MW. The remaining 0.5 MW is available to simulate the RPV structural stored energy for those tests beginning at one hour into the simulated SBWR accident. 1.5 MW matches the scaled SBWR decay heat at approximately 20 minutes following scram.

The PANDA GDCS was designed to provide good simulation of the PCCS condensate drain discharge geometry and discharge conditions after draining of the initial GDCS inventory to the RPV has stopped. Representation of the full GDCS capacity was not an objective for the PANDA design. As a result, the capacity of the GDCS is approximately 40% of the scaled SBWR GDCS volume.

The approach in PANDA for modeling the SBWR transients prior to one hour after scram will take advantage of the fact that a significant fraction of the SBWR decay heat during this period is used to heat the subcooled GDCS water which has drained into the RPV. By running the PANDA tests with a constant power of 1.5 MW for the period simulated prior to one hour and adjusting the initial conditions in the RPV and the GDCS, it is expected that the test start time can correspond closely to 10 minutes into the SBWR main steam line break.

As stated above, the detailed test procedures for M7 and M9, the PANDA Integral Systems Tests with an early start, have not been completed. For test M7, however, the approach described above will provide data to demonstrate the PCC capability to start-up when it is initially filled with air and RPV conditions are representative of SBWR conditions immediately following blowdown. For test M9, the RPV and GDCS conditions will be adjusted to cause vacuum breaker opening and reintroduction of air to the drywell and PCC. Test M9, therefore, will demonstrate the PCC startup capability if air is reintroduced to the drywell via the vacuum breakers early in the transient.

RAI Number 900.74

Question:

PANDA tests will be initiated "on the run", therefore, a transient condition will be established which is intended to simulate a particular reactor transient. How will this be accomplished without significantly affecting the transient under study?

GE Response:

The initial conditions for the PANDA tests will be based on calculated conditions in the SBWR at the time in the transient corresponding to the test start time. For the transients to be simulated, the SBWR pressures, temperatures, liquid levels, and non-condensible gas concentrations which will be the basis for the PANDA initial conditions are not varying rapidly with time. Therefore, establishing initial conditions based on the calculated values for these slowly varying parameters will not affect the test transient.

RAI Number 900.75

Question:

The staff has previously requested detailed test matrices for the PANTHERS Isolation Condenser (IC) tests. These have never been provided and the information in Appendix A of NEDC-32391P, "SBWR Test and Analysis Program Description," is not sufficiently detailed (e.g., noncondensable gas concentrations, test duration, test cycles, etc.). Provide this information for review. In addition, address the concerns raised about instrumentation for PANTHERS PCCS testing (Q900.68 above) for the IC tests.

GE Response:

The PANTHERS Test Requirements and Test Specification were sent to NRC in MFN 119-92, dated May 27, 1992. Rev. 2 of this specification was transmitted by MFN 101-94, dated August 31, 1994.

RAI Number 900.76

Question:

The scaling analysis submitted with NEDC-32391P, "SBWR Test and Analysis Program Description," is an improvement over previous documentation provided by GE; however, additional work is required to demonstrate that for each of the important phenomena identified in the phenomena identification and ranking table (PIRT), the range of thermal-hydraulic conditions expected in the SBWR is covered by one or more tests in the test program.

GE Response:

Data has or will be obtained for all of the phenomena marked 'High' in the phenomena identification and ranking table (PIRT). The data comes from a combination of testing programs and plant data. The type of data used for each phenomena is indicated by the test coverage matrix shown in Figures 5.5-1 and 5.5-2 of the TAPD. Table 1 of this RAI includes the information in those tables along with scaling information on the phenomena. More detailed information showing specifically which test or tests are used to obtain data for each phenomena is also contained in the tables in chapter 5.

Data for some of the parameters have been obtained from operating BWR's. Therefore the data will be over the same ranges as expected in the SBWR. Additionally, data from BWR simulator facilities such as SSTF, TLTA, FIST, PSTF and the Boron Mixing Facility have been used. These facilities were design to simulate operating BWR behavior for accidents and transients which are very similar to those for the SBWR. A description of each of these facilities is included The TRACG Qualification document, NEDE-32177P, Rev 1. Data obtained from this category is marked in the "BWR facility" column of Table 1.

In addition, for those parameters that were considered to be particularly important, a detailed review of the test data and ranges used for coverage was performed. This information is contained in the Qualification Data Base (QDB) that supports the TAPD. Table 1 indicates which PIRT phenomena are reviewed in the QDB. Phenomena that is covered by data from GIST, GIRAFFE, PANDA or PANTHERS has already been scaled in Appendix B of the TAPD. These phenomena are indicated by checks in the "Scaled in App. B" column of Table 1.

Table 1. PIRT phenomena data coverage

PIRT #	Phenomena	Issue	Test Coverage				Scaling		
			Separate Effects Tests	Component Tests	Integral System Tests	Plant Data	Scaled in ODB ?	Scaled in App B ?	Data from BWR Facility ?
A1	LP flashing/redistribution		X	X	X			X	X
A2	LP heat slab stored energy		X	X	X		X	X	X
A3	Inlet orifice uncovery			X	X				X
A4	LP void fraction		X	X	X			X	X
A5	LP void collapse/inlet subc.		X	X	X			X	X
A9	LP stratification		X	X	X			X	X
B1	Bypass flashing		X	X	X			X	X
B2	Bypass level		X	X	X				X
B4	CCFL at bottom of bypass			X	X				X
B5	CCFL at top of bypass			X	X				X
B6	Channel to bypass leakage			X	X	X		X	X
B7	Bypass refill			X	X			X	X
C1AX	Void coefficient					X			
C1BX	Doppler coefficient					X			
C1CX	Scram reactivity					X			
C2AX	Interfacial shear and h.t.		X	X	X	X		X	X
C2BX	Subcooled boiling		X		X	X		X	X
C3AX	Fuel pellet power dist.		X			X			
C3CX	Fuel gap conductance		X			X			
C4	Core flashing		X	X	X			X	X
C5	Inlet orifice uncovery			X	X				X
C6	Inlet orifice CCFL			X	X				X
C7	Upper tieplate CCFL		X	X	X				X
C8	Multibundle flow dist.			X	X	X			X
C8X	Core void collapse			X	X	X			
C10	Core void distribution		X		X	X		X	X
C11	Channel to bypass leakage			X	X	X		X	X
C12	Natural circulation flow		X		X	X		X	X
C13	Dryout/boiling transition		X		X				X
C14	Film boiling (low flow)		X		X				X

Table 1. PIRT phenomena data coverage (cont'd)

PIRT #	Phenomena	Issue	Test Coverage				Scaling		
			Separate Effects Tests	Component Tests	Integral System Tests	Plant Data	Scaled in CDB ?	Scaled in App B ?	Data from BWR Facility ?
C15	Film boiling (disp. drop.)		X		X				X
C23	Core pressure drop		X	X	X	X		X	X
C24	Decay heat				X	X		X	X
C25	Fuel stored energy				X	X		X	X
C26	Critical power for 9 ft core		X				X		
D1	GT flashing		X	X	X			X	X
D2	CCFL at top of GT			X	X				X
D4	Refill of GT			X	X				X
E1	D C break uncovery			X	X		X		X
E2	D C void profile		X		X			X	X
E3	GDCS interaction				X			X	
E5	D C heat slabs			X	X	X		X	X
E6	D C flashing		X		X				X
E7	IC interaction								
E8	D C break flow		X		X			X	X
F1	Chimney void distribution		X	X					X
F2	Chimney flow distribution			X	X				X
F4	Mixing at top of chimney			X		X			
F5	Geysering during startup				X	X			
I1	Separator CU/CO			X		X			
I2	Separator inertia					X			
I3	Separator pressure drop			X		X			
L1X	Steamline pressure drop				X	X			
L2X	Steamline acoustic effects				X	X			
L1	SRV/DPV critical flow		X		X		X	X	X
L2	Droplet entrainment		X		X		X		X
L3	Transition to unchoked flow		X		X		X		X
L5	Multiple choked locations				X			X	
Q1	IC pressure drop			X			X	X	

Table 1. PIRT phenomena data coverage (cont'd).

PIRT #	Phenomena	Issue	Test Coverage				Scaling		
			Separate Effects Tests	Component Tests	Integral System Tests	Plant Data	Scaled in QDB ?	Scaled in App B ?	Data from BWR Facility ?
Q2	IC capacity			X			X	X	
Q3	Stratification in IC drums			X			X	X	
Q4	IC pool stratification			X			X	X	
Q5	Secondary side heat transfer			X			X	X	
ST1	Hydrodynamic stability		X						X
ST2	Corewide stability					X	X		
ST3	Regional stability					X	X		
ATW1	Boron mixing in bypass			X					X
ATW2	Boron stratification to LP				X				X
ATW3	Boron delivery to core				X				X
XL1	Interaction between multiple IC modules and units			X	X				
XL3	System interaction – GDCS/System depressurization				X			X	
CONTAINMENT									
BR1	Break mass flow	Critical flow	X	X	X		X		X
		Friction	X	X	X		X		X
		Entrainment	X	X	X		X		X
MV1	Main vent flow				X		X		X
MV3	Vent clearing time				X		X		X
SQ1	SRV flow		X		X			X	X
DW1	Flashing/evaporation in DW				X			X	
DW2	Condensation on DW walls				X		X	X	X
	Degredation of conduction				X		X	X	X
	Wall/Structure conduction				X		X	X	X
DW3	3-D effects	Phase distribution			X		X	X	
		Noncondensables distribution			X		X	X	
		Buoyancy/ natural circulation			X		X	X	

Table 1. PIRT phenomena data coverage (cont'd)

PIRT #	Phenomena	Issue	Test Coverage				Scaling		
			Separate Effects Tests	Component Tests	Integral System Tests	Plant Data	Scaled in ODB ?	Scaled in App B ?	Data from BWR Facility ?
DW4	Condensation on reactor outflows	Interfacial Heat Transfer			X		X	X	
		Degredation by N/C			X		X	X	
WW1	Condensation/evaporation of main vent discharge	Interfacial Heat Transfer		X	X		X		X
		Degredation by N/C					X		X
WW2	Condensation/evaporation of SRV discharge	Interfacial Heat Transfer		X	X				
WW3	Condensation/evaporation of PCC vent discharge	Interfacial Heat Transfer		X	X		X	X	
WW4	Free surface condensation/ evaporation	Interfacial Heat Transfer			X			X	
		Degredation by N/C			X		X	X	
WW5	Heat sources/sinks	Condensation on WW walls			X		X	X	X
		Conduction through WW walls			X		X	X	X
		Degredation by N/C			X		X	X	X
WW6	Pool mixing and stratification	Bouyancy/ natural circulation		X	X		X	X	X
WW7	3-D effects in gas space	Temperature distribution			X		X	X	
		noncondensable distribution			X		X	X	
		Interfacial shear					X	X	

Table 1. PIRT phenomena data coverage (cont'd)

			Test Coverage				Scaling		
PIRT #	Phenomena	Issue	Separate Effects Tests	Component Tests	Integral System Tests	Plant Data	Scaled in ODB ?	Scaled in App B ?	Data from BWR Facility ?
		Mixing, entrainment into jets					X	X	
		Bouyancy/natural circulation					X	X	
		Phase separation					X	X	
WW8	Containment spray condensation	Interfacial Heat Transfer		X	X			X	
		Degradation by N/C			X			X	
WW9	Containment hydrodynamic loads	Pool Swell		X	X		X		
		Condensation oscillation			X		X		
		Chugging			X		X		
		SRV Discharge			X		X		
GD2	GDCS flow				X		X	X	
PC1	PCC flow/pressure drop			X	X		X	X	
PC2	Condensation on primary side	Interfacial H.T.	X	X	X		X	X	
		Degradation by n/c	X	X	X		X	X	
		Shear Enhancement						X	
PC3	Secondary side heat transfer	Pool temp. dist.		X	X		X	X	
		Pool void dist.		X	X		X	X	
		Natural circulation		X	X		X	X	

Table 1. PIRT phenomena data coverage (cont'd)

PIRT #	Phenomena	Issue	Test Coverage: Separate Effects Tests	Test Coverage: Component Tests	Test Coverage: Integral System Tests	Test Coverage: Plant Data	Scaling: Scaled in ODB ?	Scaling: Scaled in App B ?	Scaling: Data from BWR Facility ?
		Secondary side entrainment		X	X		X	X	
PC4	Parallel PCC tube effects	Friction		X	X		X	X	
		Void fraction		X	X		X	X	
PC5	Parallel PCC unit effects	Friction		X	X		X	X	
		Void fraction		X	X		X	X	
PC6	PCC fan component separation						X		
PC8	PCCS startup with n/c	Purging by presssure diff.			X		X	X	
		Degredation by N/C			X		X	X	
DWB1	Loakage between drywell and wetwell			X	X		X	X	
VB1	Vacuum breaker flow characteristics			X			X		
EQ1	Equalization line flow				X			X	
EQ2	Equalization line sloshing				X			X	
OC1	Heat transfer to safety envelope								
DPV1	Mass flow in DPVs	Critical flow					X		
		Friction					X		
		Entrainment					X		
CW1	Containment liner gap conductance								
CW2	Concrete properties at high temperature			X			X		

Table 1. PIRT phenomena data coverage (cont'd)

PIRT #	Phenomena	Issue	Test Coverage				Scaling		
			Separate Effects Tests	Component Tests	Integral System Tests	Plant Data	Scaled in ODB ?	Scaled in App B ?	Data from BWR Facility ?
PAR1	Passive Autolitic Recombiners	Operation in hydrogen rich environment		X			X		
PAR2		Added heat load from recombination reaction							
XC1	System interaction	IC/DPV/PCCS			X			X	
XC2	System interaction	IC/DPV/ GDCS/PCCS			X			X	
XC4	System interaction	FAPCS/ PCCS			X			X	
XC5	System interaction	multiple PCC modules and units			X			X	
XC6	System interaction	light noncondensable DW/PCCs/WW			X			X	
XC7	System interaction	containment system response (DW/WW/MV)				X			X

RAI Number 900.77

Question:

Responses to the staff's previous requests for additional information (April 11, 1994) are also needed to determine the adequacy of NEDC-32391P, "SBWR Test and Analysis Program Description." Of particular interest are responses to Q901.23 through Q901.27.

GE Response:

Responses to the referenced RAIs have been sent in to the NRC by letter MFN 096-94, *SUBMITTAL OF ADDITIONAL INFORMATION ON LICENSING TOPICAL REPORT* (NEDE-32177P and NEDE-32178P), dated September 20, 1994.

RAI Number 900.78

Question:

The SBWR is unique from the standpoint of suppression pool thermal capacity. It is designed only for the first hour of decay heat energy, unlike previous designs which could accommodate all of the decay heat energy. Therefore, discuss the interactions expected between the PCCS and the suppression pool during transient periods such as PCCS purging, return to steady state operation, and vacuum breaker opening. Specifically, discuss the potential of opening the main vents for short periods, thereby sending mass and energy to the pool and possible instabilities as seen in the single tube condensation tests at the University of California (Berkeley). This discussion should rely on test data as much as possible.

GE Response:

The statement in this RAI that the SBWR design is unique from the standpoint of suppression pool thermal capacity is incorrect. All BWR pressure suppression pools are sized to accommodate the primary system blowdown energy. None of the suppression pools in existing GE pressure suppression containment types are designed to accommodate all of the decay energy without resort to some other energy removal system. In the absence of such a system, the pool will continue to heat with time as decay energy is added.

In earlier containment designs, the suppression pool temperature is limited by operation of the pool cooling mode of the Residual Heat Removal (RHR) System. The suppression pool absorbs the blowdown energy prior to operator initiation of RHR. Energy addition to the suppression pool continues by flow of drywell steam (generated by decay heat) through the main vents, and energy is removed from the pool by the RHR system to the ultimate heat sink. The peak pool temperature is established by the relative rates of energy addition and extraction. Typically, a maximum pool temperature near 190 degrees F occurs about 6 hours into the accident scenario, when the RHR heat exchanger delta T is sufficient to remove energy at the rate of energy addition to the pool from decay heat. The suppression pool temperature then slowly decreases as the decay energy addition decreases.

In the SBWR the situation is similar. During the blowdown period, the suppression pool absorbs the majority of the primary system energy, although there is some energy extraction by the PCCS. Depending on the break scenario, the blowdown period lasts from about 10 to 30 minutes. Following blowdown, GDCS reflood of the vessel causes subcooling of its fluid contents, and little steaming occurs until about 1 hour into the accident scenario. At this time, the PCCS is capable of rejecting all of the decay heat. In this way, the PCCS is analogous to the RHR system.

A critical element of SBWR design is the PCCS heat exchanger vent configuration. The PCCS vent exits into the suppression pool at a shallower submergence than the top main vent. This geometry is important, because the SBWR pressure suppression containment, like all earlier containments, is a forced flow, pressure driven system, not a temperature driven natural convection system. In all pressure suppression containment systems, mass and energy are added to the drywell from the break in the primary system, and the drywell pressure increases. The pressure will continue to increase, lowering the water level in the vent system, until a flow path is established between the drywell and the wetwell. The wetwell pressure is set by the thermodynamic conditions in the wetwell, including partial pressure of the original wetwell air (or nitrogen in the case of the SBWR), the partial pressure of the air purged over from the drywell to the wetwell air apace, and the vapor pressure of steam corresponding to the suppression pool surface temperature. Once the vents have cleared, the drywell pressure is equal to the wetwell pressure, plus the submergence head of the vents, plus any flow head losses in the vent system. There would be flow from the drywell to the wetwell even if there are only non-condensable gases in the drywell. (In fact, some of the containment testing performed in the 1970's and '80's was performed with only non-condensables.) Once sufficient mass and energy are added to the drywell so that the vent submergence head is overcome, flow will occur. This holds true whether the flow is through the main vents, or through the PCCS heat exchangers

Early in the LOCA scenario, mass and energy addition rates into the drywell from the primary system are larger than the heat removal capacity of the PCCS. During blowdown, the drywell pressure is such that both the PCCS vent and the main vents are cleared, and flow goes to the suppression pool via both paths. As primary system steaming decreases, the drywell pressure will decrease, eventually allowing the top main vents to re-flood and flow to the suppression pool will stop. Flow will still occur, however, through the PCC heat exchanger and PCC vent. It is the difference in submergence between the main vents and PCCS vent that preferentially directs flow through the heat exchanger, and shifts the primary LOCA heat sink from the suppression pool to the PCCS pool.

Table 1 illustrates both the similarities and differences in suppression pool design as containment configurations have evolved. This table gives the ratio of pool volume to core rated thermal power. Both blowdown energy and decay heat are a direct function of core rated power. Thus the ratio of pool volume to core thermal power is a direct indication of the suppression pool's ability to absorb the total primary system accident energy. The value given for the SBWR is the highest of all the containment types listed. The design is very robust. The relatively high value of this parameter for the SBWR is the result of two factors, (1) the potential for thermal stratification in the SBWR suppression pool, which has no safety grade system capable of mixing the pool, and (2) the requirement that the pool absorb both the blowdown energy and that small fraction of the excess decay energy that is released, until the PCCS system is capable of assuming the full load at about one hour.

Table 1
Ratio of Suppression Pool Volume to Core Thermal Power

Containment Type	Ratio (Cubic Feet per MWth)
SBWR	57.58
ABWR	32.20
Mk III (GESSAR)	36.21
Mk III (Grand Gulf)	35.48
Mk II (Nine Mile Point 2)	46.58
Mk I (Browns Ferry)	37.35

In the SBWR, reopening of the main vents is not expected to occur following GDCS reflood of the RPV. If, due to the addition of non-condensables, for example, the PCCS heat rejection capability temporarily drops below the decay energy level, the drywell pressure will increase. However, before the drywell pressure reaches the point where the main vents will reopen, a pressure difference will exist that will clear the PCCS vent, effectively purging the non-condensables and re-establishing PCCS performance.

Even if it is postulated that flow through the main vents is somehow reestablished, the amount of energy added to the pool before an effective PCCS purge of non-condensables causes only a small increase in suppression pool temperature. A bounding calculation of an event of this type was transmitted to the NRC staff by MFN No. 214-93. This calculation was based on the bounding assumption that all the decay heat energy is absorbed by the suppression pool during the time period required to purge all the hydrogen produced by a 100% metal-water reaction from the drywell to the wetwell via the PCCS. The resulting additional pool heatup for this scenario is 3 degrees K.

At one hour into the accident scenario, the steam generated by decay heat in the SBWR is about 12 kg/sec.. The top vent area of the SBWR is 3 square meters, yielding a mass flux of about 4 kg/m^2-sec. The condensation regime has been observed to change from steady to intermittent (chugging) at mass fluxes lower than 10 lbm/sec ft^2 (48.9 kg/sec m^2). Therefore, even if main vent flow were to reoccur, it would be within the chugging regime. Cyclic flooding and re-clearing of the main vents that occurs during chugging results in improved suppression pool mixing, and a reduction of pool thermal stratification. The SBWR design uses conservative assumptions for suppression pool stratification, based on limited mixing. While the effect of chugging in reducing thermal stratification is difficult to quantify, it is certainly present, and the effect of the energy addition to the pool would likely be less than the 3 degrees K estimated above.

Instabilities were seen in the first single tube condensation experiments performed at UC Berkeley. This experiment, reported in NEDC-32310, "Single

Tube Condensation Test Program", was performed in a natural circulation loop. Subsequent single tube experiments utilizing forced circulation loops, including two experiments at UC Berkeley and two at the Massachusetts Institute of Technology, have not shown any evidence of flow oscillations or instabilities. Thermocouple instrumentation of the heat exchanger tubes in the PANTHERS experiment (see response to RAI 900.68) make it possible to monitor for instabilities in this prototype heat exchanger test. No evidence of instabilities has been identified in data reviewed to date, which include conditions that span the PCCS flow regime. Given that the SBWR is a forced flow design, and that no instabilities have been seen in forced flow experiments, they are not expected to be a factor in SBWR performance. Also the condensation instabilities seen in the UC Berkeley natural convection experiments were local in nature, and did not greatly effect the overall heat rejection within the tube.

RAI Number 900.79

Question:

Heat loss has proven to be a significant problem in evaluating the GIRAFFE data. Therefore, provide the heat loss evaluation of both the PANTHERS and PANDA facilities and discuss how these losses will be considered in the evaluation of the test data.

GE Response:

Reference: PANTHERS-PCC TEST PLAN AND PROCEDURES, SIET Document No. 00098PP91, Revision 1, July 12, 1994, sent to the NRC in MFN No. 098.94, dated August 16, 1994.

Section 8.1.2.5 of the PANTHERS Test Plan & Procedures (see reference) gives the equation for the global energy balance of the PCC at PANTHERS. The equation includes the heat losses of the inlet and outlet lines. However, these heat losses were measured during the shakedown of the test facility and found to be negligible (i.e., less than 50 kW) compared to the total thermal power (around 1 to 14 MW). Therefore, the condensation thermal power formula will be simplified to that shown at the end of the referenced section.

Quantification of heat losses for PANDA is a planned item in the test facility startup program. The measurements have not yet been performed. PANDA is very heavily insulated, and heat losses are not expected to have a major effect on the results. The design goal is to limit heat losses to 10% of the decay heat at 24 hours into the LOCA scenario. Calculations indicate losses will be substantially less than the target values.

RAI Number 900.80

Question:

Interaction between the ICs and the PCCS may have a profound impact on the performance of the system. Discuss the possibilities of tests considering both units operational. In particular, the early in time test to obtain GIST-type data should be one of the tests considered.

GE Response:

The systems interaction studies performed as part of the SBWR test reassessment and reported in NEDC-32391P indicated that the minimum RPV water level was slightly effected by the presence of the IC and PCC for some postulated break scenarios. However, there was essentially no effect on system performance. The SBWR is a very robust design from the standpoint of core cooling. Minimum accident water levels are calculated to be approximately 1 to 4 meters above the top of the fuel, and peak clad temperatures are essentially unchanged from steady state performance values. Overall system performance would only be effected if the water level dropped below the top of the fuel, and even then there would be very significant margins to 10CFR50.46 and Appendix K temperature limits.

Appendix A of NEDC-32391 defines the tests GE has concluded are technically adequate for SBWR certification. PANDA test M6 was added to the matrix specifically to address IC effects. As a result of staff comments from the meeting on August 18, we are considering adding IC operation to PANDA tests M8 and M9 as well. As noted in the response to RAI 900.73, PANDA tests M7 and M9 will be started approximately 10 minutes into the accident scenario.

RAI Number 900.81

Question:

Transient behavior is of particular concern to the staff, therefore, each PANDA test duration should include at least one purge cycle of the PCCS. Confirm if that is the case.

GE Response:

It is unclear what is meant by a "purge cycle" in this RAI statement. Every PANDA test begins with some air fraction within the drywell. Over time, this air fraction will decline, but there will always be some small residual air content in the drywell. Tests M1 through M4, are of this type. Tests M5 through M9 have test conditions defined to address specific TRACG qualification needs as defined in NEDC-32391P. Some, but not all, of these tests will result in the vacuum breaker opening, and re-enty of non-condensables into the drywell. In these cases, the purge of these non-condensables into the wetwell will be investigated. Again, there can be no assurance that all the air will be purged from the drywell in any given test.

Superimposed on these system purges may be short cycle variations in the non-condensable content with the PCC heat exchanger. These will be investigated, should they occur.

If the staff will be more specific in what they mean by "PCCS purge cycle" we can respond more fully.

Purdue University Questions - Set 5

1. Provide the SBWR drywell spray flow rate and water temperature.

2. Provide the SBWR wetwell spray flow rate and water temperature.

3. What were the droplet size, flow rate, and water temperature of drywell and wetwell sprays that were assumed in TRACG analyses?

GE Response:

1. The maximum allowable differential pressure across the containment liner determines the drywell depressurization rate and consequently the maximum allowed drywell spray flowrate. These parameters have not been finalized yet.

   The Fuel & Auxiliary Pools Cooling System (FAPCS) pumps are variable speed pumps and can provide a flow rate between 257 and 422 m^3/h in the drywell spray mode. If these flow rates are too high, it can be reduced to 150 m^3/h for long term operation without causing problems with the pump. If an even lower flow rate is required, the flow can be partly bypassed by opening the valve in the discharge line to the suppression pool.

   The spray temperature has been calculated to be 55°C with a spray flowrate of 346 m^3/h with the supression pool water (source of drywell spray water being cooled by the FAPCS heat exchanger) at 79°C.

2. The maximum allowed wetwell spray flowrate has not been finalized yet.

   The Fuel & Auxiliary Pools Cooling System (FAPCS) pumps are variable speed pumps and can provide a flow rate between 307 and 445 m^3/h in the wetwell spray mode. If these flow rates are too high, it can be reduced to 150 m^3/h for long term operation without causing problems with the pump. If an even lower flow rate is required, the flow can be partly bypassed by opening the valve in the discharge line to the suppression pool.

   The spray temperature has been calculated to be 55°C with a spray flowrate of 346 m^3/h with the supression pool water (source of wetwell spray water being cooled by the FAPCS heat exchanger) at 79°C.

3. The drywell and wetwell sprays are simulated with the use of a TRACG PUMP component and a component representing the system heat exchanger. The flow rates used for the two spray modes were 321 m^3/hr and 307 m^3/hr for the drywell and wetwell, respectively. The temperature of the spray is not prescribed. The water is circulated through the simulated heat exchanger, characterized by a heat transfer area of 386 m^2, an overall heat transfer coefficient of 1510 Wm^2-K, and a sink temperature of 313K. It is expected that the outlet temperature will be only slightly above the sink temperature. Spray droplet size is not prescribed. It is determined by TRACG as the value implied by a critical Weber number of 6.5, based on relative velocity, or 0.2 mm, whichever is larger. As an example, for containment conditions of 300 kPa and 100% steam, the relative velocity is about 5 m/sec, yielding a droplet size in the range of 7 to 8 mm.

RAI Number: 900.83

Question:

Discuss how TRACG models mixtures of steam and non-condensable gases, including mixtures with more than one species of non-condensable gas (e.g., steam, nitrogen, hydrogen).

GE Response:

In addition to steam, TRACG solves the mass conservation equation for a second gas species. In a given computational cell, the two vapor species are perfectly mixed so that they have the same temperature and velocity. Thus the noncondensible gas is transported with the steam to the next cell with the same velocity as the steam. The concentration and partial pressure of the noncondensibles are tracked in every cell. Conventional donor cell techniques are used to calculate the flow of the noncondensibles from one cell to the next. The assumption of perfect mixing within a cell can make the results sensitive to the cell size, and the cell size must be chosen appropriately for the problem being solved. In a three (or two) dimensional grid, buoyancy effects due to larger concentrations of a light gas in certain regions can be properly accounted for within these assumptions.

Currently, TRACG allows for only one gas field other than steam. A mixture of two species would be treated as a gas with averaged properties. For this specific analysis of the containment design basis (100% metal-water reaction) event, a mass conservation model for a second gas field is being implemented in TRACG.

RAI Number: 900.87

Question:

Provide details of the CSAU study related to SBWR containment analysis.

GE Response:

GE intends to follow the CSAU methodology developed by Boyack et al (Quantifying Reactor Safety Margins, NUREG/CR-5249, 12/89). The 14 step methodology developed by this team is outlined in the attached figure from the above reference. Currently, GE is at Step 8 in the process. The test and analysis needs have been defined and the Separate Effects Data analysis is completed. The remaining steps involve the determination of bias and uncertainty in the TRACG calculations (Step 9), establishing whether there is a scale effect (Step 10), and accounting for the effects of uncertainties in the plant operating parameters (Step 11). Under Step 9, all the parameters identified as High in the PIRT tables (e.g., 4.1-2(a)) will be addressed. It is expected that a much smaller subset of this list will show significant effect on the containment pressure and temperature response in the preliminary sensitivity studies. For this reduced set of sensitive parameters, reasonable ranges will be defined for the subsequent statistical analysis in Steps 12 and 13. The model and plant parameters will be perturbed from their nominal values in a set of TRACG calculations. These calculations will serve to define the upper 95th percentile pressure and temperatures, which will be compared with the allowable design limits.

RAI Number: 900.91

Question:

The staff is concerned that assumptions termed as "licensing basis" which are used for calculations of accidents and transients in the SBWR do not represent the actual operation of the plant which would be expected in such cases. These analyses routinely exclude operation of safety systems that would be expected to operate, such as the isolation condenser. It is also possible that selected non-safety systems could operate and change the integral plant behavior. GE should include in its test programs a range of test conditions to ensure that the data will represent a sufficiently broad basis for code assessment assuming both "licensing basis" conditions and realistic plant conditions during accidents.

GE Response:

The "licensing basis" calculations do not take credit for equipment not classified as Engineering Safeguards. Also, single failure assumptions are required in the analysis. However, GE has performed analysis to show that scenarios where such equipment is available improve the accident response, and that the licensing assumptions do in fact provide bounding results.
In NEDC-32391P, calculations have been performed with the ICs available. Cases have also been run with active systems operating (CRD and FAPCS). Based on these calculations (Appendix C), testing needs have been defined. The PANDA tests will include tests where the ICs are operational. The effects of the FAPCS in the drywell spray mode will be simulated by adding cold water to the drywell. The GIST tests included one (A05) in which the CRD system was simulated. The ICs have a beneficial effect on the limiting LOCA transients and were not simulated in GIST.

RAI Number: 900.93

Question:

Provide a discussion of vacuum breaker actions for analyzed transients and accidents, including a Gravity-Driven Cooling System line break and include discussion of assumptions made for both expected and "licensing-basis" scenarios. In addition, detail why failure to close (after actuation) of a drywell-to-wetwell vacuum breaker is not, in GE's view, a credible failure.

GE Response:

Vacuum breaker cycling has been predicted for nearly all LOCAs, following GDCS initiation. The injection of subcooled GDCS water into the vessel reduces the pressure in the vessel and drywell to below the setpoint of the vacuum breakers and they cycle open, returning noncondensible gases to the drywell. Predictions indicate the vacuum breakers remain open for only brief periods, and can cycle several times during the GDCS injection period of the transient. The LOCA transient which is predicted to provide the most vacuum breaker cycles is the GDCS line break. This accident dumps the inventory of one GDCS pool directly into the drywell, which produces vacuum breaker openings. Later, as the GDCS flow from the unbroken lines fills the vessel to the level of the break and spills over into the drywell, additional vacuum breaker openings are predicted. Predictions of this transient indicate that as soon as the decay heat boiloff resumes, the drywell is re-pressurized, flow through the PCCS resumes and the noncondensibles are slowly purged through the PCCS, back to the wetwell.

Differences in the 'licensing basis' and expected LOCA calculations such as those presented to the NRC relate to availability of additional safety systems. As was shown, the use of intermittent drywell spray, while reducing the drywell pressure, also produces additional vacuum breaker cycling. For all cases analyzed to date however, the PCCS was able to return the recycled noncondensibles to the drywell and retain part of the pressure reduction benefit resulting from the use of the spray.

The assumption of the reliability of vacuum breaker operation is based on the design requirement of the vacuum breaker. The vacuum breaker valve design reliability objective is to fail to open or close less than once in every ten thousand demands. To achieve this objective, simplicity of design was used. The design configuration selected is a vertical poppet valve opening with high wetwell pressure and closing by gravity plus drywell pressure. The valve has double sealing surfaces one hard and one soft. The sealing surfaces are designed so that a design basis seal obstruction could be accommodated on one seal without the failure of the second seal. To demonstrate reliability, the prototype valve has undergone extensive testing. Before the valve reliability test was begun, the valve was aged and degraded to simulate sixty years of service. Aging consisted of soft seal irradiation, whole valve thermal aging, whole valve dynamic aging, design basis accident steam aging and ingestion of grit to coat seal and moving surfaces. The valve was then cycled three thousand times without failure. Using a Bayesian statistical approach, three thousand cycles without failure was shown to demonstrate a high probability of meeting the reliability objective of one failure in ten thousand.

Enclosure 2 to MFN 113-94

RAI Number: 900.94

Question:

Provide a listing of the TRACG code version used for each TRACG run analyzed and presented during the "scaling" part of the August 18, 1994, meeting, including a discussion of any differences in the results obtained with the "preliminary" and the "Level 2 " versions of the TRACG code.

GE Response:

The results discussed at the meeting are contained in Figures B.3-1 to B.3-4 for GIST and Figures B.3-5 to B.3-6 for GIRAFFE. For GIST, TRACG calculations are shown for the test, for the current SBWR design and the 1988 SBWR design. Of these, the test predictions and the calculations for the current SBWR design were made with the Level 2 version of the code, while the calculations for the 1988 SBWR design were old calculations. Calculations made with the preliminary code version and the Level 2 version have shown very little differences for other similar calculations. The GIRAFFE test predictions as well as the corresponding calculations for the SBWR in Figures B. 3-5 and B.3-6 were all made with the Level 2 version of the code.

→ MFN
140-94

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 11, 1994

RECEIVED
OCT 17 1994
P.W. MARRIOTT

Mr. Patrick W. Marriott, Manager
Advanced Plant Technologies
GE Nuclear Energy
175 Curtner Avenue
San Jose, California 95125

Dear Mr. Marriott:

SUBJECT: NUCLEAR REGULATORY COMMISSION INSPECTION REGARDING GE NUCLEAR ENERGY (GE) SIMPLIFIED BOILING WATER REACTOR (SBWR) TESTING ACTIVITIES AT THE TOSHIBA NUCLEAR ENGINEERING LABORATORY PLANNED FOR AUGUST 8 THROUGH 12, 1994

In a letter dated May 4, 1994, I informed you that the Office of Nuclear Reactor Regulation staff would be conducting an inspection of the GIRAFFE test program at the Toshiba Nuclear Engineering Laboratory (Toshiba) in Kawasaki City, Japan on August 8 through 12, 1994. The staff performed the first phase of the inspection on June 21 through 23, 1994, at your San Jose, California offices to review GE records and activities supporting the GE oversight of the GIRAFFE test program that was performed by Toshiba personnel.

Based on the staff's discussions with GE staff during the first phase of the inspection in June 1994, in a letter dated July 1, 1994 (MFN No. 087-94), you indicated that you would only be using the data from the GIRAFFE facility developmental tests to substantiate the results of the PANDA and PANTHERS design-basis tests at another scale. On the basis of your decision in this regard, the staff has deferred its plans for a quality assurance inspection of the GIRAFFE facility at Toshiba.

The cooperation of your staff (Mr. Terry McIntyre and Mr. Ken Brayman) in providing initial planning support for an inspection at Toshiba was appreciated. Should you have any questions concerning this matter, please contact either Mr. Richard McIntyre at (301) 504-3215, or Ms. Melinda Malloy at (301) 504-1178.

Sincerely,

R. W. Borchardt

R. W. Borchardt, Director
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of Nuclear Reactor Regulation

cc: See next page

Docket Nos. 52-004 and 99900403

Mr. Patrick W. Marriott
GE Nuclear Energy

Docket No. 52-004

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GE Nuclear Energy

J. E. Quinn, Projects Manager
LMR and SBWR Programs

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March 1, 1995

MFN No. 036-95
Docket STN 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Richard W. Borchardt, Director
Standardization Project Directorate

Subject: **GE GIRAFFE Audit Report**

Transmitted herewith is a copy of GE Audit Report No. ARP 95-1, Quality Assurance Audit of the SBWR GIRAFFE Test Program by Services & Projects Quality, dated January 24 - 26, 1995, as requested by NRC staff. This audit examined the adequacy, implementation and resulting documentation of the Toshiba Quality Assurance Program for the SBWR, GIRAFFE Quality Assurance Plan, and applicable procedures which implemented the requirements of the SBWR Design and Certification Program Quality Assurance Plan. The applicable elements of JEAG-4101 and NQA-1 were covered. The report concludes that testing can be started upon satisfactory disposition of corrective actions and recommendations identified in the report.

Please note that the information contained in the attachment is of the type which GE maintains in confidence and withholds from public disclosure. It has been handled and classified as proprietary to GE as indicated in the attached affidavit. We hereby request that this information be withheld from public disclosure in accordance with the provisions of 10CFR2.790.

Sincerely,

James E. Quinn, Projects Manager
LMR and SBWR Programs

Enclosure: Audit Report No. ARP 95-1, Quality Assurance Audit of SBWR GIRAFFE Test Program by Services & Projects Quality, dated January 24 - 26, 1995

cc: P. A. Boehnert (NRC/ACRS)
I. Catton (ACRS)
S. Q. Ninh (NRC)
J. H. Wilson (NRC)

Posted 4/21/95 cws

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April 13, 1995

MFN No. 053-95
Docket STN 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Richard W. Borchardt, Director
Standardization Project Directorate

Subject: **GE GIRAFFE Audit Report (Non Proprietary)**

Transmitted herewith is a copy of the Non Proprietary version of GE Audit Report No. ARP 95-1, Quality Assurance Audit of the SBWR GIRAFFE Test Program by Services & Projects Quality, dated January 24 - 26, 1995, as requested by NRC staff. This audit examined the adequacy, implementation and resulting documentation of the Toshiba Quality Assurance Program for the SBWR, GIRAFFE Quality Assurance Plan, and applicable procedures which implemented the requirements of the SBWR Design and Certification Program Quality Assurance Plan. The applicable elements of JEAG-4101 and NQA-1 were covered. The report concludes that testing can be started upon satisfactory disposition of corrective actions and recommendations identified in the report.

Sincerely,

James E. Quinn, Projects Manager
LMR and SBWR Programs

Enclosure: Audit Report No. ARP 95-1 (Non Proprietary), Quality Assurance Audit of SBWR GIRAFFE Test Program by Services & Projects Quality, dated January 24-26, 1995

cc: P. A. Boehnert	(NRC/ACRS)	(2 paper copies plus E-Mail w/encl.)
I. Catton	(ACRS)	(1 paper copy plus E-Mail w/encl.)
S. Q. Ninh	(NRC)	(2 paper copies plus E-Mail w/encl.)
J. H. Wilson	(NRC)	(1 paper copy plus E-Mail w/encl.)

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MFN No. 053-95

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AUDIT REPORT No. ARP 95-1

QUALITY ASSURANCE AUDIT

OF

SBWR GIRAFFE TEST PROGRAM

BY

SERVICES & PROJECTS QUALITY

JANUARY 24 - 26, 1995

Prepared by:	Approved by:
Signature and date on the original in the audit file	Signature and date on the original in the audit file
N. E. Barclay Date	F. E. Hatch Date
Manager, Audit Programs	Manager
Lead Auditor	Services & Projects Quality
Services & Projects Quality	

I. AUDIT SCOPE

This audit examined the adequacy, implementation and resulting documentation of the Toshiba Quality Assurance Program for the Simplified Boiling Water Reactor (AS-50092, Revision 0), GIRAFFE Quality Assurance Plan (AS-50128-E, TOGE-110-T01, December 1994) and applicable procedures which implement the requirements of the SBWR Design and Certification Program Quality Assurance Plan, NEDG-31831, Revision May, 1990 at the Toshiba GIRAFFE test facility in Kawasaki, Japan.

II. AUDIT SUMMARY

This audit reviewed Toshiba's Quality System as applicable to the GIRAFFE/Helium Test Program as defined in GE-NE's Test Specification 25A5677, Revision 0 and related GE-NE documentation. This audit covered only the current GIRAFFE/Helium test program, not earlier tests performed by Toshiba in the GIRAFFE facility. The control of the GIRAFFE Helium Test Program is satisfactory, to the extent audited, except as noted in the five CARs attached and the four Recommendations. Testing can be started upon satisfactory correction of the five CARs and resolution of the four Recommendations.

III. AUDIT TEAM

The audit team consisted of:

N. E. Barclay, Manager Audit Programs, S&PQ - Lead Auditor

P. E. Novak, ARP Quality Project Manager, S&PQ - Auditor

M. Herzog, Senior Engineer SBWR Test Programs - Technical Specialist

T. R. McIntyre, Project Manager SBWR Test Operation & Analysis - Technical Specialist

K. Tomita, QA Consultant, GETSCO - Translator

The key people from Toshiba's staff supporting the audit included:

S. Yokobori, Senior Specialist, Core & Fuel Technology Group

K. Watanabe, Section Manager, Quality Assurance Department, Nuclear Energy Division

T. Tobimatsu, Specialist, Core & Fuel Technology Group

H. Oikawa, Deputy Manager, Nuclear Safety Engineering Section

K. Arai, Deputy Manager, Systems Analysis Group

T. Kurita, Engineer, Core & Fuel Technology Group

IV. AUDIT PROCESS

V. AUDIT RESULTS

VI. FOLLOW-UP AND CLOSE-OUT

Implementation of the committed and preventive actions of the CARs is required of the responsible Project Manager.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

MFN No. 082-95

June 1, 1995

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
General Electric Nuclear Energy
175 Curtner Avenue
San Jose, CA 95125

SUBJECT: CONFIRMATION OF NUCLEAR REGULATORY COMMISSION INSPECTION REGARDING GE NUCLEAR ENERGY SIMPLIFIED BOILING WATER REACTOR (SBWR) TESTING ACTIVITIES AT THE TOSHIBA NUCLEAR ENGINEERING LABORATORY

Dear Mr. Quinn:

The Office of Nuclear Reactor Regulation staff will be conducting an inspection of the GIRAFFE test program at the Toshiba Nuclear Engineering Laboratory in Kawasaki City, Japan on June 8 through June 14, 1995. The inspection team will consist of Messrs. Richard McIntyre, Juan Peralta, John Kudrick, Michael Snodderly, and Son Ninh. Richard McIntyre discussed the dates of the inspection with Mr. Terry McIntyre of your staff on May 30, 1995.

The inspection will review the quality assurance (QA) program and controls implemented during the design, procurement, construction, and testing associated with GIRAFFE Test Specification No. 25A5677. The adequacy of QA controls exercised during these activities is important to the staff since GE has used data from these tests to qualify the TRACG code for ~~SBWR~~ safety analysis applications. Enclosed is the GIRAFFE Inspection Agenda.

The cooperation of your staff in notifying Toshiba of our plans and in providing the support needed to complete the inspection is appreciated. Should you have any questions concerning this inspection, please contact either Mr. McIntyre, at (301) 415-3215, or Mr. Son Ninh, at (301) 415-1125.

Sincerely,

Theodore R. Quay

Theodore R. Quay, Director
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 52-004
and 99900403

Enclosure:
As stated

cc w/enclosure:
See next page

Mr. James E. Quinn
GE Nuclear Energy

Docket No. 52-004

cc: Mr. Laurence S. Gifford
GE Nuclear Energy
1299 Pennsylvania Avenue, N.W.
Suite 1100
Washington, DC 20004

Mr. Brian McIntyre
Westinghouse Electric Corporation
Energy Systems Business Unit
Box 355
Pittsburgh, PA 15222

Director, Criteria & Standards Division
Office of Radiation Programs
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460

Mr. Sterling Franks
U.S. Department of Energy
NE-42
Washington, DC 20585

Mr. John E. Leatherman, Manager
SBWR Design Certification
GE Nuclear Energy
175 Curtner Avenue, MC-781
San Jose, CA 95125

Mr. Steven A. Hucik
GE Nuclear Energy
175 Curtner Avenue, MC-780
San Jose, CA 95125

Mr. Frank A. Ross
Program Manager, ALWR
Office of LWR Safety & Technology
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Mr. Victor G. Snell, Director
Safety and Licensing
AECL Technologies
9210 Corporate Boulevard
Suite 410
Rockville, MD 20850

Mr. Richard W. Burke, Sr., Manager
BWR Design Certification
Electric Power Research Institute
3412 Hillview Avenue
Palo Alto, CA 94304-1395

GIRAFFE INSPECTION AGENDA

June 8 - ENTRANCE MEETING: 9:30 am - AT GETSCO TOKYO OFFICE

- NRC Inspection Team

  - Richard McIntyre, Team Leader, RVIB
  - Juan Peralta, TQMB
  - Michael Snodderly, SCSB
  - Son Ninh, PDST
  - John Kudrick, SCSB

- NRC Team Leader Introductions and Inspection Scope

- GE/Toshiba overview of the GIRAFFE QA Program and its implementation for GIRAFFE SBWR test activities

- Team tour of GIRAFFE Test Facility

GIRAFFE TEST PROGRAM INSPECTION

- NRC inspection team review of the extent and effectiveness of the corrective actions taken to resolve issues identified by GE in Audit Report No. ARP 95-1, "Quality Assurance Audit of SBWR GIRAFFE Test Program by Services & Projects Quality - January 24-26, 1995," dated February 2, 1995.

- NRC inspection team review of process and procedures that implement the overall Toshiba QA program at the GIRAFFE test facility and assessment of their effectiveness in assuring that testing activities are conducted in compliance with NQA-1 provisions.

  - JEAG 4101-1990, Japan Electric Association's "Guide for Quality Assurance of Nuclear Power Plants"

  - AS-50092, Rev. 0, December 16, 1993, Toshiba's "Quality Assurance Program For Simplified Boiling Water Reactor"

  - TOGE110-T01 - AS 50128-E, December 1994, Toshiba's "GIRAFFE Quality Assurance Plan (TOGE-110 Test Programs)"

  - 25A5677, Rev 1, GE's "GIRAFFE Test Specification"

  - TOGE110-T02, Toshiba's "GIRAFFE Shakedown and Matrix Test Procedures"

Enclosure

- Team review of applicable Toshiba NED Standard Procedures applied to GIRAFFE activities such as:

  - No. 4401, Quality Assurance Fundamental Code
  - No. 4403, Document Control Code
  - No. 4404, Procurement Control Code
  - No. 4405, Nonconforming Material Control Code
  - No. AL-B05A001, Quality assurance Guide for Co-Operative Research With GE
  - No. QS-160A11, General Procedure for Witness Inspection
  - No. QS-160A35, General Control Guide for Measuring Equipment
  - No. AE-012B002, Technical Documents Control Procedure

- Team performance based review of the conduct of [illegible] Test H3

- Team review of documentation and records for:

  - Tests H1, H2, and H3 - Design Record File with test results data
  - internal/external audits
  - nonconformance reports
  - corrective actions
  - purchase orders/contractual agreements for design/test/services items

- Team technical review of GIRAFFE Test Program (Tests T1 and H1, H2 & H3) Design Record Files for following areas if available:

  - Test facility
  - Test program
  - Test results
  - Test data
  - Test log
  - Test analysis

<u>JUNE 14 - EXIT MEETING: 4:00 pm - AT GIRAFFE TEST FACLITY</u>

Posted 6/12/95

Gomez Carolina B.

From: Garcia Shara L.
To: Quinn James E.; Buchholz Robert H.; Cuenca Bernie; Leatherman John E.; McIntyre Terry R.; Schaefer Kurt T.; Gomez Carolina B.; Catton Ivan (ACRS TH Sub Com.); 'Wilson Jim (NRC SBWR PM)'; Boehnert Paul (NRC/ACRS SBWR); Ross Frank (DOE); Srinivasan Ram (EPRI); Ninh Son (NRC SBWR) ; Mulford Tom (EPRI); Cook Trevor (DOE)
Cc: Garcia Shara L.
Subject: SBWR - Updated Affidavit for the Enclosure to GE Letter MFN No. 039-95
Date: Friday, June 09, 1995 4:24PM

June 9, 1995

MFN No. 083-95
Docket STN 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Theodore E. Quay, Director
Standardization Project Directorate

Subject: SBWR- UPDATED AFFIDAVIT FOR THE ENCLOSURE TO GE LETTER MFN No. 039-95.

Reference: GE Letter MFN No. 039-95, J. E. Quinn (GE) to R. W. Borchardt (NRC), GE GIRAFFE TESTING AND TRACG COMPUTER CODE, dated March 8, 1995.

The enclosure to this letter is sent to replace the affidavit for the enclosure to the referenced letter. This update of the affidavit is made to more clearly describe the ownership of the transmitted information.

Sincerely,

James E. Quinn, Projects Manager
LMR and SBWR Programs

Enclosure: AFFIDAVIT

cc: P. A. Boehnert (NRC/ACRS) (2 paper copies w/encl. plus E-Mail w/encl.)
I. Catton (ACRS) (1 paper copy w/encl. plus E-Mail w/encl.)
S. Q. Ninh (NRC) (2 paper copies w/encl. plus E-Mail w/encl.)
D. C. Scaletti (NRC) (1 paper copy w/encl. plus E-Mail)
J. H. Wilson (NRC) (1 paper copy w/encl. plus E-Mail w/encl.)

General Electric Company

AFFIDAVIT

I, George B. Stramback, being duly sworn, depose and state as follows:

(1) I am Project Manager, General Electric Company ("GE") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) GE is an owner of the information sought to be withheld. This information is contained in the GE proprietary presentation material used during the March 8 & 9, 1995 meeting between Nuclear Regulatory Commission Staff and GE, to discuss GIRAFFE Testing and TRACG computer code.

(3) In making this application for withholding of proprietary information, GE claims to have an unrestricted right to dissemination of this information and has a royalty-free license to any patent relating to this information, as defined in the contract with its associates. GE relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), 2.790(a)(4), and 2.790(d)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information", and some portions also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GE's competitors without license from GE constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals cost or price information, production capacities, budget levels, or commercial strategies of GE, its customers, or its suppliers;

d. Information which reveals aspects of past, present, or future GE customer-funded development plans and programs, of potential commercial value to GE;

e. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in both paragraphs (4)a., (4)b. and (4)d., above.

(5) The information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GE and its associates, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GE and its associates, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the component to whom the work was provided, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within GE is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GE are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it would provide other parties, including competitors, with information related to GE fuel designs, analysis results and potential commercial offerings, which were developed at a considerable expense to GE and its associates.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GE's comprehensive BWR technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process.

The research, development, engineering, and analytical costs comprise a substantial investment of time and money by GE and its associates.

The precise value of the expertise to devise an test and evaluation process, and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GE's competitive advantage will be lost if its competitors are able to use the results of the GE experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GE would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GE of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

STATE OF CALIFORNIA)

) ss:

COUNTY OF SANTA CLARA)

George B. Stramback, being duly sworn, deposes and says:

That he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief.

Executed at San Jose, California, this ______ day of ______________ 1995.

____
George B. Stramback
General Electric Company

Subscribed and sworn before me this ______ day of ________________ 1995.

____
Notary Public, State of California

GE Nuclear Energy

J. E. Quinn, Projects Manager
LMR and SBWR Programs

General Electric Company
175 Curtner Avenue, M/C 165 San Jose, CA 95125-1014
408 925-1005 (phone) 408 925-3991 (facsimile)

July 20, 1995

MFN 099-95
Docket STN 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Theodore E. Quay, Director
Standardization Project Directorate

Subject: **SBWR - Withdrawal of GE GIRAFFE Audit Report & Associated Affidavit**

Reference:
1. Letter from Dino Scaletti (NRC) to Mr. J. E. Quinn (GE), *Request For Withholding Information From Public Disclosure, General Electric (GE) "Audit Report ARP 95-1 Quality Assurance Audit of Simplified Boiling Water Reactor (SBWR) GIRAFFE Test Program by Service and Projects Quality January 24 through 26"*, dated July 6, 1995.
2. Letter MFN 036-95 from J. E. Quinn (GE) to R. W. Borchardt (NRC), *GE GIRAFFE Audit Report,* dated March 1, 1995.

In response to the NRC's Reference 1 letter, GE formally requests the withdrawal of the proprietary version of the GIRAFFE Audit Report and its associated affidavit. This material was transmitted to the NRC in Reference 2. Please return these documents to GE.

The proprietary version of the GIRAFFE Audit Report will be available for NRC review in GE's San Jose California offices.

Sincerely,

James E. Quinn

cc:	P. A. Boehnert	(NRC/ACRS)	(2 paper copies plus E-Mail)
	I. Catton	(ACRS)	(1 paper copy plus E-Mail)
	S. Q. Ninh	(NRC)	(2 paper copies plus E-Mail)
	J. H. Wilson	(NRC)	(1 paper copy. plus E-Mail)
	D. Scaletti	(NRC)	(1 paper copy. plus E-Mail)

MFN 099-95

bcc: (E-Mail except as noted)

N. E. Barclay		
J. A. Beard		
P. F. Billig		
R. H. Buchholz		
T. Cook	(DoE)	(2 paper copies plus E-Mail)
J. D. Duncan		
A. Ehlers		
R. T. Fernandez	(EPRI)	
J. R. Fitch		
J. E. Leatherman		
J. E. Quinn		
T. J. Mulford	(EPRI)	(2 paper copies plus E-Mail)
P. E. Novak		
F. A. Ross	(DoE)	
K. T. Schaefer		
B. Shiralkar		
R. Srinivasan	(EPRI)	
J. E. Torbeck		
GE Master File	M/C 747	(1 paper copy plus E-Mail)
SBWR Project File		(1 paper copy plus E-Mail)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 6, 1995

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
General Electric Nuclear Energy
San Jose, California 95125

SUBJECT: REQUEST FOR WITHHOLDING INFORMATION FROM PUBLIC DISCLOSURE, GENERAL ELECTRIC (GE) AUDIT REPORT NO. ARP 95-1 "QUALITY ASSURANCE AUDIT OF SBWR GIRAFFE TEST PROGRAM" BY SERVICE AND PROJECTS QUALITY JANUARY 24 THROUGH 26, 1995

Dear Mr. Quinn:

By your letter dated March 1, 1995, you submitted the subject GE GIRAFFE Audit Report approved February 22, 1995, and requested that it be withheld from public disclosure. This request was made in accordance with 10 CFR 2.790 and is supported by affidavit dated March 8, 1995, executed by David Robare which claims that the information "...is classified as proprietary because it would provide other parties, including competitors, with information related to validation of GE proprietary design and analysis computer codes which were developed at a considerable expense to General Electric." In addition, the affidavit identifies the following reasons for maintaining the information as proprietary:

1. Information which, if used by a competitor, would reduce his expenditures of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.

2. Information which reveals aspects of past, present, or future GE customer-funded development plans and programs, of potential commercial value to GE.

The GE request for a proprietary determination extends to essentially the entire audit report as indicated by the side bar markings. We have reviewed the request and determined that the affidavit has provided an insufficient basis for withholding the document from public disclosure. The staff has concluded that disclosure to the public of the portions of the document that you identified as proprietary would not provide a competitor with meaningful information that would reduce his expenditures or improve his competitive position. The report does not disclose processes or data relative to design and analysis computer codes, nor does it reveal meaningful information related to past, present, or future customer-funded development plans and programs. Therefore, we have concluded that no portion of the document is proprietary.

Due to our determination, we intend to place the subject document in the NRC Public Document Room in 30 days from the date of this letter. If you wish to withdraw this document you may do so within the 30 day time period, pursuant to 10 CFR Section 2.790.

Sincerely,

Dino C. Scaletti

Dino C. Scaletti, Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of Nuclear Reactor Regulation

Docket No. 52-004

cc: See next page

Mr. James E. Quinn
GE Nuclear Energy

Docket No. 52-004

cc: Mr. John E. Leatherman, Manager
SBWR Design Certification
GE Nuclear Energy
175 Curtner Avenue, MC-781
San Jose, CA 95125

Mr. Steven A. Hucik
GE Nuclear Energy
175 Curtner Avenue, MC-780
San Jose, CA 95125

Mr. Richard W. Burke, Sr., Manager
BWR Design Certification
Electric Power Research Institute
3412 Hillview Avenue
Palo Alto, CA 94304-1395

Mr. Laurence S. Gifford
GE Nuclear Energy
1299 Pennsylvania Avenue, N.W.
Suite 1100
Washington, DC 20004

Enclosure to be distributed to the following addressees after the result of the proprietary evaluation is received from Simplified Boiling Water Reactor:

Mr. Brian McIntyre
Westinghouse Electric Corporation
Energy Systems Business Unit
Box 355
Pittsburgh, PA 15222

Director, Criteria & Standards Division
Office of Radiation Programs
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460

Mr. Sterling Franks
U.S. Department of Energy
NE-42
Washington, DC 20585

Mr. Frank A. Ross
Program Manager, ALWR
Office of LWR Safety & Technology
U.S. Department of Energy
NE-42
19901 Germantown Road
Germantown, MD 20874

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

January 13, 1995

copies: Leatherman, Buchholz, McIntyre / MFN No. 127-95

Mr. Patrick W. Marriott, Manager
Advanced Plant Technologies
GE Nuclear Energy
175 Curtner Avenue
San Jose, California 95125

Dear Mr. Marriott:

SUBJECT: CONFIRMATION OF THE NUCLEAR REGULATORY COMMISSION (NRC) ACTIVITIES REGARDING GE NUCLEAR ENERGY (GE) SIMPLIFIED BOILING WATER REACTOR (SBWR) TESTING ACTIVITIES AT THE TOSHIBA NUCLEAR ENGINEERING LABORATORY

The Office of Nuclear Reactor Regulation staff will be conducting an inspection of the GIRAFFE test program at the Toshiba Nuclear Engineering Laboratory in Kawasaki City, Japan on February 23 through March 1, 1995. The inspection team will tentatively consist of Messrs. Richard McIntyre, John Kudrick, Larry Campbell, Mike Snodderly, Son Ninh, and one or two additional people from the Office of Nuclear Regulatory Research. Son Ninh discussed the dates of the inspection with Mr. John Leatherman of your staff on January 5, 1995. We will let you know the final makeup of the team as soon as it has been settled.

The inspection will involve the observation of test activities and the review of the quality assurance (QA) program and controls implemented during the design, procurement, construction, and testing associated with GIRAFFE Test Specification No. 25A5677. The adequacy of QA controls exercised during these activities is important to the staff since GE is using data from these tests to qualify the TRACG code for SBWR safety analysis applications.

The cooperation of your staff in notifying Toshiba of our plans and in providing the support needed to complete the inspection is appreciated. Should you have any questions concerning this inspection, please contact either Mr. McIntyre, at (301) 504-3215, or Mr. Son Ninh, at (301) 504-1125.

Sincerely,

R. W. Borchardt

R. W. Borchardt, Director
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 52-004 and 99900403

cc: See next page

Mr. Patrick W. Marriott
GE Nuclear Energy

Docket No. 52-004

cc: Mr. Laurence S. Gifford
GE Nuclear Energy
1299 Pennsylvania Avenue, N.W.
Suite 1100
Washington, D.C. 20004

Mr. Brian McIntyre
Westinghouse Electric Corporation
Energy Systems Business Unit
Box 355
Pittsburgh, Pennsylvania 15222

Director, Criteria & Standards Division
Office of Radiation Programs
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Mr. Sterling Franks
U.S. Department of Energy
NE-42
Washington, D.C. 20585

Mr. John E. Leatherman, Manager
SBWR Design Certification
GE Nuclear Energy
175 Curtner Avenue, MC-781
San Jose, California 95125

Mr. Steven A. Hucik
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San Jose, California 95125

Mr. Frank A. Ross
Program Manager, ALWR
Office of LWR Safety & Technology
U.S. Department of Energy
NE-42
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Mr. Victor G. Snell, Director
Safety and Licensing
AECL Technologies
9210 Corporate Boulevard
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Rockville, Maryland 20850

Mr. Richard W. Burke, Sr., Manager
BWR Design Certification
Electric Power Research Institute
3412 Hillview Avenue
Palo Alto, California 94304-1395

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

MA/ 196-95

September 25, 1995

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, CA 95125

SUBJECT: NRC INSPECTION REPORT NO. 99900404/95-02

Dear Mr. Quinn:

This letter addresses the inspections at the Gravity Driven Integral Full-Height Test for Passive Heat Removal (GIRAFFE) Test Program at the Toshiba Nuclear Engineering Laboratory in Kawasaki City, Japan, and at the Societa' Informazioni Esperienze Termoidrauliche (SIET S.p.A.) Performance Analysis and Testing of Heat Removal System (PANTHERS) Test Facility in Piacenza, Italy, conducted by Richard P. McIntyre of the Nuclear Regulatory Commission's (NRC's) Special Inspection Branch, Juan D. Peralta of the Quality Assurance and Maintenance Branch, John A. Kudrick, Michael R. Snodderly and Andrzej Drozd of the Containment Systems and Severe Accident Branch, Alan E. Levin of the Reactor Systems Branch, and Son Q. Ninh and James H. Wilson of the Standardization Project Directorate. The inspection at GIRAFFE was conducted June 8 through 14, 1995, and the inspection at PANTHERS was conducted July 19 through 21, 1995. The details of the inspections were discussed with management at each test facility and with members of your staff present during the inspection and at the exit meetings on June 14, 1995, at GIRAFFE and on July 21, 1995, at PANTHERS.

The purpose of the inspections was to determine if testing activities performed at the GIRAFFE and PANTHERS facilities to support design certification of the GE Nuclear Energy (GE-NE) simplified boiling water reactor (SBWR) design were conducted under the appropriate provisions of NEDO-11209-04A, "GE Nuclear Energy Quality Assurance Program Description," Revision 8, the most recent revision that has been approved by the NRC. The pertinent provisions of NEDO-11209-04A were implemented at GIRAFFE by TOGE110-T01 (AS 50128-E), "GIRAFFE Quality Assurance Plan (TOGE110 Test Programs)," Revision 1 (December 1994), and at SIET PANTHERS by "Quality Plan Relative to Nuclear Area Orders," Revision 2.

Areas examined during the NRC inspections and our findings are discussed in the enclosed inspection report. The inspections consisted of an examination of procedures and representative records, interviews with personnel, and observations by the inspectors.

The results of the inspection indicate that GE-NE, in general, was adequately implementing the SBWR Project quality assurance program at GIRAFFE and at SIET PANTHERS and no nonconformances were identified. However, an Unresolved Item concerning the appropriateness of GE-NE's acceptance of design services, including related hardware, provided by ANSALDO to the PANTHERS test facility, was identified during the inspection.

ANSALDO, under contract to GE-NE, designed, fabricated and supplied both Passive Containment Cooling System (PCCS) and Isolation Condenser (IC) system prototypic heat exchangers installed in the PANTHERS facility for design certification testing. However, based on conversations with GE-NE during the inspection, it appears that GE-NE did not perform an audit of ANSALDO's facilities for placement on their Approved Suppliers List to ensure that design and fabrication activities had been adequately conducted under a suitable quality assurance program.

The response requested by this letter is not subject to the clearance procedures of the Office of Management and Budget as required by the Paperwork Reduction Act of 1980, Public Law No. 96-511.

In accordance with 10 CFR Part 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be placed in the NRC's Public Document Room.

Should you have any questions concerning this inspection, we will be pleased to discuss them with you.

Sincerely,

Robert M. Gallo, Chief
Special Inspection Branch
Division of Inspection and Support Programs
Office of Nuclear Reactor Regulation

Docket No.: 52-004

Enclosure: Inspection Report No. 99900404/95-02

cc w/encls: See Next Page

cc: Mr. Rob Wallace
GE Nuclear Energy
1299 Pennsylvania Avenue, N.W.
Suite 1100
Washington, DC 20004

Mr. Brian McIntyre
Westinghouse Electric Corporation
Energy Systems Business Unit
Box 355
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REPORT NO.:	99900404/95-02
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NUCLEAR INDUSTRY ACTIVITY:	GE Nuclear Energy (GE-NE) is engaged in the supply of advanced boiling water reactor designs to utilities. GE-NE also furnishes engineering services, nuclear replacement parts, and dedication services for commercial grade electrical and mechanical equipment.
INSPECTIONS CONDUCTED:	June 8 through 14, 1995, at Toshiba's GIRAFFE, and July 19 through 21, 1995, at SIET PANTHERS.
TEAM LEADER:	Richard P. McIntyre (signed) 9/14/95 Richard P. McIntyre — Date Vendor Inspection Section (VIS) Special Inspection Branch (PSIB)
OTHER INSPECTORS:	Juan D. Peralta, HQMB John A. Kudrick, SCSB (GIRAFFE only) Michael R. Snodderly, SCSB (GIRAFFE only) Andrzej Drozd, SCSB (SIET PANTHERS only) Alan E. Levin, SRXB (SIET PANTHERS only) Son Q. Ninh, PDST (GIRAFFE only) James H. Wilson, PDST (SIET PANTHERS only)
REVIEWED:	G C Cwalina (signed) 9/21/95 Gregory C. Cwalina, Section Chief, VIS — Date
APPROVED:	Robert M. Gallo (signed) 9/25/95 Robert M. Gallo, Chief, PSIB — Date
INSPECTION BASES:	10 CFR Part 50, Appendix B and 10 CFR Part 21
INSPECTION SCOPE:	To determine if activities performed to support the design of the SBWR and, specifically, testing activities performed at the GIRAFFE Test Facility at the Toshiba Nuclear Engineering Laboratory in Kawasaki City, Japan, and at the Societa' Informazioni Esperienze Termoidrauliche (SIET S.p.A.) PANTHERS Test Facility in Piacenza, Italy, were conducted under the appropriate provisions of NEDO 11209-04A, Revision 8, the most recent GE-NE Quality Assurance Program Description that has been approved by the NRC.
PLANT SITE APPLICABILITY:	None

Enclosure 1

1 INSPECTION SUMMARY

1.1 Unresolved Item

- Unresolved Item 99900404/95-02-01 was identified and is discussed in Section 3.7.2 of this report.

2 STATUS OF PREVIOUS INSPECTION FINDINGS

No previous inspections have been conducted at these test facilities.

3 INSPECTION FINDINGS AND OTHER COMMENTS

3.1 GE-NE SBWR Quality Assurance Program

Chapter 17 of the SBWR standard safety analysis report (SSAR) describes the GE-NE quality assurance (QA) program for the design phase of the SBWR program. The OA program is identified as "Nuclear Energy Business Operations Quality Assurance Program Description", NEDO-11209-04A, Revision 8, the latest revision approved by the NRC. NEDO-11209-04A applies to all GE-NE activities affecting quality of items and services supplied to nuclear power plants and establishes GE-NE's compliance with the provisions of Appendix B to 10 CFR 50.

NEDG-31831, "SBWR Design and Certification Program Quality Assurance Plan," dated May 1990, was developed by GE-NE to fulfill the QA requirements of the SBWR reactor design and certification program. NEDG-31831 meets the requirements of ANSI/NQA-1-1983 and its NQA-1a-1983 addenda as endorsed by the NRC in Regulatory Guide 1.28, Revision 3. Additionally, NEDG-31831 provides that design and testing work performed by international technical associates will be performed to their internal QA programs acceptable to the regulatory authorities of their respective countries as evaluated by GE-NE for compliance with the provisions of NQA-1-1983.

3.1.1 GIRAFFE

In its September 26, 1994 response (MFN 113-94) to RAI 900.67, GE-NE stated that GIRAFFE/Helium tests to be performed by Toshiba in support of SBWR design certification would be conducted in accordance with Japanese National Standard JEAG 4101-1990, "Guide for Quality Assurance of Nuclear Power Plants." GE-NE also stated that JEAG 4101-1990 meets the intent of Appendix B to 10 CFR 50 and American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME) NQA-1-1983. Subsequently, in an attachment to a letter dated April 27, 1995 GE-NE provided a description of the Toshiba QA plan, TOGE110-T01 (AS 50128-E), "GIRAFFE Quality Assurance Plan (TOGE110 Test Programs)", Revision 1 (December 1994), which would govern the PCCS heat removal test program using the GIRAFFE facility.

TOGE110-T01 summarizes the Toshiba GIRAFFE test QA plan which implements the applicable provisions of JEAG 4101-1990, and those in the following Toshiba documents: (1) Toshiba Energy Systems Group (ESG) Standard Code No. 4401

(1991), "Quality Assurance Fundamental Code", (2) 4401-1, "Nuclear Quality Manual," Revision 0, and (3) AS-50092, "Quality Assurance Program For Simplified Boiling Water Reactor," Revision 1.

During a January, 1995, audit GE-NE identified several deficiencies associated with Toshiba's implementation of the QA program governing SBWR GIRAFFE Testing. These deficiencies, including recommended actions, were documented in five Corrective Action Requests (CARs) in GE-NE Audit Report No. ARP 95-1, "Quality Assurance Audit of SBWR GIRAFFE Test Program by Services & Projects Quality - January 24-26, 1995," dated February 22, 1995.

During the inspection, the team assessed the extent and effectiveness of the corrective actions taken by GE-NE/Toshiba to resolve the QA issues identified by GE-NE in Audit Report No. ARP 95-1 and reviewed the applicable procedures that govern the implementation of the Toshiba QA program at the GIRAFFE test facility. Specifically, the team evaluated the effectiveness of the QA program and controls, as described above, in governing the implementation of Toshiba/GE-NE activities related to the overall GIRAFFE test program, including the soundness of the data obtained during PCCS testing. The team concluded that Toshiba, in conjunction with GE-NE, had taken adequate corrective measures to resolve the audit findings and achieve a satisfactory level of compliance with the applicable NQA-1 provisions. Also, based on reviews of documentation in the GIRAFFE Design Record File (DRF), the team confirmed that the GIRAFFE QA program set forth in TOGE110-T01, in conjunction with the pertinent criteria in JEAG 4101-1990 and AS-50092, provided sufficient evidence of QA implementation at a level appropriate to Design Certification testing. Although no QA-related nonconformances were identified, the team made several technical observations related to potential inadoquacies in testing methods, objectives and/or acceptance criteria. These observations are discussed below.

3.1.2 SIET PANTHERS

In a September 8, 1994, letter to the NRC, GE-NE transmitted a copy of SIET Document No. 00006-QQ-92, "Quality Plan Relative to Nuclear Area Orders," Revision 2, which would govern the performance of separate-effects tests on the full-size heat exchangers in the SBWR IC System and in the PCCS at SIET's PANTHERS test facility. SIET currently holds accreditation from the Italian national registration body, Sistema Nazionale per L'Accreditamento di Laboratori (SINAL), as a technically competent laboratory in relation to its compliance to the pertinent Italian and European standards.

00006-QQ-92 was developed by SIET to fulfill the requirements of the American Society of Mechanical Engineers (ASME) NQA-1-1993 and of the International Atomic Energy Agency (IAEA) Document No. 50-C-QA, Revision 1, in conjunction with the applicable provisions of Document No. 00001-QQ, "SIET Quality Manual," as they pertain to work orders in the nuclear area.

In February, 1995, GE-NE conducted a quality assurance audit to examine the effectiveness of the SIET's QA program, as delineated in the quality plan documents, for implementing the requirements of NEDG-31831 at the PANTHERS test facility. Test Specification 23A6999, "Isolation Condenser & Passive

Containment Condenser Test Requirements," Revision 4, provides that testing be conducted in accordance with the requirements of NEDG-31831.

GE-NE identified deficiencies associated with SIET's implementation of the QA program governing SBWR PANTHERS testing. These deficiencies, including recommended actions, were documented in two Corrective Action Requests (CARs) in GE-NE Audit Report No. ARP 95-3, "Quality Assurance Audit of SBWR PANTHERS Test Program by Services & Projects Quality - February 6-8, 1995," dated March 10, 1995.

During the inspection, the team reviewed DRF documentation which summarized the status of the resolution of the audit open items. These documents provided a detailed account of the findings and the extent and effectiveness of the corrective actions taken by GE-NE/SIET to resolve them. These documents also addressed the closure of recommendations which had remained open from an April 1994 readiness assessment, conducted by GE-NE, EPRI, and DOE, the results of which had been documented in "PANTHERS-PCC Readiness Assessment Report," dated April 29, 1994.

Based on the review of QA-related documents found in the PANTHERS DRF, including: (1) 00006-QQ-92, (2) the Contract/Agreement between ENEL S.p.A., Ente Nazionale Energie e Ambiente (ENEA), ANSALDO S.p.A., and GE-NE, (3) GE-NE facsimile dated July 18, 1995 on "Status of CARS and Recommendations from QA Audit," and (4) pertinent QA implementing procedures, the team concluded that activities performed to support design certification testing at the SIET PANTHERS facility were being conducted in accordance with the appropriate provisions of NQA-1-1983.

During the inspection exit meeting, however, the team questioned GE-NE/SIET related to the final configuration of the PANTHERS DRF (discussed in Section 3.4.2.1 below) and on certain NQA-1 Basic Requirements which had not been specifically addressed in the 00006-QQ-92 document.

Although not evident in the implementation of its QA program, the team noted that SIET's 00006-QQ-92 did not specifically address NQA-1 Basic Requirements 3, "Design Control," 4, "Procurement Document Control," and 8, "Identification and Control of Items." The team requested that SIET review its position on the bases of the exclusion from the QA program and that SIET review 00006-QQ-92 to ensure a level of compliance in these areas commensurate with actual SIET activities in design certification testing in the nuclear area.

3.2 Test Control

3.2.1 GIRAFFE

The GIRAFFE heat removal performance tests are controlled by Toshiba's TOGE110-T07, "GIRAFFE Heat Removal Performance Tests - Test Plan and Procedure" (TP&P), Revision 2. The GIRAFFE TP&P was developed as required by, and in accordance with, Toshiba's TOGE110-T01, "GIRAFFE Quality Assurance Plan," Revision 1, and GE-NE's, Document Number 25A5677, "GIRAFFE Helium Test Specification," Revision 1. The team reviewed the GIRAFFE TP&P which will be used to conduct the heat and pressure loss measurement tests, helium leak tests, shakedown tests, helium tests H-1 through H-4 and tie-back tests T-1 and T-2. The team confirmed that test objectives, quality assurance requirements, facility description and control, data acquisition and analysis, initial conditions, prerequisites, instructions, acceptance criteria, and post test activities for the conduct of the tests were included in the TP&P. The test procedures used for the testing were found to be acceptable.

3.2.1.1 Witness of Matrix Test H-3

One objective of the inspection team was to verify that tests are performed in accordance with written test procedures. The team had planned to witness Matrix Test H-3 on June 13, 1995. However, the test was postponed due to rain, as the excessive heat loss from the facility during rain prevents obtaining meaningful data. Toshiba agreed to conduct a H-3 demonstration test that the team could witness even though the data would not meet their acceptance criteria.

The team observed the H-3 demonstration test which was conducted in accordance with its TP&P. The inspection team witnessed that the specified test parameters and initial conditions had been properly established. The team also witnessed a demonstration, by GE-NE's sub-contractor Kokan-Keisoku, of how non-condensable gas measurements would be taken and measured. Non-condensable gas measurement is governed by a separate procedure, titled, "GIRAFFE Non-Condensable Gas Measurements," DRF No. T15-0013, Revision 3, dated May 30, 1995, which was approved by GE-NE and Kokan-Keisoku. The observed activities confirmed the use of appropriate test control measures.

3.2.1.2 GIRAFFE Test Results

The team reviewed the preliminary test results for H-1, H-2 and an aborted H-3 test. Several observations resulted from this review. The most notable was the lack of drywell to wetwell vacuum breaker actuation. After reviewing the test matrix, the team believes that one of the more important aspects of the test is the investigation of the facility's behavior when lighter than air non-condensables are reintroduced into the drywell. For the SBWR, vacuum breaker actuation will occur immediately after the core is initially quenched and steaming stops.

The tests conducted thus far appear to have inadequately modeled this aspect of the test matrix and as they focused primarily on the pressure response of the drywell. The apparent inadequate modeling is of concern because the team's understanding was that the main objective of these tests was to investigate the integral impact of lighter than air non-condensables on the PCCS. An important aspect of this impact is the reintroduction of helium into the drywell and whether or not the helium will accumulate in the upper regions of the PCCS. Therefore, the tests should demonstrate whether or not the PCCS will return smoothly to steady state operation. In the team's opinion, this aspect of the operation cannot be demonstrated without actuation of the vacuum breaker.

GE-NE's position is that the reintroduction of lighter than air non-condensables to the drywell is adequately modeled by the initial conditions of the test. In other words, the maximum amount of helium that can be introduced into the PCCS will be established at the beginning of the test. Nevertheless, the team still believes that the issue of adequate modeling of vacuum breaker actuation should be addressed in GE-NE's data evaluation report. As the staff believes that the concern warrants further evaluation by GE-NE, a request for additional information (RAI) will be forwarded to GE-NE and resolution of this issue will be pursued by the staff accordingly.

3.2.1.3 GIRAFFE Power Scaling

Until the team arrived on site, the available documentation indicated that reactor pressure vessel (RPV) bundle power was scaled to the surface area of the PCC tubes. The ratio of SBWR's PCC tube's surface area to that of GIRAFFE's is 690. This means that GIRAFFE is powered at 1/690th of the SBWR's rated power. In response to a specific question on the scaling ratio, GE-NE stated that for the H series tests the RPV bundle power would be based on the ratio of the vessels' volume rather than the surface area of the PCC tubes. The GIRAFFE volumes have been scaled to 1/400th of SBWR's.

GE-NE further indicated that the change had occurred within a week of the team's inspection. Changing the scale from 1/690 to 1/400 dramatically affects RPV bundle power level by changing it from 41 kW to 66 kW. While the increase in power will lead to more conservative results, a change of this magnitude at such a late stage raises questions regarding test planning.

The team believes that two conclusions can be drawn from this change. First, the scaling analysis, referenced in NEDO-32391, "SBWR Test and Analysis Program Description," Revision B, does not address the PCCS. It is due to this scaling omission that such a fundamental consideration was not revealed until June 1995. Second, this situation illustrates that a thorough understanding of the phenomena is required to properly evaluate the test results. Performing a scaling analysis based either on the surface area of the PCC tubes or on the volume of the vessels appears to have merit. However, both cannot be correct.

To better understand the issue, the team reviewed a letter from Toshiba to GE-NE dated May 31, 1995, on the GIRAFFE RPV bundle power. The letter indicated why vessel volume rather than PCC heat transfer area should be used as the scaling base. The conclusion reached by Toshiba, and now supported by GE-NE, indicates that the scale should be based not only on surface area but also on the volume ratios and total gas mass. Toshiba indicated that the final scale factor should be the smallest value resulting from the above parameters. In the case of GIRAFFE, this results in a ratio of 1/400 rather than 1/690.

GE-NE representatives indicated that the proper scale will be confirmed by a comparison of the test results from the various scaled tests of GIRAFFE, PANDA, and PANTHERS. The team believes that it is inappropriate to rely on a comparison of test results to prove or disprove such an important parameter and a more systematic approach is necessary.

Additionally, there was another parameter that the team also believes is as important as the ones mentioned above. This parameter is the rate of gas transfer between the drywell and the PCC. Unfortunately, this also requires accurate simulation of the drywell internals. This has not been accomplished by any of the system test facilities. Therefore, absent a scaling analysis, this factor must be considered as an uncertainty contributor.

The team discussed the need for GE-NE to address this issue. In a future revision to NEDO-32391, should consider expanding the scaling analysis to include the PCC so that scaled dimensions may be better understood and an uncertainty band assigned to the gas flow rate between the drywell and PCC. In the interim, GE-NE was requested to determine the impact of using a scaling ratio greater than or less than the selected value of 400 on the evaluation of the results to obtain a better understanding of the significance of the issue. The possibility exists that the design is robust enough and the net effect would thus be negligible. Finally, the comparison of the various scaled tests would then support the findings of the above approaches. The team believes that the concern warrants further evaluation by GE-NE. A request for additional information (RAI) will be forwarded to GE-NE and resolution of this issue will be pursued by the staff accordingly.

3.2.1.4 GIRAFFE Heat Loss to the Environment

The team reviewed how heat loss from the facility's major components was determined. GIRAFFE is an outdoor facility and to minimize heat loss electrical heaters, hereafter referred to as microheaters, have been installed on all the major components except the RPV. These microheaters, which are wire strips wrapped around the insulation of the suppression chamber (SC), drywell and the gravity driven core cooling system (GDCS) vessels, significantly reduce the thermal gradient across the vessel wall thereby reducing the amount of internal energy lost to the environment. The microheater power levels were reverified during a shakedown test (to recalibrate the facility) and were selected to avoid superheated conditions.

The shakedown test determined the power level to be used, during the H series of testing, by filling and heating the RPV with pure steam to a saturation temperature corresponding to the maximum pressure expected during testing. The RPV bundle heaters were then adjusted until steady state conditions were achieved. This required a power level of 8 kW and thereby established the heat loss of the RPV.

The drywell was then filled with steam and connected to the steam filled RPV. With the microheaters set at predetermined power levels, the RPV bundle power was adjusted until steady state conditions were reached. A drywell heat balance was achieved when an additional 12 kW were supplied to the RPV bundle heater, 8 kW were supplied to the drywell microheaters, and 1 kW to the line connecting the RPV and the drywell.

The GDCS was then added to the configuration using the same process. The GDCS heat loss was found to be 7.7 kW. Summing the heat losses from these three major vessels yielded a total heat loss of 36.7 kW. It should be noted that the microheater power was maintained constant during this test. Originally, power to the microheaters was to be controlled by maintaining a near zero differential temperature across the vessel. However, this approach was not successful and actually produced some degree of superheat inside the vessel. As a result, constant heater power is now supplied to both the drywell and GDCS microheaters.

This shakedown test procedure was varied for the suppression chamber. For the other vessels, the thermal conditions are near constant and substantially above ambient conditions. The suppression chamber, however, is only slightly above ambient. As a result, a small change in ambient temperature has a relatively greater effect on the heat loss from the suppression pool.

The heat loss was determined for two different pressure/temperature conditions to establish an approximate heat-loss curve. During a performance test, the microheater power was initially set at a value from the heat-loss curve. However, microheater power was reduced to compensate for a gradual rise in SC pressure after PCCS venting to the SC had occurred. Microheater power was reduced enough to maintain a constant SC temperature. During initial PCCS venting, the SC pressure was allowed to increase due to the addition of non-condensables with no change in heater power but this transfer of mass and energy from the drywell to the SC along with the initial microheater power setting resulted in a gradual pressure rise in the SC. This gradual rise in SC pressure is considered nonprototypic by GE-NE. The team is concerned that the conspicuous lack of vacuum breaker cycling during the H2 test may have been an anomaly in the experiment caused by the effect of the microheaters on the pressure in the SC.

During the inspection, GE-NE committed to providing a basis for microheater adjustment in the SC. Since the team believes the concern warrants further evaluation by GE-NE, a request for additional information (RAI) will be forwarded to GE-NE and resolution of this issue will be pursued by the staff accordingly.

3.2.2 SIET PANTHERS

The team reviewed test control-related aspects of the SBWR PANTHERS test program. Most of the material reviewed was from the PANTHERS PCCS tests, which used a prototypic, full-scale PCCS heat exchanger, with the objective of acquiring thermal-hydraulic performance data to confirm the applicability of heat transfer models developed from single-tube condensation experiments, and for validation of computer models for SBWR accident and transient analyses. PANTHERS PCCS testing was completed in late 1994. A small amount of information was also reviewed from the PANTHERS IC test program, which had just begun its shakedown phase of testing. Documentation reviewed included test procedures, test logs, test checklists, and test results as reflected by selected data and Apparent Test Results reports.

The test procedures were well organized and documented. There was evidence of test procedure modifications, which had occurred after the beginning of testing, that required minor P&ID modifications. Each revision was checked by at least two individuals. The tests were identified according to which P&ID version they were performed on. There were instances of particular P&ID

modifications that were not reflected in the test procedures. A review of these cases indicated that the modifications were minor enough to not justify the issuance of a new revision of the test procedures.

Any deviations from the test procedures were identified and listed in a Deviations Log with a clear explanation of the nature of the deviation and undertaken corrective action. The deviations included a pump failure (SLP-09, the test was repeated), a few instances of short Data Acquisition System (DAS) failure to record data (no effect on steady state recording) and software errors in calculating derived parameters (no effect on recorded data). In one instance the steam flow rate was incorrectly measured, but the correct value was calculated from other measured parameters, thus there was no need to repeat the test.

In general, implementation in the area of test control was satisfactory and it appeared that a complete record of facility and test operations had been kept. Checklists for the tests reviewed were properly signed off, verifying that the test procedures were followed. The team did note that changes in some test procedures were made by letter from ENEA's Responsible Test Engineer to SIET's facility operations personnel. In some cases, the specified changes were entered by hand on the procedures and checklists, and signed during test operations; a copy of the letter was also appended to the checklists in the DRF. However, the team also found cases in which the requisite changes had not been entered, nor was there a copy of the letter in evidence. These cases were discussed with SIET and ENEA personnel, who asserted that the changes to the procedures, as indicated in the letter, were in fact implemented.

Aside from the above-noted minor deficiencies, test records were in acceptable condition. Apparent Test Results reports also served to document the test results for GE-NE's use, and provided a means by which to trace relevant documentation for each test.

Although a facility description report had been issued early in the program as a stand-alone document, GE-NE informed the NRC team that the information in that report had been incorporated into the Test Plan and Procedures (TP&P) report for the PANTHERS program. GE-NE further indicated that the TP&P report had not been updated and reissued to reflect changes in the material contained therein, nor to incorporate the final, as-built drawings for the PANTHERS/PCCS facility. Accordingly, the NRC recommended to GE-NE that the TP&P be treated as a "living" document, and that it be updated and reissued to serve as a contemporaneous record reflecting the actual PANTHERS test program and facility configuration (see Section 3.4.2.1). A similar recommendation was made with regard to the Test Specifications for the program.

3.2.2.1 Data Acquisition System (DAS)

The test data was recorded by the DAS. The DAS had implementing software with built-in calibration tables for temperature conversion, and calibration constants for pressure conversion. The data conversion software was independently verified line-by-line. The recorded measurements were physically separated from the measurements used for the control of the facility. Each DAS channel was assigned to a specific instrument ID, and there is a list of instruments IDs and their location in Appendix A of the test report.

Each test has associated files name, which include date of the test, list of DAS channels and instruments IDs, as well as name of the software subroutine used. The test data are stored redundantly on computer hard disk, diskettes and back-up tapes. The team concluded that the retrievability of test data would have been enhanced considerably had a table been included directly identifying recording channels with measurement locations on the P&ID.

3.3 Procurement and Calibration of Test Instrumentation

3.3.1 GIRAFFE

Toshiba's AS-50092 provides that methods shall be establish for assuring that the measuring instruments and testing devices are calibrated and adjusted at established intervals or before use in order to maintain their necessary accuracy. Additionally, TOGE110-T07, "Test Plan and Procedures" for GIRAFFE Heat Removal Performance Tests (January 1995) provides that critical instrumentation be calibrated prior and after matrix testing is completed.

Critical instruments for the GIRAFFE/Helium tests are identified in Table 7.8, "List of Essential Instrumentations," of TOGE110-T07. During a walk-down of the test facility the team confirmed that test-related instrumentation was adequately tagged with instrument identification number and calibration status. The team also verified that instrumentation not intended for use in collecting data during testing had been prominently identified as "N/A" as specified in TOGE110-T07 (this practice had resulted from a recommended action item by GE-NE in ARP 95-1).

While reviewing calibration records in Section 4.5 of the GIRAFFE DRF, the team confirmed that critical instrument had been calibrated prior to initiation of testing using instruments traceable to Japan's Ministry of International Trade and Industry (MITI) standards. In one instance where an instrument had to be sent to an outside organization for calibration, the team found documented evidence of calibration traceable to MITI standards.

Overall, the team found calibration records in the DRF to be well organized thus providing evidence of suitable QA controls exercised over GIRAFFE/Helium test instrument calibration activities as required by TOGE110-T01 and AS-50092.

3.3.2 SIET PANTHERS

PANTHERS Test Specification 23A6999, Revision 4, dated April 28, 1995, requires that all test instrumentation be calibrated against standards traceable to the U.S. National Institute of Standards and Technology (NIST) or equivalent.

In Italy, under the auspices of the Western European Calibration Cooperation (WECC), national calibration standards equivalent to NIST are maintained by the Servizio di Taratura in Italia or Italian Calibration System (SIT). SIT establishes and maintains the accreditation of Italian calibration or metrological institutes, such as, the Istituto Metrologico Gustavo Colonnetti (IMGC), the Istituto Elettronico Galileo Ferraris (IEN), and the Ente Nazionale Energie e Ambiente (ENEA). These institutes then provide calibration services to other laboratories, (e.g. SIET), and companies, certifying the traceability of the institutes' standards to SIT.

During the inspection the team toured the calibration facilities at SIET. The team selected a sample of PANTHERS test instruments and confirmed the adequacy of controls in effect to maintain their accuracy and prevent their inadvertent use during any given test sequence. These controls included a computerized listing of instruments in the facility by SIET-specific identification numbers. For in-house calibration services, SIET issues its own calibration certificates providing traceability to a "primary" standard or reference instrument certified by SIT. A list of calibration procedures, and some examples, were made available and briefly scrutinized by the team. Also, the team was informed that SIET was actively pursuing accreditation by SIT as a primary metrological institute in certain areas of measurement.

Based on the above, the team concluded that Control of Measuring and Test Equipment activities at the SIET PANTHERS test facility were effective and identified this area as a strength in the program.

3.4 As-Built Drawings and Configuration Control

3.4.1 GIRAFFE

Section 5(a), "Design Verification and Validation Control," of TOGE110-T01, in conjunction with Section 4, "Design Control," of JEAG 4101-1990 include provisions that require, prior to the conduct of tests, confirmation that the GIRAFFE test facility satisfies the requirements of the test specification, including its fabrication control and/or installation provisions (i.e. configuration). Also, these documents require that the as-built facility configuration be factually depicted in drawings and/or documents which are to be verified and approved, in accordance with the appropriate procedures, prior to being filed in the DRF.

During the inspection, the team verified that Toshiba had properly established the configuration of the GIRAFFE facility for the GIRAFFE/Helium test program. Drawings of the facility found in Section 3.1 of the DRF were confirmed to be as-builts that were generated as a result of two facility measurement activities performed by Toshiba. The issued as-built drawings contained both as-designed and as-built tolerances on the facility dimensions. The team also reviewed (through a translator) the procedure developed by Toshiba for the preparation of the as-built documentation.

Based on this review, the team concluded that the as-built documentation found in the DRF established the adequacy of Toshiba's as-built verification of GIRAFFE's critical dimensions and parameters in conformance with JEAG 4101-1990 and TOGE110-T01 provisions.

3.4.2 SIET PANTHERS

The PANTHERS design history was well documented in the DRF. The internal (SIET) and external (GE-NE, ANSALDO, ENEL) documents are filed separately. Each volume has an index of documents which includes official correspondence as well as notes from relevant informal discussions and records of teleconferences. Many documents regarding test requirements were available in English. The Contract/Agreement between ENEL S.p.A., Ente Nazionale Energie e Ambiente (ENEA), ANSALDO S.p.A., and GE-NE was included in the files. ENEL/ENEA(SIET) were responsible for the design of the facility excluding the PCC and IC heat exchanger (HX) units, which were designed and delivered by ANSALDO. A copy of the design documentation for the HX units was not included in the PANTHERS/PCC design records.

3.4.2.1 Verification of As-built Dimensions and Elevations

PANTHERS Test Specification 23A6999, Revision 4, dated April 28, 1995, provides that test document control and test plant configuration control activities be performed in accordance with NEDG-31831. At the SIET PANTHERS test facility, the corresponding NEDG-31831 provisions are met via 00006-QQ-92 and implemented through SIET Procedures 0002-QQ, "Procedure for Document Control," Revision 3, 0011-QQ, "Internal Procedure for Test Plant Configuration Control," Revision 0, and 00383-PO, "Methods for the Execution of Dimensional Measurements," Revision 0.

In Audit Report ARP 95-3, and earlier in the "PANTHERS-PCC Readiness Assessment Report," GE-NE had identified some deficiencies related to test procedure deviation, document control, and as-built drawing control practices. As a result of GE-NE recommendations (1) a deviation log was filed in the DRF to formally record test procedure deviations for PCC tests, and (2) 00006-QQ-92, and SIET Procedure 0002-QQ, were revised to include provisions for the incorporation of deviations, and a deviation log, in the DRF to reflect any modifications to Test Procedures that had been authorized by the Experiment Manager.

During the inspection the team examined the following documents: PANTHERS-PCC Document Plan No. 00096ED91, Revision 7 (July 17, 1995), PANTHERS-PCC Drawing No. 24.02.13, "PANTHERS-PCC: Drain Line," Revision 2, PANTHERS-PCC Drawing No. 24.02.28, "PANTHERS-PCC: Vent Line," Revision 3, and PANTHERS-IC Document Plan No. 00398ED95, Revision 2 (July 17, 1995). Additionally, one inspector selected a pressure tab elevation to be checked (the Delta-P tab for measurements on the condensate drain tank, L-L002). Measurements obtained in the field by the team corroborated, within the specified tolerance, the dimensions in the as-built drawing.

Based on the information above, including reviews of drawings in the master vendor drawing file (not yet incorporated into the DRF), the team confirmed that SIET had (1) identified and confirmed critical dimensions of PANTHERS-PCC components during receipt inspections, (2) performed as-built dimension measurements of PANTHERS-PCC components supplied by ANSALDO S.p.A. although the process had not been formally proceduralized, i.e., SIET Procedures 0011-QQ and 00383-PO were initially issued in February and March 1995, respectively, and (3) completed as-built measurements of the PANTHERS-PCC test facility.

Related to the final configuration of the PANTHERS-IC/PCCS DRF, the team requested that, subsequent to the completion of all testing activities at PANTHERS, all test plans, specifications, procedures, documents and drawings be updated to incorporate all changes, deviations and/or test anomalies, thereby establishing the final "as-tested" configurations of the test facility.

3.5 Corrective Actions

3.5.1 GIRAFFE

Requirements on the nonconformance control process are prescribed in Section 10, "Nonconformance Control and the (sic) Corrective Actions," of Toshiba's TOGE110-T01 (AS 50128-E), Revision 1, and in Section 7, "Nonconformance Control and Corrective Action," of Toshiba's AS-50092, Revision 1. Additional requirements on nonconformance control are also found in Section 14, "Test Controls," of Toshiba's TOGE110-T07, Revision 2.

Section 14.3, "Test Nonconformances," TOGE110-07, states that any nonconformance to a pretest control or test procedure shall be treated as a nonconformance, and documented and reported for resolution prior to continuation of the next phase of testing. Additionally, Section 14.4, "Nonconformance Report and Corrective Actions," TOGE110-07, specifies that the nonconformance report (NCR) will include a description, evaluation of the nonconformance and any required corrective actions. It also provides that both the Toshiba and the GE-NE responsible engineers will review and approve the NCR.

Based on a review of GIRAFFE H1 and H2 test results, the team determined that at least two deviations occurred during performance of these tests which required a modification to the initial test condition in the GDCS pool and a change to RPV bundle power. The team determined that NCRs were properly issued, reviewed, and approved in accordance with procedural requirements. The technical justifications for these deviations are being evaluated by the NRC staff and are discussed in detail in Section 3.2.1 of this inspection report.

The team reviewed findings, and associated corrective actions, related to Corrective Action Request (CAR) No. 3 that had been generated during an audit conducted by GE-NE in January, 1995 (Section 3.1.1, above), in order to evaluate the effectiveness of the corrective action program at the GIRAFFE test facility. The team verified that all recommended corrective actions associated with this CAR, including confirmation that all personnel performing verifications for the GIRAFFE Helium test program were trained to Procedure TOGE110-T09, "Verification Plan on the Design Documents of the TOGE110 Test Program," had been effectively implemented by Toshiba. The team also confirmed that documentation of this training was maintained in the GIRAFFE design record file (DRF).

Based on the results of these reviews, the team concluded that Toshiba was implementing an appropriate nonconformance control and corrective action program at the GIRAFFE test facility.

3.5.2 SIET PANTHERS

SIET's corrective action program is described in Section 16 of 00006-QQ-92. The inspection team evaluated the pertinent portions of the Quality Manual which addressed nonconforming equipment and test samples, technical concerns, and the corrective action processes. Additionally, SIET Procedures 00003-QQ, "Instrument Control," and 00007-QQ, "Procedure for Internal Audits," were examined to ascertain their adequacy in addressing nonconformance issues related to instrumentation and internal audit findings, respectively.

See Section 3.1.2, above, for a detailed discussion of SIET corrective actions to the audit findings identified in GE-NE Audit Report No. ARP 95-3, "Quality Assurance Audit of SBWR PANTHERS Test Program by Services & Projects Quality - February 6-8, 1995," dated March 10, 1995.

Based on the results of these reviews, it was concluded that 00006-QQ-92 contains appropriate provisions for the identification and documentation of conditions adverse to quality and for the initiation of corrective actions in a timely manner.

3.6 Quality Assurance Records

3.6.1 GIRAFFE

Requirements on the control of quality records at the GIRAFFE test facility are prescribed in Section 11.0, "Retention of QA Documents," of Toshiba's TOGE110-T01 (AS 50128-E), Revision 1, and in Section 8, "Control of Quality Records," of Toshiba's AS-50092, Revision 1. Additional requirements on QA records retention are also found in Section 12, "Record Retention," and in Section 13, "Quality Assurance Requirements," of GE-NE's Document Number 25A5677, Revision 1, and in Section 6, "Verification of Facility As-Built Configuration," and in Section 18, "Record Retention," of Toshiba's TOGE110-T07, Revision 2.

In order to evaluate the implementation of Toshiba's QA records control process the team reviewed a selected sample of QA documents in the DRF associated with H1 and H2 tests. Reviews included test facility as-built drawings, TP&P, instrument lists, calibration records, test data, nonconformance item reports, audit reports, and personnel training and qualification records. The team determined that these documents were easily retrievable and were properly maintained and controlled.

Based on the results of these reviews, the team concluded that the QA records control process was established and properly implemented for the GIRAFFE Helium test program.

3.6.2 SIET PANTHERS

Specific quality provisions applicable to the PANTHERS facility are identified in SIET document SIET 00001-QQ (Quality Manual). Specifically, Section 12 requires that SIET 00002-QQ, "Procedures for Controlling Documents," be used for all document control activities.

SIET uses a comprehensive set of procedures to update, maintain, and control activities associated with testing at the PANTHERS facility. Section 12 of SIET 00001-QQ also lists types of controlled documents at SIET and states that they are subject to a verification and issue procedure as described in SIET 00002-QQ. SIET maintains documentation of all instructions, procedures, and drawings associated with the PANTHERS facility, as well as changes thereto.

Based on this review, the team concluded that SIET has a program in place that is effective in controlling and documenting instructions, procedures, and drawings associated with SBWR testing activities at the PANTHERS facility.

3.7 Audits

3.7.1 GIRAFFE

The audit program requirements are prescribed in Section 12, "Internal Audit," of Toshiba's TOGE110-T01 (AS 50128-E), Revision 1, and in Section 9, "Audit," of Toshiba's AS-50092, Revision 1.

The team reviewed the results of an internal audit of the GIRAFFE Helium test program conducted in January 1995. The team also reviewed related internal audit documentation including auditors' qualification and certification records, audit checklist, audit report, audit findings and corrective actions. The team verified that the audit was performed by appropriate trained QA personnel not having direct responsibilities in the areas being audited. The qualification and certification records for the lead auditor and his staff were also examined and the team found them satisfactory.

An audit was conducted on January 24, 1995, and covered the areas of Engineering, Technical Office Drawings, Test Activities Plant (Plant Log and Data Log), Instrumentation Laboratory, Training, Personnel Qualifications, Document Control, and Instrumentation Control. The audit report, dated February 3, 1995, identified non-conformances and discussed corrective actions of personnel at the time of the audit Reports of each audit are issued to the Managing Director of SIET, to the Nuclear Activities Director, and to the managers of Engineering, Technical Office, and Instrumentation.

The team noted that no external supplier audits were performed by Toshiba since facility instrumentation such as magnetic flow meters, pressure D/P transmitters, and Helium gas flow meters were to be calibrated internally. Issues related to calibration of this equipment are discussed in Section 3.3.1 above.

While reviewing TOGE110-T01, the team noted one minor discrepancy in the second paragraph on page 7. This paragraph did not state that audit results receive final approval from the Toshiba QA department senior manager. The team discussed this discrepancy with Toshiba and GE-NE staff.

Based on the results of these reviews, the team concluded that Toshiba was implementing an appropriate internal audit program at the GIRAFFE test facility.

3.7.2 SIET PANTHERS

Section 17 of SIET 00001-QQ requires that periodic internal audits be conducted by qualified Quality Office personnel in accordance with 00007-QQ, "Procedures for Carrying Out Internal Audits on the Quality System." Section 17 also specifies that the Quality Office carry out periodic internal audits to ensure that the practices in 00001-QQ and Quality Procedures are being efficiently applied. Audit reports are distributed to interested units and the Managing Director.

SIET requires an annual plan for conducting internal audits at the PANTHERS facility. Annual audits were conducted in 1992, 1993, 1994, and 1995 at PANTHERS. The 1995 audit was conducted on January 24, 1995, and covered the areas of Engineering, Technical Office Drawings, Test Activities Plant (Plant Log and Data Log), Instrumentation Laboratory, Training, Personnel Qualifications, Document Control, and Instrumentation Control. The audit report, dated February 3, 1995, identified non-conformances and discussed corrective actions required by personnel at the time of the audit. Reports of each audit are issued to the Managing Director of SIET, to the Nuclear Activities Director, and to the managers of Engineering, Technical Office, and Instrumentation. Overall, the team concluded that SIET was implementing an appropriate internal audit program for PANTHERS test activities.

However, based on conversations with GE-NE during the inspection, it appears that GE-NE did not perform an audit of ANSALDO's facilities for placement on their Approved Suppliers List to ensure that design and fabrication activities related to the Passive Containment Cooling System (PCCS) and Isolation Condenser (IC) heat exchangers (HX) had been adequately conducted under a suitable QA program.

Since ANSALDO is one of the four parties involved in the PANTHERS technical agreement with GE-NE, this issue is identified as Unresolved Item 95-02-01. GE-NE is requested to provide appropriate justification for not performing an audit of ANSALDO as a supplier of safety-related equipment and services as provided for in its QA program.

4 PERSONNEL CONTACTED

Toshiba Nuclear Engineering Laboratory - GIRAFFE

- ● Kenji Arai, Deputy Manager, Systems Analysis Group
- ● Seiichi Yokobori, Senior Specialist, Core & Fuel Technology Group
- ● Kunimichi Watanabe, Chief Specialist, Quality Assurance Department
- ● Tomohisa Kurita, Engineer, Core & Fuel Technology Group
- ● Hirohide Oikawa, Senior Specialist, Reactor Design Engineering Department

Societa' Informazioni Esperienze Termoidrauliche (SIET) - PANTHERS

- ○ Gustavo Cattadori, Head of Component Qualification Division
- ○ Alberto Musa, Quality Assurance Manager
- ○ Stefano Botti, Project Manager, IC-PCC
- ○ Carlo Salomoni, Quality Assurance
- ○ Paolo Masoni, Responsible Test Engineer, ENEA

GE Nuclear Energy

- ○ Forrest Hatch, Manager, NSPD Quality
- ● Terry McIntyre, Project Manager, SBWR Test Ops
- ● ○ Norman Barclay, Manager, Audit Programs
- ○ Paul Billig, Senior Engineer
- ● Maryann Herzog, GIRAFFE Test Responsible Engineer
- ○ Sergio Kanobelj, Liaison Engineer

Nuclear Regulatory Commission

- ● ○ Richard P. McIntyre, Team Leader, Special Inspection Branch
- ● ○ Juan D. Peralta, Quality Assurance and Maintenance Branch
- ● John A. Kudrick, Containment Systems and Severe Accident Branch (SCSB)
- ● Michael Snodderly, SCSB
- ○ Andrzej Drozd, SCSB
- ○ Alan E. Levin, Reactor Systems Branch
- ● Son Q. Ninh, Standardization Project Directorate (PDST)
- ○ James H. Wilson, PDST
- Ted Fujii, Interpreter (State Department)
- ● Kenjiro Ohkuwara, Interpreter (State Department)

● Attended the exit meeting at GIRAFFE on June 14, 1995
○ Attended the exit meeting at SIET on July 21, 1995

MFN-276-95

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 7, 1995

Mr. Jack Duncan
GE Nuclear Energy
175 Curtner Avenue
San Jose, CA 95125

Dear Jack:
Subject: GIRAFFE/SIT Trip Report dtd 10/27/95

As you have requested, enclosed for your information is a copy of my trip report concerning the visit to GIRAFFE and observation of GIRAFFE/SIT Test GS-2. Note that a copy of this report has been placed in the NRC's Public Document Room. The figure of the GIRAFFE facility included was taken from a non-proprietary report.

Please feel free to contact me if you have any questions.

Sincerely,

Alan E. Levin, Senior Reactor Engineer
Reactor Systems Branch
Division of Systems Safety and Analysis
Office of Nuclear Reactor Regulation

cc (w/o encl.): J. Wilson, PDST

copies to JE Quinn
M Herzog
S Sitaraman
BS Shiralkar
JE Leatherman
From JDD 11/15/95

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 27, 1995

MEMORANDUM TO: Gary M. Holahan, Director
Division of Systems Safety and Analysis

THRU: Robert C. Jones, Chief
Reactor Systems Branch
Division of Systems Safety and Analysis

Timothy E. Collins, Chief
Advanced Reactor Systems and Special Projects Section
Reactor Systems Branch
Division of Systems Safety and Analysis

FROM: Alan E. Levin, Sr. Reactor Engineer
Special Projects and Advanced Reactor Systems Section
Reactor Systems Branch
Division of Systems Safety and Analysis

SUBJECT: TRIP TO JAPAN, OCTOBER 8-14, 1995

I traveled to Tokyo and Kawasaki, Japan from October 8-14, to meet with General Electric Nuclear Energy (GE) and Toshiba Corporation to review testing at the "GIRAFFE" facility, at Toshiba's Nuclear Engineering Laboratory in Kawasaki. This testing is being performed for GE by Toshiba as part of the Simplified Boiling Water Reactor (SBWR) design certification testing program. The objectives of the trip included: (1) review and discussion of selected issues related to long-term cooling containment performance tests (GIRAFFE "H" series); (2) review of documentation and data from tests performed to date in the Systems Interaction Test (GIRAFFE/SIT) series; and (3) observation of a matrix test in the GIRAFFE/SIT series. All of the objectives of the trip were accomplished. This report contains a brief description of the GIRAFFE facility and the "H" and "SIT" test programs, a synopsis of the discussions related to those two test programs, and a test observation report. GE and Toshiba personnel contacted are listed on p. 3 in the discussion of the first two days' meetings.

Description of the GIRAFFE Facility and Testing Programs

GIRAFFE is a full-height, low-pressure, integral test facility representing the current configuration of the SBWR. The volume scale of the facility is approximately 1/400. A sketch of the facility is shown in Fig. 1. The facility consists of several large vessels interconnected by piping; the vessels represent the reactor pressure vessel (RPV), the drywell (DW), the wetwell (WW) or suppression chamber (SC) containing the suppression pool (SP), the gravity drain cooling system (GDCS) water supply pool, and two tanks of water containing the passive heat exchangers in the SBWR, namely the passive containment cooling system (PCCS) and the isolation condenser system (ICS). Each heat transfer system in the SBWR (3 ICs and 3 PCCs) is represented in GIRAFFE by a few parallel vertical tubes. The configuration is not the same as that of the plant itself, since, for instance, the SBWR GDCS pool sits within the DW, but the interconnecting piping maintains pressure communication between appropriate components. The SBWR design includes vacuum breakers (VBs) between the WW and DW, which are designed to open when the WW gas space pressure exceeds the DW pressure by a specified amount, in order to permit the PCCS to function (see further explanation below); these VBs are modeled in GIRAFFE. The other key SBWR safety system represented in GIRAFFE is the automatic depressurization system (ADS), which in the plant consists of a set of conventional safety/relief valves (SRVs) that exhaust to the SP and squib-actuated depressurization valves (DPVs) exhausting to the DW. Since GIRAFFE is a low-pressure loop, with a maximum pressure capability of slightly more than 1 MPa (about 150 psia), tests are begun "on the fly," with the facility already depressurizing through the break and ADS. GE's calculations have shown that for all scenarios tested in GIRAFFE, all ADS valves are open by the time the RPV has depressurized to 1 MPa (unless the test simulates the single active failure of one DPV as part of a design basis loss-of-coolant accident), so that the ADS is represented by a flow path between the RPV and the DW. It should be noted that there is no direct ADS path between the RPV and SP, representing the SRVs. GE has claimed that this is not necessary, since the flow area of the DPVs is much larger than that of the SRVs, and would thus be the preferred flow path when all valves are open. GE also considers the lack of an SRV flow path "conservative" with regard to containment pressure, which is one of the key parameters in the GIRAFFE tests, since this configuration does not permit direct condensation of steam from the SRVs in the SP.

The PCCS is a unique cooling system, allowing long-term heat removal from the containment in the event of a loss-of-coolant accident (LOCA). It is designed to condense steam from the DW and to separate the condensate from the non-condensible gas in the DW. The PCCS heat exchanger is open to DW at the inlet, with condensate flowing to the GDCS pool and non-condensible gases (and any uncondensed steam) exhausting to the SP. These interconnections are also represented in GIRAFFE.

The GIRAFFE facility has been used for SBWR-related testing for more than 5 years. The first test programs were performed essentially as "proof-of-principle" tests to study condensation behavior of steam in the presence of non-condensible gases, and to investigate the performance of the PCCS, especially in regard to non-condensible gas venting from the DW to the WW. In June 1994, the NRC performed a quality assurance (QA) inspection on aspects of the early GIRAFFE testing programs, and raised questions about the extent to which Toshiba's QA procedures met GE's QA commitments for the SBWR. In view of the staff's concerns, GE "withdrew" those GIRAFFE data from the SBWR design certification database, although they were retained for use in a "confirmatory" capacity. In addition, GE committed to have Toshiba's QA program for GIRAFFE testing upgraded, because of further planned testing in the facility needed for SBWR design certification. The upgrading of the QA program was completed early in 1995.

As a result of the staff's review of GE's Test and Analysis Program Description (TAPD), GE initiated two "new" test programs at GIRAFFE: long-term cooling performance (primarily containment-related), representing times greater than one hour post-LOCA, with lighter-than-steam non-condensible gas; and systems interaction tests to investigate integral system behavior (primarily reactor-system-related) during the early phase of a LOCA, representing times from about 10 minutes to 2 hours post-LOCA. The former tests were referred to as the "H"-series, denoting the effects of hydrogen, which was simulated in the tests by helium; the latter tests were called GIRAFFE/SIT. The "H"-series tests were completed between approximately April and August 1995, and the GIRAFFE/SIT tests are currently in progress. An earlier trip to the GIRAFFE facility was made by several NRC staff members in June 1995, to conduct a follow-up QA inspection on the revamped Toshiba QA program, and to observe one of the "H"-series tests. Unfortunately, poor weather prevented testing during the staff's June visit; since GIRAFFE is completely outdoors, testing cannot be performed in rainy weather. This trip, then, was the only time that actual matrix testing related to SBWR design certification could be observed in the facility.

Meetings with GE and Toshiba, October 11-12, 1995

I met with representatives of GE and Toshiba at GE's offices in Tokyo on October 11 and 12. GE was represented by Jack Duncan, the responsible engineer for the GIRAFFE/SIT program. Toshiba representatives included: S. Yokobori, K. Arai, T. Kurita, T. Tobimatsu, and W. Mizumachi. Dr. Yokobori has overall responsibility for Toshiba for GIRAFFE SBWR testing. Mr. Mizumachi is the manager for SBWR activities at Toshiba. The remainder of the Toshiba attendees are also involved in GIRAFFE test planning, test performance, and analysis.

The purpose of these meetings was primarily to review the SIT test plans and procedures and to discuss preliminary results from the first SIT matrix test, denoted "GS-1." We also discussed the logistics of transmitting test information and test data from Toshiba, through GE, to the NRC, as required by the staff's review procedure outlined in SECY-91-273. Toshiba reviewed the test procedures for the SIT tests, which are extremely detailed. Step-by-step facility start-up strategies are listed for each test. This is important because each test is begun, as noted above, "on the fly." An actual LOCA in the SBWR would initiate at normal system operating pressure, around 7 MPa. The reactor would begin depressurizing through the break, and the associated loss of inventory would result in reactor scram, main steam isolation valve (MSIV) closure, IC initiation, and ADS actuation as the reactor water level dropped to successively lower values. The introduction of cold water from the outlet plenum of the IC serves to decrease the rate of inventory loss and to depressurize the RPV; subsequent actuation of the ADS causes the RPV to depressurize to near-containment pressure, at which point GDCS valves open and the elevation head of the GDCS reservoirs allows gravity-driven emergency core coolant injection. The GIRAFFE operating pressure of approximately 1 MPa is reached, in most cases, at about the same time as the last ADS valve is opened. Thus, facility initialization must try to capture the thermal-hydraulic characteristics of the system in the middle of the blowdown period. These characteristics include: RPV water level; DW water level (from break and ADS effluent); RPV, WW, and DW pressures and temperatures; core power, accounting for scaling and heat losses; and IC pressure and temperature. The test logic must also account for opening of the GDCS valves at the appropriate time in the transient, reduction of power according to an appropriate decay curve, and actuation of other key components as needed, as the WW-to-DW vacuum breakers.

Other aspects of the test procedures over the duration of the tests were also discussed. For instance, three of the SIT tests represent DEG breaks of a GDCS injection line. Thus, the side of the break in communication with a GDCS pool dumps cold water into the DW, which affects both the GDCS injection head and the condensation of steam in the DW. However, in the SBWR, there are 3 independent GDCS pools, while in GIRAFFE there is a single pool. To account for the depletion of inventory in the SBWR pool affected by the break, flow from the GIRAFFE GDCS pool to the DW is terminated one hour into the test.

Toshiba reviewed the results of facility characterization tests that were performed to confirm proper scaling of pressure losses through the various components of the GIRAFFE facility, and also to measure heat losses that required compensation through the addition of core power or through use of microheaters wrapped around the outside of the test vessels. In general, the facility scaling appears to conform well to the specifications provided by GE.

Toshiba and GE also presented preliminary results of the first SIT test. The SIT matrix comprises 4 tests. One of the major objectives of this program is to investigate the effect of the ICS and PCCS on integral system response in the early stages of a LOCA. The first test represented a DEG break of a GDCS injection line, without use of the ICS or PCCS, as a "control" case. The preliminary results showed a relatively smooth progression of events, with the RPV depressurizing rapidly through the open ADS flow path. The cold water entering the DW from the broken GDCS line helped to condense steam from the RPV and to reduce DW pressure rapidly. The RPV collapsed liquid level dropped well below the top of the active fuel (TAF), but two-phase level swell kept the mixture level above the TAF, and no core heatup was detected. GDCS flow initiated at about 100 seconds after the start of the test, and GDCS inventory was essentially depleted at about 6000 s. An interesting aspect of the test is that the DW-to-WW vacuum breaker actuated repeatedly during the early part of the test. Steam and non-condensible gases flowed from the DW into the WW at the start of the test, through the LOCA vent path (horizontal vents in the SBWR, represented by holes in a pipe from the DW into the WW in GIRAFFE). As the GDCS water in the DW condensed the steam therein, however, the DW pressure dropped below the WW pressure enough to actuate the VB at its differential pressure setpoint; the VB then reclosed at a smaller differential pressure (with the WW still at a higher pressure than the DW), until further condensation in the DW once again caused the VB to open. Throughout virtually the entire GDCS injection period, the DW pressure was lower than the WW pressure, beginning to rise above the WW pressure only near the end of the test, after GDCS injection was completed and steam production in the RPV had resumed.

GE also presented pre-test analyses of Test GS-1, performed with the TRACG code. The test results compared quite well with the pre-test predictions, especially parameters such as containment pressure and GDCS initiation and flow rate. There is some question as to how the VBs are handled in TRACG, since the calculations did not appear to show as many actuations and the pressure responses of the WW and DW during VB opening were somewhat different from the test data, but overall, the analyses appear to predict the trends observed in the tests quite well. The extent to which the use of the ICS and PCCS might affect TRACG performance is not clear at this time, however.

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Meeting and Test Observation at Toshiba Nuclear Engineering Laboratory, October 13

On October 13, I traveled to Toshiba NEL in Kawasaki (about 15 miles south of Tokyo) for further discussions about the GIRAFFE SIT and "H"-series tests, and to observe the performance of test GS-2. The test was nominally a repeat of GS-1, i.e., a DEG break of a GDCS injection line, but with actuation of the PCCS and ICS. However, the discussions also included coverage of preliminary results of a "shakedown" run of GS-2, as well, which had been performed on October 12.

As discussed above, the pre-test procedures in GIRAFFE are relatively complex due to the necessity of initializing a test "on the fly." These complexities are increased when the ICS is used. GS-2 was the first test ever performed in GIRAFFE in which the ICS was brought on line at the test initiation pressure of about 1 MPa. Toshiba determined that it would be difficult to allow the ICS to operate during test initiation, with the condensate returning directly to the RPV, while maintaining pressure in the RPV. Thus, the IC return to the RPV was valved-off, and condensate was allowed to collect in the heat exchanger. If the accumulated condensate was allowed to flow to the RPV when the IC was brought on-line, it would distort the previously-established RPV water level at the start of the test. Thus, the IC was drained outside the facility immediately prior to test initiation, to allow proper loop conditions to be established. This procedure had not been tested prior to performance of GS-2. Therefore, Toshiba performed a "shakedown" run of that test to determine if the ICS start-up procedures accomplished the desired result. In addition, data were taken as if the "shakedown" run was an actual matrix test. Post-test evaluation of the data showed to Toshiba's satisfaction that the ICS start-up procedure was successful, and the data were presented at the NEL as a "preview" of what would likely be seen when the test was performed "officially" later that day. The results of both tests will be discussed further, below.

The topics of discussion other than the preliminary GS-2 run included two major topics: questions related to microheater power adjustments during the "H"-series tests, and possible "lessons learned" from performance of GIRAFFE tests that could be useful in the operation of the NRC's "PUMA" confirmatory SBWR test facility.

As noted previously, microheaters are used as part of the heat loss compensation process for the GIRAFFE facility. Because of its "tall, skinny" aspect ratio, GIRAFFE tends to have significant heat losses--up to about 35% of total input power. The losses are compensated partly by the addition of power in the simulated core, over and above that needed to scale the appropriate reactor power, and by the use of microheater cables, wound around the outside of several of the GIRAFFE vessels, including the WW. Questions about microheater power adjustment were raised by the Containment Systems Branch (SCSB) in its initial review of "H"-series test data. One of SCSB's concerns in the "H" tests was whether the VBs would actuate during the long-term cooling phase of the transients being modeled in GIRAFFE, allowing the recycling of non-condensibles back from the WW to the DW and possibly affecting the performance of the PCCS heat exchanger. During the "H" tests, the VBs did not, in general, actuate, because the WW pressure was not sufficiently greater than the DW pressure to cause the VBs to open. SCSB expressed concern that this could be due to adjustments in microheater power applied to the WW during the test, which would affect directly the WW pressure and, in effect, "drive" the test behavior. Toshiba explained that the philosophy behind the adjustment of WW microheater power was based on the pressure behavior of the WW. In the initial phases of the "H" tests, the microheaters were maintained at essentially constant power. During this period, energy is being added to the SP by venting of non-condensible gases (and possibly some steam) through the PCCS. After this period, however, non-condensible venting was observed to stop, and the system began to operate in an almost-steady mode. With the cessation of energy addition to the SP, Toshiba reasoned that the "ideal" pressure (if heat losses were zero) would stay constant, and manually adjusted the WW microheaters to achieve constant pressure. In general, these adjustments were to reduce microheater power and thus to keep the WW pressure from rising. While this explanation, on its face, appeared to be reasonable, it is clear that the microheater adjustment does have the potential to affect the WW pressure, and thus to affect whether the VBs do or do not actuate. Further discussion about this issue between SCSB staff and GE is planned.

Toshiba also presented a rather extensive list of possible areas in which its experience in operation of GIRAFFE might prove useful as the NRC prepares to begin its testing in the PUMA facility at Purdue University. Although PUMA is the same approximate volume scale as GIRAFFE (1/400), it is 1/4-height and 1/100-area, compared to GIRAFFE's full height. However, PUMA's maximum operating pressure is approximately the same as GIRAFFE's, and the problem of test initialization "on the fly" is common to both facilities. Toshiba provided a list of about 20 items that were considered to be important in facility design, preparation, and operation. Some of those items can be considered to be representative of good engineering practice, such as provision for fuel rod simulator overtemperature protection, proper calibration of instrumentation, and adequate facility characterization testing. However, of particular note was a recommendation that the capability be included to isolate all loop vessels from one another. Toshiba has found that it is much easier to establish approximate test initiation conditions independently in each vessel prior to establishing communication paths between those vessels. Accordingly, all major components are isolated from one another during pre-test preparation, and only after starting conditions are established and controlled in each vessel are the valves opened to allow the system to equilibrate prior to beginning the actual test. This and Toshiba's other recommendations will be provided to and discussed with the Office of Research prior to the beginning of matrix testing in PUMA (scheduled for about mid-November).

The final activity at the NEL was review of the "shakedown" run of GS-2 and observation of the "official" run of that test. Toshiba had plotted some of the key data from the shakedown run, for comparison to both GS-1 and TRACG pre-test analysis. To some extent, the response of GS-1 and GS-2 were similar, especially near the start of the test. The minimum water level in the RPV was not as low as in GS-1. This was due in part to a higher starting level, the value for which was determined from an analysis of the event. The

ICS return valve opens prior to ADS actuation, so that any accumulated water in the IC tubes and outlet plenum enters the RPV. This adds inventory and also helps depressurize the RPV. As a result, the predicted water level in the RPV when the pressure reaches about 1 MPa, which is used to determine that parameter in GIRAFFE, is somewhat higher than if the ICS is not employed. Other trends in the two tests were quite similar. The DW and WW pressure curves in GS-1 and GS-2 were of the same general shape, with condensation in the DW occurring due to the injection of GDCS water through the broken line. As a result, the WW pressure stayed higher than the DW pressure, again causing numerous actuations of the VB; however, since the PCCS operates only when the DW pressure is greater than the WW pressure, that system did not play a substantial role until very late in the transient. The peak containment pressure in GS-2 was about 10% lower in GS-2 than in GS-1, at least partly as a result of IC heat removal. The DW and WW pressures began to increase shortly after the cessation of GDCS flow to the DW (at one hour). In GS-1, after GDCS injection to the RPV had ended, steam production resumed in the RPV, and the venting of that steam through the ADS to the DW brought the DW pressure above that of the WW. Since the PCCS was shut off in GS-1, there was no energy removal to reduce the DW pressure, and near the end of the test, the DW pressure exceeded the WW pressure sufficiently to open the LOCA vents. In GS-2, the ICS and PCCS were both available to remove energy once steam production resumed, and the PCCS operation prevented the DW from reaching a pressure sufficiently greater than that of the WW to open the LOCA vents. In this test, therefore, the PCCS performed its function in limiting both overall DW pressure (up to 2 hours post-LOCA) and the pressure difference between the DW and the WW. There were no apparent detrimental systems interactions, and safety-related injection and heat removal systems operated as designed.

The pre-test predictions for GS-2 also tended to match the data quite well. However, the TRACG calculations of VB performance showed the same behavior as that described above for GS-1 conditions. More information about how the VBs are modeled in TRACG is needed to be able to assess the reasons for the code's behavior.

The "official" run of test GS-2 was observed beginning shortly before test initiation. All loop manipulations required to "fine-tune" the facility prior to test initiation can be done from the control room using remote manual actuation of facility components. A small control room staff was required to accomplish those tasks. The written procedures were followed closely, and steps were noted on a test log/checklist, which was signed by the test engineer. Toshiba staff operated very smoothly, and there appeared to be appropriate consideration of testing QA throughout the observed portion of the test initialization process and in the performance of the experiment. I was able to track key parameters, such as WW and DW pressures, GDCS flow, selected temperatures, and water levels through control room digital displays or analog chart recorders. The GDCS initiation time, GDCS flow rate, RPV water level, and approximate pressure-time response of the WW and DW agreed very closely with the results from the previous day's "shakedown" run. The two tests therefore provide an indication of data repeatability, which should also be valuable in the staff's assessment of the test program.

Other Observations and Concluding Remarks

In general, the trip accomplished essentially all of its objectives. Most important, in my view, was the opportunity to witness at least one matrix test in the GIRAFFE facility. Toshiba obviously has a great deal of pride in the GIRAFFE loop, and one gets the impression that that pride was wounded, to some extent, as a result of the QA deficiencies identified both by the staff in its initial inspection of the GIRAFFE program in June 1994, and by GE in an audit conducted early in 1995. Toshiba corrected those deficiencies, as indicated in the staff's June 1995 QA inspection, and appeared anxious to demonstrate that proper QA practices were being followed in these tests.

There appear still to be some problems in making proper logistical arrangements for the transmittal of GIRAFFE test information from Toshiba to GE to the NRC. Toshiba is very protective of its information, and essentially all documentation provided by Toshiba is noted as Toshiba Proprietary. GE then marks the information as GE Proprietary when providing it to the NRC, but the proprietary nature of the information may not be indicated in the manner needed by the staff to make its required assessment. This is ultimately a problem that GE must solve, but the staff will need to follow this issue closely to make certain that all relevant information on the GIRAFFE "H" and SIT test programs is provided to the NRC. ? GE saw data ~ 2 hr before NRC

One other observation concerns the interaction between Toshiba and GE on this program. For the GIRAFFE/SIT tests, it appears that GE is depending heavily on Toshiba to provide a detailed description of the facility response during the tests, including a phenomenological analysis, i.e., determining what thermal-hydraulic phenomena are causing the facility to behave as observed. The description of facility response in tests GS-1 and GS-2 was almost entirely a Toshiba effort. The extent to which GE personnel will be involved in such analyses is not clear; however, it is essential that, in fulfilling the ultimate purpose of the tests, i.e., TRACG qualification, detailed phenomenological insights be provided to GE's analysts to allow model validation and modification, as appropriate. The way in which this information is provided to and assimilated by GE, and how it is reflected in TRACG validation and applicability documentation, will need to be tracked by the NRC staff as part of its review.

Overall, the recent GIRAFFE "H"-series and SIT tests appear to comprise well-run test programs, conducted with appropriate attention to QA concerns. Some issues, such as scaling and test control (e.g., microheater power) still require additional discussion with GE for resolution, but the data provided by these test programs should be useful for code validation as part of the SBWR design certification effort.

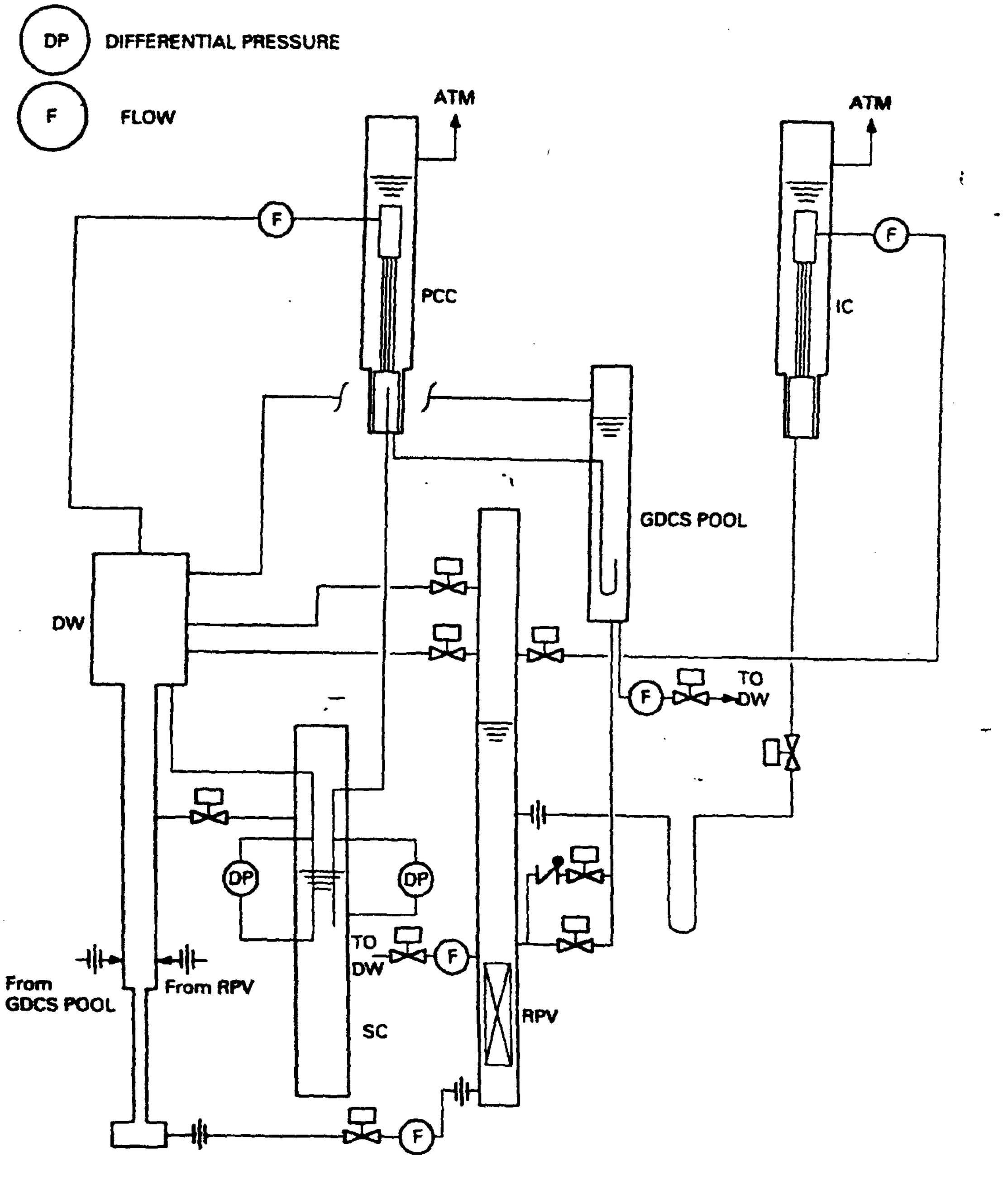

Figure 1. GIRAFFE Test Facility (System Interaction Tests)

GE Nuclear Energy

J. E. Quinn, Projects Manager
LMR and SBWR Programs

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408 925-1005 (phone) 408 925-3991 (facsimile)

March 4, 1996

MFN 034-96
Docket 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Theodore R. Quay, Director
Standardization Project Directorate

Subject: **SBWR - Redirecting Focus**

GE Nuclear Energy is redirecting the focus of its Simplified Boiling Water Reactor (SBWR) programs from plants of the 670 Mwe size to plants of 1,000 MWe or larger. Consequently, GE will be substantially reducing the level of activity on the current 670 Mwe plant Technology Phase, which has been the focus of GE's SBWR efforts with the NRC over the past 20 months. However, GE wishes to complete key ongoing test and analysis activities to make this data available for other applications of this technology.

In line with redirecting the SBWR focus, GE would like to review with NRC the orderly closure of open NRC activities for the 670 Mwe plant. The Attachment to this letter presents our listing of the open activities and our desired closure objective, output, and schedule. We look forward to discussing the efficient close out of the open items in the manner which can provide the best results for both the NRC and GE.

Sincerely,

R1 Buchholz for

James E. Quinn

Attachment: **SBWR Project Redirection - NRC Activity Closure Plan**

cc:	P. A. Boehnert	(NRC/ACRS)	(2 paper copies w/att. plus E-Mail w/att.)
	I. Catton	(ACRS)	(1 paper copy w/att. plus E-Mail w/att.)
	S. Q. Ninh	(NRC)	(1 paper copy plus E-Mail w/att.)
	D. C. Scaletti	(NRC)	(1 paper copy w/att. plus E-Mail w/att.)

Attachment to MFN 034-96

SBWR Project Redirection - NRC Activity Closure Plan

Opened NRC ACTIVITY	NRC OBJECTIVE	NEXT OUTPUT	SCHEDULE FOR NEXT OUTPUT
Review of TAPD Rev C submitted 8/28/95	Agree Testing and Analysis Program Document is complete & resolves prior issues	FSER	5/15/96
Review of Scaling Report Rev 1 submitted 10/13/95	Agree that the methodology used to scale the tests is correct & complete & resolves prior issues	Written status report of preliminary review	3/15/96
Testing Data Reports MFNs 057-95, 058-95, 075-95, 086-95, 109-95, 121-95, 157-95, 194-95, 245-95, 246-95, 273-95, 274-95, 025-96, 024-96, 018-96, 005-96, 004-96 GIR He FINAL DTR 4/26/96 GIR SIT FINAL DTR 5/17/96 PANDA FINAL DTR 5/24/96 PANTHERS IC TR 3/12/96	Agree that the required parameters are properly & completely included	Written letter of concurrence	<6/15/96
PANDA/ ANSALDO QA NRC Inspection 3/5-8/96 & 3/11/96	Confirm that Testing was done in accordance with procedures and meets NQA1	Written report of audit/findings	4/15/96
Test Analyses MFNs 119-94, 270-95, 261-95, 193-95, 185-95, 178-95, 161-95, 159-95, 098-95, 097-95, 006-96.	Closing status	Written summary of status at point of "stop work"	3/15/96

GE Nuclear Energy

MFN 034-96

bcc: (E-Mail w/att. except as noted)

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GE Master File		(1 paper copy w/att. plus E-Mail w/att.)
SBWR Project File		(1 paper copy w/att. plus E-Mail w/att.)

GE Nuclear Energy

MFN 034-96

tac: [E-Mail]

E Lumini	8-011-39-10-655-8279
S Spoelstra	8-011-31-22-456-3912
V Cavicchia	8-011-39-68-509-8601
JJ Pena	8-011-34-1-347-4215
K Maubach	8-011-49-721-987-7257
C Witteman	8-011-31-48-841-2128
A Zimmermann	8-011-49-406-396-3661
J Yamashita	8-011-81-29-423-6750
W van der Mheen	8-011-31-26-351-8092
A van Dijk	8-011-31-20-580-7041
G Yadigaroglu	8-011-41-1-632-1166
K Petersen	8-011-49-201-122-4092
H Tonegawa	8-011-81-33-597-2227
F Kienle	8-011-49-69-630-4420
P Masoni	8-011-39-51-609-8639
W Mizumachi	8-011-81-33-597-2227
G Varadi	8-011-41-5-698-2327
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March 14, 1996

MFN 037-96
Docket 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Paul Boehnert
ACRS Staff

Subject: **SBWR - ACRS, Redirecting Focus**

Reference: 1. Letter MFN 034-96, J. E. Quinn (GE) to T. R. Quay (NRC), SBWR - Redirecting Focus, dated March 4, 1996.

As discussed in the Reference 1 letter, GE Nuclear Energy is redirecting the focus of its Simplified Boiling Water Reactor (SBWR) programs from plants of the 670 MWe size to plants of 1,000 MWe or larger. Consequently, GE will be substantially reducing the level of activity on the NRC/ACRS effort as it applies to the 670 MWe plant. However, GE would like to complete key open items.

Specifically, GE would like to receive written ACRS agreement that the TAPD Revision C document submitted August 28, 1995, is complete and resolves the prior ACRS issues, and that ACRS agrees that the methodology used to scale the tests as presented in the Scaling Report Revision 1 submitted October 13, 1995, is correct and complete and resolves the prior ACRS issues.

We would then like to cease ACRS activities on the 670 Mwe SBWR. We believe that ACRS could complete the work and issue the written communications by May 15, 1995. We look forward to discussing this letter with you at your earliest convience.

Sincerely,

James E. Quinn

cc:	T. R. Quay	(NRC)	(1 paper copy plus E-Mail)
	I. Catton	(ACRS)	(1 paper copy plus E-Mail)
	S. Q. Ninh	(NRC)	(1 paper copy plus E-Mail)
	D. C. Scaletti	(NRC)	(1 paper copy plus E-Mail)

GE Nuclear Energy

MFN 037-96

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GE Master File	(1 paper copy plus E-Mail)
SBWR Project File	(1 paper copy plus E-Mail)

MHV 061-16

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 12, 1996

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, California 95125

SUBJECT: STATUS OF THE SIMPLIFIED BOILING WATER REACTOR (SBWR) TEST PROGRAMS AND TRACG REVIEW

Dear Mr. Quinn:

In your letter dated March 4, 1996, you indicated that GE was redirecting the focus of its SBWR programs from plants of the 670 MWe to plants of 1,000 MWe or larger. In line with redirecting the SBWR focus, you provided the staff with the proposed schedule for the Nuclear Regulatory Commission (NRC) to review the TAPD Revision C, Scaling Report Revision 1, test reports, test analyses, and to issue the PANDA QA audit report. Specifically, you asked the staff to proceed with the orderly closure of these activities. Following the receipt of your March 4 letter, the staff met with you and conducted a number of conference calls with the intention of understanding GE's closure objectives and the products GE wished to receive from the staff closure activities.

In your letter dated March 13, 1996, you indicated that GE was substantially reducing the level of activity on the TRACG effort as it applies to the 670 MWe plant. Specifically, you requested that the staff stop work on the review of the TRACG application Licensing Topical Report (LTR) NEDE-32178 and provide a summary of the review of this document. With regard to the TRACG Qualification LTR NEDE-32177, you asked the staff for a written feedback on GE responses to the request for additional information (RAIs) and then to stop work on review of this document. With regard to the TRACG Model LTR NEDE-32176 you requested the staff to issue a letter of acceptability of this report by April 12, 1996, a draft safety evaluation report (DSER) by June 12, 1996, and a final safety evaluation report (FSER) by October 1996.

GE's request for orderly closure of the SBWR programs will result in the closure activities competing for resources with other high priority activities such as operating reactor issues. Consequently, the staff can not accelerate the schedule for closeout of open SBWR activities as you requested. The staff, however, developed the following schedule.

SBWR TESTING PROGRAM:

1. The staff will issue its safety evaluation report (SER) on TAPD Revision C by May 15, 1996. This report will describe events since the original submission of TAPD Revision A, the status of the staff's review of the testing performance and it will characterize the staff's opinion of the quality of the test program.

2. The staff will provide the status of its review of the scaling report - what has been reviewed, what remains to be reviewed and comments relevant to these two areas by about May 17, 1996.

3. The staff will issue its report concerning the PANDA QA audit and the Ansaldo QA discussions by about April 30, 1996.

4. Per GE's request, with the exception of the review of the PANTHERS PCC data which will be completed and issued by April 22, 1996, the staff will not perform a detailed review of test reports and test analyses. The evaluation of the GIRAFFE (He and SIT) and Panda data will be limited to the QA program, the test procedures, the test objectives and the acceptability of the test data for purposes of licensing review. If GE meets the scheduled date for the submission of the final data report (DTR) for GIRAFFE He (April 26, 1996), the staff review will be issued by about May 25, 1996. Similarly, for a PANTHERS IC DTR delivered on April 15, 1996, the staff review will be issued around May 15, 1996, and for both GIRAFFE SIT and PANDA DTRs delivered on June 4, 1996, the staff review will be issued by mid-July 1996.

SBWR TRACG

1. The staff will prepare a written status of the review of the TRACG Application LTR by about May 31, 1996.

2. The staff will provide a written status on its review of GE responses to the staff's RAIs of the TRACG Qualification LTR and a summary of the status of the review of this report by about May 31, 1996.

3. The staff will issue a letter of acceptability of the TRACG Model LTR by May 15, 1996. However to proceed beyond this will require completed reviews of all the test data referred to in Item 4 above. Therefore, the staff does not plan to issue a DSER or FSER for the TRACG Model LTR at this time.

If you have any questions regarding this matter, please contact Son Ninh at (301) 415-1125 or Donald McPherson at (301) 415-1246.

Sincerely,

Dennis M. Crutchfield, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 50-004

cc: See next page

Mr. James E. Quinn
GE Nuclear Energy

Docket No. 52-004

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 11, 1996

MFN 119-96

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, California 95125

SUBJECT: STAFF EVALUATION OF GENERAL ELECTRIC'S (GE's) TEST AND ANALYSIS PROGRAM DESCRIPTION, NEDC-32391, REVISION C

Dear Mr. Quinn:

In response to your letter dated March 4, 1996, the staff has prepared the enclosed report on its evaluation of the GE's Simplified Boiling Water Reactor (SBWR) Test and Analysis Program Description (TAPD).

Overall, the staff notes that GE has made significant progress in addressing previous issues and questions identified by the staff in the Draft Safety Evaluation Report (DSER) and the requests for additional information (RAIs). The staff concludes that, with the exception of the PAR and PIRT issues, TAPD Revision C can be accepted as a framework for the SBWR testing program and the TRACG qualification process if it is fully implemented as described. However, a final approval of the adequacy of the test program for qualification of the TRACG code and for design certification of the SBWR is not possible without completing a detailed review of the test data, scaling report, TRACG licensing topical reports, and GE's analysis thereof.

You are requested to review the enclosed report to determine if it contains any GE proprietary information and provide your response within 30 days of the date of this letter.

If you have any questions regarding this matter, please contact Son Ninh at (301) 415-1125.

Sincerely,

Theodore R. Quay

Theodore R. Quay, Director
Standardization Project Directorate
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 52-004

Enclosure: Introduction
and Background

cc w/enclosure:
See next page

Mr. James E. Quinn
GE Nuclear Energy

Docket No. 52-004

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Enclosure to be distributed to the following addressees after the result of the proprietary evaluation is received from Simplified Boiling Water Reactor:

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Office of Radiation Programs
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Mr. Sterling Franks
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INTRODUCTION AND BACKGROUND

In 1992, General Electric Nuclear Energy (GE) submitted to the NRC an application for design certification of the Simplified Boiling Water Reactor (SBWR). The SBWR is a "passive" plant design, in that operation of safety systems does not require "active," ac-powered components. To support design certification, GE developed a Design Certification Testing Program, to satisfy the requirements of 10 CFR 52.47(b)(2)(i)(A), which states that for a plant that "utilizes simplified, passive, or other innovative means to accomplish its safety functions," the applicant must demonstrate that:

1. The performance of each safety feature of the design has been demonstrated through either analysis, appropriate test programs, experience, or a combination thereof;

2. Interdependent effects among the safety features of the design have been found acceptable by analysis, appropriate test programs, experience, or a combination thereof;

3. Sufficient data exist on the safety features of the design to assess the analytical tools used for safety analyses over a sufficient range of normal operating conditions, transient conditions, and specified accident sequences, including equilibrium core conditions.

The NRC staff began its review of GE's design certification test program in 1991, prior to GE's formal design certification application. In October 1992, the staff issued its preliminary review of the test program in SECY-92-339, "Evaluation of the General Electric Company's (GE's) Test Program to Support Design Certification for the Simplified Boiling Water Reactor (SBWR)." In this document, the staff indicated that it had several concerns regarding the proposed test program that needed to be resolved. These concerns involved such issues as the design of test facilities, scope and range of test matrices, and GE's classification of certain programs as "confirmatory" rather than required for design certification.

Between 1992 and 1994, the staff and GE met several times to attempt to resolve the issues discussed in SECY-92-339. In addition, the staff continued its detailed review of GE's test programs, both those completed prior to the submission of the application and those planned for the future. The detailed test review raised additional concerns. In March 1994, by letter from Dennis M. Crutchfield, Associate Director for Advanced Reactors and License Renewal, NRR, to Patrick W. Marriott, Manager, Advanced Plant Technologies, GE, the staff detailed testing-related issues, both those remaining from SECY-92-339 and new concerns, that it believed needed to be resolved to permit the design certification process to continue.

On April 1, 1994, in response to the staff's letter, GE committed to perform a reassessment of the testing and analysis programs for the SBWR, and to report the conclusions of that reassessment to the staff. The outcome of GE's reassessment, entitled "SBWR Test and Analysis Program Description," NEDC-32391, hereinafter referred to as TAPD, was submitted to the staff on August 10, 1994. The staff issued a draft safety evaluation report (DSER) on the initial version (Revision A) of TAPD to GE in November 1994. In that review, the staff reached the conclusion that, while the document provided a good framework for the assessment of testing and analysis requirements for the SBWR, additional information was required on several aspects of the material in the report, and that additional testing in two major areas was required to support SBWR design certification: containment-related integral-effects testing with lighter-than-steam non-condensible gases; and integral systems testing covering the late blowdown and early ECCS injection phases of SBWR design-basis accidents. The staff said that, if the required modifications to the test program were made, and if the additional information requested was provided, satisfaction of the requirements of 10 CFR 52.47(b)(2)(i)(A) was feasible.

The staff met with GE in December 1994 and January 1995. In addition, GE presented the TAPD to the Advisory Committee on Reactor Safeguards (ACRS) in January 1995. As a result of these meetings, a number of action items were identified. GE committed to address these items in subsequent revisions of the TAPD. GE informed the staff that this would be a "two-stage" process, with Revision B of the TAPD addressing about half of the action items, and Revision C addressing the remainder. In response to the staff's conclusion regarding additional testing, GE also committed to perform two series of tests in the GIRAFFE facility at Toshiba's Nuclear Engineering Laboratory, in Kawasaki, Japan: an "H" series, using helium to simulate hydrogen behavior in the containment; and a series of "system interaction tests," denoted GIRAFFE/SIT, to examine the late blowdown/early ECCS injection phases of SBWR LOCAs.

TAPD, Revision B, was submitted to the NRC in April 1995. While a number of the action items were resolved, the staff found that there were still many unresolved issues and questions that GE needed to address. The staff issued Requests for Additional Information (RAIs) 900.102 - 900.181, concerning TAPD, Revision B, in June 1995. GE agreed to address these RAIs in Revision C of the TAPD.

TAPD, Revision C, was submitted to the NRC in August 1995. It comprised a substantial revision of the previous versions of the report, and included a supplement describing in detail the process of developing Phenomena Identification and Ranking Tables (PIRTs) for the SBWR. In addition, a separate report, entitled "Scaling of the SBWR Related Tests," NEDC-32288, Revision 1, was issued in October 1995 to supplement the TAPD in the area with regard to the scaling approaches for the various SBWR test facilities.

In March 1996, during the staff's review of TAPD, Revision C, and the associated scaling report, GE announced that it was withdrawing the SBWR from the NRC's design certification program. GE committed to complete the "technology phase" of the SBWR program, which comprises the test programs and associated reports, plus a very limited description of SBWR modeling using the TRACG computer code. GE has completed all of its planned testing activities and has issued all test reports with the exception of the PANDA test reports. The NRC staff agreed to complete its review of the TAPD, Revision C and also to provide feedback on the scaling report.

Summary of Staff's Evaluation of the SBWR TAPD Revision C Report and Major Conclusions

Evaluation of the SBWR TAPD Revision C Related to Reactor Systems Area

This assessment of the SBWR test and analysis program covers only the TAPD descriptive material (primarily PIRT development) and the test matrices for relevant programs. Detailed evaluation of the test data has not been performed, and no conclusions can be drawn about the final acceptability of the test programs to provide data for code validation, to satisfy the requirements of 10 CFR 52.47 (b)(2)(i)(A).

The staff has reviewed TAPD, Revision C, and has determined that GE has essentially fulfilled its commitments to address (1) the "actions items" from the DSER, except as noted below, and (2) non-scaling-related RAIs from its review of TAPD, Revision B.

In the DSER, the staff stated, "The staff requires considerably more information than is available in the TAPD report on the details of the code qualification program for TRACG. Neither the TAPD report nor the code qualification documentation for TRACG that GE has submitted...provides sufficient information on code models and correlations and their applicability over the range of SBWR thermal-hydraulic conditions, nor has the staff been able to determine from these documents how the test data will be used to quantify uncertainties and biases in the analyses, especially for LOCAs." In February 1996, GE submitted the TRACG Model Licensing Topical Report (LTR), Revision 1 to the NRC for review. However, on March 13, 1996, GE requested that staff suspended the review of the TRACG Qualification LTR Revision 1 and the TRACG Application Revision 0, and also requested that staff provide written summary of status of the review of these reports. The staff has committed to issue status reports on the reviews of the Application and Qualification LTRs, and also to issue a letter documenting an acceptance review of the Model LTR (letter, Crutchfield to Quinn, "Status of the Simplified Boiling Water Reactor (SBWR) Test Programs and TRACG Review," April 12, 1996).

The staff concludes that TAPD, Revision C represents a substantial improvement over Revisions A and B, and that most of the staff's non-scaling-related comments and questions have been satisfactorily addressed. The remaining outstanding issues related to TAPD Revision C concern the PIRT, and are addressed in more detail below. Most significantly, the staff notes that GE has complied with its commitment to perform late blowdown/early ECCS integral systems testing in the GIRAFFE facility; the GIRAFFE/SIT series of experiments was completed in October 1995. The staff reviewed GE's test matrix for GIRAFFE/SIT, and determined that it likely would address the technical issues for which the testing was required.

GE also revised the test matrix for the PANTHERS/IC test program, performed at SIET Laboratories in Piacenza, Italy, in response to staff comments in the TAPD, Revision A, review. The staff reviewed the revised test matrix, and determined that the changes satisfactorily addressed the staff's concerns.

GE has addressed most of the staff's comments and questions regarding discussion of the PIRT as presented in Revisions A and B of the TAPD. The staff notes that, the PIRT process, as documented in the TAPD and the PIRT supplement, represents a commendable effort that addresses in detail the thermal-hydraulic phenomena relevant to the SBWR in the context of safety analysis. However, the staff still has several comments and questions related to the PIRT in TAPD, Revision C, many of which concern consistency in phenomena identification and ranking in different sections and/or tables in the TAPD, or the rationale for choosing certain rankings during various phases of SBWR accidents. Additional comments relate primarily to coverage of specific phenomena in data from test facilities and programs outside of those performed as part SBWR design certification testing program. These comments and questions are listed in Appendix A to this report.

In the DSER, the staff indicated that it would also review the implementation of quality assurance (QA) in the conduct of the test programs, to determine if GE and its partners in the SBWR test program fulfilled GE's commitment to meet NQA-1 requirements for SBWR design certification testing activities. The staff has conducted QA inspections of all of GE's major SBWR design certification test programs (GIST, PANTHERS/PCCS, PANTHERS/IC, GIRAFFE, and PANDA), and has concluded that, for GIST, PANTHERS, and GIRAFFE, NQA-1 requirements were met, or that appropriate remedial actions were taken to correct deficiencies found during those inspections. The PANDA QA inspection was conducted in March 1996, and two non-conformances were reported to GE as a result of that review. The staff therefore requires that GE implement corrective actions to close the deficiencies identified during the PANDA QA inspection.

Summary and Conclusions

When the TAPD was originally submitted to the NRC, GE posed three major questions to the staff for review:

1. Is the test program adequate for qualification of the TRACG code?

2. Is the test and analysis program adequate for design certification of the SBWR?

3. Is construction of a new integral test facility required for additional SBWR testing?

The staff's original evaluation stated that, if GE provided the required additional information on TRACG and modified the test programs per staff recommendations, accomplishment of the first two objectives was "feasible."

The staff further determined that the required additional testing could likely be accomplished in an existing SBWR test facility (i.e., GIRAFFE), so that construction of a new facility was not required.

The conclusions reached in the current evaluation of the revised TAPD are consistent with those cited above. Since the staff will not have the opportunity to review detailed information regarding TRACG qualification using data from the SBWR test program, a final conclusion cannot be reached on Question 1. The response to the second question must also be a preliminary one. As stated above, the staff's evaluation of the test matrices for reactor-systems-related testing is that the specified test conditions appear to be adequate to provide necessary data for design certification and TRACG qualification. However, final conclusions concerning the adequacy of testing to satisfy the requirements of 10 CFR 52.47(b)(2)(i)(A) cannot be drawn without a detailed review of the test data and GE's analysis thereof.

Evaluation of the SBWR TAPD Revision C Related to Containment Area

The staff has reviewed TAPD, Revision C and has determined that GE has sufficiently addressed many of the previous staff's concerns and that TAPD, Revision C defines a systematic and comprehensive plan to test and analyze the SBWR-related phenomena. The staff concludes that the plan, as described, can be accepted as a framework for the SBWR testing program and TRACG qualification process. However, in that GE has not fully dealt with all of the previous staff's concerns in Revision C, the following discussion is provided.

Some of the containment issues identified in the DSER (letter from J. H. Wilson to P. W. Marriott, November 29, 1994) are not addressed in the Revision C, i.e., (a) PCCS and containment response with a stuck open vacuum breaker; (b) degradation of PCCS performance through ingestion of debris in the drywell, and (c) potential influence of the passive autocatalytic recombiners (PARs), including interaction between the PARs and PCCS. In the subsequent meetings GE presented a position that these issues can be addressed analytically using qualified TRACG code. In principle, the staff can accept such an approach; however, the final acceptance of this approach can be made only after the qualification of the TRACG code is completed.

The staff remains concerned with the exclusion of the PAR testing from the TAPD framework. In the response to Question 900.135, (which is not included in the Revision C), GE claims that "An extensive database already exists on the PAR units." The staff is not aware of such a database; therefore, GE should provide additional information with a detailed description of the PAR technology. Without this additional information, the staff believes there may be a need in the future for additional tests.

The review of TAPD, Revision C led to a number of additional questions listed in Attachment 1. These questions do not invalidate the acceptance of the TAPD, Revision C as a framework document. Rather, it is a list of detailed issues that need to be addressed before final approval of the program can be granted.

The staff's review of TAPD, Revision C has focused on the three general areas: 1) scaling of the test facilities, 2) quality of the test data, including adequacy of the test matrices, and 3) physical models incorporated into the TRACG code. These three areas are discussed below.

The staff has previously provided an evaluation of the GE TAPD scaling analysis. The staff's major concern was the application of the scaling analysis within the frame-work of the testing program. The only other related comment the staff would make in this evaluation is regarding the statement in Revision C Section 1.2.2 that "GE has used a procedure similar to CSAU methodology .... and submitted to the NRC." This statement refers to a Rash to Jones letter in 1992 that submitted a set of view graphs from a presentation, essentially outlining what is now TAPD, including initial PIRTs. It contains a few of the elements of CSAU, but it does not constitute a procedure similar to CSAU. In particular, there were no sensitivity and uncertainty analyses included.

Regarding testing, the staff has performed an evaluation of the PANTHERS/PCC data and is reviewing the GIRAFFE data. The PANDA results have not yet been submitted for the staff's evaluation. In general, the test matrices described in Revision C seem to be adequate, i.e., the range of parameters expected for the SBWR operation seems to be well covered. However, by witnessing these tests the staff noted that in the case of the PANDA program some test procedures were modified. In some cases the tests were not performed as long as originally intended. In another case, GE claims that the objectives of two different tests are met with a single test, e.g., tests M6 and M8. The staff is concerned that such late modifications may affect the implementation of the framework document.

The <u>TRACG Model</u> (LTR NEDE-32176P) review is pending and its evaluation will be included in a separate SER. The TAPD, Revision C identifies the SBWR-related phenomena and a need for associated computer models. In particular, Table 2.3-2 provides a good cross-reference between the SBWR containment phenomena and the code physical model. The list seems to be comprehensive and, as presented, is acceptable.

However, the staff is concerned with the application of the TRACG as a best-estimate code. This issue has already been raised in RAI 900.134. The staff was informed verbally (August 1995 meeting at San Jose) that GE is now proposing a new "hybrid" approach, i.e., a mixture of best estimate and bounding (conservative) calculations. This new approach may have a significant impact on some TAPD items. Discussion of this change is missing from the document.

SUMMARY AND CONCLUSIONS

The staff's review of TAPD, Revision C has determined that it defines a systematic and comprehensive plan to test and analyze SBWR-related phenomena. The acceptance of the plan is based on current knowledge without having the opportunity to evaluate many of the test results. As a result, it should be understood that final acceptance or approval can only be provided after having completed the evaluation of all of the program elements, i.e., the scaling report, the test data evaluation, the TRACG model, and the TRACG qualification report.

While the staff has accepted the plan, there are certain areas that have not been addressed which are necessary to have a complete program. These areas are identified in the form of RAIs from the series 900.102-900.181. Examples of such areas include the effect of noncondensible gases (900.132), or the one regarding best estimate scenarios (900.134), or regarding TRACG nodalization (900.141). These examples are issues that have not been addressed within TAPD, Revision C and need to be resolved before TRACG qualification can be used for design certification.

APPENDIX A

Note: Most comments are related to the PIRT Tables, and generally deal with identified phenomena and/or their rankings in those tables. References to tables and page numbers are keyed to the main TAPD document and Supplement 1 on PIRTs.

900.182 p. S1-2, critical flow is described as the "primary parameter of interest" in the early phase(s) of a LOCA. However, in Table 2.3-1 (p. 2-36), phenomenon E8 (break flow) is ranked only "5" (medium) for SBLOCAs. This appears to be inconsistent for a primary parameter of interest.

900.183 Also with regard to E8, the table of phenomena definitions (Table S1-1) describes "break flow" in terms of critical flow only. However, there are times in the transient, especially after blowdown, during which flow out the break would not be critical.

900.184 The ranking rationales in Tables S1-2 through -8 are somewhat ambiguous, since they do not break down phenomena ranking into different phases of the accidents covered. Also, some of the accident categories are quite broad (e.g., SBWR LOCA), and do not appear to differentiate between LOCAs of different types (e.g., MSLB, GDCSLB), for which the phenomena and their rankings may not be the same.

900.185 The handling of the specific phenomenon of break flow is somewhat confusing, since both E8 and L1 - L4 deal with it. Although the table does not limit E8 to liquid breaks (or non-MSLBs), since the "L" phenomena cover steamline phenomena, the implication is that E8 does not. Some clarification is needed of what is meant by these phenomena, and further justification of the importance rankings is indicated.

900.186 There appears to be somewhat of a "disconnect" between identification of phenomena from the "top-down" process and those from the "bottom-up" process. Section 2 of the TAPD does not include any isolation condenser-related phenomena, although they are later included in Section 4.

900.187 The cross-reference to the TRACG model report Section 3.1 for phenomenon L2X, acoustic effects, is misleading, since the TRACG report does not have any details on the phenomenon beyond the basic general conservation equations.

900.188 The discussion of phenomenon C8 (p. S1-17) refers to its importance in operating BWRs. It is difficult to see why it should be rated even "medium" for the SBWR (Table 2.3-1, p. 2-34).

900.189 With regard to Section 3.1, while in the context of the TAPD, it is appropriate to focus on SBWR "unique" features, it is still necessary to validate TRACG for phenomena that occur in the operating fleet, as well, since the code has never been approved as a licensing-basis tool.

900.190 Although this version of Table 3.2-1 is somewhat clearer than previous versions, and the table column headers are more descriptive, the way in which the entries are classified and the right most two columns, i.e., what qualifies as "SBWR Unique" and what is in the "Existing Fleet" is still somewhat hard to follow. In addition, there are still a number of apparent inconsistencies and other unclear attributions in this table and other related ones (e.g., Table 3.3-1, the tables in Section 4.1, and Table S1 9). Some examples are given below.

a. The reference to PIRT Item C12 for B11/7 in Table 3.2-1 (p.3-5) is hard to follow. It would appear that F1 is more relevant.

b. For B32/2 (p. 3-7), why is "stratification in IC drums" under "condensation in tubes?"

c. It is difficult to see why, for B32/4, "impact on IC unit heat transfer correlation" is a "phenomenon." In addition, this "high" ranked entry does not appear to be carried into Table 3.3-1 on p. 3-33.

d. The entries for E50/10 in Table 3.2-1 and Item 32 in Table 3.3-1 appear to be misleading. PANDA and GIRAFFE/SIT are noted as sources of data to address this issue, which involves passive/active systems interactions. The staff is not aware of any data taken in either of these test programs that would address this issue.

e. There appear to be some inconsistencies between the TAPD discussion of TRACG qualification and information that appears in the TRACG documentation itself. For instance, the TAPD cites data for chimney void fraction up almost to SBWR operating pressure. However, no data are cited in the TRACG Qualification Report below about 20 bars. Since low-pressure phenomena are of substantial interest in the SBWR, the apparent lack of low-pressure data is of concern.

f. The staff disagrees with assertions that TRACG models have been "qualified" for SBWR applications. For instance, in Section 3.3.1.2, this claim appears to be made for predictions of SBWR stability. Not only is this statement apparently at odds with information in the TRACG Qualification Report, but until the staff accepts TRACG as being qualified for SBWR, claims that it is qualified must be viewed as preliminary, at best.

g. In Table 4.1-1a, the issue listed for L5 is not clear; it is also not clear why this issue is ranked in the GDCS phase, rather than the blowdown phase. The rank of "high" for a large break is also not clear, since depressurization through the break would appear to be dominant.

h. In Table 4.1-1b, the medium ranking in the GDCS phase for IC phenomena appears to be inconsistent with the information in Tables 3.2-1 and 3.3-1, which show "high" ranking in the blowdown phase.

i. Item C27 in Table S1-9 is ranked "high" for stability, but does not appear at all in Table 4.5-1a.

900.191 The description of the systems interactions study described in Section 4.2.2 and the results discussed in Appendix C do not appear to be entirely consistent. It would be useful to number the cases or to use some other unique identifier to be able to determine the correspondence between these two parts of the report.

900.192 There appear to be some inconsistencies in Table 5.1-1a, where specific test facilities are cited for phenomena that are not appropriate. Examples include:

a. Phenomenon A4 (p. 5-3): how do these facilities address lower plenum axial void distribution?

b. Item E1: Neither Edwards test data nor Marviken tests include uncovery of a horizontal break line.

900.193 In a similar vein to #11, the treatment of CCFL does not seem consistent in the tables in Section 5 when compared to comparable information in the TRACG Qualification Report. The applicability of SSTF to SBWR for this phenomenon (Table 5.2-1a) is open to question, while areas in which SSTF might be useful (e.g., Phenomenon C9--parallel channel flow distribution) are not shown.

900.194 While indirect confirmation of phenomena can be derived from some separate-effects tests, that does not necessarily mean that they are S-E tests for those phenomena. An example is interfacial heat transfer (Item C2Ax), where information on interfacial heat transfer might be inferred from test results and associated analyses on the Edwards and Marviken experiments; that was not, however, the main objective of the tests.

900.195 Please clarify Refs. 71 and 72 (p. 8-4), which are called out in Table 5.2-1a. They have different titles, but the same number and date.

900.196 For Item A9, bottom head stratification, Table 5.5-1a indicates this will be evaluated by analysis. Considering the "high" ranking for this phenomenon during start-up transients, it is not clear that evaluation in the apparent absence of data is appropriate. Please clarify how this phenomenon will be assessed.

900.197 Reference to coverage of the issue of "decay heat" (C24) by integral systems tests is ambiguous. Certainly, integral tests can assist in evaluating the effect of different decay heat levels on system behavior. As far as validating the decay heat model is concerned, however, that cannot be accomplished using an out-of-reactor test facility.

900.198 Several phenomena are listed as having only plant data available for "test coverage." These include C3 (gap conductance); C9 (parallel channel flow distribution; C3BX (pellet heat transfer); C8X (void collapse); F2 (chimney flow distribution); and I2 (separator inertial pressure drop). It is not clear for some of these phenomena whether existing plant data are sufficiently detailed to provide the basis for code model assessment. For some cases, at least, it would appear that reasonably detailed local data are needed, while plant tests tend to be more "globally" instrumented, and local data may not be available.

APPENDIX B

SIGNIFICANT QUESTIONS

900.199	Pg. 1-1 & 4-3	Hydrogen generated by 100 percent metal-water reaction is said to be addressed as DB requirement, with reference to Table 4.1-2c. No further details are given, except that apparently the potential effect of light NCs on the PCCS is considered in the Interaction XC6. What is the effect of the 500 kmol of hydrogen on the containment pressures and on the volume fractions of H_2 and O_2 in the containment during a LOCA? How do these compare to the requirements of 10 CFR Section 50.34(f). Rough estimates appear to indicate that the containment design pressure would be exceeded if 500 kmol of hydrogen were to be added. Or does 100 percent here refer to the clad surface only, with the clad layer to be oxidized, being the one used in Section 6.2.5.3 of the SSAR (0.00023 in.)? That would correspond to less than 1 percent of metal-water reaction.
900.200	Pg. 1-8	The first sentence of Section 1.2.2, Major SBWR Test Facilities, states "GE has used a procedure similar to CSAU methodology .... and submitted to the NRC", referring to Rash to Jones letter of 1992. That letter submits a set of view graphs from a presentation, essentially outlining, what is now TAPD, including initial PIRTs. It contains a few of the elements of CSAU, but it does not constitute "a procedure similar to CSAU". In particular, there is no sensitivity and uncertainty analysis and many of the steps leading to that analysis are also missing. Please revise the text accordingly.
900.201	Pg. 1-8	The remainder of the first paragraph of Section 1.2.2 appears also to overstate the case. Where in the PIRT are 900 data sets defined? (A PIRT ranks phenomena and does not define data sets). And if it were correct that of the important phenomena "each has been qualified", then there would be no need for a TAPD. All that would still be needed is a documentation of that effort rather than a TAPD! Please revise as appropriate.

900.202	Pg. 2-3 & 2-4	At the beginning of Section 2.2.1.1 the piping and valve sequence for the GDCS lines is prescribed, and the break is assumed to occur between the squib valve and the nozzle entering the vessel. Under "Blowdown Period" in Section 2.2.1.2 it says "simultaneously the pool side of the broken line drains ....". The squib valves only are actuated 150 s after ADS actuation, about 300 s after the break occurs (see Figure 6.3-54 of the SSAR), i.e. towards the end of blowdown and close to the beginning of the GDCS Refill Phase. (There are several later references to "almost immediate" tank draining also in Sections 3 and 4, for instance Page 4-2, 2nd paragraph.) Please clarify.
900.203	Pg. 2-26 & 28	The first paragraph of Section 2.3 apparently describes the procedure applied for the LOCA in-vessel PIRT of Table 2.3-1, while the second paragraph on Page 2-28 describes the procedure used for the containment PIRT, Table 2.3-2. The procedures are not quite identical, and this should be clarified. The team of experts was apparently not the same, consensus was used on Page 2-26, while averaging is used on Page 2-28. Either procedure is appropriate, but it should be clarified with the first paragraph of Page 2-26 that the procedure, described there, was not used for all subsequent PIRTs.
900.204	Sect. 2.3	It is surprising to find that the isolation condensers are not at all mentioned in the current PIRT, not even under transients. (For instance, note inclusion of Transient 15.5.1, Inadvertent Startup of ICs in Table 3-1 of the Applications Report (NEDE-32178P)). This would appear to be an omission and should be corrected. In particular with the three uses of the PIRTs outlined on Page 2-26, their inclusion is important for all three uses, but in particular for the third one of determining model bias and uncertainties. With the extensive PANTHERS test data and the university test data of Reference 19, there would appear to be a sufficient data base, and one would not expect that the inclusion of the ICs here would significantly affect the tables of Sections 5 and 6.

900.205	Sect 2.3-1	At the top of Section 2.3.1 the overall transient is broken down into three time periods, followed by a statement, that rankings were performed for "each of these periods". While this was done for the containment, it was not done for the in-vessel events of Table 2.3-1. At least this statement should be corrected, including a justification, why rankings for the long term cooling period are not expected to introduce further significant in-vessel phenomena.
900.206	S1 Tables S1-3 & 4	While the phenomena descriptions of Supplement 1 are extremely helpful in understanding the PIRTs, there are two major deficiencies, which should be corrected: 1. The phenomena brought in via Section 3 into the combined PIRTs of Section 4 are not covered at all. 2. The ranking rationales of Tables S1-3 and S1-4 do not address individual rankings and are much too brief to be of help.
900.207	4th ¶ of Section 2.3.1	The PIRTs of Revision C have been slightly revised from the previous PIRTs. We assume that this was done without the team of experts, by one or few in-house contributors. While this is, strictly speaking, not within the rules for PIRTs, from a practical point such revisions are unavoidable and should be acceptable, if done cautiously by experts. We recommend that this be pointed out in the report, with a description of the procedure used for PIRT modifications.

900.208	2nd ¶, Page 2-28	In accordance with the focus on the first 72 hr, given in Section 1, the deletion of PC6 (PCCS vent fan) from Table 2.3-2 is justified, since the fans are apparently only available after 72 hr. However, in Section 3, several items with up to 100-day time scale are being retained. This significant discrepancy in focus is not clear to us. Also, details about this PCCS fan are still not known to us. It is not shown in the SSAR. What is its purpose? Can it become an obstruction? Can it push excessive steam and/or NCs through the PCCS vent lines into the suppression pool? Is it considered in the modeling of the pressure drop in the PCCS intake lines, which was ranked high? Why is this fan not included in the PANTHERS and/or PANDA experiments, if it is a resistance in the flow path? We would like to know more about its location, its function and purpose.
900.209	Table 2.3-2	Another phenomenon which we would consider to be of interest only after the 72 hr focus, if at all, is OC1, heat transfer to safety envelope. The safety envelope appears to begin at the outside surface of the containment concrete walls. Apparently free convection on the outside of the 2 m thick containment concrete walls is considered here; it takes approximately one week for 1 percent of the temperature rise inside the containment (about 50 to 100 ^{0}C) to be felt on the outside of the wall. Why is this included?
900.210	Section 3	In Revision C the contents of the QDB sheets is described in more detail. Apparently they include specification of the required data range for the important process variables. This information would be of great value in assessing the completeness of the currently available data base. We again would like to recommend that this information should be made available, maybe as an appendix or a supplement to the report.
900.211	Sect. 3.2 Table 3.2-1	Such system structure tables as Figure 3.2-1 generally have further detailed subsystem structures associated with them, leading from the systems to the components. A "system and component perspective" was promised in Section 3.1. Without seeing the further breakdown from such major systems as Nuclear Boiler System, one cannot ascertain the completeness of the features and phenomena selected in Table 3.2-1.

900.212 Table 3.2-1 From the information given, it is not at all clear, what belongs to the RPV System and what to the Nuclear Boiler System.

900.213 Table 3.2-1 The term "unique SBWR design feature" is now well defined in this revision of the report. We concur with the definition, but we still have some problems with it:

1. TRACG will have to be validated for all phenomena, not just for the SBWR unique ones. While we would expect there to be a sufficient data base for the non-unique ones, we do not see, why they should be excluded from consideration for code validation.

2. It remains unclear, how under QDB Screening (Columns 10 and 11 of Table 3.2-1) many phenomena are to be qualified against BWR fleet data. In the text on Page 3-2 the third paragraph and the end of the last sentence on that page appear to be in conflict. If validation can be based on fleet data, then the phenomenon is not SBWR unique as defined in the third paragraph.

3. It is also often not clear, why a feature is considered unique. For instance, Entry T10/0 in Table 3.2-1 lists "pressure suppression type containment" as a unique concept. There have certainly been previous pressure suppression type containment designs. If uniqueness here now refers to the data range (Item 2 in the third paragraph of Section 3.2), then fleet data would not be available to assess this phenomenon.

900.214 Table 3.2-1 In many cases, the reader cannot appreciate what is meant by the brief entries in Columns 5 and 6. For instance, Page 3-5, System/Issue No. B11/7 and 8, the entries in the first row are clear, but what do the next two rows mean? (Core flow measurement/determination and Potential for Bundle flow maldistribution...) What are their rankings? In the next row (B11/8), what is "nuclear heatup" and why does it enter under RPV chimney and not under core?

In Row B11/7 reference is made to PIRT No. C12, which is part of the core bundle. Wouldn't F1 be more appropriate?

900.215 Table 3.2-1 The indexing of the entries in Table 3.2-1 can often not be followed. There appear to be inconsistencies. It should be revised and/or fully explained. For instance, for System MPL # E50, GDCS, we find the following sequence of numbers and letters:

System MPL /Issue No.	Unique Features	Issue	Important Phenomena
E50	1)		
E50/1	a)	1)	1)
E50/8		2)	1)
E50/9		3)	1)
E50/2	b)	2)	1)
E50/3			2)
E50/10		3)	1)
E50/4	c)	3)	1)
		a)	
E50/5		b)	2)
	2)		
E50/6	a)	1)	1)
	b)		
E50/7			2)

900.216 Section 3.3 & Table 3.3-1 The subsections of Section 3.3 provide mainly details to the entries of Table 3.3-1. However, the user must at times count the table items marked by asterisk to find the appropriate subsection. The System MPL/Issue No. should be given with each subsection, and the titles should remain identical to the entries used in Table 3.3-1 (Many are, but not all.)

900.217 Table 3.2-1 E50 Under E50/1, the GDCS period is specified, but one of the concerns is equalization line draining, which would only be anticipated for the long term cooling phase of some LOCA scenarios. Please explain or modify.

900.218 Table 3.2-1 E50 Similarly, it would appear that Time Phase 7 would also be relevant for Item E50/8, since ADS and FW interactions would not be expected after the blowdown period (See also the time scales given in Table 4.1-1c.)

900.219 Table 3.2-1 E50 We do not understand why Item E50/9 has been added; with the check valves between GDCS pools and the RPV, manometric oscillations would not appear to be possible.

900.220	Table 3.2-1 E50	The E50 entries in Table 3.2-1 repeatedly reference PIRT Ref. Nos. GD3 & GD4. No such PIRT entries are found in Sections 2, 4, or 5 of the report, nor are they defined in Table S1-1.
900.221	Table 3.2-1 E50	E50/4 appears to consider equalization line flow which would occur in Phase 9 only. In this context, the entry in Column 5, Issue, is completely unclear: What does equalization line flow have to do with interactions with ADS and FW? Please explain or modify.
900.222	E50 Table 3.2-1	The E50 entries E50/1 to E50/5 are apparently divided into different time ranges in Column 4, Unique Features, which is not really a "unique feature", but the subdivision appears to make sense. However, the definitions of short, medium and long term cooling are not clear, and the terms are apparently not used in the same context as the Time Phases 7 to 9 of Column 8. In particular, since this item is classified in Section 3.3, below, as a key item, a more thorough definition of what is meant here should be provided. Apparently more than just equalization line flow is considered in Section 3.3, while the text of Column 4, here, really only applies to equalization line flow. What is "System post-LOCA heat transfer", as listed under E50/2? Please clarify.
900.223	Table 3.2-1 E50/6	The Squib valves and the biased open check valves are listed as components to be developed, apparently for the GDCS lines as well as the equalization lines. Their flow and pressure drop characteristics apparently remain to be established. The potentially relatively low flow rate through the equalization line is mentioned. When and where are these data to be developed and where will they be reported? The Table 3.3-1 entry "design specification must be met by prototype hardware" implies that future testing is planned. What are the design specifications, in particular loss coefficients over the total operating range, including low flow rates in the equalization lines?

900.224	Table 3.3-1 No. 34	An essentially new item is the possible effect of stuck open equalization line check valves, with sloshing between the SP & RPV coolant levels. This is listed as E50/7 of Table 3.2-1, with PIRT Ref. No. EQ2. Being ranked high (7), it is carried forward to Table 3.3-1 as Item 34, where it is marked as item for further evaluation. However, no further entries for this item nor a definition of EQ2 are found in Sections 4 or 5. Rev. B listed this item in Table 5.3-2, to be covered by PANDA tests. It is not listed in the corresponding Section 5 table of Revision C. However, it was finally found in Table 5.3-2b under medium ranked phenomena and without any more reference to PANDA. Please explain. Why does Column 4 of Table 3.3-1 refer to MAAP calculations and Column 5 to TRACG evaluations?
900.225	Subsection 3.3.5	The statement is made that the "TRACG models have been qualified against GIST test data". However, GIST is not considered part of qualification data base. GIST data can be used, but they cannot be the only data source. (The same actually also applies to App. A.3.1.4.) Mention should be made, most likely in Appendix A, that GIST data are being used, but only as additional assurance, not as part of qualification data base.

900.226	Sect. 3 & Sect. 4	There were ten GDCS phenomena identified in Table 3.2-1 (System E50). Nine of these were ranked ≥ 4 and were carried forward to Table 3.3-1, even though some of the wording and the sequence was changed in this process. In particular, four items were grouped together in No. 32 and declared to be the "single most significant phenomenon" (top of Subsection 3.3.5). The four had ranks 7, 5, 4, and 7 in Table 3.2-1, while three other items were ranked 8. Why and how are items ranked seven and below suddenly more significant than items ranked 8? Why are some of them lumped in No. 32 and then appear separately again later in Section 4, like for instance E50/4 which enters as EQ1 in Table 4.1-2a. What happened to E50/2, referred to PIRT Ref. No. GD4 and ranked 8 in Table 3.2-1, it is No 31 in Table 3.3-1, but never shows up in Sections 4 or 5? Frequently, Table S1-9 permits tracking of items, but in this case there is no entry there either. A complete accounting of were items go from Section 3 to Section 4 is required.
900.227	Table 3.3-1	What is the vague reference to "Russian data" in No. 30 of Table 3.3-1? The BWR test data in the same entry are also not referenced properly.
900.228	Table 3.2-1	Several entries under G21/2 remain unclear (what is Post-LOCA decay heat removal?), and PIRT Ref. No. FPS1b is not found anywhere else.
900.229	Table 3.2-1 System T10	Considering the entries for the Containment System (T10) in Row T10/0, what is unique about a pressure suppression type containment concept? Under T10/25 a time limit of 100 days is introduced. An explanation appears required here, why this time period is considered, since Figure 1.1-1 stated that the TAPD focus extends to 72 hr. Such a time limit would certainly also require additional action, like replenishing the PCCS pool. Nothing said about that. What does containment heat transfer for times beyond 6 h have to do with the 100 day time span?

900.230 Table 3.2-1 T10 & T11

The concern about heat conduction through the 2 m thick concrete walls is not clear. First of all, the PCCS is supposed to be designed for 100 percent decay heat removal after the GDCS refill period. In that case, even if long term heat conduction into containment structures were zero, the containment pressure would remain within bounds. And over very long time periods, like the 100 days mentioned in T10/25, as the decay heat slowly decreases one would expect the pressure to decrease as well. Over such long time periods, concrete conductivities could indeed change and so could the liner to concrete resistance. However, the effect on containment pressure should not be significant as long as the PCCS is operating as designed.

Also, under T10/25, considering 100 days, this effect is ranked 7, while under T11/1, with considerations over 72 h only, the effect is ranked 8. Please explain.

Several of the sub-categories of Important T/H Phenomena in T11 are not clear. What is "loss in ignition" CO_2 content in T11/5? CO_2 release from concrete generally only occurs at much higher temperatures than those driven by a drywell long term temperature of about 140 ^{0}C. Please explain, what is meant with these four sub-categories, in particular a) and d).

900.231 Table 3.2-1, T10; Table 3.3-1, Entries 49-52

Item Unique Features 1-b, T10/7 in Table 3.2-1 has four subcategory entries in Column Issue. These appear to correspond to Entries 49 to 52 in Table 3.3-1. The connection between the first three entries and the last entry is not clear. Considering the wording in Table 3.2-1, Item 4 is "DW response to LOCA break". But Items 1 to 3 also deal with exactly that subject and the phenomena listed under Item 4 are also phenomena occurring with Items 1 to 3. Why are Items 1 to 3 not considered as sub-categories of Item 4? This structure is not clear at all.

Why does Item 52 refer to ABWR horizontal vent tests, when we are discussing drywell Th/H phenomena? The horizontal vent system (and suppression pool) was handled under Unique Feature 1-a, T10/1, Entries 43 to 48 in Table 3.3-1.

900.232	Table 3.2-1, T10; Table 3.3-1, Entry 56	The Table 3.2-1 Entries T10/31 & 32 consider drywell to wetwell pressure differences and bypass flow. This is an extremely important item, and it is ranked 9. The corresponding entry in Table 3.3-1 is No. 56. But why is it described there as "gas space temperature distribution/wall heat transfer ...."? That description is not clear and the bypass flow should be primarily driven by pressure differences. The text of the corresponding Subsection 3.3.8.7 describes the problem well, but does not explain the Issue/Phenomena entry in Table 3.3-1.
900.233	Table 3.3-1	Entry 53 contains a second vague mention of "Russian studies", without providing any reference or description.
900.234	Table 3.3-1 No. 59:	This item was carried forward apparently from T10/29 Table 3.2-1. There it was ranked 8. Here it is said to be not an issue. It does not appear to be carried forward from here, even though it is said to be "covered by PANDA tests." These statements appear to be contradictory. (WW3, as described in Section 4 or in Table S1-1 does not include submergence.) Please explain and/or revise.

900.235	Sect. 3.3.8.4, Table 3.3-1 No. 51:	We fully agree that there is no general pool of data to cover stratification and mixing of steam and non-condensibles in the drywell. However, this subsection also states that the TRACG mixing model has been "verified" in the Qualification Report. (We assume that not "verified", but "validated" or "qualified" was meant.) The Qualification Report (Sect. 3.8) compares TRACG predictions to radial void fraction data in core configurations from EBWR and VK-50 experiments, to validate it's turbulent mixing model. The comparison was of limited success, with the discrepancies convincingly attributed to a lack of available information on several details of the test data. This does not mean that "reactor plenum data are well predicted", or that the TRACG model "has been verified", as is claimed here. There is really not much connection between the stratification of gases in a large volume, like the drywell, and the radial void distribution in the chimney section of the reactor. A crucial point here is, that the TRACG drywell stratification has lately been proposed to be handled via an empirical upper bound model. Once such a model, including uncertainty estimates, has been formulated and submitted, it must be evaluated and accepted. The modeling and qualification effort of the TRACG mixing model, described here, may then no longer be required. Please comment.
900.236	Sub-Sections 3.3.8.5 and 3.3.8.6: (Table 3.3-1 No 54 & 55)	The two subsections consider suppression pool stratification for the short term blowdown period as well as for long term cooling. For the first period a "conservative interpretation" of the data is referred to, but the text implies that a future mechanistic model may be substituted. For the second time period a mechanistic model, to be qualified, is implied. We were under the impression that conservative empirical models would be used for both time phases. Please explain what time scales are considered for these two items and how suppression pool stratification will be modeled for each phase.
900.237	Sub-Sections 3.3.8.5 and 3.3.8.6: (Table 3.3-1 No 54 & 55)	Of the two entries, only one corresponding entry is found in Table 4.1-2a (WW6), i.e., all the previous detail, presented here, is lost. WW6 is carried forward into Tables 5.2-2, 5.3-2, 5.5-2 & 6.1-1, but with reference to PANDA, & PSTF & Mark III data only. No more reference to "ABWR horizontal vent tests" is given, as in Table 3.3-1. Please explain.

900.238	Table 3.2-1, T15/4	Entry T15/4 lists potential detonation of H_2/O_2 with steam. This was assigned an Importance of 5. H_2 (but not O_2)can really only be produced from massive fuel clad/water reaction, while both can be produced to a moderate degree by radiolytic decomposition of water. With PARs the presence for either should have an infinitesimal probability. The minimum required O_2 concentration for deflagration in H_2/O_2 systems is about 5 vol percent, with a correspondingly higher <u>detonation</u> limit[1]. O_2 is originally uniformly mixed with nitrogen at 3.5 vol percent. Thus, its concentration after adding H_2O and H_2 can only be lower than that value. If detonations are not credible, as the above argument implies, than they cannot have a rank of 5. However, if they are possible at all, then they will have to be a top priority! A detonation in a PCCS unit could leave a gaping hole in the containment boundary! Either the item should have a rank of 0, since incredible (which we hope it is), or it must be carried forward. (Table 3.3-1 implies that it is included in No. 65, but detonations or even deflagration burning are not mentioned there at all.) [1] H. F. Coward and G. W. Jones, "Limits of flammability of gases and vapors", Bulletin 503, Bureau of Mines, Department of the Interior, AD-701 575, 1952.
900.239	Table 4.1-2a Table 5.3-2	Why are the suppression pool hydrodynamic loads being brought in here (WW9)? The current GE position is to use a previous "approved methodology" for these and not TRACG. We assume that the entries in Table 5.3-2 that TRACG qualification against these data has been completed are erroneous?

[1]H.F. Coward and G.W. Jones, "Limits of flammability of gases and vapors", Bulletin 503, Bureau of Mines, Department of the Interior, AD-701.575, 1952.

900.240	Table 4.1-2a	The entries considering conduction through the concrete walls and convection on it's outside would not be items for TRACG validation (OC1 and CW2). However, if wall heat transfer is indeed important, then property data for items of CW2 would certainly be of interest. Also of interest would then be the liner/concrete gap conductance. This was carried in Rev. B as PIRT Ref. No. CW1, but has essentially disappeared in Revision C. CW1 is used in Table 3.2-1 for conduction through walls, which was ranked low. Table 3.3-1, in No. 60 mentions it, referring back to Item T10/25 in Table 3.2-1, which has no reference to liner/concrete gap conductance. It does not seem to be used at all in Section 4. We would expect that the analysis would be done with a simple model or code for heat conduction, analyzing the process with fine nodalization over very long time periods. Please explain and confirm.
900.241	Table 4.1-2a	At this time it is not clear what the assumed conditions are, for the operation of the PARs during LOCA scenarios. We would assume that they would also not be covered by TRACG analysis, and the three entries for System T49 in Table 3.3-1 would also imply this. Please confirm or explain.
900.242	Table 3.2-1 System T49	Typical flammability control systems use hydrogen igniters (glow plugs) to cause controlled recombination (combustion) of H_2 and O_2. Such a system is described in Section 6.2.5 of the SSAR. Reference there is to "igniters" and "glow plugs" while the phrase "Passive Autocatalytic Recombiners" (PAR) is never used. This report exclusively uses the term PAR. Are they the same, or is another system being considered now? Use of PARs is listed as unique in T49/1 in Table 3.2-1. The glow plugs mentioned in the SSAR would not appear to be unique for flammability control. If the PARs are different from the glow plugs of the SSAR, can they also remove H_2 alone, i.e., without the presence of O_2?

900.243	Table 3.2-1 System U71 Table 3.3-1 No. 74	Without a definition, what comprises this system, it is not clear how these entries interface with those of System T11, Containment Vessel. By the SSAR, Section 6.2.1.1.2, the safety envelope appears to be the outside surface of the containment concrete walls, while the reactor building structure would be outside the safety envelope. But item 74 in Table 3.3-1 refers to heat transfer to the safety envelope. Why is FP holdup mentioned for regions outside the containment when there has not been a scenario identified, which resulted in FP release from the containment (U71/2 in Table 3.2-1)? A more detailed description is required as to what is meant and how T11 and U71 are related.
900.244	Section 4.0 & 4.2	At the beginning of Section 4 one gets the impression that the interactions, to be considered here, will be the ones identified in Tables 4.1-1c and 4.1-2c. (The list of interactions is screened in Section 4.2 ....). Actually that is not so. Of the LOCA/Containment interactions of Table 4.1-2c parts of XC2 and XC4 are the only ones considered in Section 4.2. It is suggested that this should be made clear in Section 4.0 and at the beginning of Section 4.2.
900.245	Table 4.1-2b	Page 4-2, end of second paragraph, states that the "integral response of the containment for the DBA" with 100 percent metal-water reaction "is included as an interaction (XC6) in Table 4.1-2c". From the references to XC6 in the remainder of the report, we assumed that XC6 only covers the effect of H_2 on stratification and PCCS performance.

900.246	Section 4.2.2 Section C.3	In Section 4.2.2 six interaction scenarios were listed as having been analyzed, with more details to be given in Appendix C. However, there does not appear to be a one to one correspondence between the scenarios of Section 4.2.2 and C.3. The text, justifying why these six cases were chosen is almost identical in the two sections, but the scenarios are not! As far as we can determine, there is a partial correspondence:

Sect. 4.2.2	App. C.3
1	1&7
2a (inadvertent DPV)	3
2b (IC drain before and after DPV)	?
2c (connection IC & DPV severed)	?
3	?
4	?
5	6
6	4

Please revise the corresponding report sections, so that a reader of Section 4 can indeed readily find the additional detail in Appendix C, without extensive detective work.

900.247	Section 4.2.3	The fifth paragraph of Page 4-26 states "but the only system for which possible adverse interactions were identified was the FAPCS". Close to the top of the next page it says "results for these cases all show the use of the FAPCS has a favorable effect on containment pressure and temperature". These statements appear to be contradictory. After study of Appendix C one sees what apparently is meant: After running the first three interaction cases, the possibility of an adverse effect with limited use of the FAPCS as drywell spray was suspected. Running that case, it was found that no adverse effects were observed. Please confirm and/or modify the text in Section 4.2.3.

900.248 Table 4.1-2c There does not appear to be a systematic development of the interactions of Table 4.1-2c and without a complete indexing system one often cannot understand where they come from. In particular in view of the fact that GE claims in Section 7 that Section 4 "identified" the important interactions to satisfy 10 CFR 52.47 requirements, we feel that the following further information is required:

- a description of the method to define all important interactions,
- a key of their progression from Section 3 to Table 4.1-2b,
- a more detailed description of the interactions, preferably at the point where they are first introduced, and
- a description of the interrelations between the interactions of Table 4.1-2c and those of Section 4.2.

900.249 Table 4.1-2c Many of the interaction descriptions are very unclear and change from entry to entry. Consider for instance Interaction XC2, first introduced in line T10/24 of Table 3.2-1. Eight items of interactions are listed there, nothing is said, beyond a listing of acronyms. Then, in Table 3.3-1, Item 58, three of those items are mentioned only and PANDA experiments are listed as data base. The corresponding more detailed text mentions most of the component/phenomena list of Table 3.2-1 and adds the main vents. Finally, the Table 4.1-2c entry lists only IC/PCCS/GDCS of the original eight entries and adds the DPVs. This is certainly not consistent, and the reader is at a loss to follow.

900.250 Section 4.3.1 The third paragraph of Page 4-30 reports in the summary section some results from an apparently analytical study on the effects of hydrogen on PCCS performance. This would appear to correspond to Interaction XC6 of Table 4.1-2c. No details of this were provided in Section 4.2 or Appendix C. Since XC6 is carried on to Table 5.3-2a (GIRAFFE/Helium), we anticipate that the details will be provided with GIRAFFE/Helium reports? This again points to the perplexity which is created when new items are first presented in a summary section and not in the body of the section which is being summarized.

900.251	Table 4.3-3	Interactions XC8 and XC9 are not listed here, without any justification. Please modify or justify.
900.252	Interaction XC3	In Section 4.3.1 the further deletion of interactions XC1 and XC3 is justified. This appears reasonable for XC1. However, it is by no means clear what is meant with XC3, and what is meant by "heat sink". Returning to Table 3.2-1, and searching for XC3 in Column 7, one gets to G21/1, which has many cryptic and unclear entries in Columns 4 and 5, while Column 6 implies FAPCS/PCCS interactions. Going forward to Table 3.3-1, one finds under G21/1 only FAPCS/PCCS interactions discussed, the same applies for the description in Subsection 3.3.6.1. Nowhere does one ever find out which heat sink is meant. Therefore, one cannot follow the argument in Section 4.3.1, to drop XC3. This example also shows how laborious it is to track such an item. Please provide clarification.
900.253	Table 4.3-3	While we consider it reasonable, to remove the CW items from further considerations, we do not understand, why OC1 was retained. Natural convection on the outside of the containment walls is not of interest for weeks, and is meaningless, when uncoupled from heat conduction through the wall.
900.254		Section 4.3 now contains an added discussion of Interaction XC8, finally making it clear that contrary to the apparently erroneous entries in Section 3 (specifying Time Period 7 in Table 3.2-1), the long term effect of unlikely horizontal vent opening during time phases 8 and 9 (GDCS refill and long term cooling) are the focus of this interaction. Nothing is said, what would cause such drywell pressure increase of at least 0.2 bar, to open the horizontal vents, but the phenomenon is carried forward to Section 5, even though it was omitted in Table 4.3-3. We would expect further details to be given with the GIRAFFE/Helium, GIRAFFE/ SIT and PANDA tests, since these are referenced in Table 5.3-2a for this interaction. Further detail should be provided up front, were the interaction is first introduced, i.e., in descriptive text, detailing Table 3.2-1 entries. A summary section should not present information, which was not introduced in the body of the section being summarized.

900.255	Section 5.5	The value of the overall tables in Section 5.5 could be greatly enhanced, if the notation of "T", "Q" and "X" of the preceding tables were to be retained, which could be done very easily. If more than one apply, there is enough room to show them side by side or show only the symbol indicating most work required ("Q" supersedes "X", etc.).
900.256	Section 5	Phenomenon DPV1, depressurization valves mass flow, is referenced in Table 5.5-2a as being validated against component tests. No corresponding entry is given in Table 5.2-2a. Please correct or explain.
900.257	Section 5	Interaction XC4, which was considered in previous versions of the report has disappeared here. It was last mentioned in this version in Table 4.3-3. Validation against PANDA test data were planned in previous versions. This could be an oversight, or it might have been intended to combine it with FPS1, and the corresponding entry was missed. Please clarify.
900.258	Table 5.3-2a	For suppression pool stratification as well as for drywell 3-d effects GE has stated that bounding models are to be applied. In all likelihood, that would appear to be the most practical approach. However, the claim to use PANDA and GIRAFFE data for the 3-d effects of DW3, WW6 and WW7 appears questionable. The geometry of the containment cells differs so drastically from the tanks of the test models. Therefore, we cannot see how one can compare the 3-d flow patterns between them, or use models of a simplified tank to confirm 3-d flow patterns in much more complex geometries.
900.259	Table 5.3-2a	The PANDA entry for EQ1 states via a footnote that it "may" be included in the PANDA Phase III tests. Please finalize.
900.260	Sect C.3	The first sentence of the Subsection *Isolation Condenser/DPV Interaction* does not appear to make sense. The previous paragraph dealt with IC/GDCS interactions during the refill phase. We are now in the blowdown phase. What is the "the same two cases"?

900.261	Table 6.1-1	Considering all containment items marked either "Q" or "T,Q" in Section 5, the following questions remain: • The following entries from Tables 5.3-2a and 2b for the PANDA test facility do not show up in Table 6.1-1: WW3, EQ1, XC8, XC9. • None of the GIRAFFE/SIT entries of Table 5.3-2a and 2b are found in Table 6.1-1 (12 items). • The following entries from Table 5.3-2a and 2b for the GIRAFFE/Helium tests do not show up in Table 6.1-1: WW7, PC2 to PC4, XC8. Please correct or justify.
900.262	Table 6.1-1	Interaction XC4 (FAPCS/PCCS) was marked as "T,Q" in Table 5.3-2 of Rev. B, to be qualified via PANDA test data. It was omitted, apparently as an oversight in Section 5 of Revision C, and it also is not shown here. Section 4.2.3 stated that for four selected cases of FAPCS interaction with other systems, primarily the PCCS, its effect was always beneficial. PCCS operation would stop with spray actuation and would resume if the sprays stopped. However, these are calculations and not experimental validation. Please correct or explain.
900.263	Page 7-1	Under "Test Plan" on Page 7-1, GIST is listed as completed tests for GDCS flow, GDCS initiation times and RPV levels. We are under the impression that, as for the early GIRAFFE tests, GIST data are only to be used as support and not as sole qualification basis. Please explain and/or modify the text accordingly.
900.264	Sect. A.3.1.4.4	With the GIST TRACG Analysis Plan (Section A.3.1.4.4) it should be mentioned that GIST data are to serve as support only and not as sole validation data base.
900.265	Sect. A.3.1.3.3	PANDA test data are referenced for qualification of phenomenon WW8 (suppression chamber spray condensation) in Table 5.3-2a. The test program of Table A.3-9b shows only drywell spray actuation in Test M5, unless this is planned for tests M9 or M10, which were not defined yet in Revision C of the report.

900.266	Sect A.3.2.3 & 4	Component development for the DPVs and the vacuum breaker valves is described in detail in Sections A.3.2.3 and A.3.2.4. In Section 3 (Tables 3.2-1, System MPL/Issue No. 50/6, and Table 3.3-1, No 33) the need for flow pressure drop characteristics of the squib and check valves for the GDCS drain lines and equalization lines was mentioned, emphasizing in particular the low flow regime. We would have expected a corresponding section for these valves here too. Please explain.

APPENDIX B
MINOR QUESTIONS

900.267	Pg. 2-6	Spillover holes in the main vents are mentioned in Line 8. Where are these holes located? We have found no other reference to these holes. Please state their elevation, number and size.
900.268	Table 2.2-1	Bypass valve closure at 6 s is not explained. (Apparently, due to loss of power to condenser circulating pumps, as described under transients in Section 2.2.2.1?)
900.269	Pg. 3-3 2nd ¶	There are 13, not 12, safety systems (see also Table 3.2-2).
900.270	Fig. 3.2-1	Figure 3.2-1 is too small in its current 8 ½ by 11 inch presentation. Many of the details, in particular the system identification numbers, cannot be identified, even with a magnifying glass.
900.271	Table 3.3.1 No. 55	Under Issue/Phenomena it is not stated that this is the suppression pool temperature distribution/plume.
900.272	Table 3.3-1 No. 57	The item is carried forward as WW3 and is marked in Table 5.3-2a as "T&Q". We assume it should then also be marked as Q here.
900.273	Table 3.3-1 No. 68	We assume it should read "vent line". The vent line, not the vent sparger, passes through the gas space.
900.274	Figure 6.0-1	The two black circles are still almost illegible. Please correct.
900.275	Table 3.2-2	The T10 Entry should apparently be 33 and not 34; Item T10/33 is shaded, i.e., not evaluated.
900.276	Table 3.2-1	It is interesting to note that the three sub-phenomena T15/10 to 12 have a ranking of 8, while the preceding row, a summary entry for these three sub-phenomena, has a ranking of 7. Please correct or explain.
900.277	Page 4-26	Third paragraph, Line 9: "...the PCCS was able to resume the decay heat load..."; we assume it should be "remove" instead of "resume".
900.278	Table 3.2-1	Acronyms SPTMS and PSWS are used but nowhere defined. Please correct

900.279	Table 5.5-2a	The x mark for DPV1, Component Tests, should be removed, or an appropriate entry in Table 5.2-2a should be provided.

Panda References

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September 28, 1994

MFN No. 116-94
Docket STN 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Richard W. Borchardt, Director
Standardization Project Directorate

Subject: PANDA Readiness Review

This letter transmits the PANDA Readiness Review Plan for your use in preparation for the activity to be conducted October 19 through 21, 1994, at the Paul Scherrer Institute in Switzerland.

Sincerely,

T R McIntyre

T. R. McIntyre, Acting Manager
Advanced Plant Technologies

Enclosures: PANDA Readiness Review Plan

cc: P. A. Boehnert (ACRS)
R. W. Hasselberg (NRC)
M. Malloy (NRC)
A. Drozd (NRC)
J. Kudrick
R. McIntyre

1.3 Assessment Team

The readiness assessment will be conducted by a team of engineers from GE, EPRI, and ENEA.
Representatives from the DOE and NRC will also participate as observers.

The participants are listed below:

Name	Organization
TR McIntyre	GE-NE - Leader
JE Torbeck	GE-NE
PF Billig	GE-NE
DA Kaye	GE-NE
WR Usry	GE-NE
V Cavicchia	EPRI Consultant
P Masoni	ENEA (PANTHERS Proj Mgr)
T Cook	DOE
R Camp	DOE Consultant
J Kudrick	NRC
A Drozd	NRC
R McIntyre	NRC

1.4 Methodology

The scope of the readiness assessment is presented in Section 2.0. The work will be carried out by review of facility documents, observation of the physical conditions of the test loop, and interviews with facility personnel.

The assessment will be divided into horizontal and vertical reviews. The horizontal review will consists of determining the overall readiness of the facility, its personnel, and documentation. The vertical review will look at a more detailed examination of a part of the facility (e.g., a single instrument line, data calculation, etc.) to verify the technical adequacy and correctness of the work.

1.0 INTRODUCTION

1.1 Background

PANDA is a large-scale integrated SBWR containment experiment that will be performed by the Paul Scherrer Institut in Wuerenlingen, Switzerland. The test facility is an approximately 1/25 volumetric, full scale height simulation of the SBWR containment system. This test is a key part of the SBWR Test Program described in NEDC-32391P. The PANDA Test Program objectives are specified in Section A.3.1.3.2 of NEDC-32391P and the PANDA Test Specification (GE document 22A5587 Rev A).

1.2 Purpose

The purpose of this readiness assessment is to assure the technical adequacy of the facility and personnel to conduct the upcoming PANDA tests in accordance with the test requirements. The specific goal is to ensure that all preparations are either complete or proceeding so that testing may be initiated with high confidence that quality results will be obtained.

1.5 Schedule

The assessment is planned for October 19-21, 1994. The work will begin each day at 9:00 AM at PSI. During the opening session, the team will decide which tasks are to be conducted as a single team and which ones will be assigned to sub-groups. At the closing session, preliminary findings and recommendations will be presented to PSI.

2.0 SCOPE OF THE REVIEW

2.1 Quality Assurance

a. Quality Assurance (QA) Plan and conformance with the plan.

b. Procedure to assure consistency between information that can be found in more than one document (e.g., instrument lists).

2.2 Facility Assessment

a. Facility as-built documentation including fabrication drawings, as available.

b. For unavailable or incomplete documents, status and procedures to finalize documentation.

c. Physical condition of the test facility.

d. Vertical Review: Confirm compliance of as-built piping drawings for a key system (e.g., air supply piping) by tracking the line from its source through the facility.

e. Facility specifications.

f. Compliance to controls on facility documentation.

g. Adequacy of verification on facility documentation.

h. Status and adequacy of spare parts on site or deliverable times.

i. Evidence of permanent labels on facility components (e.g., valves) and applicable instruments (e.g., pressure transducers).

2.3 Instrumentation and Data Acquisition System

a. Calibration procedures.

b. Compliance to controls on calibration.

c. Adequacy of documentation and verification on instrument installation and calibration, including assurance that all instruments will be recalibrated before expiration of the calibration.

d. Identification of critical instruments for testing.

e. Vertical Review: For a select number of instruments, trace the history and layout of each instrument through the following stages:

i) procurement
ii) calibration
iii) installation
iv) connection to control room
v) field test
vi) data recording

f. DAS validation and control.

2.4 Data Reduction

a. Documentation and verification of software configuration.

b. Vertical Review: For a select number of calculations, review the software for agreement with the calculated parameter.

2.5 Test Plan & Procedures

a. Adequacy of Test Plan to satisfy test objectives.

b. Compliance of document with QA procedures.

c. Evidence of administrative controls on tests.

d. Process of preparation, review, and revision of Test Procedures.

e. Identification of test prerequisites, initial conditions, and acceptance criteria.

f. Procedures to resolve unexpected results or unanticipated behavior during testing.

2.6 Process Control System

a. Adequacy to satisfy Test Procedures.

b. Documentation of verification of controls.

2.7 Shakedown Tests

a. Results of conducted shakedown tests and compliance with QA procedures.

b. Status of remaining shakedown tests.

2.8 Personnel

a. Responsibility assignments including backups for key roles.

b. Adequacy of training or background to meet responsibility requirements.

2.9 Pre-test Analyses

a. Status and schedule for completing pre-test analyses.

b. Adequacy of controls and verification.

2.10 Test Schedule

a. Evidence of test schedule and agreement with SBWR program integrated schedule.

b. Detailed Action Plan to track critical path and maintain schedule.

2.11 Occupational Safety and Health

a. Evidence of facility safety plan.

b. Safety training requirements.

c. Compliance with local statutes.

3.0 CONCLUSION

3.1 Preliminary Assessment

At the conclusion of the readiness assessment, the review team will present their conclusions and findings at the close-out meeting. Open items from the assessment will be presented and a schedule to close the items will be developed and agreed upon by all parties.

3.2 Final Assessment

A written draft final assessment will be prepared by October 28 and sent out for comment. All comments will returned by November 4, and a final assessment report issued be November 11, 1994.

The final assessment and documentation of closure of open items will be filed in the test program's Design Record File.

GE Nuclear Energy

P. W. Marriott, Manager
Advanced Plant Technologies

General Electric Company
175 Curtner Avenue, MC 781 San Jose, CA 95125-1014
408 925-6948 (phone) 408 925-1103 (facsimile)

November 7, 1994

MFN No. 145-94
Docket STN 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Richard W. Borchardt, Director
Standardization Project Directorate

Subject: PANDA Facility Schematic

References: PANDA Readiness Assessment Meeting
October 19 through 21, 1994.

This letter transmits color copies of the PANDA Facility Schematics requested by Jack Kudrick at the referenced meeting. This figure is a more detailed version of Figure A.3-7 of NEDO-32391, SBWR Test and Analysis Program Description (TAPD). This version of the schematic includes support systems piping as well as process system piping, and is color coded by support system function.

Sincerely,

P. W. Marriott, Manager
Advanced Plant Technologies

Enclosure: PANDA Facility Schematic.

cc: P. A. Boehnert (ACRS) (w/o attachment)
R. W. Hasselberg (NRC) (w/o attachment)
M. Malloy (NRC) (w/o attachment)
J. A. Kudrick (NRC (w/1 attachment)

GE Nuclear Energy

MFN No. 145-94

bcc:	R. H. Buchholz	
	R. W. Burke	(EPRI)
	T. Cook	(DoE)
	S. A. Delvin	
	T. Y. Fernandez	(EPRI)
	D. L. Foreman	
	S. M. Franks	(DoE)
	L. S. Gifford	
	J. E. Leatherman	
	P. W. Marriott	
	T. R. McIntyre	
	F. A. Ross	(DoE)
	B. S. Shiralkar	
	R. Srinivasan	(EPRI)
	GE Master File	M/C 747
	SBWR Project File	M/C 781

GE Nuclear Energy

J. E. Quinn, Projects Manager
LMR and SBWR Programs

General Electric Company
175 Curtner Avenue, M/C 165 San Jose, CA 95125-1014
408 925-1005 (phone) 408 925-3991 (facsimile)

February 16, 1995

MFN No. 028-95
Docket STN 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Richard W. Borchardt, Director
Standardization Project Directorate

Subject: **Transmittal of PANDA Project Control Plan and Quality Assurance Procedures**

Transmitted hereby for your information is an Uncontrolled Copy of the PANDA Project Control Plan, and Quality Assurance Procedures.

This GE PANDA Project Control Plan (PPCP) describes the organization, quality related activities, events and procedures necessary to ensure and verify that the PANDA project at the Paul Scherrer Institute (PSI) is conducted under the provisions of the GE SBWR Quality Assurance Plan as described in the SBWR Design and Certification Program Quality Assurance Plan, NEDG-31831.

Sincerely,

James E. Quinn, Projects Manager
LMR and SBWR Programs

Enclosure: An Uncontrolled Copy of the PANDA Project Control Plan
and Quality Assurance Procedures

cc: (all w/attachment)
P. A. Boehnert (NRC/ACRS)
R. P. McIntyre (NRC)
S. Q. Ninh (NRC)
J. H. Wilson (NRC)

GE Nuclear Energy

MFN No. 028-95 (Attachment as specified below)

bcc:
J. A. Beard
R. H. Buchholz
R. W. Burke (EPRI) - w/2 copies of Attachment
T. Cook (DoE) - w/Attachment
J. D. Duncan
R. T. Fernandez (EPRI)
J. R. Fitch
L. S. Gifford
J. E. Leatherman
J. E. Quinn
T. R. McIntyre
F. A. Ross (DoE)
K. T. Schaefer
R. Srinivasan (EPRI) - w/Attachment
GE Master File M/C 747 - w/Attachment
SBWR Project File - w/Attachment

GE Nuclear Energy

J. E. Quinn, Projects Manager
LMR and SBWR Programs

General Electric Company
175 Curtner Avenue, M/C 165 San Jose, CA 95125-1014
408 925-1005 (phone) 408 925-3991 (facsimile)

March 27, 1995

MFN 044-95
Docket STN 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Richard W. Borchardt, Director
Standardization Project Directorate

Subject: **PANDA As-Built Drawing Package**

Reference: 1) MFN 018-95, from J. E. Quinn (GE) to R. W. Borchardt (NRC), Approach to Achieve Closure of Items Related to the GE SBWR TAPD, dated February 14, 1995.

2) MFN 030-95, from J. E. Quinn (GE) to R. W. Borchardt (NRC), SBWR Test Submittals, dated February 21, 1995.

GE has submitted Reference 1 to the NRC which presents the approach (Process and List of Additional Work) to achieve closure of items related to the GE SBWR Test and Analysis Program (TAPD). The As-Built Drawing Package attached to this letter completes item 33 of Attachment 2 to MFN 018-95 for the PANDA Facility.

GE has submitted Reference 2 to the NRC which lists SBWR Test Submittals and relates them to the Item No. in Attachment 2 to Reference 1. The PANDA As-Built Drawing Package attached to this letter completes Item No. 2 of the Attachment to MFN 030-95.

Should you have any questions concerning the PANDA Facility please contact Terry McIntyre of our staff on 408-925-1441, or John Torbeck on 408-925-6101.

Sincerely,

RWBuchholz

for James E. Quinn, Projects Manager
LMR and SBWR Programs

Enclosure: PANDA As-Built Drawing Package

cc: P. A. Boehnert (NRC/ACRS)
I. Catton (ACRS)
S. Q. Ninh (NRC) - w/attachment
J. H. Wilson (NRC)

Appendix 1

PANDA Experimental Facility

Vessels, Pools, IC and PCC Units

Facility Design Drawings

Drawing	Number
Configuration of Vessels	1 - 290111 C
Drywell	0 - 290112
Suppression Pool (Wetwell)	0 - 290113
GDCS Pool	1 - 290114
Reactor Pressure Vessel (RPV)	1 - 290115
IC and PCC Pool Support Structure	1 - 290116
Manhole DN 700	2 - 290117
Manhole DN 1000	2 - 290118
Manhole DN 600	2 - 290119 C
Vessel Internals	0 - 290120
IC/PCC Pool Configuration	0 - 290129
IC/PCC Pool Details	0 - 290161 B
IC/PCC Pool Details	1 - 290162 C
IC Unit	0 - 290130
PCC Unit	0 - 290132
IC Tubes	1 - 290163
PCC Tubes	1 - 290164

Ø4000

5200

Einbauten siehe Zeichnung 164A3526-10
Pces int. voir dessin 2-290120

Designation / Designation	Pos. / Item	Profil / Size	Long. / Lenght	Matiere / Material	Certif. / Certif.	Observation / Remarks	Kg
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" - "	16			" - "		A2603	
" - "	15			" - "		A2602	
" - "	14			" - "		A2601	
" - "	13			" - "		A2600	
Tragstruktur	12				164A3526-24		
Vis t.6p. - 6Kt Schrauben	11	M30	120	8.8		DIN 931	
Ecrou - Mutter	10	M30	0.8d	8		DIN 934	
IC-POOL	9				164A3526-11	(0-290120)	
Mannloch DN 600	8				164A3526-9	(2-290119)	
Mannloch DN 1000	7				164A3526-8	(2-290118)	
Mannloch DN 700	6				164A3526-7	(2-290117)	
IC-POOL Fixation - Befestigung	5				164A3526-6	(1-290116)	
RPV	4				164A3526-5	(1-290115)	
GDCS	3				164A3526-4	(1-290114)	
WET-WELL	2				164A3526-3	(0-290113)	
DRY-WELL	1				164A3526-2	(0-290112)	

Rev.	Modification	Rev.	Modification
A	mis à jour 16.09.92 Ben	D	
B	mis à jour 25.09.92 Ben	E	
C	ajouté pos.12 06.11.92 Ben	F	

Echelle—Scale: 1:50

Dessine—Drawn: 29.06.92 Ben

Controle—Checked:

Liste de pieces sep.,p.
Sep. Material List,p.

No d'affaire: 47185

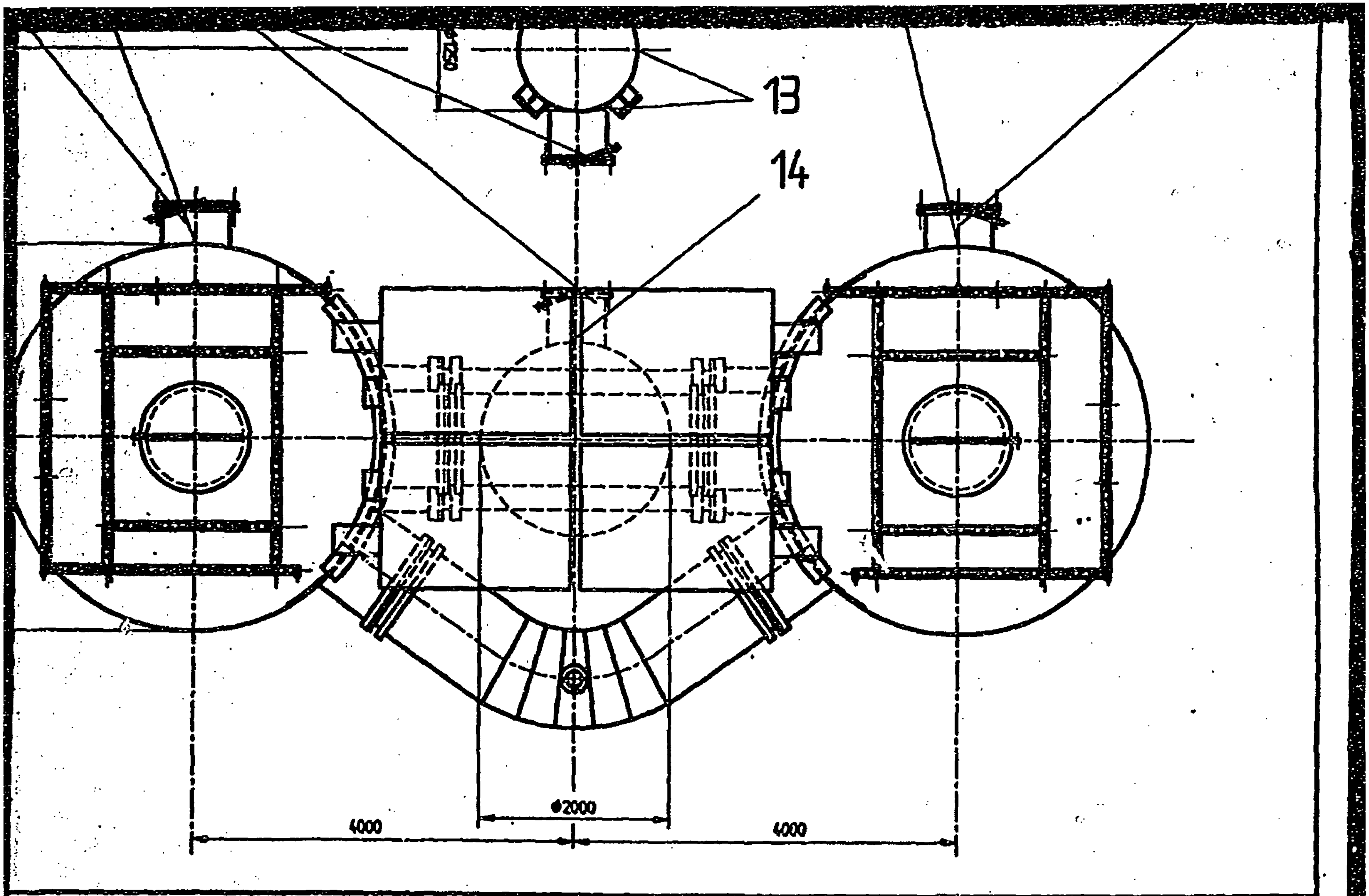
Anlage : PANDA
Baugruppe : Grossbehälter

ENSEMBLE
ZUSAMMENSTELLUNG

1-290111c

GIOVANOLA
CASE POSTALE 271
CH—1870 MONTHEY
TEL. (025) 73 21 11
FAX. (025) 71 89 52

No. de dessin—Dwg. No.
164A3526-1c.



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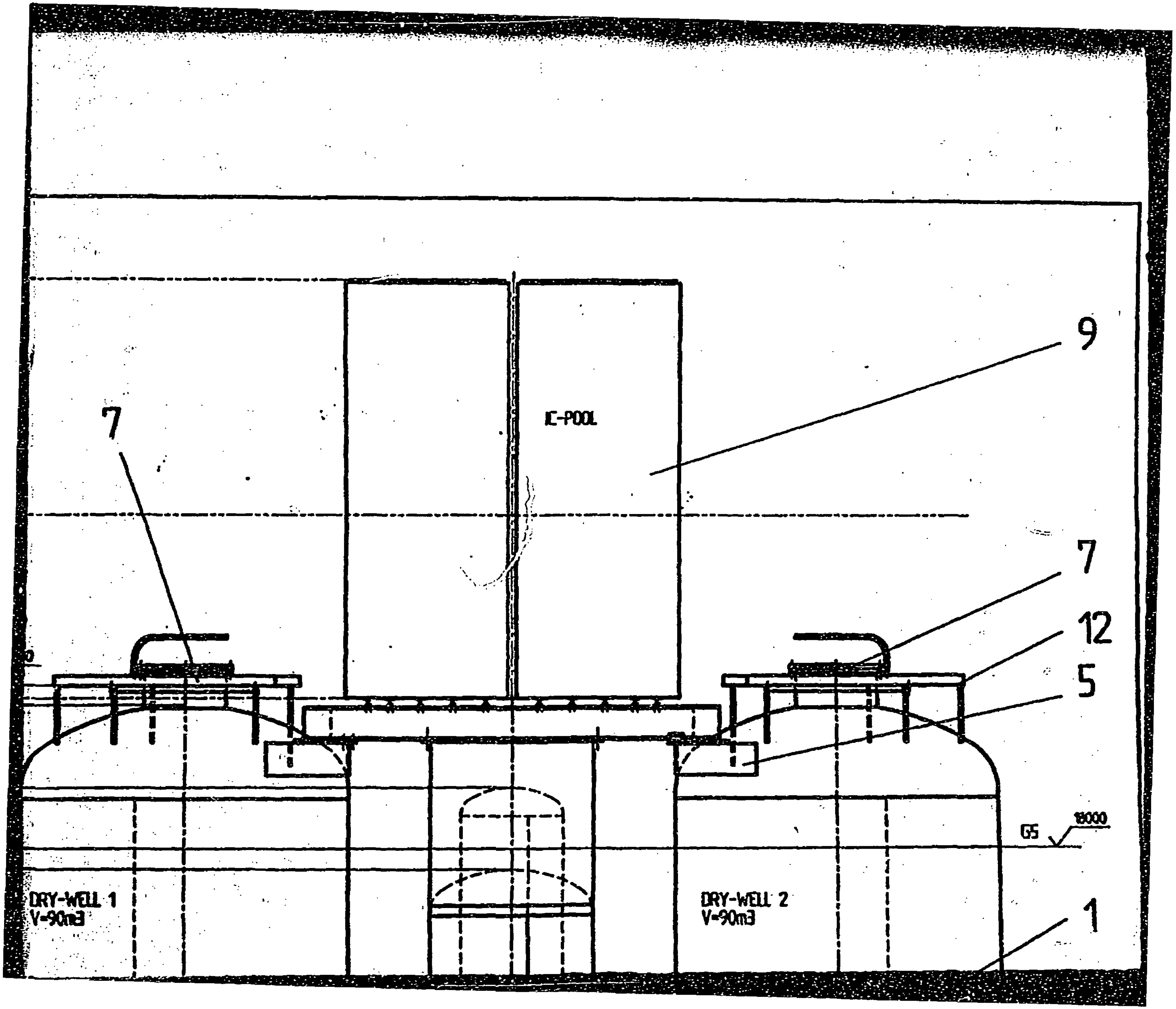


9
IC-POOL
7
7
12
5
GS
18000
DRY-WELL 1
V=90m3
DRY-WELL 2
V=90m3
1

PANDA DOCUMENT REVIEW/APPROVAL

Checked by	[illegible] PSI Responsible Engineer	Date	95-3-1
Reviewed by	[illegible] GE Site QA Representative	Date	[illegible]
~~Verified by~~ Approved	[illegible] PSI PANDA PM	Date	1-III-95
Approved by	[illegible] GE Project Manager	Date	2 Mar 95

PANDA MASTER DOCUMENT

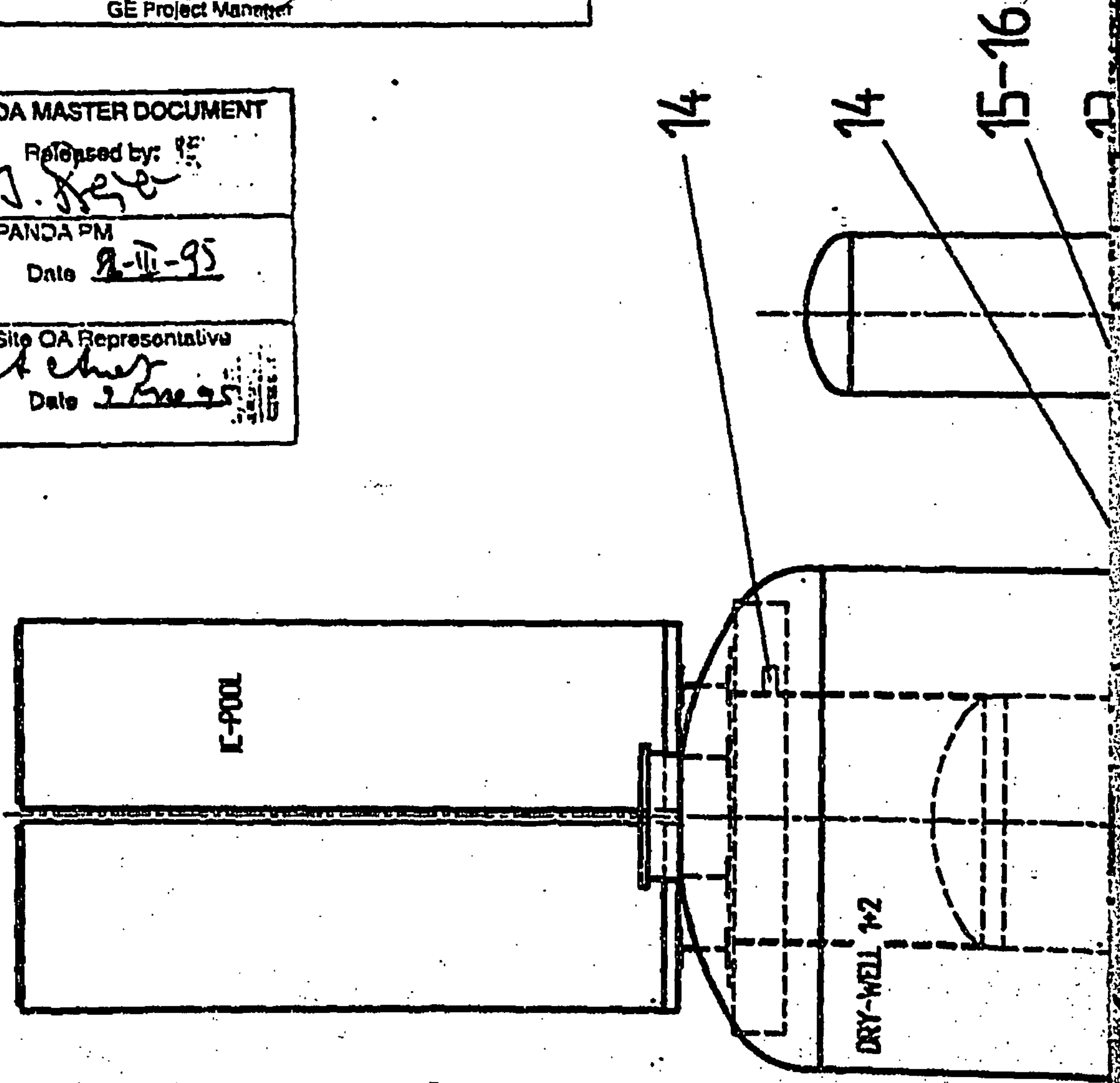
Released by: [illegible]

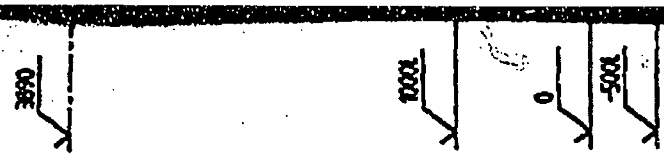
PSI PANDA PM

Date [illegible]-III-95

GE Site QA Representative [illegible]

Date [illegible]





Qualité Werkstoffverbindungen	Procédé Schweissverfahren	Métal d'apport Schweisszusatzwerkstoff
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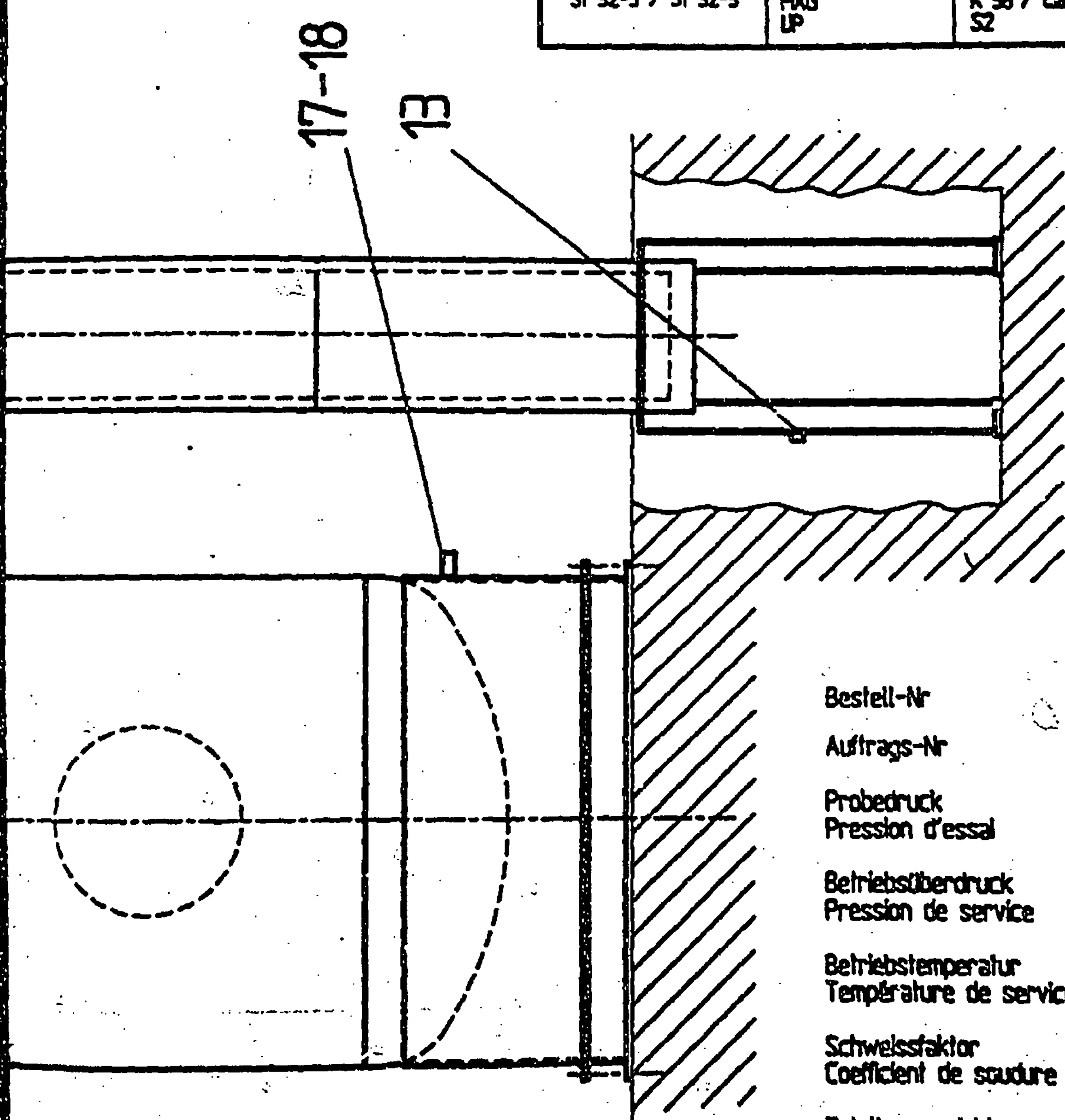
1.4571 / St 52-3	Electrode MIG UP	Limarosta 309 S Fluxinox 309S CN 23/12 UP
St 52-3 / St 52-3	Electrode MAG UP	Suprafherme K 56 / Carmig 23 S2



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Auftrags-Nr	47185
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Betriebsüberdruck Pression de service	-1/+10 bar
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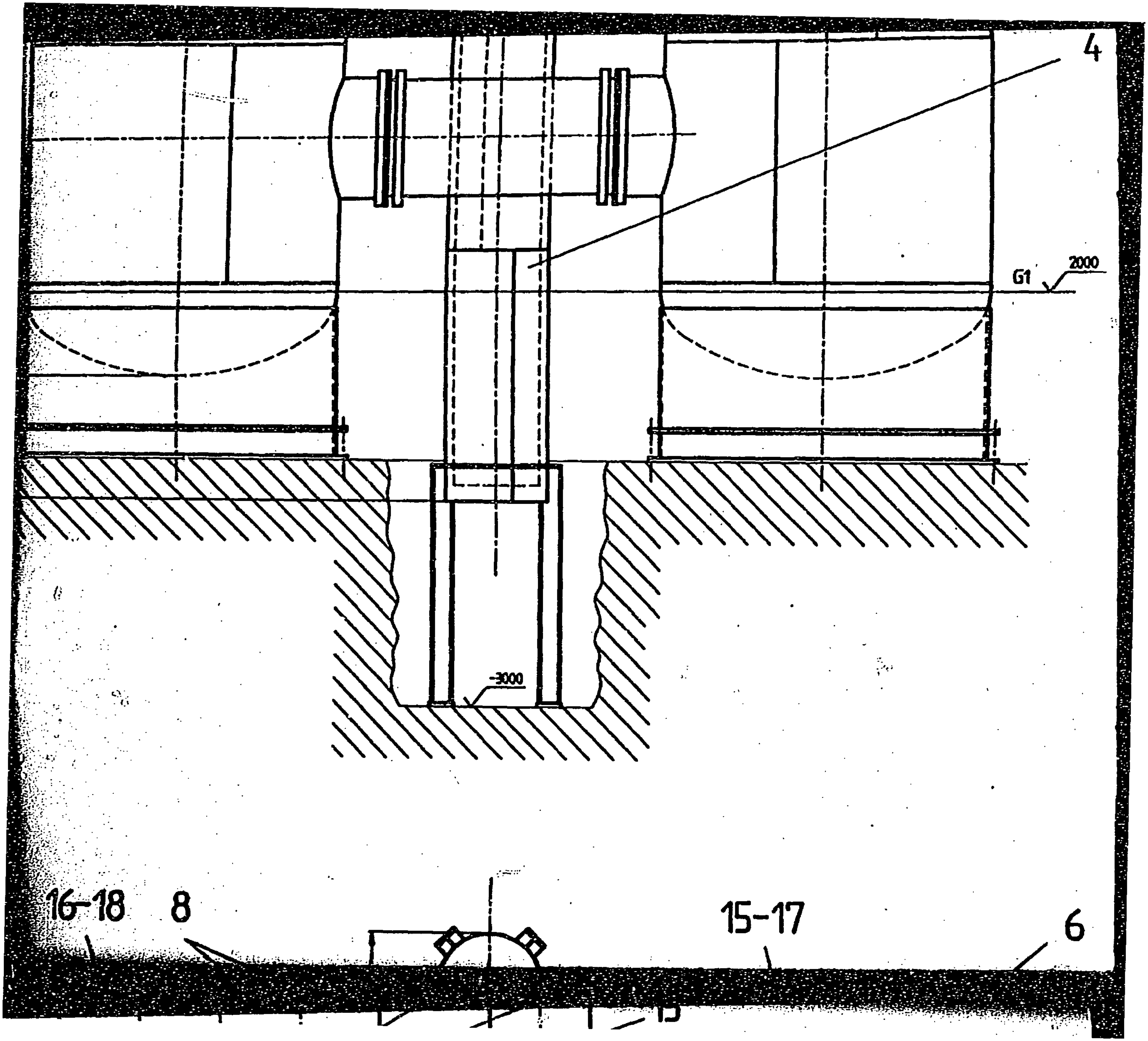
Schweissfaktor Coefficient de soudure	0,85
Totalleergewicht Poids total à vide	~1641 kg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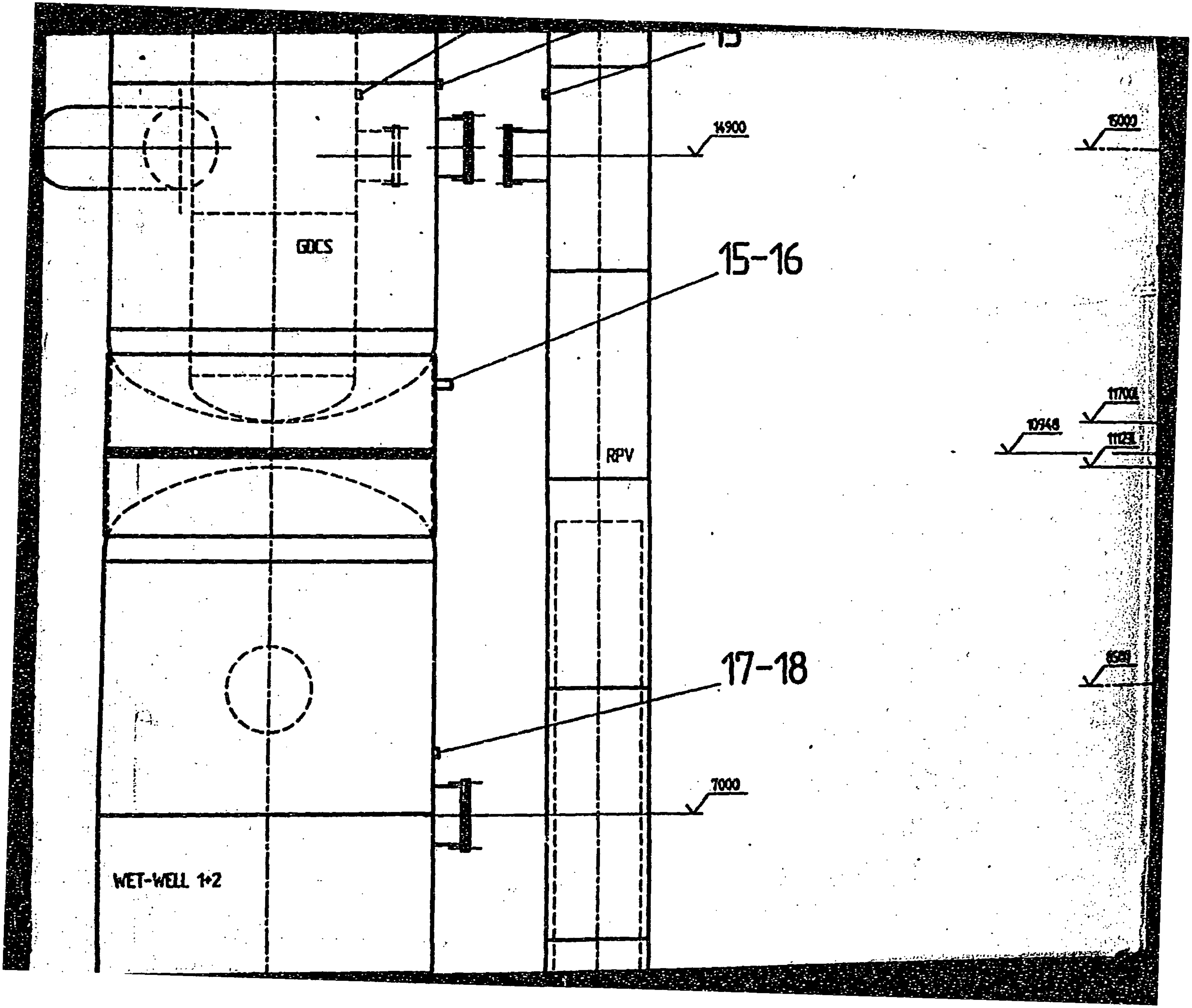

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GDCS
15-16
10948
RPV
17-18
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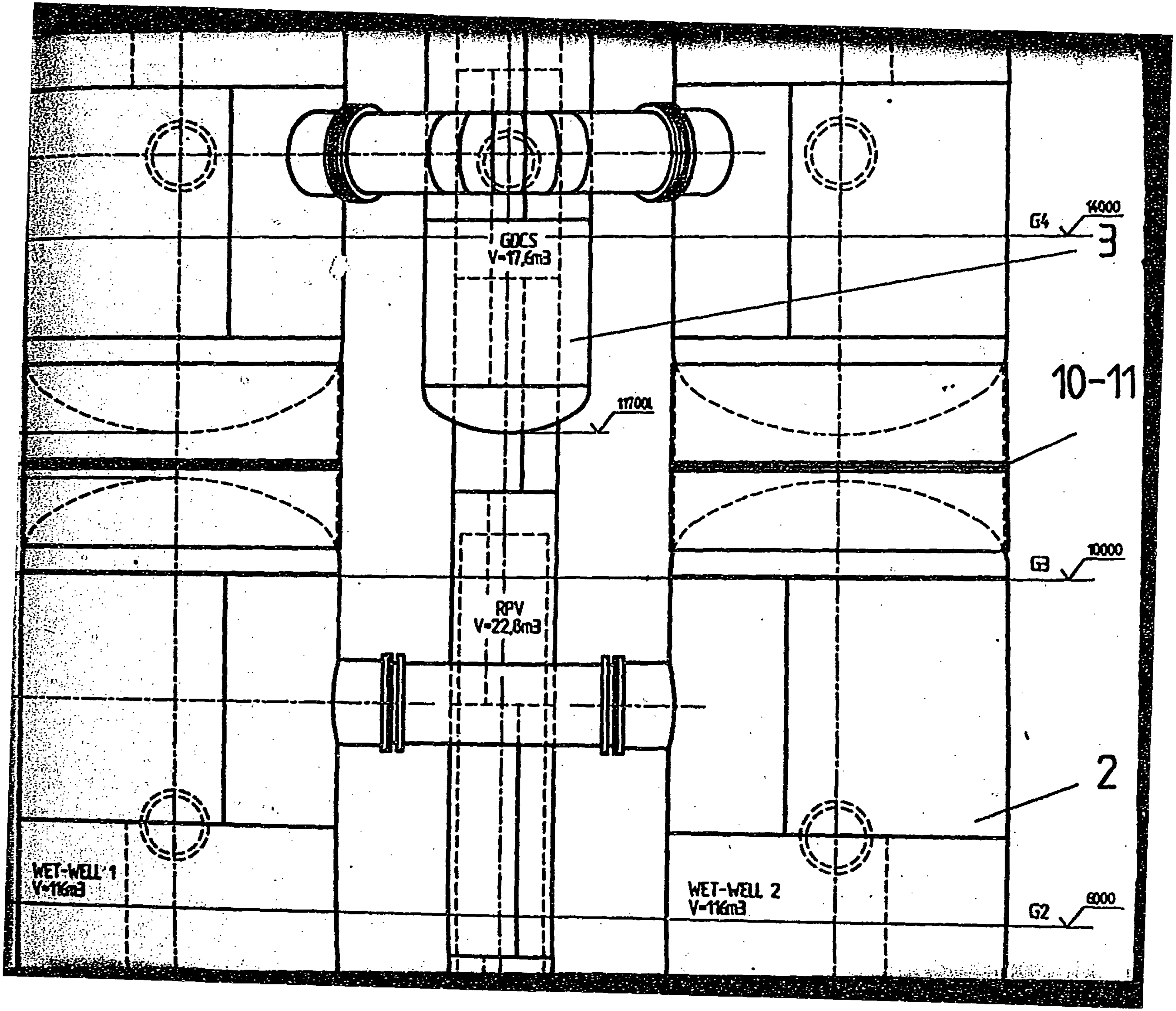
WET-WELL 1+2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11700L
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WET-WELL 1
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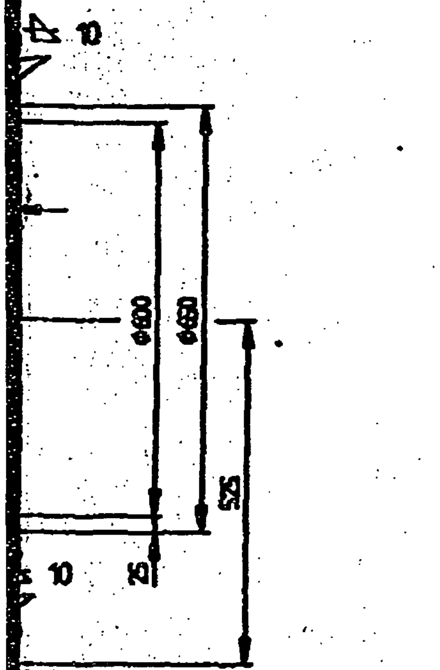
6000
G2



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2	" - "	15	ø114,3x4,5	716	" - "	3.1B		18
2	" - "	14	ø200x20	360	" - "	3.1B		70
1	" - "	13	ø168,3x4,5	368	" - "	3.1B		6
4	" - "	12	ø88,9x3,05	285	" - "	3.1B		7
7	" - "	11	ø32x8	339	" - "	3.1B		12
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2	Bride - Flansch	9	ø1140/944	44	" - "	3.1B		226
2	Revêt. - Verkleidung	8	ø1044/944	51	" - "			14
5	Virole - Zarge	7	404x12	2953d.	" - "	3.1B		573
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Modifications Revisions			
A	mis à jour 28.07.92 Ben	D	ajouté Pos.19 19.8.92
B	modif. DN brides 03.08.92 Ben	E	modif.pos.25-26 7.10.92 Ben
C	modif.pos.430-431-530-531 19.8.92	F	ajout. pos.19. 8.10.92 Ben

Echelle–Scale
1:50 1:25 1:20 1:5 1:2 1:1

Dessiné–Drawn
16.06.92 Ben

Contrôle–Checked

Liste de pièces sep.p.
Sep. Material List.p.

No d'affaire
47165

PANDA MASTER DOCUMENT
Released by:
PSI PANDA PM
Date 2-III-95
GE Site QA Representative
Date 2 Mar 95

Anlage : PANDA
Baugruppe : Grossbehälter

DRY-WELL Behälter

0-290112

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TEL. (025) 73 21 11
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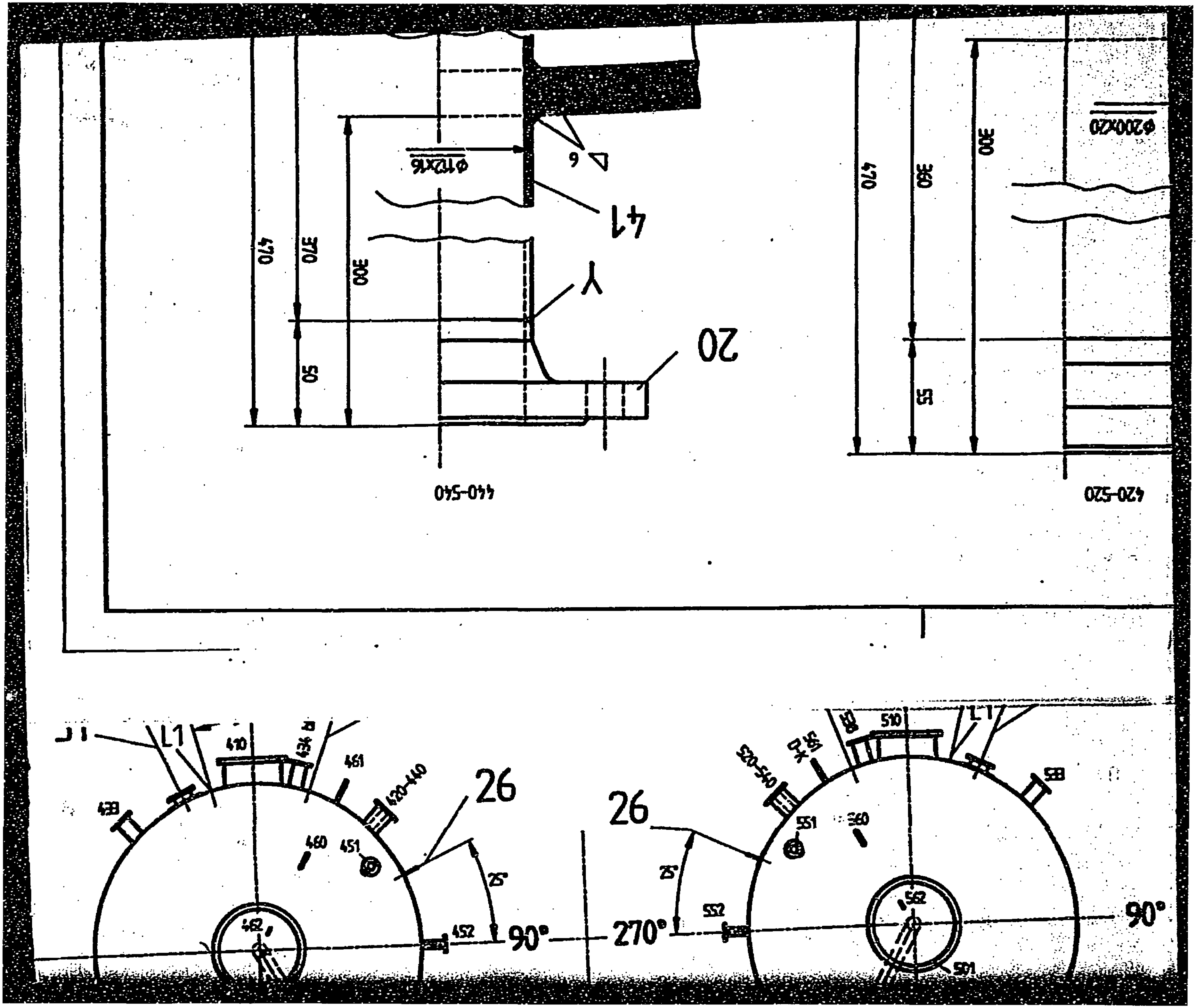
No. de dessin–Drg. No.
164A3526-2

1R L 3+



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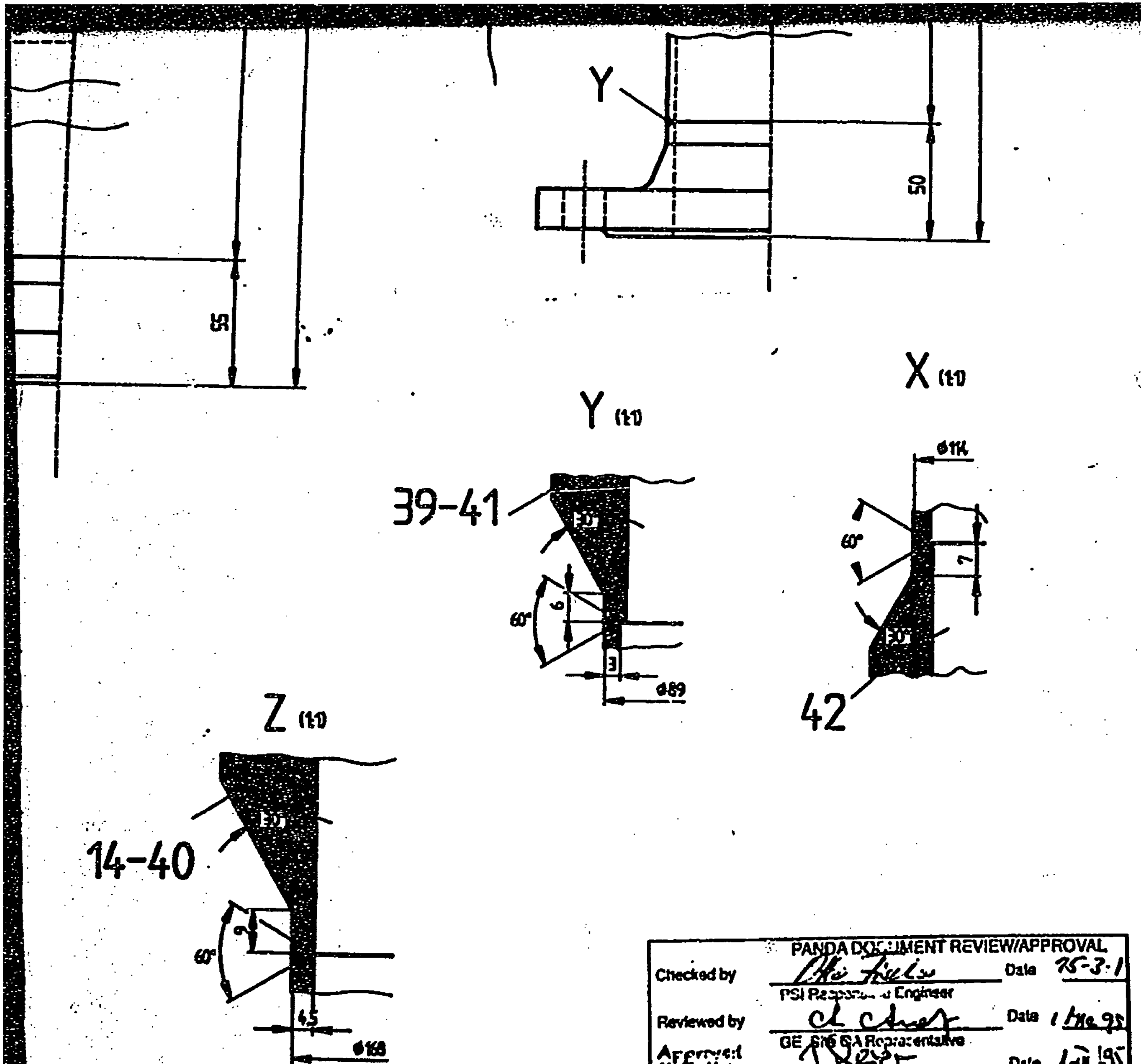


PANDA DOCUMENT REVIEW/APPROVAL

Checked by	[signature]	Date	95-3-1
	PSI Responsible Engineer		
Reviewed by	[signature]	Date	1 Mar 95
	GE [illegible] QA Representative		
Approved by	[signature]	Date	1-III-95
	PSI PANDA PM		
	[illegible]	Date	

Stutzennummer 410-510 sehen Zeichnung
Piquages n° 410-510 voir dessin

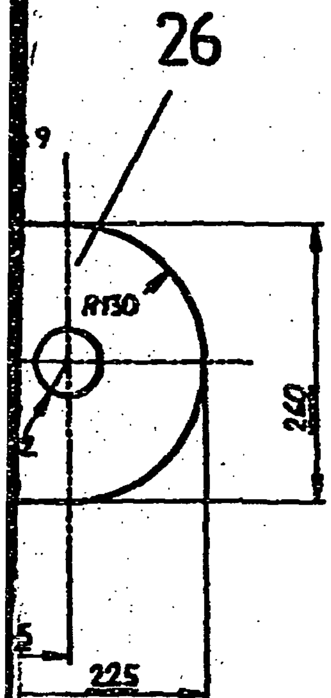
164A3526-7 (2-290117)

Stutzennummer 401-501 sehen Zeichnung
Piquages n° 401-501 voir dessin

164A3526-8 (2-290118)

Poinçonnage complet / Komplette Stempelung	Seulement marquage de la qualité / Nur Materialqualität markiert

~49000kg



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		38						
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72	Tige fil. - Gewindestangen	35	M24	325	5.6	Stp	DIN975	55
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4	Tube - Rohr	33	ø219,1x11	80	St 52			18
4	Plaque - Platte	32	ø340	30	St 37-2			85
4	Fourrure - Futterblech	31	440x440	14	1.4571			87
2	Virole - Zarge	30	180x25	1968d.	St 52-3			139
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2	Virole - Zarge	28	1542x25	12488d.	" - "			7938
					St 37-2			
2	Plaque - Platte	26	225x20	260	" - "			9
2	Fourrure - Futterblech	25	195x14	390	" - "			8
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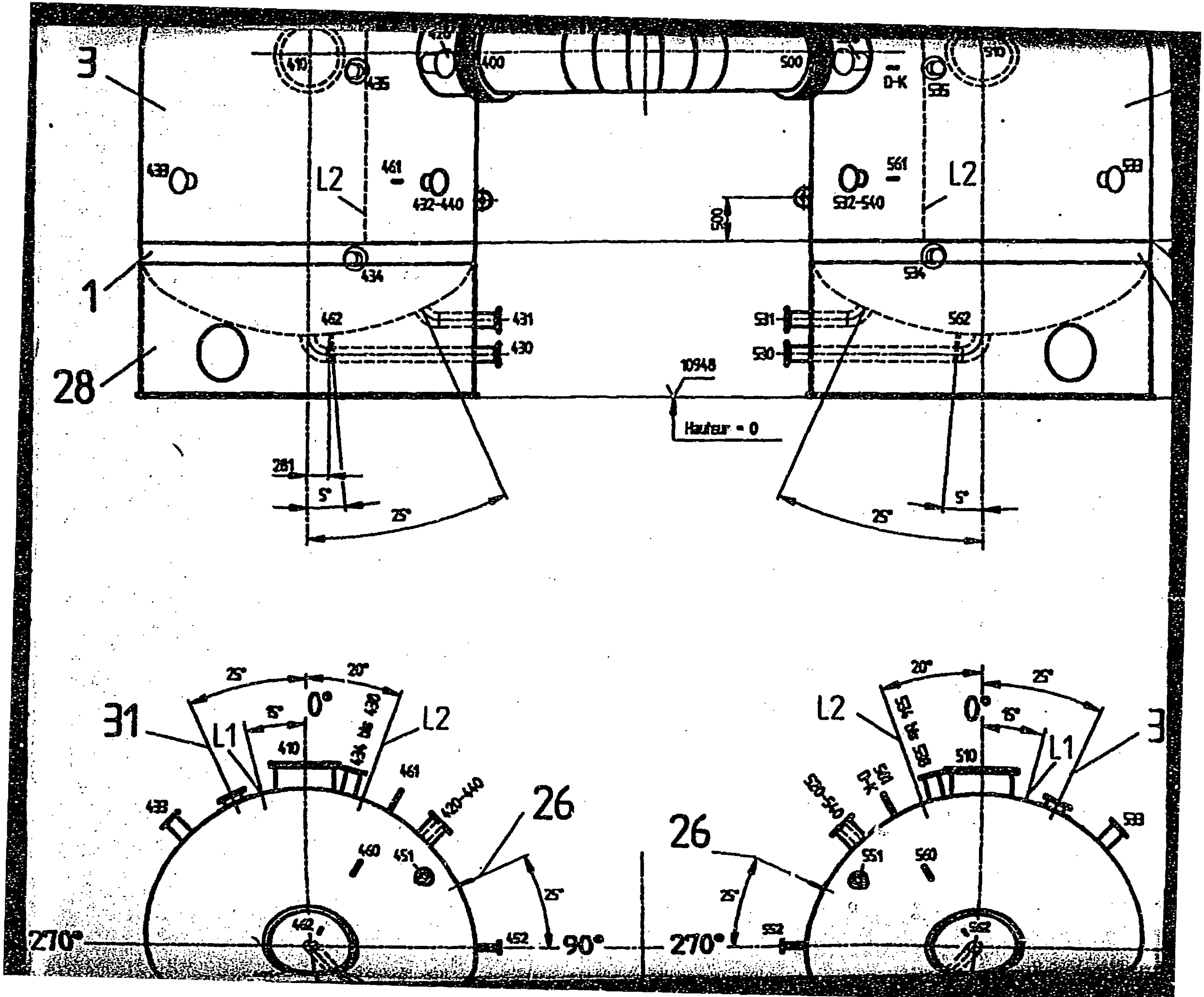
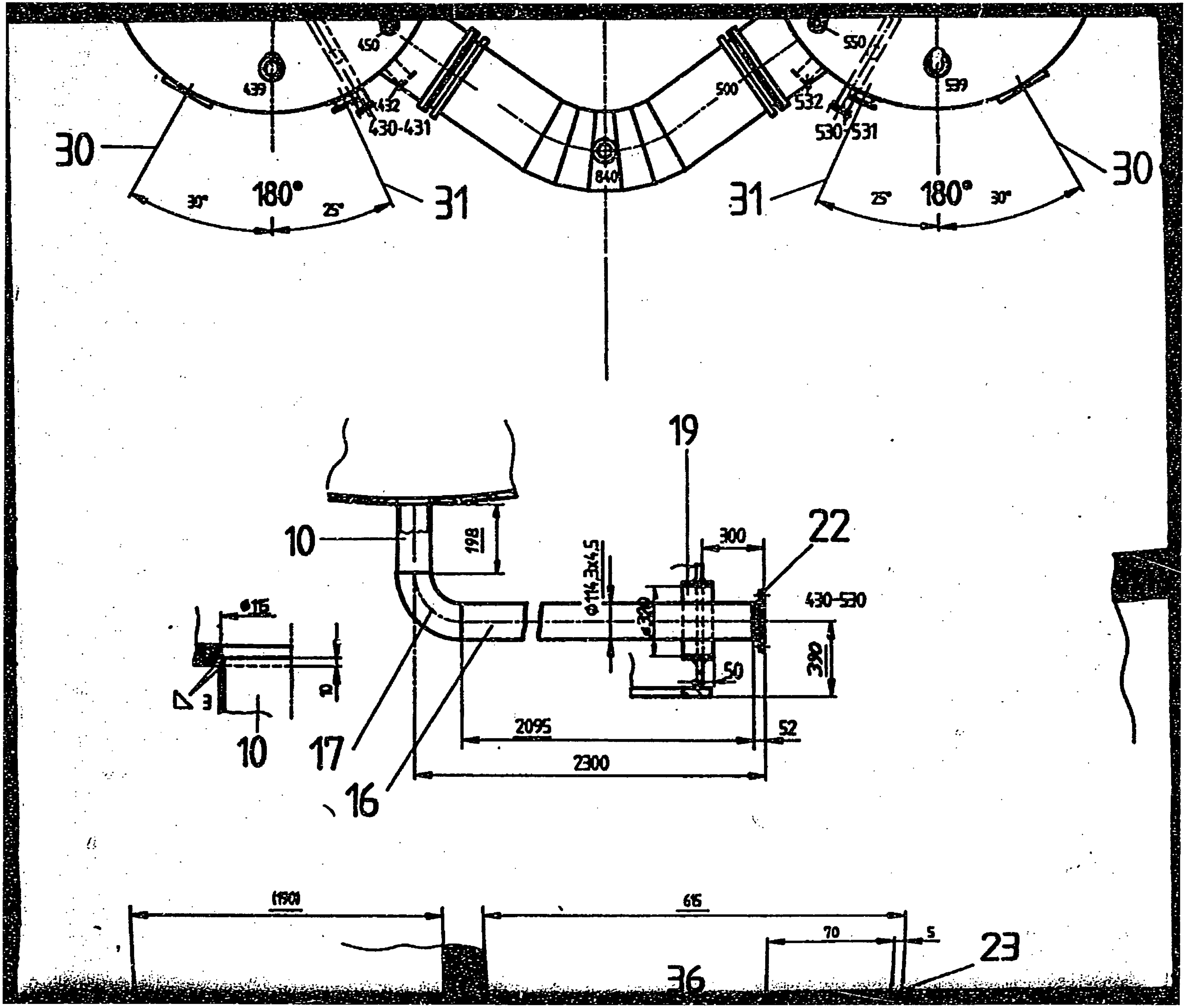
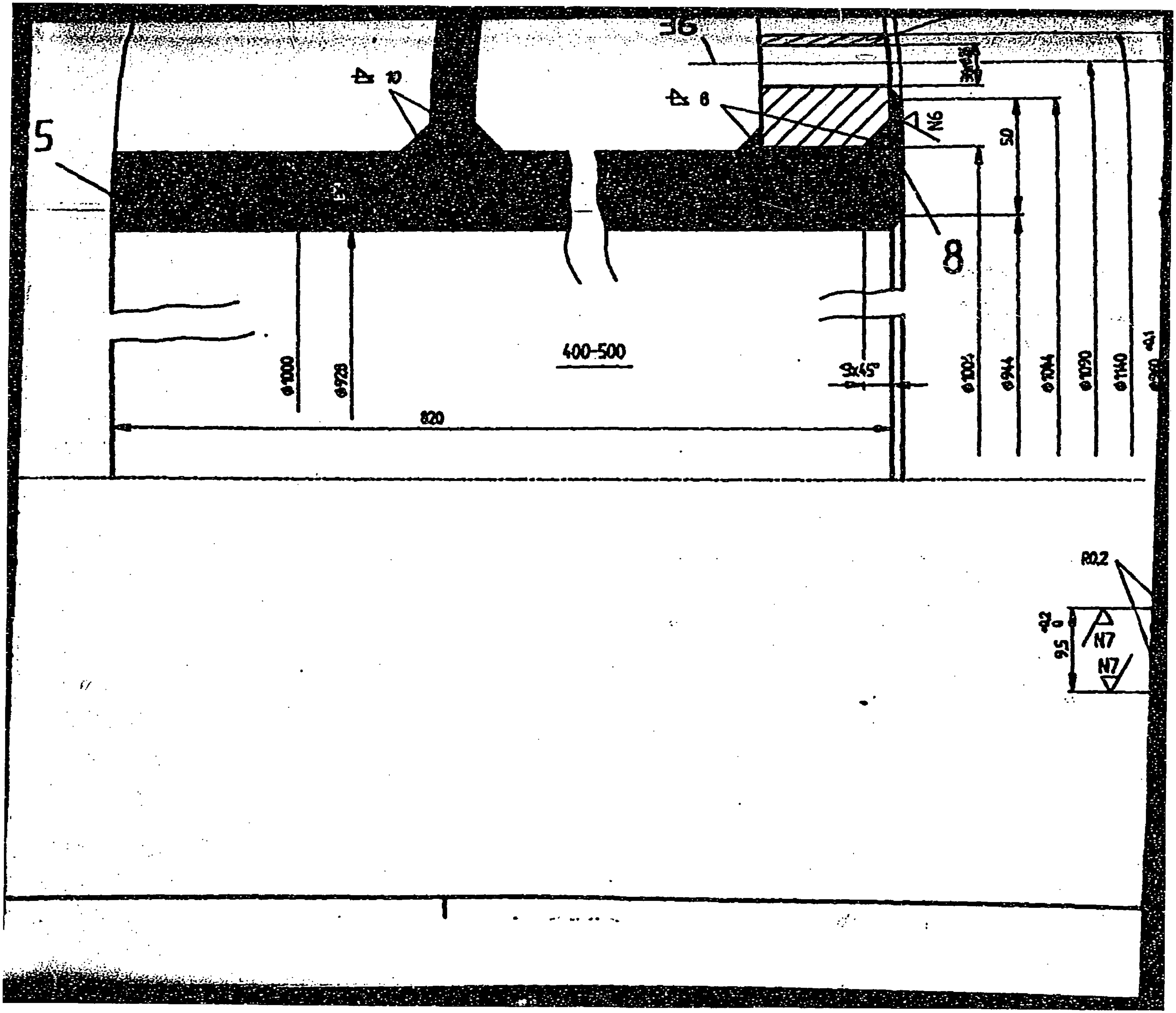
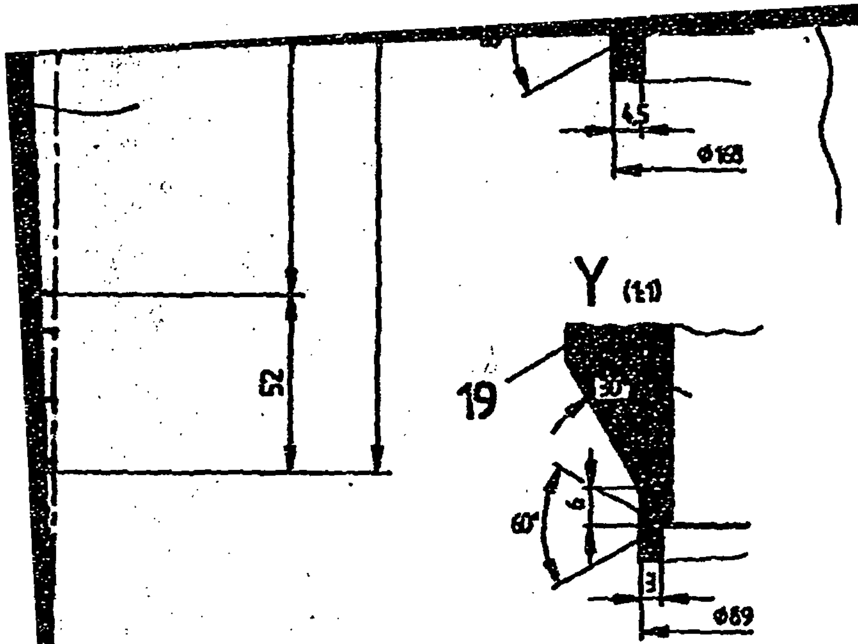
10	" - "	20	C80x88,9		" - "	3.1B	DIN2633	37
4	Virole - Zarge	19	150x25	1084d.	St 52-3			65
2	Tube - Rohr	18	ø114,3x4,5	368	1.4571	3.1B		9

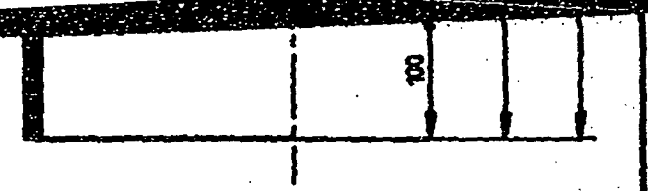

3
L2
1
28
31
L1
26
410
400
500
510
435
535
D-K
438
461
432-440
561
532-540
533
434
534
462
431
430
531
530
562
10948
Hauteur = 0
281
5°
25°
20°
15°
0°
436 bis 438
420-440
460
451
452
90°
270°
551
560
552
520-540
D-K 561


30
31
180°
30°
25°
439
450
432
430-431
840
500
532
530-531
550
539
19
22
300
10
198
Φ114,3x4,5
430-530
390
50
Φ15
3
17
16
2095
2300
52
(1150)
615
70
5
23
36



5
8
10
6
N6
50
400-500
820
5x45°
Ø1000
Ø928
Ø1004
Ø944
Ø1044
Ø1090
Ø1140
R0,2
9,5
N7
N7



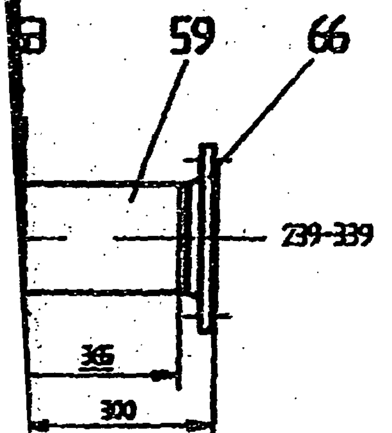


Stutzennummer 220-320 sehen
Piquages n° 220-320 voir

164A3526-7 (2-290117)

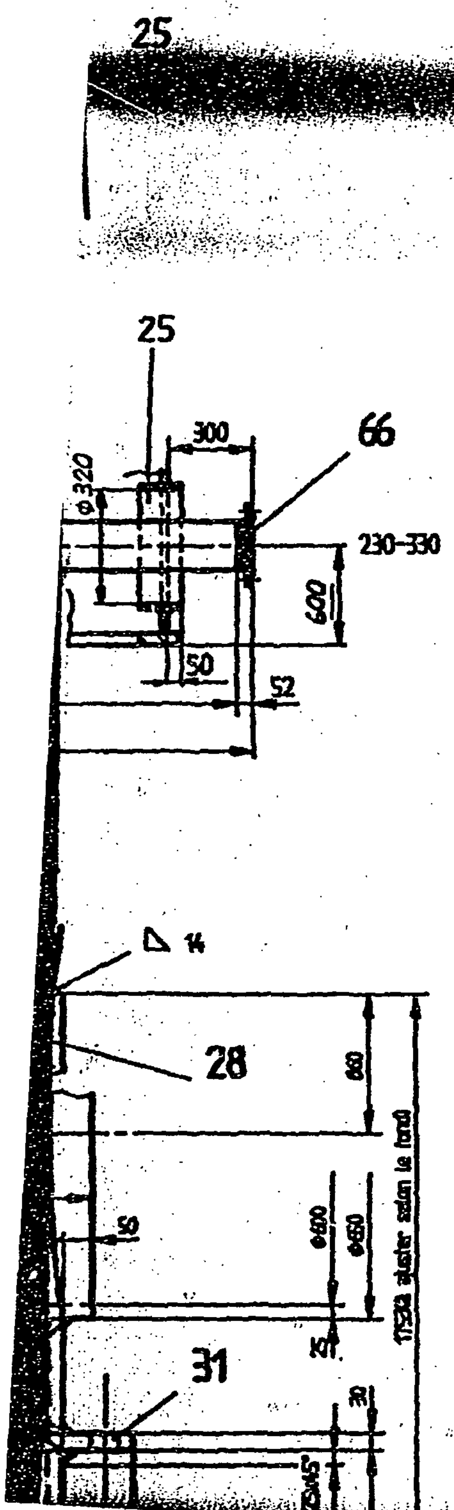
Poinçonnage complet Komplette Stempelung	Seulement marquage de la qualité Nur Materialqualität markiert

~72700kg



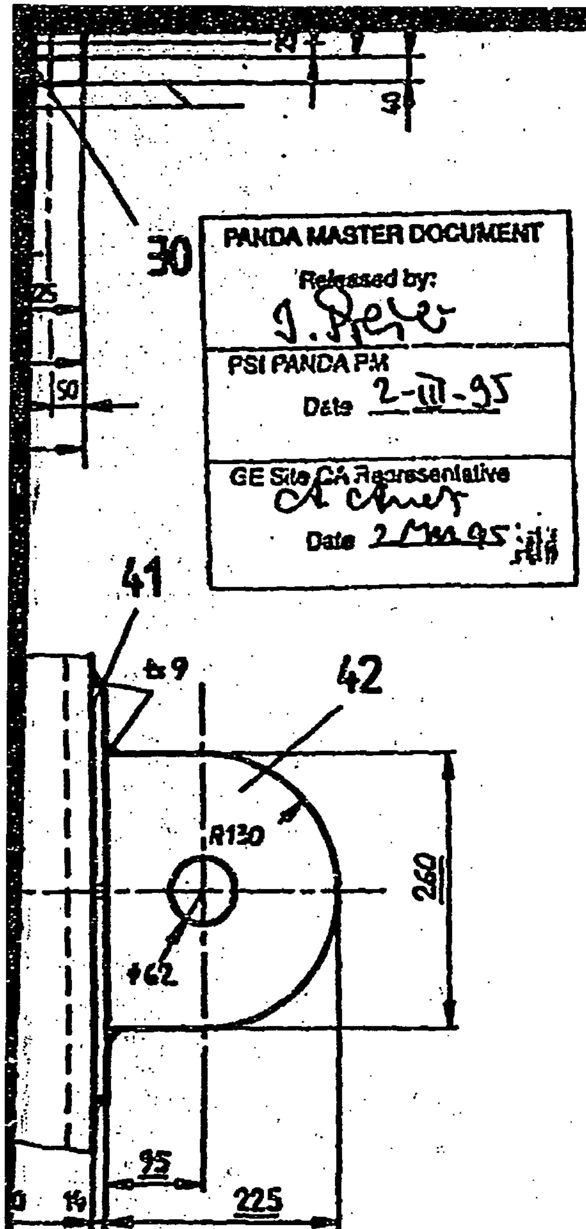
16	Bride - Flansch	66	C100x114,3		1.4571	3.1B	DIN 2633	74
12	Tube - Rohr	65	Ø200x20	368	1.4571	3.1B		633
2	Joint plat - Flachdichtung	64	Ø168/110	3	viton			
16	Ecrou - Mutter	63	M16	0,8d	5-2	Stp	DIN 934	
16	Vis t.6p. - 6 Kt.Schrauben	62	M16	65	5.6	Stp	DIN 931	2
2	Tube - Rohr	61	Ø114,3x6,5	543	1.4571	3.1B		13
2	" - "	60	Ø114,3x4,5	98	1.4571	3.1B		
2	" - "	59	Ø114,3x4,5	365	1.4571	3.1B		9
		58						
2	Tube - Rohr	57	Ø114,3x4,5	193	1.4571	3.1B		4
72	Tige fil. - Gewindestangen	53	M30	[illegible]	5.6	Stp	DIN 976	[illegible]
288	Ecrou - Mutter	52	M30	[illegible]	5-2	Stp	DIN 934	
72	Tige fil. - Gewindestangen	51	M24	[illegible]	[illegible]	[illegible]	[illegible]	
288	Ecrou - Mutter	50	M24	0,8d	5-2	Stp	DIN 934	64

25



72	Tige fil. - Gewindestangen	51	M24	325				
288	Ecrou - Mutter	50	M24	0,8d	5-2	Stp	DIN 934	64

72	Tige fil. - Gewindestangen	53	M30	430	5.6	Stp	DIN 975	
288	Ecrou - Mutter	52	M30	0,8d	5-2	Stp	DIN 934	53
72	Tige fil. - Gewindestangen	51	M24	325	5.6	Stp	DIN 975	
288	Ecrou - Mutter	50	M24	0,8d	5-2	Stp	DIN 934	64
32	Vis 6p. - 6 Kt.Schrauben	49	M16	65	5.6	Stp	DIN 931	4
32	Ecrou - Mutter	48	M16	0,8d	5-2	Stp	DIN 934	
4	Joint plat - Flachdichtung	47	Ø130/90	3	viton			
4	O-Ring Dichtung	46	Ø int 940x7		viton			
4	O-Ring Dichtung	45	Ø int 1430x7		viton			
4	Tube - Rohr	44	Ø88,9x3,05	370	1.4571	3.1B		10
					St 37-2			
2	Plaque - Platte	42	225x20	260	"-"			8
2	Fourrure - Futterblech	41	195x14	390	"-"			8
2	Bride - Flansch	40	Ø1680/1504	110	St 52-3	3.1B		760
2	"-"	39	Ø1680/1448	110	"-"	3.1B		984
2	"-"	38	Ø1140/950	70	"-"	3.1B		343
2	"-"	37	Ø1140/1004	70	"-"	3.1B		251
4	Plaque - Platte	36	Ø340	30	St 37-2			85
4	Tube - Rohr	35	Ø219,1x11	80	St 52			18
2	Anneau - Ring	34	Ø4050/3770	40	St 52-3		en 4 segments	1060
2	Virole - Zarge	33	613x25	12488d.	"-"		à ajuster selon le fond	3004
64	Renfort - Verstärkung	32	125x18	330	"-"			373
2	Anneau - Ring	31	Ø4250/4000	30	"-"		en 4 segments	760
2	Anneau - Ring	30	Ø4250/3850	40	"-"		en 4 segments	1600
2	Virole - Zarge	29	150x25	1963d.	"-"			138
2	"-"	28	1753x25	12488d.	"-"		à ajuster selon le fond	8592
15	Bride - Flansch	27	C150x168,3		1.4571	3.1B	DIN 2633	101
20	"-"	26	C80x88,9		"-"	3.1B	DIN 2633	73
4	Virole - Zarge	25	150x25	1084d.	St 52-3			65
6	Coude - Bogen	24	Ø114,3x2,6	3d-90°	1.4571	3.1B		10
2	Tube - Rohr	23	Ø114,3x4,5	2095	1.4571	3.1B		51
2	"-"	22	Ø114,3x4,5	716	"-"	3.1B		17
3	"-"	21	Ø168,3x4,5	368	"-"	3.1B		20
[illegible]	"-"	20	[illegible]	366	"-"	3.1B		31



PANDA MASTER DOCUMENT
Released by: J. Dreier
PSI PANDA PM
Date 2-III-95
GE Site QA Representative
A. Chuet
Date 2 Mar 95

Nb. Pces.	Désignation Designation	Pos. Item	Profil Size	Long. Length	Matière Material	Certif. Certif.	Observation Remarks	Kg
7	" - "	17	ø32x8	333	" - "	3.1B		12
2	" - "	16	ø114,3x4,5	194	" - "	3.1B		5
4	Fourrure - Futterblech	15	440x440	14	" - "			87
2	Revêt. - Verkleidung	14	ø1596/1436	9	" - "			24
2	" - "	13	ø1040/940	9	" - "			14
2	Bride - Flansch	12	ø1680/1438	441	" - "	3.1B		420
2	" - "	11	ø1140/940	441	" - "	3.1B		230
1	Virole - Zarge	10	2740x9	2944d.	" - "	3.1B		580
1	" - "	9	360x12	4499d.	" - "	3.1B		155
1	" - "	8	2500x12	4499d.	" - "	3.1B		1060
2	" - "	7	820x36	3028d.	" - "	3.1B		1430
2	" - "	6	870x40	4587d.	" - "	3.1B		2954
2	" - "	5	1972x21	12500d.	" - "	3.1B		8282
2	" - "	4	3000x20.5	12502d.	" - "	3.1B		12044
2	" - "	3	3000x21.5	12499d.	" - "	3.1B		12291
2	Fond - Korbbogenboden	2	ø4000	21.5	" - "	3.1B	Epaiss. = 18.6	6800
2	" - "	1	ø4000	23.5	" - "	3.1B	Epaiss. = 20.4	7430

Modifications Revisions

A	mis à jour 28.07.92 Ben	D	ajouté: Pos. 25 12.8.92
B	modif. CN brides 04.08.92 Ben	E	modif. pos. 41-42 7.10.92
C	modif. pos. 230-231-330-331	F	ajout. pos. 25 8.10.92

Echelle-Scale 1:50 1:20 1:10 1:5 1:2 1:1

Dessiné-Drawn 16.06.92 Ben

Contrôlé-Checked

Liste de pièces sep. p. Sep. Material List. p.

No d'affaire 47185

Anlage : PANDA
Baugruppe : Grossbehälter

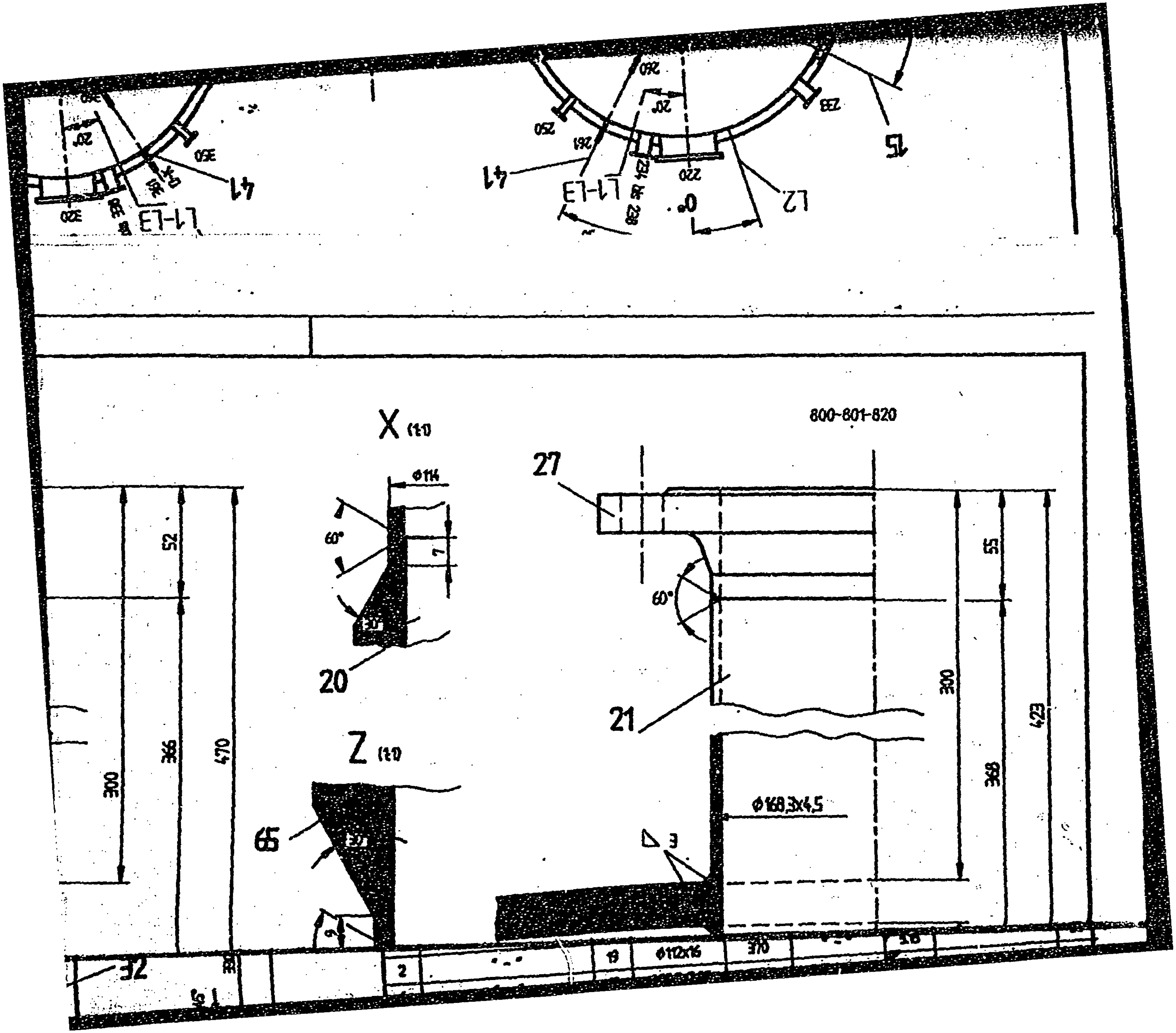
WET-WELL Behälter

0-290113

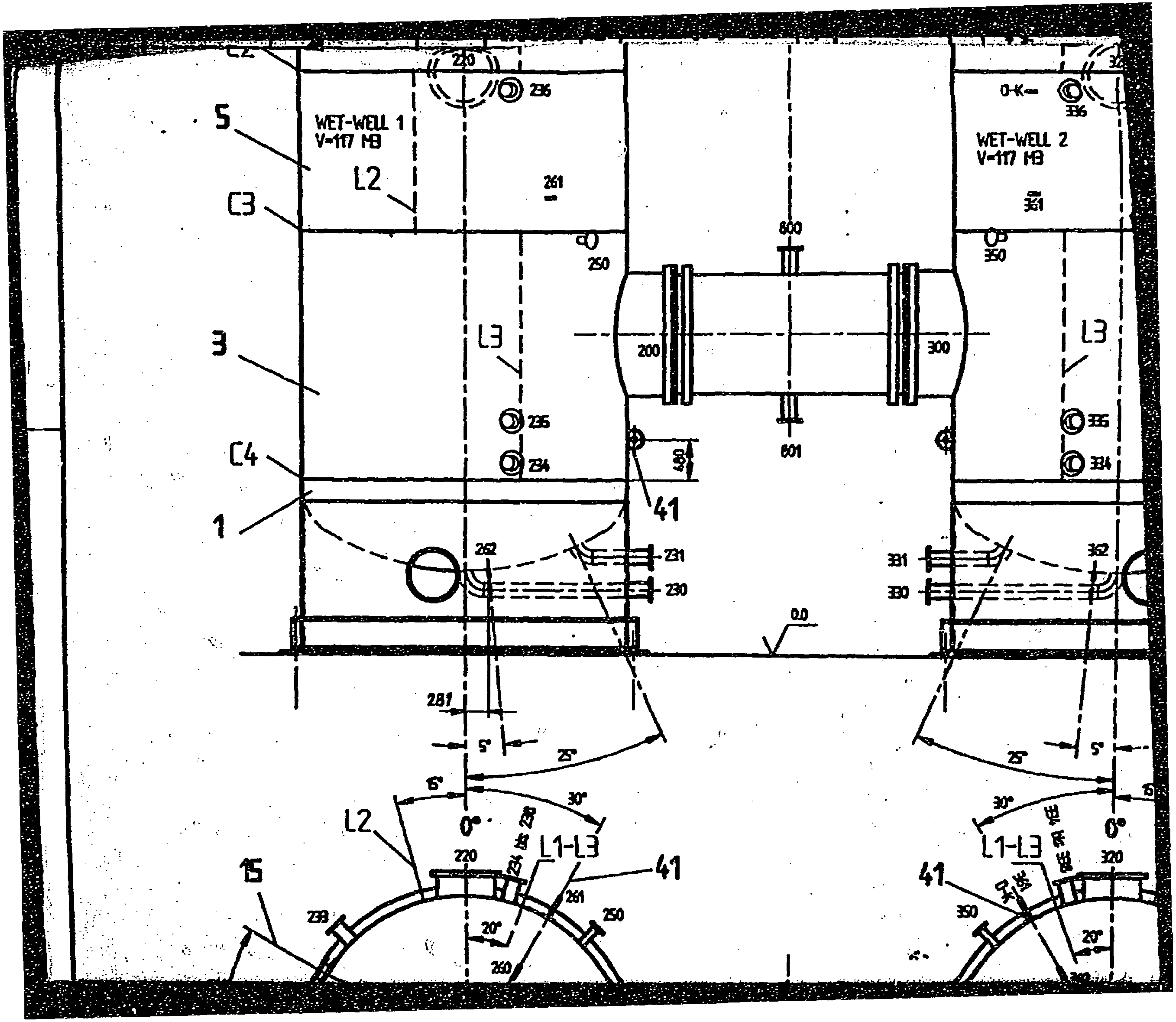
GIOVANOLA

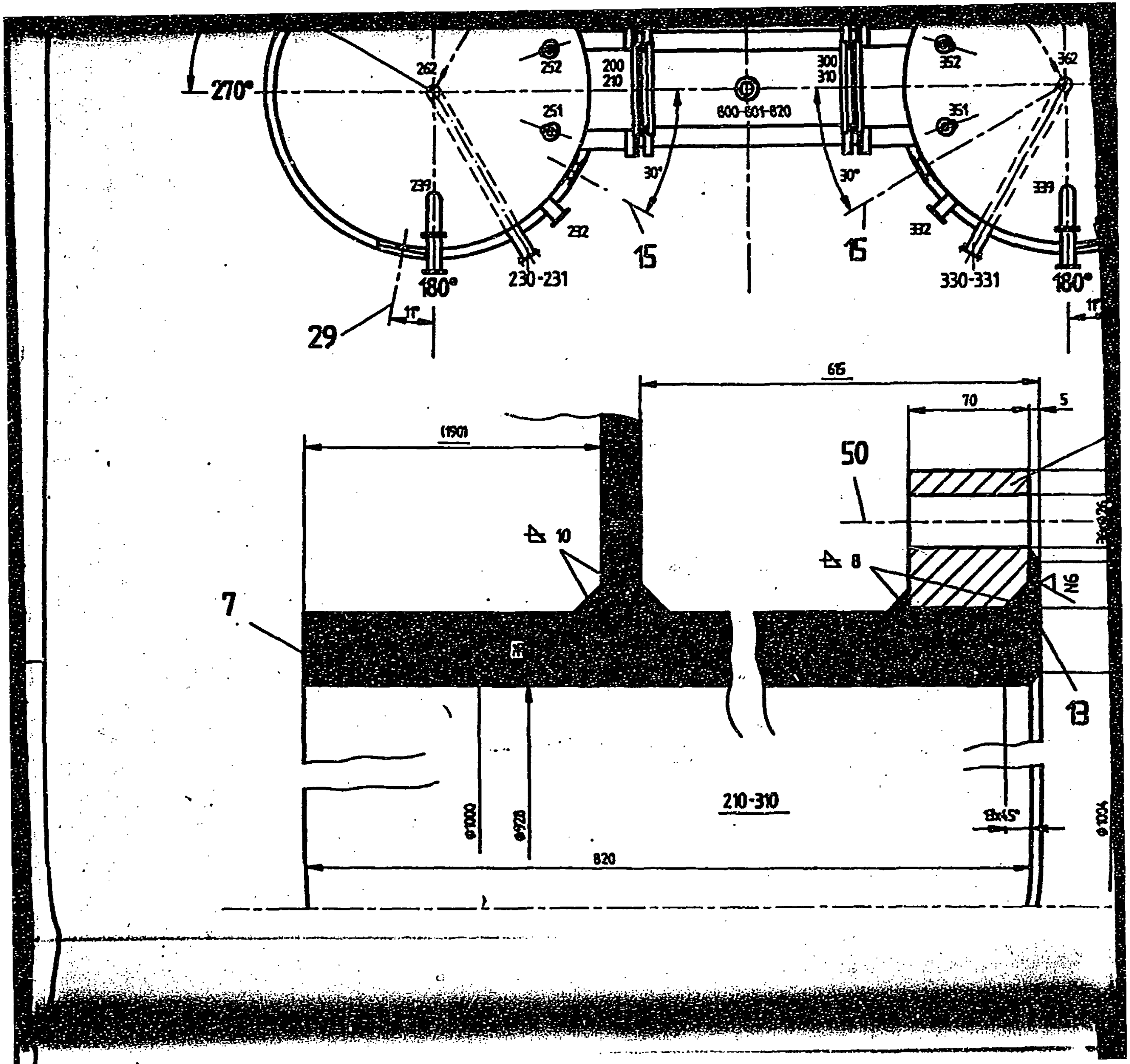
CASE POSTALE 271
CH-1870 MONTHEY
TEL. (025) 73 21 11
FAX. (025) 71 69 52

No. de dessin-Dwg. No.
164A3526-3 f

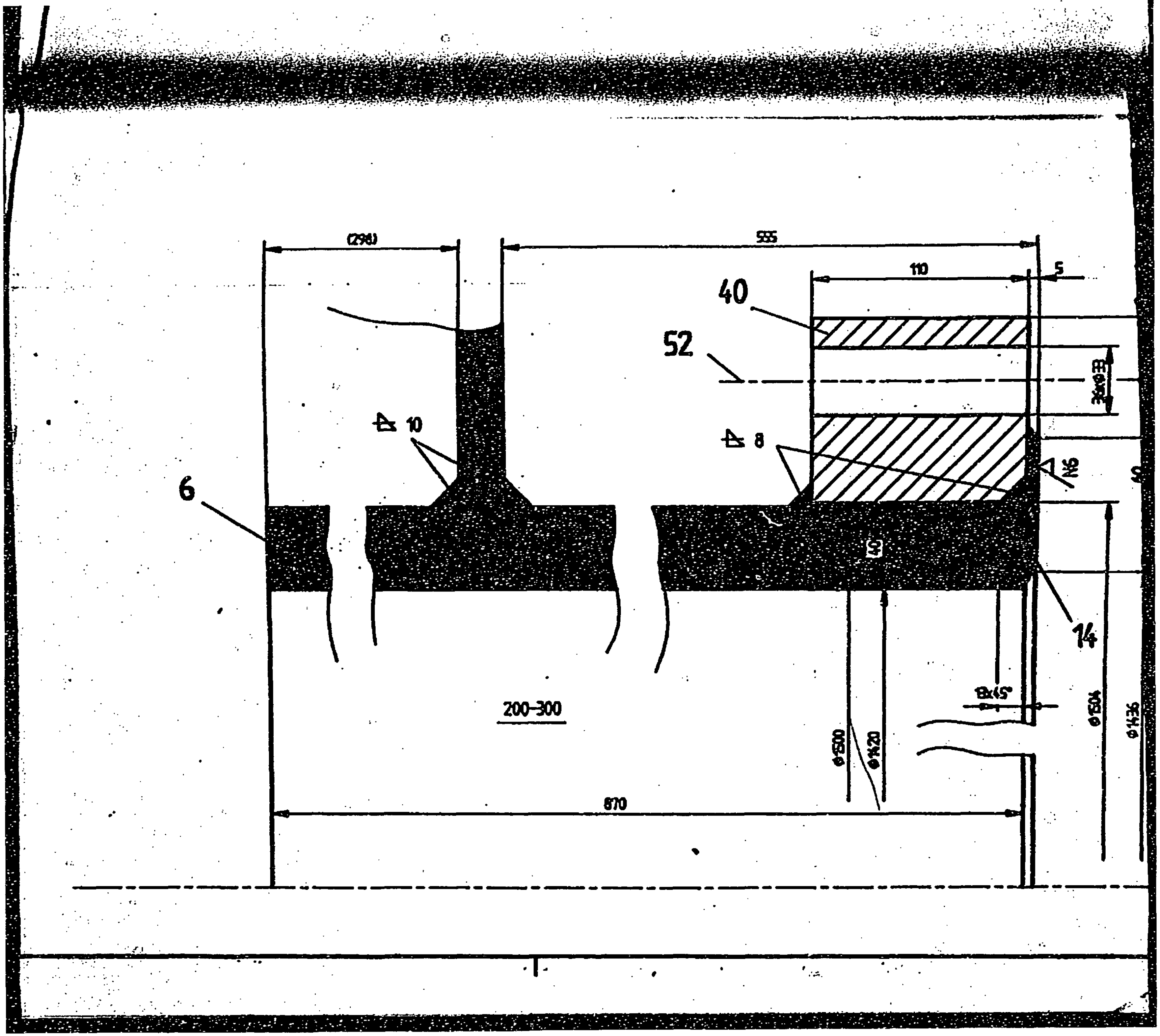


800-801-820
X (1:1)
Z (1:1)
Ø114
60°
20
27
21
65
Ø168,3x4,5
52
366
470
300
55
368
423
Ø112x16
370
19


WET-WELL 1
V=117 M3
WET-WELL 2
V=117 M3
5
L2
C3
3
L3
C4
1
41
15
L1-L3
220
236
261
250
200
300
600
601
480
235
234
262
231
230
0.0
281
5°
25°
15°
30°
0°
20°
233
260
320
336
361
350
335
334
331
330
362
25°
30°
0°
20°



270°
262
252
251
200
210
600-601-620
300
310
352
351
362
30°
30°
239
232
15
15
332
339
230-231
180°
330-331
180°
29
11°
11°
615
70
5
(190)
50
10
8
N6
7
13
210-310
820



(298)
555
110
5
40
52
10
8
6
14
N6
200-300
870
13x45°

Poinçonnage complet / Komplette Stempelung | Seulement marquage de la qualité / Nur Materialqualität markiert

~3500kg

Nb. Posa.	Designation Designation	Pos. Item	Profil Size	Long. Lenght	Matière Material	Certif. Certif.	Observation Remarks	Kg
3	Bride - Flansch	22	C100x114,3		1.4571	3.1B	DIN 2633	14
3	Tube - Rohr	21	Φ88,9x3,05	428	1.4571	3.1B		5
3	" - "	20	Φ88,9x3,05	1040	" - "	" - "		20
5	Bride - Flansch	17	C80x88,9		1.4571	3.1B	DIN2633	18
8	" - "	16	C40x48,3		" - "	" - "	DIN2633	7
1	" - "	15	C150x168,3		" - "	" - "	DIN2633	31
4	Tube - Rohr	13	Φ48,3x3,2	326	" - "	" - "		5
4	" - "	12	Φ32x8	325	" - "	" - "		6
1	" - "	11	Φ114,3x4,5	360	" - "	" - "		4
1	" - "	10	" - "	254	" - "	" - "		3
1	" - "	9	Φ168,3x11	360	" - "	" - "		15
3	Coude - Bogen	8	Φ88,9x2,6	3d-90°	" - "	" - "	à ajuster	3
		7						
3	Tube - Rohr	6	Φ88,9x8	130	" - "	" - "		6
1	" - "	5	Φ88,9x8	360	" - "	" - "		2
1	Virole - Zarge	4	3000x9,5	6253d.	" - "	" - "		1425
1	Virole - Zarge	3	1983x10	6252d.	" - "	" - "		992
1	Fond - Korbbogenboden	2	Φ2000	10,5	" - "	" - "	Ep.min. = 9,2	410
1	Fond - Korbbogenboden	1	Φ2000	10,5	" - "	" - "	Ep.min. = 9,2	410

Modifications / Revisions

A	modif. DN brides 07.08.92 Ben	D	
B	modif. pos. 12 14.8.92 Ben. H.	E	
C	modif. 610-623 24.8.92 Ben. H.	F	

Echelle-Scale: 1:25 1:5 1:2

Dessiné-Drawn: 18.08.92 Ben

Contrôlé-Checked: Benedetti

Liste de pièces sep.,p. / Sep. Material List,p.

No d'affaire: 47135

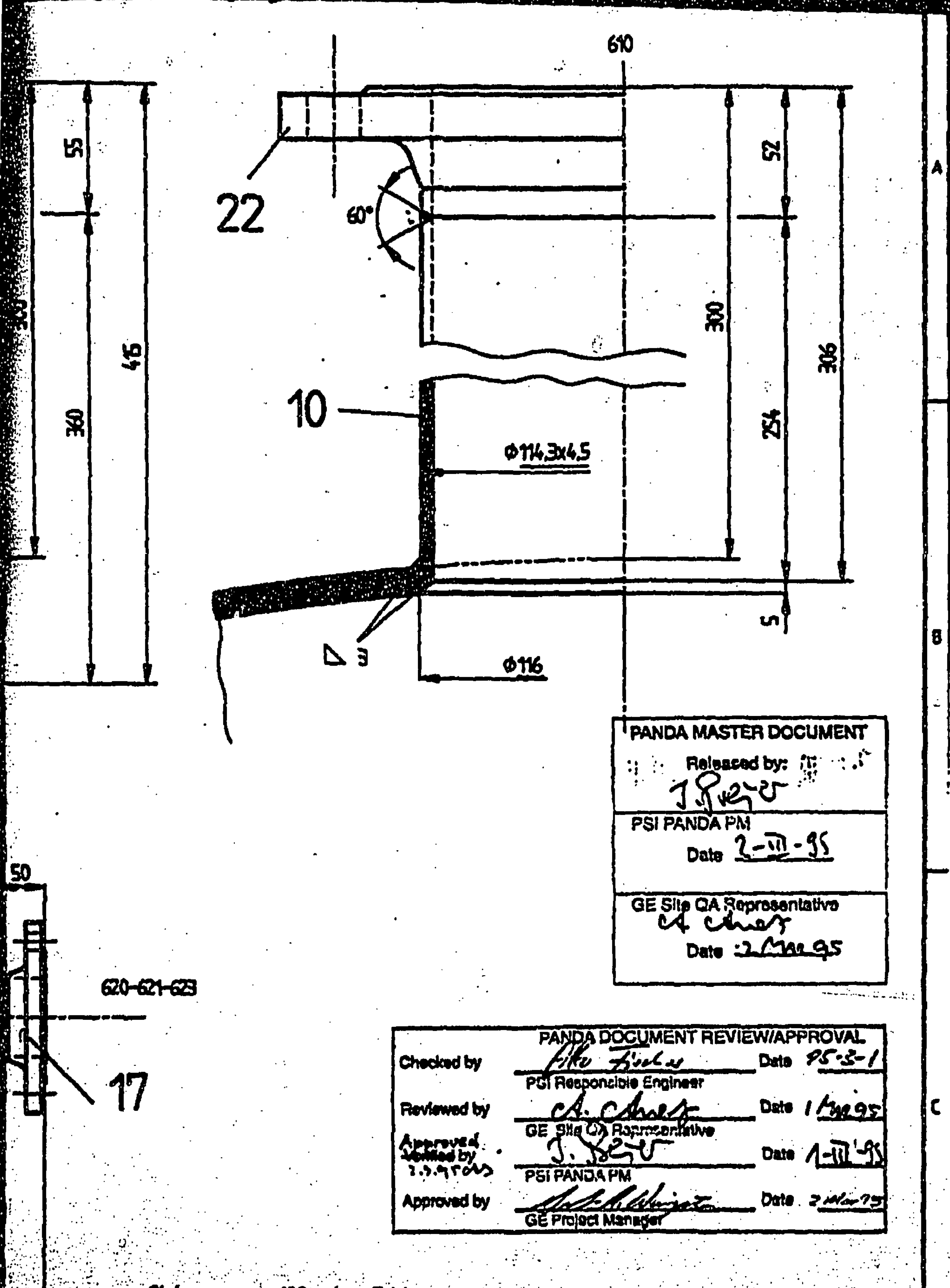
Anlage : PANDA
Baugruppe : Grossbehälter

GDCS Behälter

1-290114

No. de dessin-Dwg. No.: 164A3526-4c

GIOVANOLA
CASE POSTALE 271
CH-1870 MONTHEY
TEL. (025) 73 21 11
FAX. (025) 71 89 52



PANDA MASTER DOCUMENT

Released by:

PSI PANDA PM

Date 2-III-95

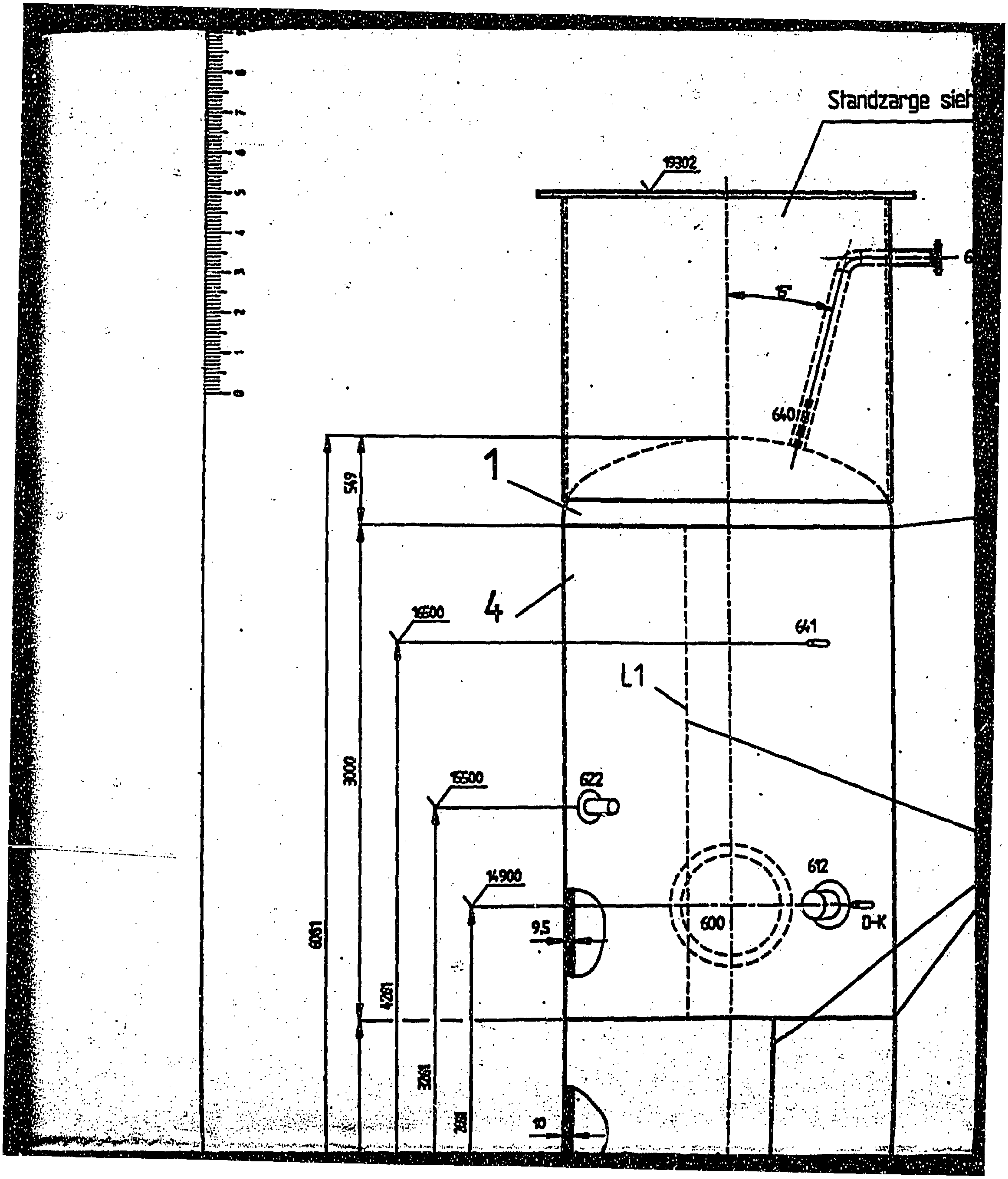
GE Site QA Representative

Date 2 Mar 95

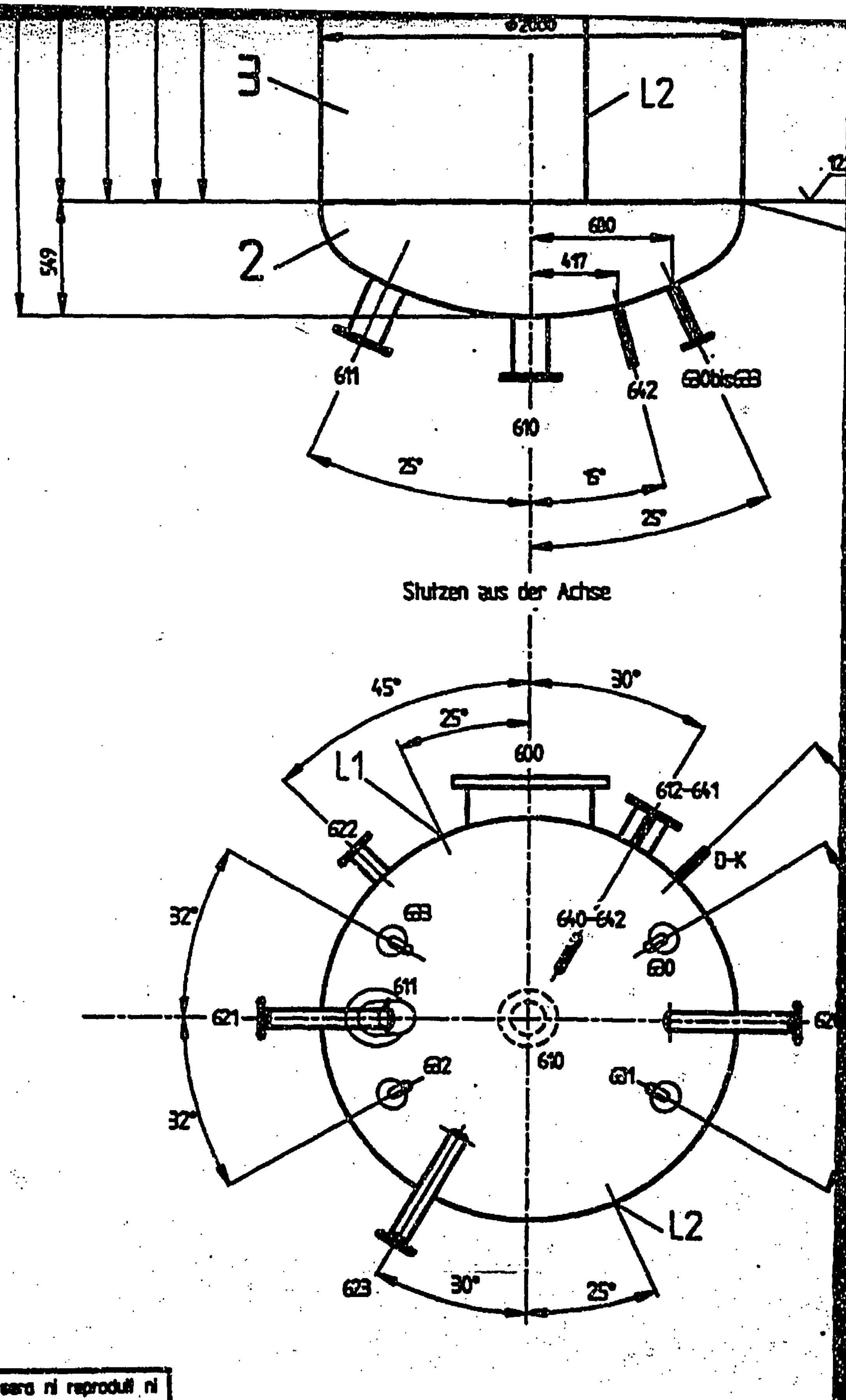
PANDA DOCUMENT REVIEW/APPROVAL

Checked by	PSI Responsible Engineer	Date	95-3-1
Reviewed by	GE Site QA Representative	Date	1 Mar 95
Approved ~~Verified~~ by	PSI PANDA PM	Date	1-III-95
Approved by	GE Project Manager	Date	2 Mar 95

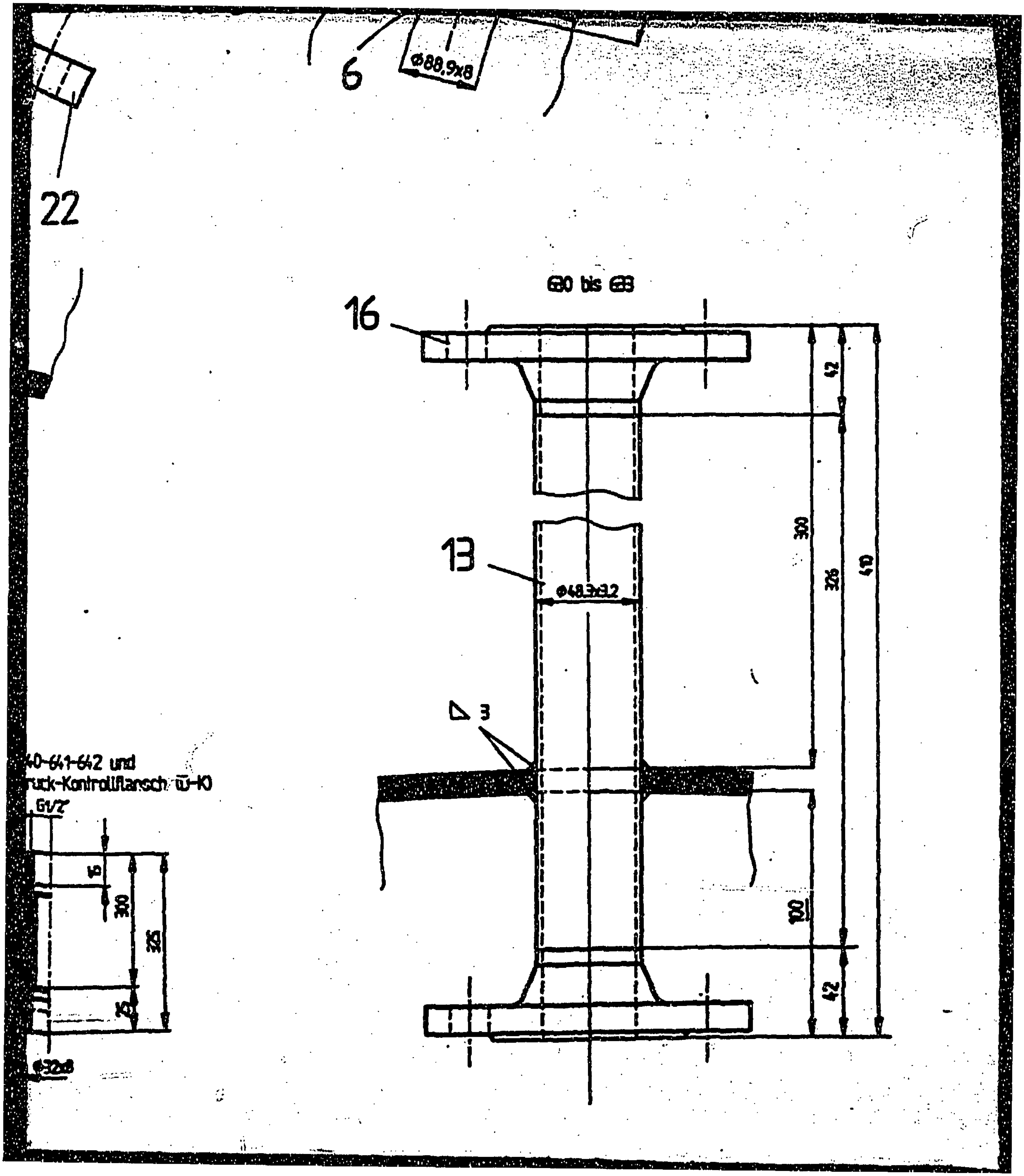
Stufzennummer 600 sehen Zeichnung



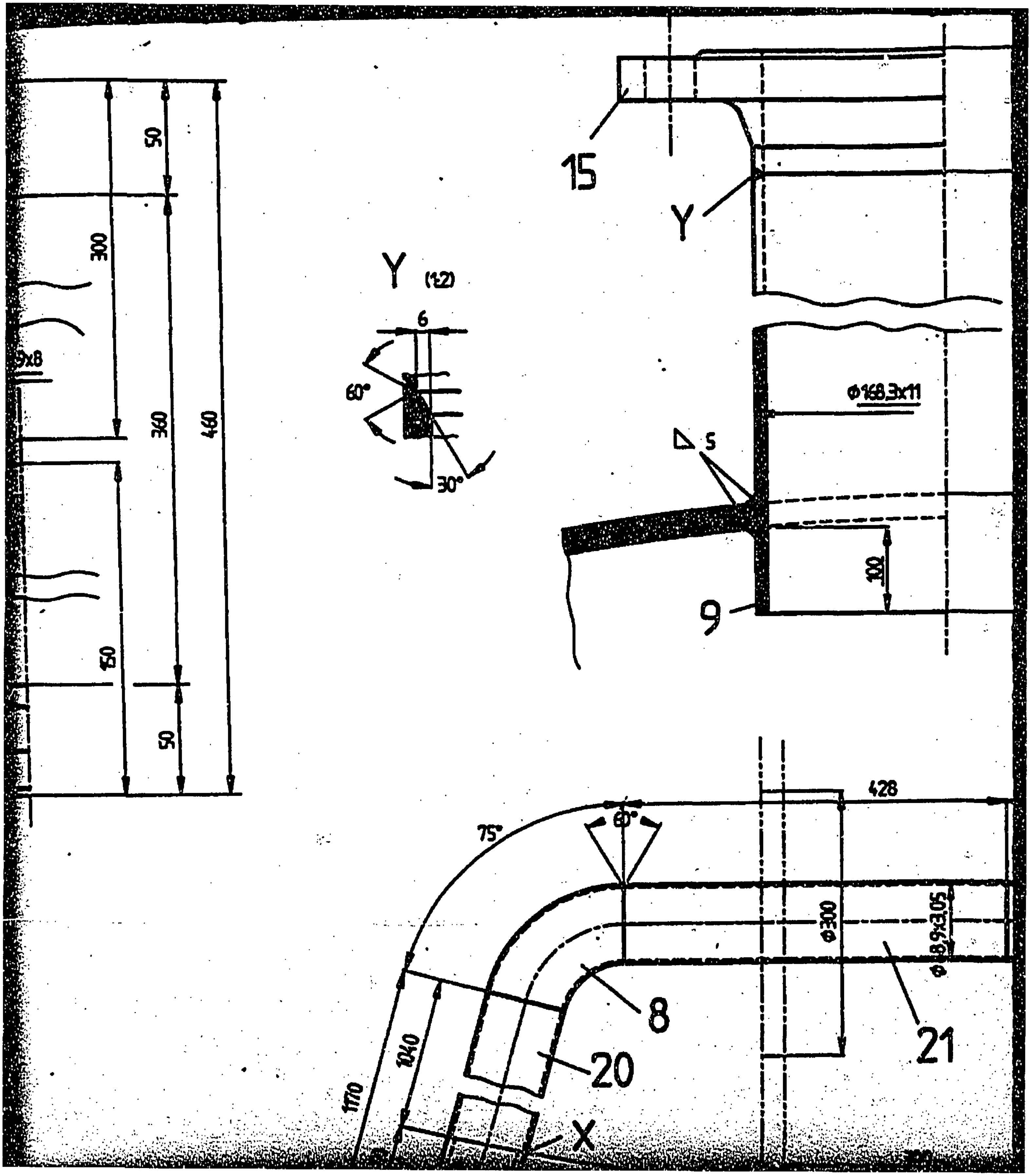
Standzarge sieh
19302
15°
640
1
4
549
16500
641
L1
3000
15500
622
14900
612
9,5
600
D-K
6081
4281
3281
2881
10



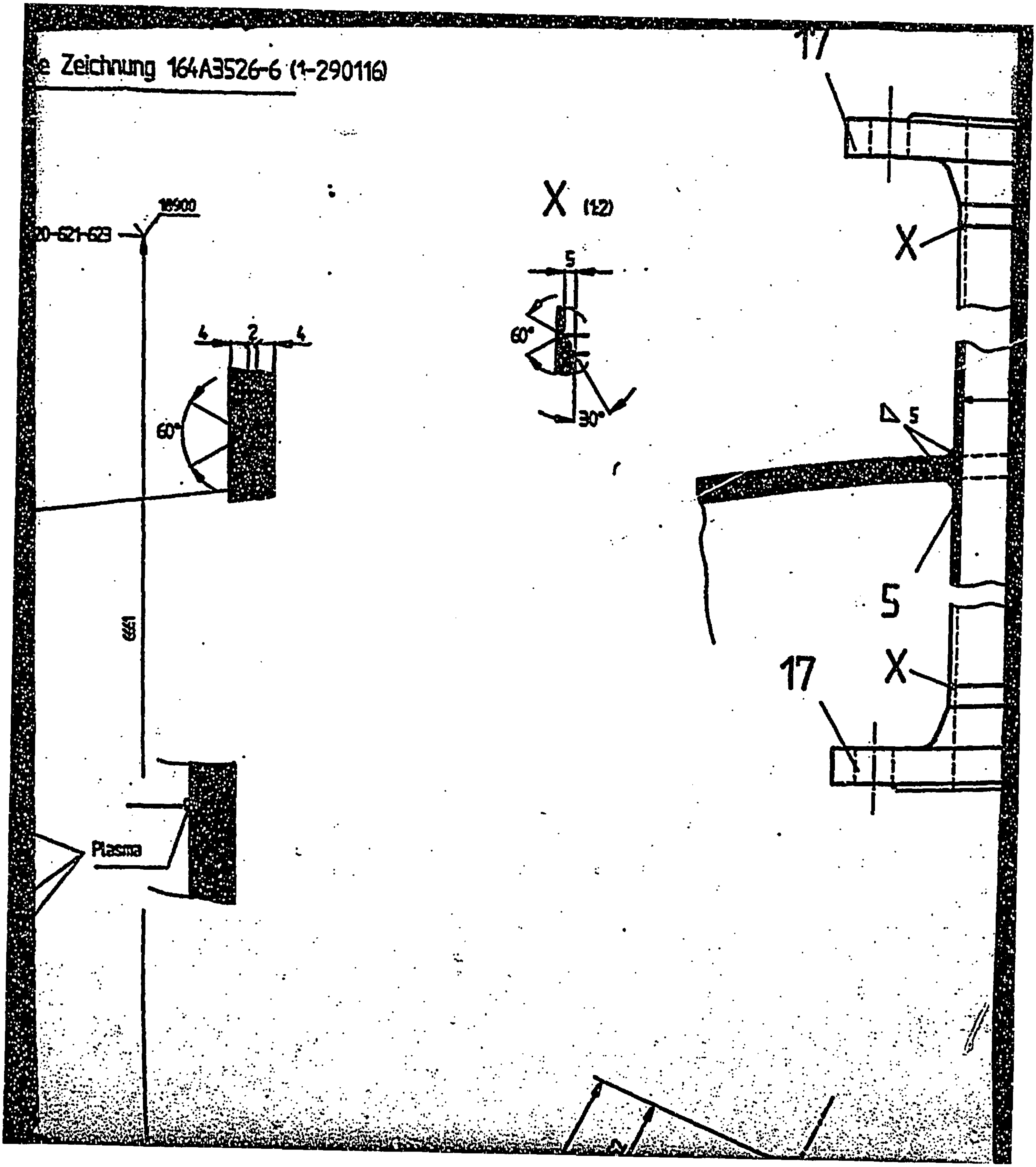
Ø2000
3
L2
2
549
695
600
417
611
610
642
630bis633
25°
15°
25°
Stutzen aus der Achse
45°
30°
25°
600
L1
612-641
622
D-K
633
640-642
630
32°
621
611
610
632
631
623
30°
25°
L2



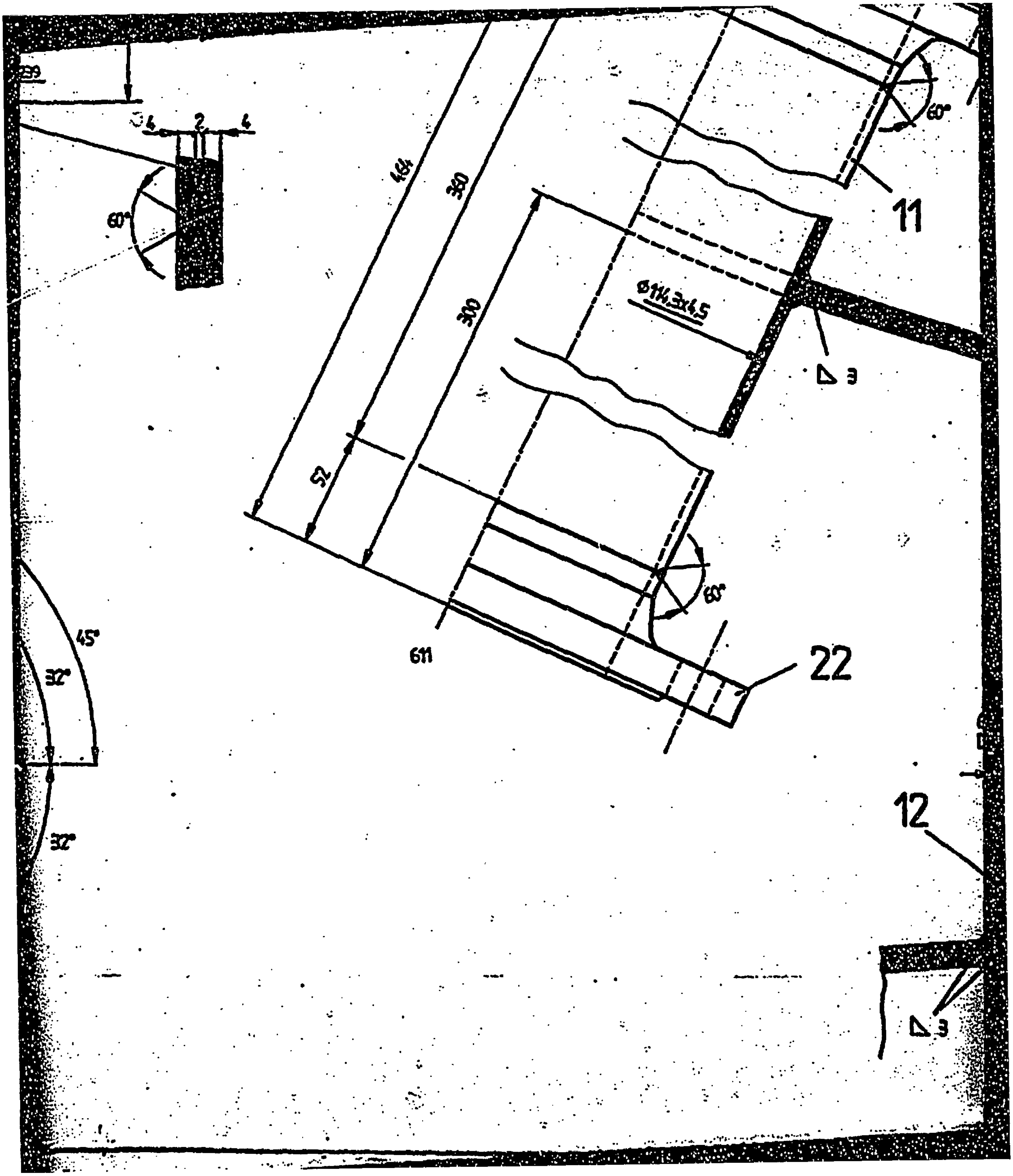
6
Φ88,9x8
22
630 bis 638
16
42
300
326
410
13
Φ48,3x3,2
3
100
42
40-641-642 und
ruck-Kontrollflansch (Ü-K)
G1/2"
15
300
325
25
Φ32x8



50
300
360
460
150
50
9x8
Y (1:2)
6
60°
30°
15
Y
Φ168,3x11
5
100
9
428
75°
60°
Φ300
Φ 88,9x3,05
8
21
20
1040
1170
X



e Zeichnung 164A3526-6 (1-290116)
18900
20-621-623
4
2
4
60°
X (1:2)
5
60°
30°
17
X
5
5
17
X
Plasma



239
4
2
4
60°
464
360
300
52
Ø114,3x4,5
60°
11
3
60°
611
22
45°
32°
32°
12
3

Nb. Poss.	Designation Designation	Pos. Item	Profil Size	Long. Lenght	Matiere Material	Certif. Certif.	Observation Remarks	Kg
4	Pied - Fuss	27	HEB 260	2900	US137-1			1080
12	Tube - Rohr	26	Φ219,1x12,7	100	1.4571	3.1B		75
2	Oreille - Ohr	25	180x15	210	" - "			9
2	Disque - Scheibe	24	Φ240	20	" - "			14
2	Bride - Flansch	23	C100x114,3		" - "	3.1B	DIN2633	9
4	" - "	22	C150x168,3		" - "	3.1B	DIN2633	31
5	" - "	21	C80x88,9		" - "	3.1B	DIN2633	18
3	" - "	20	C40x48,3		" - "	3.1B	DIN2633	5
3	Tube - Rohr	19	Φ32x8	425	" - "	3.1B		3
1	" - "	18	Φ114,3x6,3	370	" - "	3.1B		4
1	" - "	17	Φ114,3x4,5	424	" - "	3.1B		4
2	" - "	16	Φ168,3x4,5	94	" - "			3
4	" - "	15	Φ168,3x11	345	" - "	3.1B		60
5	" - "	14	Φ88,9x5,6	370	" - "	3.1B		21
3	" - "	13	Φ48,3x3,2	378	" - "	3.1B		4
2	Fourrure - Futterblech	12	160x10	315	" - "			8
2	Fourrure - Futterblech	11	340x10	340	" - "			18
3	Renfort - Verstärkung	10	Φ1352/1252	10	" - "			49
1	Fond plat - Boden	9	Φ1230	86L	" - "	3.1B		800
1	Virole - Zarge	8	3000x10	3896d.	" - "	3.1B		935
1	" - "	7	3000x10	" - "	" - "	3.1B		935
1	" - "	6	" - "	" - "	" - "	3.1B		935
1	" - "	5	2500x8	3902d.	" - "	3.1B		624
1	" - "	4	" - "	" - "	" - "	3.1B		624
1	" - "	3	" - "	" - "	" - "	3.1B		624
1	" - "	2	2460x8	" - "	" - "	3.1B	à ajuster	614
1	Fond - Korbbogenboden	1	Φ1250	min5,5	" - "	3.1B		100

Modifications Revisions

A	ajouté pos.31 Ben 30.6.92	D	supp. pos. 34 22.9.92 Ben
B	modif.ON brides 11.08.92 Ben	E	
C	mis à jour 15.09.92 Ben	F	

Echelle - Scale 1:50 1:10 1:5 1:2 1:1

Dessine - Drawn 24.06.92 Ben

Controle - Checked [signature]

Liste de pieces sep.,p. Sep. Material List,p.

No d'affaire 47185

Anlage : PANDA
Baugruppe : Grossbehälter

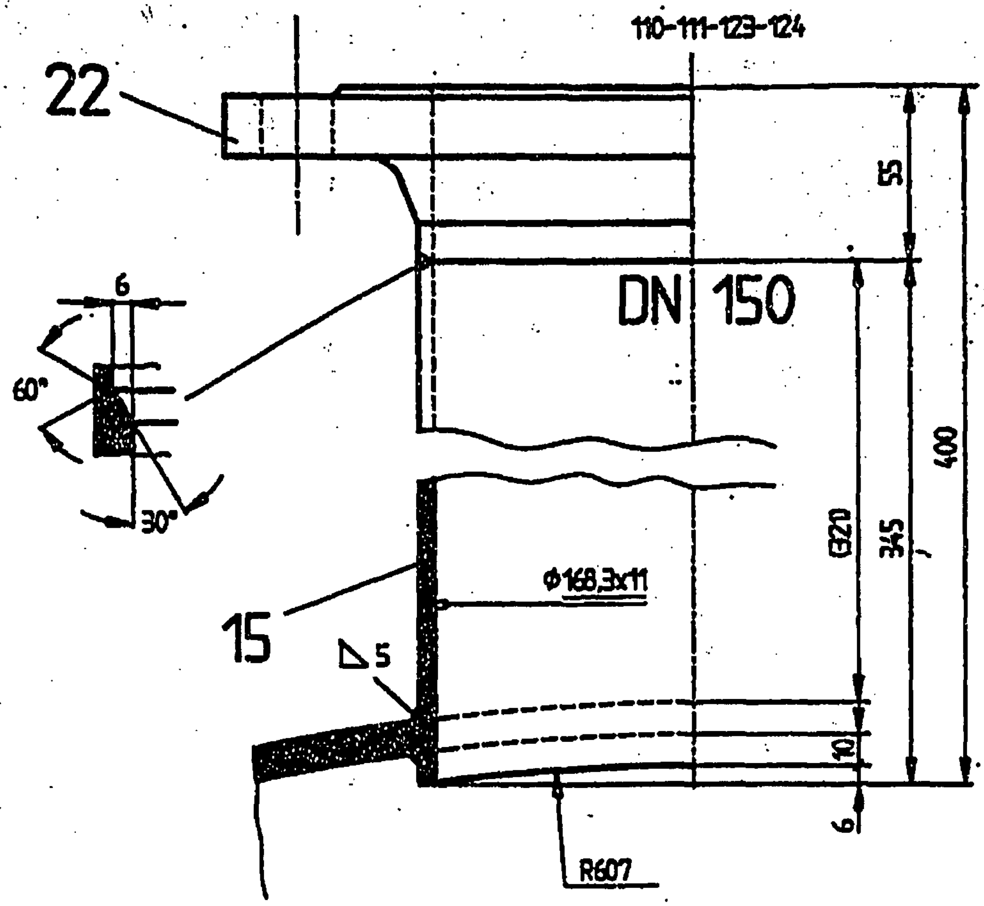
RPV Behälter

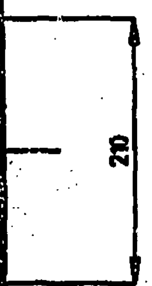
1-290115

GIOVANOLA

CASE POSTALE 271
CH-1870 MONTHEY
TEL. (025) 73 21 11
FAX. (025) 71 89 52

No. de dessin - Dwg. No. 164A3526-5d





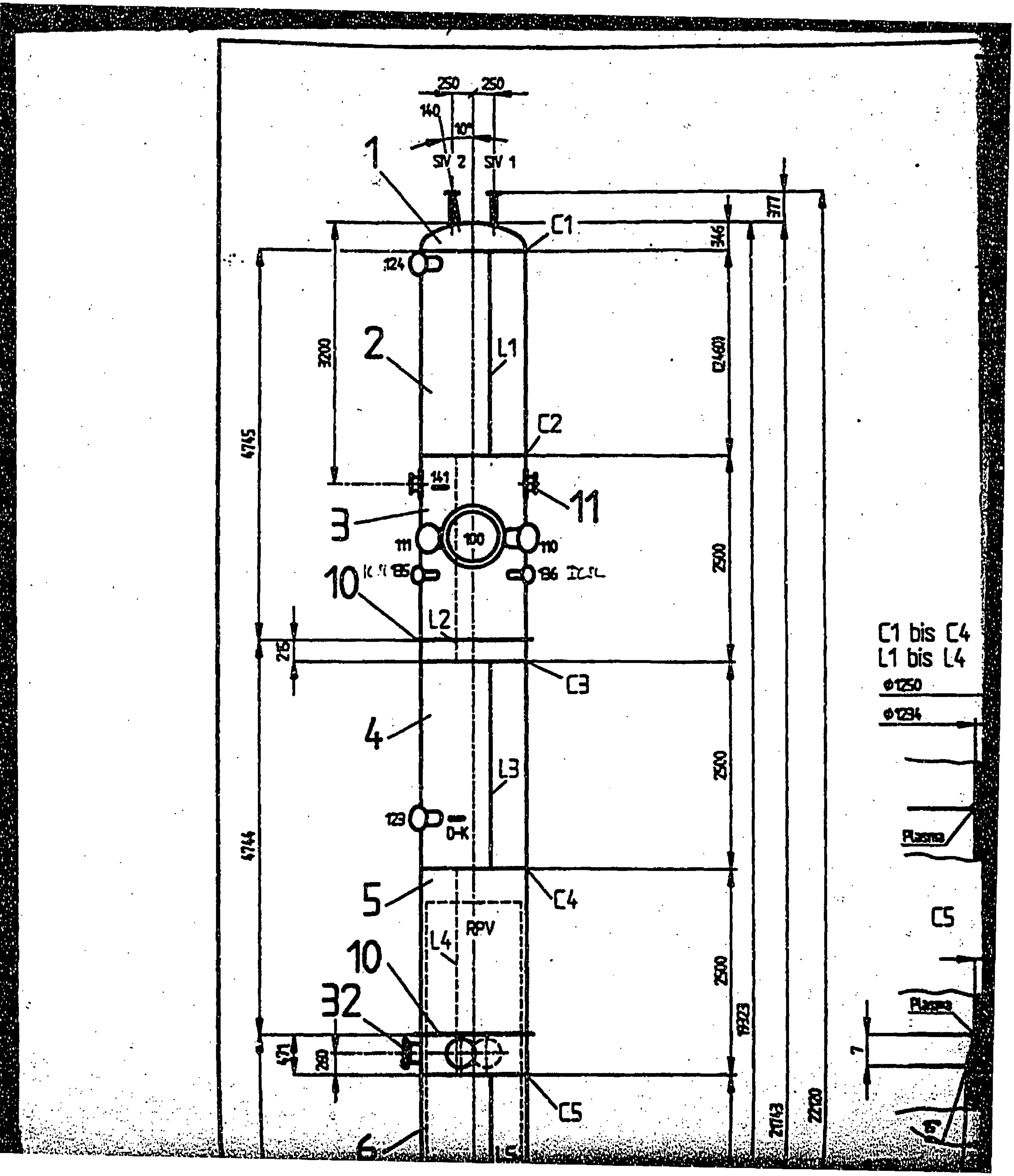
Schweissnahtvorbereitung und Zusatzwerkstoff siehe
Zeichnung 1-290111 (Zusammenstellung)

Poinçonnage complet Komplette Stempelung	Seulement marquage de la qualité Nur Materialqualität markiert

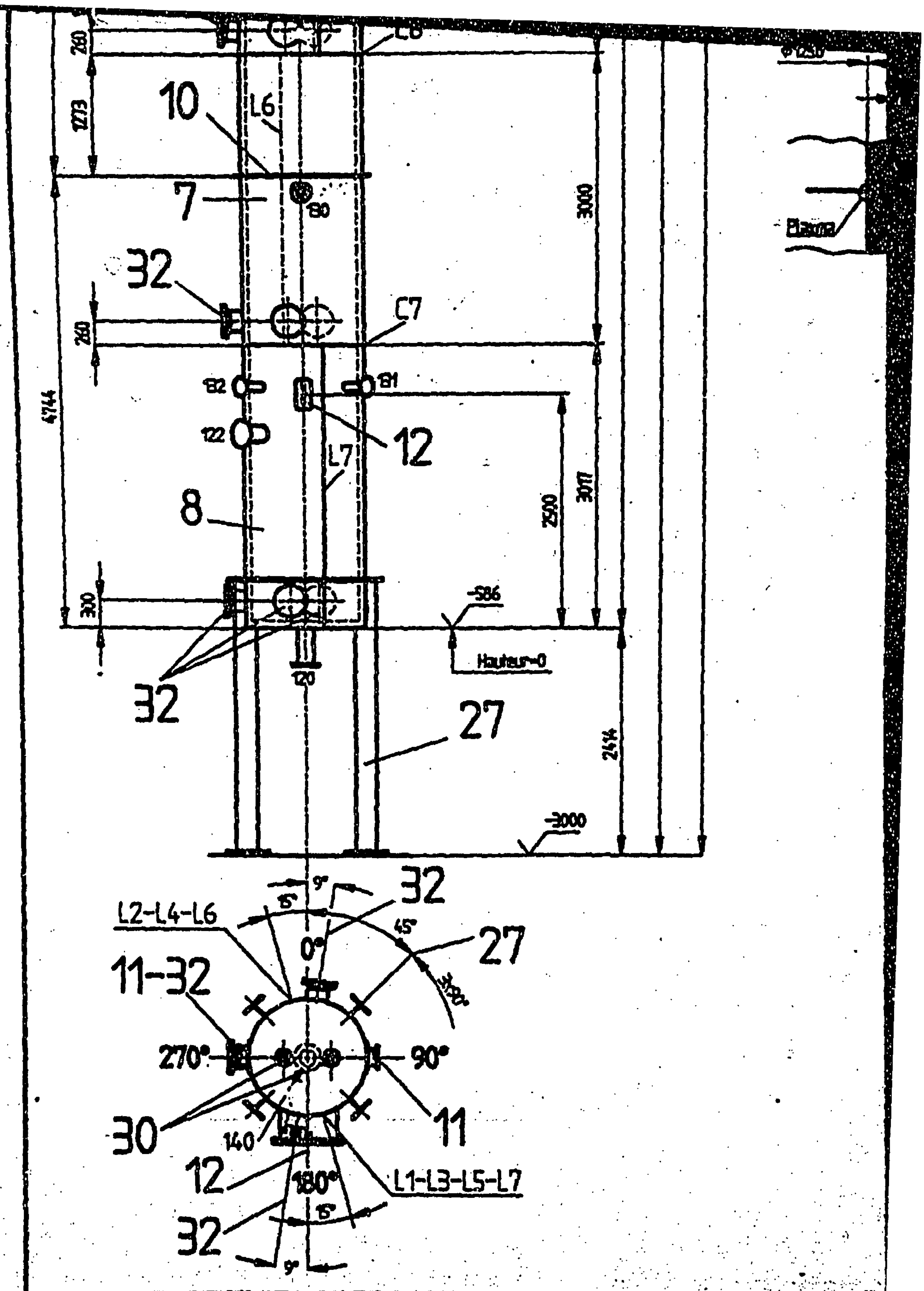
Stutzennummer 100 sehen 164A3526-9
Piquage n° 100 voir (2-290119)

~8000kg

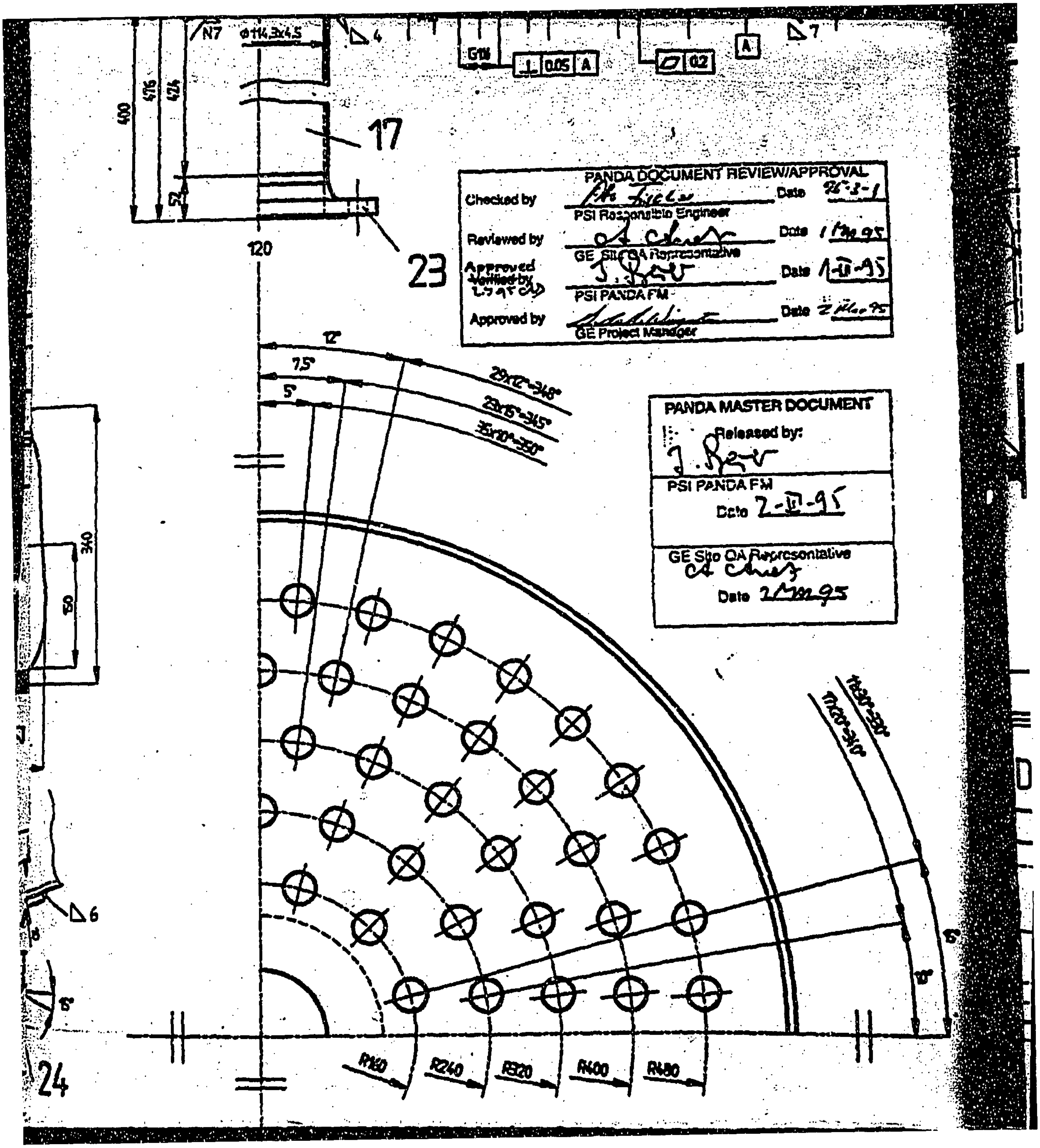
144	Ecrou - Mutter	37	M20	0,8d	5-2	Stp	DIN934	9
144	Vis 1.6 p. - 6Kt. Schrauben	36	M20	80	5.6	Stp	DIN931	34
12	Joint - Dichtung	35	Φ265/210	3	viton			
		34						
12	Couvercle - Deckel	33	B200 ND16		1.4571	3.1B	DIN2527	193
12	Bride - Flansch	32	C200x219,1		" - "	3.1B	DIN2633	182
1	Anneau - Ring	31	Φ1614/1254	20	" - "			



250
250
140
10°
SIV 2
SIV 1
1
C1
3111
346
124
2
L1
3200
12460
4745
C2
141
3
11
111
100
110
10
185
196
L2
2500
215
C3
4
L3
2500
123
4744
5
C4
RPV
L4
10
32
2500
19223
121
280
C5
6
21143
22100
C1 bis C4
L1 bis L4
Φ1250
Φ1234
Plasma
C5
Plasma



260
1273
10
L6
7
180
32
C7
260
182
181
122
12
L7
4744
8
3000
3017
2500
300
-586
Hauteur=0
120
32
27
2414
-3000
Plasma
9°
15°
L2-L4-L6
32
0°
45°
27
11-32
270°
90°
30
140
11
12
180°
L1-L3-L5-L7
32
15°
9°



PANDA DOCUMENT REVIEW/APPROVAL

Checked by	PSI Responsible Engineer	Date	95-3-1
Reviewed by	GE Site QA Representative	Date	1 Mar 95
Approved ~~Verified by~~ 2.3.95 CAD	PSI PANDA FM	Date	1-III-95
Approved by	GE Project Manager	Date	2 Mar 95

PANDA MASTER DOCUMENT

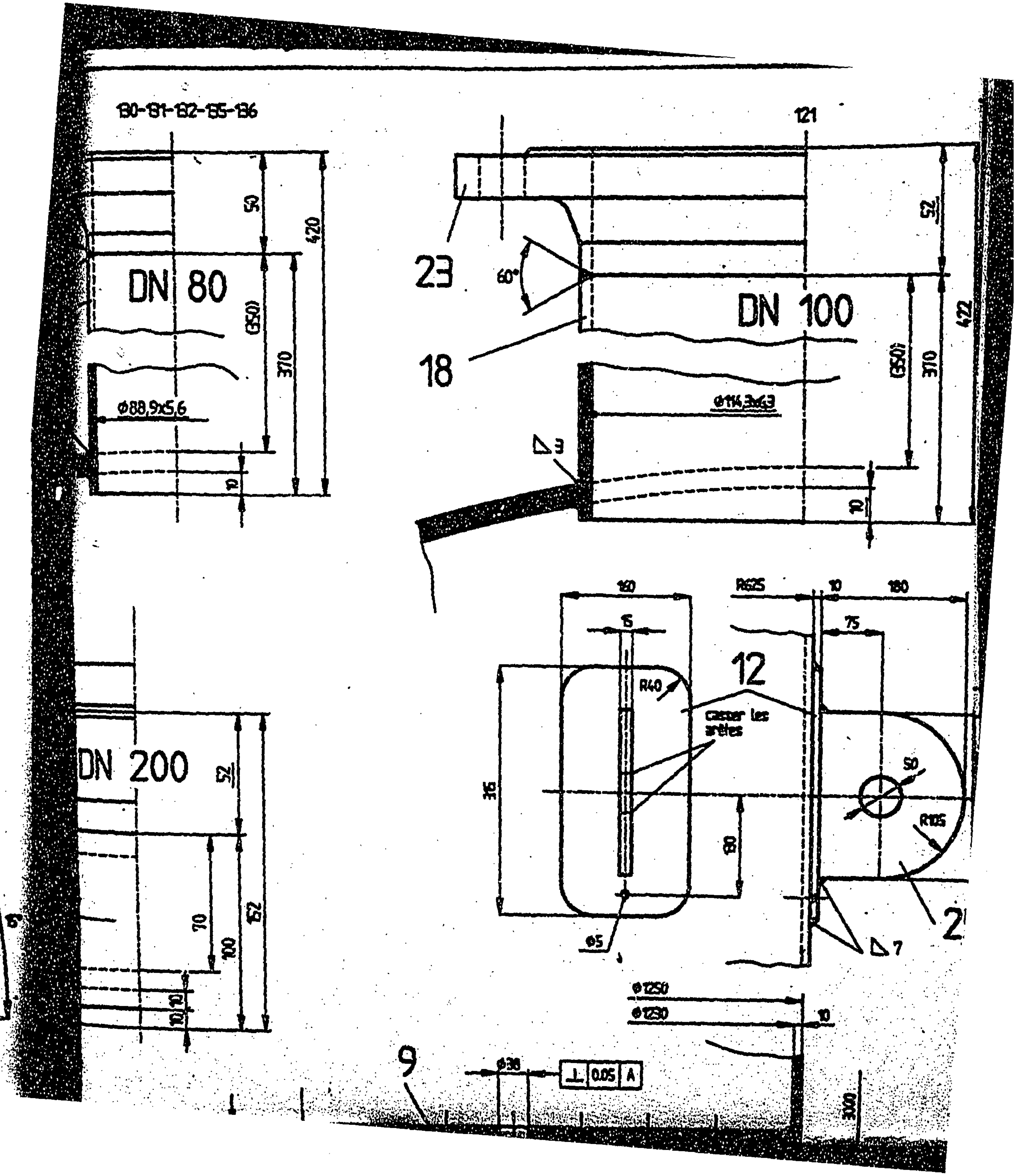
Released by:

PSI PANDA FM

Date 2-III-95

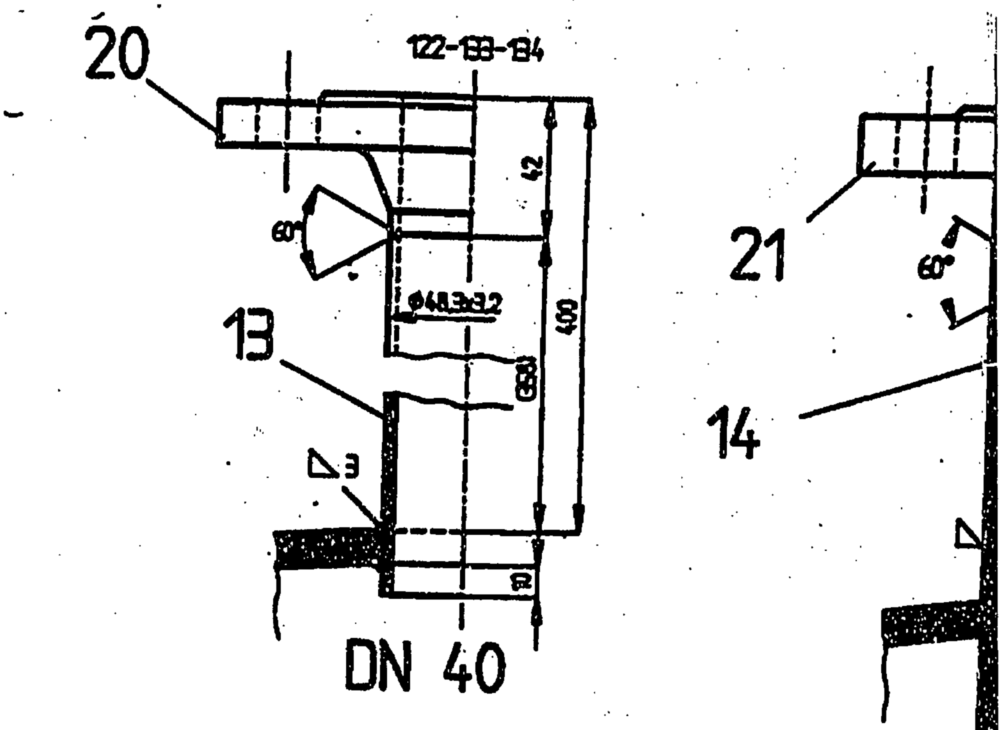
GE Site QA Representative

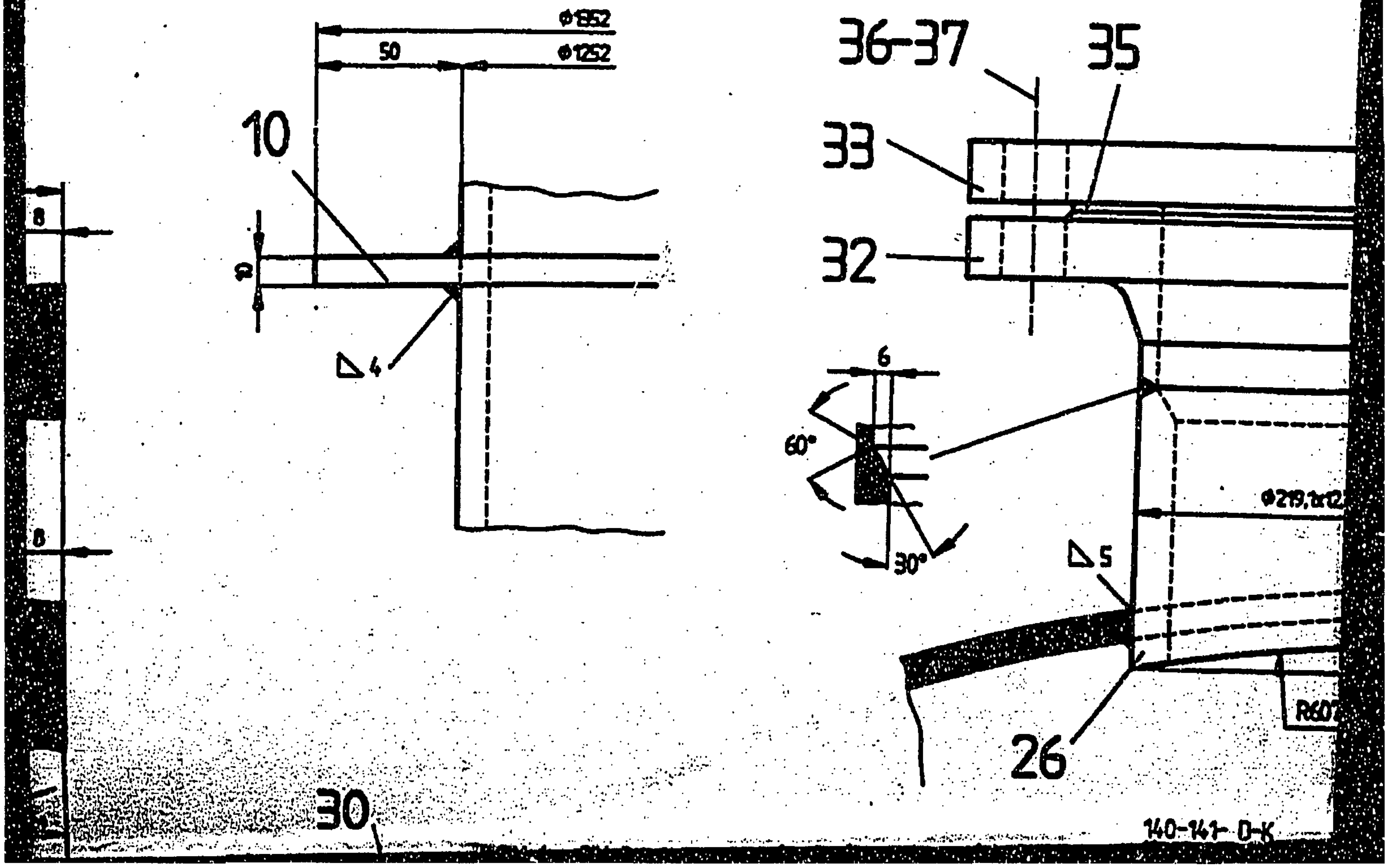
Date 2 Mar 95

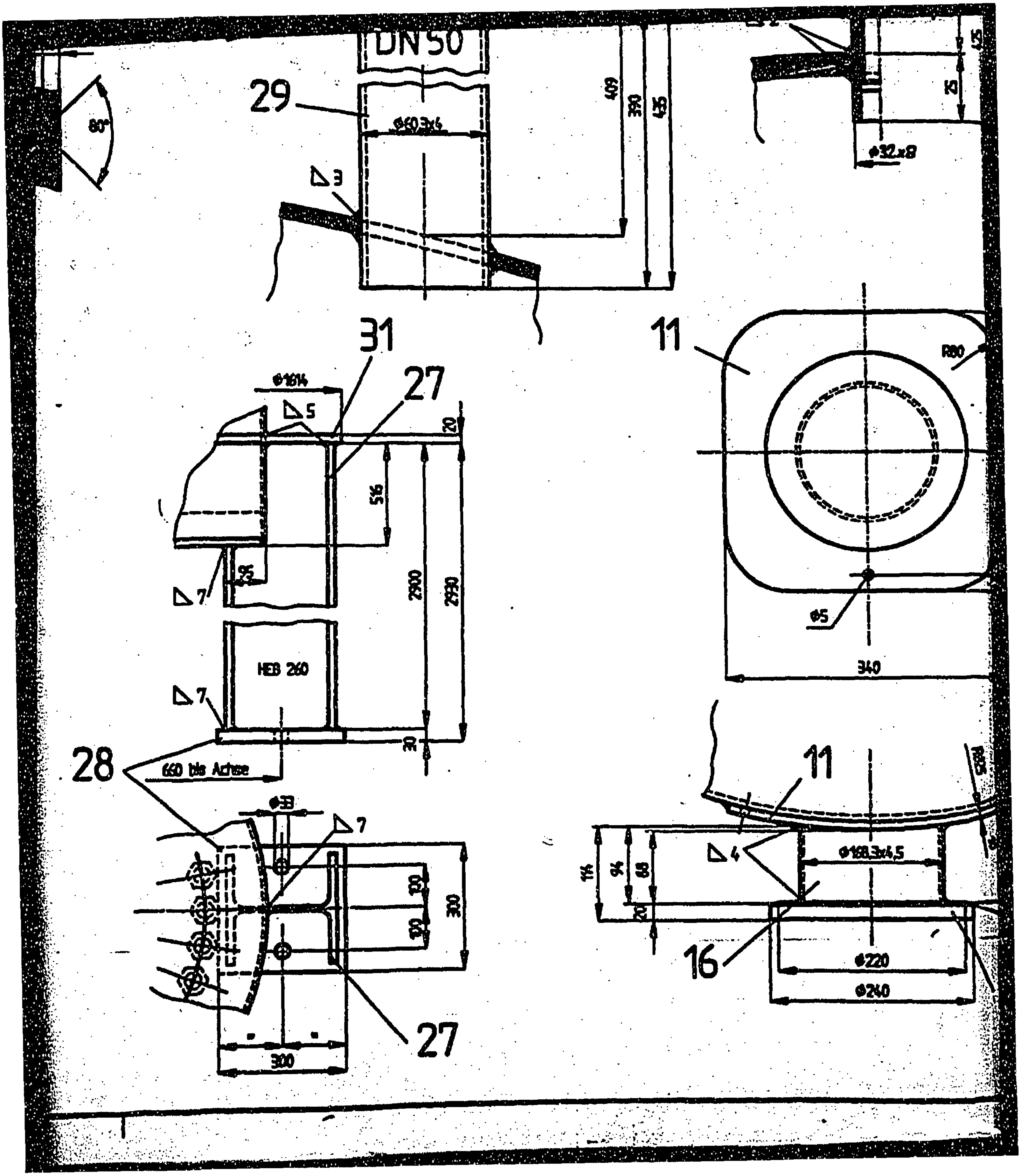


130-131-132-135-136
DN 80
50
420
(350)
370
Ø88,9x5,6
10
121
23
60°
18
DN 100
52
422
(350)
370
Ø114,3x6,3
3
10
DN 200
52
152
70
100
10
10
160
15
R625
10
180
75
12
R40
casser les
arêtes
316
50
180
R105
2
Ø5
7
Ø1250
Ø1230
10
9
Ø38
0,05
A
3000

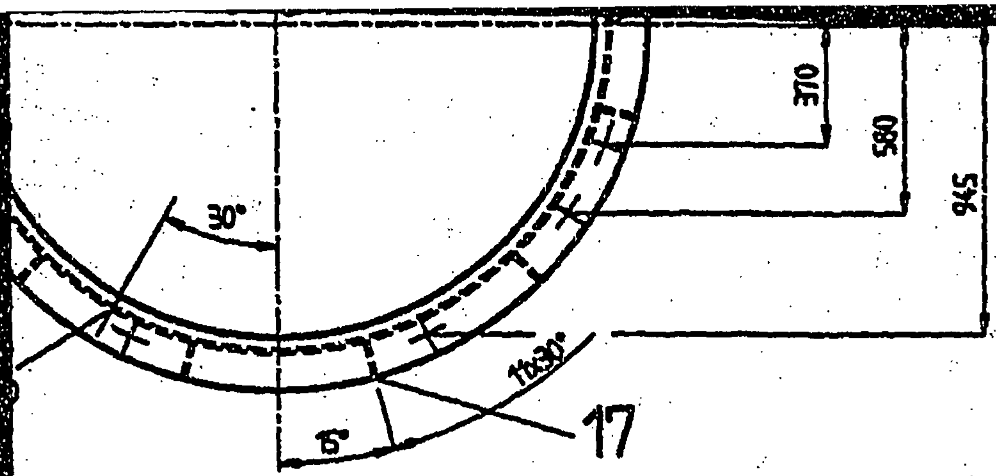
Piquage	Angle	Hauteur	Niveau
D-K	180	12086	11500
131	142	2586	2000
134	120	7151	6565
136	105	15021	14435
110	135	15466	14880
130	180	4586	4000
100	180	15486	14900
140	210	—	—
141	210	16086	15500
122	225	2086	1500
132	218	2586	2000
133	240	7151	6565
123	225	12086	11500
135	255	15021	14435
111	225	15466	14880
124	225	18826	18240
121	315	7586	7000







DN50
29
Φ60,3x4
3
409
390
435
80°
Φ32x8
31
27
Φ1614
5
20
516
95
7
2900
2930
HEB 260
7
30
28
660 bis Achse
Φ33
7
100
100
300
300
27
11
R80
Φ5
340
11
114
94
88
20
4
Φ168,3x4,5
16
Φ220
Φ240



Pos 1 bis 13 - 25 bis 29 siehe Zeichnung
voir dessin 164A3526-13 (2-290162)

~1500kg

Nb. Pces.	Designation Designation	Pos. Item	Profil Size	Long. Lenght	Matiere Material	Certif. Certif.	Observation Remarks	Kg
16	Vis t. cu. - Senkschr.	30	M6	30	8.8		DIN 963A	
28	Rondelle - Scheibe	24	pr.M27		St.		DIN 125 A	
80	Rondelle - Scheibe	23	pr.M12		St.		DIN 125 A	
40	Ecrou - Mutter	22	M27	0,8d	8			7
80	Ecrou - Mutter	21	M12	0,8d	8			
12	Vis t. 6 p. - 6 Kt. Schr.	20	M27	120	8.8		DIN 931	8
16	Vis t. 6 p. - 6 Kt. Schr.	19	M27	100	8.8		DIN 931	10
104	Vis t. 6 p. - 6 Kt. Schr.	18	M12	50	8.8		DIN 933	6
12	Renfort - Verstärkung	17	100x12	300	St.52-3			34
1	Virole - Zarge	16	120x12	1923d	St.52-3			22
1	Bride - Flansch	15	Φ2220/1900	30	St.52-3			244
1	Virole - Zarge	14	1929x12	6245d	St.52-3		à ajuster	1155

Modifications Revisions				
A	mis à jour	25.09.92	Ben	
B	mis à jour	02.10.92	Ben	
C	mis à jour	13.10.92	Ben	
D	mis à jour	18.10.92	Coq.	
E				
F				

Echelle—Scale 1:20 1:10 1:2

Dessine—Drawn 25.09.92 Ben

Controle—Checked

Liste de pieces sep..p. Sep. Material List.p.

No d'affaire 47185

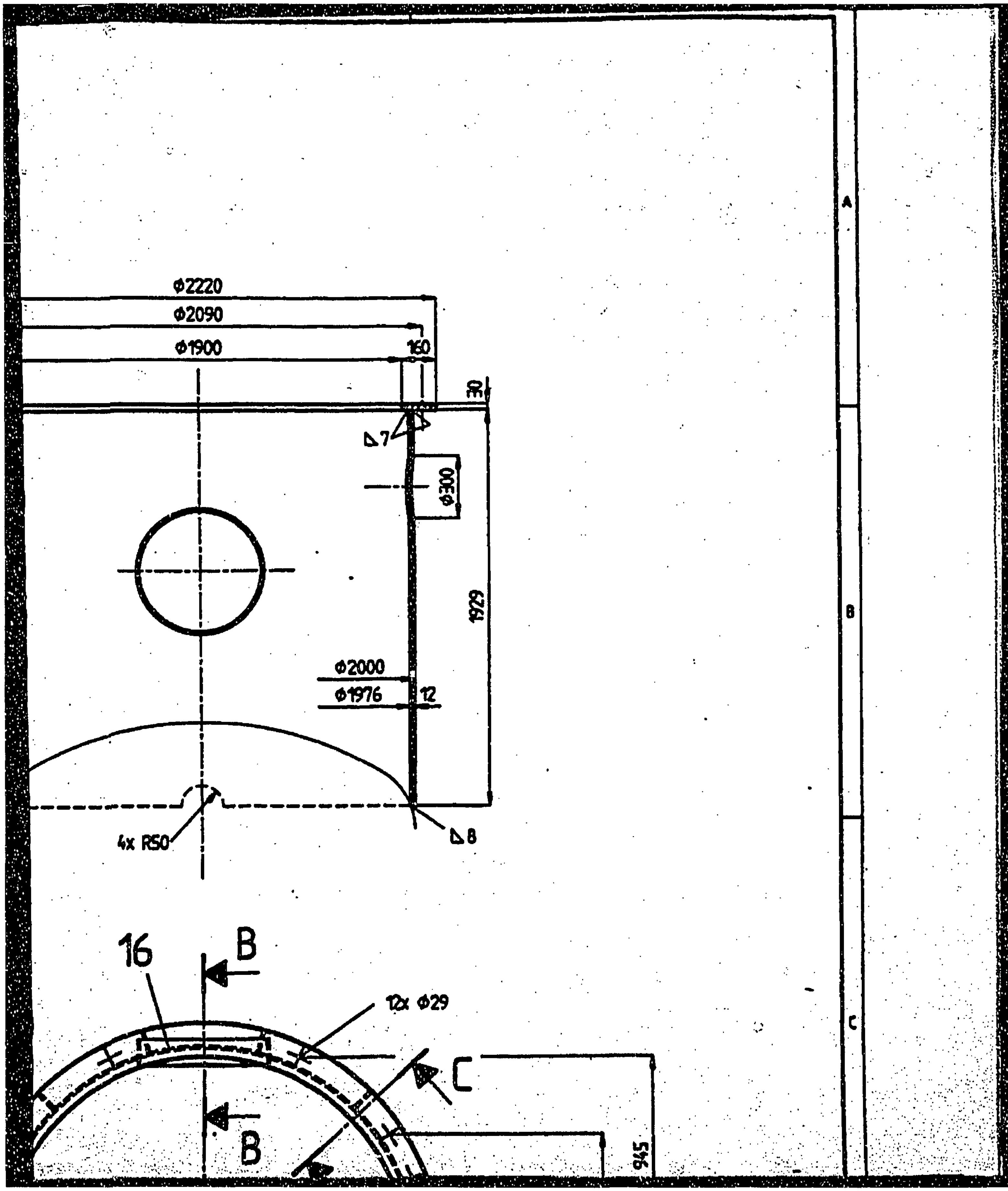
Anlage : PANDA
Baugruppe : Grossbehälter

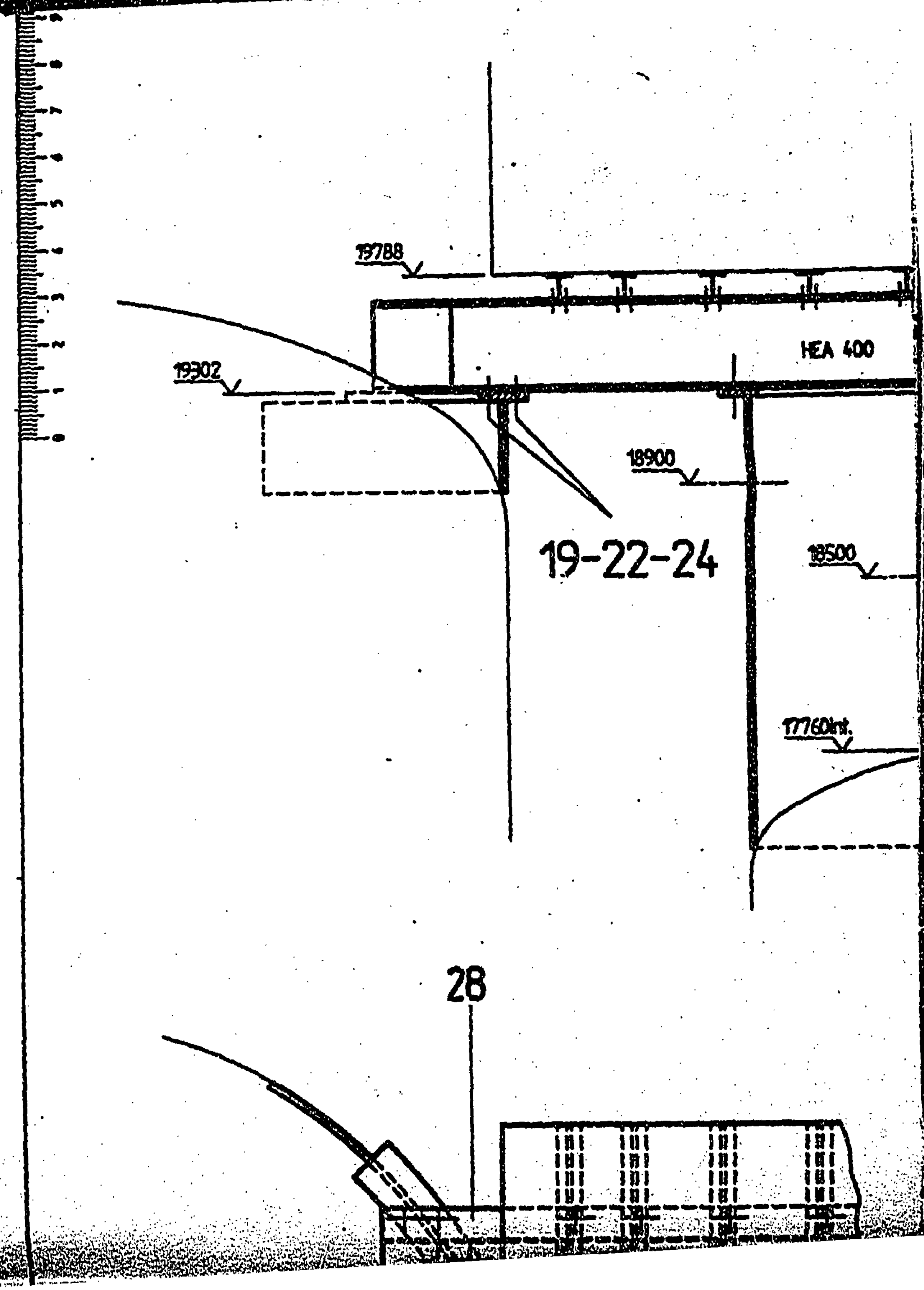
IC POOL : Befestigung - Zusammenstellung
IC POOL : fixation - ensemble

1-290116

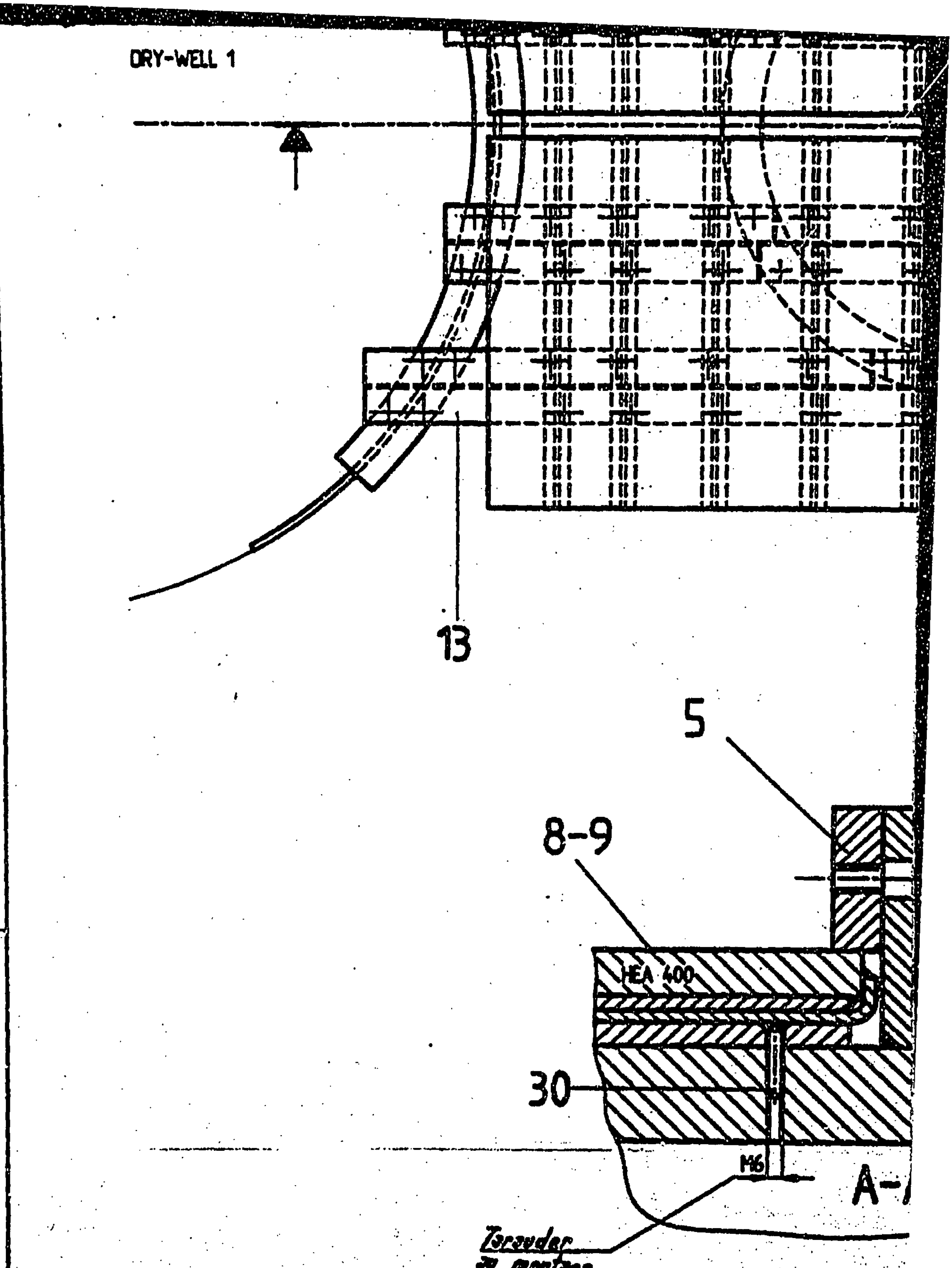
GIOVANOLA
CASE POSTALE 271
CH-1870 MONTHEY
TEL. (025) 73 21 11
FAX. (025) 71 69 52

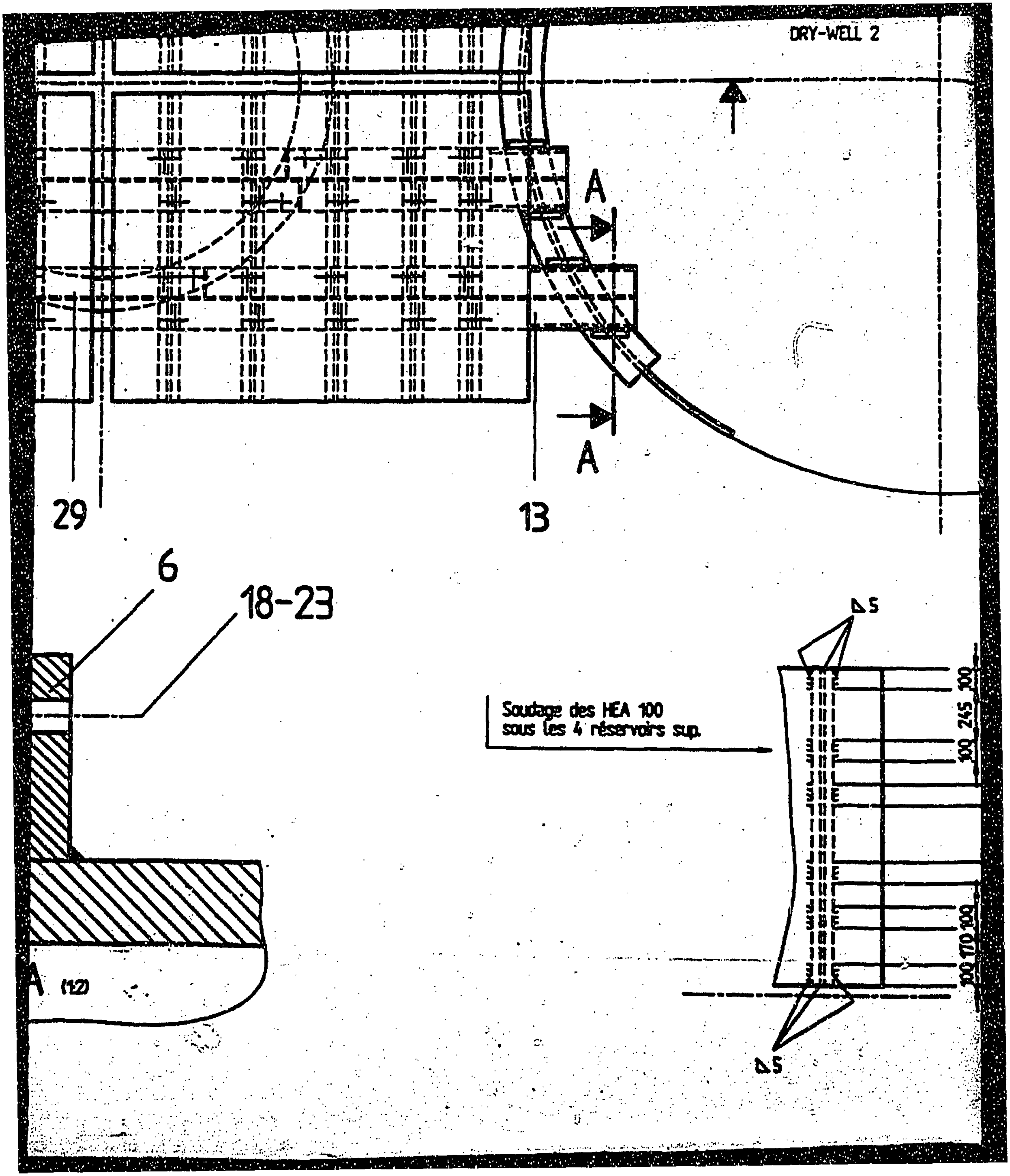
No. de dessin—Dwg. No. 164A3526-6d

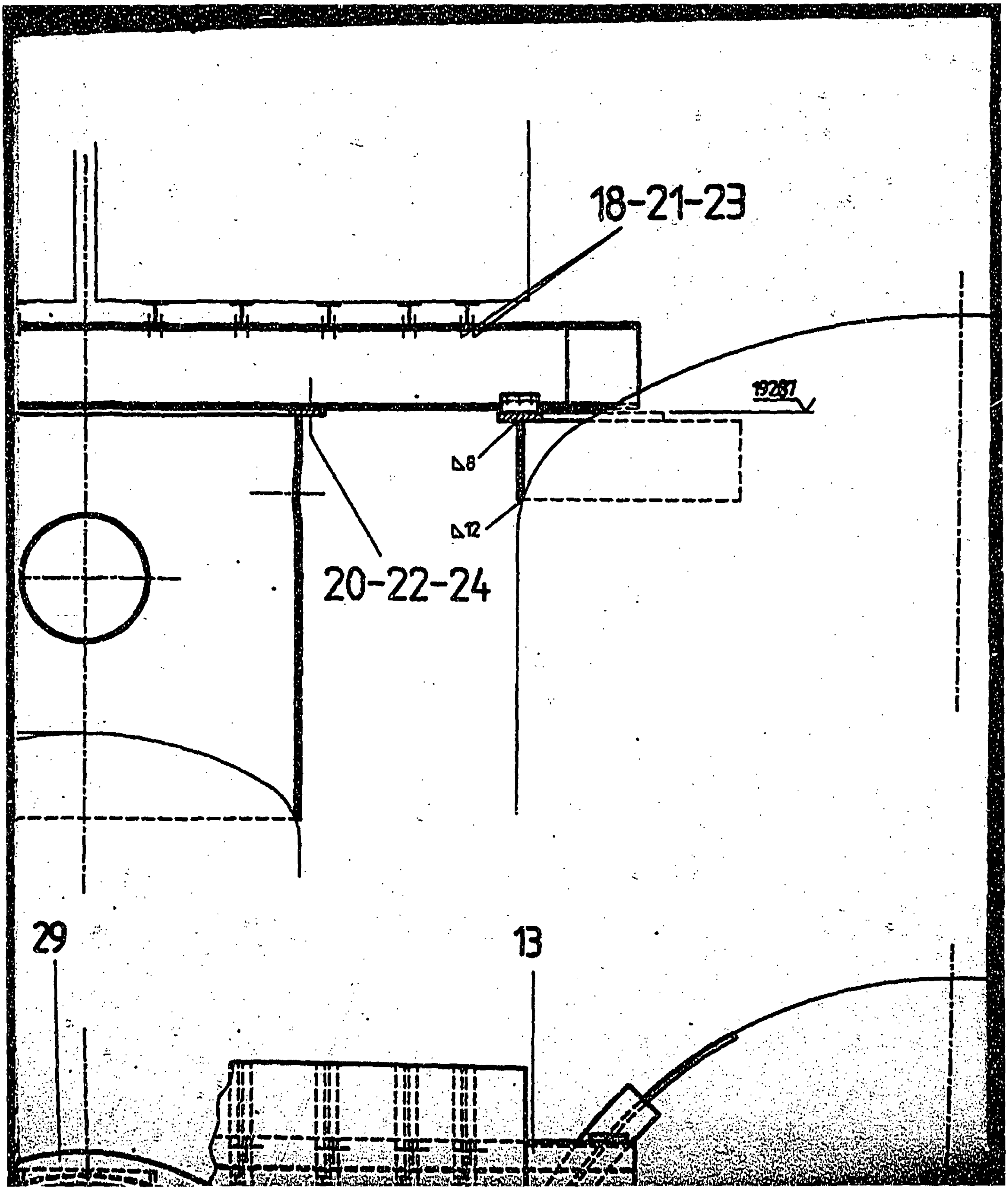

Φ2220
Φ2090
Φ1900
160
30
Δ7
Φ300
1929
Φ2000
Φ1976
12
4x R50
Δ8
16
B
12x Φ29
C
B
945
A
B
C

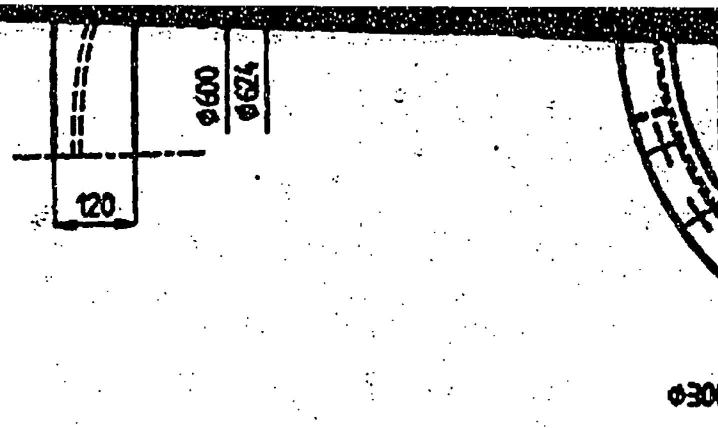


19788
19302
HEA 400
18900
19-22-24
18500
17760int.
28


DRY-WELL 1
13
5
8-9
HEA 400
30
M6
A-A
Tarauder
au montage


DRY-WELL 2
A
A
29
13
6
18-23
Soudage des HEA 100
sous les 4 réservoirs sup.
ΔS
ΔS
100
245
100
100
170
100
100
A (1:2)


18-21-23
19287
Δ8
Δ12
20-22-24
29
13



Korrosionsschutz:

Alle Teile aus Stahl sandgestrahlt und Anstrich Friazinc ZS (2 Anstriche)

PANDA MASTER DOCUMENT

Released by:

PSI PANDA PM

Date 2-III-95

GE Site QA Representative

Date 2 Mar 95

PANDA DOCUMENT REVIEW/APPROVAL

Checked by — Date 95-3-1

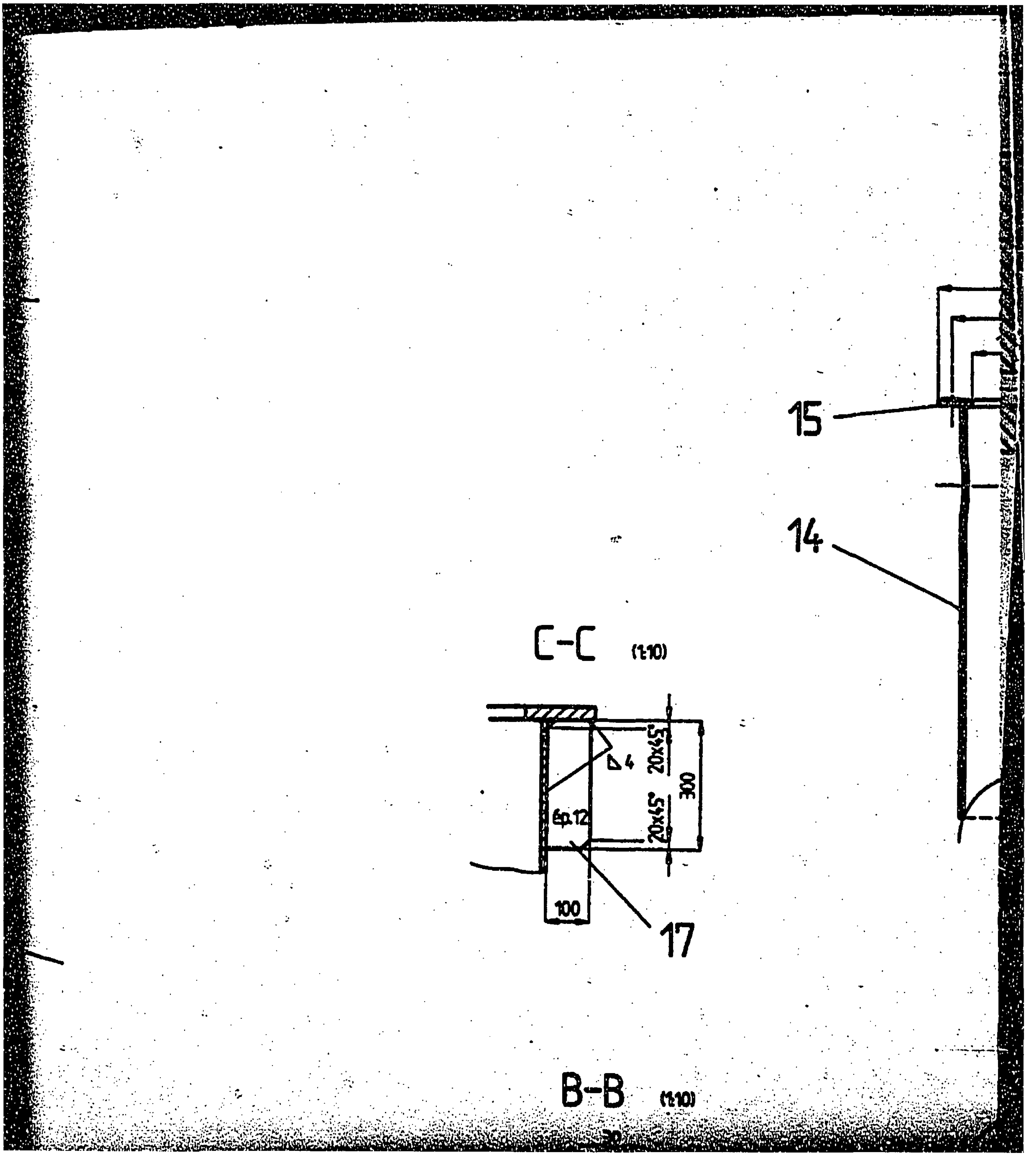
PSI Responsible Engineer

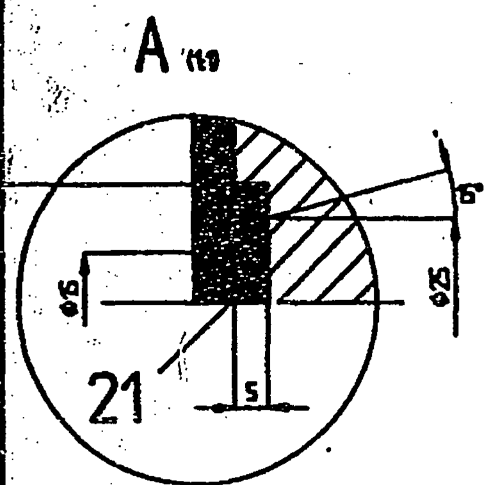
Reviewed by — Date 1 Mar 95

GE Site QA Representative

Approved/Verified by — Date 1-III-95

PSI PANDA PM


15
14
C-C (1:10)
20x45°
4
300
20x45°
Ep.12
100
17
B-B (1:10)



Nb. Pces	Designation Designation	Pos. Item	Profil Size	Long. Lenght	Matière Material	Certif. Certif.	Observation Remarks
1	Vis à oeillet - Augenschr.	15	M20	150	4.6		DIN 444 A
1	Ecrou - Mutter	14	M20	0,8d	8		DIN 934
20	Ecrou - Mutter	13	M24	0,8d	5-2	Stp	DIN 934
20	Vis 1.6 p. - 6 Kt Schrauben	12	M24	130	5.6	Stp	DIN 931
2	Circlips - Sicher.Ring	11	pr.Φ18		St.		DIN 471
1	Axe - Achse	10					A2587
2	Oreille - Ohr	9	40x12	65	St 37-2		
1	Rondelle - Scheibe	8	Φ75/51	3	bronze		
1	Rondelle - Scheibe	7	Φ74/51	15	St 37-2		
1	Rond - Rund	6	Φ50	1045d.	St 37		
1	Bride - Flansch	5	Φ920/784	45	St 52-3	3.1B	
1	Support - Support	4	80x15	582 d.	St 37-2		
1	Revêt. - Verkleidung	3	Φ790/730	51	1.4571		
1	Couvercle - Deckel	2	Φ920	45	St52-3	3.1B	
1	Virole - Zarge	1	474x40	2325d.	1.4571	3.1B	

	Long. Lenght	Matière Material	Certif. Certif.	Observation Remarks	Kg
	5	1.4571			
	6	1.4571	3.1B		29
	3	St37-2			
	71	St.		DIN 94	

Modifications Revisions

A	mis à jour 17.07.92 Ben	D	
B	modif. pos. 4 14.10.92 Ben	E	
C		F	

Echelle–Scale 1:1
Dessine–Drawn 19.06.92 Ben
Controle–Checked
Liste de pieces sep.,p. Sep. Material List,p.
No d'affaire 47185

Anlage : PANDA
Baugruppe : Grossbehälter

Mannloch DN 700

Stutzen Piquages 220-320-410-510

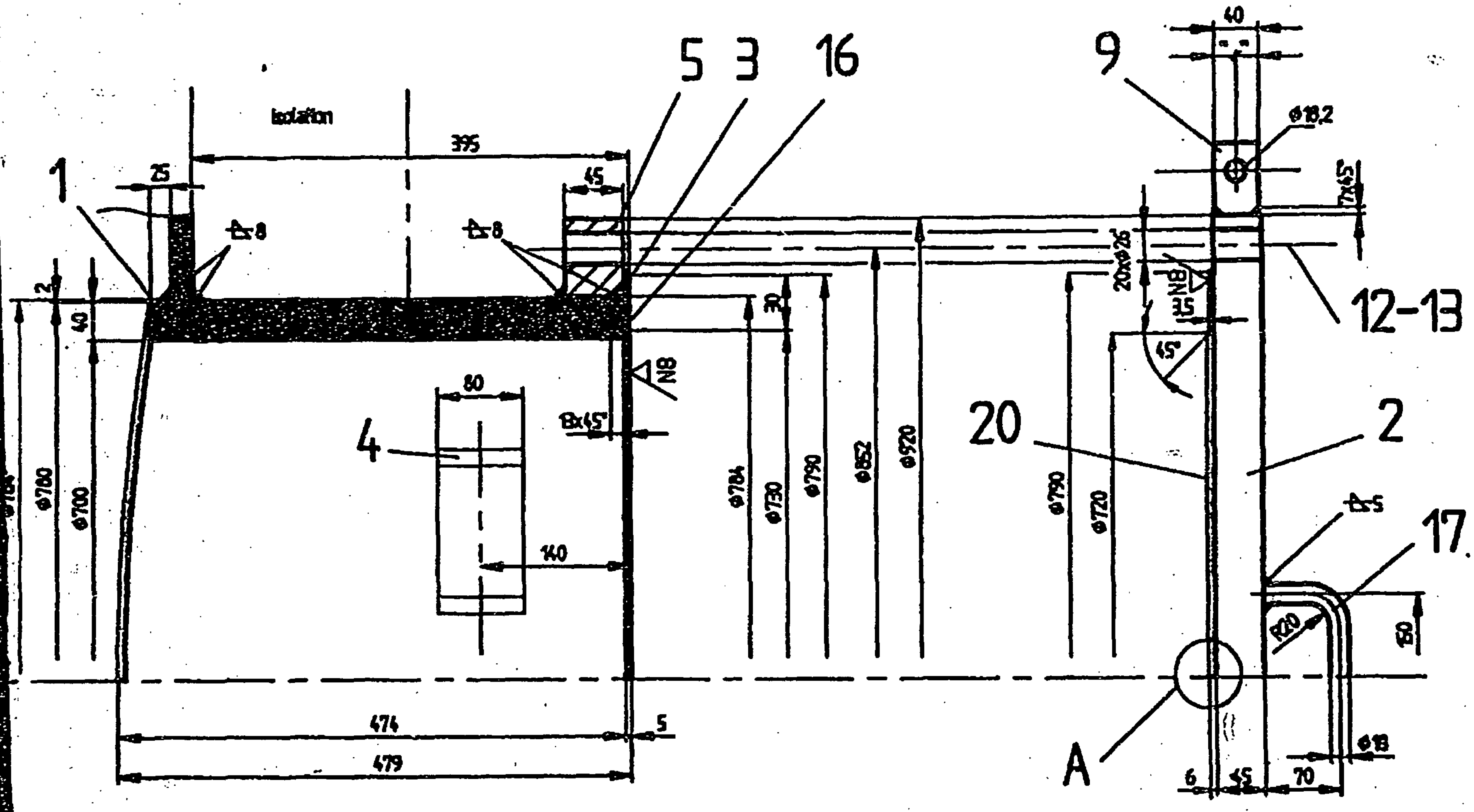
2-290117

GIOVANOLA

CASE POSTALE 271
CH-1870 MONTHEY
TEL. (025) 73 21 11
FAX. (025) 71 89 52

No. de dessin–Dwg. No. 164A3526-7b

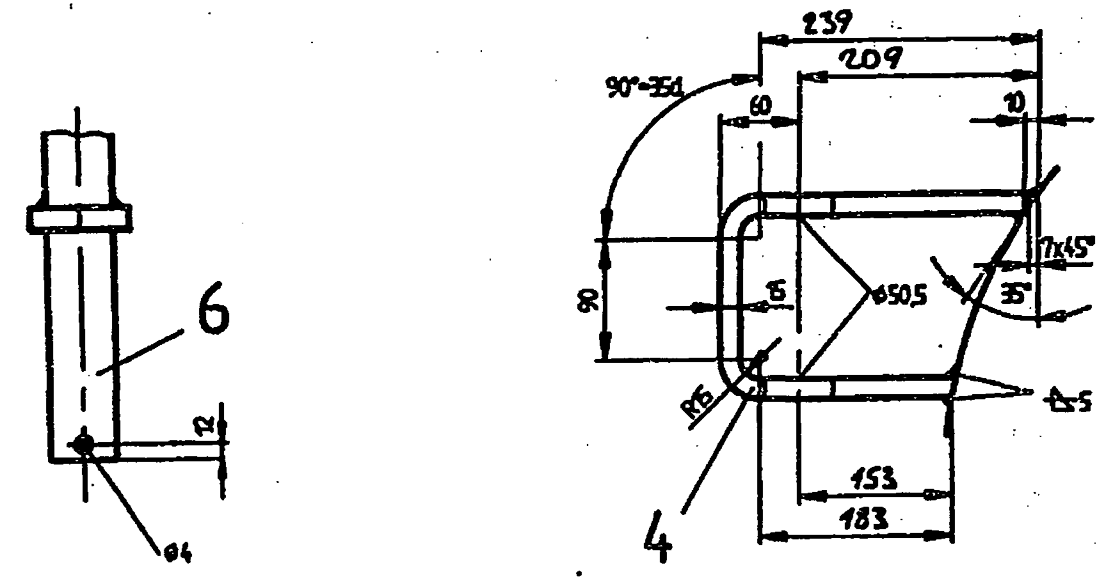
17 I 150



Poinçonnage complet Komplette Stempelung	Seulement marquage de la qualité Nur Materialqualität markiert

~720kg

2	Poignée - Handgriff	17	ø18	2666.	St 37		GF 12700	1
1	Joint plat - Flachdichtung	16	ø790/730	3	viton			



PANDA DOCUMENT REVIEW/APPROVAL			
Checked by	PSI Responsible Engineer	Date	95-3-1
Reviewed by	GE Site QA Representative	Date	1 Mar 95
Approved Verified by 2-3-95	PSI PANDA PM	Date	1-III-95
Approved by	GE Project Manager	Date	2 Mar 95

PANDA MASTER DOCUMENT

Released by:

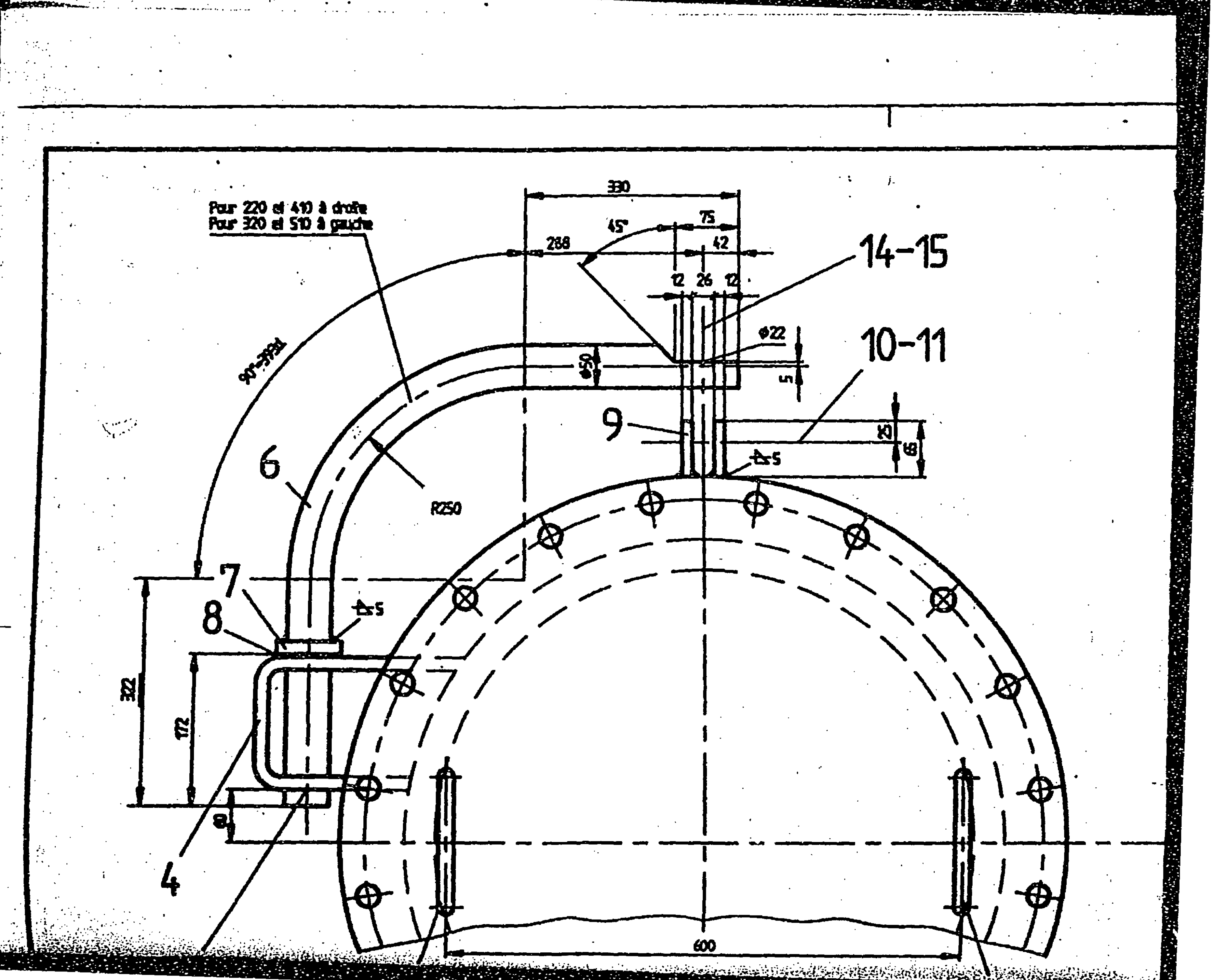
PSI PANDA PM

Date 2-III-95

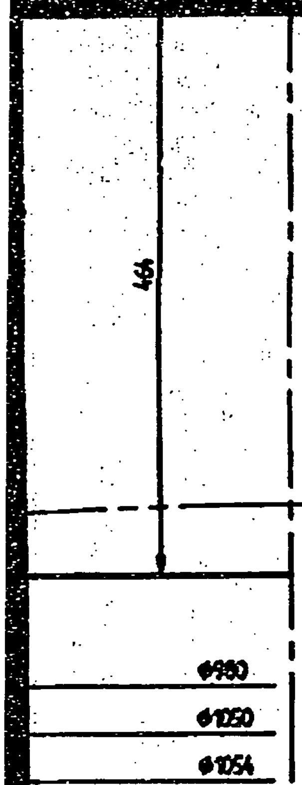
GE Site QA Representative

Date 2 Mar 95

1	Pastille - Schaibe	21
1	Revêt. - Verkleidung	20
1	Rondelle - Schaibe	19
1	Goupille - Splint	18
Nb. Poss.	Designation Designation	Pos. Item



Pour 220 et 410 à droite
Pour 320 et 510 à gauche
330
75
45°
288
42
12
26
12
14-15
Φ22
Φ50
5
10-11
9
R250
6
7
8
a≤5
322
172
80
4
600



Nb. Pces.	Designation Designation	Pos. Item	Profil Size	Long. Lenght	Matiere Material	Certif. Certif.	Observation Remarks	Kg
1	Axe - Achse	16					A 2568	
1	Joint - Flachdichtung	15	Φ1100/1000	3	viton			
2	Poignée - Handgriff	14	Φ20	354d.	St 37		GF 12701	2
1	Rond - Rund	13	Φ50	1650d.	St 37			25
1	Rondelle - Scheibe	12	Φ74/51	3	bronze			
1	" - "	11	Φ75/51	15	St 37-2			
1	Renfort - Verstärkung	10	260x15	450	" - "			14
1	" - "	9	50x10	208	" - "			1
2	Oreille - Ohr	8	40x15	75	" - "			1
1	Support - Support	7	100x15	450d.	" - "			5
1	Couvercle - Deckel	6	Φ1190	50	St 52-3	3.1B		436
1	Bride - Flansch	5	Φ1190/1054	50	" - "	3.1B		108
1	Pastille - Scheibe	4	Φ25	5	1.4571			
1	Revêt. - Verkleidung	3	Φ1100/1000	51	" - "			6
1	" - "	2	Φ1100	6	" - "	3.1B		45
1	Virole - Zarge	1	464x35	3168d.	" - "	3.1B		414

Modifications Revisions			
A	mis à jour 17.07.92 Ban	D	
B	*Modif. pos. 13 14.10.92 Ban*	E	
C		F	

Echelle–Scale 1/.

Dessine–Drawn 19.06.92 Ban

Controle–Checked *[signature]*

Liste de pieces sep.,p. Sep. Material List,p.

No d'affaire 47185

Anlage : PANDA
Baugruppe : Grossbehälter

Mannloch DN 1000

Stutzen Piquages 401-501

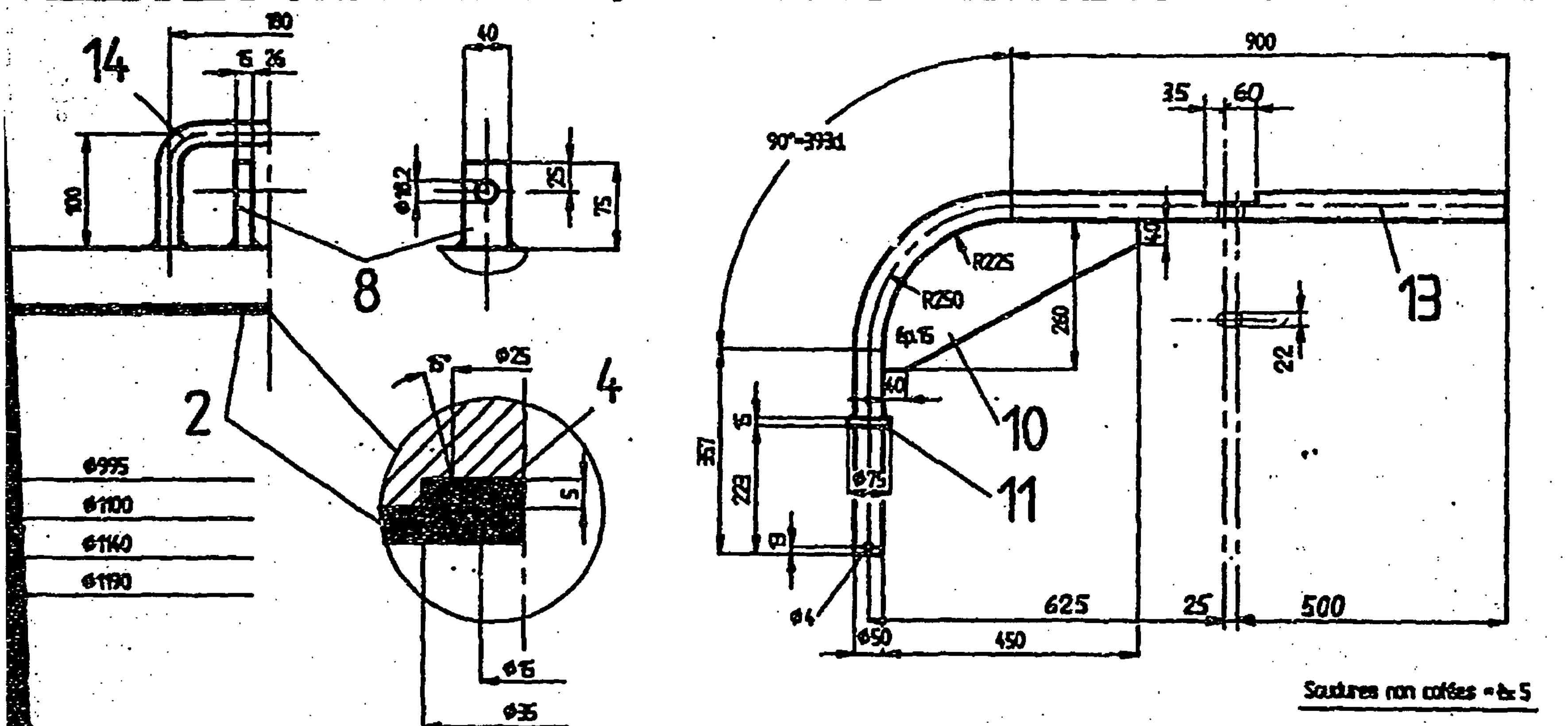
2-290118

No. de dessin–Dwg. No. 164A3526-8b

GIOVANOLA
CASE POSTALE 271
CH–1870 MONTHEY
TEL. (025) 73 21 11
FAX. (025) 71 85 52

PANDA DOCUMENT REVIEW/APPROVAL

...d by	*[signature]* PSI Responsible Engineer	Date	95-3-1
...d by	*[signature]* GE Site QA Representative	Date	1 Mar 95
...ved by ...-95	*[signature]* FSI PANDA PM	Date	1-III-95
...d by	*[signature]* GE Project Manager	Date	2 Mar 95

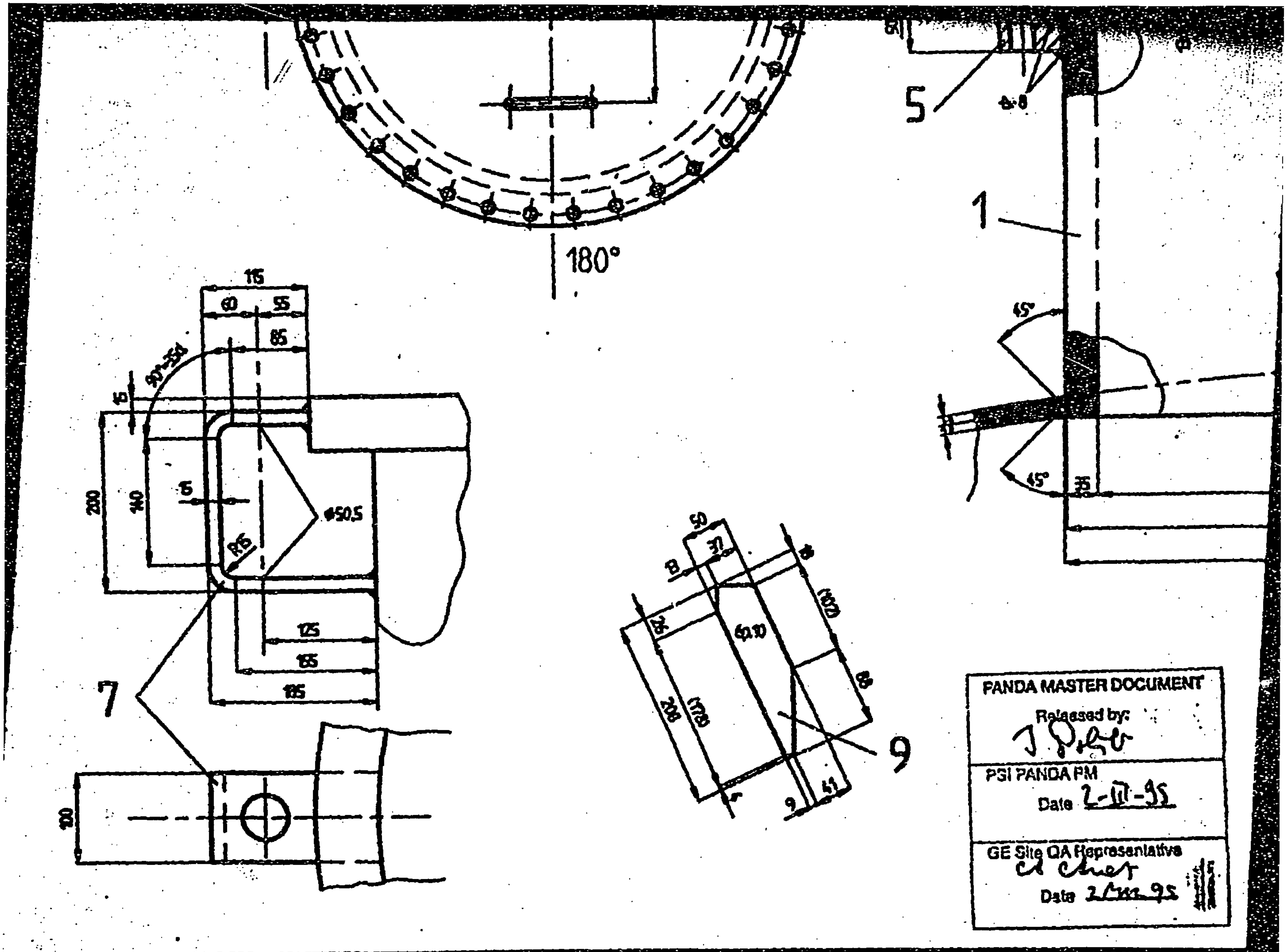


Soudures non cotées = a=5

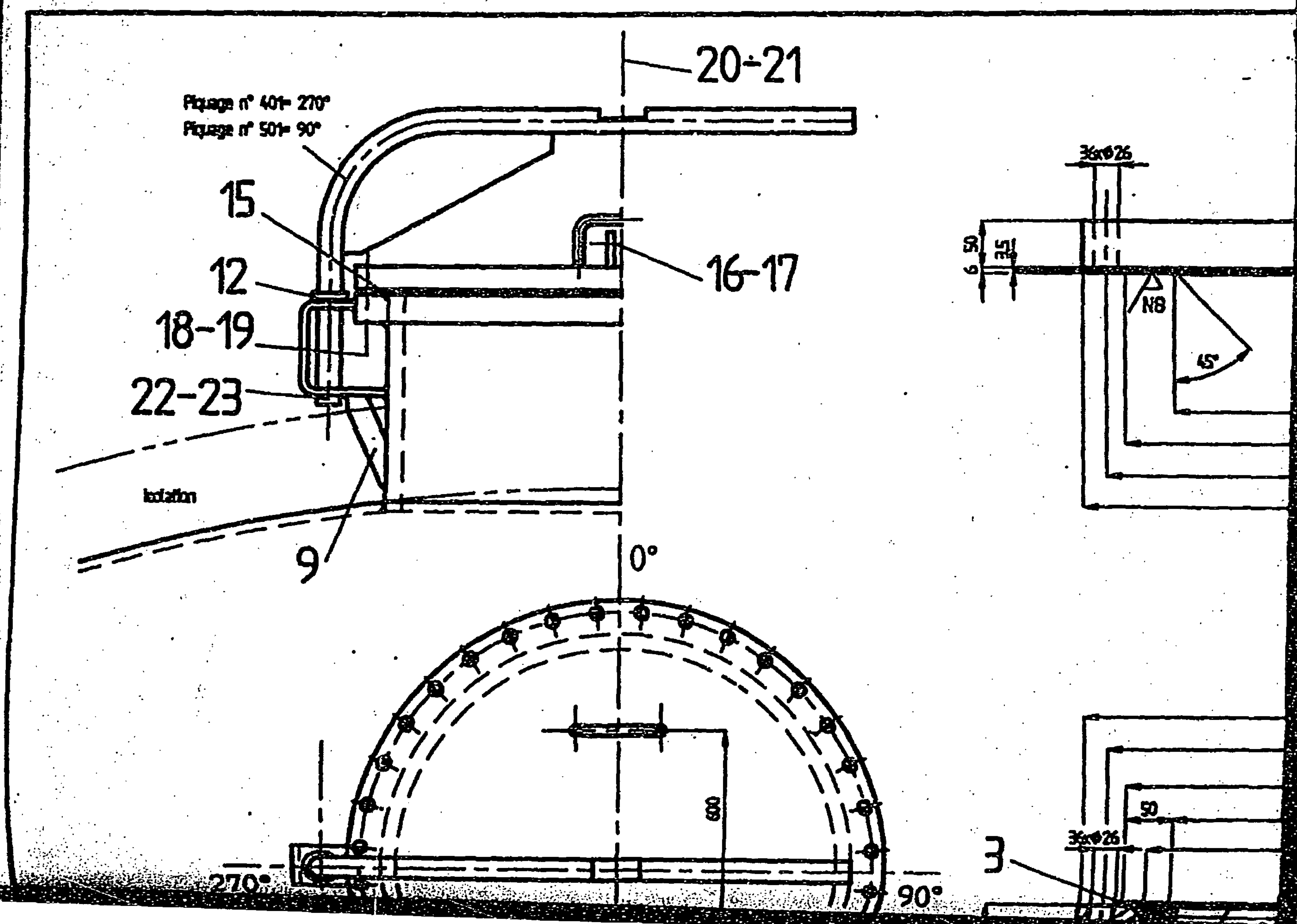
Poinçonnage complet Komplette Stempelung	Seulement marquage de la qualité Nur Materialqualität markiert

~1100kg

1	Rondelle - Scheibe	23	Φ70/51	3	St37-2			
1	Goupille - Splint	22	Φ4	71	St.		DIN 94	
1	Vis à oeillet - Augenschr.	21	M20	300	5.6	Stp	DIN 444 A	
1	Ecrou - Mutter	20	M20	0,8d	8		DIN 934	
36	Ecrou - Mutter	19	M24	0,8d	5-2	Stp	DIN 934	4
36	Vis 6 p. - 6 Kt Schrauben	18	M24	150	5.6	Stp	DIN 931	23
2	Circlips - Sichring	17	pr.Φ18		St		DIN 471	



PANDA MASTER DOCUMENT
Released by:
J. [signature]
PSI PANDA PM
Date 2-III-95
GE Site QA Representative
[signature]
Date 2/Mar 95



20÷21
Piquage n° 401= 270°
Piquage n° 501= 90°
15
12
18-19
22-23
16-17
Isolation
9
0°
36xΦ26
50
35
6
N8
45°
270°
90°
500
50
36xΦ26
3

19

8

	Nb. Pces.	Designation / Designation	Pos. Item	Profil Size	Long. Lenght	Matière Material	Certif. Certif.	Observation Remarks	Kg
1	1	Joint plat - Flachdichtung	16	Ø675/665	3	Viton			
1	1	Vis à oeillet - Augenschr.	15	M20	150	4.6		DIN 444 A	
1	1	Ecrou - Mutter	14	M20	0,8d	8		DIN 934	
20	20	Ecrou - Mutter	13	M24	0,8d	5-2	Stp	DIN 934	2
20	20	Vis 1.6 p. - 6 Kt Schrauben	12	M24	110	5.6	Stp	DIN 931	11
2	2	Circlips - Sicher.Ring	11	pr.Ø18		St.		DIN 471	
1	1	Axe - Achse	10					A2597	
2	2	Oreille - Ohr	9	30x16	65	St 37-2			
1	1	Rondelle - Scheibe	8	Ø75/51	3	bronze			
1	1	Rondelle - Scheibe	7	Ø74/51	15	St 37-2			
1	1	Rond - Rund	6	Ø50	883d	St 37			13
1	1	Bride - Flansch	5	Ø780/644	40	St 52-3	3.1B		48
1	1	Support - Support	4	80x15	565d.	St 37-2			5
1	1	Revêt. - Verkleidung	3	Ø675/615	St	1.4571			2
1	1	Couvercle - Deckel	2	Ø780	36	" - "	3.1B		138
	1	Virole - Zarge	1	597x20	1948d.	" - "	3.1B		186

Modifications Revisions				
A	mis à jour	17.07.92 Ben	D	
B	modif. pos. 4	14.10.92 Ben	E	
C	mis à jour	19.11.92 Ben	F	

Echelle-Scale: /.

Dessiné-Drawn: 25.06.92 Ben

Controle-Checked: [signature]

Liste de pièces sep.p. / Sep. Material List.p.

No d'affaire: 47185

PANDA MASTER DOCUMENT

Released by: [signature]

PSI PANDA PM

Date 2-III-95

GE Site QA Representative [signature]

Date 2 Mar 95

Anlage : PANDA
Baugruppe : Grossbehälter

Mannloch DN 600

Stutzen / Piquages 100-600

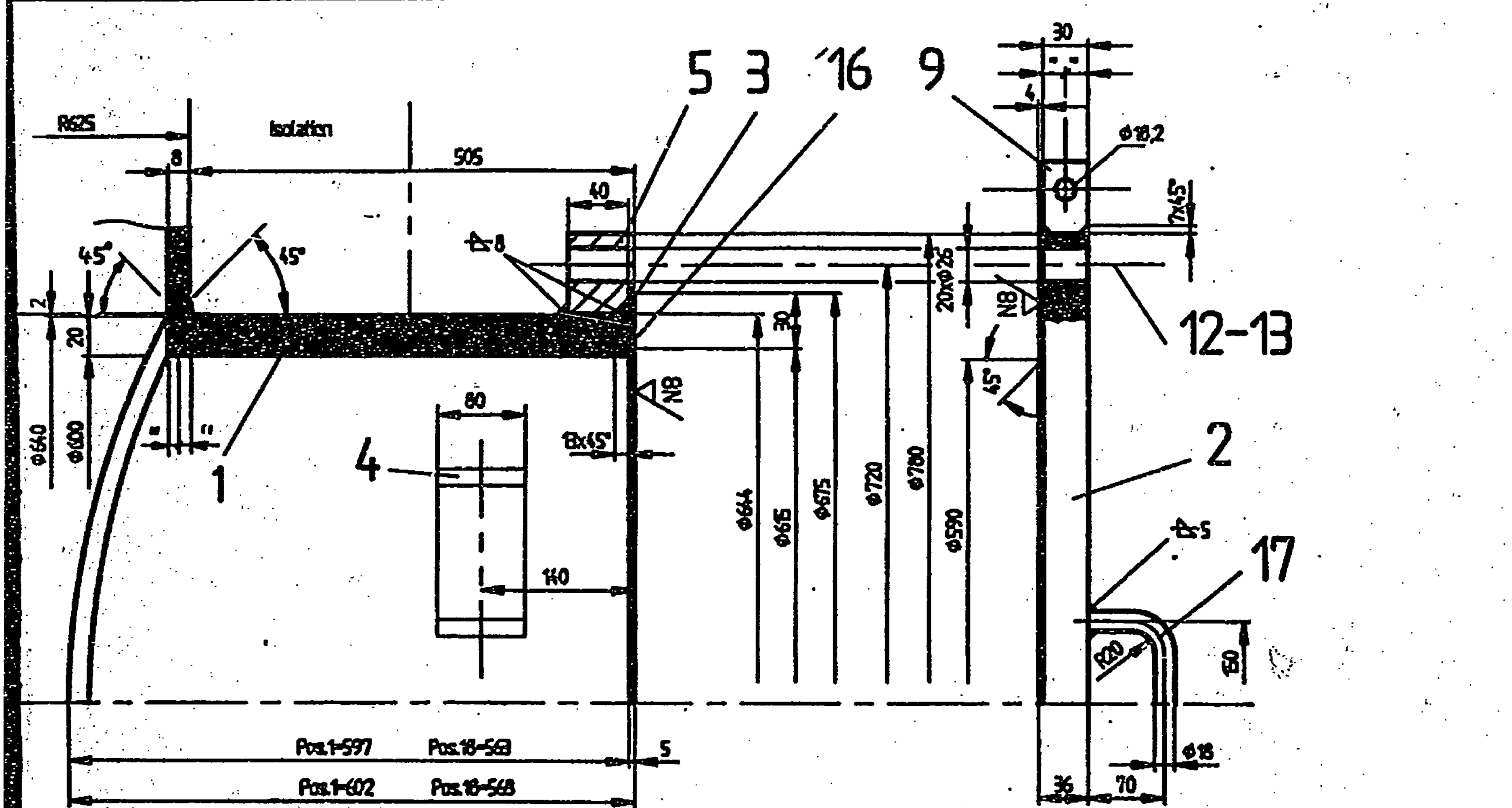
2-290119c

Long. Lenght	Matière Material	Certif. Certif.	Observation Remarks	Kg
3	St37-2			
71	St.		DIN 94	

G GIOVANOLA
CASE POSTALE 271
CH-1870 MONTHEY
TEL. (025) 73 21 11
FAX. (025) 71 89 52

No. de dessin-Drwg. No.
164A3526-9c

177 161



RPV

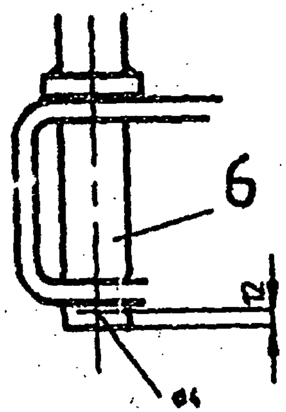
GDCS

Poinçonnage complet / Komplette Stempelung	Seulement marquage de la qualité / Nur Materialqualität markiert

par pce ~400kg

1		Renfort - Verstärkung	19	ϕ844/644	15	1.4571			28
1		Virole - Zarge	18	563x20	1948d.	" - "	3.18		175
2	2	Poignée - Handgriff	17	ϕ18	266l.	St 37		GF 12700	1

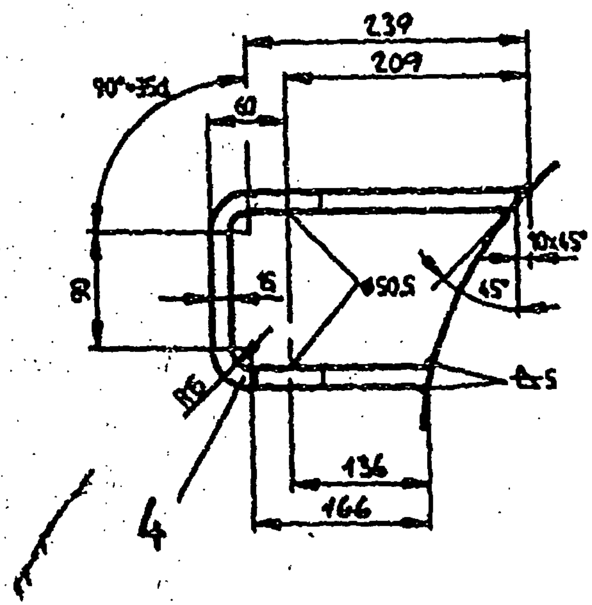
20-21 17 17

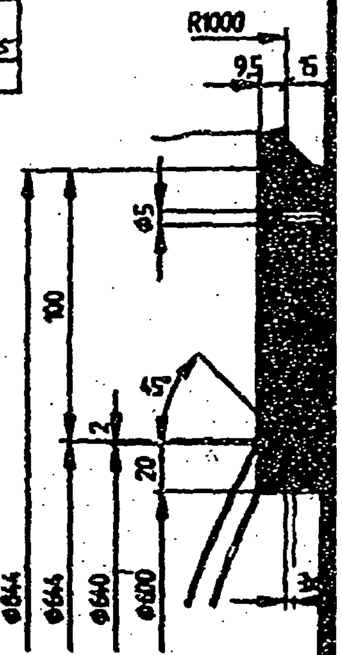


PANDA DOCUMENT REVIEW/APPROVAL

Checked by	PSI Responsible Engineer	Date	95-3-1
Reviewed by	GE SU QA Representative	Date	1 Mai 95
Approved / Verified by	PSI PANDA PM	Date	1-10-95
Approved by	GE Project Manager	Date	1 Mai 95

Nur für GDC
Seulement p

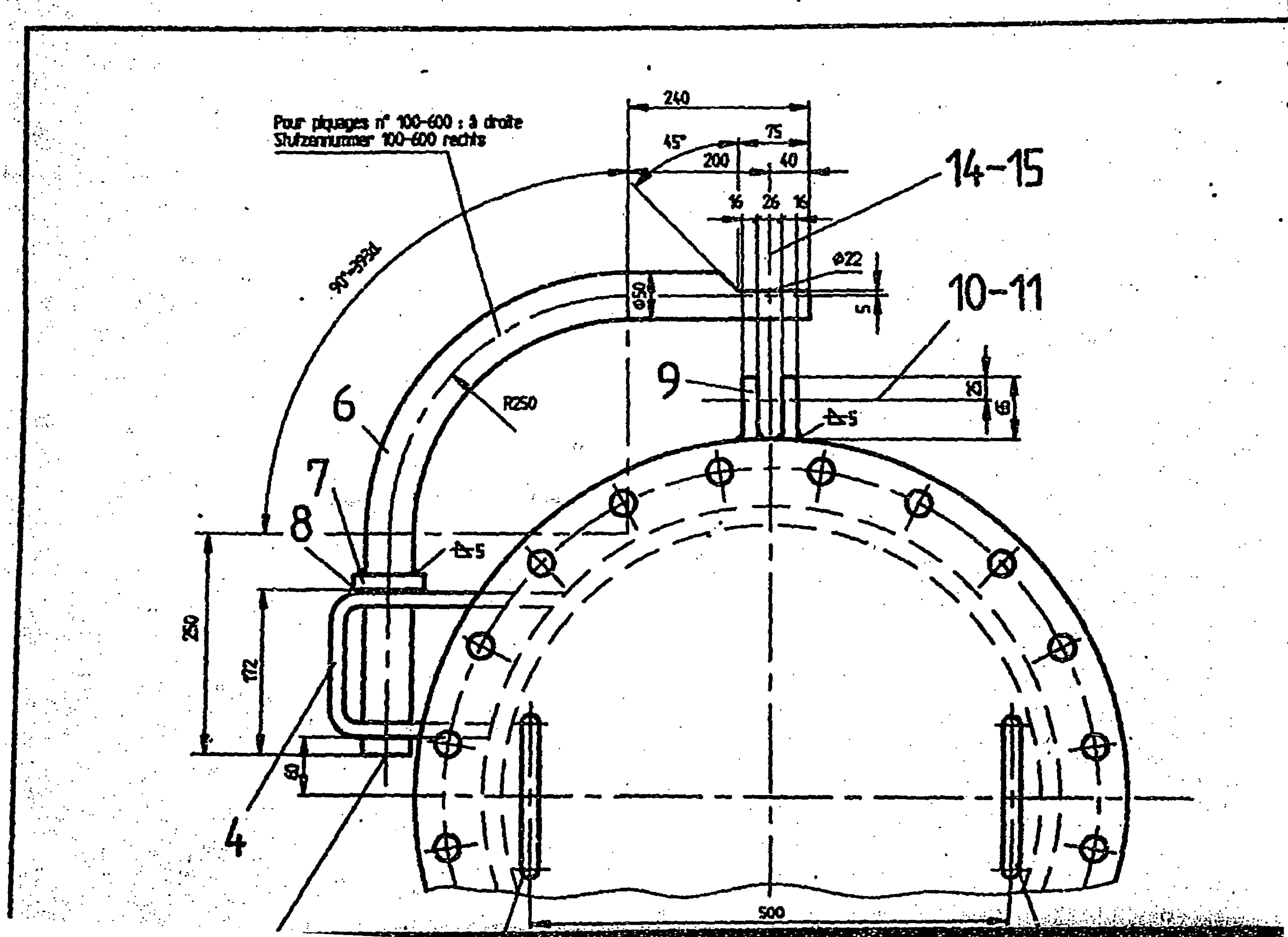




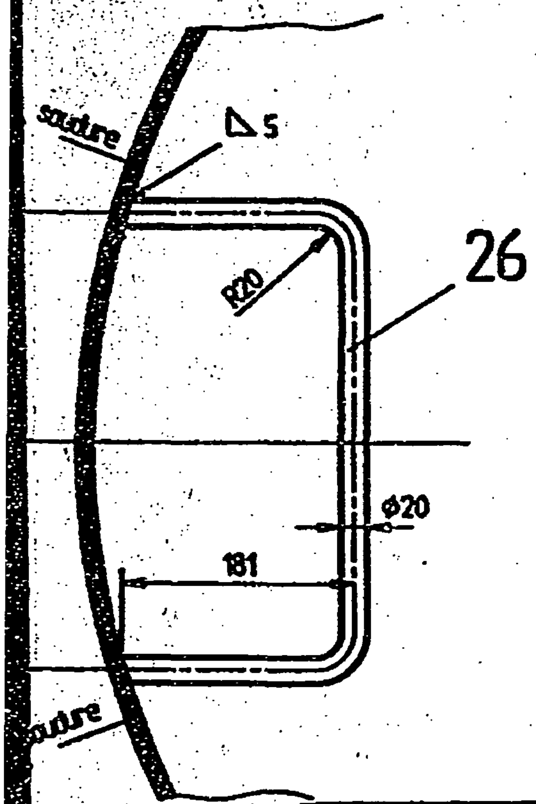
RPV

GDCS

1	1	Rondelle - Scheibe	2
1	1	Goupille - Splint	2
	No. Pos.	Designation Designation	Po Re



Pour piquages n° 100-600 : à droite
Stutzennummer 100-600 rechts
240
45°
75
200
40
16
26
16
14-15
Ø22
Ø50
5
10-11
9
10
18
R250
6
7
8
5
250
172
50
4
500



Nb. Pces	Désignation Designation	Pos. Item	Profil Size	Long. Lenght	Matière Material	Certif. Certif.	Observation Remarks	Kg
7	Support - Support	15	127B/1		1.4301		Sl.stand.Internes	
3	Oreille - Ohr	14	130x10	150	1.4571			
2	Oreille - Ohr	13	130x10	170	1.4571			
		12						
2	Support - Support	11	167 d.x10	80	1.4571			
2	Support - Support	10	167 d.x10	1232	1.4571			
4	Plat - Platte	9	84x8	100	1.4571			
4	Plat - Platte	8	80x8	100	1.4571			
2	Grille - Gitter	7	595x25	1210	V2A			
25	Marche - Steigbügel	6	Ø20	686 d.	1.4571			
1	Virole - Steigrohr	5	2300x6	3330d.	1.4571			
1	Virole - Steigrohr	4	2500x6	3330d.	1.4571			
1	Virole - Steigrohr	3	3000x8	3324d.	1.4571			
1	Virole - Steigrohr	2	3000x8	3324d.	1.4571			
6	Support - Support	1	100x10	300	1.4571			

Modifications Revisions

A	mis à jour Ben 09.07.92	D	mis à jour 12.9.92 Coquoz
B	mod. échelle Ben 15.07.92	E	mis à jour 17.9.92 Ben
C	mis à jour Ben	F	mis à jour 22.9.92 Ben

Echelle—Scale 1:50 1:10 1:5

Dessiné—Drawn 07.07.92 Ben

Controlé—Checked [signature]

Liste de pièces sep. p. Sep. Material List p.

No d'affaire 47185

PANDA MASTER DOCUMENT

Released by: [signature]

PSI PANDA PM Date 2-III-95

GE Site QA Representative [signature] Date 2-III-95

Anlage:PANDA
Baugruppe:Grossbehälter

Einbauten - Pces intérieures

0-290120

GIOVANOLA
CASE POSTALE 271
CH-1870 MONTHEY
TEL. (025) 73 21 11
FAX. (025) 71 89 52

No. de dessin—Drg. No. 164A3526-10 f

18 L 39

		41						
		40						
		39						
1	Chaîne - Kette	38	ϕ3	900	A4		DIN 766	
4	Tube -Rohr	37	ϕ33,7x2,6	1848	1.4571			
16	Ecrou - Mutter	35	M8	0,8d	A4		DIN 934	
16	Vis t.6p. - 6Kt Schraube	34	M8	25	A4		DIN 933	
50	Fixation - Befestigung	33			inox			
2	Echelle - Leiter	32		2000	"			
2	Echelle - Leiter	31		3400	"			
2	Echelle - Leiter	30		1500	"			
16	Renfort - Verstärkung	29	104dx5	980	1.4571			
8	Renfort - Verstärkung	28	ϕ16	3876	1.4571			
8	Tube - Rohr	27	ϕ33,7x2,6	3876	1.4571			
30	Marche - Steigbügel	26	ϕ20	786d	1.4571			
		25						
24	Oreille - Ohr	24	45x10	100	1.4571			
8	Oreille - Ohr	23	130x10	170	1.4571			
16	Oreille - Ohr	22	130x10	136	1.4571			
16	Support - Support	21	200x10	200	1.4571			
8	Grille - Gitter	20	600x25	1970	V2A			
8	Support - Support	19	UNP 160x65x10	3926	1.4571			
2	Support - Support	18	UNP 120x60x6	1881	1.4571			
1	Grille - Gitter	17	600x25	1280	V2A			
5	Support - Support	16	127/13/4		1.4301		Sl.standblapas	

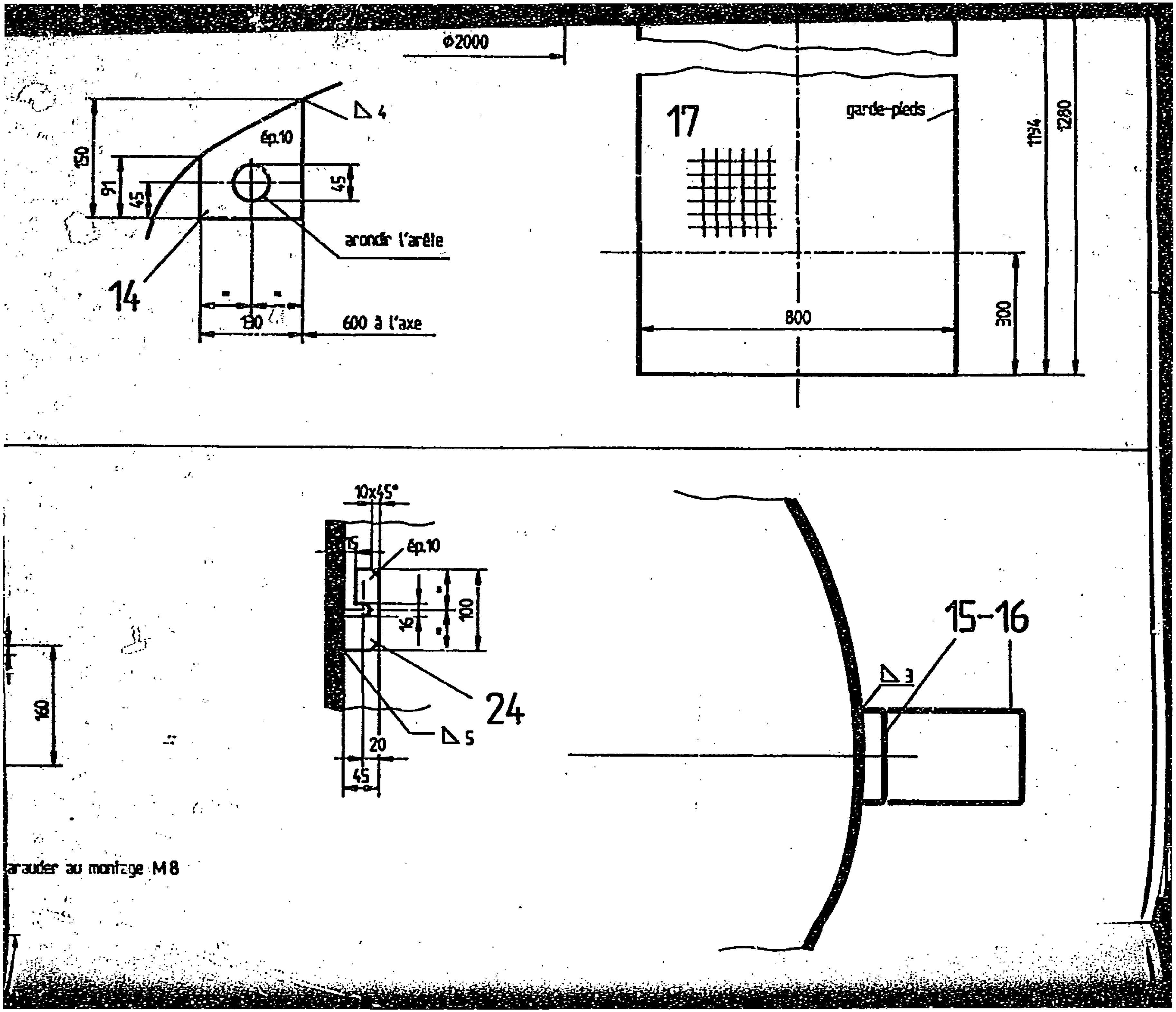
PANDA DOCUMENT REVIEW/APPROVAL

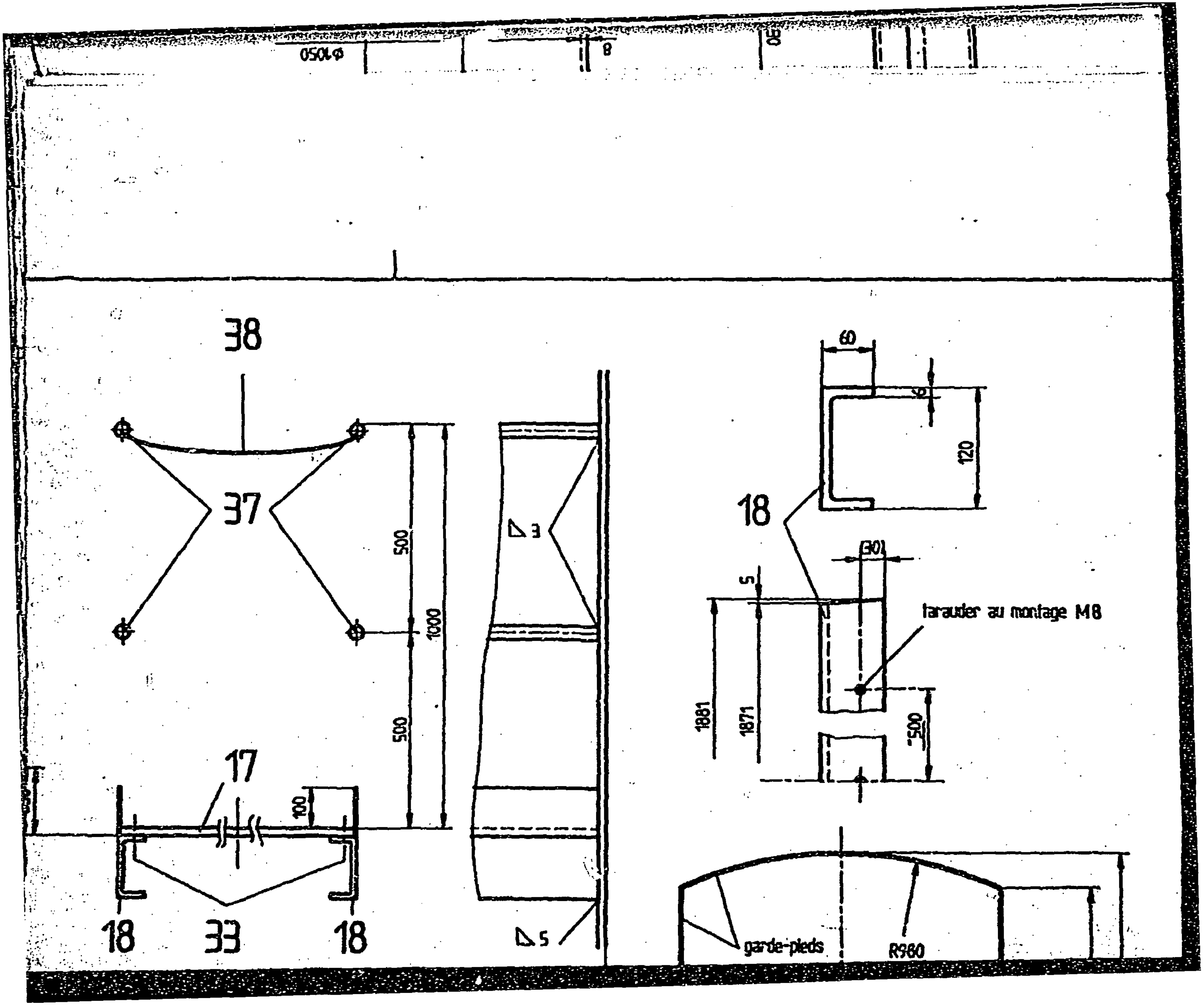
Checked by ______ Date 95-3-1
PSI Responsible Engineer

Reviewed by ______ Date 1 Mar 95
GE Site QA Representative

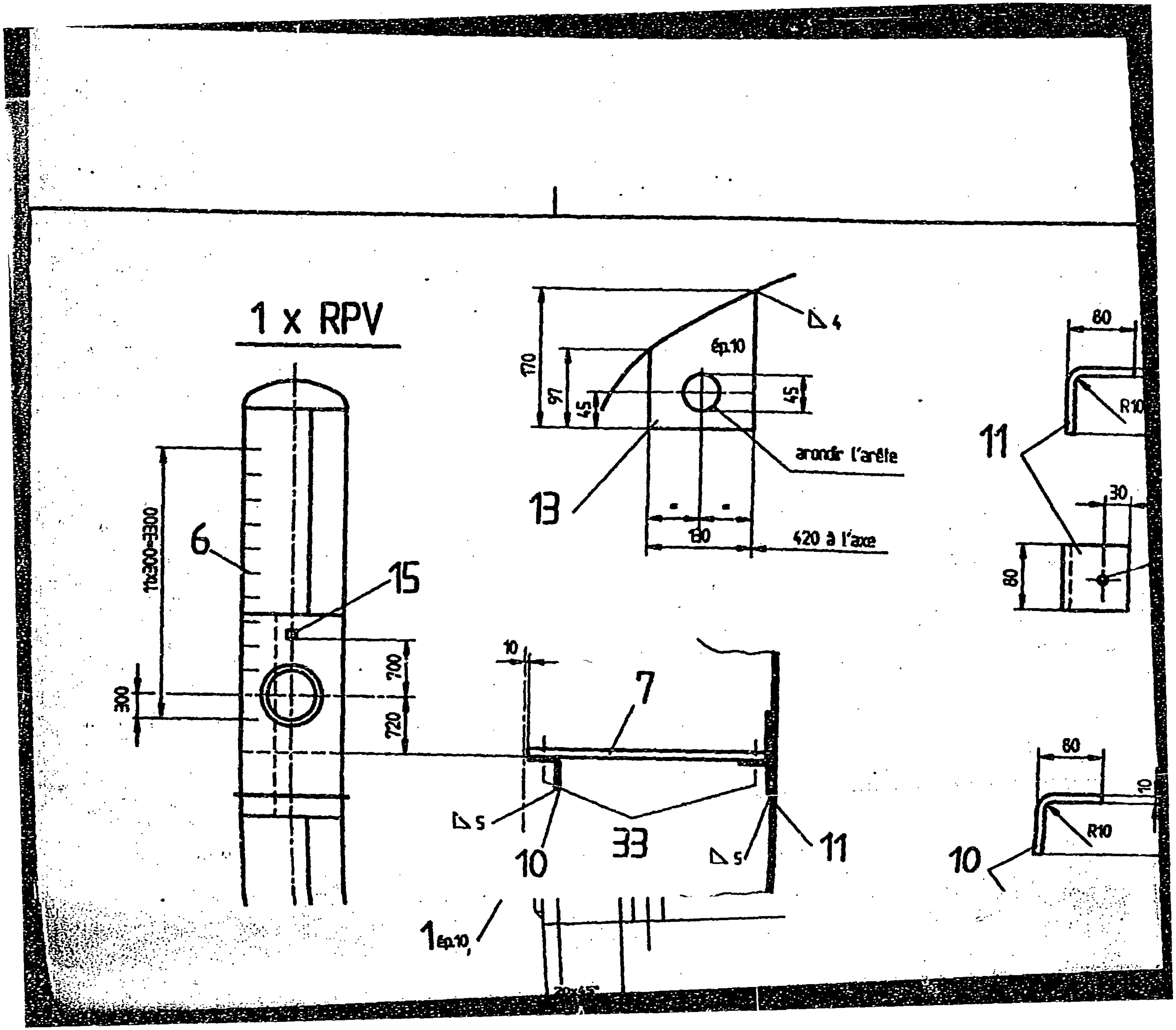
Approved / Verified by ______ Date 1-III-95
PSI PANDA PM

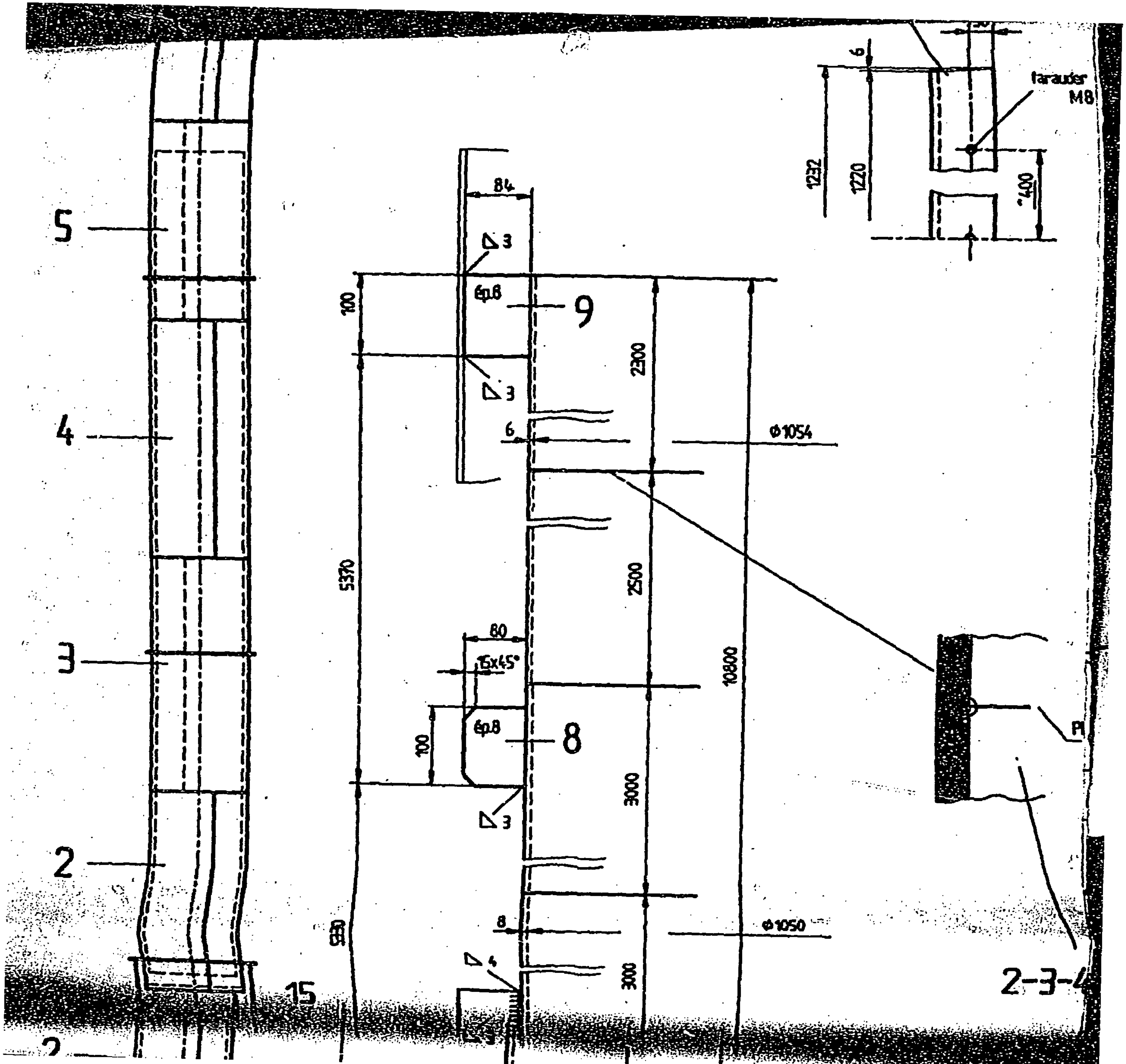
Approved by ______ Date 2.II.95
GE Project Manager


Φ2000
Δ 4
ép.10
150
91
45
45
arondir l'arête
14
130
600 à l'axe
17
garde-pieds
1134
1280
800
300
10x45°
15
ép.10
100
16
24
Δ 5
20
45
160
15-16
Δ 3
arauder au montage M 8

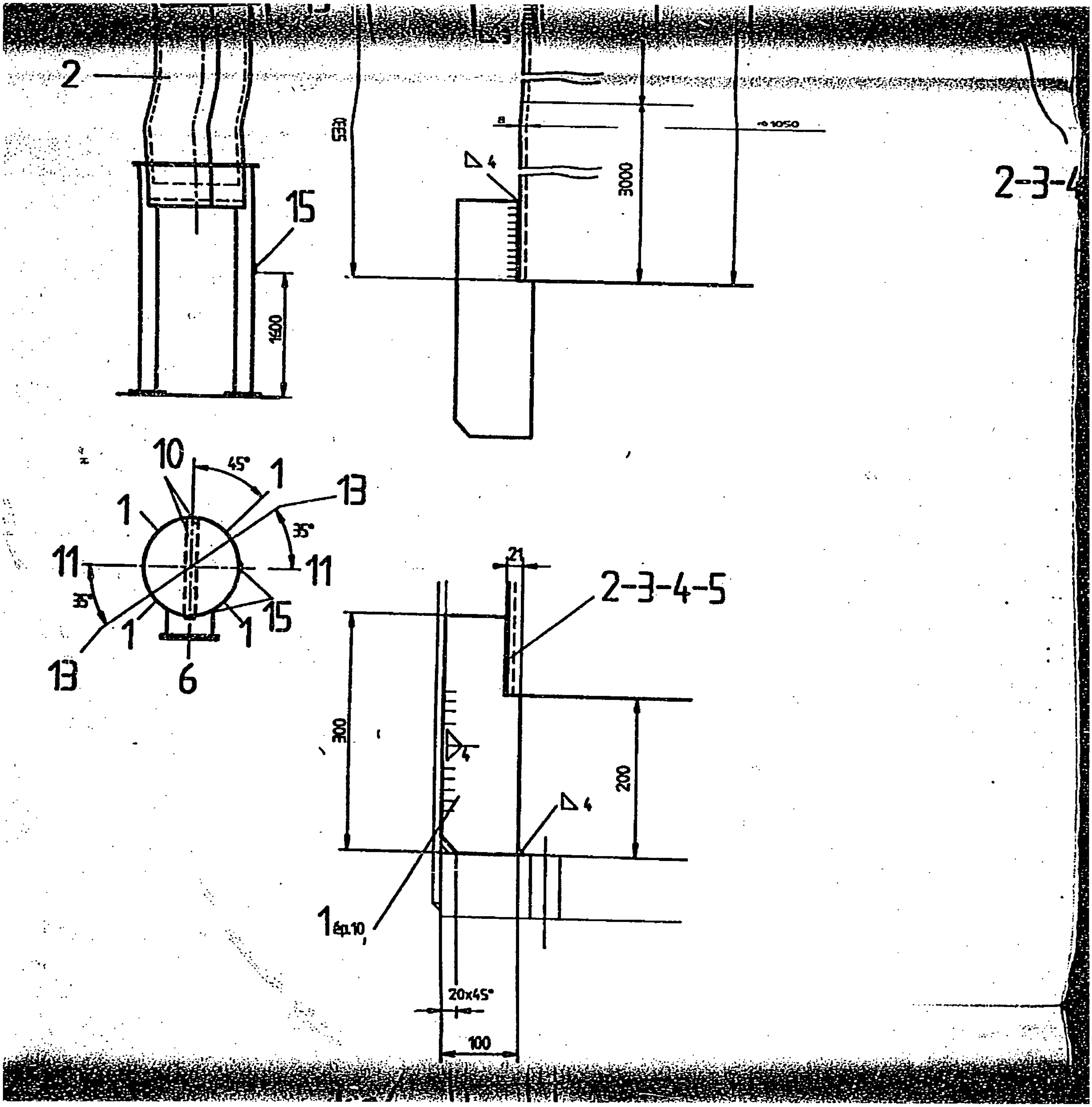


38
37
500
1000
500
17
100
18
33
18
3
5
60
6
120
18
(30)
5
tarauder au montage M8
1881
1871
500
garde-pieds
R980

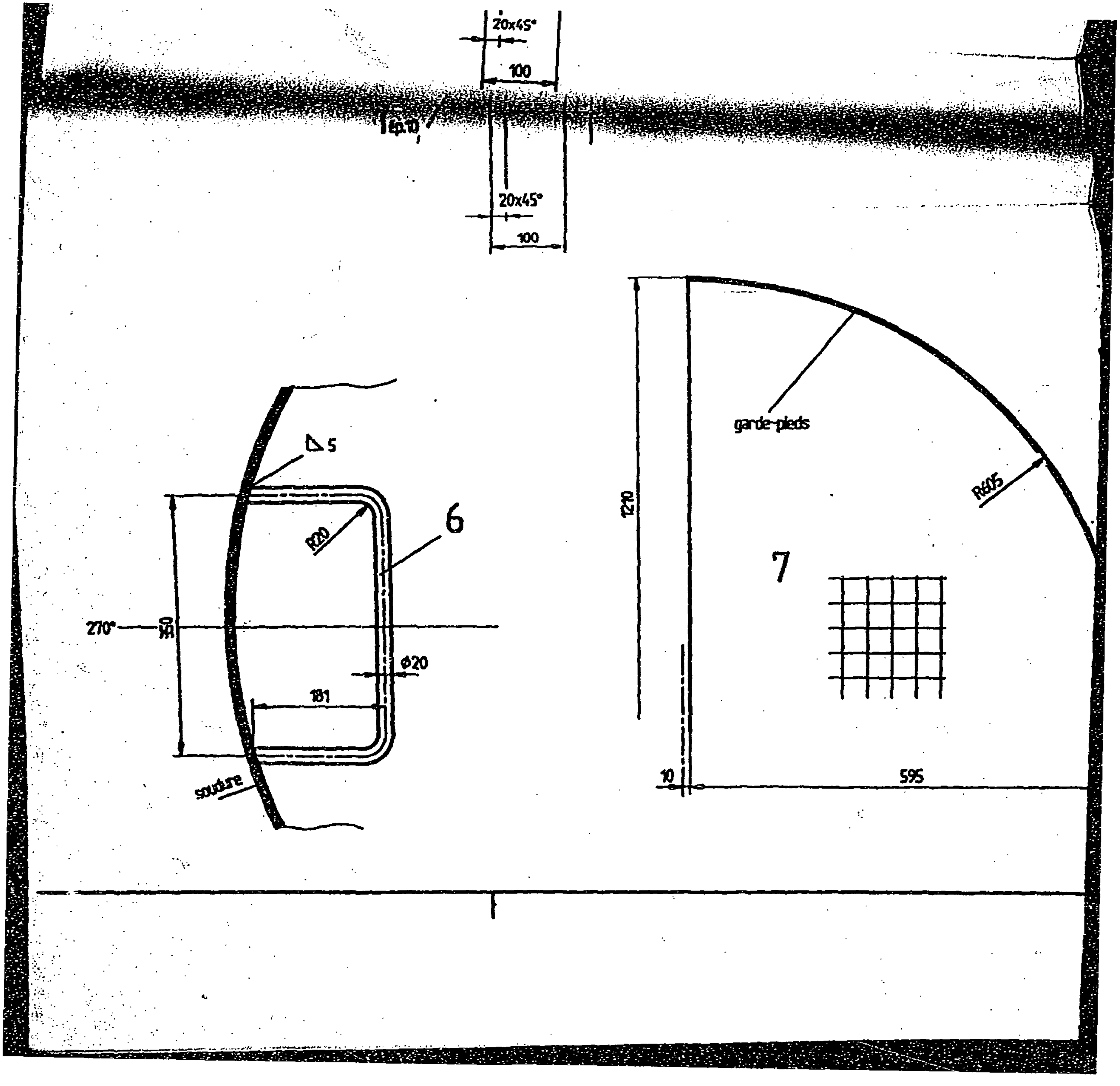

1 x RPV
6
15
10x300=3300
300
700
720
170
97
45
45
Ep.10
Δ 4
arondir l'arête
13
180
420 à l'axe
10
7
Δ 5
10
33
Δ 5
11
1 Ep.10
80
R10
11
30
80
80
10
R10
10



5
4
3
2
2
15
84
Δ3
Ép.6
9
100
Δ3
2300
6
Φ1054
5370
2500
10800
80
15x45°
Ép.8
8
100
Δ3
3000
8
Φ1050
Δ4
3000
6
1232
1220
400
Taraudé M8
Pl
2-3-4



2
15
1600
5330
3000
8
≈1050
4
2-3-4
10
45°
1
13
35°
11
15
6
21
2-3-4-5
300
200
1ép.10
20x45°
100



20x45°
100
Ep.10
20x45°
100
garde-pieds
R605
1210
7
10
595
5
6
R20
270°
350
ϕ20
181
soudure

Stutzen 1/2" - Innengewinde

PANDA DOCUMENT REVIEW/APPROVAL

Checked by	*(signature)* PSI Responsible Engineer	Date	95-3-1
Reviewed by	*(signature)* GE Site QA Representative	Date	1 Mar 95
Approved ~~Verified by~~ 2.3.95	J. *(signature)* PSI PANDA PM	Date	1-III-95
Approved by	*(signature)* GE Project Manager	Date	2 Mar 95

PANDA MASTER DOCUMENT

Released by: J. *(signature)*

PSI PANDA PM

Date 2-III-95

GE Site QA Representative *(signature)*

Date 2 Mar 95

Rev.		Désignation / Gegenstand / Designation		Pos.	Profil / Size	Long. / Länge / Length	Matière / Werkstoff / Material	Certif. / Attest / Certif.	Observations / Bemerkungen / Remarks	Kg
Modifications / Änderungen / Revisions	C		F		I			L		
	B	Corrigé disp. 22.09.92 Ab	E		H			K		
	A	Nouvel disp. 14.09.92 Ab	D		G			J		

Objet - Designation Client - Customer I

Anlage: PANDA

Baugruppe: Grossbehälter

IC POOL - ZUSAMMENSTELLUNG

Liste de pièces séparées / Sep. stückl. Lista

Echelle - Scale: 1:10

Etabli pour - Issued for: 0-290 129

Dessiné - Drawn: 26.08.92 Abbet M.

Contrôlé - Checked: *(signature)*

N° d'affaire: 47185

Dess. ens. - Assembly dwg.

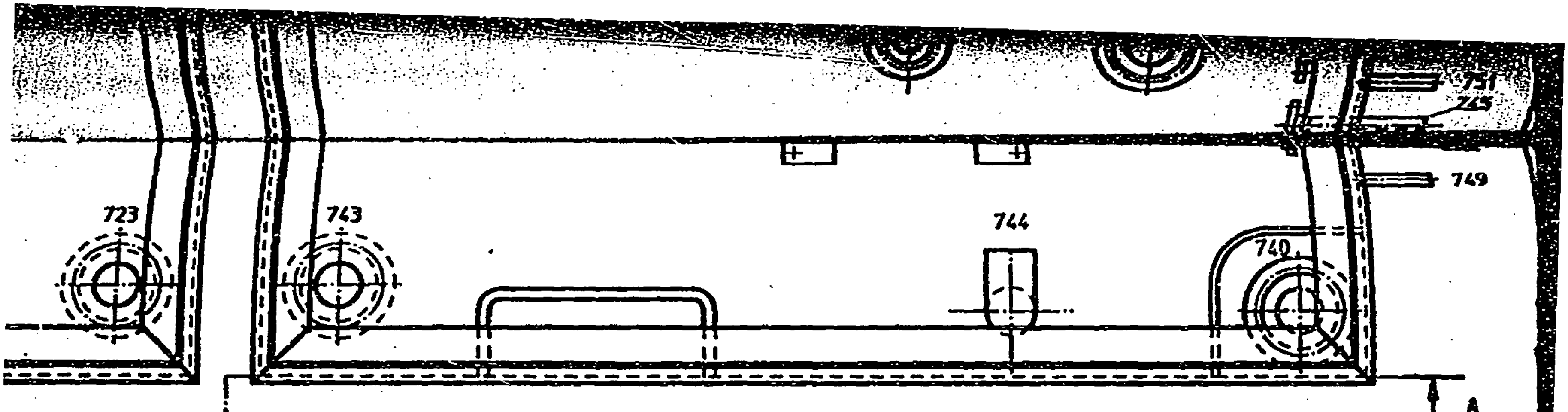
Remplace - Supersedes

N° de dessin - Dwg N°: 164A3526-12b

GIOVANOLA

CASE POSTALE 271
CH-1870 MONTHEY (SUISSE)
TEL 025/7921

18 L 41



POSITIONIERUNG DER FLANSCHE UND STUTZEN

PCC1

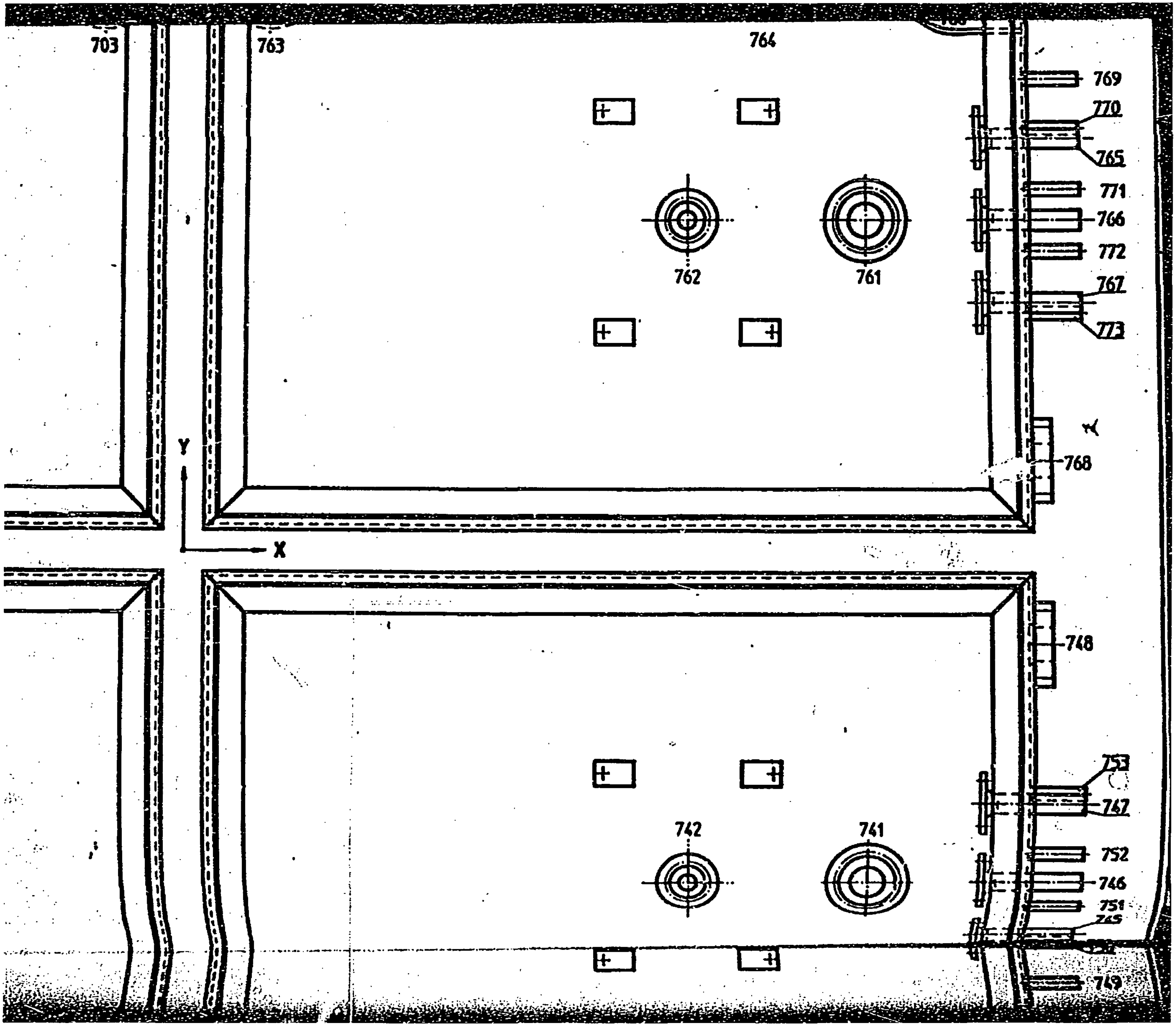
NW	X	Y
80	-1920	-1420
80	-1650	-800
40	-1215	-800
80	-200	-1420
80	-1400	-1420
40		-1000
40		-800
40		-600
80		-220
1/2"		-1150
1/2"		-1025
1/2"		-875
1/2"		-725
1/2"		-575

PCC2

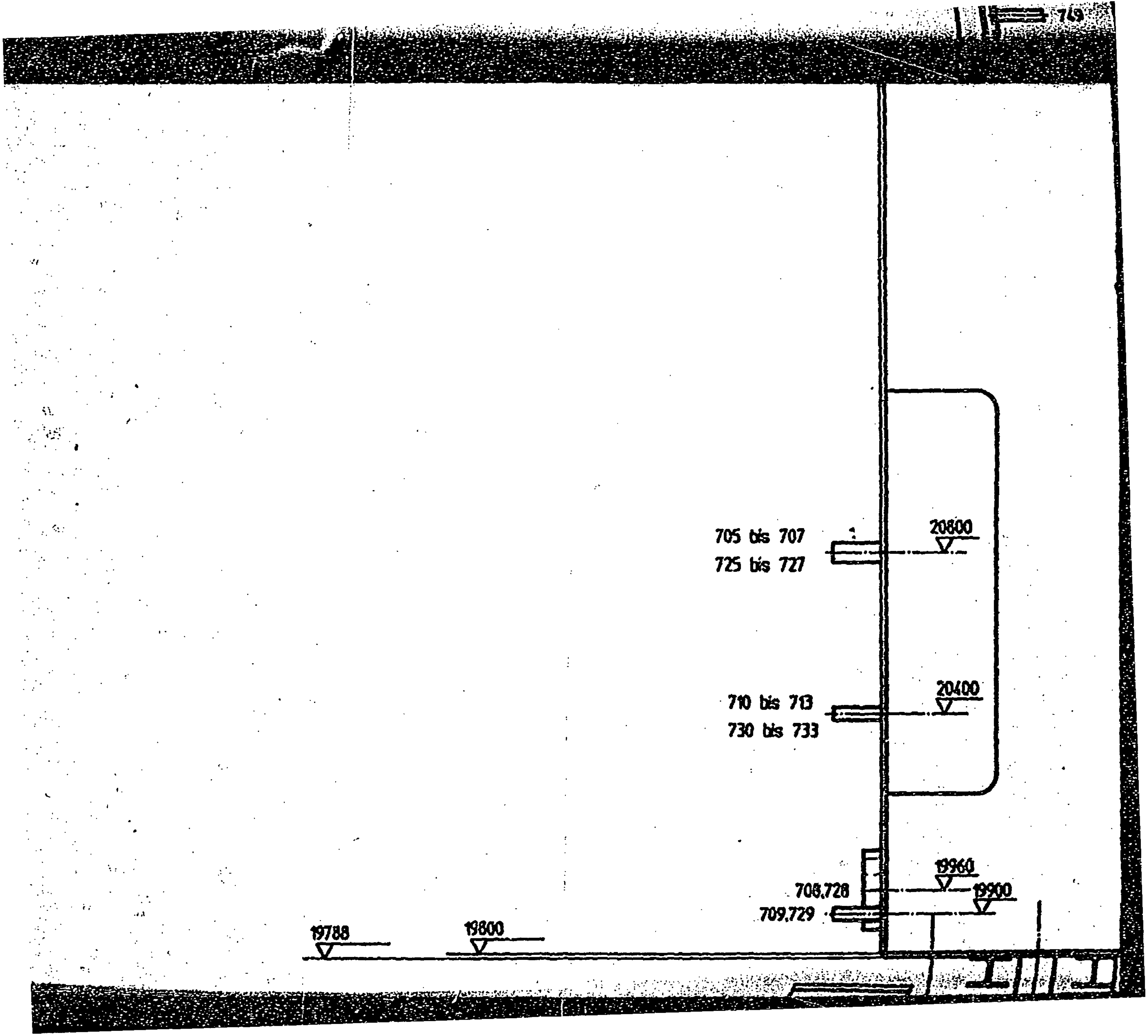
Nr.	NW	X	Y
740	80	1920	-1420
741	80	1650	-800
742	40	1215	-800
743	80	200	-1420
744	80	1400	-1420
745	40		-1000
746	40		-800
747	40		-600
748	80		-220
749	1/2"		-1150
750	1/2"		-1025
751	1/2"		-875
752	1/2"		-725
753	1/2"		-575

PCC3

Nr.	NW	X	Y
760	80	1920	1420
761	80	1650	800
762	40	1215	800
763	80	200	1420
764	80	1400	1420
765	40		1000
766	40		800
767	40		600
768	80		220
769	1/2"		1150
770	1/2"		1025
771	1/2"		875
772	1/2"		725
773	1/2"		575



703
763
764
769
770
765
771
766
772
767
773
762
761
Y
X
768
748
753
747
742
741
752
746
751
749


705 bis 707
725 bis 727
20800
710 bis 713
730 bis 733
20400
19960
708,728
19900
709,729
19788
19800

Nb. Stk. Pcs	Désignation Gegenstand Designation		Pos. Pos. Item	Profil Profil Size	Long. Länge Length	Matière Werkstoff Material	Certif. Attest Certif.	Observations Bemerkungen Remarks	Kg
1	Tube	Rohr	11	ø88.9x3.05	545	1.4571			3.5
1	Tube	Rohr	10	ø88.9x3.05	588	1.4571			3.8
1	Tube	Rohr	9	ø88.9x3.05	700	1.4571			4.5
1	Tube	Rohr	8	ø88.9x3.05	4485.5	1.4571			29
1	Bride	Blockflansch	7	ø200/80	45f.	1.4571			11.8
4	Plaque	Platte	6	60x20	95	1.4571			3.6
1	Tôle	Blech	5	266x12	266	1.4571			6
1	Fond	Boden	4	1476x12	1976	1.4571			280
1	Paroi	Wand	3	498.5dx12	4088	1.4571			440
2	Paroi	Wand	2	1476x12	5064d.	1.4571			1395
2	Paroi	Wand	1	1976x12	5064d.	1.4571			1860

Modifications / Änderungen / Revisions

C		F		I		L	
B	Ajouté Pos 23 et 24 16.11.92 Ab.	E		H		K	
A	mis à jour 02.10.92 Bsn	D		G		J	

Objet - Designation (Client - Customer)

Anlage: PANDA

Baugruppe: Grossbehälter

IC POOL - Fabrikations-Details

Liste de pièces séparée - Sep. Material Liste

Etabli pour - Issued for: 0-290161 b

Echelle - Scale: 1:10

Dessiné - Drawn: 21.09.92 Abbet M.

Contrôlé - Checked: [illegible]

N° d'article: 47185

Dess. ens. - Assembly dwg.

Remplace - Supersedes

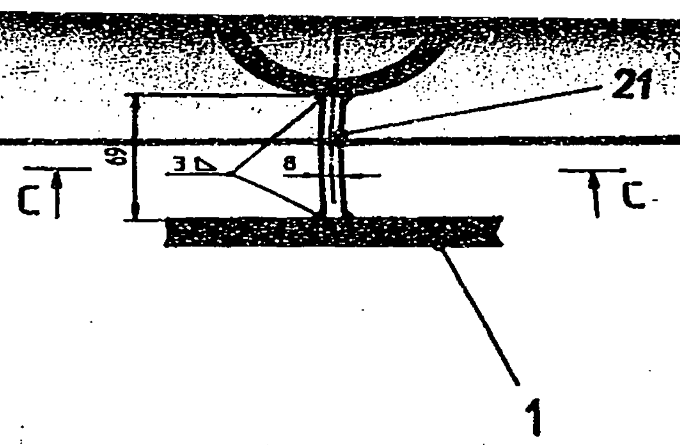
N° de dessin - Dwg. n°: 164A3526-14b

GIOVANOLA

CASE POSTALE 271
CH-1870 MONTHEY (SUISSE)
TEL 025/73211

PANDA MASTER DOCUMENT
Released by: [illegible]
PSI PANDA PM
Date 2-III-95
GE Site QA Representative
[illegible]
Date 2 Mar 95

181 47



PANDA DOCUMENT REVIEW/APPROVAL

Checked by ____ Date 95-3-1
PSI Responsible Engineer

Reviewed by ____ Date 1/Mar/95
GE Site QA Representative

Approved ____ Date 1-III-95
PSI PANDA PM

Approved by ____ Date 2/Mar/95
GE Project Manager

2

0-290129

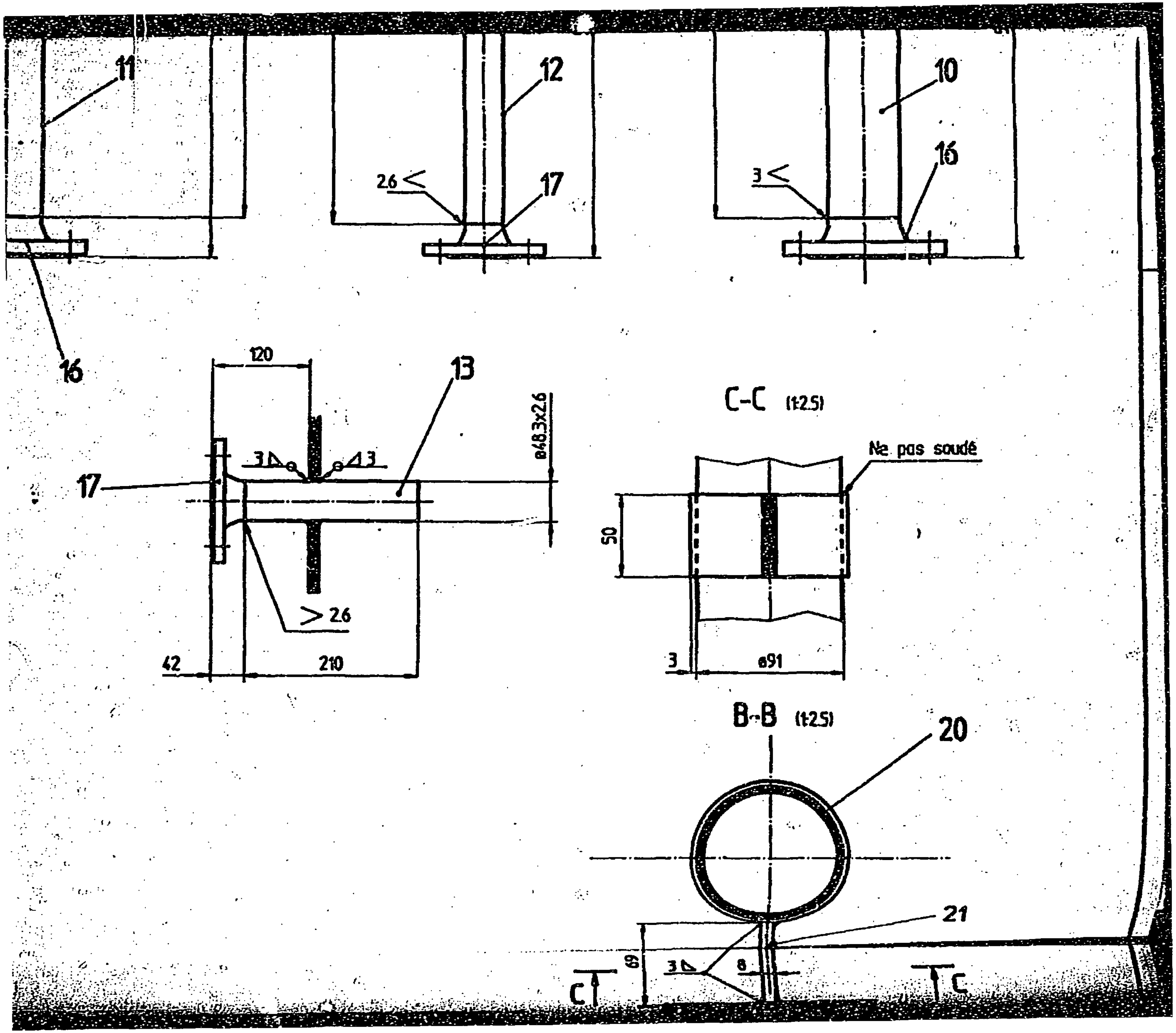
EXECUTION: 2 PAIRES SELON DESSIN 164A3526-12

(Pos. 7, 16 et 17 = Trous ou tarraudages hors axes)

Total ca 4150 Kg

2	Patte de lev.	Tragöse	24	100x12	160	1.4571			3
4	Cornière	Winkel	23	40x4	2300	1.4301			22
16	Echelon	Handgriff	22	ø20	674d.	1.4571			26.6
1	Plaque	Platte	21	50x8	69	1.4571			0.2
1	Tôle	Blech	20	50x3	295d.	1.4571			0.3
2	Plat	Flachstahl	19	30x5	1430	1.4571			3.3
2	Plat	Flachstahl	18	30x5	1930	1.4571			4.5
5	Bride	Flansch	17	C40x48.3		1.4571		DIN 2633	9.3
6	Bride	Flansch	16	C80x88.9		1.4571		DIN 2633	22.2
1	Coude	Bogen	15	ø88.9x2.6	30-90°	1.4571			1
5	Tube	Rohr	14	ø32x8	125	1.4571			3
3	Tube	Rohr	13	ø48.3x2.6	210	1.4571			1.8
1	Tube	Rohr	12	ø48.3x2.6	616	1.4571			1.8

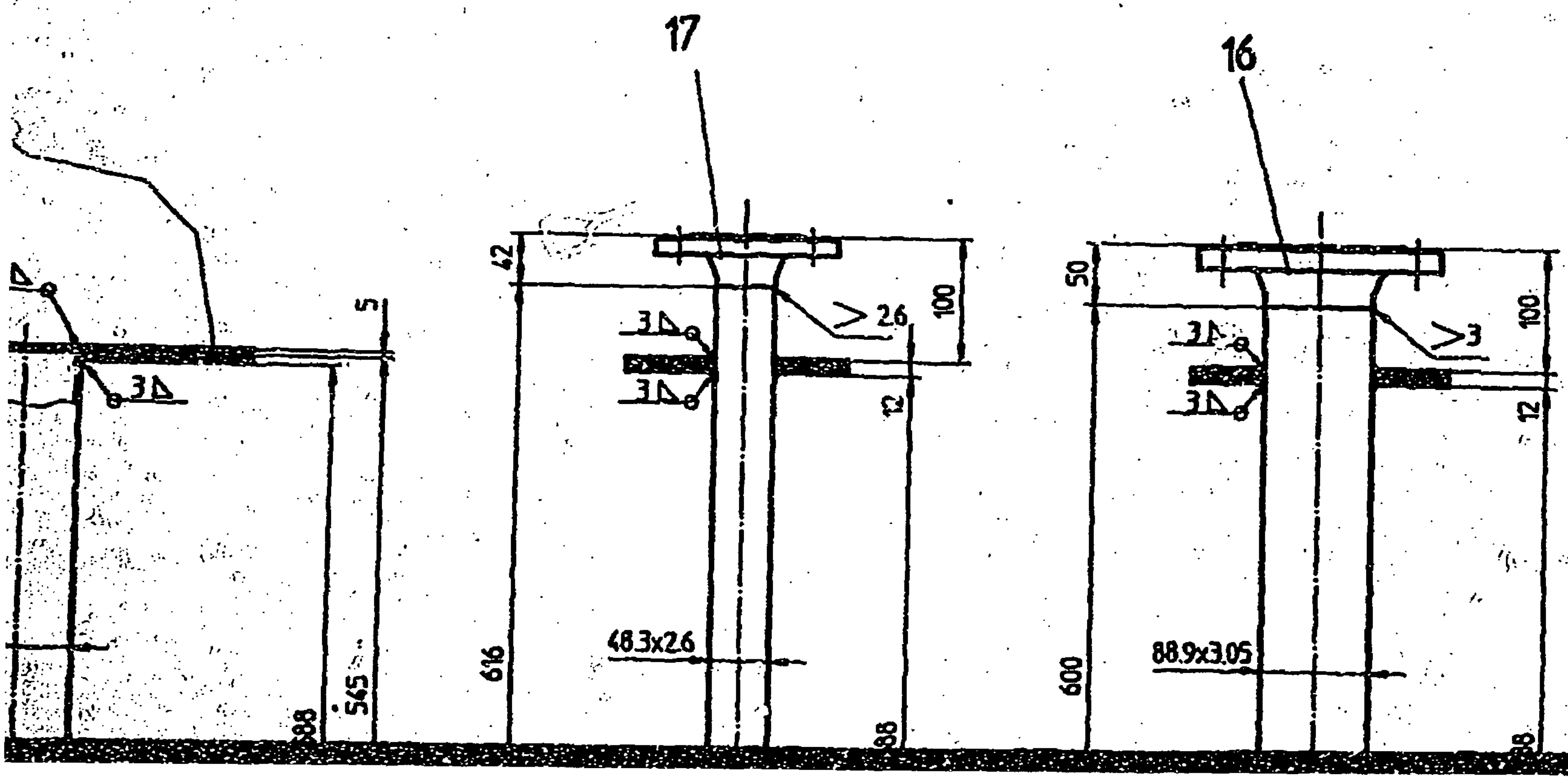
1

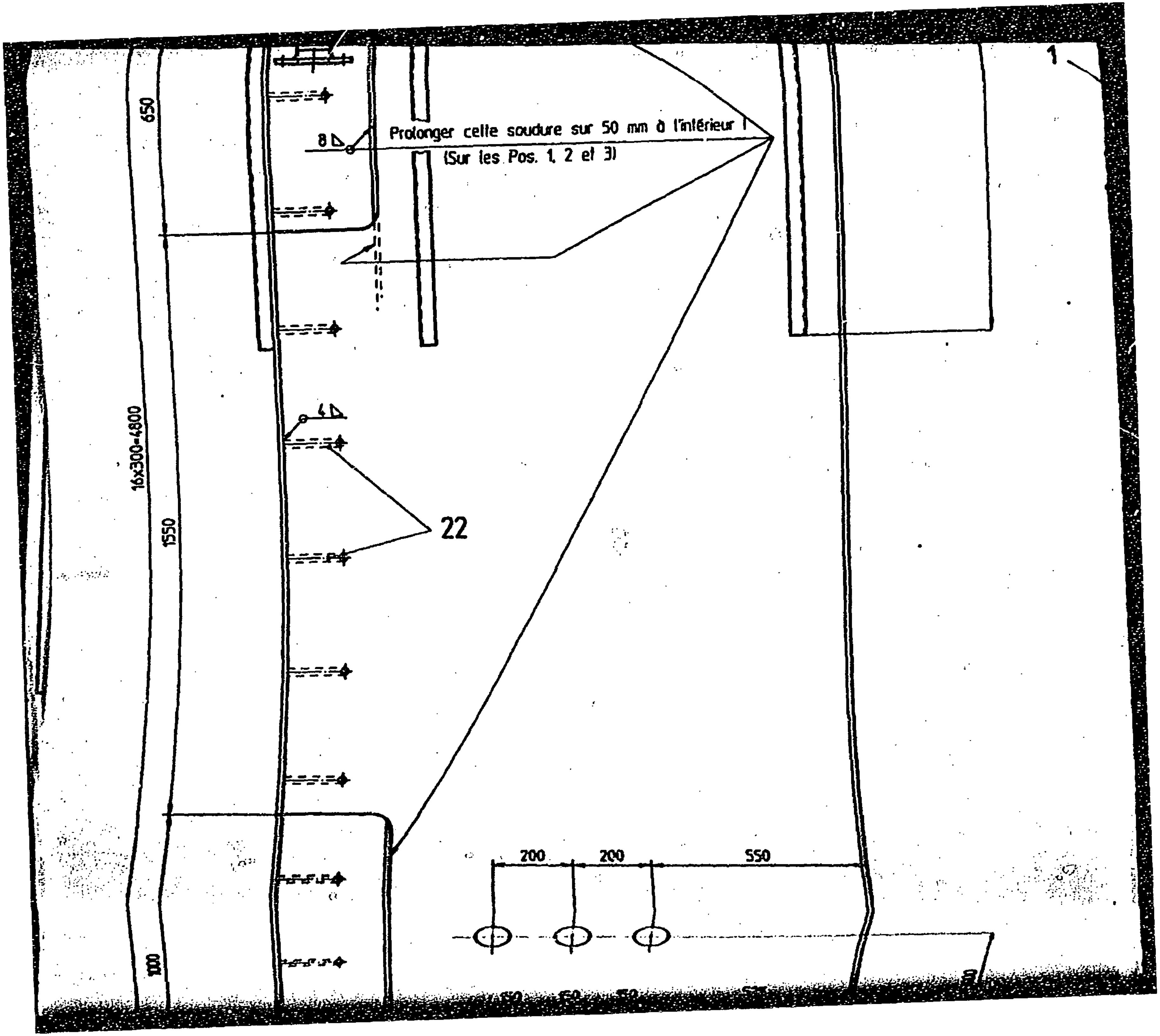


11
12
10
2.6
17
3
16
16
120
13
C-C (1:2.5)
ø48.3x2.6
3
3
Ne pas soudé
17
50
2.6
42
210
3
ø91
B-B (1:2.5)
20
21
69
3
8
C
C

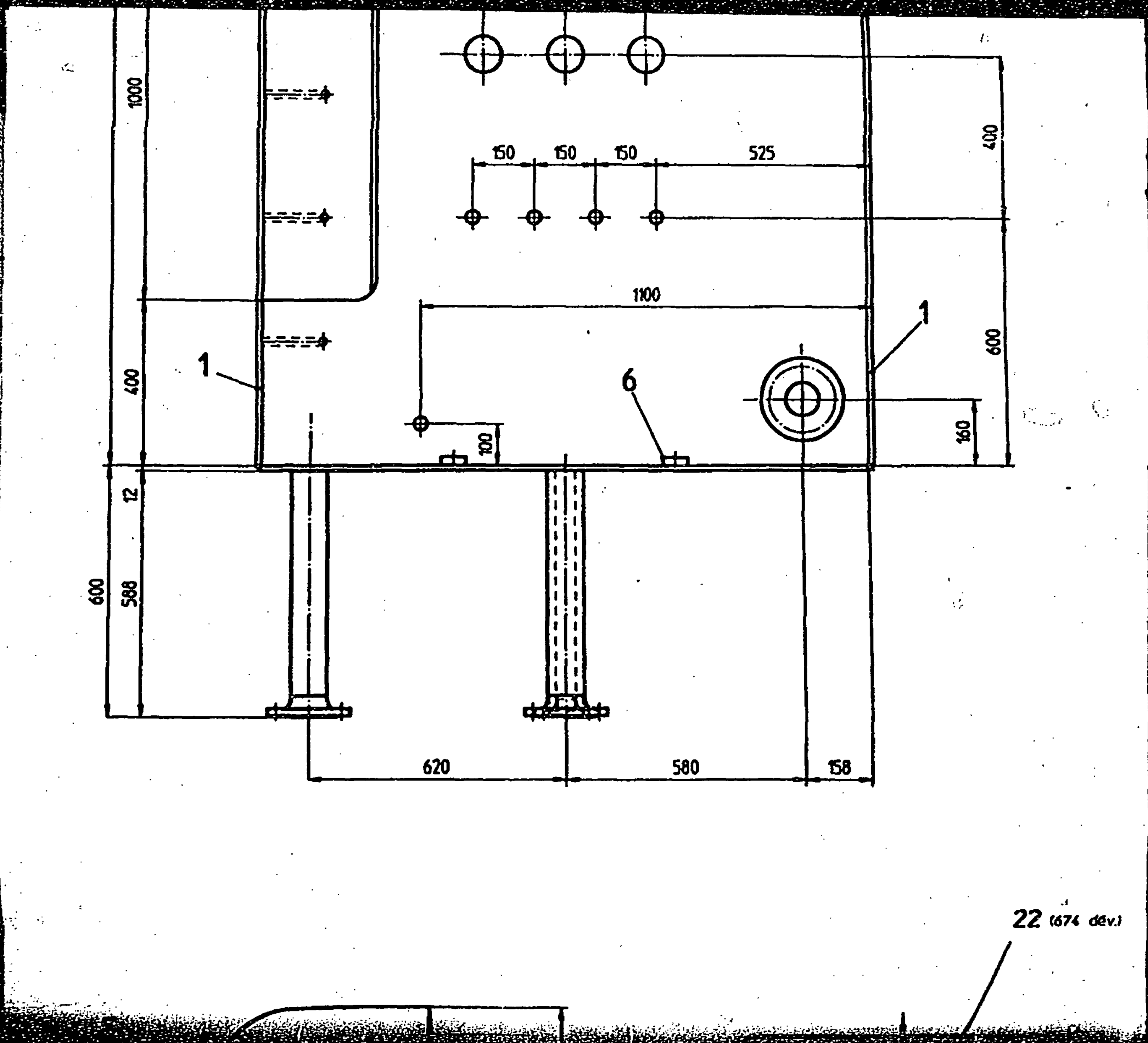
15

les soudures verticales !

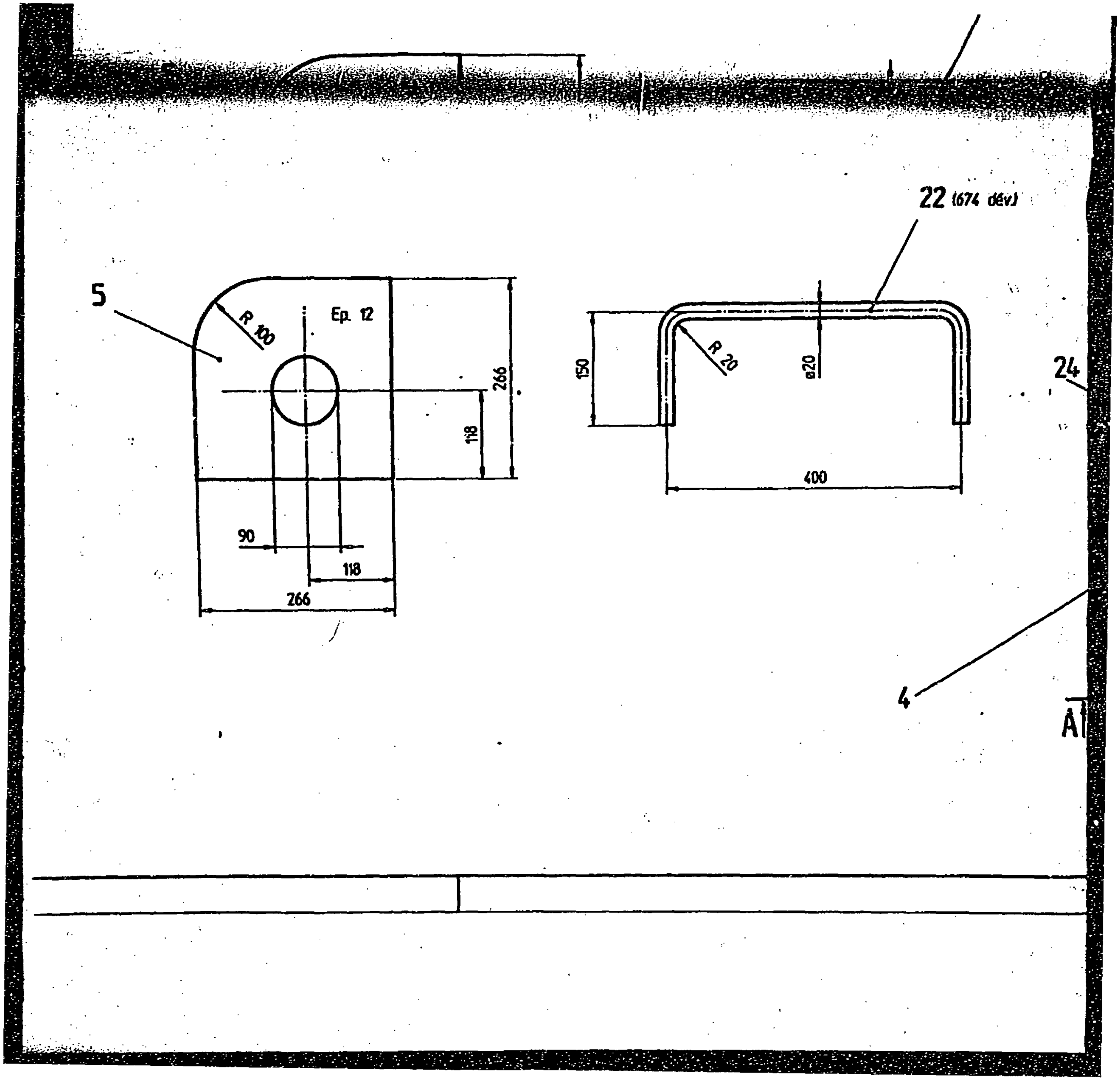




1
650
8
Prolonger cette soudure sur 50 mm à l'intérieur !
(Sur les Pos. 1, 2 et 3)
4
16x300-4800
1550
22
200
200
550
1000



1000
400
12
600
588
1
150
150
150
525
400
1100
600
1
6
100
160
620
580
158
22 (674 dév.)


5
R 100
Ep. 12
266
118
90
118
266
22 (674 dév)
R 20
ø20
150
400
24
4
A

Korrosionsschutz:

Alle Teile Stahl sandgestrahlt und Anstrich Friazinc ZS (2 Anstriche)

Pos. 13-28-29 d'après tolérances HEA 400

~ 4000 kg

Nb. Pces.	Designation Designation	Pos. Item	Profil Size	Long. Lenght	Matiere Material	Certif. Certif.	Observation Remarks	Kg
2	Plaque - Platte	29	290x8	1310	St.37-2			19
1	" "	28	290x3	510	St.37.2			4
4	Plaque - Platte	27	50x20	170	St37-2			5
2	Plaque - Platte	26	290x10	247	St37-2		1 paire !	11
2	Plaque - Platte	25	290x10	347	St37-2		1 paire !	16
3	Plaque - Platte	13	290x8	510	St37-2			14
12	Renfort - Verstärkung	12	144x10	350	St37-2			48
2	Plaque - Platte	11	333d x 5	500	St37-2			13
2	Plaque - Platte	10	333d x 5	350	St37-2			9
2	Traverse - Querträger	9	HEA 400	5100	USt37-1		1 paire !	1275
2	Traverse - Querträger	8	HEA 400	4450	USt37-1		1 paire !	1110
20	Traverse - Querträger	7	HEA 100	1500	USt37-1		10 paires !	500
8	Plaque - Platte	6	84x30	170	St37-2			26
4	Plaque - Platte	5	44X20	170	St37-2			13
1	Support - Auflager	4	754x40	2956	St37-2			200
1	Support - Auflager	3	754x40	2956	St37-2			200
1	Virole - Zarge	2	385x25	4163d	St52-3		ajuster selon fond	320
1	Virole - Zarge	1	390x25	4163d	St52-3		ajuster selon fond	325

Modifications Revisions			
A	mis à jour 7.10.92 Coquoz	D	
B	ajouté Pos. 13-25-26-27 19.10.92	E	
C	ajouté Pos. 28-29 26.10.92	F	

Echelle-Scale: 1:20 1:2

Dessine-Drawn: 22.09.92 Ben

Controle-Checked: [signature]

Liste de pieces sep.,p. / Sep. Material List,p.

No d'affaire: 47185

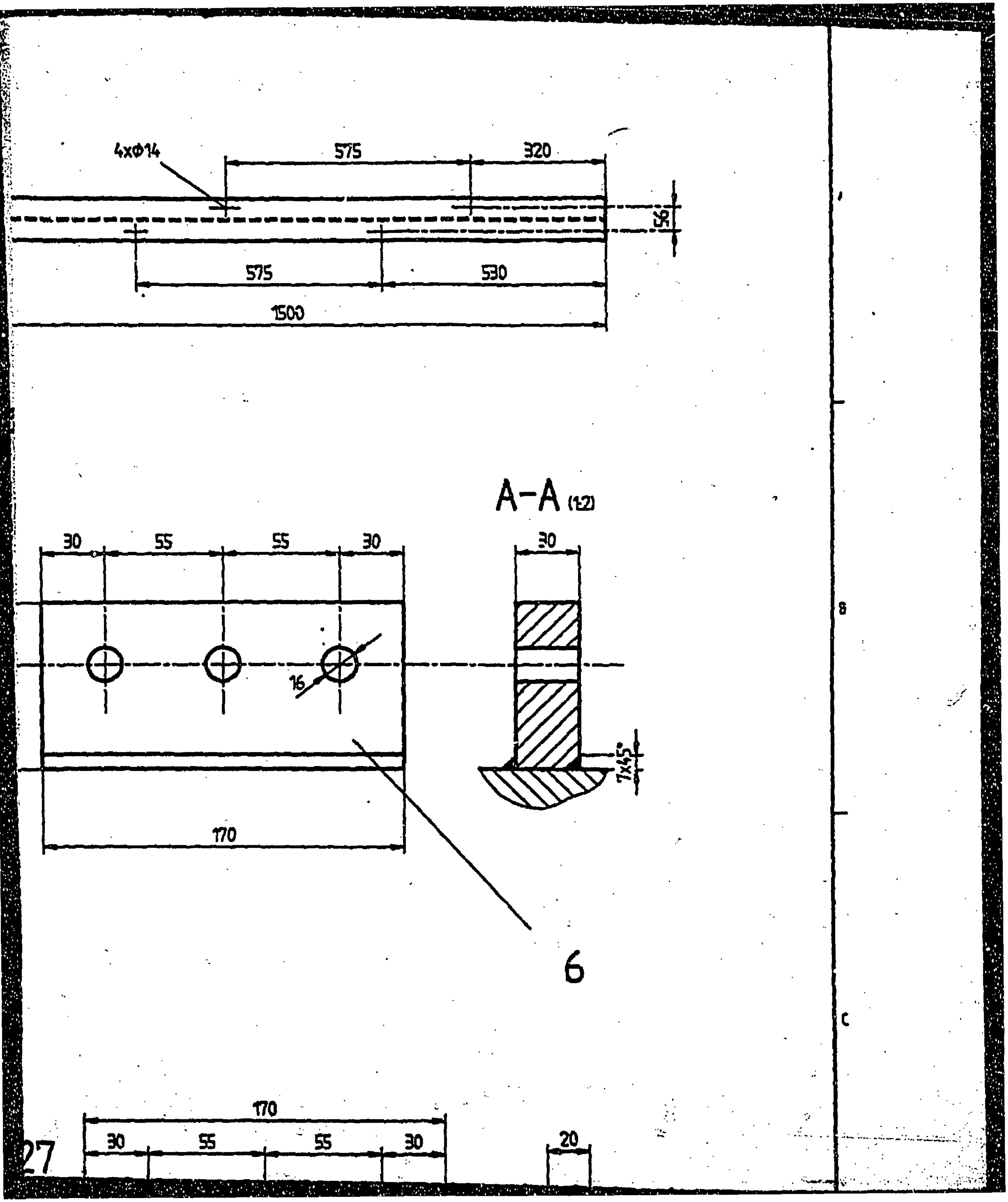
Anlage : PANDA
Baugruppe : Grossbehälter

IC POOL : Befestigung-Details
IC POOL : fixation-détails

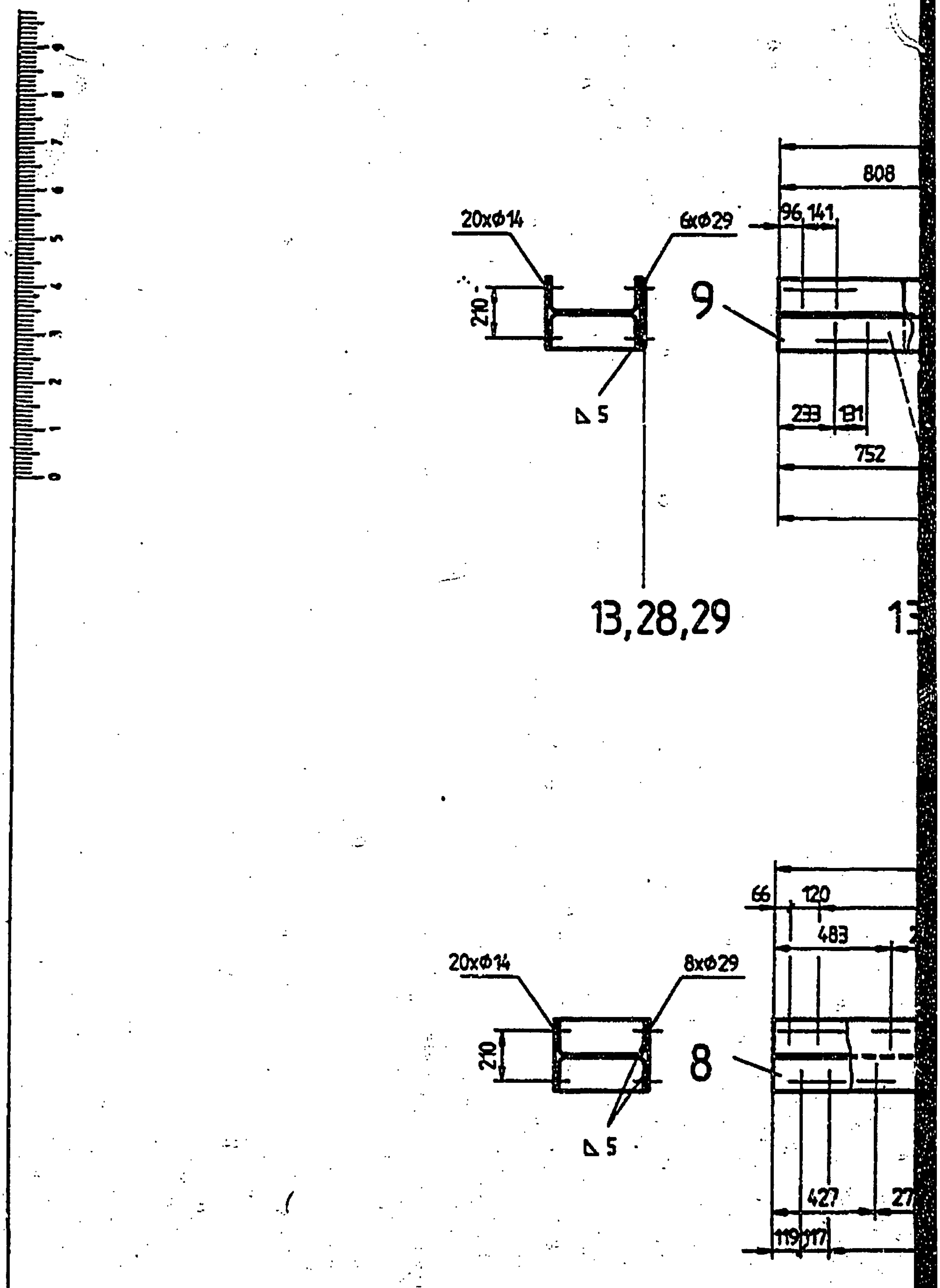
1-290162c

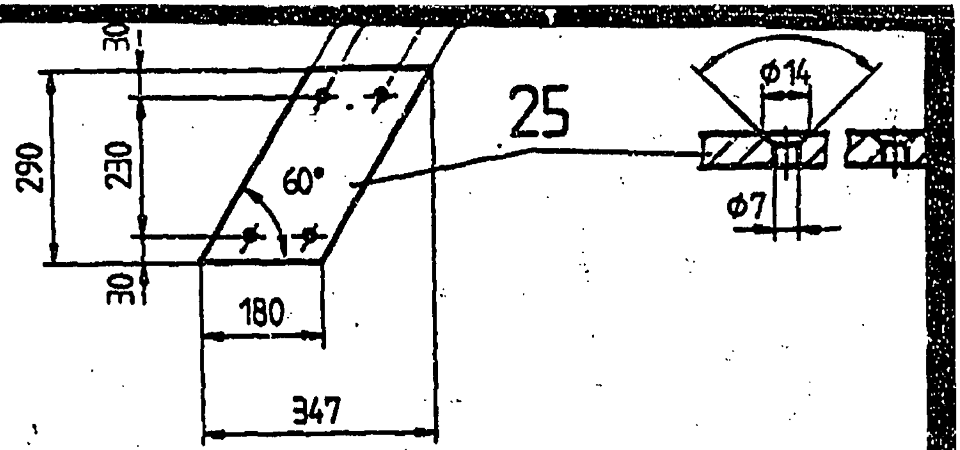
No. de dessin-Dwg. No.: 164A3526-13c

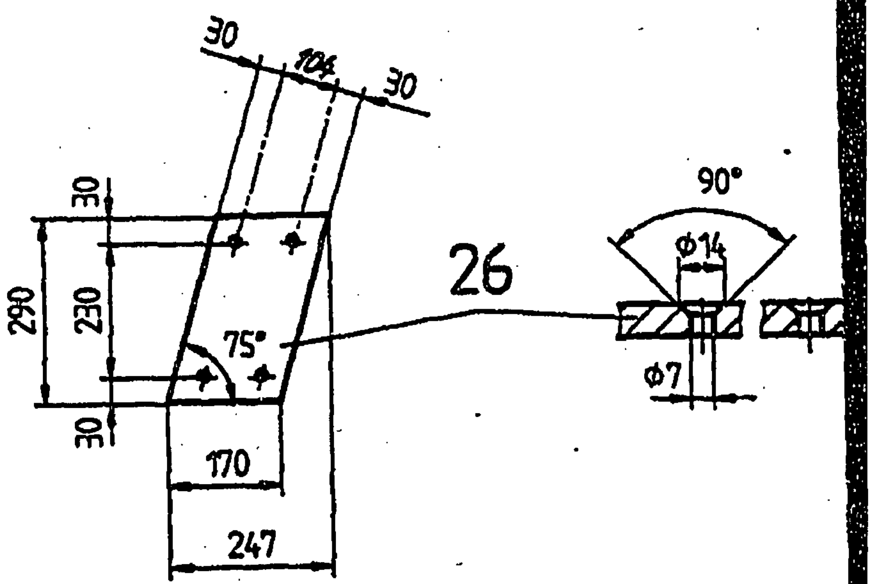
GIOVANOLA
CASE POSTALE 271
CH-1870 MONTHEY
TEL. (025) 73 21 11
FAX. (025) 71 89 52



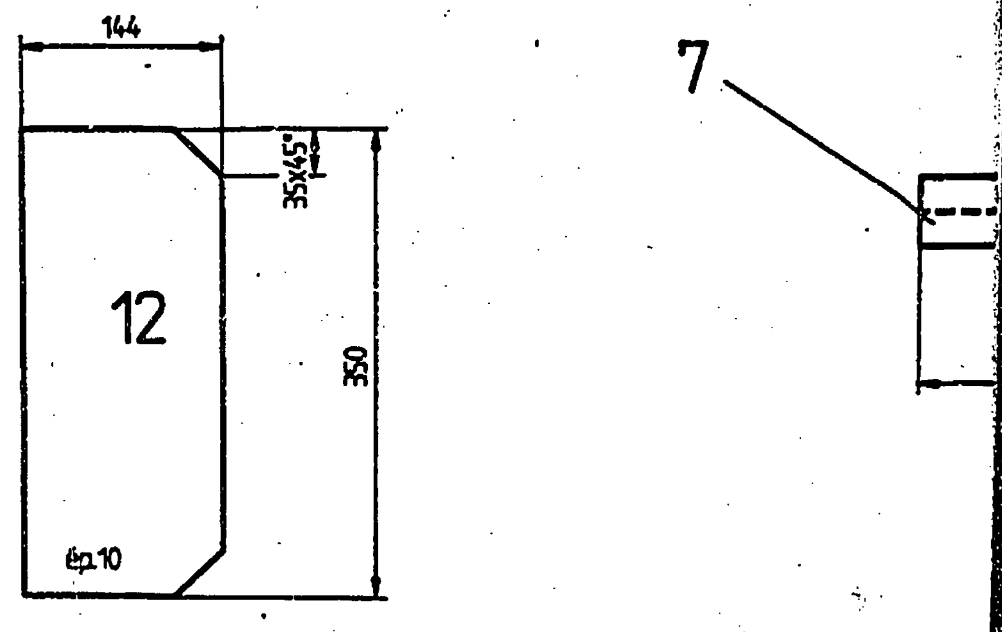
4xΦ14
575
320
56
575
530
1500
A–A (1:2)
30
55
55
30
16
170
30
7x45°
6
170
30
55
55
30
20
27
B
C


808
96 141
20xΦ14
6xΦ29
210
9
Δ 5
233
131
752
13,28,29
66
120
483
20xΦ14
8xΦ29
210
8
Δ 5
427
119
117

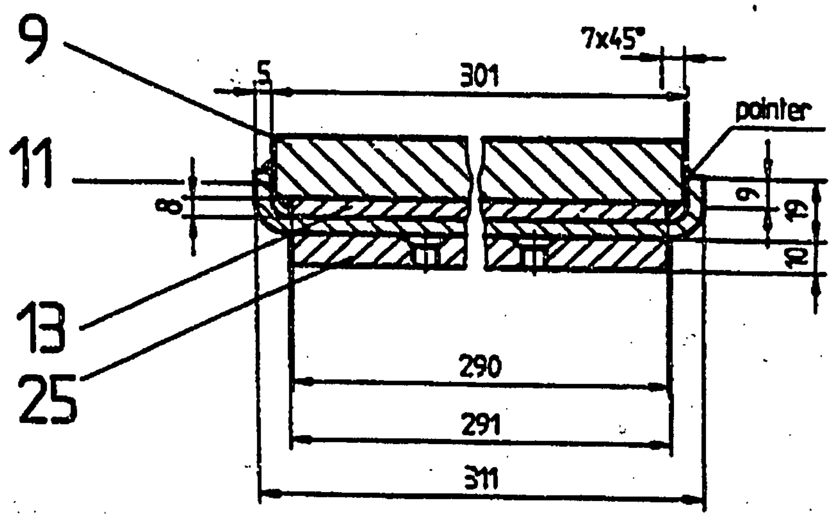

25
30
290
230
60°
30
180
347
Φ14
Φ7

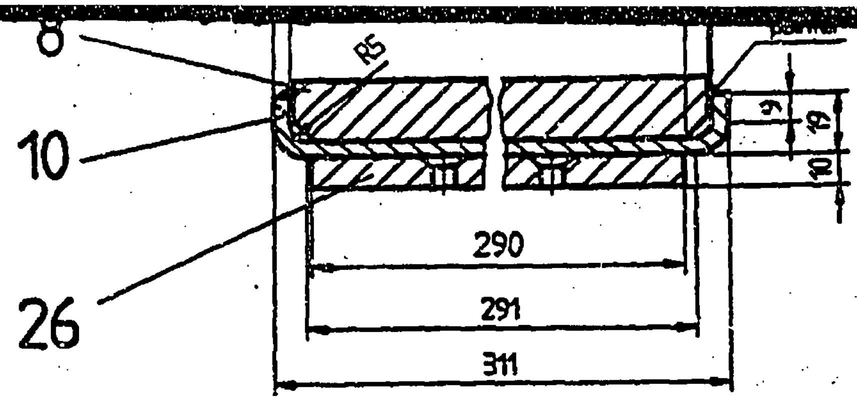

26
30
104
30
30
290
230
75°
30
170
247
90°
Φ14
Φ7

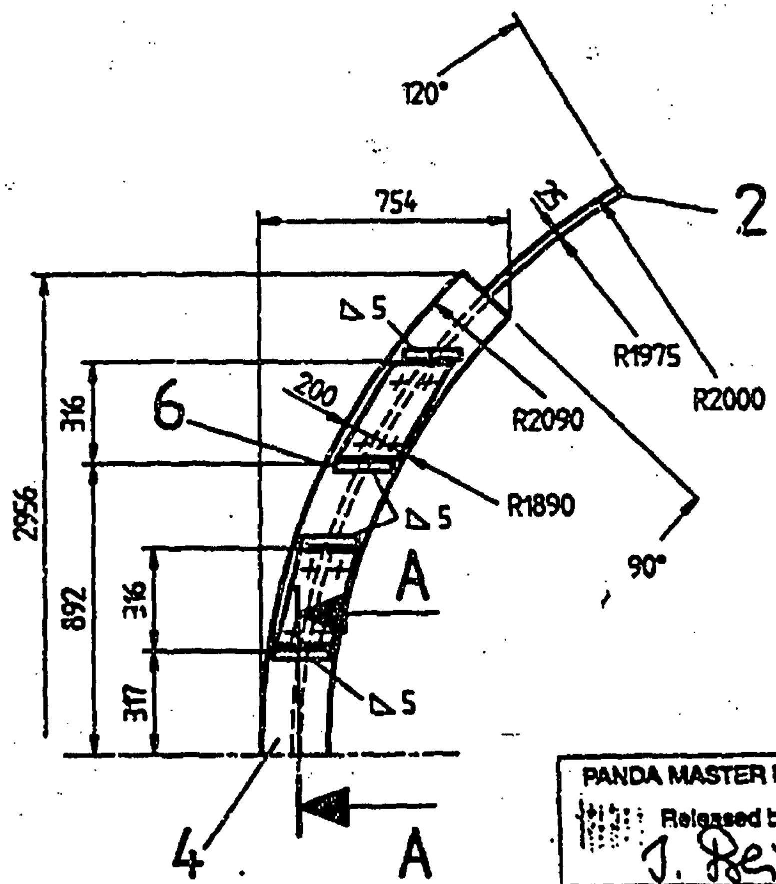
1 | 2


144
35x45°
12
350
ép.10
7
30
84

C-C (1:2)


9
7x45°
5
301
pointer
11
8
9
19
10
13
25
290
291
311





PANDA MASTER DOCUMENT

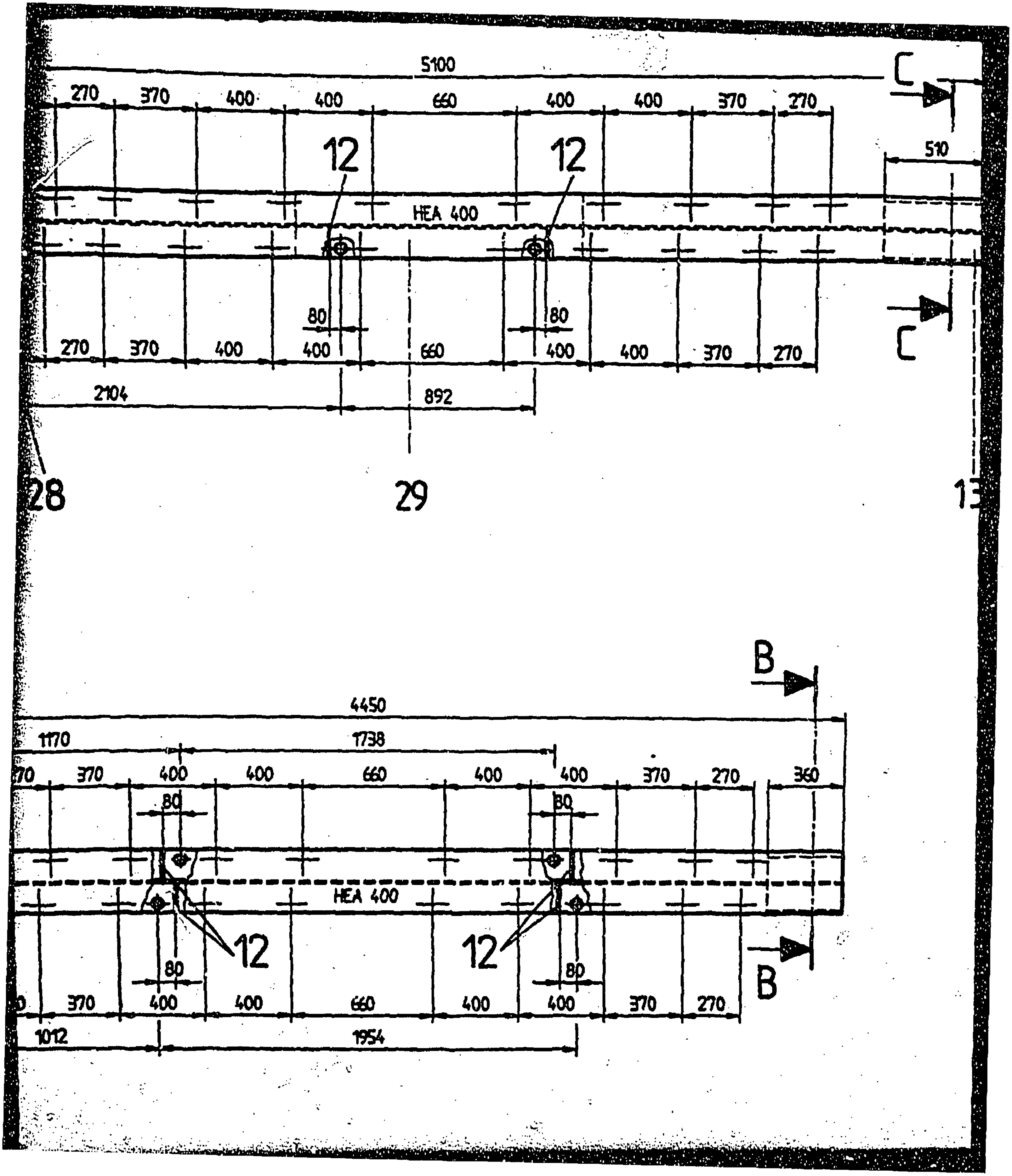
Released by:

PSI PANDA PM

Date 2-III-95

GE Site CA Representative

Date 2 Mar 95


5100
270
370
400
400
660
400
400
370
270
C
510
12
12
HEA 400
80
80
270
370
400
400
660
400
400
370
270
C
2104
892
28
29
13
B
4450
1170
1738
370
400
400
660
400
400
370
270
360
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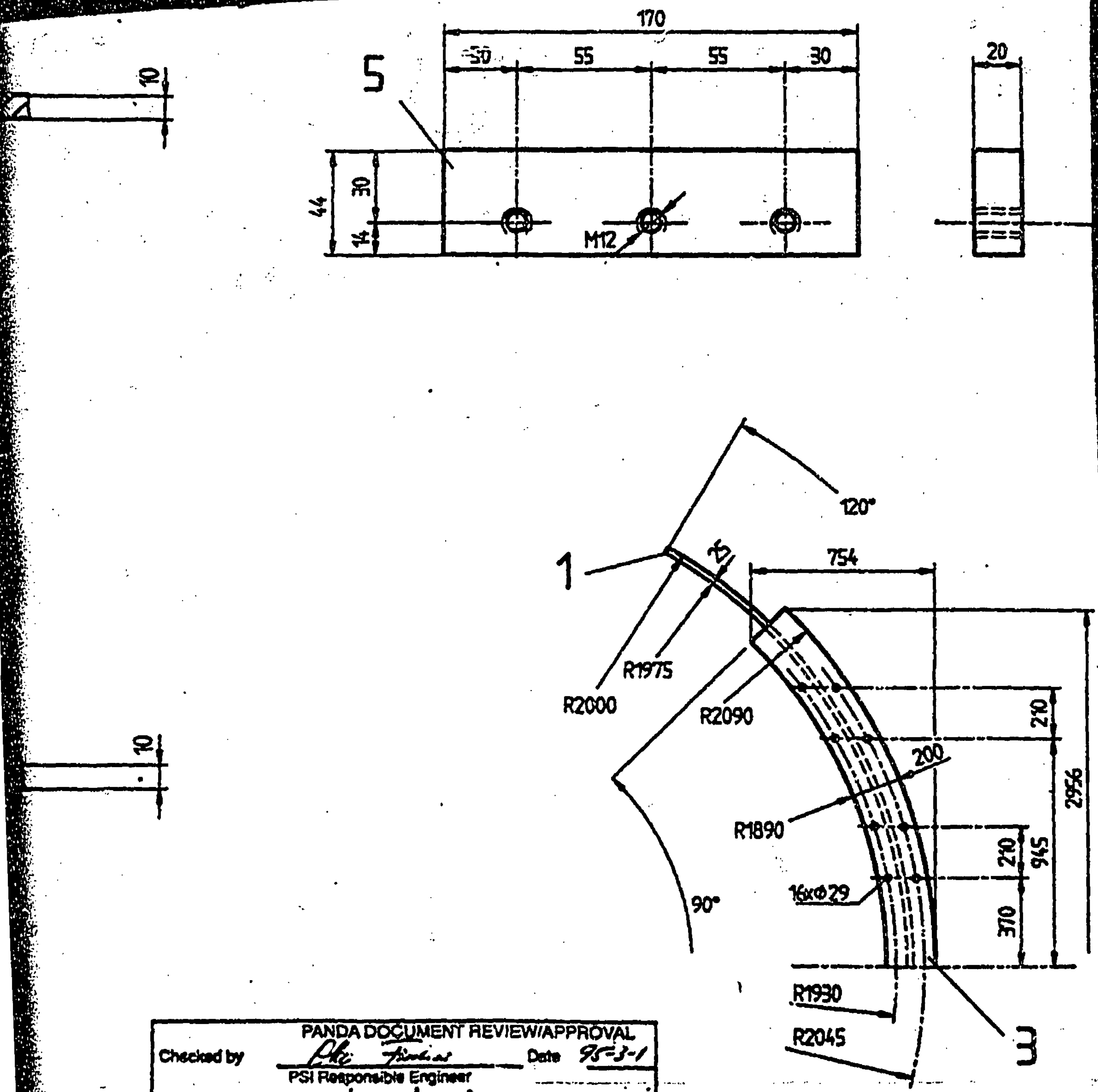
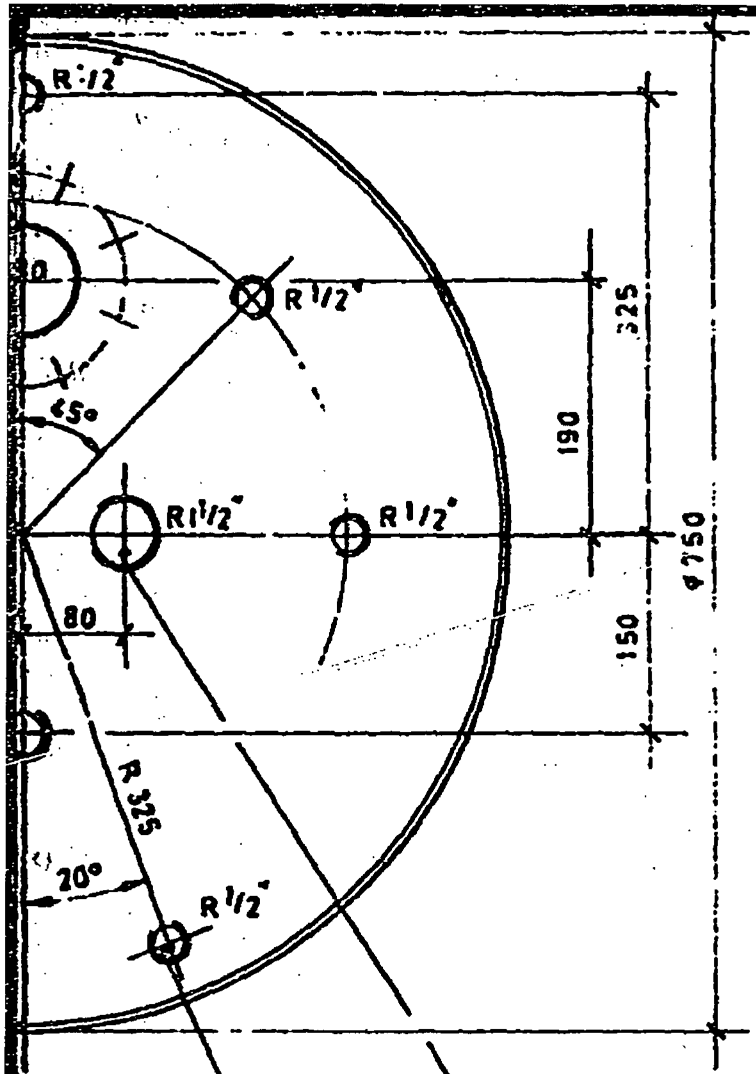
400
370
270
1012
1954



PANDA DOCUMENT REVIEW/APPROVAL

Checked by	[signature] PSI Responsible Engineer	Date	95-3-1
Reviewed by	[signature] GE Site QA Representative	Date	1 Mar 95
~~Verified by~~ Approved CAS 2.3.95	[signature] PSI PANDA PM	Date	1-III-95
Approved by	[signature] GE Project Manager	Date	2 Mar 95



19,55 46,57

P4, P5
P4
P4
U3

P5[4] Anwendung nur für einseitig geschweisste Längsnähte

Anlage: PANDA
Baugruppe: Kondensatoren

Isolation condenser (Ic)
0-290 130

Index	Änderung	Datum	Visum
E			
D			
C	Aend. Pos. 54, 58, 59	28.10.92	
B	Div. Kundenänd.	13.10.92	
A	Div. Kundenänderungen	23.9.92	

Zugehörende Zeichnungen: 1R-24070-1

Kondensator spez. Typ IC

Massstab		Datum	Visum
1:5	Gez	1.9.92	
1:2	Gepr		
10:1	Ges		

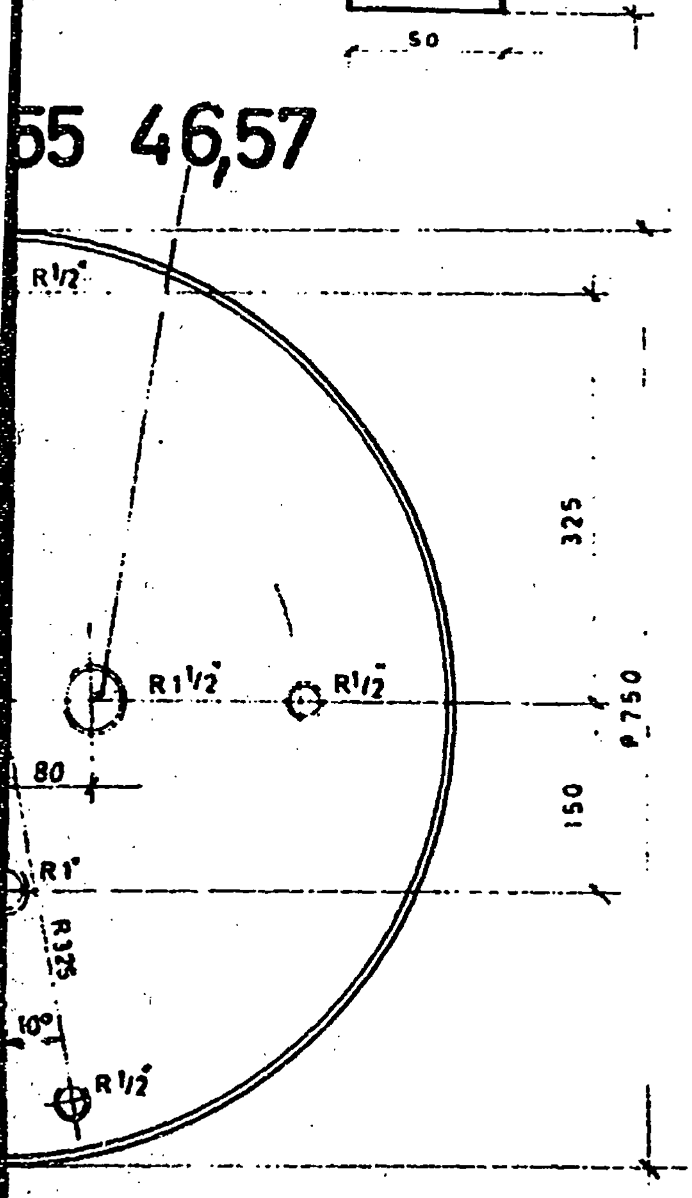
jäggi bern — HEIZUNG LÜFTUNG KLIMA / ENERGIE UMWELT KÄLTE / VERFAHRENSTECHNIK

Zeichnungs-Nr.: 0R-24070 Index: C

12 mm dick

5,63 m² | ca. 980 kg

55 46,57



Gew. Bohrungen 1/2", 1", 1 1/2" durchgehend

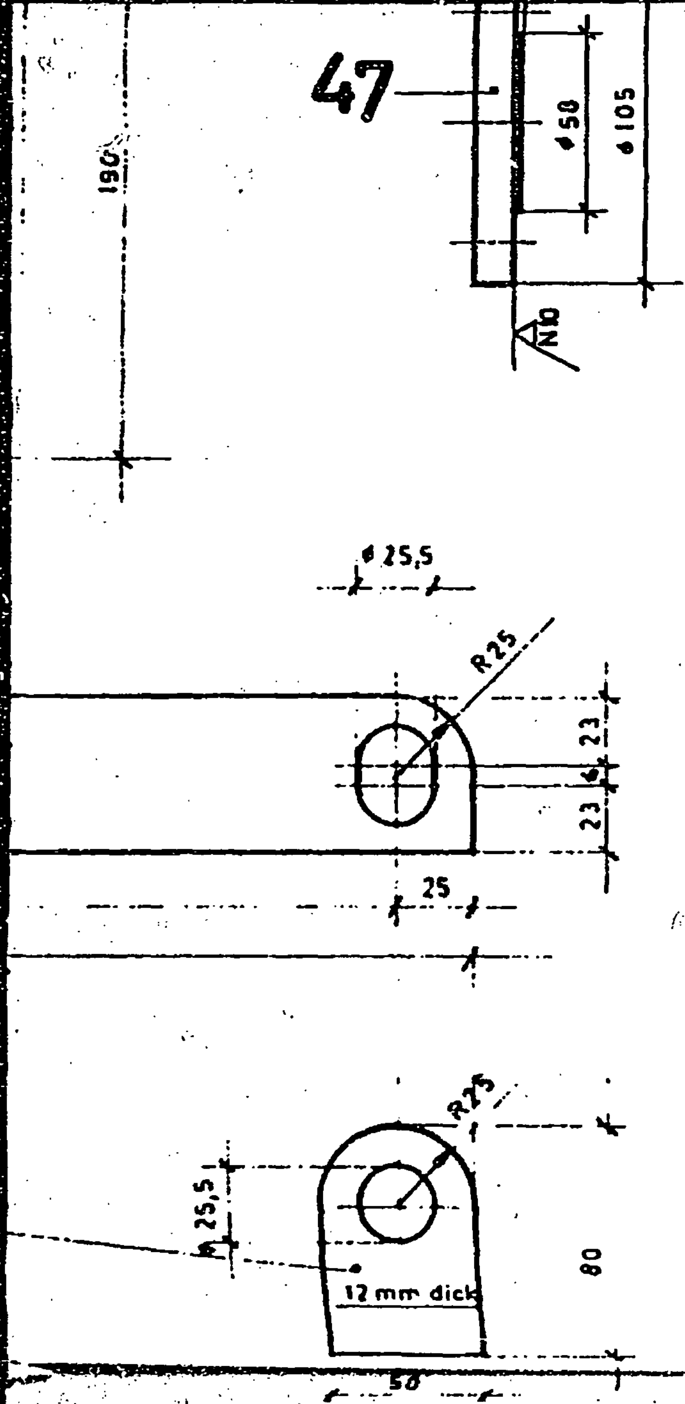
PAUL SCHERRER INSTITUT VILLIGEN

Versuchsanlage PANDA

338
5,63
ca. 980
10
10
13
-10/+200
10/+200
0
3?80
SVDB
CH
SVDB / Kunde
SVDB / Kunde

keine

6,7,8



PANDA DOCUMENT REVIEW/APPROVAL

Checked by	Otto Fischer (signature) — PSI Responsible Engineer	Date	95-3-1
Reviewed by	(signature) — GE Site QA Representative	Date	1 Mar 95
Approval Verified by (CM 2-3-95)	J. Dzięgs (signature) — PSI PANDA PM	Date	1 Mar 95
Approved by	(signature) — GE Project Manager	Date	2 Mar 95

jäggi bern

Jäggi AG Bern
Wangenstrasse 102
CH 3018 Bern

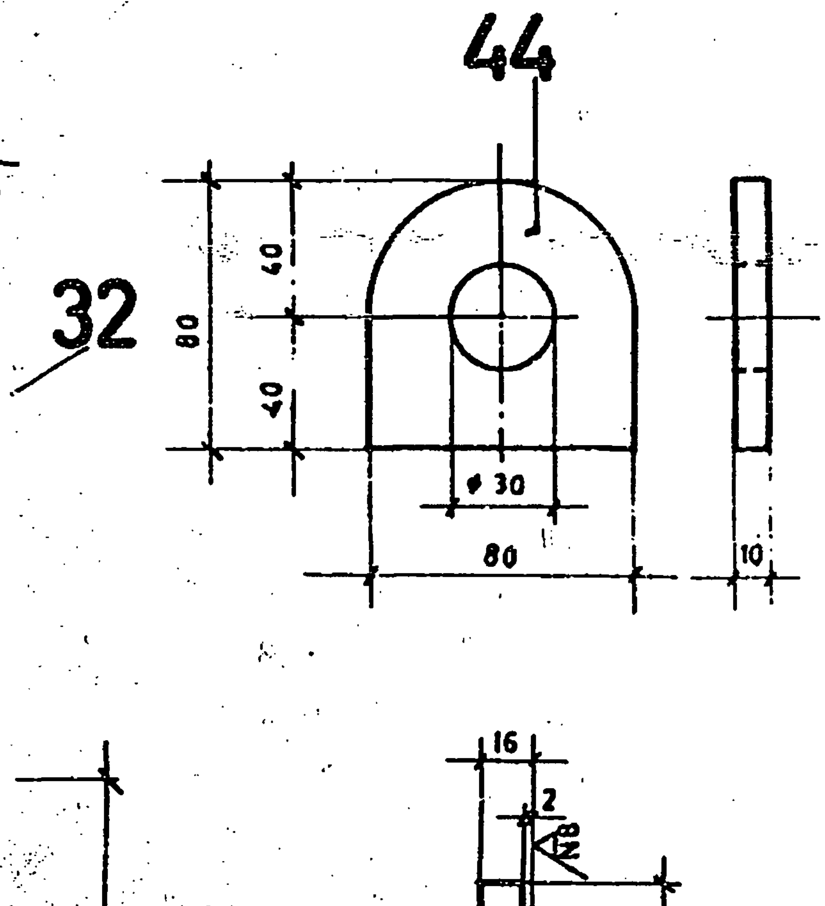
Auftrags Nr / Order No. / N° ordre No	Fabr. Nr / Serial No / Fabrication No	Baujahr / Year Built / Année de Fabr.
61.6.92 4227	2134	1992

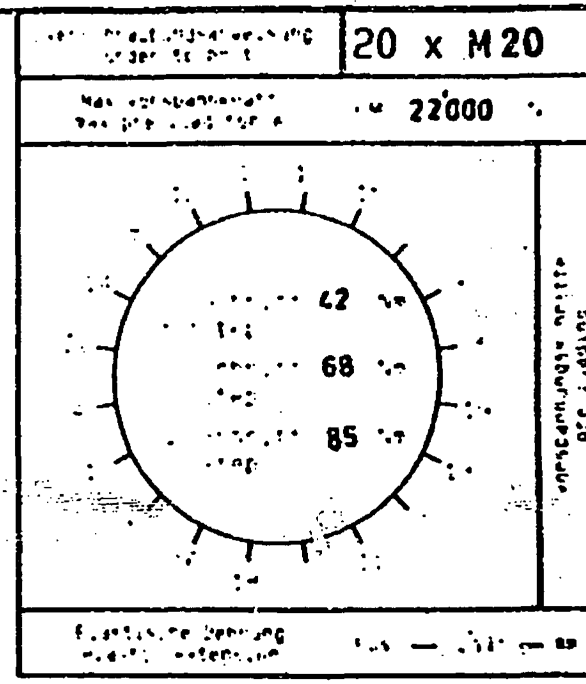
Besteller Nr / Order No. Purchaser / Commande No	Position Nr / Item No / Position No
16609	

	Rohrseite / Tubeside / Côté Tubes	Mantelseite / Shellside / Côté Manteau	Doppelmantel / Doublejacket / Enveloppe cyl
Zul. Betriebsüberdruck / Max. working pressure / Pression de serv. max (bar)	10	—	—
Zul. Betriebstemp. / Max. working temp. / Temp. de service max	-10/+200	—	—
Inhalt / Volume / Volume	338	—	—
Medium / Medium / Fluide	—	—	—
Werkstoff / Material / Materiaux	1,4571	—	—

Fläche / Surface Area / Surface d'echangeur	Leergewicht / Weight empty / Poids à vide
5,63 m²	ca. 980 kg

5-4657





PANDA MASTER DOCUMENT

Released by:

J. Dreier

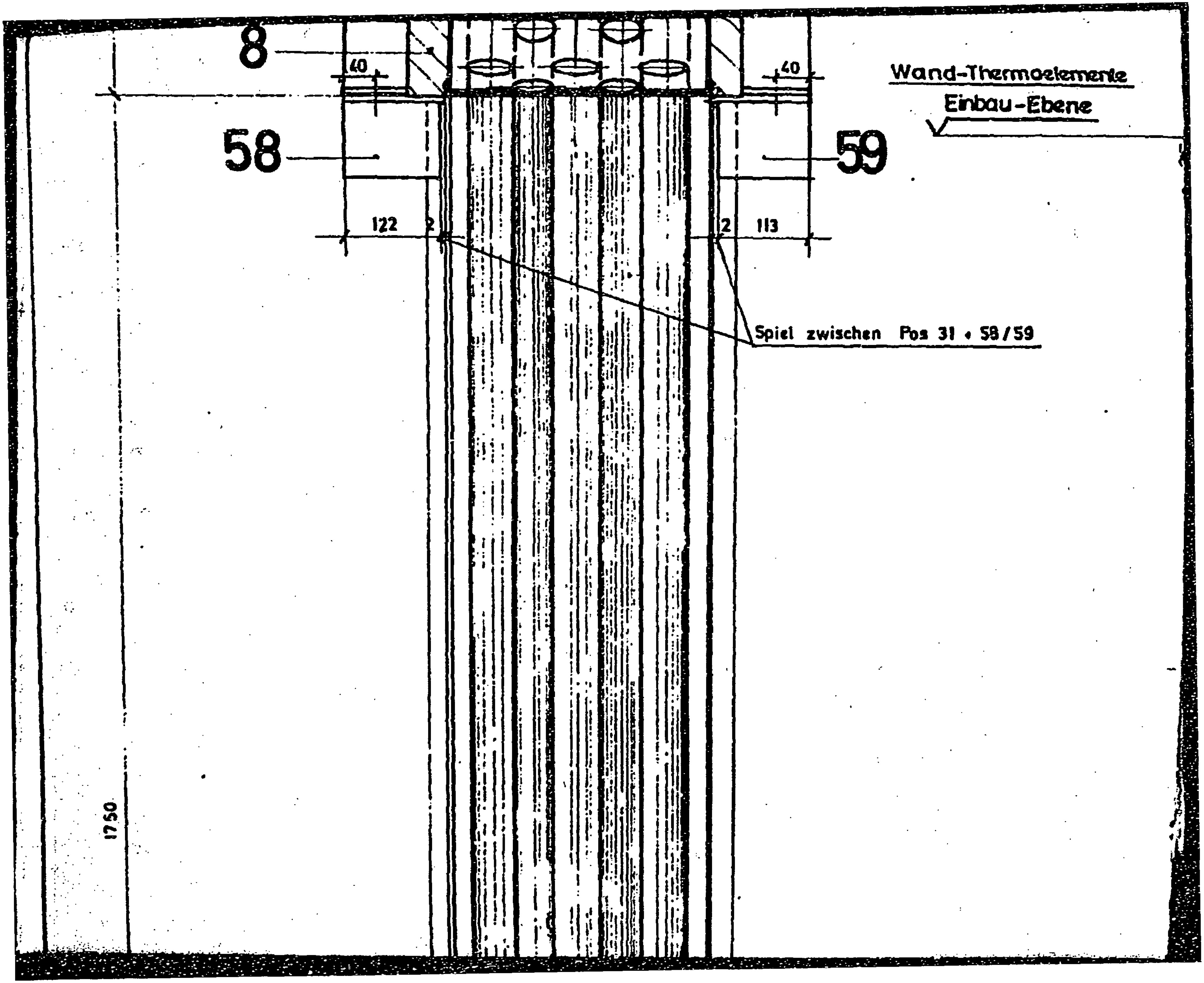
PSI PANDA PM

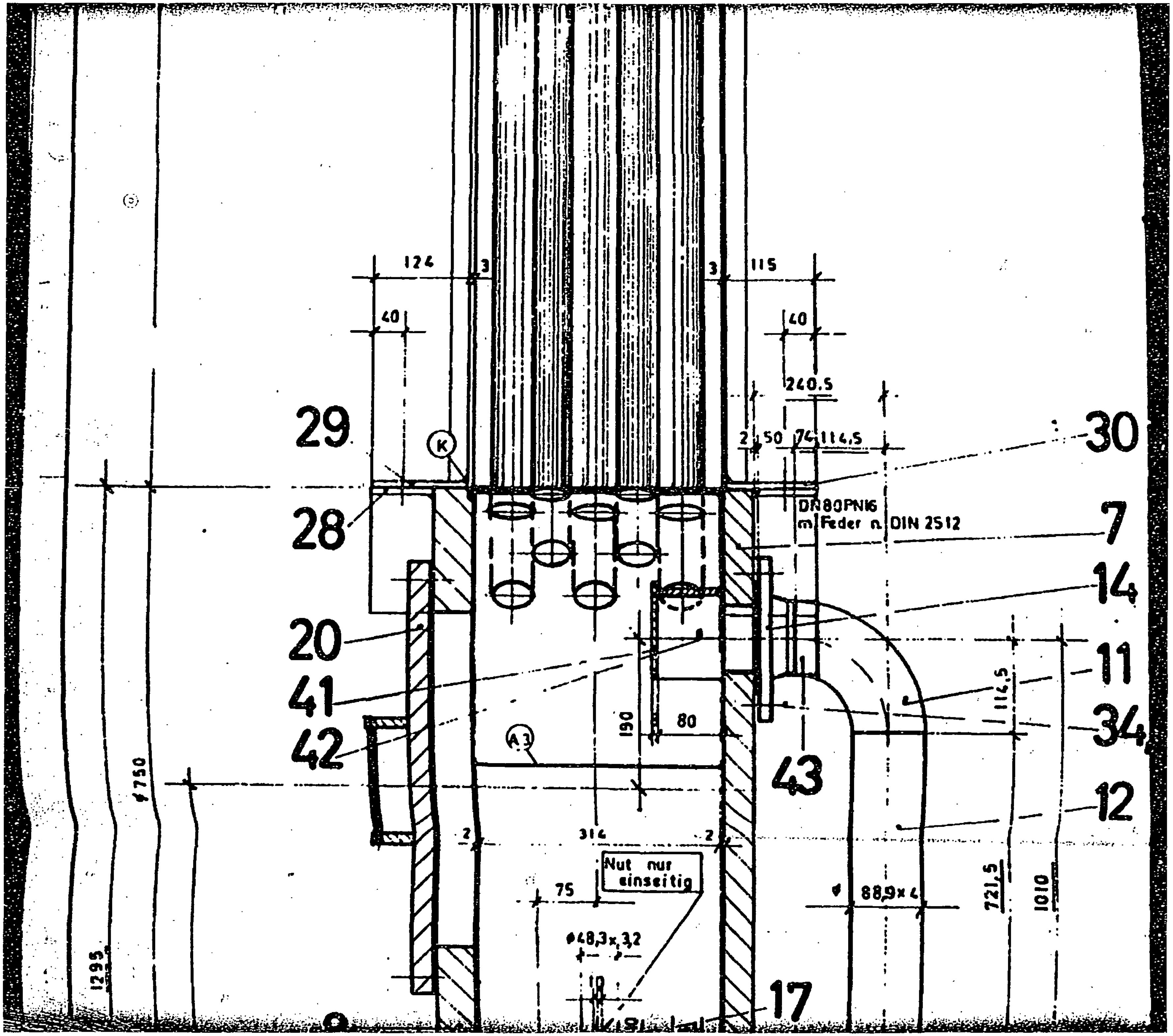
Date 2-III-95

GE Site QA Representative

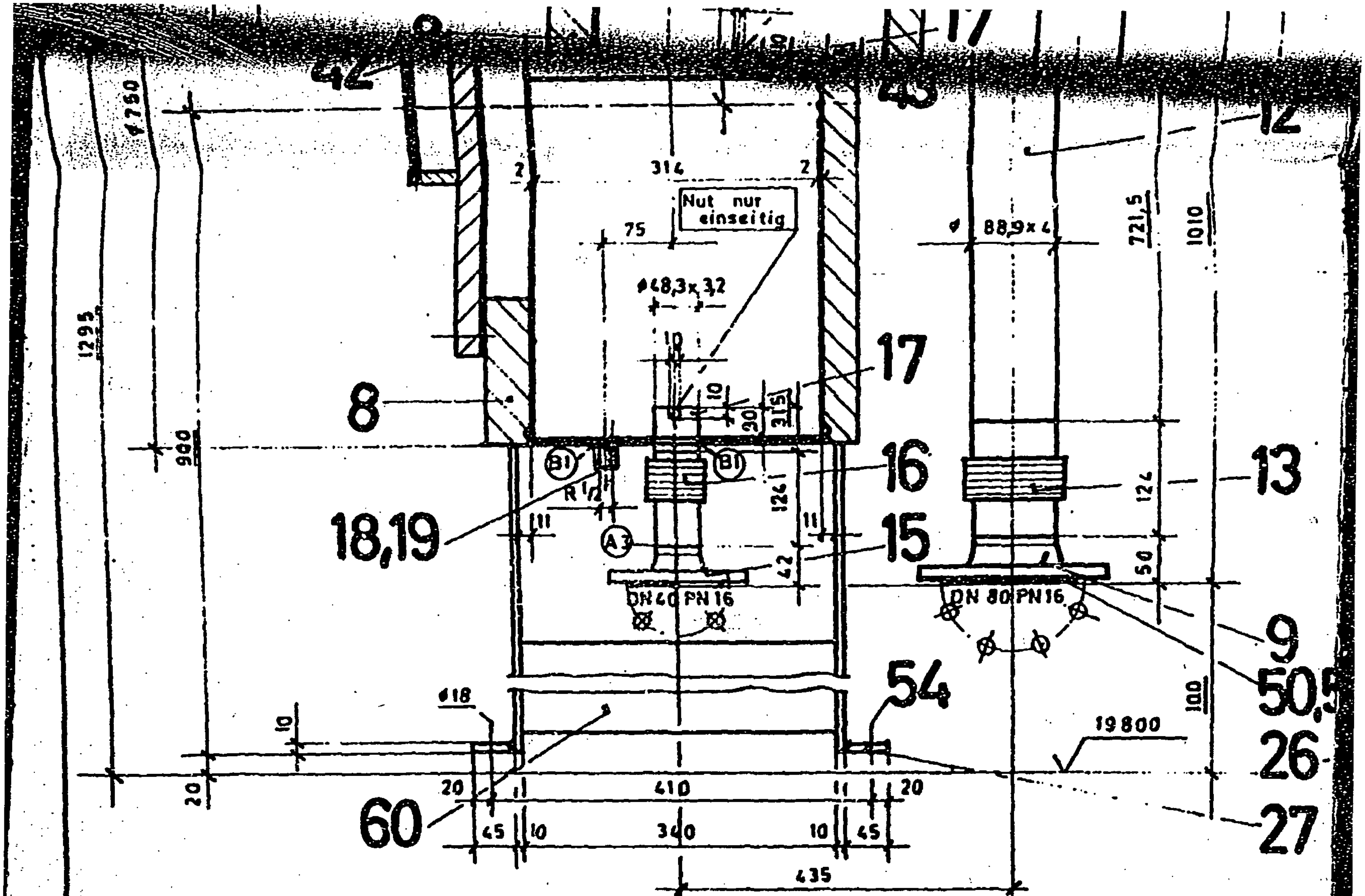
A Chiers

Date 2 Mar 95

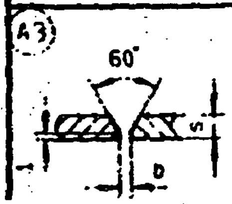

8
40
40
Wand-Thermoelemente
Einbau-Ebene
58
59
122
2
2
113
Spiel zwischen Pos 31 + 58/59
1750



124
3
3
115
40
40
240,5
29
K
2
50
74
114,5
30
28
DN80PN16
m. Feder n. DIN 2512
7
14
20
11
41
114,5
34
42
190
80
A3
43
ø750
12
2
314
2
Nut nur einseitig
75
ø
88,9×4
721,5
1010
ø48,3×3,2
10
1295
17

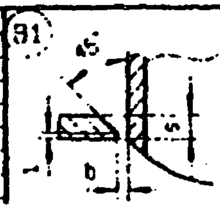


A3



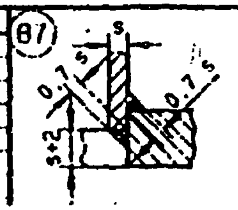
s	b
<2	0
>2 <3	1
>3 <4	1,5
>4 <5	2
>5 <6	2
>6 <8	2
>8 <10	2

B1



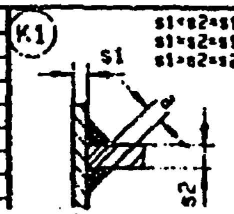
s	b
<2	0
>2 <3	1
>3 <4	1,5
>4 <5	2
>5 <6	2
>6 <8	2
>8 <10	2

B7



s	0,7 s
2	1,4
3	2,1
4	2,8
6	4,2
8	5,6
10	7
12	8,4

K1



s1<s2=s1
s1=s2=s1
s1>s2=s2

s1/s2	a
2	2,4
4	2,8
5	3,5
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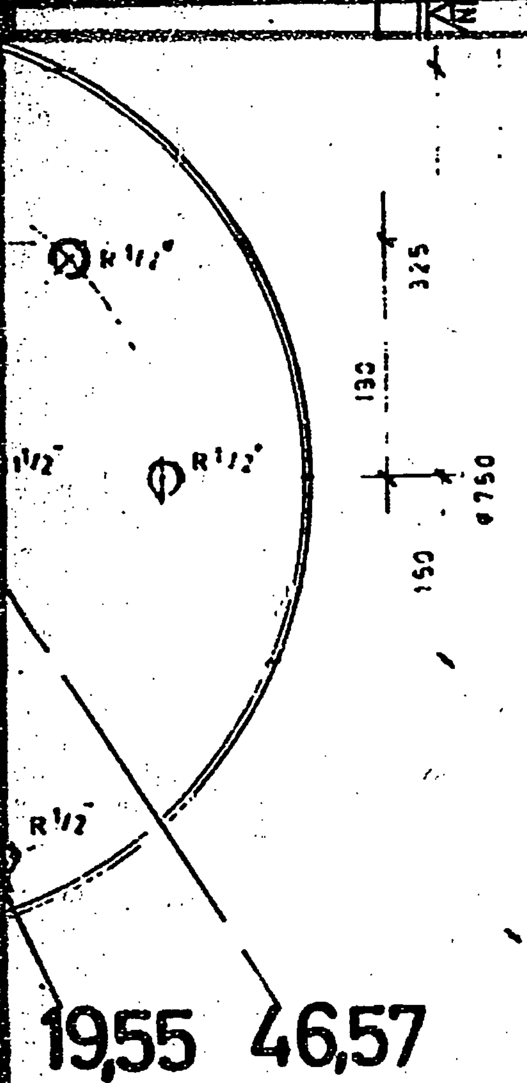
10	7
12	8,4



P 4
U 3

PS[4] Anwendung nur für einseitig geschwersste Längsnähte

Anlage: PANDA
Baugruppe: Kondensatoren

Passive containment cooler(Pcc)

0-290 132

1R-24071-1

E			
D			
C	Aend. Pos. 54, 58, 59	28.10.92	
B	Div. Kundenänd.	13.10.92	
A	Div. Kundenänderungen	23.9.92	

Kondensator spez. Typ PCC

jäggi bern

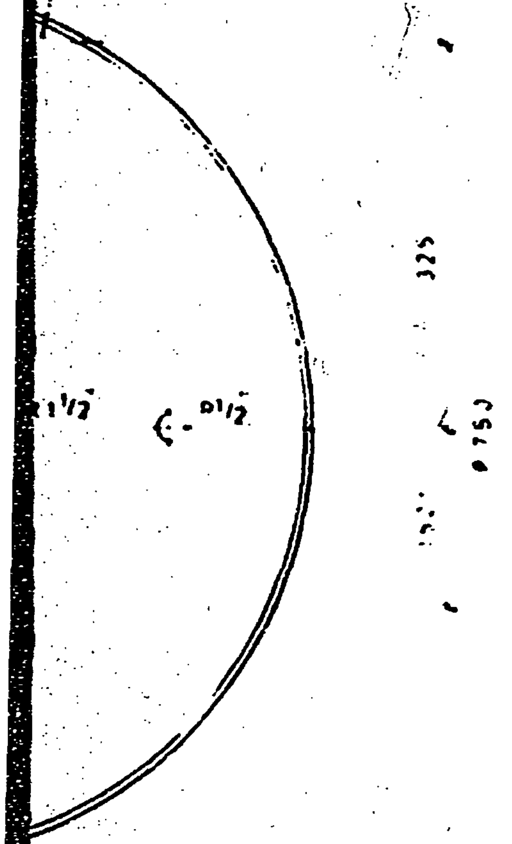
0R-24071 C

12 mm 1:..

5,63 m²

ca. 950 kg

6,57



Bohrungen 1/2", 1", 1½" durchgehend

PAUL SCHERRER INSTITUT VILLIGEN

Versuchsanlage PANDA

272
5,63
ca. 950
10
10
13
-10/+200
-10/+200
0
2720
SVDB
CH
SVDB / Kunde
SVDB / Kunde

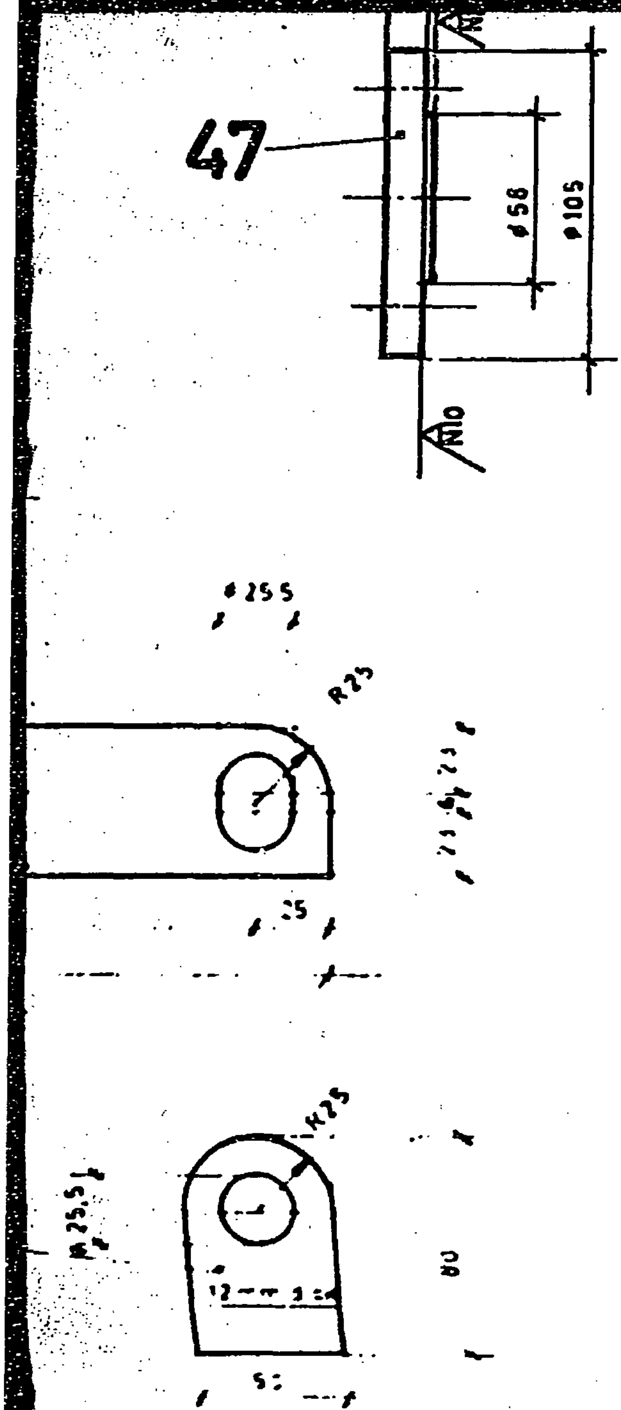
CrNiMo 1812 X

19 12 3n CA 26 X

keine

6,7,8

P4, P5*



PANDA DOCUMENT REVIEW/APPROVAL

Checked by	PSI Responsible Engineer	Date	95-3-1
Reviewed by	GE Site QA Representative	Date	1 Mar 95
Approved by	PSI PANDA PM	Date	1-III-95
Approved by	GE Project Manager	Date	2 Mar 95

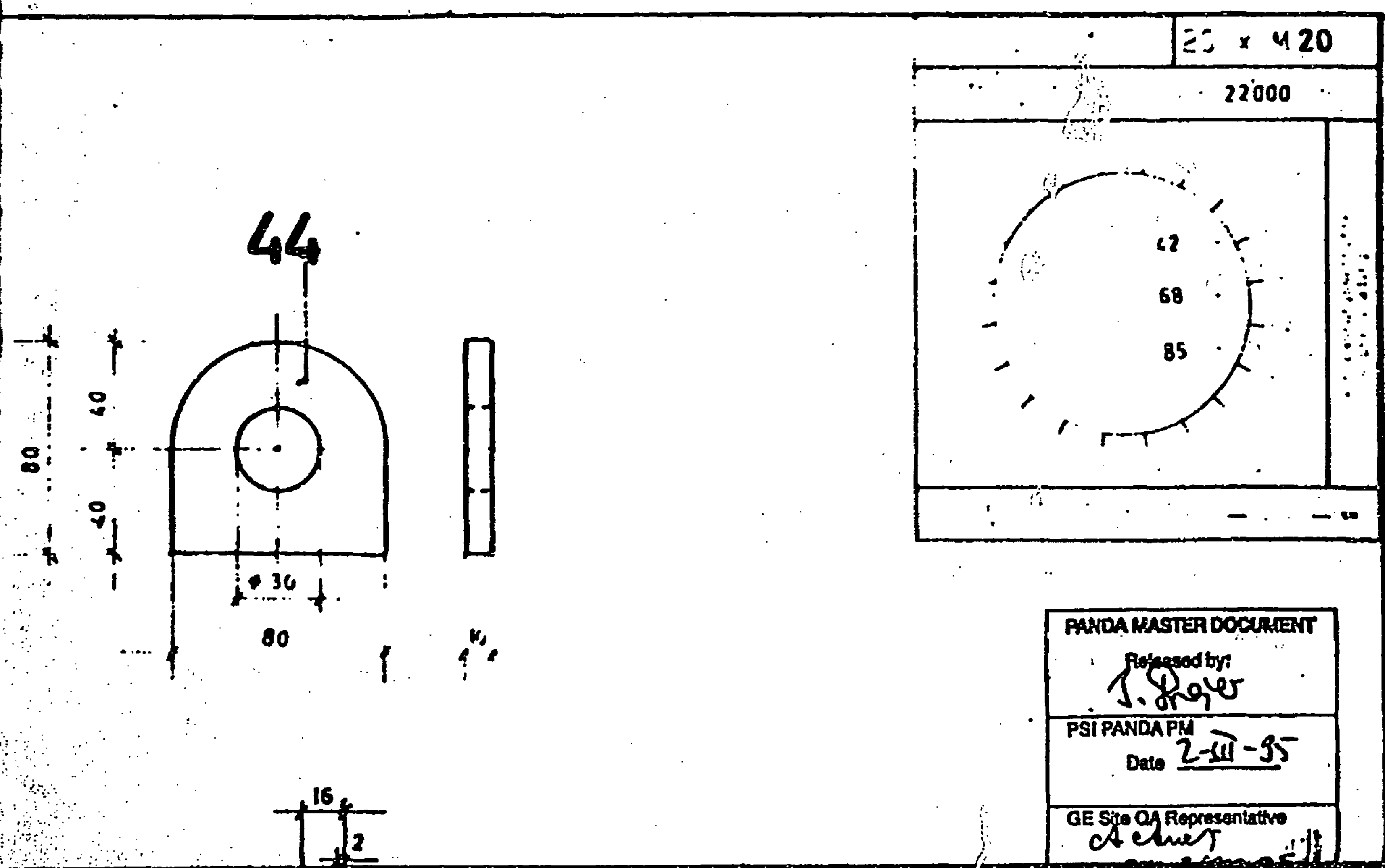
jäggi bern

61 6 92 4228	2135-2136-2137	1992
16609		

	10	—	—
	-10/+200	—	—
	272	—	—
	—	—	—
	1,4571	—	—

5,63 m²	ca. 950 kg

657



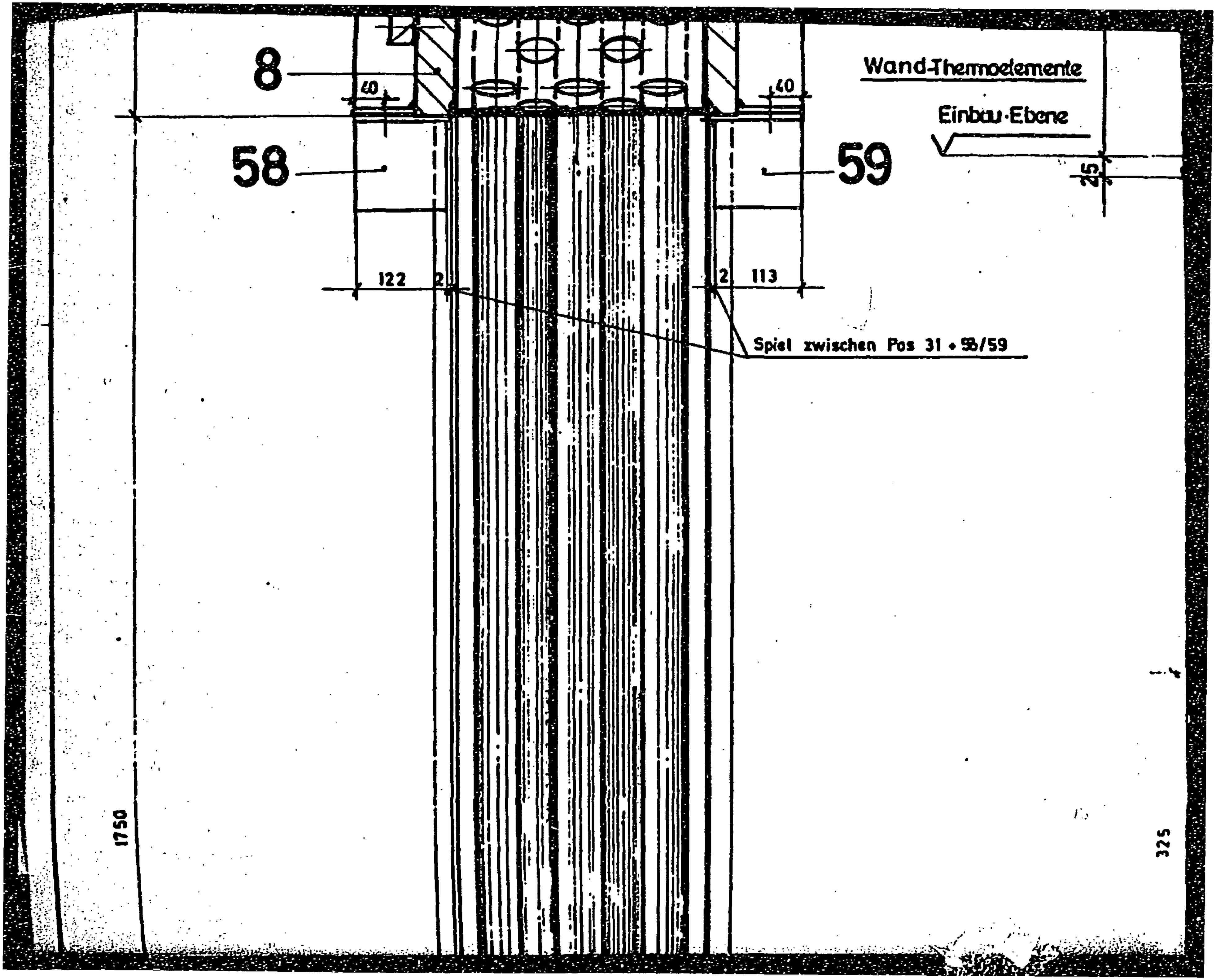
PANDA MASTER DOCUMENT

Released by:

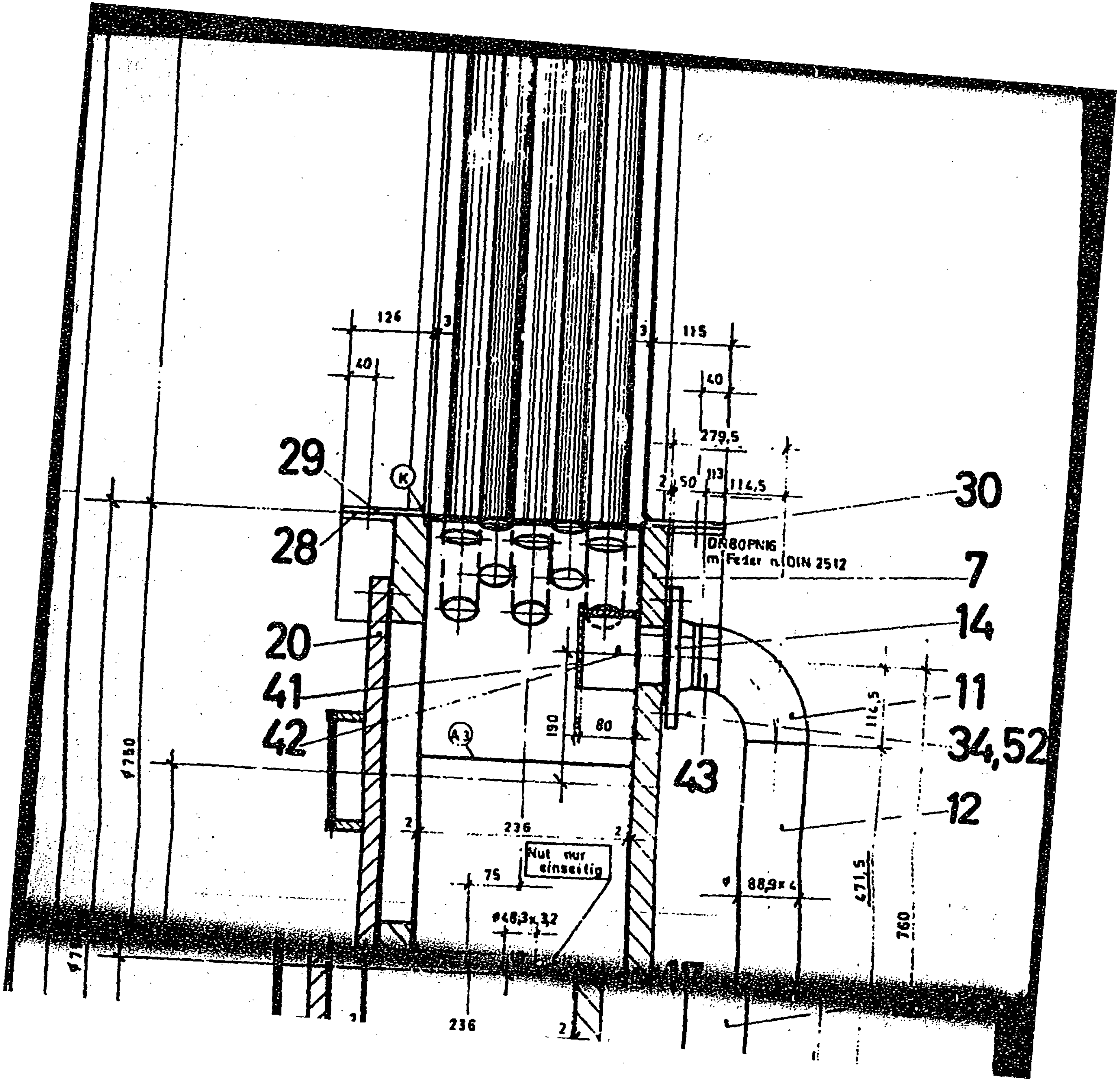
PSI PANDA PM

Date 2-III-95

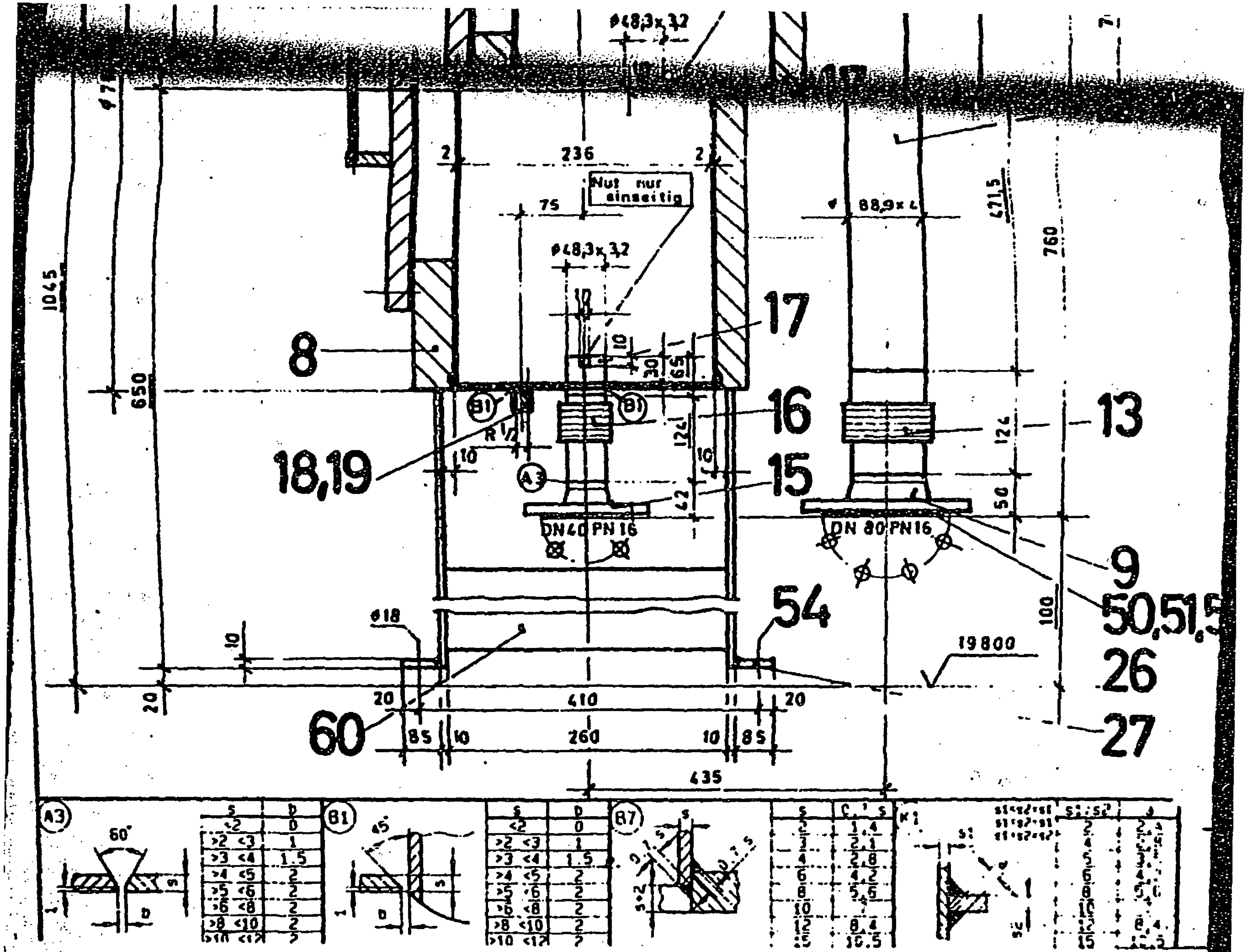
GE Site QA Representative



Wand-Thermoelemente
Einbau-Ebene
8
58
59
40
40
25
122
2
2
113
Spiel zwischen Pos 31 + 58/59
1750
325



126
3
3
115
40
40
279,5
29
K
2
50
113
114,5
30
28
DN 80 PN16
m Feder n. DIN 2512
7
14
20
41
11
114,5
42
190
80
34,52
A3
ø 750
43
12
2
236
2
Nut nur einseitig
75
ø 88,9 x 4
471,5
ø 48,3 x 3,2
760
236
2



ø48,3x3,2
236
Nut nur einseitig
75
ø48,3x3,2
ø 88,9x4
471,5
760
1045
650
8
17
16
13
18,19
R 1/2
15
B1
A3
124
42
50
DN40 PN16
DN 80 PN16
9
50,51,5
54
ø18
19800
26
100
10
20
410
260
435
85
60
27
A3
60°
B1
45°
B7
K1
s
b
s		b
<2		0
>2	<3	1
>3	<4	1,5
>4	<5	2
>5	<6	2
>6	<8	2
>8	<10	2
>10	<12	2

C

PANDA DOCUMENT REVIEW/APPROVAL

Checked by	[signature]	Date	95-3-1
	PSI Responsible Engineer		
Reviewed by	[signature]	Date	1 March 95
	GE Site QA Representative		
Approved ~~Verified~~ by	[signature]	Date	1-III-95
	PSI PANDA PM		
Approved by	[signature]	Date	2 Mar 95
	GE Project Manager		

Pos.	Anz.	α	A	gestr. L	B	C
1	5	51,75°	1705	2066	2059	117
2	5	37,80°	1656	1920	1932	87
3	5	24,30°	1656	1826	1842	66
4	5	10,40°	1705	1778	1786	54

Genehmigungsvermerk:

Anlage: PANDA
Baugruppe: Kondensatoren
Registerrohre ϕ 51 x 2 (Ic)
1-290 163

Allgemeintoleranzen nach RDG V 010 RDG V 011 Jaggi AG Bern

Index	Änderung	Datum	Visum
E			
D			
C			
B			
A	Titeländ.	13.10.92	[initials]

Zugehörende Zeichnungen: 0R-24070

Ic. 0-290130

Paul Scherrer Institut Villigen

Registerrohre ϕ51x2

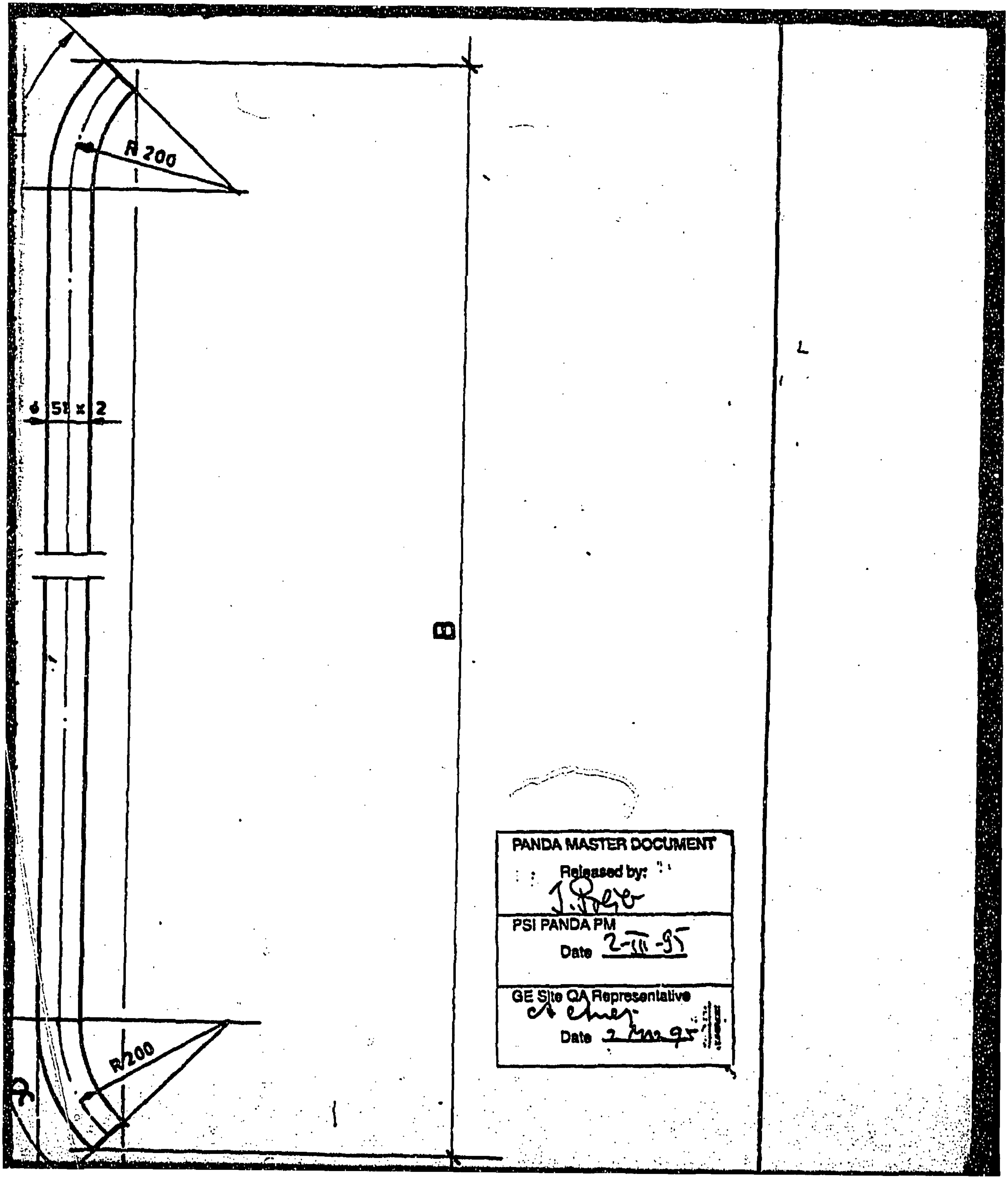
m.Anordnung Wand-+Gas-Thermoelem.

Massstab		Datum	Visum
1:5	Gez	24.9.92	[initials]
10:1	Gepr		
	Ges		

jäggi bern — HEIZUNG · LÜFTUNG · KLIMA / ENERGIE · UMWELT · KÄLTE / VERFAHRENSTECHNIK

Zeichnungs-Nr.	Index
1R-24070 -1	A

18D-104



PANDA MASTER DOCUMENT

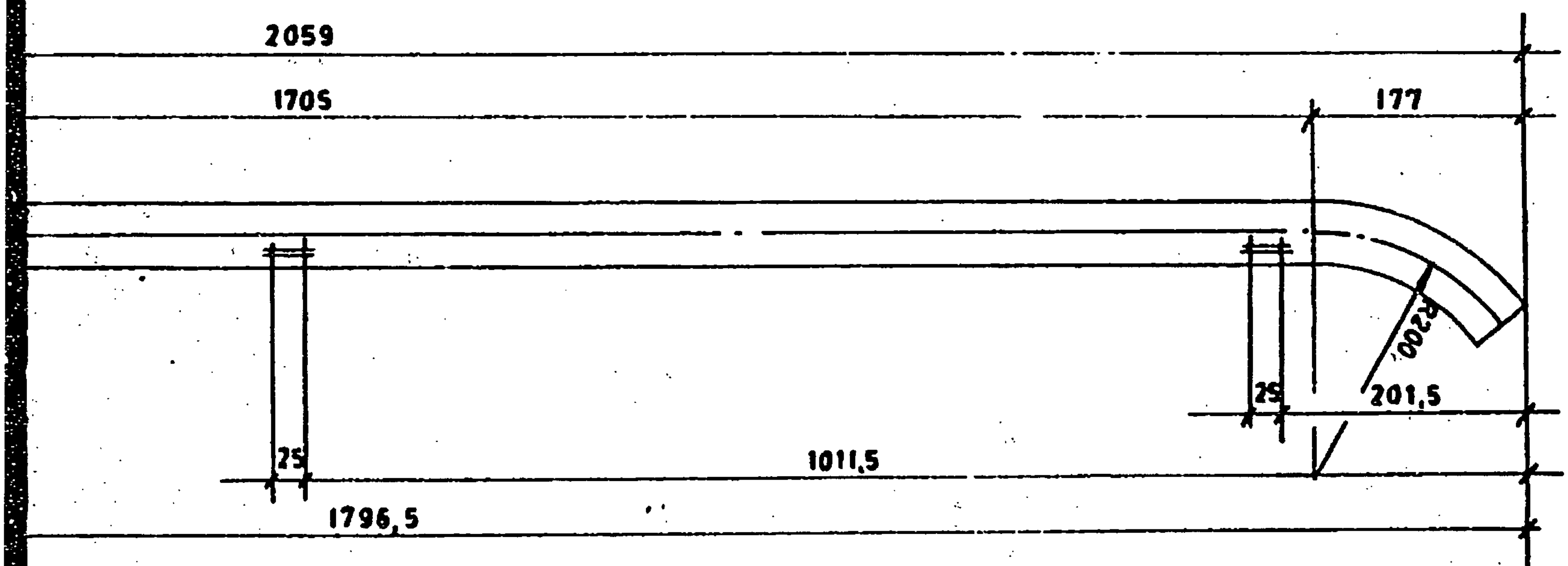
Released by: J. Dreier

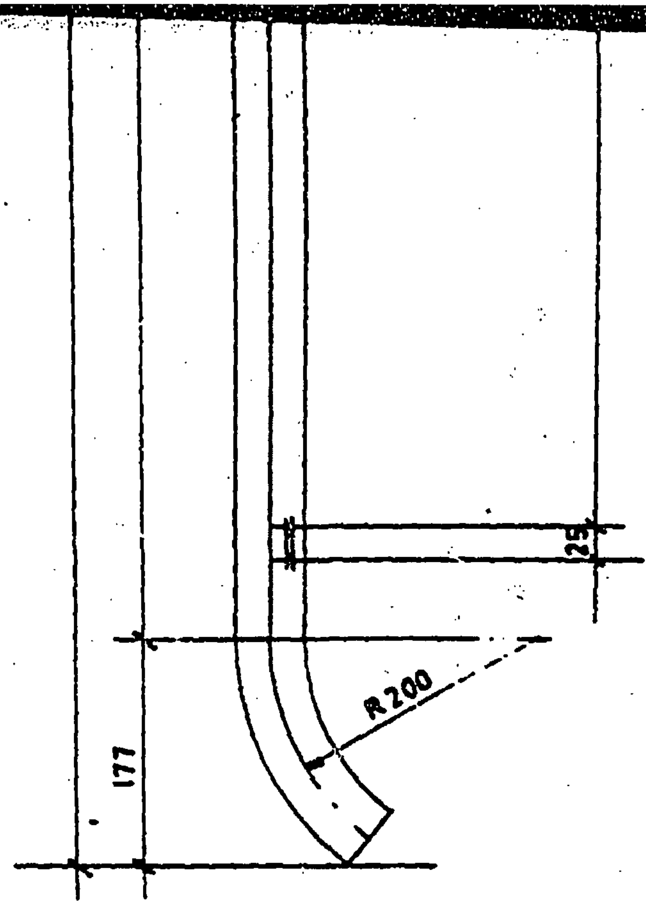
PSI PANDA PM

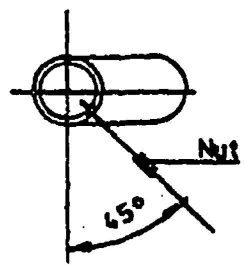
Date 2-III-95

GE Site QA Representative

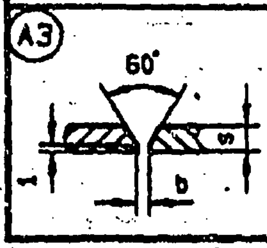
Date 2 Mar 95


2059
1705
177
R200
25
201,5
25
1011,5
1796,5

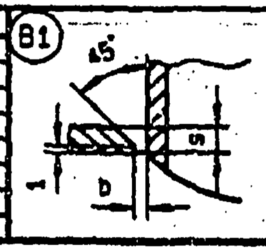




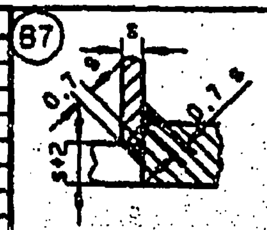
A
1

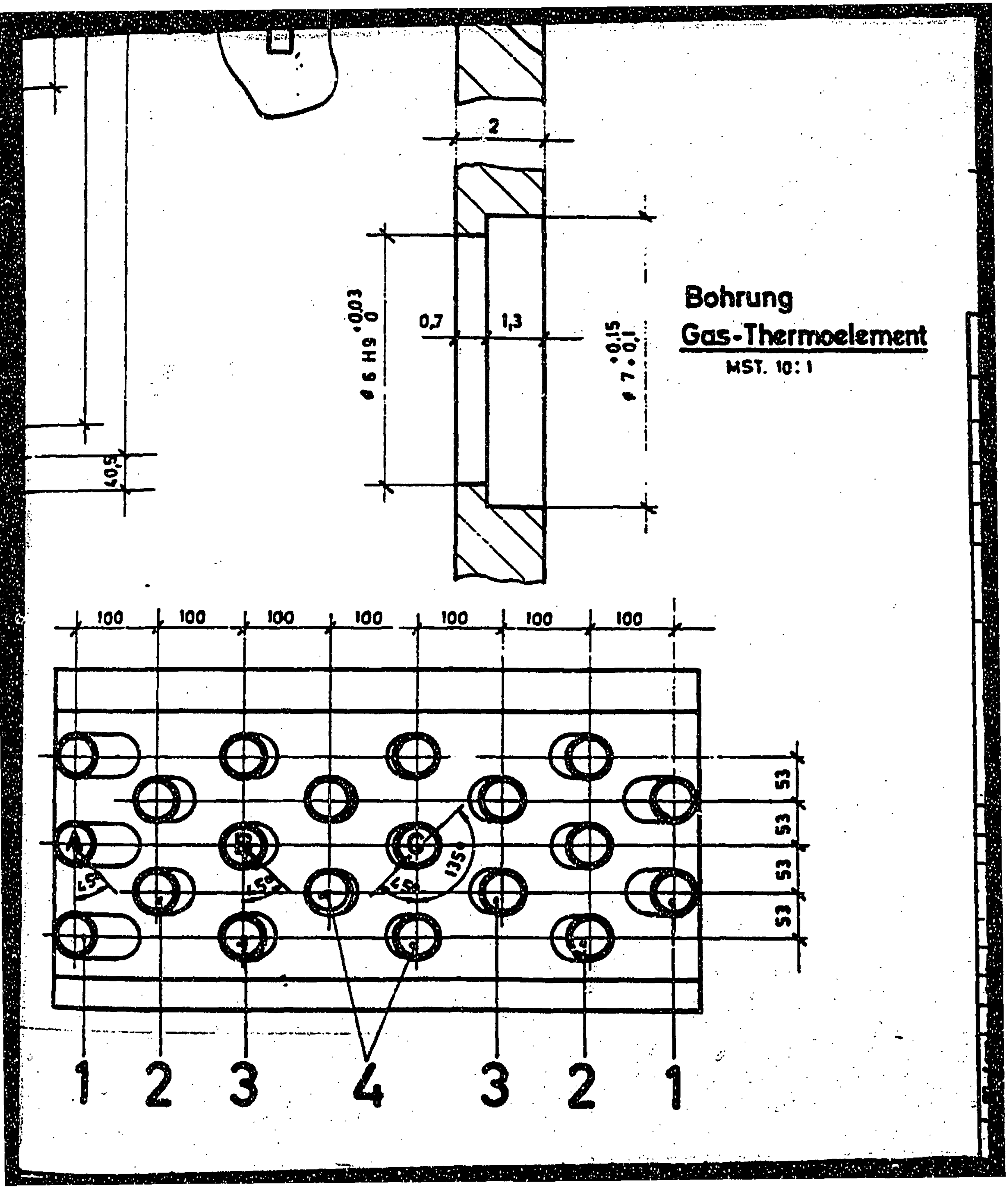


s	b
<2	0
>2 <3	1
>3 <4	1,5
>4 <5	2
>5 <6	2
>6 <8	2
>8 <10	2
>10 <12	2

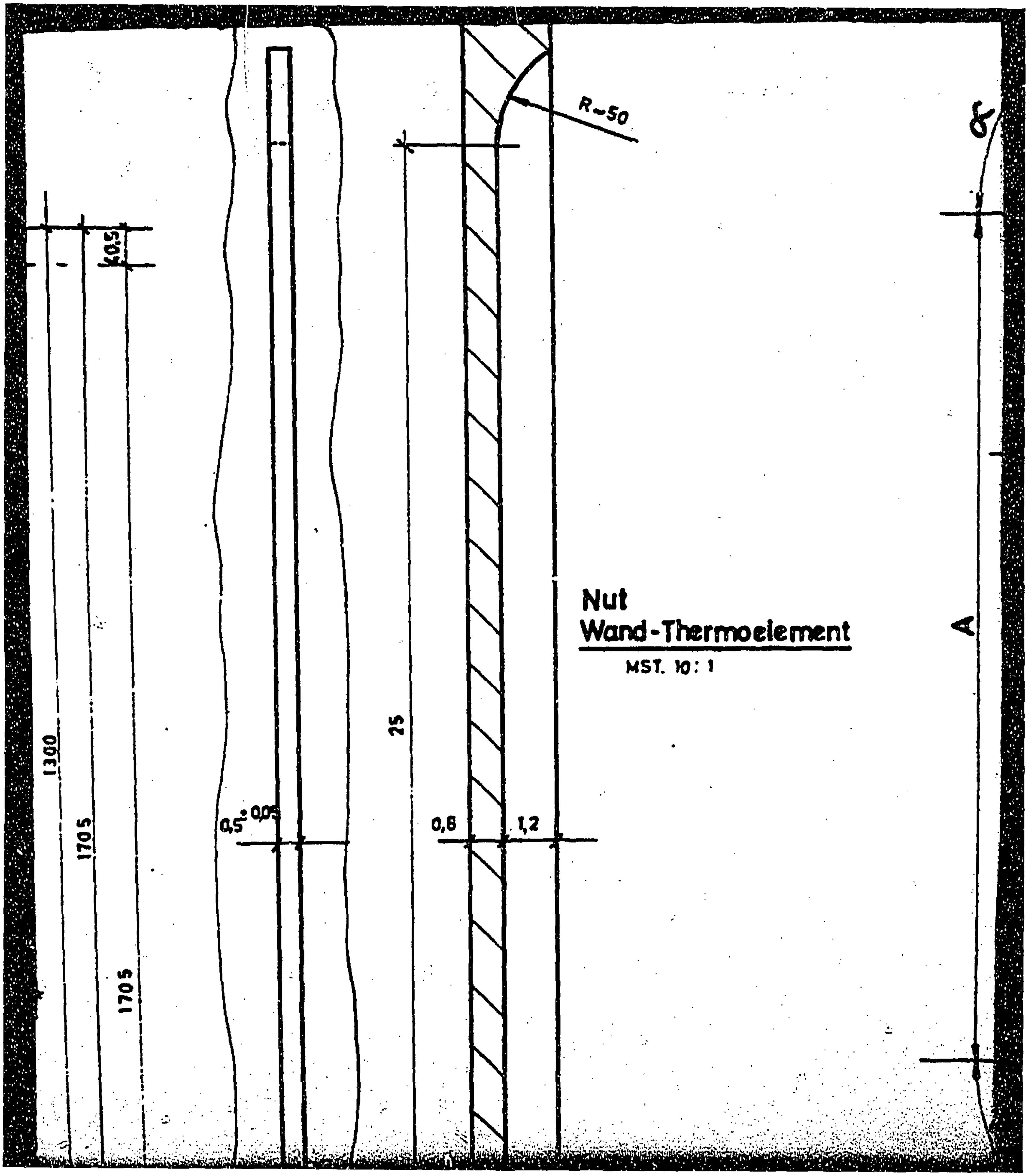


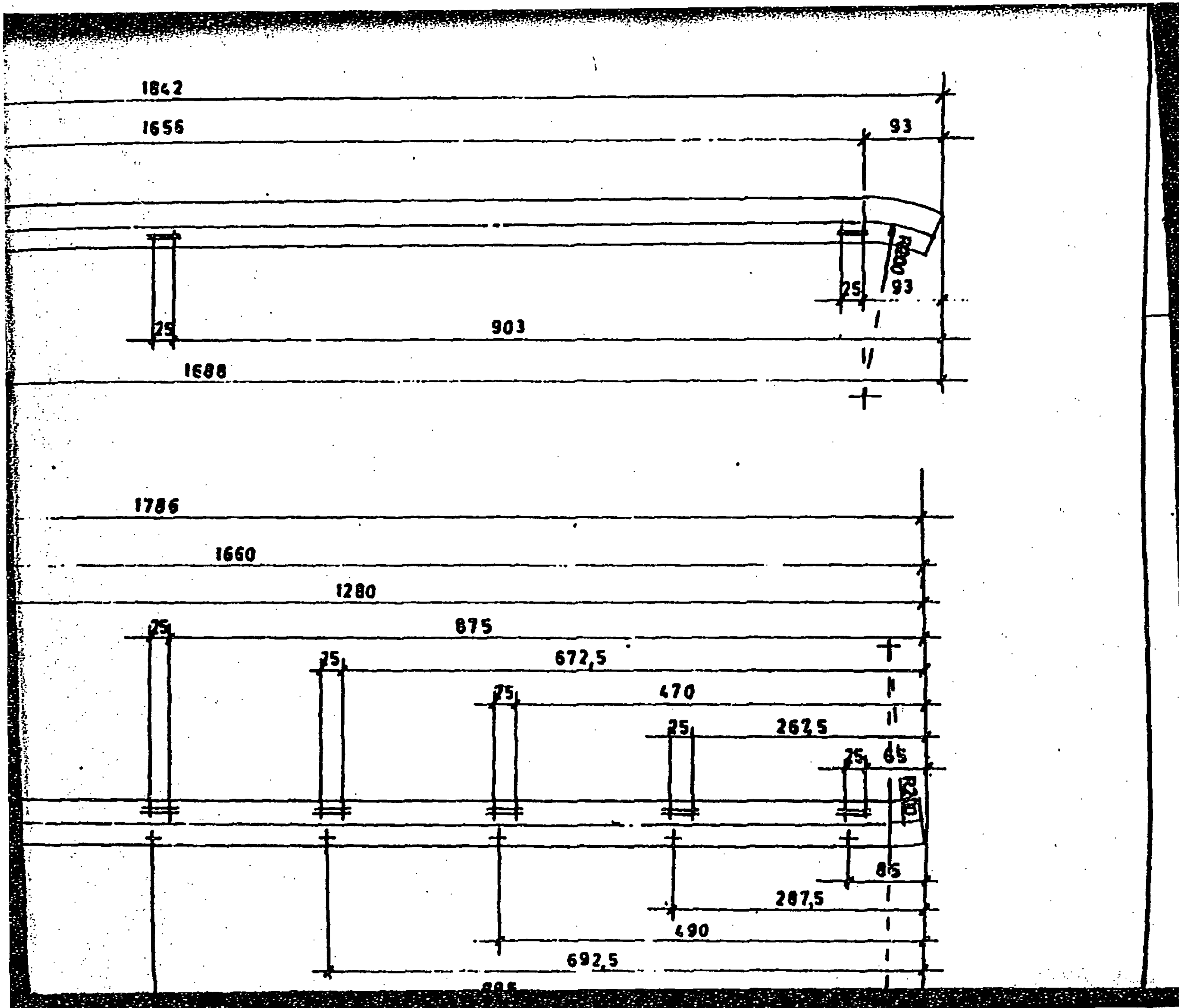
s	b
<2	0
>2 <3	1
>3 <4	1,5
>4 <5	2
>5 <6	2
>6 <8	2
>8 <10	2
>10 <12	2

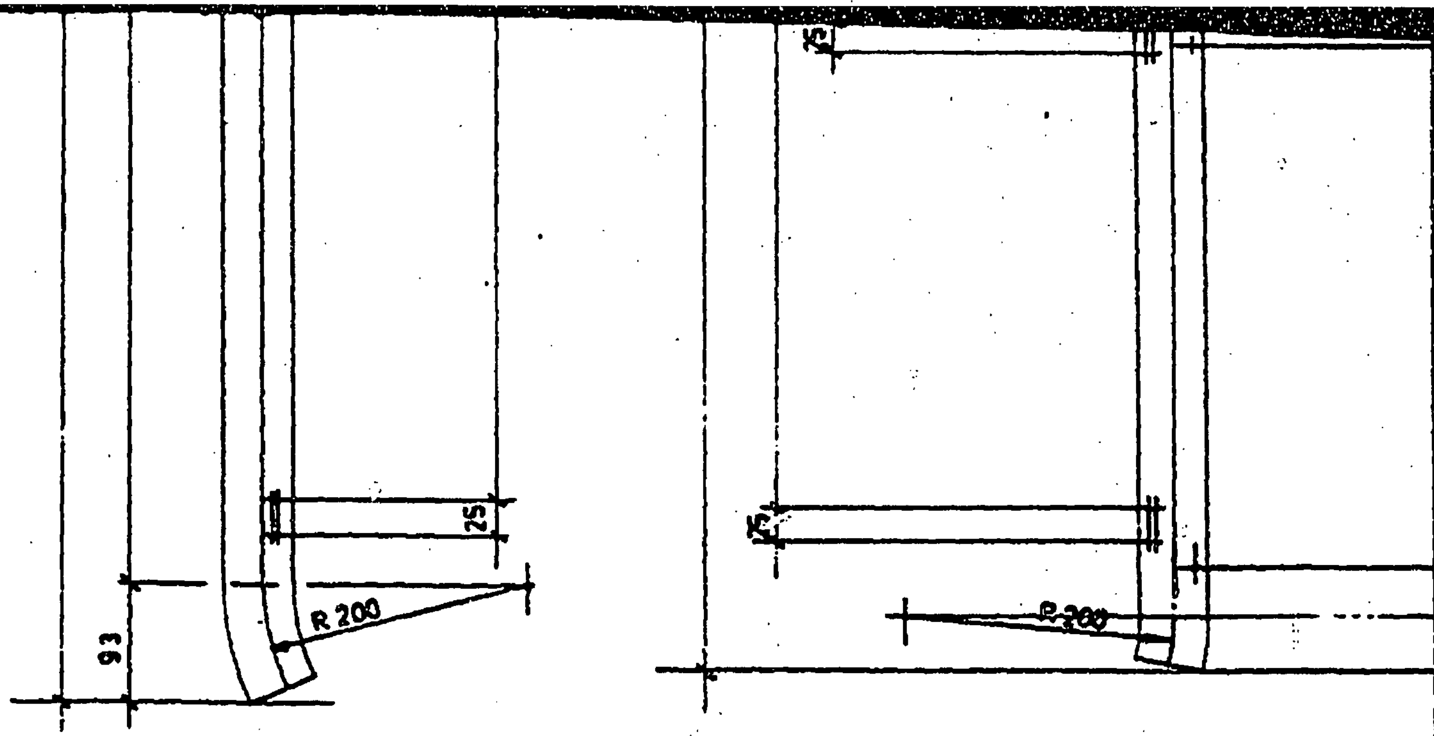


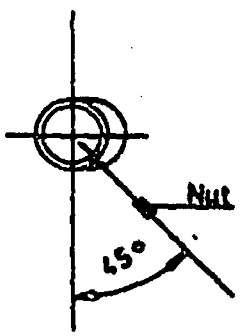


Bohrung
Gas-Thermoelement
MST. 10:1
2
0,7
1,3
ø 6 H9 +0,03 0
ø 7 +0,15 +0,1
40,5
100
53
45°
135°
1
2
3
4
3
2
1

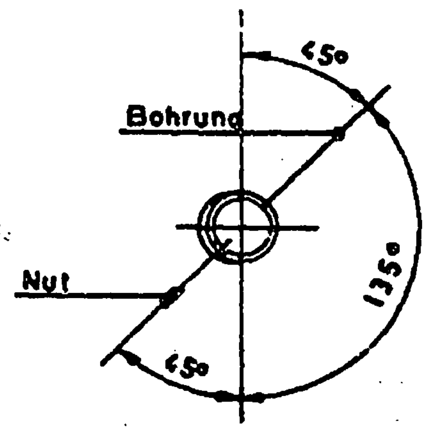

Nut
Wand-Thermoelement
MST. 10 : 1
R~50
0,5
25
1300
1705
1705
0,5 ± 0,05
0,8
1,2
A


1842
1656
93
R800
25
93
25
903
1688
1786
1660
1280
25
875
25
672,5
25
470
25
262,5
25
65
R200
85
287,5
490
692,5





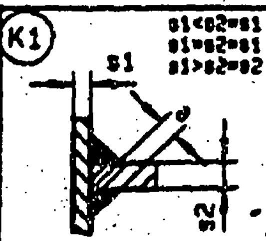
B
3



C
4

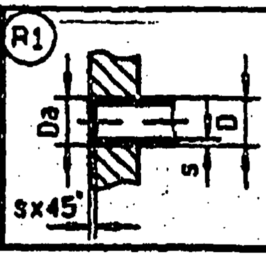
s	0,7 s
2	1,4
3	2,1
4	2,8
6	4,2
8	5,6
10	7
12	8,4
15	10,5

K1



s1/s2	a
2	2,4
4	2,8
5	3,5
6	4,2
8	5,6
10	7
12	8,4
15	10,5

R1



D	Da	s
16	16,25	1
20	20,25	1,5
25	25,25	1,5

C

PANDA DOCUMENT REVIEW/APPROVAL		
Checked by	[signature] PSI Responsible Engineer	Date 95-3-1
Reviewed by	[signature] GE Site QA Representative	Date 1 Mar 95
~~Verified by~~ Approved CAS 2-3-95	[signature] PSI PANDA PM	Date 1-III-95
Approved by	[signature] GE Project Manager	Date 2 Mar 95

Pos.	Anz.	α	A	gestr. L	B	C
1	5	51,75°	1705	2066	2059	117
2	5	37,80°	1656	1920	1932	87
3	5	24,30°	1656	1826	1842	66
4	5	10,40°	1705	1778	1786	54

Genehmigungsvermerk:

Anlage: PANDA
Baugruppe: Kondensatoren
Registerrohre ϕ 50,8x 1,65 (Pcc)
1-290 164

Allgemeintoleranzen nach RDQ-V-010 / RDQ-V-011 (Jäggi AG Bern)

Index	Änderung	Datum	Visum
E			
D			
C			
B			
A	Titeländ.	13.10.92	Me

Zugehörende Zeichnungen: 0R-24071

Pcc. 0-290 132

Paul Scherrer Institut Villigen

Registerrohre ϕ 50,8x1,65
m.Anordnung Wand-+Gas-Thermoelem.

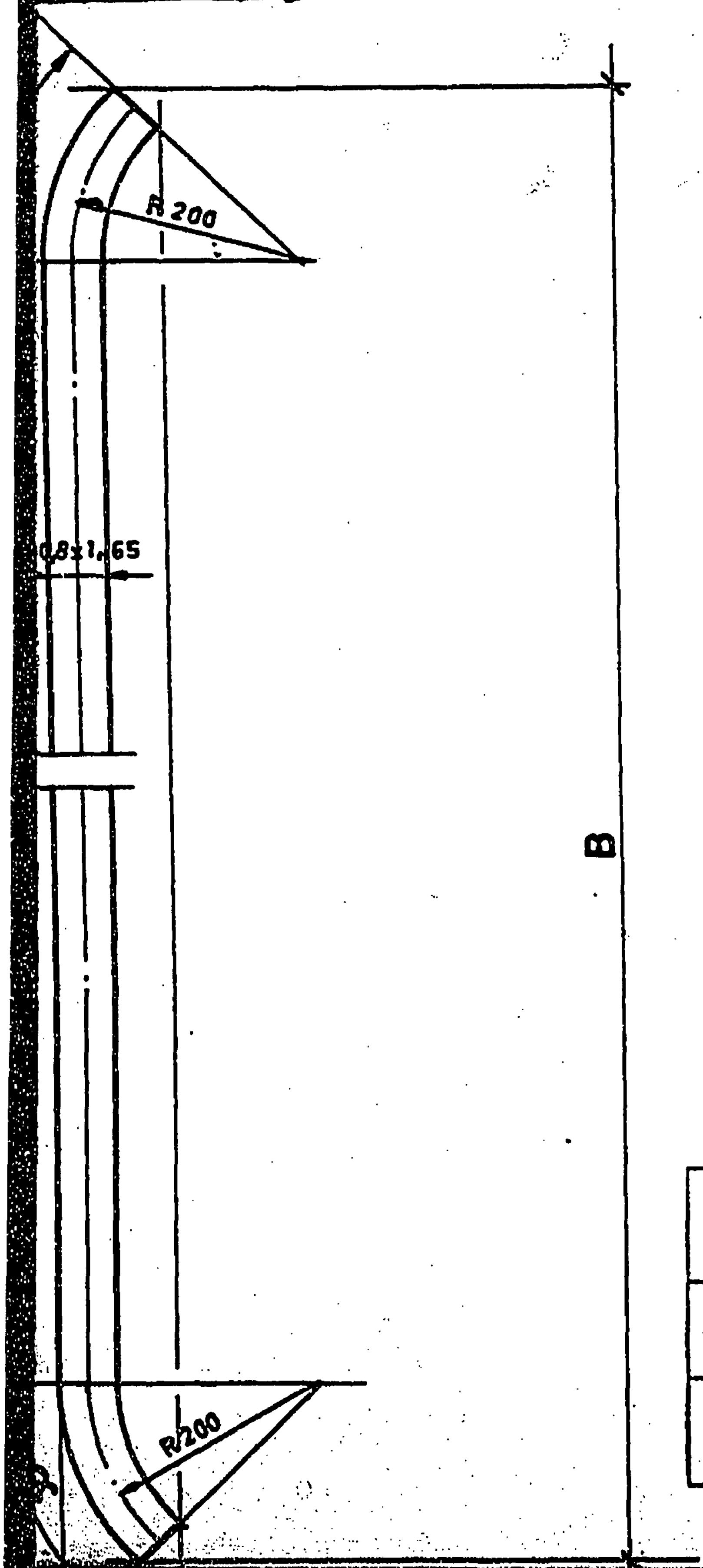
Massstab: 1:5, 10:1

	Datum	Visum
Gez.	24.9.92	[signature]
Gepr.		
Ges.		

jäggi bern — HEIZUNG · LÜFTUNG · KLIMA · ENERGIE · UMWELT · KÄLTE · VERFAHRENSTECHNIK

Zeichnungs-Nr.: 1R-24071 -1 Index: A

18D105



PANDA MASTER DOCUMENT

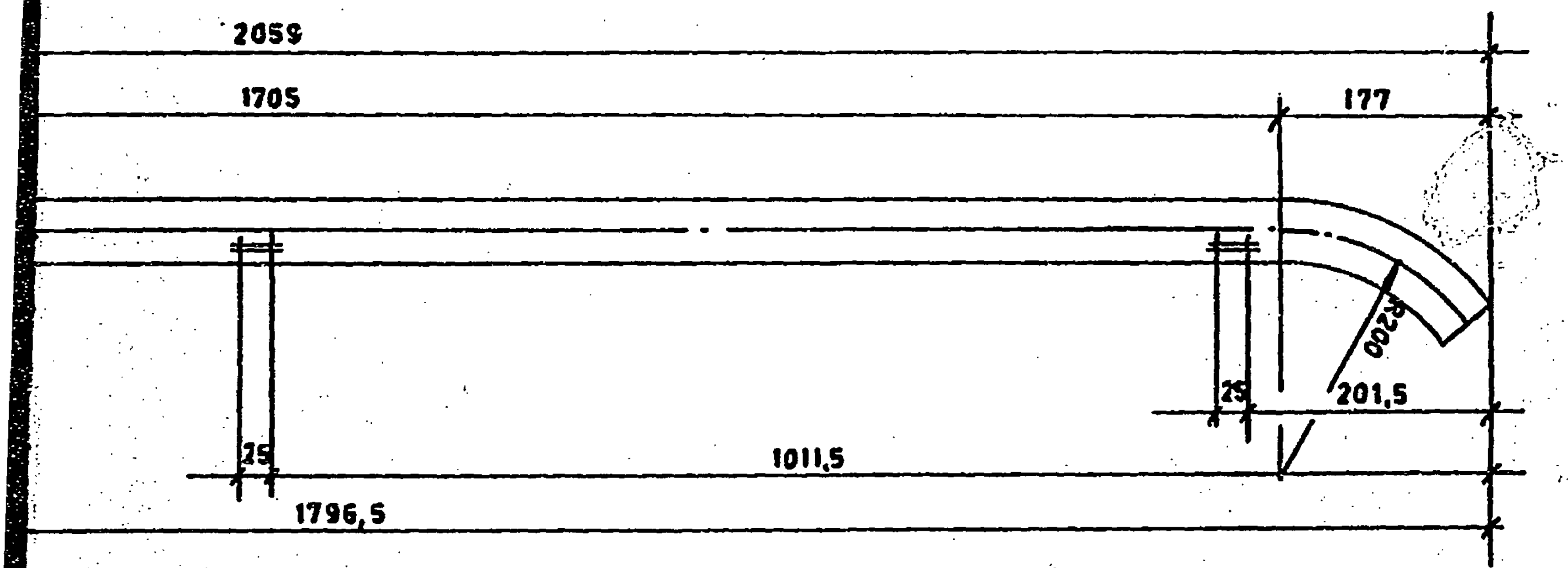
Released by:

PSI PANDA PM

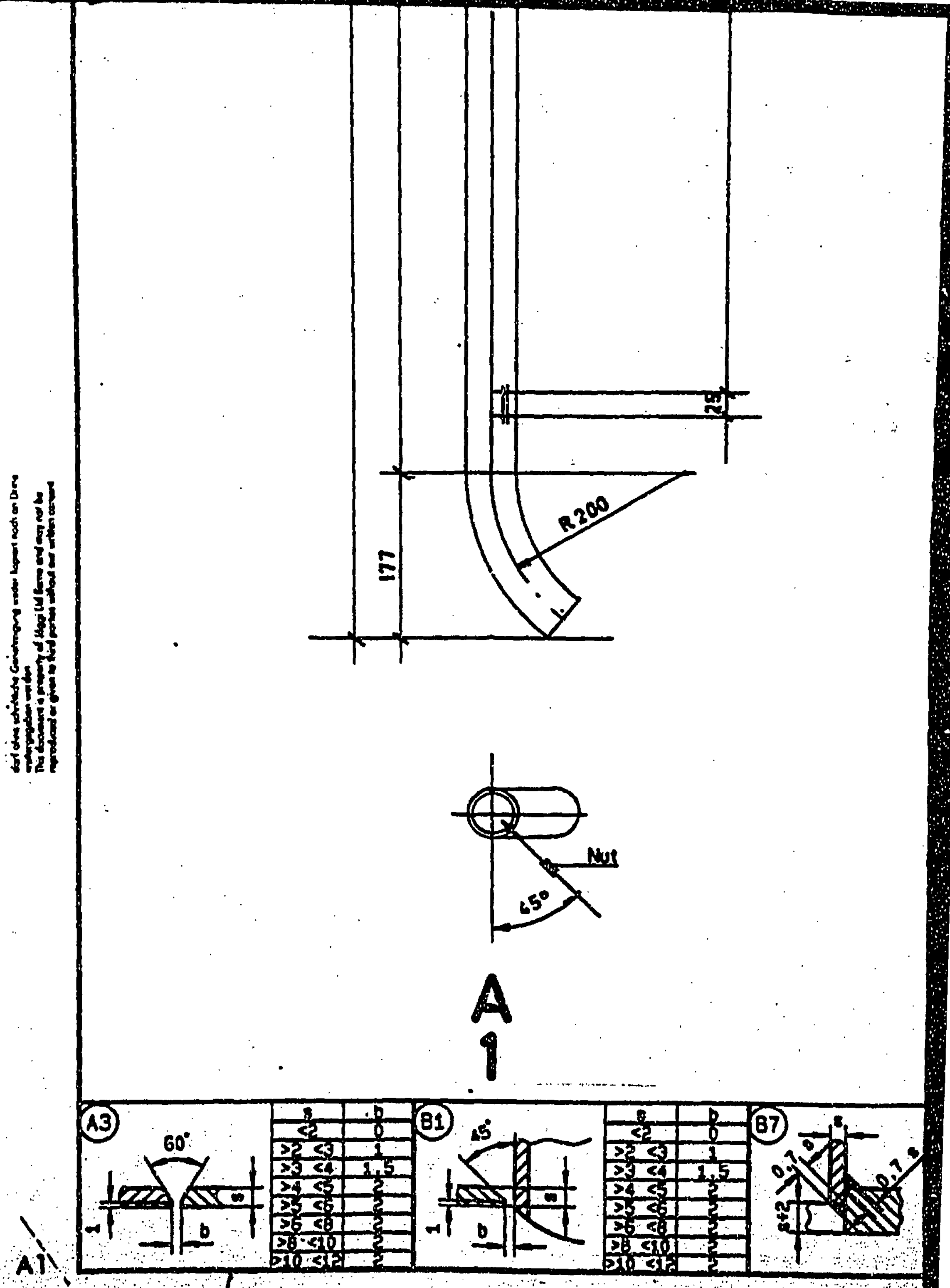
Date 2-III-95

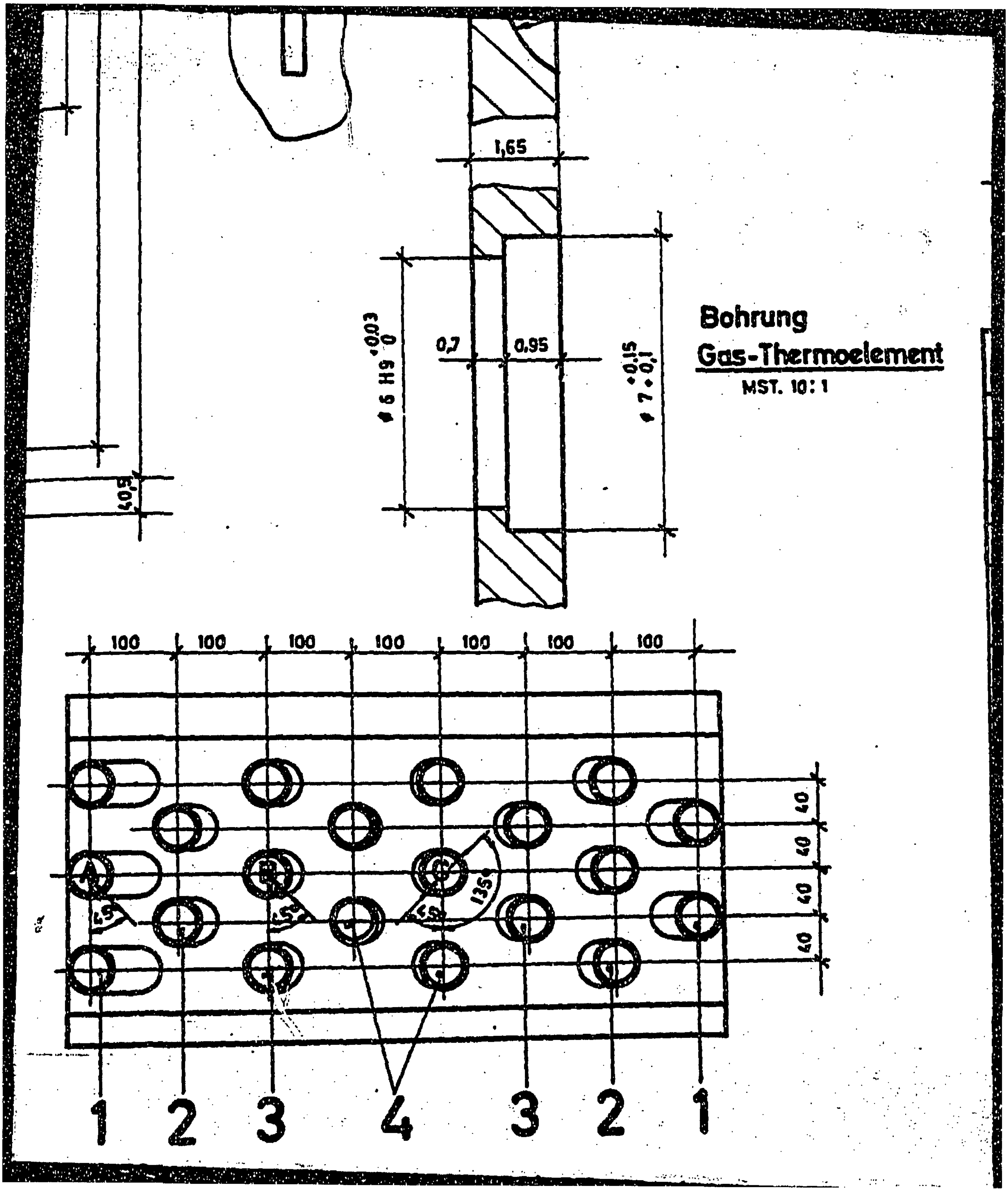
GE Site QA Representative

Date 2 Mar 95



2059
1705
177
R200
25
201,5
25
1011,5
1796,5


25
R 200
177
Nut
45°
A
1
A3
60°
s
1
b
s b
<2 0
>2 <3 1
>3 <4 1,5
>4 <5 2
>5 <6 2
>6 <8 2
>8 <10 2
>10 <12 2
B1
45°
s
1
b
s b
<2 0
>2 <3 1
>3 <4 1,5
>4 <5 2
>5 <6 2
>6 <8 2
>8 <10 2
>10 <12 2
B7
s
a
0,7 s
0,7 s
s+2
A1


Bohrung
Gas-Thermoelement
MST. 10:1
1,65
0,7
0,95
ø 6 H9 +0,03 0
ø 7 +0,15 +0,1
40,9
100
100
100
100
100
100
100
40
40
40
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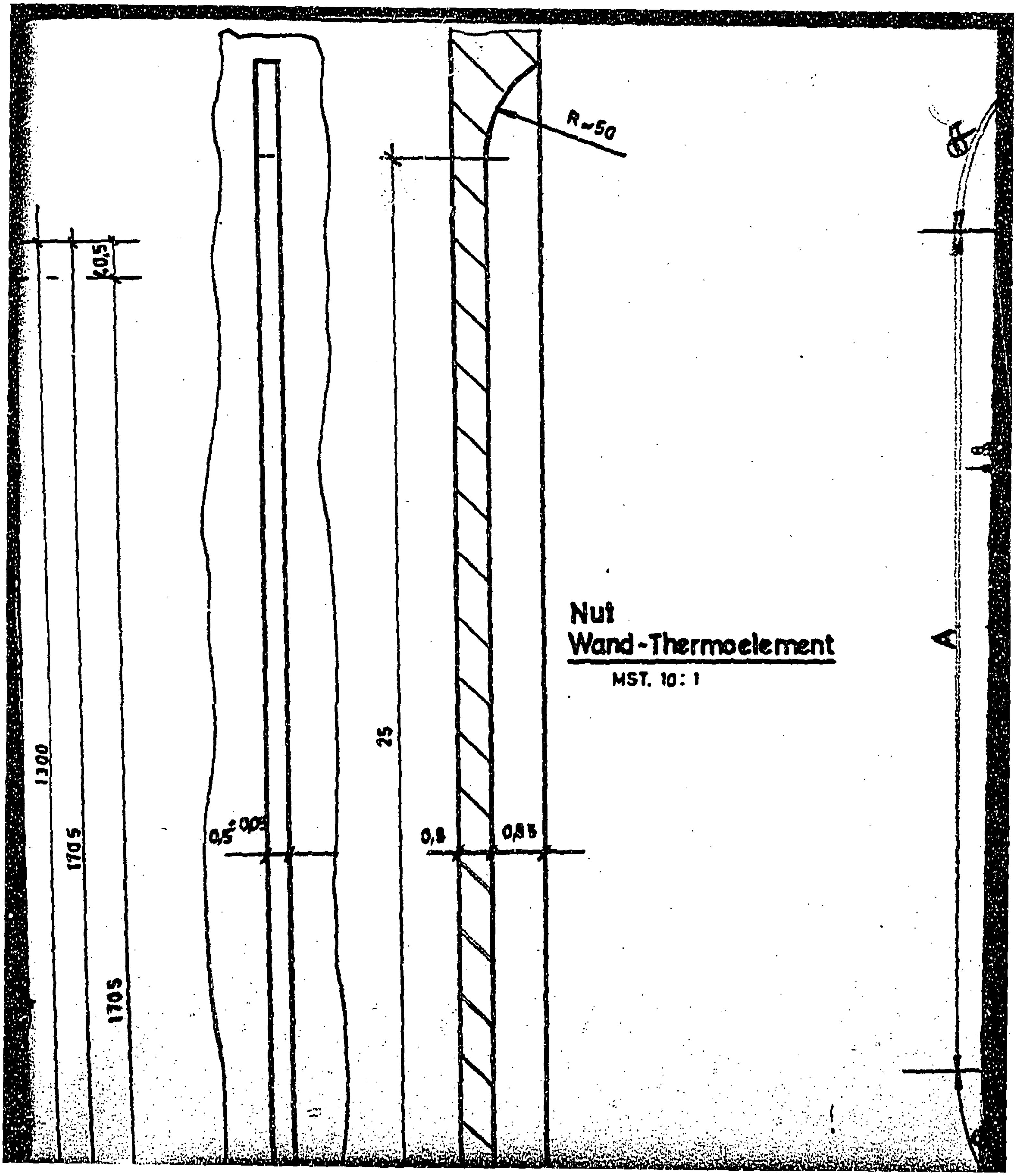
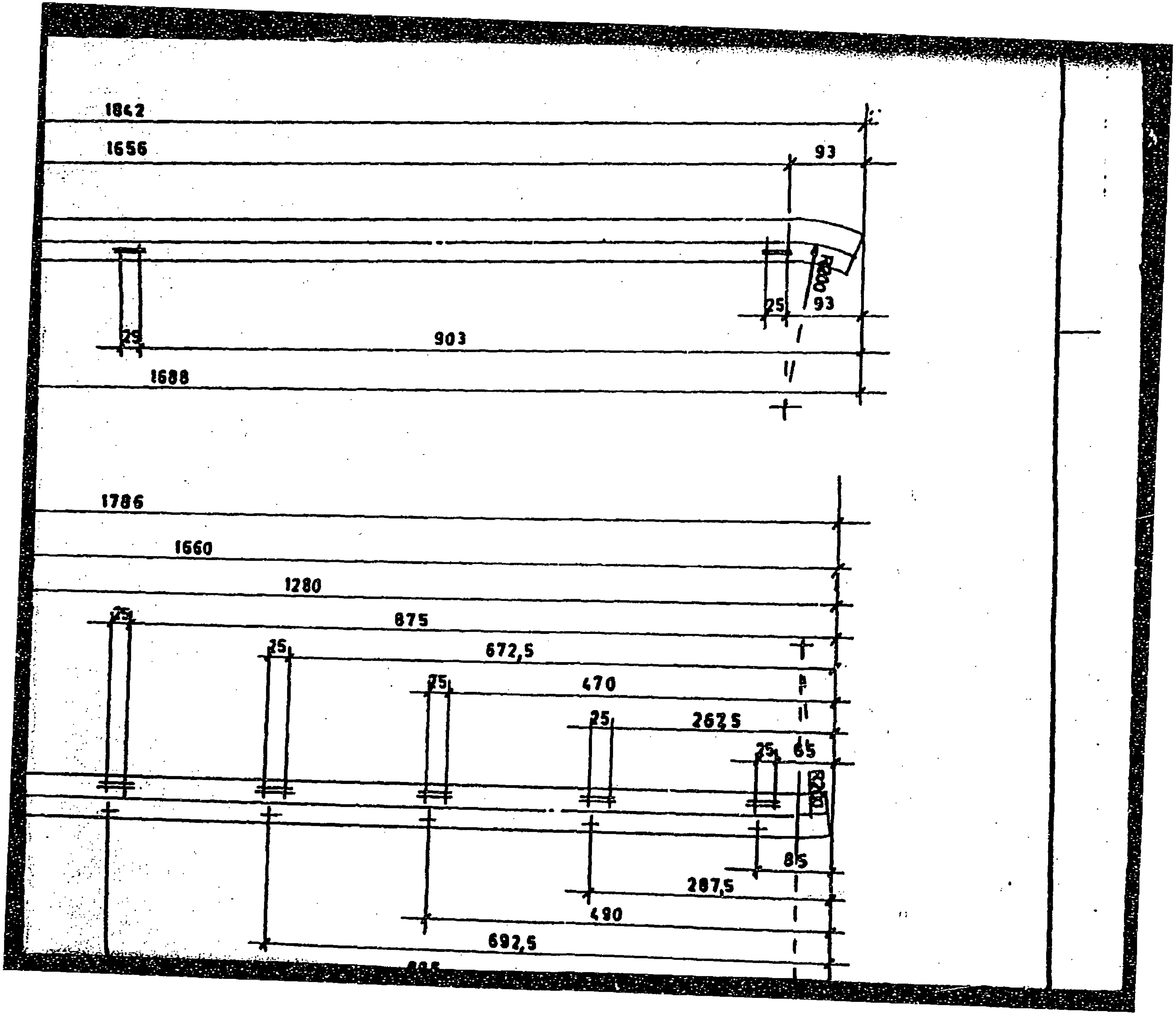
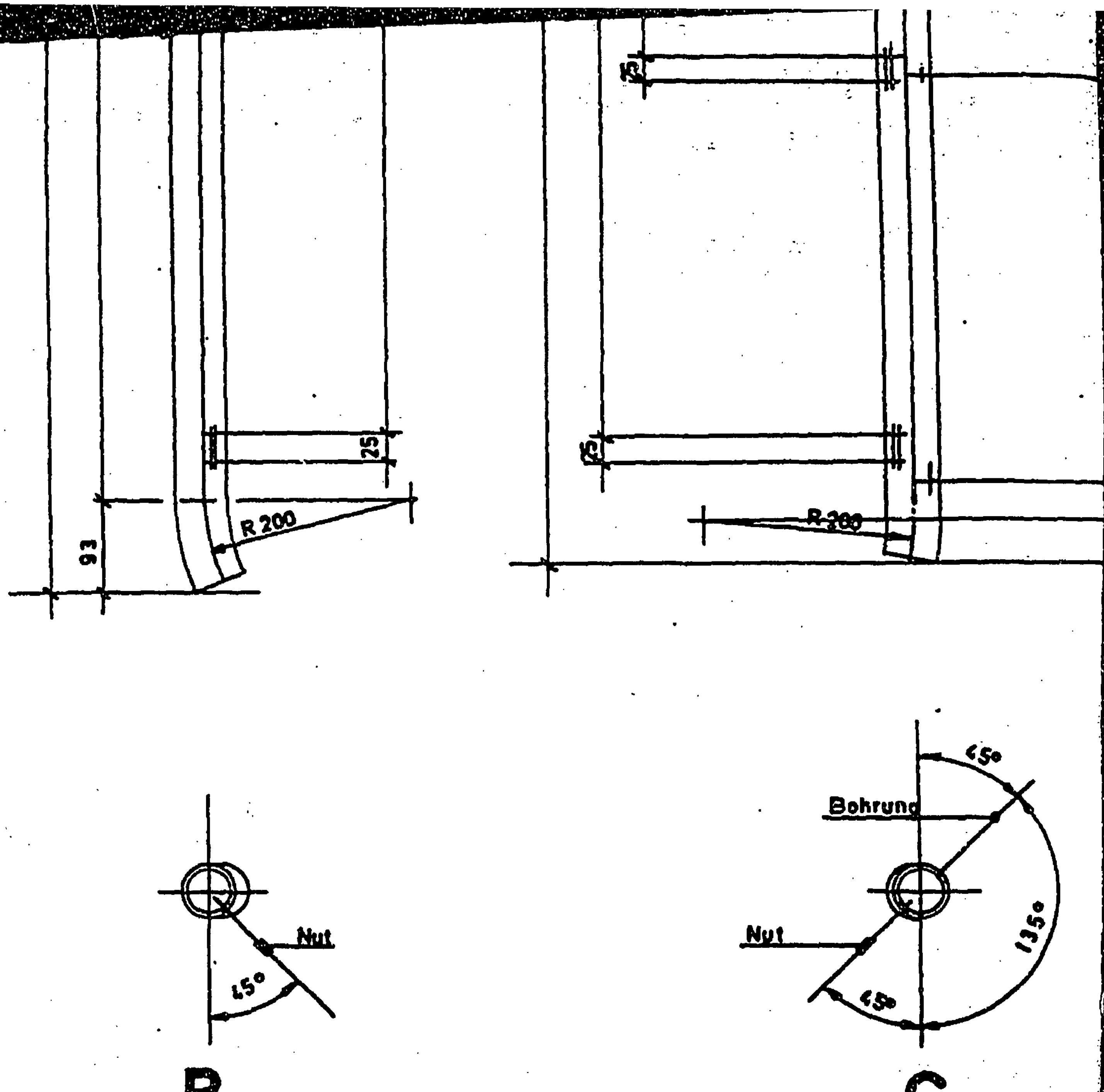
45°
45°
45°
135°
1
2
3
4
3
2
1



R~50
0,5
1300
1705
1705
25
0,5±0,05
0,8
0,85
Nut
Wand-Thermoelement
MST. 10: 1
A


1842
1656
93
R200
25
93
25
903
1688
1786
1660
1280
25
875
25
672,5
25
470
25
262,5
25
65
85
287,5
490
692,5

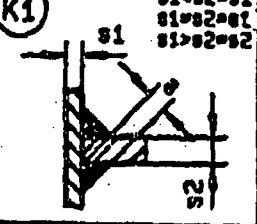


B
3

C
4

s	0,7 s
2	1,4
3	2,1
4	2,8
6	4,2
8	5,6
10	7
12	8,4
15	10,5

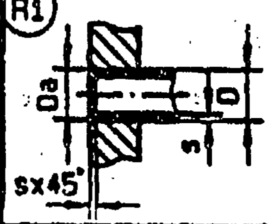
K1



s1<s2=s1
s1=s2=s1
s1>s2=s2

s1/s2	a
2	2,4
4	2,8
5	3,5
6	4,2
8	5,6
10	7
12	8,4
15	10,5

R1



D	Da	s
16	16,25	1
20	20,25	1,5
25	25,25	1,5

PANDA Experimental Facility

Vessels, Pools, IC and PCC Units

As-Built Drawings

Drawing	Number	Date
Building Reference Points	R - 290299	10.11.93
Vessel Elevations, Circumferences	1 - 290300	10.11.93
IC/PCC Pool Reference Points	0 - 290301	10.11.93
IC Unit (Messprotokoll)	0 - 290130	20.01.93
IC Tubes (Messprotokoll)	1 - 290163	26.01.93
PCC1 Unit (Messprotokoll)	0 - 290132	29.01.93
PCC1 Tubes (Messprotokoll)	1 - 290164	29.01.93
PCC2 Unit (Messprotokoll)	0 - 290132	15.02.93
PCC2 Tubes (Messprotokoll)	1 - 290164	15.02.93
PCC3 Unit (Messprotokoll)	0 - 290132	24.02.93
PCC3 Tubes (Messprotokoll)	1 - 290164	24.02.93
Additional Information		
Tolerances of Vessels and Piping	TOL.DS41	27.02.95

Massstab / Echelle / Scala	1:50	Format / Format / Formato	105 / 60
Gezeichnet / Dessiné / Disegnato		16.12.93 UB82 / 28.8.92	
Geändert / Modifié / Cambiato	I	8.9.92 M.ROTH / 06.01.93 M.Roth	
PSI NUMMER: 92.154 11 PA		PLANNUMMER: 991 / 201	

GRUNDRISS EG
GRUNDRISS DG , DACHAUFSICHT
PSI OST
5303 WÜRENLINGEN PANDA

Amt für Bundesbauten
Office des constructions fédérales
Ufficio delle costruzioni federali
Baukreis 4
8023 Zürich

ARCH. BÜRO M. ERNI AG DORFSTR. 30 5303 WÜRENLINGEN TEL. 056 / 98 16 81

PSI R-290299

PSI / PANDA

VERMESSUNGSFIXPUNKTE

Ingenieure + Berater

MASSSTAB	DATUM	PLANNUMMER	INDEX
1:50	10.11.93		

PANDA MASTER DOCUMENT
Released by: J. Bero
PSI PANDA PM
Date 2-III-95
GE Site QA Representative
Date 2 Mar 95

Bitte auch die Pläne des Elek. Ingenieurs beachten.
B.Bolliger AG Plannr. 92.312.100 / 601

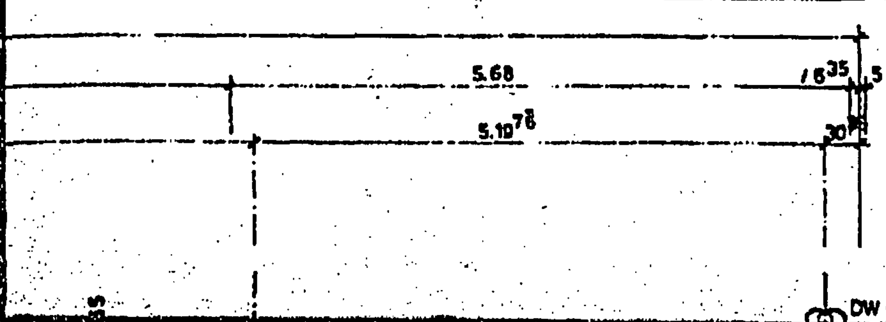
Detailschnitte (1-1) / (2-2) 1:20 beachten.

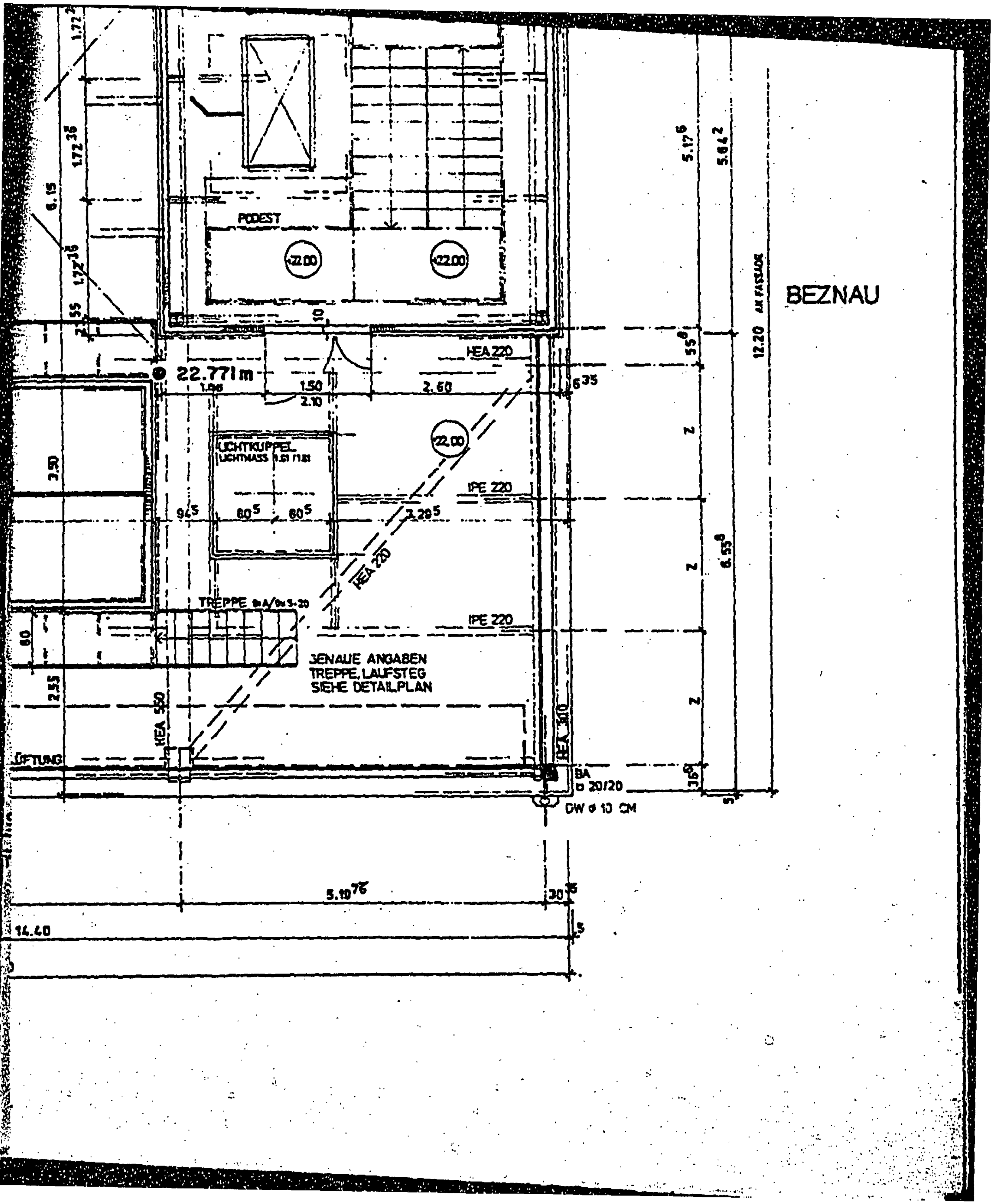
○ LAGEFIXPUNKTE
● HÖHENBOLZEN

As-Built Data are written in bold

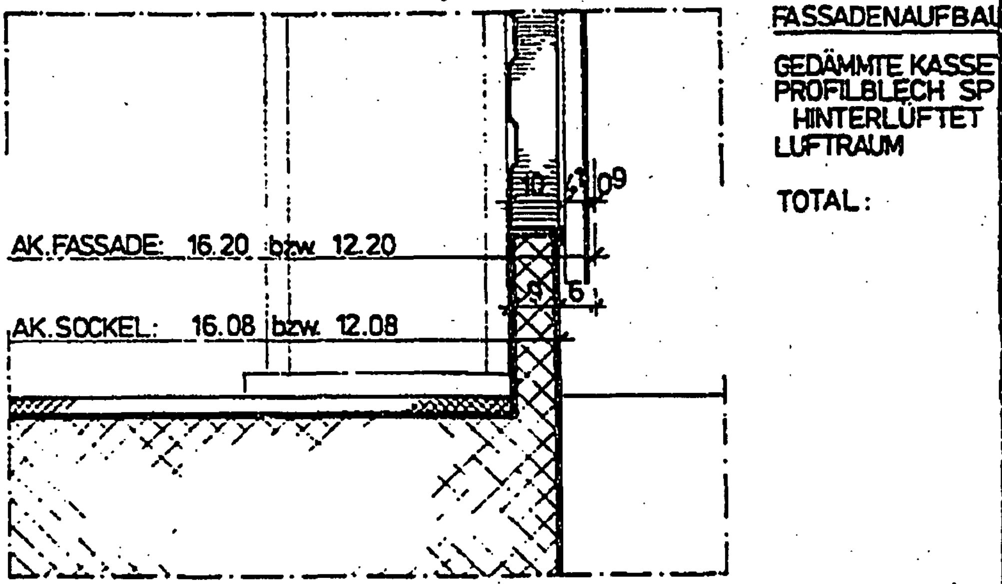
PANDA DOCUMENT REVIEW/APPROVAL

Checked by	PSI Responsible Engineer	Date	1-III-95
Reviewed by	GE Site QA Representative	Date	1 Mar 95
Approved / Verified by	PSI PANDA PM	Date	1-III-95
Approved by	GE Project Manager	Date	2 Mar 95



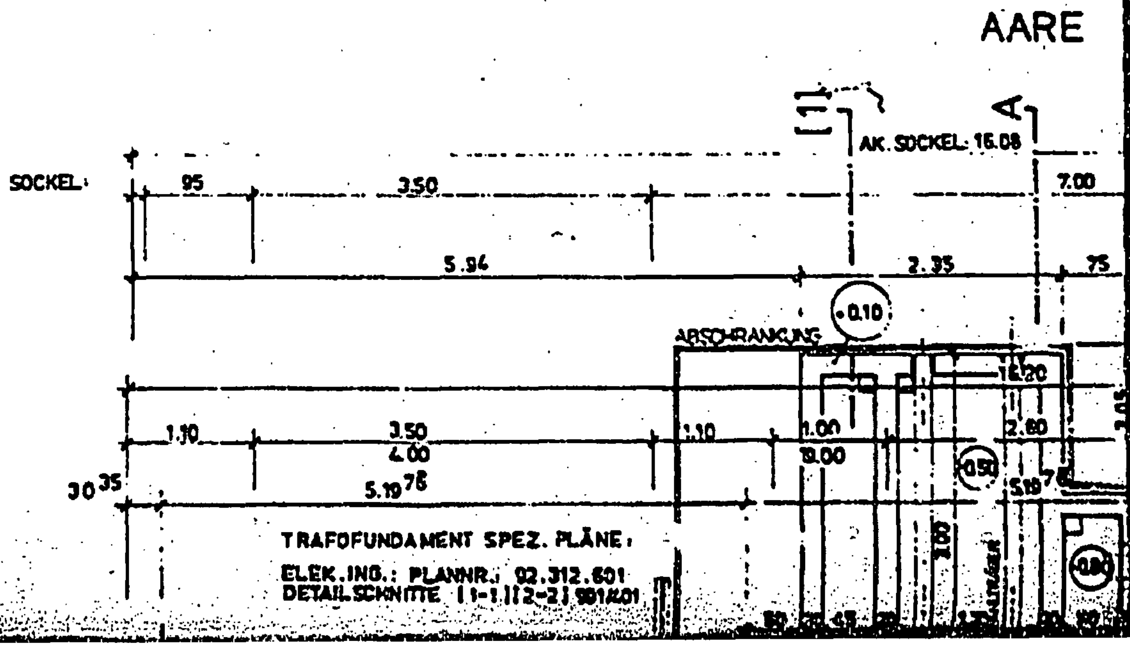


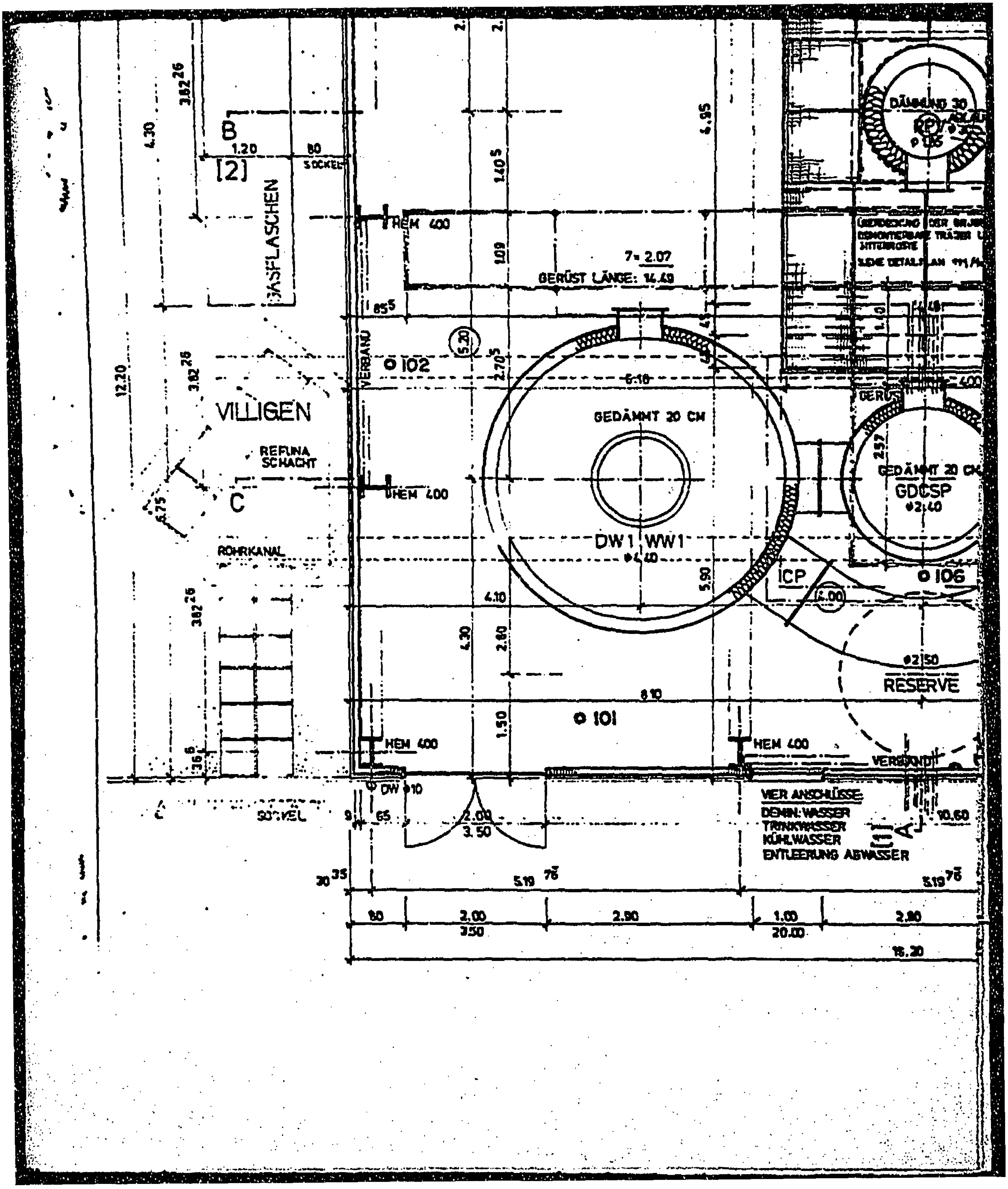
PODEST
+22.00
+22.00
22.771 m
HEA 220
LICHTKUPPEL
LICHTMASS 1.51 / 1.81
22.00
IPE 220
HEA 220
TREPPE
IPE 220
GENAUE ANGABEN
TREPPE, LAUFSTEG
SIEHE DETAILPLAN
HEA 550
HEA 300
LÜFTUNG
BA
DW ø 10 CM
BEZNAU
AM FASSADE
12.20
5.10
14.40



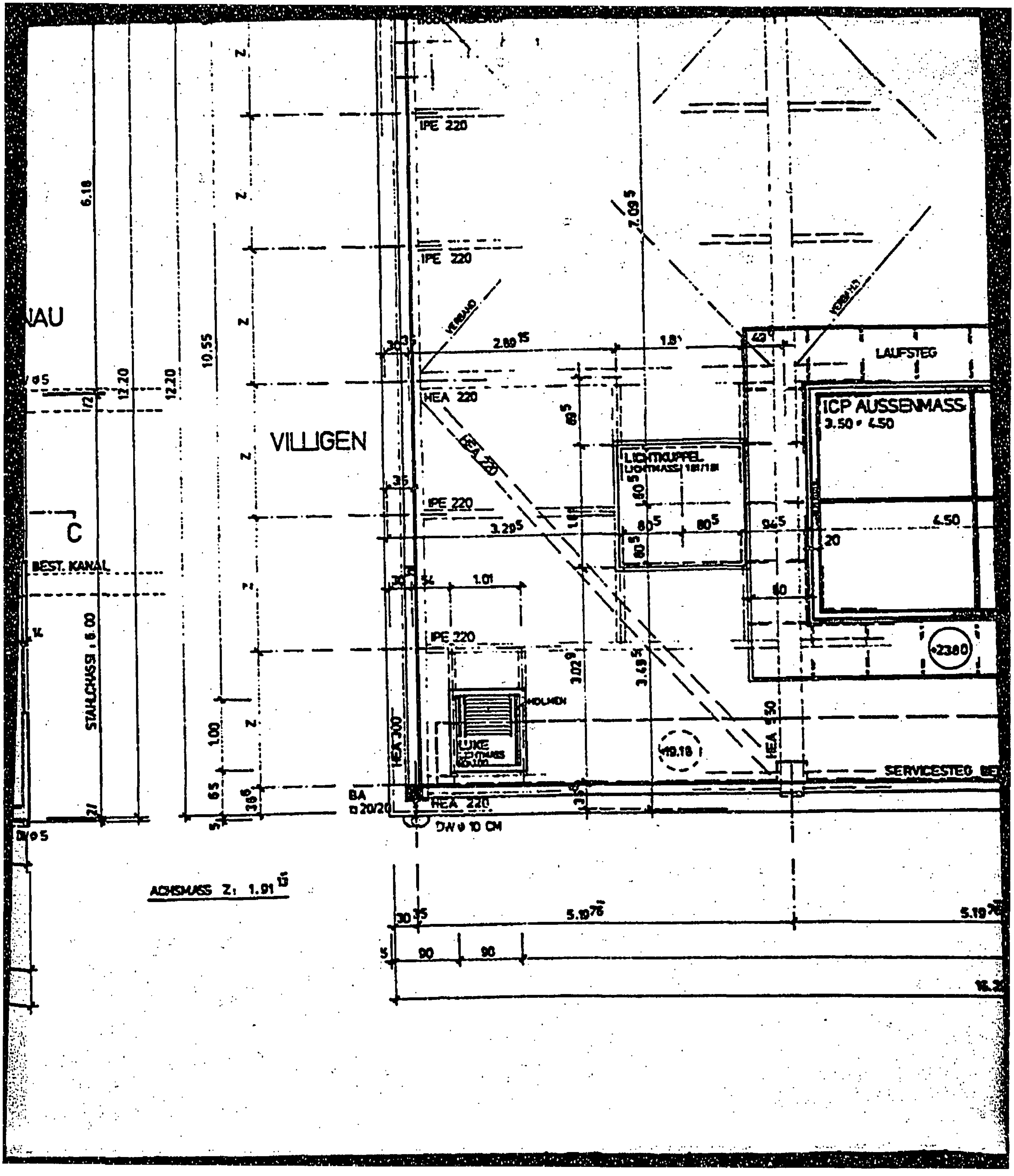
SOCKELDETAIL 1:10

GRUNDRISS EG 1:50





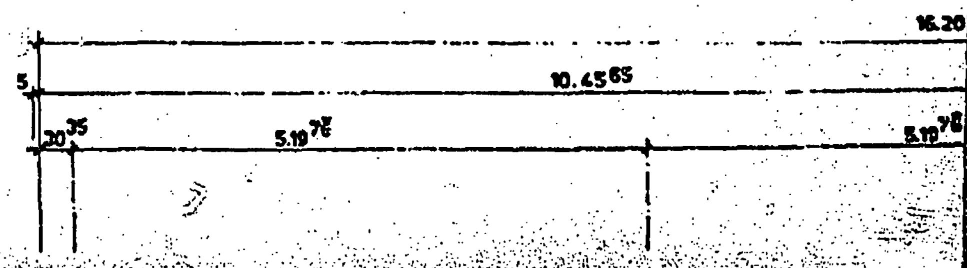
B
[2]
SOCKEL
GASFLASCHEN
VILLIGEN
REFUNA SCHACHT
C
ROHRKANAL
SOCKEL
VERBAND
HEM 400
GERÜST LÄNGE: 14.49
GEDÄMMT 20 CM
DW1 WW1
ø 102
ø 101
ø 106
ICP
GEDÄMMT 20 CM
GDCSP
RESERVE
DÄMMUNG 30
RP
DW ø10
VIER ANSCHLÜSSE:
DEMIN. WASSER
TRINKWASSER
KÜHLWASSER
ENTLEERUNG ABWASSER



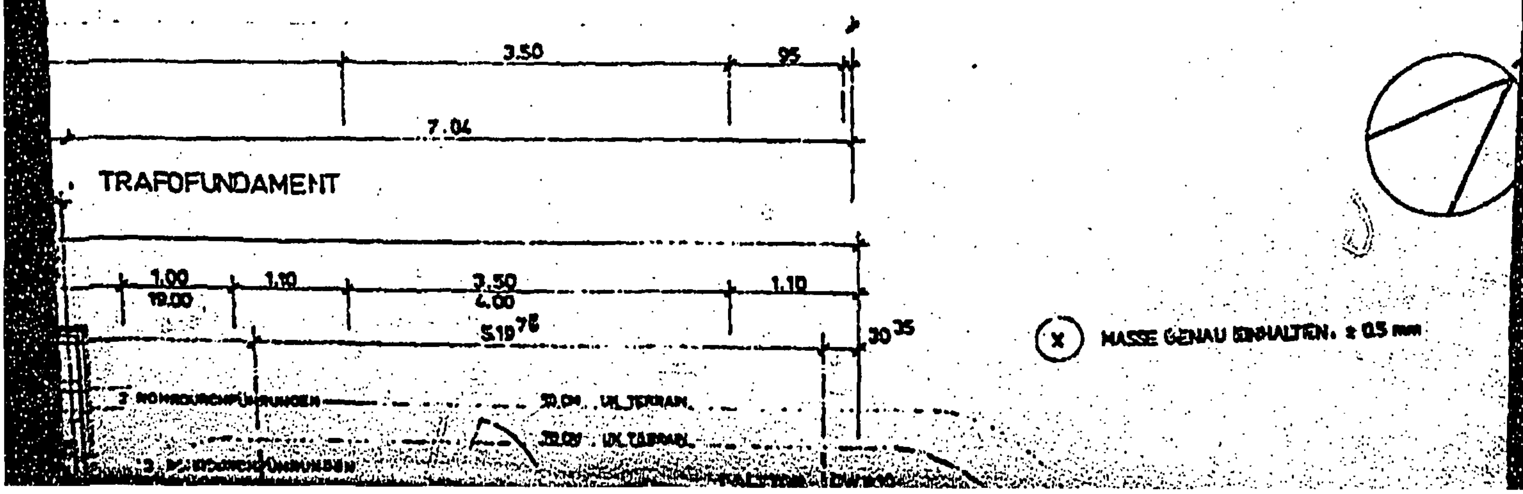
IPE 220
IPE 220
IPE 220
IPE 220
HEA 220
HEA 220
HEA 300
HEA 550
VILLIGEN
LICHTKUPPEL
ICP AUSSENMASS
3.50 • 4.50
LAUFSTEG
SERVICESTEG
LUKE
BA
□20/20
DW ⌀ 10 CM
BEST. KANAL
STAHLCHASSI : 6.00
ACHSMASS Z: 1.91
C
6.18
10.55
12.20
12.20
7.08
2.89
3.29
1.01
5.19
90
90

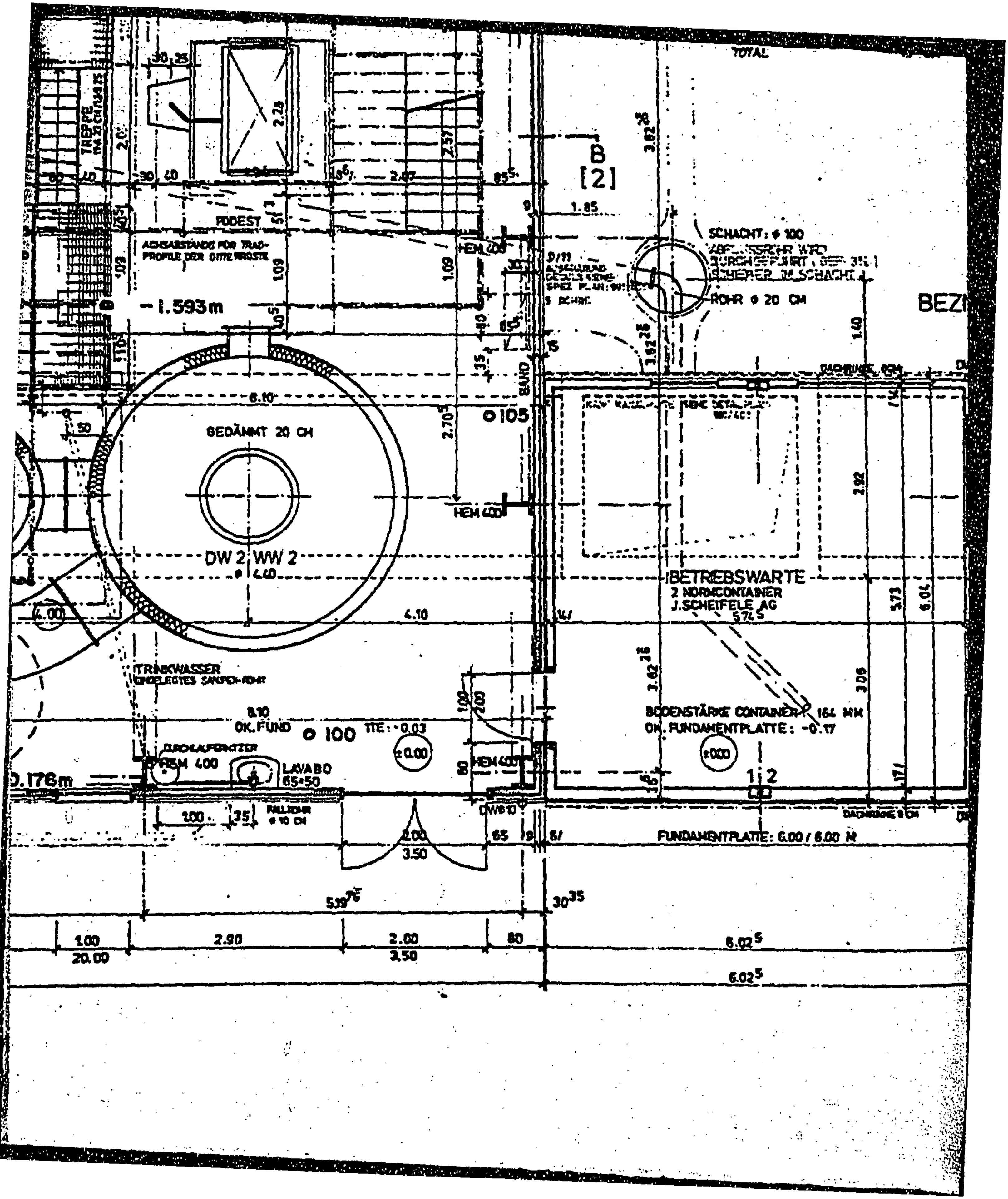
GRUNDRISS DG 1:50

AARE



TEN 10 CM
41 / 0.75
4[1] CM
0[9] CM
15 CM




TOTAL
TREPPE
PODEST
ACHSABSTÄNDE FÜR TRAG-PROFILE DER GITTERROSTE
B
[2]
HEM 400
SCHACHT: ø 100
ROHR ø 20 CM
BEZ
-1.593 m
GEDÄMMT 20 CM
DW 2 WW 2
ø 105
BAND
BETRIEBSWARTE
2 NORMCONTAINER
J.SCHEIFELE AG
TRINKWASSER
8.10
OK.FUND
ø 100
±0.00
LAVABO
65*50
BODENSTÄRKE CONTAINER: 164 MM
OK. FUNDAMENTPLATTE: -0.17
FUNDAMENTPLATTE: 6.00 / 6.00 M
DACHRINNE
20.00
6.02⁵

5200

Einbauten siehe Zeichnung 164A3526-10
Pces int. voir dessin 2-290120

gnation / gnation	Pos. Item	Profil Size	Long. Lenght	Matiere Material	Certif. Certif.	Observation Remarks	Kg
- Armaschild	18			1.4301		A2605	
- "	17			" - "		A2604	
- "	16			" - "		A2603	
- "	15			" - "		A2602	
- "	14			" - "		A2601	
- "	13			" - "		A2600	
struktur	12				164A3526-24		
6KT Schrauben	11	M30	120	8.8		DIN 931	
- Mutter	10	M30	0,8d	8		DIN 934	
-POOL	9				164A3526-11	(0-290121)	
ch DN 600	8				164A3526-9	(2-290119)	
ch DN 1000	7				164A3526-8	(2-290118)	
ch DN 700	6				164A3526-7	(2-290117)	
ion - Befestigung	5				164A3526-6	(1-290116)	
RPV	4				164A3526-5	(1-290115)	
GDCS	3				164A3526-4	(1-290114)	
T-WELL	2				164A3526-3	(0-290113)	
Y-WELL	1				164A3526-2	(0-290112)	

ur 16.09.92 Ben	D		Echelle-Scale 1:50
ur 25.09.92 Ben	E		Dessine-Drawn 29.06.92 Ben
pos.12 06.11.92 Ben	F		Controle-Checked 11.11.93

NDA

tellung
. GIOVANOLA
MASSE (innen)
KPUNKTE

As-Built Data are written in bold

Liste de pieces sep.,p.
Sep. Material List,p.

No d'affaire 47185

1-290300

No. de dessin-Dwg. No.
164A3526-1c.

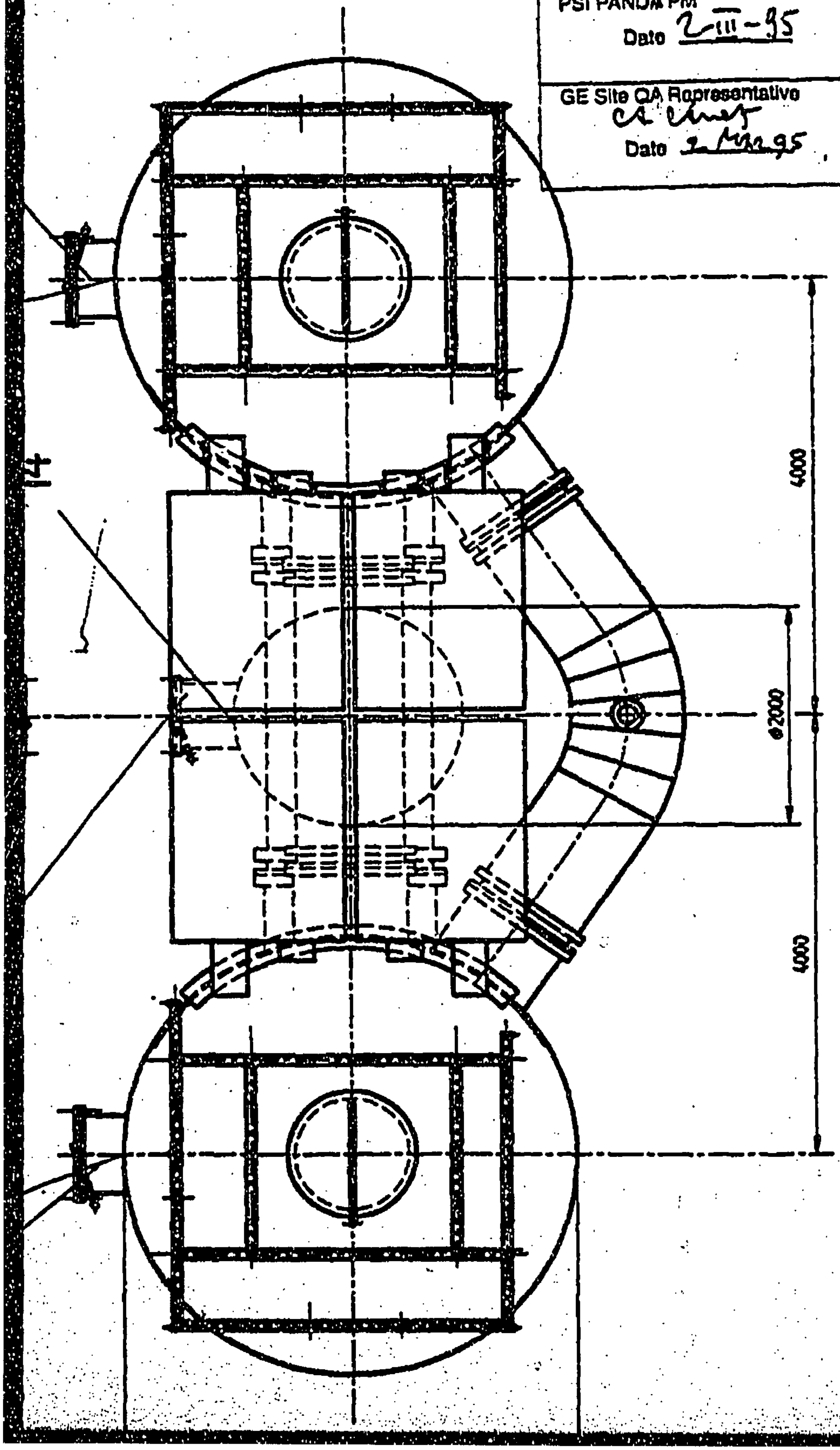
Released by:

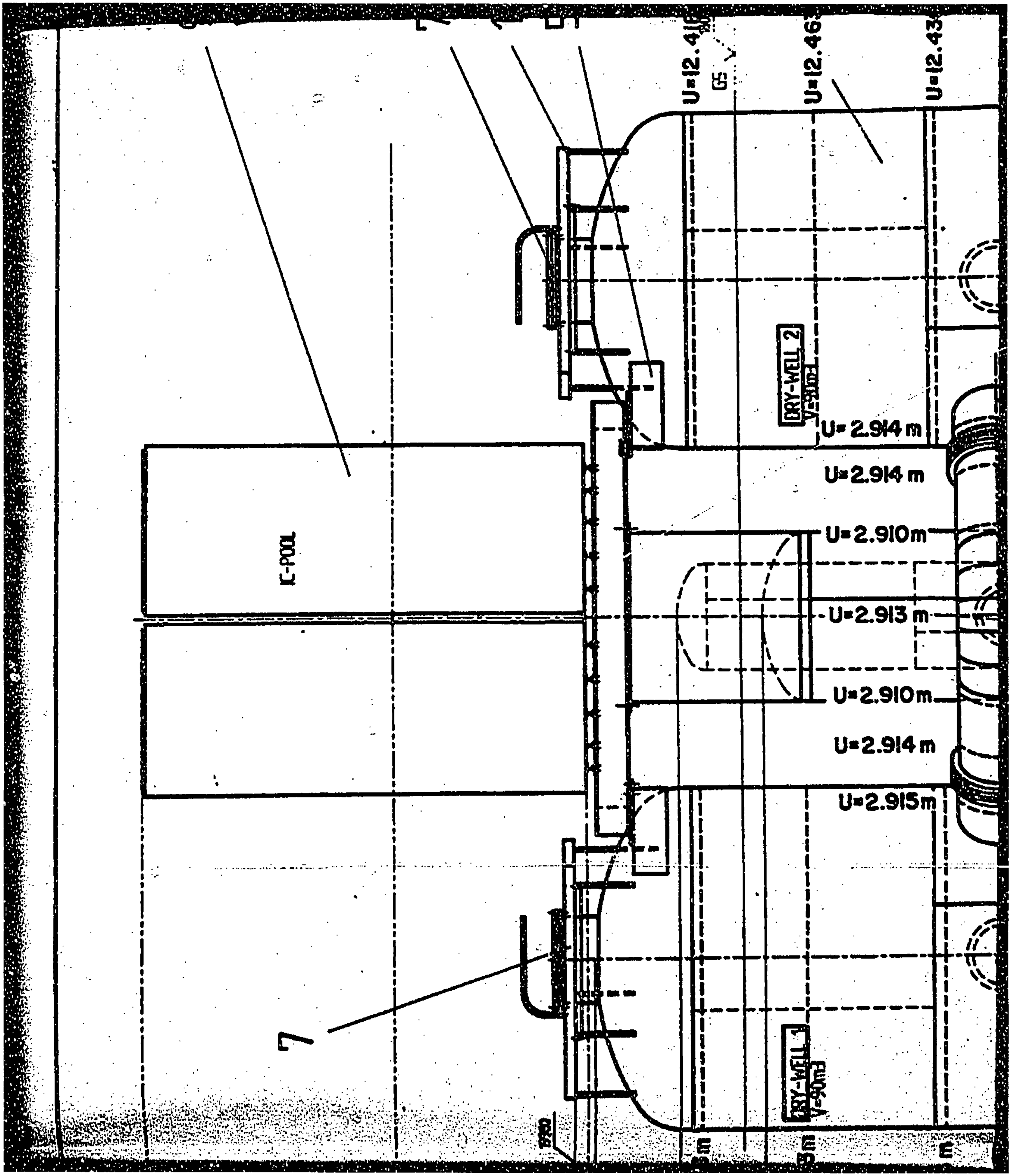
PSI PANDA PM

Date 2-III-95

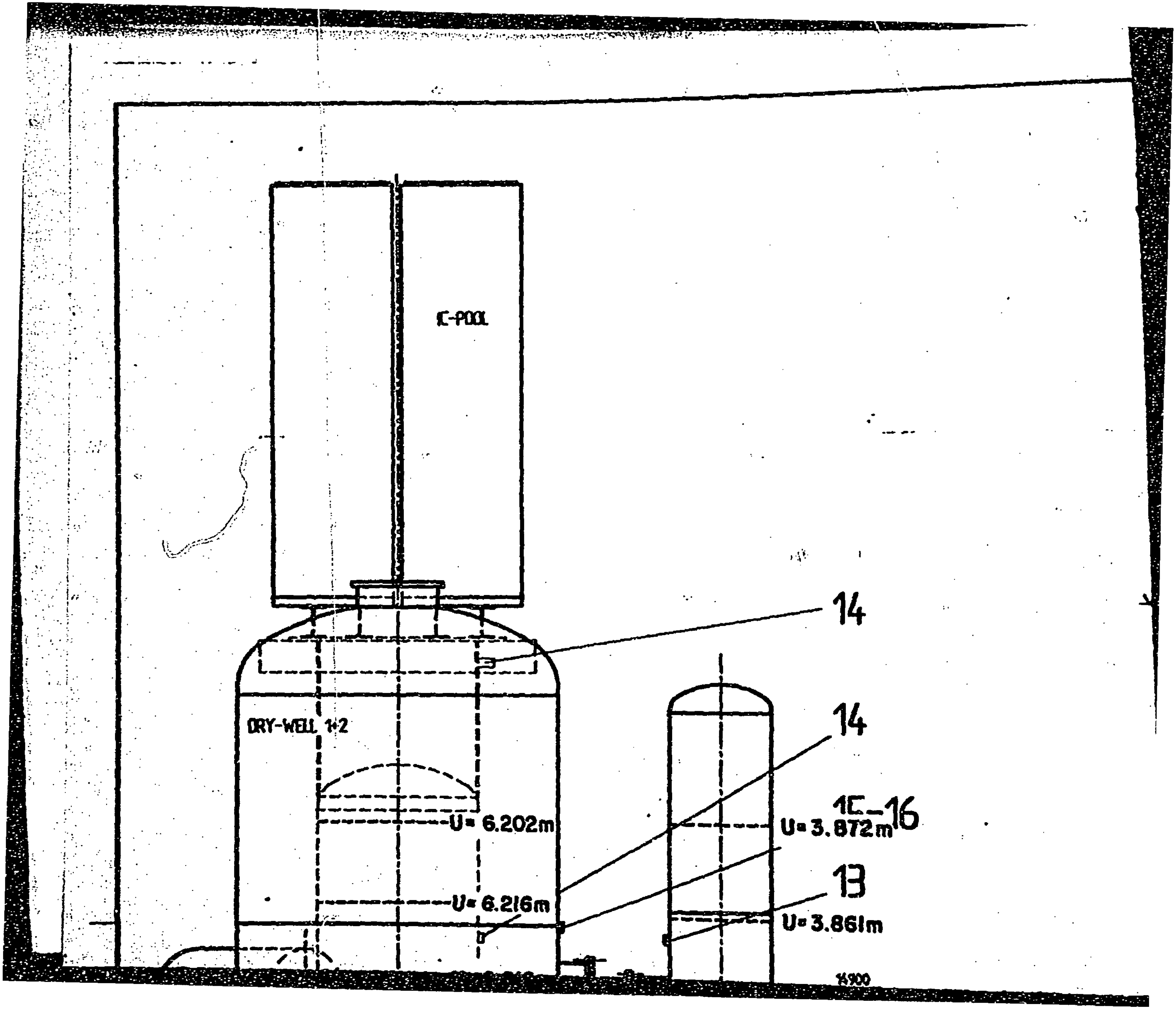
GE Site QA Representative

Date 2-Mar-95



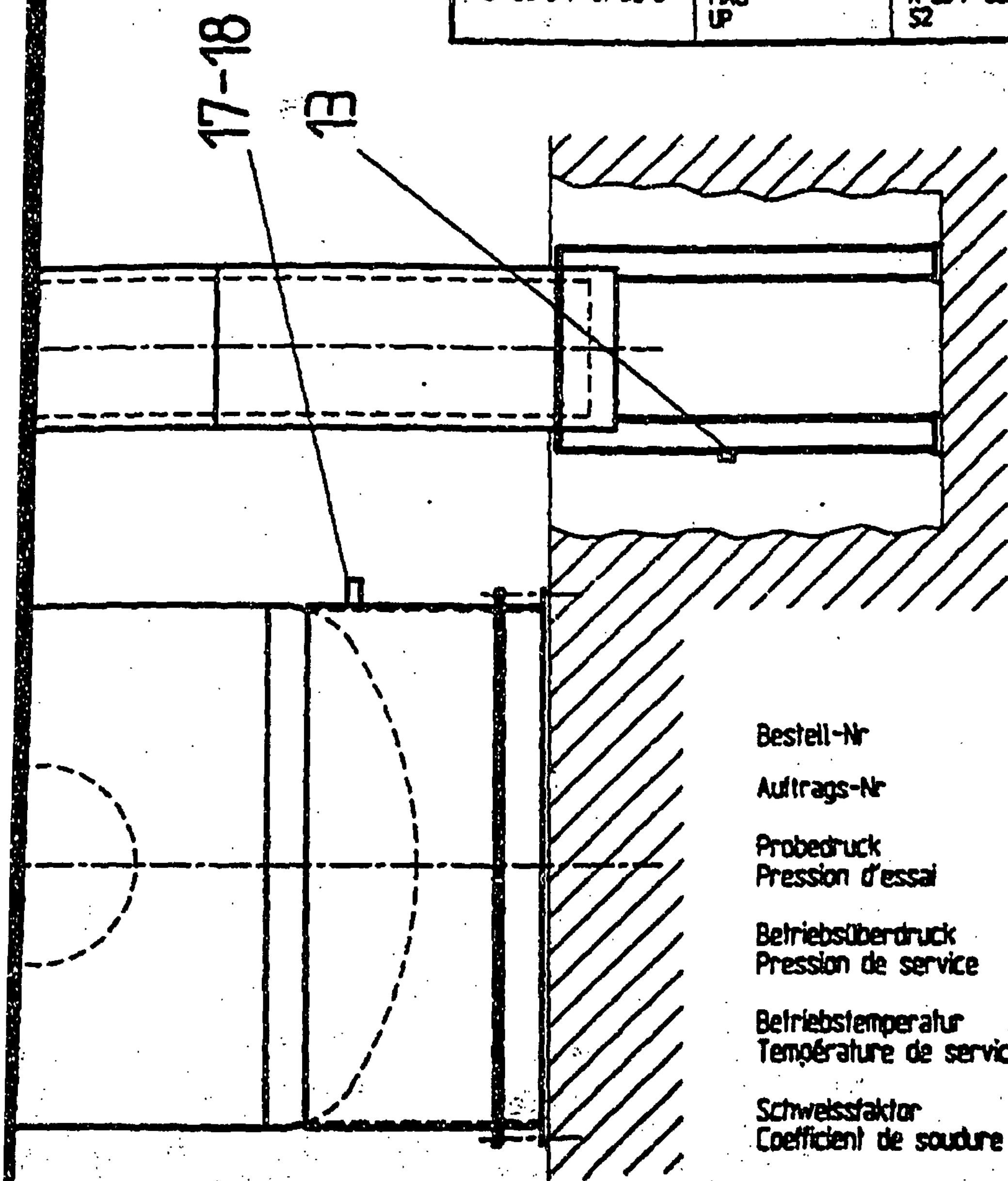


IC-POOL
DRY-WELL 2
DRY-WELL 1
U=12.41
U=12.46
U=12.43
U=2.914 m
U=2.914 m
U=2.910m
U=2.913 m
U=2.910m
U=2.914 m
U=2.915m
7



IC-POOL
14
DRY-WELL 1+2
14
U= 6.202m
U= 3.872m
IC-16
13
U= 6.216m
U= 3.861m
14900

Qualité Werkstoffverbindungen	Procédé Schweissverfahren	Métal d'apport Schweisszusatzwerkstoff
14571 / 14571	UP Plasma Electrode MIG/TIG	EAS 4MUP ohne SAS-4A 19-12-3 LSI
14571 / St 52-3	Electrode MIG UP	Limarosta 309 S Fluxinox 309S CN 23/12 UP
St 52-3 / St 52-3	Electrode MAG UP	Supratherme K 56 / Carmig 23 S2



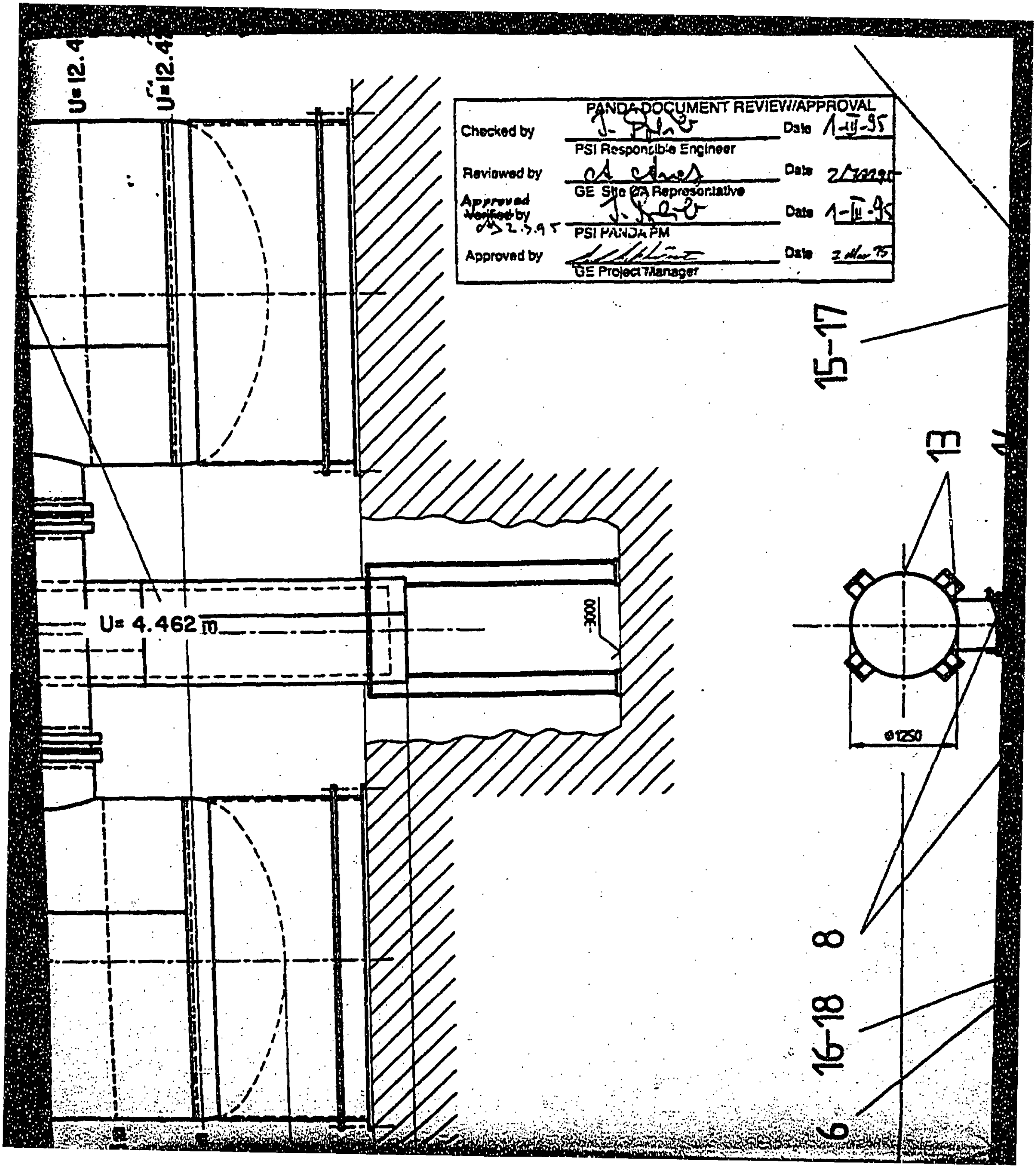
Bestell-Nr	15972
Auftrags-Nr	47185
Probedruck Pression d'essai	13 bar
Betriebsüberdruck Pression de service	-1/+10 bar
Betriebstemperatur Température de service	200 °C
Schweissfaktor Coefficient de soudure	0.85
Totalleergewicht Poids total à vide	~164 to.

2	Pladresse
2	-
2	-
2	-
2	-
2	-
1	Trag
72	Vis t.f.p. -
72	Ecrou
1	C
2	Mannlo
2	Mannlo
4	Mannlo
1	C-POOL Foca
1	
1	
1	W
1	GR
Nb. Pces.	Des Des

Modifications Révisions		
	A	cls à j
	B	cls à j
	C	ajouté

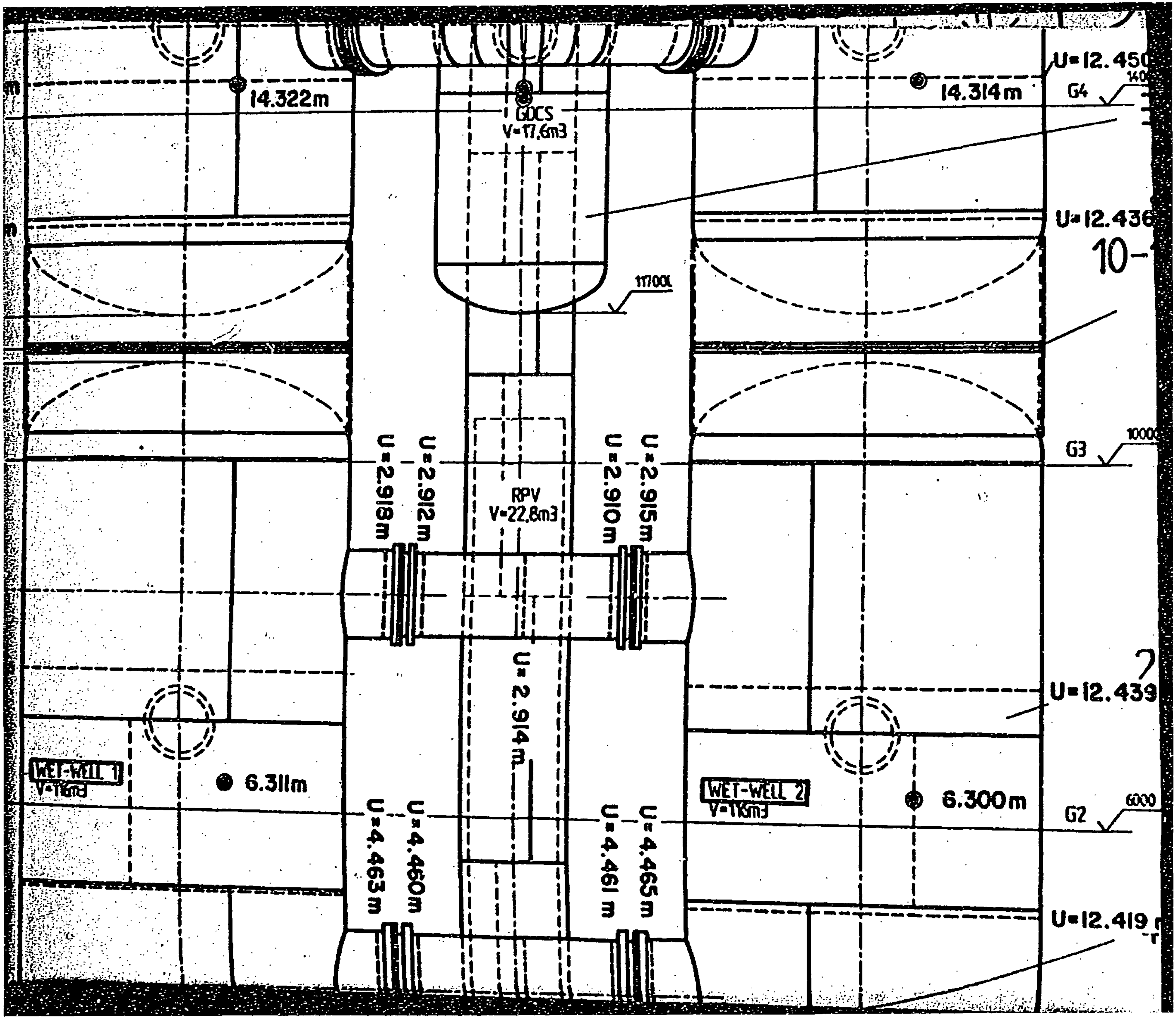
PSI / PA

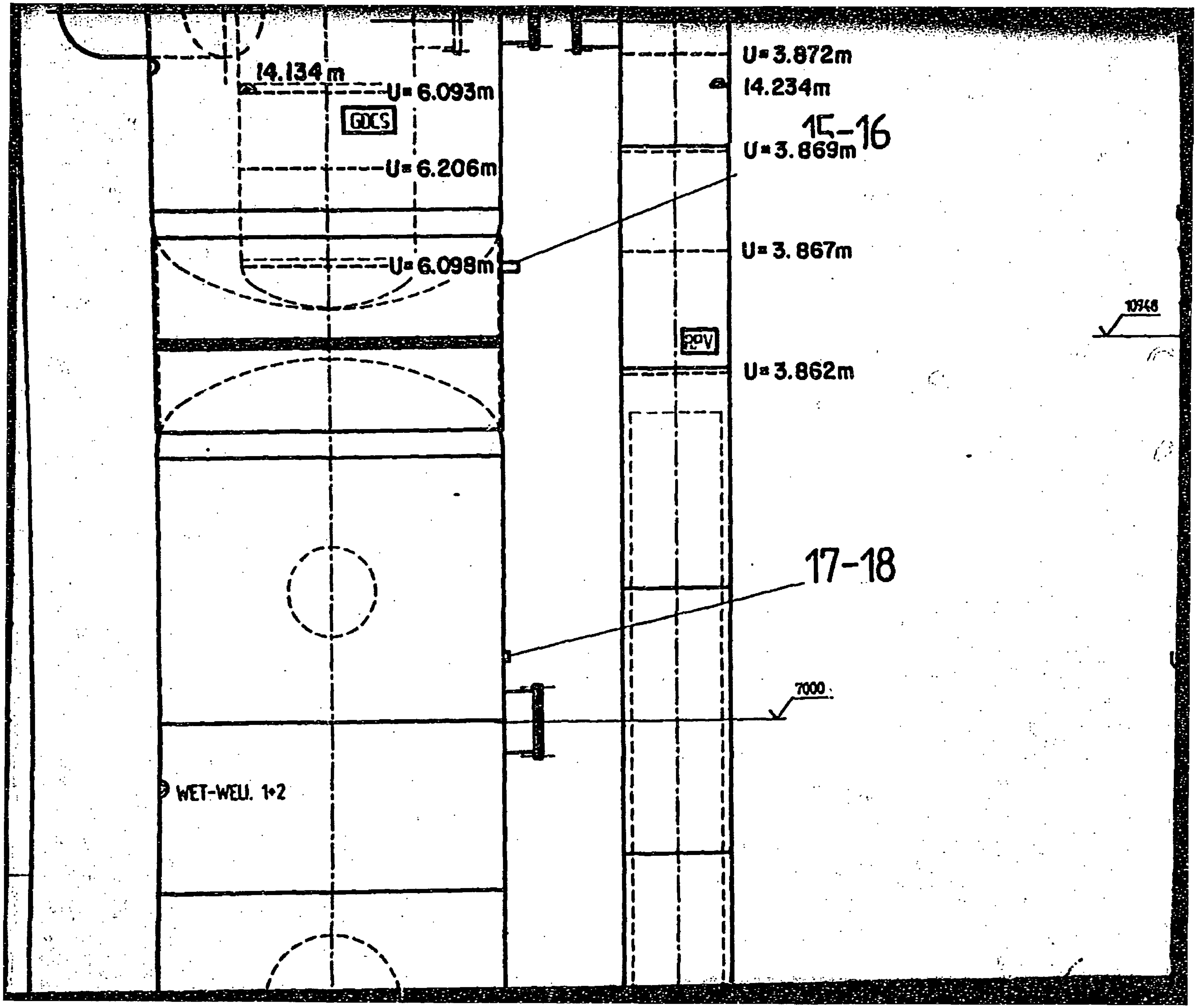
Zusammens
Plangrundlage
UMFANGSM
HOEHENFIX



PANDA DOCUMENT REVIEW/APPROVAL

Checked by	[signature] PSI Responsible Engineer	Date	1-III-95
Reviewed by	[signature] GE Site QA Representative	Date	2 Mar 95
Approved ~~Verified~~ by (2.3.95)	[signature] PSI PANDA PM	Date	1-III-95
Approved by	[signature] GE Project Manager	Date	2 Mar 95


14.322m
GDCS
V=17,6m3
14.314m
U=12.450
140
G4
U=12.436
10-
11700L
U=2.918m
U=2.912m
RPV
V=22,8m3
U=2.910m
U=2.915m
G3
10000
U=2.914m
U=12.439
WET-WELL 1
V=116m3
6.311m
WET-WELL 2
V=116m3
6.300m
G2
6000
U=4.463m
U=4.460m
U=4.461m
U=4.465m
U=12.419



14.134 m
U=6.093m
GDCS
U=6.206m
U=6.098m
U=3.872m
14.234m
15-16
U=3.869m
U=3.867m
RPV
U=3.862m
10948
17-18
7000
WET-WELL 1+2

	-875	751	1/2"		-875	771	1/2"		875
	-725	752	1/2"		-725	772	1/2"		725
	-575	753	1/2"		-575	773	1/2"		575

...utzen 1/2" = Innengewinde

As-Built Data are written in bold

PANDA DOCUMENT REVIEW/APPROVAL

Checked by	J. Dreier (signature) PSI Responsible Engineer	Date	1-III-95
Reviewed by	(signature) GE Site QA Representative	Date	2 Mar 95
Approved Verified by C/M 2.3.95	J. Dreier (signature) PSI PANDA PM	Date	1-III-95
Approved by	(signature) GE Project Manager	Date	2 Mar 95

PANDA MASTER DOCUMENT

Released by: J. Dreier (signature)

PSI PANDA PM Date 2-III-95

GE Site QA Representative (signature) Date 2 Mar 95

Nb. Stk. Pos.	Désignation / Gegenstand / Designation	Pos.	Profil / Size	Long. / Länge / Length	Matière / Werkstoff / Material	Certif.	Observations / Bemerkungen / Remarks

Modifications / Änderungen / Revisions							
C		F		I		L	
B	Corrigé disp. 22.09.92 Ab	E		H		K	
A	Nouvel disp. 14.09.92 Ab	D		G		J	

PSI / PANDA

IC - POOL Zusammenstellung
Plangrundlage GIOVANOLA
HOEHENFIXPUNKTE

Ingenieure + Berater

Liste de pièces séparées / Sep. Material List

Etabli pour - based for: 0-290 301

Ass. - Assembly dwg.

Remplace - Supersedes

Echelle - Scale: 1:10

Dessiné - Drawn: 26.08.92 Abbel M.

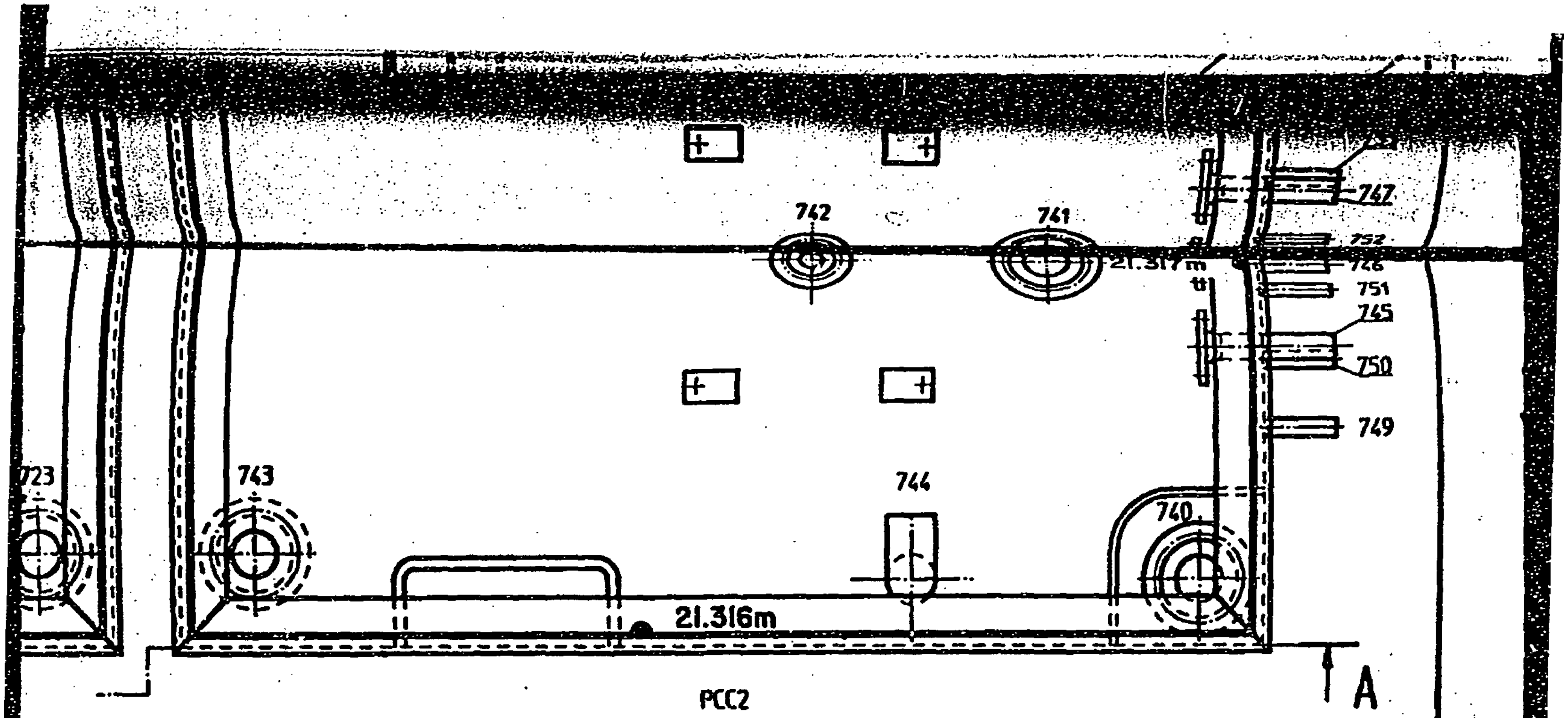
Contrôlé - Checked: (signature) 26.10.93

N° d'affaire: 47185

N° de dessin - dwg. n°: 164A3526-12b

Massstab	Datum	Plan-Nummer	E-Code
1:10	10.11.93		

Gez.: JOLLER / Gepr.: STELLER / 89 x 120



ERUNG DER FLANSCHE UND STUTZEN

C1

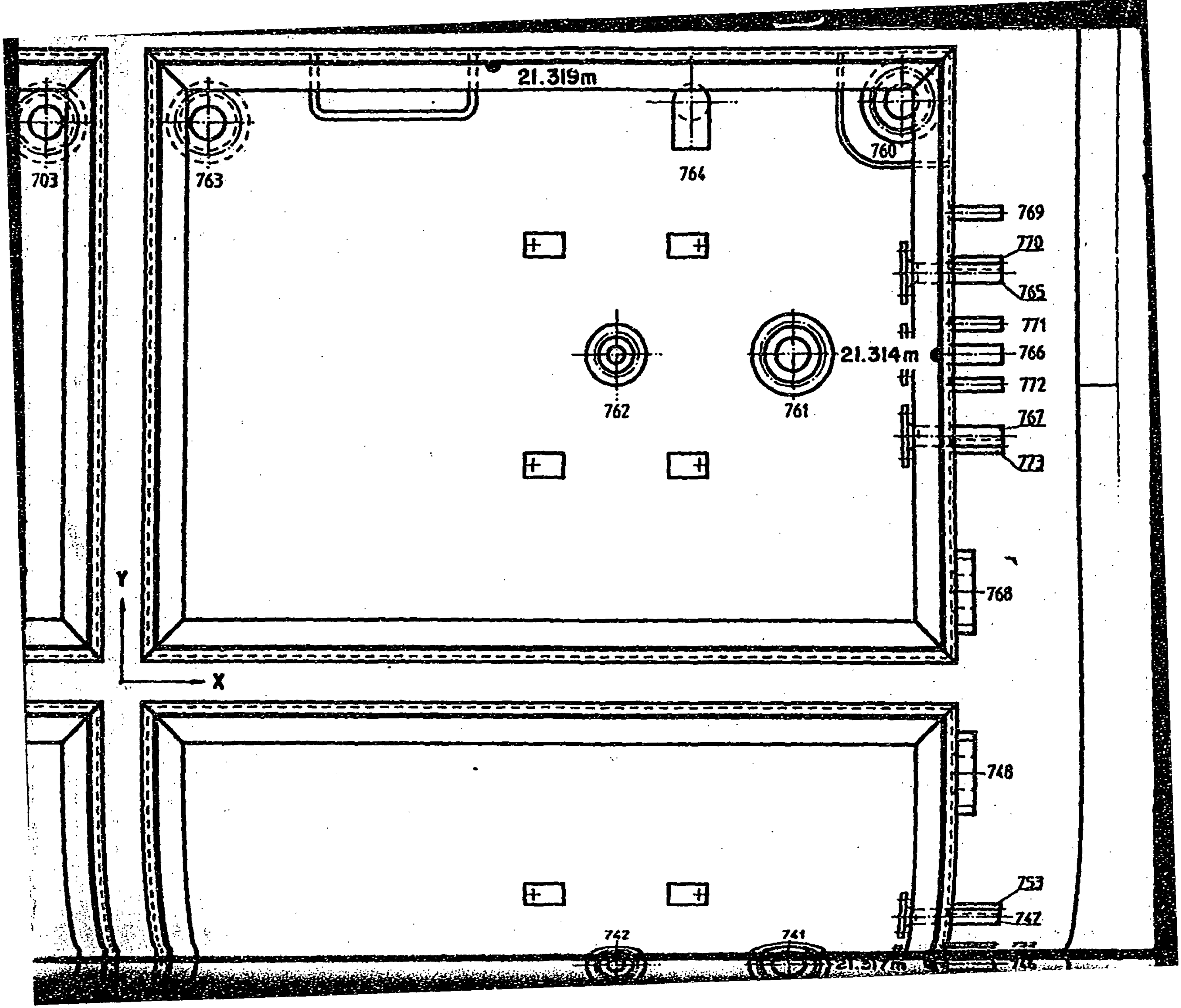
X	Y
920	-1420
650	-800
215	-800
00	-1420
400	-1420
	-1000
	-800
	-600
	-220
	[illegible]

PCC2

Nr.	NW	X	Y
740	80	1920	-1420
741	80	1650	-800
742	40	1215	-800
743	80	200	-1420
744	80	1400	-1420
745	40		-1000
746	40		-800
747	40		-600
748	80		-220
749	1/2"		-1150

PCC3

Nr.	NW	X	Y
760	80	1920	1420
761	80	1650	800
762	40	1215	800
763	80	200	1420
764	80	1400	1420
765	40		1000
766	40		800
767	40		600
768	80		220
769	1/2"		1150


21.319m
703
763
764
760
769
770
765
771
21.314m
766
772
762
761
767
773
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X
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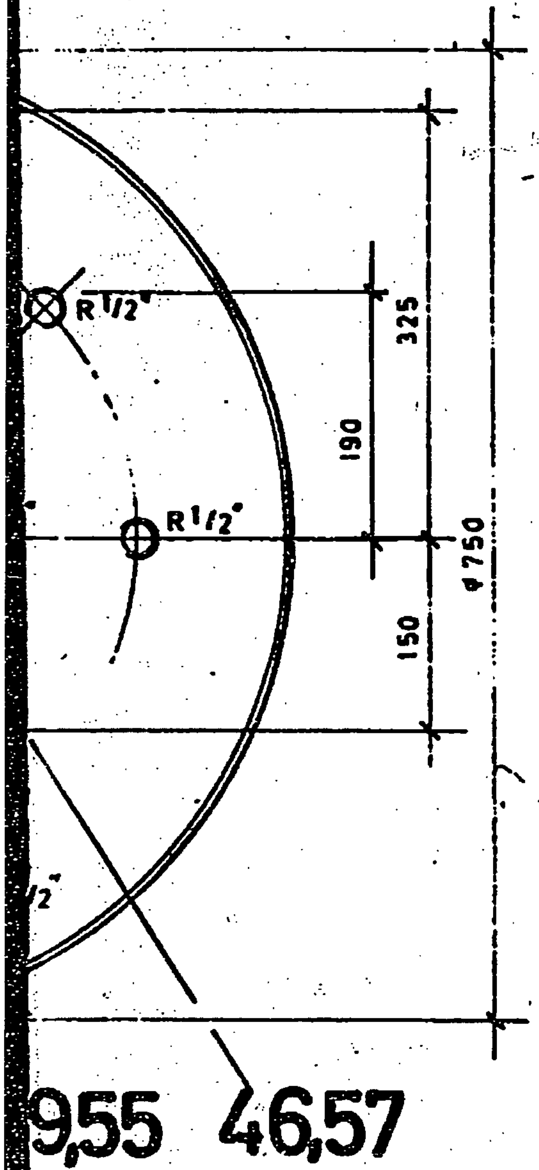
753
747
742
741



[illegible]	6,7,8
[illegible]	P4, P5*
[illegible]	P4
[illegible]	P4
[illegible]	U3

P5* Anwendung nur für einseitig geschweisste Längsnähte

Massprotokoll

20.1.93

Anlage: PANDA
Baugruppe: Kondensatoren

IC1

Isolation condenser (Ic)

0-290 130

Allgemeintoleranzen nach EDO V 010 EDO V 011 Jäggi AG Bern				Zugehörende Zeichnungen
E		–		1R-24070-1
D				
C	Aend. Pos. 54, 58, 59	28.10.92	[illegible]	
B	Div. Kundenänd.	13.10.92	[illegible]	
A	Div. Kundenänderungen	23.9.92	[illegible]	
Index	Änderung	Datum	Visum	

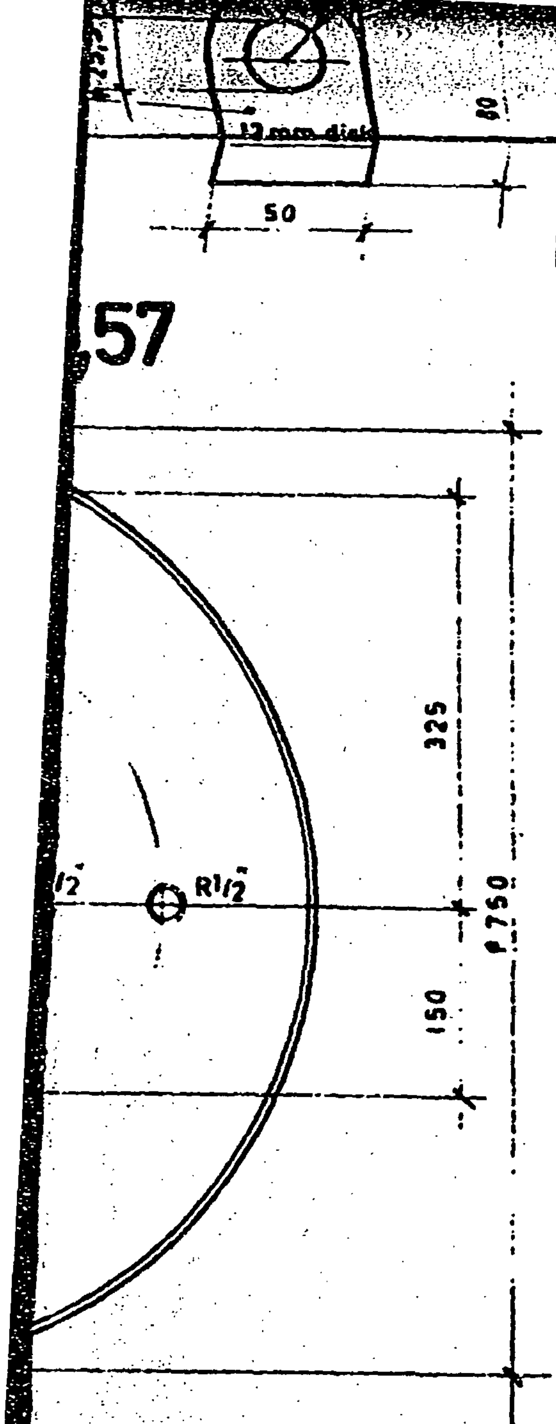
	Massstab		Datum	Visum
Kondensator spez. Typ IC	1:5	Gez	1.9.92	[illegible]
	1:2	Gepr		
	10:1	Ges		

jäggi bern — HEIZUNG LÜFTUNG KLIMA / ENERGIE UMWELT KÄLTE / VERFAHRENSTECHNIK

Zeichnungs Nr	Index
0R-24070	C

As-Built Data are written by hand

57



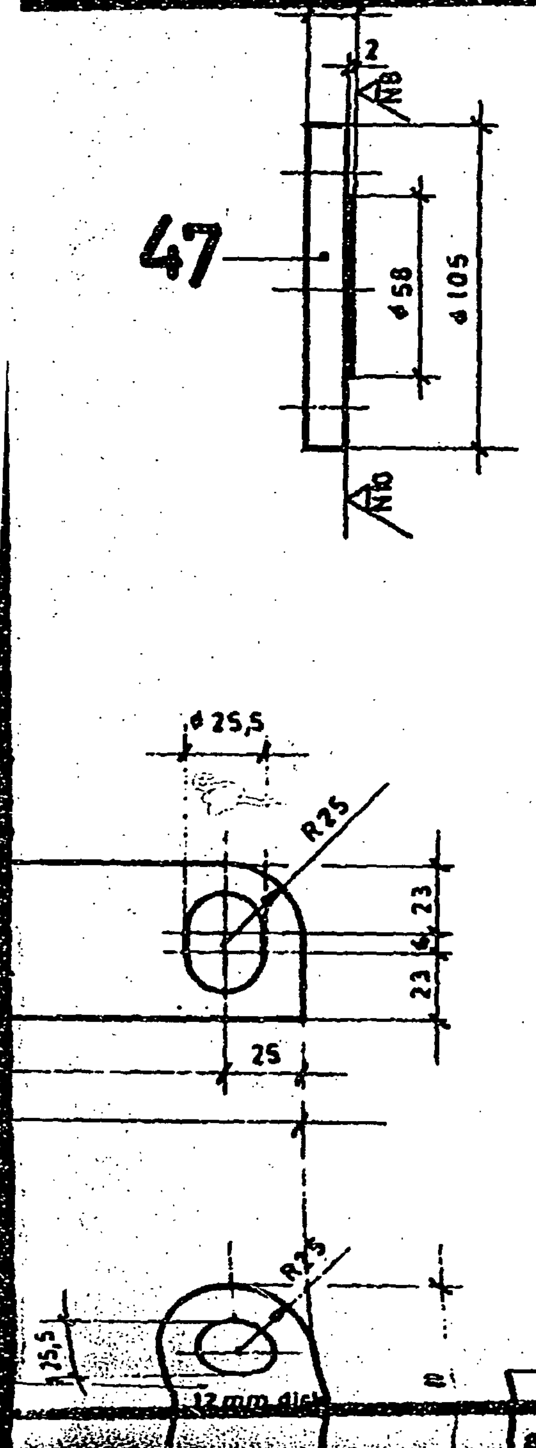
...hrungen 1/2", 1", 1 1/2" durchgehend

PAUL SCHERRER INSTITUT VILLIGEN

Versuchsanlage PANDA

Volume	338
Heat exchange surface	5.63
Weight empty	ca. 980
	10
Design pressure	10
Test pressure	13
Max working temperature	-10/+200
Design temperature	-10/+200
	0
	3380
	SVDB
	CH
	SVDB / Kunde
	SVDB / Kunde

	... Nr 4912	X
	19 12 3n CR	X



Reviewed by	[signature] GE Site QA Representative	Date	1 Mar 95
Approved / Verified by ... 2.3.95	[signature] PSI PANDA PM	Date	1-III-95
Approved by	[signature] GE Project Manager	Date	2 Mar 95

jäggi bern

Jäggi AG Bern
Wangenstrasse 107
CH 3018 Bern

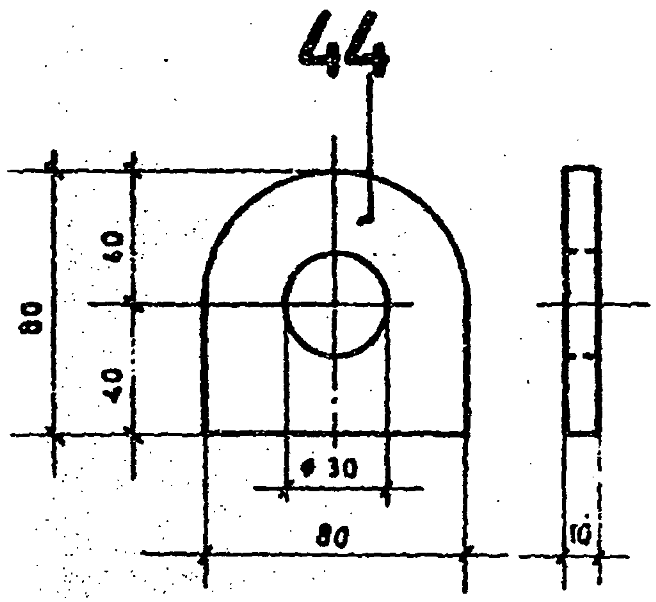
Auftrags Nr / Order No / D'ordre No	Fabr Nr / Serial No / Fabrication No	Baujahr / Year Built / Année de Fabr
61.6.92.4227	2134	1992

Bestell Nr / Order No Purchaser / Commande No	Positions Nr / Items No / Position No
16609	

		Rohrseite / Tubeside / Coté tubes	Mantelseite / Shellside / Coté Manteau	Doppelmantel / Doublejacket / Enveloppe cyl
Zul. Betriebsüberdruck / Max. working pressure / Pression de serv. max	bar / barg / bar	10	——	——
Zul. Betriebstemp / Max. working temp / Temp. de service max	°C	-10/+200	——	——
Inhalt / Volume / Volume		338	——	——
Medium / Medium / Fluide		——	——	——
Werkstoff / Material / Matériaux		1,4571	——	——

As-Built Data are written

1750
4250



PANDA MASTER DOCUMENT

Released by: J. Dreier

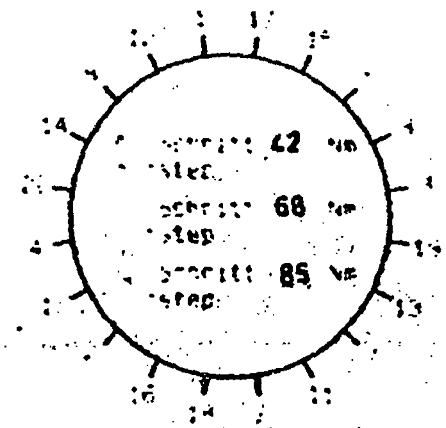
PSI PANDA PM

Date 2-VI-95

GE Site QA Representative

Date 2 Mar 95

Verschraubungsanweisung / order to bolt	20 x M20
Max. Vorspannkraft / max pre-load force	22000



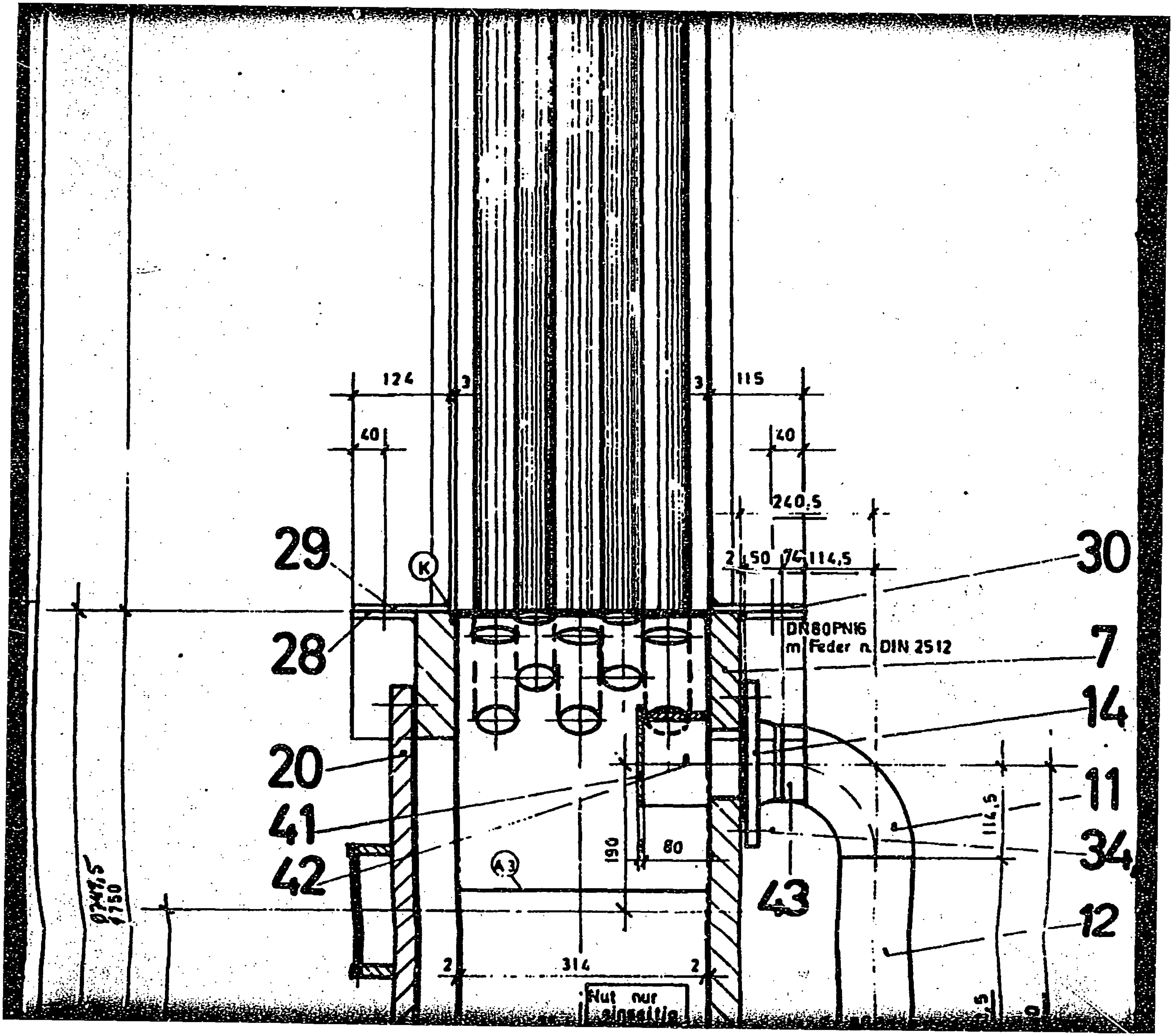
Vorspannungsschritte / pre loading

Elastische Dehnung / elastic extension	

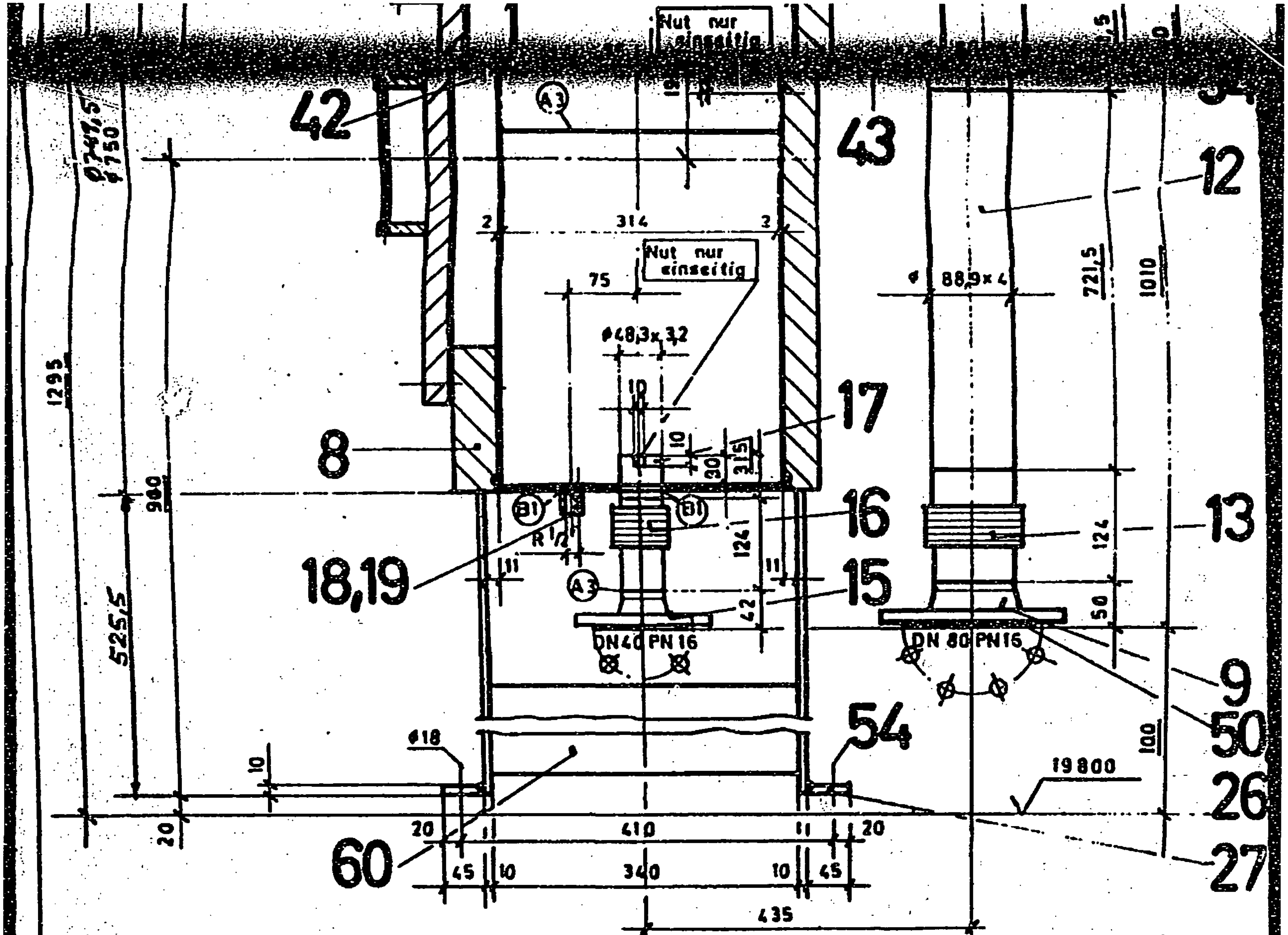
PANDA DOCUMENT REVIEW/APPROVAL

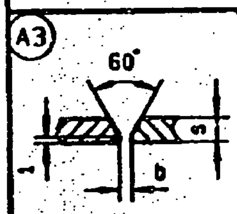
Checked by [signature] Date 95-3-1

PSI Responsible Engineer



124
3
3
115
40
40
240,5
2
50
74
114,5
29
K
30
28
DN80PN16
m Feder n. DIN 2512
7
14
20
11
41
34
42
43
12
190
80
A3
114,5
2
314
2
Nut nur einseitig
Ø741,5
Ø750





s	b
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>3 <4	1.5
>4 <5	2
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>6 <8	2
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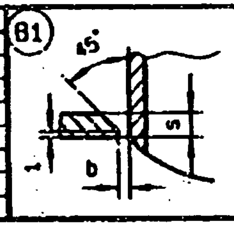
>10 <12	2



s	b
<2	0
>2 <3	1
>3 <4	1.5
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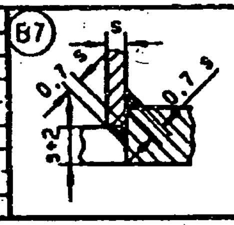
>5 <6	2
>6 <8	2
>8 <10	2
>10 <12	2



s	0,7 s
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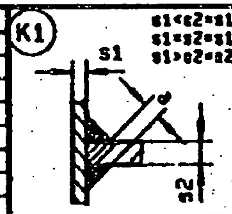
3	2,1
4	2,8
6	4,2
8	5,6
10	7
12	8,4
15	10,5



s1<s2=s1
s1=s2=s1
s1>s2=s2

s1/s2	a
2	2,
4	2,
5	3,
6	4,
8	5,
10	7
12	8,
15	10

Posted 4/21/95

GE Nuclear Energy

J. E. Quinn, Projects Manager
LMR and SBWR Programs

General Electric Company
175 Curtner Avenue, M/C 165 San Jose, CA 95125-1014
408 925-1005 (phone) 408 925-3991 (facsimile)

April 13, 1995

MFN 051-95
Docket STN 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Richard W. Borchardt, Director
Standardization Project Directorate

Subject: **GE PANDA Audit Report (Non Proprietary)**

Transmitted herewith is a copy of the Non Proprietary version of GE Audit Report No. ARP 95-2, Quality Assurance Audit of the SBWR PANDA Test Program by Services & Projects Quality, dated February 2, 1995, as requested by NRC staff. This audit examined the adequacy, implementation and resulting documentation of the GE PANDA Project Quality Control Plan at the PANDA test facility of the Paul Sherrer Institute (PSI) at Wuerenlingen, Switzerland. This plan and supporting procedures were prepared and provided by GE Nuclear Energy (GE-NE) and accepted by PSI to implement the requirements of the SBWR Design and Certification Program Quality Assurance Plan. The readiness of the PANDA test facility to perform tests was also examined. The applicable requirements of NQA-1 were addressed. The Report requires appropriate disposition of open items and recommendations prior to the initiation of testing at PANDA.

Sincerely,

[signature] for

James E. Quinn, Projects Manager
LMR and SBWR Programs

Attachment: Audit Report No. ARP 95-2 (Non Proprietary), Quality Assurance Audit of SBWR PANDA Test Program by Services & Projects Quality, January 31 through February 2, 1995

cc: (1 paper copy plus E-Mail w/att. except as noted below)

P. A. Boehnert	(NRC/ACRS)	(2 att.)
I. Catton	(ACRS)	
S. Q. Ninh	(NRC)	(2 att.)
J. H. Wilson	(NRC)	

MFN No. 051-95

bcc: (E-Mail w/att. except as noted below)

N. E. Barclay		
J. A. Beard		
P. F. Billig		
R. H. Buchholz		
T. Cook	(DoE)	(2 att.)
J. D. Duncan		
R. T. Fernandez	(EPRI)	
J. R. Fitch		
L. S. Gifford		
F. E. Hatch		
J. E. Leatherman		
J. E. Quinn		
T. R. McIntyre		
P. E. Novak		
F. A. Ross	(DoE)	
K. T. Schaefer		
R. Srinivasan	(EPRI)	(2 att.)
J. E. Torbeck		
GE Master File		(1 att.)
SBWR Project File		(1 att.)

AUDIT REPORT ARP 95-2

QUALITY ASSURANCE AUDIT

OF

SBWR PANDA TEST PROGRAM

BY

SERVICES AND PROJECTS QUALITY

JANUARY 31 THROUGH FEBRUARY 2, 1995

Prepared by:

Signature and date on the original in the audit file

P. E. Novak Date
ARP Quality Project Manager
Lead Auditor
Services & Project Quality

Approved by:

Signature and date on the original in the audit file

N. E. Barclay Date
Manager, Audit Programs
Services & Projects Quality

I. AUDIT SCOPE

This audit examined the adequacy, implementation, and resulting documentation of the GE PANDA Project Control Plan (PPCP-QA-01, Revision 0) at the PANDA test facility of the Paul Sherrer Institut (PSI) at Wuerenlingen (near Baden), Switzerland. This plan and supporting procedures were prepared and provided by GE Nuclear Energy (GE-NE) and accepted by PSI to implement the requirements of the SBWR Design and Certification Program Quality Assurance Plan (NEDG-31831 dated May 1990).

II. AUDIT SUMMARY

The PSI/GE-NE quality system applicable to the PANDA test program and its implementation is acceptable, to the extent audited, except as noted in the attached three Corrective Action Requests (CARs) issued to the Project Manager, SBWR Test Operations & Analysis. The audit team also noted opportunities for continuous improvement. These opportunities are documented in seven recommendations in section VII.

III. AUDIT TEAM

The GE-NE audit team consisted of :

P. E. Novak, ARP Quality Project Manager, S&PQ - Lead Auditor

N. E. Barclay, Manager, Audit Programs, S&PQ - Auditor

T. R. McIntyre, Project Manager SBWR Test Operations & Analysis - Technical Specialist

J. E. Torbeck, Systems Performance Engineer - Technical Specialist

G. A. Wingate, Systems Design Engineer - Technical Specialist

Key people contacted from PSI were:

G. Varadi, Alpha-Project Manager, Deputy Head of Thermal Hydraulics Laboratory

J. Dreier, Group Leader (Experimental), PANDA Project Manager, Thermal-Hydraulics Laboratory

O. Fischer, Engineer, Thermal-Hydraulics Laboratory

IV. AUDIT PROCESS

V. AUDIT RESULTS

VI. FOLLOW-UP AND CLOSE-OUT

Commitment and implementation of the committed and preventive actions of the three CARs is required of the responsible Project Manager.

VII. RECOMMENDATIONS

Posted 4/21/95

GE Nuclear Energy

J. E. Quinn, Projects Manager
LMR and SBWR Programs

General Electric Company
175 Curtner Avenue, M/C 165 San Jose, CA 95125-1014
408 925-1005 (phone) 408 925-3991 (facsimile)

April 17, 1995

MFN No. 052-95
Docket STN 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Richard W. Borchardt, Director
Standardization Project Directorate

Subject: **GE PANDA Audit Report (Proprietary)**

Transmitted herewith is a copy of GE Audit Report No. ARP 95-2 (Proprietary), Quality Assurance Audit of the SBWR PANDA Test Program by Services & Projects Quality, dated February 2, 1995, as requested by NRC staff. This audit examined the adequacy, implementation and resulting documentation of the GE PANDA Project Quality Control Plan at the PANDA test facility of the Paul Sherrer Institute (PSI) at Wuerenlingen, Switzerland. This plan and supporting procedures were prepared and provided by GE Nuclear Energy (GE-NE) and accepted by PSI to implement the requirements of the SBWR Design and Certification Program Quality Assurance Plan. The readiness of the PANDA test facility to perform tests was also examined. The applicable requirements of NQA-1 were addressed. The Report requires appropriate disposition of open items and recommendations prior to the initiation of testing at PANDA.

Please note that the information contained in the attachment is of the type which GE maintains in confidence and withholds from public disclosure. It has been handled and classified as proprietary to GE as indicated in the attached affidavit. We hereby request that this information be withheld from public disclosure in accordance with the provisions of 10CFR2.790.

Sincerely,

TRM'Intyre for JE Quinn

James E. Quinn, Projects Manager
LMR and SBWR Programs

Enclosure: Audit Report No. ARP 95-2, (Proprietary), Quality Assurance Audit of SBWR PANDA Test Program by Services & Projects Quality, January 31 through February 2, 1995

cc:	P. A. Boehnert	(NRC/ACRS)	(2 paper copies plus E-Mail w/o encl.)
	I. Catton	(ACRS)	(E-Mail w/o encl.)
	S. Q. Ninh	(NRC)	(2 paper copies w/encl. plus E-Mail w/o att.)
	J. H. Wilson	(NRC)	(1 paper copy w/encl. plus E-Mail w/o att.)

Poston
7/19/95

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 6, 1995

MFN No. 116-95

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
General Electric Nuclear Energy
175 Curtner Avenue
San Jose, CA 95125

SUBJECT: REQUEST FOR WITHHOLDING INFORMATION FROM PUBLIC DISCLOSURE, GENERAL ELECTRIC "AUDIT REPORT ARP 95-2 QUALITY ASSURANCE AUDIT OF SIMPLIFIED BOILING WATER REACTOR (SBWR) PANDA TEST PROGRAM BY SERVICE AND PROJECTS QUALITY JANUARY 31 THROUGH FEBRUARY 2, 1995"

Dear Mr. Quinn:

By your letter and affidavit dated April 17, 1995, you submitted the subject General Electric Company (GE) PANDA Audit Report approved March 14, 1995, and requested that it be withheld from public disclosure. This request was made in accordance with 10 CFR 2.790 and is supported by affidavit executed by David Robare which claims that "...the information is classified as proprietary because it would provide other parties, including competitors, with information related to validation of General Electric proprietary design and analysis computer codes which were developed at a considerable expense to General Electric."

The GE request for a proprietary determination extends to essentially the entire audit report as indicated by the side bar markings. We have reviewed the request and determined that the affidavit has provided an insufficient basis for withholding the document from public disclosure. The staff has concluded that disclosure to the public of the portions of the document that you identified as proprietary would not provide other parties, including competitors, with meaningful information related to validation of General Electric proprietary design and analysis computer codes. The report does not disclose information that could be used by competitors to improve their position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product, nor does it reveal meaningful information related to past, present, or future customer-funded development plans and programs. Therefore, we have concluded that no portion of the document is proprietary.

Due to our determination, we intend to place the subject document in the NRC Public Document Room in 30 days from the date of this letter. If you wish to withdraw this document you may do so within the 30 day time period, pursuant to 10 CFR Section 2.790.

Sincerely,

Dino C. Scaletti

Dino C. Scaletti, Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors and license Renewal
Office of Nuclear Reactor Regulation

Docket No. 52-004

cc: See next page

Mr. James E. Quinn
GE Nuclear Energy

Docket No. 52-004

cc: Mr. John E. Leatherman, Manager
SBWR Design Certification
GE Nuclear Energy
175 Curtner Avenue, MC-781
San Jose, CA 95125

Mr. Steven A. Hucik
GE Nuclear Energy
175 Curtner Avenue, MC-780
San Jose, CA 95125

Mr. Richard W. Burke, Sr., Manager
BWR Design Certification
Electric Power Research Institute
3412 Hillview Avenue
Palo Alto, CA 94304-1395

Mr. Laurence S. Gifford
GE Nuclear Energy
1299 Pennsylvania Avenue, N.W.
Suite 1100
Washington, DC 20004

Enclosure to be distributed to the following addressees after the result of the proprietary evaluation is received from Simplified Boiling Water Reactor:

Mr. Brian McIntyre
Westinghouse Electric Corporation
Energy Systems Business Unit
Box 355
Pittsburgh, PA 15222

Director, Criteria & Standards Division
Office of Radiation Programs
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460

Mr. Sterling Franks
U.S. Department of Energy
NE-42
Washington, DC 20585

Mr. Frank A. Ross
Program Manager, ALWR
Office of LWR Safety & Technology
U.S. Department of Energy
NE-42
19901 Germantown Road
Germantown, MD 20874

Posted 7/25/95

GE Nuclear Energy

J. E. Quinn, Projects Manager
LMR and SBWR Programs

General Electric Company
175 Curtner Avenue, M/C 165 San Jose, CA 95125-1014
408 925-1005 (phone) 408 925-3991 (facsimile)

July 20, 1995

MFN 122-95
Docket STN 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Theodore E. Quay, Director
Standardization Project Directorate

Subject: **SBWR - Withdrawal of GE PANDA Audit Report & Associated Affidavit**

Reference:

1. Letter from Dino Scaletti (NRC) to Mr. J. E. Quinn (GE), *Request For Withholding Information From Public Disclosure, General Electric (GE) "Audit Report ARP 95-2 Quality Assurance Audit of Simplified Boiling Water Reactor (SBWR) PANDA Test Program by Service and Projects Quality January 31 through February 2"*, dated July 6, 1995.

2. Letter MFN 052-95 from J. E. Quinn (GE) to R. W. Borchardt (NRC), *GE PANDA Audit Report (Proprietary)*, dated April 17, 1995.

In response to the NRC's Reference 1 letter, GE formally requests the withdrawal of the proprietary version of the PANDA Audit Report and its associated affidavit. This material was transmitted to the NRC in Reference 2. Please return these documents to GE.

The proprietary version of the PANDA Audit Report will be available for NRC review in GE's San Jose California offices.

Sincerely,

[signature]

James E. Quinn

cc:			
	P. A. Boehnert	(NRC/ACRS)	(2 paper copies plus E-Mail)
	I. Catton	(ACRS)	(1 paper copy plus E-Mail)
	S. Q. Ninh	(NRC)	(2 paper copies plus E-Mail)
	J. H. Wilson	(NRC)	(1 paper copy. plus E-Mail)
	D. Scaletti	(NRC)	(1 paper copy. plus E-Mail)

MFN 122-95

bcc: (E-Mail except as noted)

N. E. Barclay		
J. A. Beard		
P. F. Billig		
R. H. Buchholz		
T. Cook	(DoE)	(2 paper copies plus E-Mail)
J. D. Duncan		
A. Ehlers		
R. T. Fernandez	(EPRI)	
J. R. Fitch		
J. E. Leatherman		
J. E. Quinn		
T. J. Mulford	(EPRI)	(2 paper copies plus E-Mail)
P. E. Novak		
F. A. Ross	(DoE)	
K. T. Schaefer		
B. Shiralkar		
R. Srinivasan	(EPRI)	
J. E. Torbeck		
GE Master File	M/C 747	(1 paper copy plus E-Mail)
SBWR Project File		(1 paper copy plus E-Mail)

MFN 023-96 Rec'd 2/20/96 JEF Copies to: JEQ, JET, PFB, BSS, Norm Barclay, RHB, MH, JDD, JEL. This copy to MFN file, JEF

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

February 20, 1996

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, California 95125

SUBJECT: CONFIRMATION OF NUCLEAR REGULATORY COMMISSION INSPECTION REGARDING THE SIMPLIFIED BOILING WATER REACTOR (SBWR) TESTING ACTIVITIES AT THE PANDA TEST FACILITY

Dear Mr. Quinn:

The Office of Nuclear Reactor Regulation staff will be conducting a quality assurance (QA) team inspection at the Paul Scherrer Institute (PCI) PANDA test facility in Wurenlingen, Switzerland on March 5 through 8, 1996. The inspection team will consist of Messrs. Richard McIntyre, Juan Peralta, Alan Levin, John Kudrick, John Monninger, and Dino Scaletti. This inspection has been discussed with your staff on several occasions over the past months.

The inspection will review the QA program and controls implemented during the design, procurement, construction, and testing associated with PANDA SBWR. The adequacy of QA controls exercised during these activities is important to the staff since GE has used data from these tests to qualify the TRACG code for SBWR safety analysis applications. The PANDA inspection agenda was discussed with your staff on February 13, 1996. The Inspection will be similar in format to the inspection of your PANTHERS facility.

Following the PANDA inspection, on March 11 and 12, 1996, four members of the inspection team, Messrs. Richard McIntyre, Juan Peralta, Alan Levin, and Dino Scaletti will be visiting the Ansaldo offices in Genoa, Italy to discuss their QA practices relating to both the AP600 and the SBWR design certification applications. The meetings will consist of a general discussion of QA practices common to both designs beginning at 9 a.m. on March 11, 1996, followed in the afternoon by a discussion of AP600 specific issues and on March 12, 1996, with specific discussions related to the SBWR.

The cooperation of your staff in notifying PSI and Ansaldo of our plans and in providing the support needed to complete the inspection at PANDA and the meeting with Ansaldo is appreciated. Should you have any questions concerning this inspection, please contact either Richard McIntyre, at (301) 415-3215, or Dino Scaletti, at (301) 415-1104.

Sincerely,

Dino C. Scaletti, Project Manager
Standardization Project Directorate
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 52-004

cc: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

DATE: 2-20-96

FAX NO. 301-415-2279   0-11-D-1

PLEASE TYPE OR USE BOLD FELT TIP PEN

TO	LOCATION
John Leatherman	San Jose, Calif
FAX # (408) 925-1193	

FROM: Dino Scaletti   PHONE EXT. (301) 415-1104

OFFICE: NRR/DRPM/PDST   MAIL STOP 0-11-H3

NUMBER OF PAGES 2 AND COVER SHEET

COMMENTS:

See attached

G.E. ARP
FEB 20 1996
RECEIVED

02/20/96 04:24PM *NRC OWFN 11A2 P01

GE Nuclear Energy

J. E. Quinn, Projects Manager
LMR and SBWR Programs

General Electric Company
175 Curtner Avenue, M/C 165 San Jose, CA 95125-1014
408 925-1005 (phone) 408 925-3991 (facsimile)

February 26, 1996

MFN 029-96
Docket 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Theodore E. Quay, Director
Standardization Project Directorate

Subject: **SBWR - NRC Site Visits to PANDA, ANSALDO and Dodewaard**

Reference: 1. Letter, D. C. Scaletti (NRC) to J. E. Quinn (GE), CONFIRMATION OF NUCLEAR REGULATORY COMMISSION INSPECTION REGARDING THE SIMPLIFIED BOILING WATER REACTOR (SBWR) TESTING ACTIVITIES AT THE PANDA TEST FACILITY, dated February 20, 1996.

We have received the Reference letter. However, based upon subsequent telecons (see Att. 1) the scope of the PANDA (Switzerland) Inspection has been narrowed. We have also (2/23/96) received a detailed agenda for this inspection. We continue to be concerned with the NRC staffing size (6) for this inspection, however, we are proceeding with all preparations, including the Technical meeting on 3/8/96.

With respect to the ANSALDO (Italy) visit, although we have discussed this trip numerous times, we are still concerned with the need for and numbers of attendees (see att. 2 for more details). We believe the PANTHERS QA audit issues are closed, and the records pertaining to closure of the only "open" item are at GENE in San Jose.

With regards to the Dodewaard (Netherlands) visit, plant startup was most recently discussed at the ACRS Thermal Hydraulic Phenomenon Subcommittee meeting held with the NRC Staff in attendance, November 29, 1995; there were no open issues from that presentation as documented in the transcript of the meeting. The TAPD does make reference to three Dodewaard reports (out of over 80 references) which can be obtained by contacting GKN by telephone and talking to the responsible individuals.

Sincerely,

James E. Quinn,
Projects Manager

GE Nuclear Energy

Attachment: 1. Memo, J. E. Leatherman (GE) to D.C. Scaletti (NRC), CONFIRMATION TO NRC REGARDING SCOPE OF INSPECTION, dated February 22, 1996

2. Memo, J. E. Leatherman (GE) to S. Ninh (NRC), ANSALDO MEETING AGENDA, GENOA, ITALY 3/11/96, dated February 23, 1996

cc:	P. A. Boehnert	(NRC/ACRS)	(2 paper copies w/att. plus E-Mail w/att.)
	I. Catton	(ACRS)	(1 paper copy w/att. plus E-Mail w/att.)
	S. Q. Ninh	(NRC)	(1 paper copies w/att. plus E-Mail w/att.)
	D. C. Scaletti	(NRC)	(1 paper copy w/att. plus E-Mail w/att.)

GE Nuclear Energy

MFN 029-96

bcc: (E-Mail w/att. except as noted)

R. Asamoto		
N. E. Barclay		
J. A. Beard		
P. F. Billig		
R. H. Buchholz		
T. Cook	(DoE)	(2 paper copies w/att. plus E-Mail w/att.)
J. D. Duncan		
R. T. Fernandez	(EPRI)	
J. R. Fitch		
J. N. Fox		
P. C. Hecht		
J. E. Leatherman		
J. E. Quinn		
T. J. Mulford	(EPRI)	(2 paper copies w/att. plus E-Mail w/att.)
P. E. Novak		
F. A. Ross	(DoE)	(2 paper copies w/att. plus E-Mail w/att.)
B. Shiralkar		
R. Srinivasan	(EPRI)	
J. E. Torbeck		
GE Master File M/C 747		(1 paper copy w/att. plus E-Mail w/att.)
SBWR Project File		(1 paper copy w/att. plus E-Mail w/att.)

Leatherman John E.

From: Leatherman John E.
To: 'Scaletti, Dino (NRC FAX)'; Scaletti, Dino (NRC)
Cc: McIntyre, Rich (NRC FAX); Ninh, Son (NRC FAX); Quinn James E.; Barclay Norman E.; Fox Jack N.; Leatherman John E.; Wingaté Gordon A.; Torbeck John E.; McIntyre, Rich (NRC); 'Ninh, Son (NRC SBWR Proj)'
Subject: Confirmation to NRC regarding scope of Inspection
Date: Thursday, February 22, 1996 5:12PM

Dino,
This memo is written to document discussions between John Torbeck (GE), Norm Barclay (GE), & Rich McIntyre (NRC) which further defined the scope of the upcoming PANDA audit as follows:

Subject: PANDA QA Audit Scope

In a telecon, on 2/21/96 from N. Barclay, P. Billig and J. Torbeck of GE to Richard McIntyre of the NRC, it was agreed that the scope of the inspection would not be as stated in your letter of 2/20/96 to James E. Quinn. The design, procurement and construction of the facility at PSI will not be included in the inspection except as covered under the PANDA Quality Plan established by GE-NE in January of 1995.

The scope would be the implementation of the PANDA Quality Plan beginning on January 31, 1995.

Regards, John

Leatherman John E.

From: Leatherman John E.
To: Ninh, Son (NRC FAX); 'Ninh, Son (NRC)'
Cc: Levin Alan (NRC FAX); McIntyre, Rich (NRC FAX); 'Scaletti, Dino (NRC FAX)'; Quinn James E.; Barclay Norman E.; Billig Paul F.; Buchholz Robert H.; Leatherman John E.; Shiralkar Bharat S.; Torbeck John E.; Levin Alan (NRC); Scaletti, Dino (NRC); McIntyre, Rich (NRC)
Subject: ANSALDO MEETING AGENDA, GENOA, ITALY 3/11/96
Date: Friday, February 23, 1996 11:36AM

At the Tuesday morning Testing phonecalls 2/13 & 2/20/96 we discussed the need for the subject meeting and its duration. We understood that we had reached consensus that the goal was to accomplish the meeting in one day, March 11, 1996, but that if necessary, additional follow-up discussions would be held March 12. Your just received Agenda topics shows a Tuesday reference agenda. We still feel, and understand that Westinghouse agrees, that the general meeting and AP600 sessions could be accomplished in the morning and any AP600 spill-over and SBWR sessions could be handled in the afternoon. We would suggest the following reference agenda:

0830 - Discussions of overall interfaces between Ansaldo and GENE & Westinghouse related to QA for design certification
1030 - AP600 specific discussions:
- QA Process on Design and Construction of Modifications to VAPORE Facility for AP600 Phase A & B Testing
- Process for Development of As-Built Drawings
- QA Interface for Other Activities Related to AP600 (as applicable) (e.g., RELAP Calculations on SPES-2 & Post-Test Data Analysis)

1230 LUNCH
1330 - W-spillover
1400 - SBWR specific Discussions:
- QA Process on Design & Fabrication of PANTHERS Heat Exchangers

We also stated in the 2/20 telecon that the IC leakage was being addressed by the design team as part of the normal design & component qualification efforts. Since these are not part of the current Technology Phase licensing review and are still in progress, we do not feel they should be included in the agenda. The IC performance data has been obtained and is being processed as per the TAPD.

We wish to reiterate that the initial PANTHERS QA audit question has been closed in our opinion, and that the need for this ANSALDO site visit for SBWR is not clear. The only "open" aspect is GE's oversight of ANSALDO, and those records are at GE in San Jose.

Please revise your agenda accordingly,
Thanks, John

GE Nuclear Energy

J. E. Quinn, Projects Manager
LMR and SBWR Programs

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408 925-1005 (phone) 408 925-3991 (facsimile)

March 4, 1996

MFN 034-96
Docket 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Theodore R. Quay, Director
Standardization Project Directorate

Subject: **SBWR - Redirecting Focus**

GE Nuclear Energy is redirecting the focus of its Simplified Boiling Water Reactor (SBWR) programs from plants of the 670 Mwe size to plants of 1,000 MWe or larger. Consequently, GE will be substantially reducing the level of activity on the current 670 Mwe plant Technology Phase, which has been the focus of GE's SBWR efforts with the NRC over the past 20 months. However, GE wishes to complete key ongoing test and analysis activities to make this data available for other applications of this technology.

In line with redirecting the SBWR focus, GE would like to review with NRC the orderly closure of open NRC activities for the 670 Mwe plant. The Attachment to this letter presents our listing of the open activities and our desired closure objective, output, and schedule. We look forward to discussing the efficient close out of the open items in the manner which can provide the best results for both the NRC and GE.

Sincerely,

RI Buchholz for

James E. Quinn

Attachment: **SBWR Project Redirection - NRC Activity Closure Plan**

cc:	P. A. Boehnert	(NRC/ACRS)	(2 paper copies w/att. plus E-Mail w/att.)
	I. Catton	(ACRS)	(1 paper copy w/att. plus E-Mail w/att.)
	S. Q. Ninh	(NRC)	(1 paper copy plus E-Mail w/att.)
	D. C. Scaletti	(NRC)	(1 paper copy w/att. plus E-Mail w/att.)

Attachment to MFN 034-96

SBWR Project Redirection - NRC Activity Closure Plan

Opened NRC ACTIVITY	NRC OBJECTIVE	NEXT OUTPUT	SCHEDULE FOR NEXT OUTPUT
Review of TAPD Rev C submitted 8/28/95	Agree Testing and Analysis Program Document is complete & resolves prior issues	FSER	5/15/96
Review of Scaling Report Rev 1 submitted 10/13/95	Agree that the methodology used to scale the tests is correct & complete & resolves prior issues	Written status report of preliminary review	3/15/96
Testing Data Reports MFNs 057-95, 058-95, 075-95, 086-95, 109-95, 121-95, 157-95, 194-95, 245-95, 246-95, 273-95, 274-95, 025-96, 024-96, 018-96, 005-96, 004-96 GIR He FINAL DTR 4/26/96 GIR SIT FINAL DTR 5/17/96 PANDA FINAL DTR 5/24/96 PANTHERS IC TR 3/12/96	Agree that the required parameters are properly & completely included	Written letter of concurrence	<6/15/96
PANDA/ ANSALDO QA NRC Inspection 3/5-8/96 & 3/11/96	Confirm that Testing was done in accordance with procedures and meets NQA1	Written report of audit/findings	4/15/96
Test Analyses MFNs 119-94, 270-95, 261-95, 193-95, 185-95, 178-95, 161-95, 159-95, 098-95, 097-95, 006-96.	Closing status	Written summary of status at point of "stop work"	3/15/96

GE Nuclear Energy

MFN 034-96

bcc: (E-Mail w/att. except as noted)

J. A. Beard		
R. H. Buchholz		
T. Cook	(DoE)	(2 paper copies w/att. plus E-Mail w/att.)
R. T. Fernandez	(EPRI)	
J. N. Fox		
P. C. Hecht		
M. Herzog		
J. E. Leatherman		
J. E. Quinn		
T. J. Mulford	(EPRI)	(2 paper copies w/att. plus E-Mail w/att.)
F. A. Ross	(DoE)	
B. Shiralkar		
R. Srinivasan	(EPRI)	
J. E. Torbeck		
GE Master File		(1 paper copy w/att. plus E-Mail w/att.)
SBWR Project File		(1 paper copy w/att. plus E-Mail w/att.)

GE Nuclear Energy

MFN 034-96

tac: [E-Mail]

E Lumini	8-011-39-10-655-8279
S Spoelstra	8-011-31-22-456-3912
V Cavicchia	8-011-39-68-509-8601
JJ Pena	8-011-34-1-347-4215
K Maubach	8-011-49-721-987-7257
C Witteman	8-011-31-48-841-2128
A Zimmermann	8-011-49-406-396-3661
J Yamashita	8-011-81-29-423-6750
W van der Mheen	8-011-31-26-351-8092
A van Dijk	8-011-31-20-580-7041
G Yadigaroglu	8-011-41-1-632-1166
K Petersen	8-011-49-201-122-4092
H Tonegawa	8-011-81-33-597-2227
F Kienle	8-011-49-69-630-4420
P Masoni	8-011-39-51-609-8639
W Mizumachi	8-011-81-33-597-2227
G Varadi	8-011-41-5-698-2327
R Tavoni	8-011-39-51-609-8688

H Blaesig (site)	52700
J Faig (site)	52700
A Toba (site)	52700

GE Nuclear Energy

J. E. Quinn, Projects Manager
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March 14, 1996

MFN 037-96
Docket 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Paul Boehnert
ACRS Staff

Subject: **SBWR - ACRS, Redirecting Focus**

Reference: 1. Letter MFN 034-96, J. E. Quinn (GE) to T. R. Quay (NRC), SBWR - Redirecting Focus, dated March 4, 1996.

As discussed in the Reference 1 letter, GE Nuclear Energy is redirecting the focus of its Simplified Boiling Water Reactor (SBWR) programs from plants of the 670 MWe size to plants of 1,000 MWe or larger. Consequently, GE will be substantially reducing the level of activity on the NRC/ACRS effort as it applies to the 670 MWe plant. However, GE would like to complete key open items.

Specifically, GE would like to receive written ACRS agreement that the TAPD Revision C document submitted August 28, 1995, is complete and resolves the prior ACRS issues, and that ACRS agrees that the methodology used to scale the tests as presented in the Scaling Report Revision 1 submitted October 13, 1995, is correct and complete and resolves the prior ACRS issues.

We would then like to cease ACRS activities on the 670 Mwe SBWR. We believe that ACRS could complete the work and issue the written communications by May 15, 1995. We look forward to discussing this letter with you at your earliest convience.

Sincerely,

James E. Quinn

cc:	T. R. Quay	(NRC)	(1 paper copy plus E-Mail)
	I. Catton	(ACRS)	(1 paper copy plus E-Mail)
	S. Q. Ninh	(NRC)	(1 paper copy plus E-Mail)
	D. C. Scaletti	(NRC)	(1 paper copy plus E-Mail)

GE Nuclear Energy

MFN 037-96

bcc: (E-Mail except as noted)
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J. N. Fox
P. C. Hecht
M. Herzog
J. E. Leatherman
J. E. Quinn
J. R. Rash
R. J. Reda
B. Shiralkar
G. L.Sozzi
J. E. Torbeck
GE Master File (1 paper copy plus E-Mail)
SBWR Project File (1 paper copy plus E-Mail)

MHV 061-16

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 12, 1996

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, California 95125

SUBJECT: STATUS OF THE SIMPLIFIED BOILING WATER REACTOR (SBWR) TEST PROGRAMS AND TRACG REVIEW

Dear Mr. Quinn:

In your letter dated March 4, 1996, you indicated that GE was redirecting the focus of its SBWR programs from plants of the 670 MWe to plants of 1,000 MWe or larger. In line with redirecting the SBWR focus, you provided the staff with the proposed schedule for the Nuclear Regulatory Commission (NRC) to review the TAPD Revision C, Scaling Report Revision 1, test reports, test analyses, and to issue the PANDA QA audit report. Specifically, you asked the staff to proceed with the orderly closure of these activities. Following the receipt of your March 4 letter, the staff met with you and conducted a number of conference calls with the intention of understanding GE's closure objectives and the products GE wished to receive from the staff closure activities.

In your letter dated March 13, 1996, you indicated that GE was substantially reducing the level of activity on the TRACG effort as it applies to the 670 MWe plant. Specifically, you requested that the staff stop work on the review of the TRACG application Licensing Topical Report (LTR) NEDE-32178 and provide a summary of the review of this document. With regard to the TRACG Qualification LTR NEDE-32177, you asked the staff for a written feedback on GE responses to the request for additional information (RAIs) and then to stop work on review of this document. With regard to the TRACG Model LTR NEDE-32176 you requested the staff to issue a letter of acceptability of this report by April 12, 1996, a draft safety evaluation report (DSER) by June 12, 1996, and a final safety evaluation report (FSER) by October 1996.

GE's request for orderly closure of the SBWR programs will result in the closure activities competing for resources with other high priority activities such as operating reactor issues. Consequently, the staff can not accelerate the schedule for closeout of open SBWR activities as you requested. The staff, however, developed the following schedule.

SBWR TESTING PROGRAM:

1. The staff will issue its safety evaluation report (SER) on TAPD Revision C by May 15, 1996. This report will describe events since the original submission of TAPD Revision A, the status of the staff's review of the testing performance and it will characterize the staff's opinion of the quality of the test program.

2. The staff will provide the status of its review of the scaling report - what has been reviewed, what remains to be reviewed and comments relevant to these two areas by about May 17, 1996.

3. The staff will issue its report concerning the PANDA QA audit and the Ansaldo QA discussions by about April 30, 1996.

4. Per GE's request, with the exception of the review of the PANTHERS PCC data which will be completed and issued by April 22, 1996, the staff will not perform a detailed review of test reports and test analyses. The evaluation of the GIRAFFE (He and SIT) and Panda data will be limited to the QA program, the test procedures, the test objectives and the acceptability of the test data for purposes of licensing review. If GE meets the scheduled date for the submission of the final data report (DTR) for GIRAFFE He (April 26, 1996), the staff review will be issued by about May 25, 1996. Similarly, for a PANTHERS IC DTR delivered on April 15, 1996, the staff review will be issued around May 15, 1996, and for both GIRAFFE SIT and PANDA DTRs delivered on June 4, 1996, the staff review will be issued by mid-July 1996.

<u>SBWR TRACG</u>

1. The staff will prepare a written status of the review of the TRACG Application LTR by about May 31, 1996.

2. The staff will provide a written status on its review of GE responses to the staff's RAIs of the TRACG Qualification LTR and a summary of the status of the review of this report by about May 31, 1996.

3. The staff will issue a letter of acceptability of the TRACG Model LTR by May 15, 1996. However to proceed beyond this will require completed reviews of all the test data referred to in Item 4 above. Therefore, the staff does not plan to issue a DSER or FSER for the TRACG Model LTR at this time.

If you have any questions regarding this matter, please contact Son Ninh at (301) 415-1125 or Donald McPherson at (301) 415-1246.

Sincerely,

Dennis M. Crutchfield, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 50-004

cc: See next page

Mr. James E. Quinn
GE Nuclear Energy

Docket No. 52-004

cc: Mr. Rob Wallace
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1299 Pennsylvania Avenue, N.W.
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Washington, DC 20004

Mr. Brian McIntyre
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MFN 068-96

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 10, 1996

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, CA 95125

SUBJECT: NRC INSPECTION REPORT NO. 99900403/96-01

Dear Mr. Quinn:

This letter addresses the inspection conducted March 5 through 8, 1996, at the Paul Scherrer Institut (PSI) PANDA Test Facility in Würenlingen, Switzerland, by Richard P. McIntyre of the Nuclear Regulatory Commission's (NRC's) Special Inspection Branch, Juan D. Peralta of the Quality Assurance and Maintenance Branch, John A. Kudrick and John D. Monninger of the Containment Systems and Severe Accident Branch, Alan E. Levin of the Reactor Systems Branch, and Dino C. Scaletti of the Standardization Project Directorate. The details of the inspection were discussed with you and the members of your staff during the inspection and at the exit meeting on March 8, 1996.

The purpose of the inspection was to determine if testing activities performed at the PANDA test facility to support design certification of the GE Nuclear Energy (GE) simplified boiling water reactor (SBWR) design were conducted under the appropriate provisions of the May 1990, GE NEDG-31831, "SBWR Design and Certification Program Quality Assurance Plan," as implemented by GE document PPCP-QA-01, "PANDA Project Control Plan" (PPCP) and the GE PANDA Quality Assurance Procedures (PQAPs).

Areas examined during the NRC inspection and our findings are discussed in the enclosed inspection report. The inspection consisted of an examination of procedures and representative records, interviews with personnel, and observations by the inspectors.

The results of the inspection indicate that GE, in general, was adequately implementing the Project Control Plan and the Quality Assurance Procedures for testing activities performed at PANDA with the exception of two nonconformances. Also, the team identified three unresolved items related to PANDA and SBWR design certification that will require response by GE and follow-up by the NRC during a future inspection at San Jose. Specifically, the inspection team identified Nonconformances with program implementation with respect to (1) the preparation and issue of Apparent Test Results Reports and Data Transmittal Reports as required by the PANDA Test Specification and PANDA Test Plans, and (2) the failure to document abnormal occurrences detected during testing (subsequently causing matrix testing to be suspended and re-evaluated) using the existing nonconformance report process.

The unresolved items concerned (1) the appropriateness of GE's acceptance of engineering services activities performed by Elektrowatt Ingenieurunternehmung AG (Elektrowatt) in October 1993 for the PANDA test facility as-built measurements, (2) the level of GE QA oversight for the engineering services work performed by the international technical associates (KEMA and Instituto de Investigaciones (IIE) of Mexico) for PANDA data analysis, and (3) the disposition for the recommendations and specific action items identified during the October 1991 PANDA Design Review regarding facility design, quality assurance programmatic aspects, and technical issues.

The response requested by this letter is not subject to the clearance procedures of the Office of Management and Budget as required by the Paperwork Reduction Act of 1980, Public Law No. 96-511.

In accordance with 10 CFR Part 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be placed in the NRC's Public Document Room.

Should you have any questions concerning this inspection, we will be pleased to discuss them with you.

Sincerely,

for Gregory C Cwalina

Robert M. Gallo, Chief
Special Inspection Branch
Division of Inspection and Support Programs
Office of Nuclear Reactor Regulation

Docket No.: 52-004

Enclosures: 1. Notice of Nonconformance
2. Inspection Report No. 99900403/96-01

cc w/encls: See Next Page

Mr. James E. Quinn
GE Nuclear Energy

Docket No. 52-004

cc: Mr. Rob Wallace
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1299 Pennsylvania Avenue, N.W.
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Director, Criteria & Standards Division
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Mr. Sterling Franks
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Mr. John E. Leatherman, Manager
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NOTICE OF NONCONFORMANCE

GE Nuclear Energy
San Jose, CA 95125

Docket No.: 52-004
99900403/96-01

Based on the results of a Nuclear Regulatory Commission (NRC) inspection, conducted from March 5 through March 8, 1996, of the GE's PANDA test program at the Paul Scherrer Institut (PSI) in Würenlingen, Switzerland, related to the SBWR design certification activities, it appears that certain activities were not conducted in accordance with NRC requirements.

A. Criterion XI, "Test Control," of Appendix B to 10 CFR 50, requires, in part, that test results be documented and evaluated to assure that test requirements have been satisfied.

Chapter II, "Basic Requirements," Section 11, "Test Control," of ANSI/ASME NQA-1-1983, "Quality Assurance Program Requirements for Nuclear Facilities," requires, in part, that test results be documented and that their conformance with acceptance criteria be evaluated.

Paragraph 5.3.14 of PQAP-TC, "Test Control," Revision 3, dated September 18, 1995, requires that the PSI PANDA Project Manager (P-PM) prepare test reports per the Test Specification and Test Plan requirements.

Section 11, "Reporting," of GE Document 25A5587, "PANDA Test Specification," Revision 1, dated January 26, 1995, requires (1) preparation of an Apparent Test Results report within approximately one week following performance of the test, and (2) preparation of Final Test Reports per the schedule specified in the Test Plan and Procedures Document.

Section 10, "Reports," of GE Document 25A5764, "PANDA Test Plan - Tests M3, M3A, M3B, M4, M7," Revisions 1, 2, and 3 dated September 18, 1995, October 16, 1995, and November 15, 1995, respectively, requires (1) preparation of an Apparent Test Results report within approximately two weeks of completion of each transient integral system test, and (2) preparation of a Data Transmittal Report approximately two months after the last test is performed.

Section 10, "Reports," of GE Document 25A5785, "PANDA Test Plan - Tests M2, M10A, M10B," dated November 21, 1995, requires (1) preparation of an Apparent Test Results report within approximately two weeks of completion of each transient integral system test, and (2) preparation of a Data Transmittal Report approximately two months after the last test is performed.

Section 10, "Reports," of GE Document 25A5788, "PANDA Test Plan - Tests M6/8," dated December 7, 1995, requires (1) preparation of an Apparent

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Test Results report within approximately two weeks of completion of each transient integral system test, and (2) preparation of a Data Transmittal Report approximately two months after the last test is performed.

Section 10, "Reports," of GE Document 25A5824, "PANDA Test Plan - Test M9," dated December 12, 1995, requires (1) preparation of an Apparent Test Results report within approximately two weeks of completion of each transient integral system test, and (2) preparation of a Data Transmittal Report approximately two months after the last test is performed.

Contrary to the above, Apparent Test Results reports and Data Transmittal Reports were not prepared and issued in accordance with the Test Specification or Test Plan and Procedures. *(96-01-01)*

B. Criterion V, "Instructions, Procedures, and Drawings," of Appendix B to 10 CFR 50, requires, in part, that activities affecting quality be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and that such activities be accomplished in accordance with these instructions, procedures, or drawings.

Criterion XV, "Nonconforming Materials, Parts, or Components," of Appendix B to 10 CFR 50, requires, in part, that nonconforming items be reviewed and accepted, rejected, repaired or reworked in accordance with documented procedures.

Criterion XVI, "Corrective Action," of Appendix B to 10 CFR 50, requires, in part, that measures be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected.

Chapter II, "Basic Requirements," Section 11, "Test Control," of ANSI/ASME NQA-1-1983, "Quality Assurance Program Requirements for Nuclear Facilities," requires, in part, that test results be documented and that their conformance with acceptance criteria be evaluated.

Paragraph 5.3.11 of PQAP-TC, "Test Control," Revision 3, dated September 18, 1995, requires that the PSI PANDA Project Manager (P-PM) (1) review and resolve all test anomalies identified during the test, and (2) document resolutions, conditions requiring correction, and corrective actions per PQAP-NC.

Section 4, "Requirements," of PQAP-NC, "Nonconformance Control and Corrective Action," Revision 0, dated January 31, 1995, provides that any nonconforming item which can affect PANDA test results, or deviations from the test specification/procedure, or test conditions and results showing abnormal occurrences shall be identified, treated as a nonconformance, and documented and reported for resolution (disposition) prior to continuation of subsequent phase testing.

Contrary to the above, (1) when abnormal occurrences (subsequently causing matrix testing to be suspended and re-evaluated) were detected during testing, no nonconformance reports were generated to document these events; (2) PSI Procedure "Data Base Modification" (issued in March 1996) was being used by PSI testing personnel to perform activities that introduced deviations from the test control process already specified by PQAP-TC, and from the nonconformance identification process established in PQAP-NC; and (3) PSI Procedure "Data Base Modification" had not been identified or described as a Quality Assurance Procedure governed by PPCP-QA-01, i.e., as a procedure comprising the bases of the QA system implemented by PSI and GE in meeting the requirements of NEDG-31831, even though it was being used to perform quality related activities affecting PANDA test results. *(96-01-02)*

Please provide a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555 with a copy to the Chief, Special Inspection Branch, Division of Inspection and Support Programs, Office of Nuclear Reactor Regulation, within 30 days of the date of the letter transmitting this Notice of Nonconformance. This reply should be clearly marked as a "Reply to a Notice of Nonconformance" and should include for each nonconformance: (1) a description of the steps that were or will be taken to correct these items; (2) a description of the steps that have or will be taken to prevent recurrence; and (3) the dates your corrective actions and preventative measures were or will be completed.

Dated at Rockville, Maryland
This 10 th day of May 1996

ORGANIZATION:	GE Nuclear Energy San Jose, California
REPORT NO.:	99900403/96-01
CORRESPONDENCE ADDRESS:	Mr. James E. Quinn, Projects Manager LMR and SBWR Programs GE Nuclear Energy 175 Curtner Avenue San Jose, California 95125
ORGANIZATIONAL CONTACT:	Mr. Kenneth W. Brayman, Manager Quality Assurance Systems (408) 925-6587
NUCLEAR INDUSTRY ACTIVITY:	GE Nuclear Energy (GE) is engaged in the supply of advanced boiling water reactor designs to utilities. GE also furnishes engineering services, nuclear replacement parts, and dedication services for commercial grade electrical and mechanical equipment.
INSPECTION CONDUCTED:	March 5 through 8, 1996
TEAM LEADER:	Richard P. McIntyre Vendor Inspection Section (VIS) Special Inspection Branch (PSIB) — 5/7/96 Date
OTHER INSPECTORS:	Juan D. Peralta, HQMB John A. Kudrick, SCSB John D. Monninger, SCSB Alan E. Levin, SRXB Dino C. Scaletti, PDST
REVIEWED:	Gregory C. Cwalina, Section Chief, VIS — 5/8/96 Date
APPROVED:	for Robert M. Gallo, Chief, PSIB — 5/8/96 Date
INSPECTION BASES:	10 CFR Part 50, Appendix B and 10 CFR Part 21
INSPECTION SCOPE:	To determine if activities performed to support the design of the SBWR and, specifically, testing activities performed at the PANDA Test Facility at the Paul Scherrer Institut in Würenlingen, Switzerland were conducted under the appropriate provisions of the May 1990, GE NEDG-31831, "SBWR Design and Certification Program Quality Assurance Plan."
PLANT SITE APPLICABILITY:	None

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1 INSPECTION SUMMARY

1.2 Nonconformance

- Nonconformance 99900403/96-01-01 was identified and is discussed in Section 3.4.1 of this report.
- Nonconformance 99900404/96-01-02 was identified and is discussed in Section 3.8 of this report.

1.2 Unresolved Item

- Unresolved Item 99900403/96-01-03 was identified and is discussed in Section 3.2 of this report.
- Unresolved Item 99900403/96-01-04 was identified and is discussed in Section 3.3.2 of this report.
- Unresolved Item 99900403/96-01-05 was identified and is discussed in Section 3.4.2 of this report.

2 STATUS OF PREVIOUS INSPECTION FINDINGS

No previous inspections have been conducted at this test facility.

3 INSPECTION FINDINGS AND OTHER COMMENTS

3.1 GE SBWR Quality Assurance Program

Chapter 17 of the SBWR standard safety analysis report (SSAR) describes the GE quality assurance (QA) program for the design phase of the SBWR program. The QA program is identified as "Nuclear Energy Business Operations Quality Assurance Program Description," NEDO-11209-04A, Revision 8, the latest revision approved by the NRC. NEDO-11209-04A applies to all GE activities affecting quality of items and services supplied to nuclear power plants and establishes GE's compliance with the provisions of Appendix B to 10 CFR 50.

NEDG-31831, "SBWR Design and Certification Program Quality Assurance Plan," dated May 1990, was developed by GE to fulfill the QA requirements of the SBWR reactor design and certification program. NEDG-31831 meets the requirements of ANSI/ASME NQA-1-1983 and its NQA-1a-1983 addenda as endorsed by the NRC in Regulatory Guide 1.28, Revision 3. Additionally, NEDG-31831 provides that design and testing work performed by international technical associates will be performed to their internal QA programs acceptable to the regulatory authorities of their respective countries as evaluated by GE for compliance with the provisions of ANSI/ASME NQA-1-1983.

3.2 PANDA QA Program for SBWR Design Certification Testing

Under an agreement between the Swiss Confederation (represented by the Paul Scherrer Institut [PSI]), the Electric Power Research Institute (EPRI), and GE, PSI performed passive decay heat removal and fission product retention tests in the PANDA test facility. The purpose of these tests was to evaluate the performance and behavior of the SBWR passive containment cooling system (PCCS) operating in typical post-LOCA containment environments. These tests were primarily focused on simulating the response of the SBWR containment cooling systems in order to (1) obtain additional data to support the adequacy of TRACG in predicting the quasi-steady heat rejection rate of a PCC heat exchanger and identify the effects of scale on PCC performance, (2) provide a sufficient database to confirm the capability of TRACG to predict SBWR containment system performance, encompassing systems interaction effects, and (3) demonstrate startup and long-term operation of a passive containment cooling system (Concept Demonstration).

A GE readiness review conducted at PSI during October 19 through 21, 1994, concluded that PSI had not adequately implemented a QA program meeting the appropriate requirements of ANSI/ASME NQA-1-1983, and that the PANDA facility was not ready to initiate testing. In a letter to GE, dated December 19, 1994, the NRC staff requested that GE provide a discussion of the corrective actions taken by GE as a result of the readiness review findings, including the area of QA.

In its response letter to the NRC, dated March 7, 1995, GE stated that as a result of a GE readiness review at PSI during October 1994, the PANDA quality assurance program would be restructured so that it would be conducted under direct GE supervision and governed by the provisions in NEDG-31831. To this effect, GE developed the PANDA Project Control Plan, PPCP-QA-01, Revision 1, dated May 1, 1995. PPCP-QA-01, in conjunction with nine other QA procedures, describe the organization, quality-related activities, events and procedures necessary to ensure and verify that the PANDA project at PSI is conducted in accordance with the provisions of NEDG-31831. All documentation related to the PANDA test facility and test results is contained in the PANDA Test File (PTF) and organized accordingly.

In accordance with the provisions of PPCP-QA-01 and PQAP-TC, "Test Control," Revision 3, dated September 18, 1995, a test specification, GE Document No. 25A5587, "PANDA Test Specification," Revision 1, was prepared and issued by GE as required by the provisions in Engineering Operating Procedure (EOP) 35-3.00, "Engineering Tests." GE Document No. 25A5587 required that the PANDA tests be performed in conformance with PPCP-QA-01, which is based on the requirements of Appendix B to 10 CFR 50, NEDG-31831, and ANSI/ASME NQA-1-1983.

During the inspection, the team reviewed all relevant documentation and available test data found in the PTF. Based on these reviews, the team concluded that, in general, GE had adequately restructured the PANDA QA program in accordance with the provisions in NEDG-31831. However, GE failed to adequately implement certain provisions of NEDG-31831, prior to January 1995, related to the appropriateness of GE's acceptance of engineering services provided by a subcontractor to PSI. Specifically, the team determined that GE had not yet adequately addressed an issue related to activities performed at PSI by Elektrowatt Ingenieurunternehmung AG (Elektrowatt) in October 1993 and which had been identified during the October 19 through 21, 1994, readiness review at PANDA. Elektrowatt was hired by PSI to perform the facility as-built measurements which was an activity having substantial impact on the quality of test results generated at PANDA.

The team was concerned that GE concluded in the October 1994 Readiness Review Report (without providing any justification or taking any compensatory or corrective actions) that the PANDA facility as-built measurement activities performed by Elektrowatt were satisfactory, while at the same time acknowledged that Elektrowatt had not been audited by either GE or PSI as a supplier of services affecting quality. This issue was identified as *Unresolved Item 99900403/96-01-03*.

3.3 Design Control

The purpose of the review of design control was: (1) to assure that applicable regulatory requirements, design bases, codes and standards, and GE test specification requirements were correctly translated into design drawings, procedures, and instructions per PQAP-DC, "Document Control," (2) to assure that changes or deviations from specified design requirements and quality standards were identified, documented, and controlled, (3) to verify final PANDA test facility as-built drawings and overall control of test facility configuration as described in PQAP-V, "Verification," and (4) to assure that computer data acquisition software and documentation was controlled as described in PQAP-DA, "Data Acquisition System Control."

The team reviewed the following material related to design control for the PANDA test program:

- Design and as-built drawings
- PANDA scaling analyses
- PANDA line loss calculations based on estimated SBWR line losses
- Record of GE Design Review (San Jose, October 1991)

The PANDA test facility at PSI was designed to evaluate the performance of the SBWR passive containment cooling system operating in post-LOCA containment environments. The PANDA tests were to demonstrate the SBWR thermal-hydraulic performance, heat removal capability, and systems interactions and to provide data for confirmation of the TRACG computer models used to analyze the SBWR performance.

GE prepared and issued document 25A5587, "PANDA Test Specification," Revision 1, on January 26, 1995, for PANDA tests. The PANDA test specification specifies the top-level requirements for tests related to post-LOCA decay heat removal from the containment of the SBWR to be performed at the PANDA test facility at PSI. The test specification provides general criteria for the PANDA test program including: purpose, objectives, facility description, test instrumentation, data acquisition system and recording, data processing and analysis, shakedown and plant characterization tests, steady-state performance tests, transient integral systems tests, pretest predictions, acceptance criteria, reporting requirements, record retention, and quality assurance.

The actual experimental testing at PSI was to be performed in accordance with the Test Specification (25A5587) through the development of specific Test Plans and Procedures in accordance with GE PANDA Quality Assurance Procedure PQAP-DC, Revision 1, "Document Control." PQAP-DC defines the requirements and process for issuing, revising, modifying, and distributing the Test Plans and Procedures.

GE and PSI prepared the Test Plans and Procedures, which define the detailed or specific test requirements. The test plans describe how the test is to be set up and performed to meet the quality assurance requirements, any special conditions associated with the test, and the test requirements specified in the Test Specification. The test procedures describe the specific procedures required to perform the test in accordance with test and quality assurance requirements. The specific test plans and procedures reviewed by the team in the course of the inspection are listed in the table below for the plant characterization, shakedown, steady-state, and integral systems tests.

TEST	TEST PLAN	TEST PROCEDURE
VESSEL HEAT LOSS	ALPHA-510	ALPHA-510
LINE PRESSURE DROP	ALPHA-510	ALPHA-510
S1-S6	ALPHA-410-1	ALPHA-410-1
S7-S9	ALPHA-410-2	ALPHA-410-2
S10-S13	ALPHA-410-2	ALPHA-410-2
M3	25A5764 R1	ALPHA-520-0
M3A	25A5764 R2	ALPHA-520-2
M3B	25A5764 R2	ALPHA-520-2
M7	25A5764 R3	ALPHA-521-0
M2	25A5785 R0	ALPHA-527-0
M10A	25A5785 R0	ALPHA-527-0
M10B	25A5785 R0	ALPHA-527-0
M6/8	25A5788 R0	ALPHA-529-0
M9	25A5824 R0	ALPHA-528-0

These Test Plan and Procedures were issued and controlled in accordance with PQAP-DC. A PANDA Engineering Review Memorandum (P-ERM) was required for review and approval of all Test Plans and Procedures by PQAP-DC. In the course of the inspection, the team reviewed several completed P-ERMs relating to revisions to the following Test Plan and Procedures:

- ALPHA-410 "PANDA Steady-State PCC Performance Tests Test Plan and Test Procedures"
- ALPHA-520 "PANDA Transient Tests M3A, M3B, & M4 Integral System Test Procedure"

Based on a review of these P-ERMs, the team concluded that issues and comments identified by GE and PSI personnel as a result of the review and approval process of the Test Plan and Procedures were adequately identified, documented, resolved, and controlled.

GE PANDA Quality Assurance Procedure PQAP-V, Revision 1, "Verification," was developed to control the process for verification of the PANDA test facility configuration and testing activities. Verifications were to be performed for activities such as: calculations affecting test results, measurements appearing on as-built drawings, and test initial conditions. PQAP-V provided a "Verification Cover Sheet" to control and document the verification process. Extensive documentation was contained in the PTF on scaling of the PANDA facility and determination of line losses for the facility, based on design information for the SBWR. During the course of the inspection, the team reviewed an independent verification that required an alternate calculation to be performed to verify the correctness of the original calculations. This verification related to the establishment of the PANDA system line loss coefficient measurements. The line loss calculations were performed by several engineers using different methodologies; the results were then cross-checked and independently design verified and documentation of the results of this design study is extensive. The team noted that the verification was performed in accordance with PQAP-V and utilized the Verification Cover Sheet for control and approval of the verification.

3.3.1 Data Acquisition System (DAS)

The team evaluated the information relating to the Data Acquisition System (DAS) contained in the PTF. The DAS information is contained in four separate volumes of the PTF. However, due to either incomplete or missing information or the use of German documentation within the PTF, this information needed to be supplemented by discussions with PSI personnel so that a thorough understanding of the scope of the DAS could be gained. Based on the information contained in the PTF and discussions with PSI personnel, the team concluded that the DAS was sufficient for meeting the instrumentation requirements of the PANDA test program and that it was controlled in accordance with PQAP-DA,"Data Acquisition System Control."

3.3.2 1991 PANDA Design Review

The original PANDA design was developed from the SBWR conceptual design as it existed in the late 1980's; the volumetric scale was derived from representation of the passive containment cooling system (PCCS) heat exchanger (HX). The PCCS HX design was changed about 1991, which necessitated a slight change in the volumetric scale of the facility (from about 1:18 to 1:25). A design review was convened in San Jose in October 1991 to assess the facility design and to determine technical issues requiring GE or PSI to follow-up. Based on a review of documentation contained in the PTF, it appeared that the design review was independent and comprehensive. Numerous recommendations were made regarding facility design, quality assurance programmatic aspects, and technical issues, and specific action items were assigned to the participating organizations (primarily, GE and PSI). However, there was no record in the PTF of whether the action items and recommendations were ever dispositioned. When GE and PSI were asked about follow-up to the design review, the NRC team was informed that, since the design review memorandum was originated by GE/San Jose, the written record of disposition of the recommendations of the review group should be located in the design record file (DRF) in San Jose. Therefore, verification of the disposition of the design review action items was not possible at PANDA. The GE disposition of the recommendations and specific action items identified during the October 1991 PANDA design review regarding facility design, quality assurance programmatic aspects, and technical issues was identified as *Unresolved Item 99900403/96-01-04*.

3.4 Test Control

The purpose of the review of test control was: (1) to determine whether a suitable test program was developed to assure that all testing required to demonstrate that systems and components would perform satisfactorily in service, (2) to determine that such a test program was identified and performed in accordance with written test procedures which incorporate or reference the requirements and acceptance limits contained in the applicable design documents, (3) to assure that test procedures include provisions for assuring that all prerequisites for the given test have been met, that adequate instrumentation is available and used, and that testing is performed under suitable environmental conditions, and (4) to assure that test results are documented and evaluated to assure that test requirements have been satisfied.

To assess the level of control over the testing program, the team examined the adequacy, implementation, and documentation resulting from the development and performance of facility characterization tests, shakedown tests, steady state tests, and integral system tests. The PANDA matrix tests (steady state and integral system) were performed in accordance with GE Panda Quality Assurance Procedure "Test Control," PQAP-TC. The purpose of PQAP-TC is to define the process for specifying, performing, evaluating, and documenting the PANDA tests. The specific Test Plans and Procedure reviewed by the team along with resulting test file documentation are specified below.

Section 8, "Shakedown and Plant Characterization," of the GE PANDA Test Specification (25A5587, Revision 1) required facility shakedown and plant characterization tests to be performed. The shakedown tests where to be run in a manner which would expose the facility components and systems to conditions similar to those expected during the matrix tests. The characterization tests were to consist of tests that quantify specific characteristics of the facility such as vessel heat loss and line pressure drop tests.

The facility characterization tests were completed in July 1995. The team reviewed Section 9 of the PTF, "Facility Characteristics," to assess whether adequate quality assurance measures had been followed in the preparation, conduct, and documentation of these tests. The facility characterization tests were performed in accordance with ALPHA-510 "PANDA Facility Characterization Heat Loss and Selected System Lines Pressure Loss Test Plan and Procedures." The heat loss test is needed for calculation of energy balances which in turn would be used to assess system performance and to reliably model heat losses from the PANDA test facility in computer code analyses.

With respect to the heat loss test, Section 9 of the PTF only included the test plan and procedure. Results of the test, apparent test result and final test result reports were not available. GE and PSI stated that the test reports were still under development and provided the team with a draft report, ALPHA-519-A, "PANDA Facility Characterization Vessel Heat Loss Measurements," dated August 11, 1995, for review. The draft report indicated that the heat loss calculations were preliminary and were intended to provide a first look at the vessel heat losses. The draft report indicated that the calculations had not included all potential heat losses nor the vessel leakage rates.

The system line pressure loss test was performed to assure that system line pressure drop characteristics measured in the PANDA facility adequately simulated the pressure loss characteristics of the full scale SBWR system. This test was performed for loss measurements in the isolation condenser and primary containment cooling (PCC) system feed line, PCC vent line, gravity driven cooling system lines, equalization lines, and main steam lines. Section 9 of the PTF included a report, ALPHA-517-0, "PANDA Facility Characterization System Line Loss Coefficient Measurements," dated February 14, 1996, which provided the results and an evaluation of the system line pressure loss tests.

The team inquired as to whether additional facility characterization tests had been performed, in addition to the heat loss and system line pressure loss test. GE and PSI indicated that a leak test had been performed at the PANDA facility in accordance with ALPHA-511 "PANDA Facility Characterization Vessel Cold Leak Test Plan and Procedure." This test is important because the leakage rate from each PANDA vessel must be known to permit calculation of vessel heat losses from the heat loss test data. The leak rate is used to separate the components of pressure drop due to condensation and mass lost from the system. Furthermore, an estimate of the overall leakage rate is necessary to characterize the system for the transient tests. The mass loss from the system must be quantified to properly interpret data from the transient tests. From the review of ALPHA-511, the team concluded that it had been developed, reviewed, and controlled through the use of the P-ERM and Verification Cover Sheet in accordance with PQAP-DC.

Section 9, "Test Matrix," of the GE PANDA Test Specification (25A5587, Revision 1) required a series of steady-state tests to be conducted using one of the PANDA PCC condensers. The objectives of the steady-state tests was to provide additional data to support the adequacy of TRACG to predict the quasi-steady heat rejection rate of a PCC heat exchanger and identify the effects of scaling on PCC performance by using one of the PANDA PCC condensers connected directly to the steam supply. The steady-state tests were conducted in accordance with ALPHA-410, "PANDA Steady-State PCC Performance Tests Test Plan and Procedures."

The team reviewed Section 8 of the PTF "Steady-State Tests," including the test specification, test plan and procedures, shakedown test results, data reduction/reduced data records, apparent test results report, and analytical work. In addition, the PTF included: a copy of the control room procedures used, excerpts of the PANDA journal, instrumentation list, DAS channel allocation table, instrument checks, checklists per the test plan and procedures, valve status reports, re-zeroing charts, DAS monitor printout, and any non-conformance reports. The test procedures specified the prerequisites for the test, instrumentation requirements, and test acceptance criteria.

Prior to performing the actual steady-state tests, PSI performed shakedown tests to expose the PANDA facility components to conditions similar to those expected during the matrix tests. During the first series of shakedown tests for the S1-S6 steady-state tests, steady-state conditions could not be achieved as required by ALPHA-410. PSI documented the failure to meet the test acceptance criteria through use of a Nonconformance Report in accordance with GE PANDA Quality Assurance Procedure PQAP-NC, "Nonconformance Control and Corrective Action," Revision 0, dated January 31, 1995. PQAP-NC establishes the requirements and procedures for the identification, documentation, resolution and control of nonconforming items. With respect to tests S1-S6, three nonconformances were identified and documented in accordance with PQAP-NC and one nonconformance resulted from the S7-S9 tests.

Section 9, "Test Matrix," of the GE PANDA Test Specification (25A5587, Revision 1) required a series of transient integral systems tests to be conducted. These tests were to provide an integral systems database for PCC system performance with conditions representative of the long-term post-LOCA SBWR containment. The objectives of the transient integral systems tests was to provide a sufficient database to confirm the capability of TRACG to predict SBWR containment system performance, including potential systems interaction effects. The transient integral systems tests were conducted in accordance with the various test plans and procedures identified in the table in Section 3.3 above.

The team reviewed the available documentation within Section 10 of the PTF relating to the transient integral systems tests. The PTF contained comparable information to that included for the steady-state tests such as copies of the control room procedures used, excerpts of the PANDA journal, instrumentation list, DAS channel allocation table, instrument checks, checklists per the test plan and procedures, valve status reports, re-zeroing charts, DAS monitor printout, trending charts, and any nonconformance reports.

The team concluded that a suitable test program was developed by GE and PSI with applicable test plans and procedures in accordance with the Test Specification. The test procedures included provisions for assuring that prerequisites were met and that adequate instrumentation was available.

3.4.1 Reporting of PANDA Test Results

Section 11, "Reporting," of the GE PANDA Test Specification (25A5587, Revision 1) specified preparation of Apparent Test Results (ATR) reports and Final Test Reports (FTR). The ATR reports are considered to be unverified reports of preliminary results for each test or each test series that were to be issued within approximately one week following performance of the tests. The FTRs are considered to be verified reports which contain the data, analysis, and results of all tests and transmitted to GE per the schedule specified in the Test Plan and Procedures documents. The FTRs are identified as Data Transmittal Reports (DTRs) within the "Reports" section of the various test plan and Procedures.

For the facility characterization tests, Section 4.3, "Post-test/Apparent Test Results Report Inputs" of ALPHA-510 specifies that following completion of the tests, data reduction will be performed to support preparation of the Test Results reports (TR). This data reduction will include time history plots of all the required measurements covering the full test duration. These results will be reviewed and reported in the TR. Section 4.4, "Post-test/Final Test Report," specifies that the Final Test Report (FTR) will transmit all the data for the system line pressure loss and the heat loss tests. It will provide detailed information on the test instrumentation, test conditions, and the format for the data. In addition, samples of key data will be presented in plots along with simplified sketches of the test facility configurations during testing.

GE and PSI provided the team with "draft" copies of ALPHA-519-A, "PANDA Facility Characterization Vessel Heat Loss Measurements," dated August 11, 1995, and ALPHA-517, "PANDA Facility Characterization System Line Loss Coefficient Measurements," dated February 14, 1996. The team concluded that these draft reports do not meet the timeliness requirements of the Test Specification or Test Plan and Procedure for providing ATR reports and FTRs after completion of the tests.

For the steady-state tests, Section 10, "Reports," of ALPHA-410, "PANDA Steady-State PCC Performance Tests Test Plan and Test Procedures," specifies preparation of apparent test results reports within approximately 1 week of completion of the steady-state tests. In addition, ALPHA-410 specifies preparation of the DTR approximately 2 months after completion of the steady-state tests. GE and PSI provided the team with various versions of ALPHA-509, "PANDA Steady-State Tests S1 through S6 PCC Performance Apparent Test Results," however, a DTR or FTR had not been issued. The team concluded that a DTR or FTR had not been prepared in accordance with the Test Specification or the Test Plan and Procedure.

For the transient integral systems tests, Section 10, "Reports," of GE Document 25A5764, "PANDA Test Plan - Tests M3, M3A, M3B, M4, M7," Revisions 1, 2, and 3 dated September 18, 1995, October 16, 1995, and November 15, 1995, respectively, requires (1) preparation of an ATR report within approximately two weeks of completion of each transient integral system test, and (2) preparation of a DTR approximately two months after the last test is performed. GE and PSI had not prepared any ATR reports or DTRs for the M3, M3A, M3B, M4, or M7 transient integral system tests.

Section 10, "Reports," of GE Document 25A5785, "PANDA Test Plan - Tests M2, M10A, M10B," dated November 21, 1995, requires (1) preparation of an ATR report within approximately two weeks of completion of each transient integral system test, and (2) preparation of a DTR approximately two months after the last test is performed. GE and PSI had not prepared any ATR reports or DTRs for the M2, M10A, or M10B transient integral system tests.

Section 10, "Reports," of GE Document 25A5788, "PANDA Test Plan - Tests M6/8," dated December 7, 1995, requires (1) preparation of an ATR report within approximately two weeks of completion of each transient integral system test, and (2) preparation of a DTR approximately two months after the last test is performed. GE and PSI had not prepared an ATR report or DTR for the M6/8 transient integral system test.

Section 10, "Reports," of GE Document 25A5824, "PANDA Test Plan - Test M9," dated December 12, 1995, requires (1) preparation of an ATR report within approximately two weeks of completion of each transient integral system test, and (2) preparation of a DTR approximately two months after the last test is performed. GE and PSI had not prepared an ATR report or DTR for the M9 transient integral system test.

The failure to prepare ATR reports, FTRs and/or DTRs, on a time schedule consist with the applicable Test Specification and Test Plan and Procedures requirements is identified as *Nonconformance 99900403/96-01-01*.

3.4.2 PANDA Test Analyses

The team also examined the analytical efforts that support the PANDA testing program. Section 10, "Pretest Predictions/Acceptance Criteria," of GE PANDA Test Specification 25A5587, Revision 1, specifies that pretest calculations be performed for some of the matrix tests planned for SBWR certification. This activity was to include development of a TRACG input model for the PANDA facility, verification of the input model against as-built test facility data, design review of the input model, calibration of the input model using heat loss and pressure drop data from test facility characterization testing, selection of the test conditions for simulation, performance of the calculations, and documentation of the results.

GE provided the NRC with the SBWR-Pretest Report for PANDA Test M9 in a letter dated December 12, 1995. This report was to support the validation efforts for the TRACG code for application to the SBWR program. These calculations include both pre and post-test calculations for tests in the PANDA test program. The analyses of the tests were being performed by an SBWR PANDA

2, and 3 dated September 18, 1995, October 16, 1995, and November 15, 1995, respectively, requires (1) preparation of an ATR report within approximately two weeks of completion of each transient integral system test, and (2) preparation of a DTR approximately two months after the last test is performed. GE and PSI had not prepared any ATR reports or DTRs for the M3, M3A, M3B, M4, or M7 transient integral system tests.

Section 10, "Reports," of GE Document 25A5785, "PANDA Test Plan - Tests M2, M10A, M10B," dated November 21, 1995, requires (1) preparation of an ATR report within approximately two weeks of completion of each transient integral system test, and (2) preparation of a DTR approximately two months after the last test is performed. GE and PSI had not prepared any ATR reports or DTRs for the M2, M10A, or M10B transient integral system tests.

Section 10, "Reports," of GE Document 25A5788, "PANDA Test Plan - Tests M6/8," dated December 7, 1995, requires (1) preparation of an ATR report within approximately two weeks of completion of each transient integral system test, and (2) preparation of a DTR approximately two months after the last test is performed. GE and PSI had not prepared an ATR report or DTR for the M6/8 transient integral system test.

Section 10, "Reports," of GE Document 25A5824, "PANDA Test Plan - Test M9," dated December 12, 1995, requires (1) preparation of an ATR report within approximately two weeks of completion of each transient integral system test, and (2) preparation of a DTR approximately two months after the last test is performed. GE and PSI had not prepared an ATR report or DTR for the M9 transient integral system test.

The failure to prepare ATR reports, FTRs and/or DTRs, on a time schedule consist with the applicable Test Specification and Test Plan and Procedures requirements is identified as *Nonconformance 99900403/96-01-01*.

3.4.2 PANDA Test Analyses

The team also examined the analytical efforts that support the PANDA testing program. Section 10, "Pretest Predictions/Acceptance Criteria," of GE PANDA Test Specification 25A5587, Revision 1, specifies that pretest calculations be performed for some of the matrix tests planned for SBWR certification. This activity was to include development of a TRACG input model for the PANDA facility, verification of the input model against as-built test facility data, design review of the input model, calibration of the input model using heat loss and pressure drop data from test facility characterization testing, selection of the test conditions for simulation, performance of the calculations, and documentation of the results.

GE provided the NRC with the SBWR-Pretest Report for PANDA Test M9 in a letter dated December 12, 1995. This report was to support the validation efforts for the TRACG code for application to the SBWR program. These calculations include both pre and post-test calculations for tests in the PANDA test program. The analyses of the tests were being performed by an SBWR PANDA analysis team, with participation from PSI, KEMA and ECN in the Netherlands, Instituto de Investigaciones (IIE) of Mexico, and GE.

GE indicated that the TRACG modeling of the PANDA test facility was developed by PSI. GE then had an individual with IIE of Mexico verify the TRACG modeling and nodalization of the PANDA facility. The team inquired to GE as to the level of quality assurance oversight that GE had performed of IIE or the individual performing the work. GE presented conflicting stories with respect to whether the agreement for review of the TRACG modeling was with IIE as a subcontractor or with an individual of IIE as a subcontractor. The extent and level of effectiveness of quality assurance oversight by GE over its SBWR program international technical associates was identified as *Unresolved Item 99900403/96-01-05*.

3.5 As-Built Drawings and Configuration Control

PQAP-V, "Verification," Revision 1, dated May 1, 1995, implements the applicable requirements of GE EOP 42-6.00, "Independent Design Verification," and EOP 40-7.00, "Design Reviews," for verification of the PANDA test facility configuration and testing activities. Records of PANDA's facility and as-built drawings are stored in Section 2.1, "Facility Drawings," and in Section 3.1, "As-Built Drawings," of the PTF.

In October 1993, PSI contracted with Elektrowatt (see Section 3.2) to generate as-built drawings for PANDA. The facility configuration was originally depicted in a Giovanola (the facility builder) design drawing No. 164-A3526-1c (PSI Drawing No. 1-290111c). This drawing was used by Elektrowatt to develop an as-built of the main configuration and was subsequently given the designation of PSI Drawing No. 1-290300. All subsequent as-built measurements taken by PSI, including instrument and valve locations, were based on the Elektrowatt measurements. The Passive Containment Cooling System (PCC) and Isolation Containment System (IC) units (manufactured by Jäggi, AG) were measured by PSI personnel after their arrival on-site to establish their as-built dimensions.

As-built tolerances for the PANDA facility were established by GE in Document No. 25A5764, "PANDA Test Plan - Tests M3, M4, M7," Revision 1, dated September 18, 1995. The team found evidence that PSI had performed a review to verify that all as-built dimensions identified in drawings generated by Elektrowatt met the tolerance criteria specified in GE Document No. 25A5764.

Except for the unresolved item identified in Section 3.2, above, and based on the reviews of pertinent documents in Sections 2.1 and 3.1 of the PANDA PTF, the team concluded that activities performed by PSI after January 1995 were consistent with the provisions in PQAP-V.

3.6 Procurement Control

PQAP-PC, "Procurement Control," Revision 0, dated January 31, 1995, defines the requirements for procurement initiated by PSI in support of the PANDA test program, after test facility commissioning, for equipment and services. This procedure implements the applicable requirements of GE Engineering Operating Procedures, EOP 45-1.00, "Procurement Initiation and Control," EOP 45-2.00, "Procurement of Engineering Services," and in part, EOP 35-3.20, "Calibration Control."

In this area, the team was primarily interested in examining the implementation of PSI procurement provisions with respect to calibration services. As discussed below in Section 3.7, the team found objective evidence that after January 1995, PSI had adequately implemented the applicable provisions in PQAP-PC.

3.7 Control of Measuring and Test Equipment

PQAP-CC, "Control of Measuring and Test Equipment," Revision 0, dated January 31, 1995 defines and establishes all requirements related to the processes and procedures used for calibration of PANDA instrumentation. Section 4, "Instrumentation," of the PTF contained all documentation related to the procurement and calibration of PANDA instrumentation, including calibration certificates furnished by companies accredited by the Swiss Federal Office of Metrology (Eidgenössisches Amt für Messwesen) in Bern.

In Section 5.4, "Instrument Calibration," of PSI Document No. ALPHA-410, "PANDA Steady-State Tests - PCC Performance Test Plan and Procedures," Revision 2, dated May 16, 1995, PSI describes in detail its approach for ensuring that calibration of the various PANDA instruments was adequately performed and documented. Except for pressure and differential pressure sensors, all instruments were individually, or on a sampling basis, sent to the Swiss Federal Office of Metrology in Bern for calibration.

All pressure and differential pressure sensors used in PANDA were manufactured by Rosemount, Inc. Except for the Model 2088 and SMART, all Rosemount pressure sensors were calibrated by PSI prior to installation in the facility using a reference or standard traceable to the Swiss Federal Office of Metrology and in accordance with the requirements in PSI Document No. ALPHA-408, "PANDA Instrumentation and Control - PANDA Pressure Transmitter Calibration," Revision 1. For the Model 2088 and SMART sensors, the Rosemount factory calibration data was used.

The team inquired as to why PSI was relying solely on the manufacturer's calibration data for the Model 2088 and SMART sensors. PSI stated that these instruments were software-controlled and PSI lacked the necessary hardware and/or software to test them properly. PSI also stated that Rosemount of Switzerland, where these instruments would be re-calibrated after completion of testing, is a metrology laboratory accredited by the Swiss Federal Office of Metrology.

Based on the above information, the team concluded that PSI had adequately implemented the provisions in PQAP-CC and PQAP-PC and this area was identified as a strength in the PANDA QA program.

3.8 Nonconformance Control and Corrective Action

PQAP-NC, "Nonconformance Control and Corrective Action," Revision 0, dated January 31, 1995, establishes the requirements and describe the procedure for the identification, documentation, resolution and control of nonconforming items for the PANDA program. This procedure applies to all PANDA quality related activities that can affect PANDA test results and it implements the applicable requirements of GE EOP 75-4.10, "Control of Nonconforming Material," and EOP 75-3.00, "Corrective Action and Audits."

Based on reviews of nonconformance reports found in the PTF, and based on conversations with PSI test personnel, the team learned that although abnormal occurrences, subsequently causing matrix testing to be suspended and re-evaluated, had been detected during testing, no nonconformance reports had been generated by PSI to document these events. The team also learned of the existence of a new PSI procedure ("Data Base Modification," issued in early March 1996) used extensively by PSI testing personnel to evaluate, and when necessary, modify, i.e., revise or delete, actual test results data. Although this "Data Base Modification" procedure was clearly being used to perform an activity affecting quality as well as an activity that introduced deviations from the test control process specified by PQAP-TC, and from the nonconformance identification process identified in PQAP-NC, the "Data Base Modification" procedure had not been identified or described as a Quality Assurance Procedure governed by PPCP-QA-01. This issue was identified as *Nonconformance 99900403/96-01-02*.

3.9 Personnel Training and Qualification

PQAP-PT, "Personnel Training and Qualification," Revision 0, dated January 31, 1995, establishes the personnel training and qualification requirements to be implemented on the PANDA Project for test facility personnel. PQAP-PT implements the applicable requirements of the appropriate GE EOPs and states that individuals who perform activities affecting the quality of the PANDA project must be proficient in the appropriate technical discipline and the procedural systems.

Technical qualifications specify a minimum education, experience, and/or special technical training requirements. Procedurally, each individual shall be indoctrinated or instructed in the applicable quality assurance procedures. Indoctrination and training shall be attained and maintained by methods such as procedure reading, class training and/or on the job training.

The team verified through review of PTF training records that all PANDA personnel had received training in all sections of the PQAP and test procedures.

Personnel qualifications were done in accordance to level of education and years of experience in the desired fields. All personnel running and supervising the tests were appropriately trained and qualified in accordance with PQAP-PT. The PSI ALPHA Project Manager and the and the PSI PANDA Project Manager both qualified to the highest qualification level required.

There were no records of subcontractor training and qualification in the PTF. However, GE stated that such documentation existed in the PANDA DRF maintained in San Jose for the training of certain international technical associates performing PANDA data analysis.

Based on the above review of personnel training and qualification records in the PANDA PTF, the team concluded that GE/PSI had adequately implemented the provisions and requirements of PQAP-PT for PSI personnel.

3.10 Quality Assurance Records

PQAP-R, "Quality Assurance Records," Revision 0, dated January 31, 1995, defines the requirements for identification, accumulation, review, maintenance, and retention of the quality assurance records in the PTF. PQAP-R implements the applicable requirements of GE EOP 42-10.00, "Design Record File," and EOP 75-6.00, "Quality Assurance Records."

PQAP-R requires that a central file of legible, accurate and complete QA records, the PANDA Test File, shall be established with an index and table of contents. PQAP-R also requires that the PTF be stored in an archive for the duration of the testing and at completion of testing, the PTF will be transferred to GE for inclusion in the PANDA Design Record File.

The NRC team was informed of two pertinent facts about the test files at PSI: first, since the program is still active, the PSI files have not been closed and, in fact, detailed information on most of the tests had not yet been included in the PTF; and, second, the PSI files do not, and are not intended to, comprise the complete DRF for the PANDA program. Important supporting information is contained in the DRF at GE's offices in San Jose. When the PSI test files have been completed and closed, the PTF will be provided to GE, and the combined set of files will comprise the complete PANDA DRF.

Test result records were identifiable and retrievable to the extent they were included in the PTF. However, the team was told that test data is not included in the PTF until it has completed the PSI Project Manager's review process. This process resulted in the team having to request completed test data that was not yet stored in the PTF.

Overall, the documentation in the PTF reflected evidence of appropriate implementation of the PPCP and the QA procedures. Based on the results of these reviews, the team concluded that the QA records control process was adequately established and implemented for the PANDA test program.

3.11 Audits

Sections 4.0, "Project Assessment," and 4.1, "Audits," of PPCP-QA-01, define the project implementation requirements for internal audit activities at PANDA though GE established procedures P&P 70-11, GE Quality System Requirements, and Administrative Guide AG-017. All internal audits and oversight of the PANDA test program were conducted by GE certified auditor(s). The team confirmed that audits were performed by appropriately trained QA personnel with GE-certified lead auditors. Audits included the following:

- Audit plan and schedule
- Audit check list
- Preaudit orientation and training (if required)
- Assessment
- Audit report issued to management
- Corrective action requests (CARs)
- Resolution of audit findings
- Follow-up to closure of CARs

The team reviewed results of a GE audit of the PANDA Test Facility conducted January 31 through February 2, 1995. The team also reviewed the results of the readiness assessment conducted in October 1994, including the open items and recommendations that were documented in the Readiness Assessment Report.

During the January 1995 GE audit, it was determined that 11 of the 15 open items and 5 of the 9 recommendations identified during the readiness review were still unresolved. GE performed a second readiness review in September 1995 and the results were documented in a report identifying several findings. Corrective action requests (CARs) were issued and the appropriate follow-up to assure closure of the CARs was documented.

The team determined that no external supplier audits were performed by either PSI or GE for PANDA suppliers. Based on the results of these reviews, the team concluded that GE was implementing an appropriate internal audit program at the PANDA test facility.

4 PERSONNEL CONTACTED

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June 10, 1996

MFN 081 -96
Docket No. 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Robert M. Gallo, Chief
Special Inspection Branch
Division of Inspection and Support Programs
Office of Nuclear Reactor Regulation

Subject: SBWR PANDA Testing
Reply to Notice of Nonconformance
NRC Inspection Report No. 99900403/61-01

The subject inspection report, dated May 10, 1996, documented the NRC inspection of the PANDA Test Facility which was conducted March 5 through 8, 1996. This letter requests a 30-day extension to fully address the NRC staff findings. Specifically, GE needs until July 10, 1996 to gather sufficient information to give a complete response to Unresolved Item No. 96-01-03 in the report.

GE believes that with the 30 day extension, our responses to the nonconformances (96-01-01and 96-01-02) and the unresolved items (96-01-03, 96-01-04 and 96-01-05) will fully address the issues and concerns raised by the staff in the inspection report

If you have any questions regarding this request, please call R.H. Buchholz at (408)-925-4584.

Sincerely,

James E. Quinn
Projects Manager

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GE Nuclear Energy

MFN 081 -96

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July 8, 1996

MFN 101-96
Docket No. 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555-0001

Attention: Robert M. Gallo, Chief
Special Inspection Branch
Division of Inspection and Support Programs
Office of Nuclear Reactor Regulation

SUBJECT: SBWR PANDA TESTING-
REPLY TO NOTICE OF NONCONFORMANCE,
NRC INSPECTION REPORT NO. 99900403/96-01

This letter addresses the NRC staff findings documented in the subject report dated May 10, 1996. In accordance with Enclosure 1 of the subject report, this letter is being sent to the Chief, Special Inspection Branch, Division of Inspection and Support Programs, Office of Nuclear Reactor Regulation. Specifically, this letter addresses Nonconformances 96-01-01 and 96-01-02 and Unresolved Items 96-01-03, 96-01-04 and 96-01-05.

The staff's inspection report states that, "The results of the inspection indicate that GE, in general, was adequately implementing the Project Control Plan and the Quality Assurance Procedures for testing activities performed at PANDA with the exception of two nonconformances." Based on discussions with the staff during the exit meeting at the end of the inspection, we understand this statement to mean that the staff has concluded that the two nonconformances and three unresolved items do not invalidate the application of the PANDA data for qualification of the TRACG computer code. We also note that during the exit meeting the inspection team was more explicit in its affirmation of the PANDA Test Program Project Control Plan and Quality Assurance Procedures and the execution of the quality plan.

GE believes that the enclosed responses to the nonconformances and unresolved items fully address all the issues and concerns raised by the staff in the inspection report. Should there be any questions with regard to this submittal, please call John Torbeck of our staff on 408-925-6101.

Sincerely,

James E. Quinn
Projects Manager

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MFN-101-96
July 8, 1996

GE RESPONSES TO NONCONFORMANCES

Nonconformance 96-01-01

Apparent Test Results reports and Data Transmittal Reports were not prepared and issued in accordance with the Test Specification or Test Plan and Procedures. The failure to prepare ATR reports, FTRs and/or DTRs, on a time schedule consist(sp) with the applicable Test Specification and Test Plan and Procedures requirements is identified as *Nonconformance 99900403/96-01-01.*

GE Response

Background

PANDA Nonconformance Report (NCR) No. P-014 was prepared in accordance with PANDA QA Procedure PQAP-NC to address this deviation. In the closure of PANDA NCR No. P-014 it was concluded that the program objectives could be met with the delay in the schedule for the Apparent Test Results Reports (ATRs) and Data Transmittal Reports (DTRs).

Although the Test Specification and the Test Plans call for issuing the Apparent Test Results reports (ATRs) within 1 or 2 weeks, there was no specific application for the ATRs defined in the PANDA QA Procedures (PQAPs), Test Specification or Test Plans. The ATRs were intended only as a backup tool to confirm that the test acceptance criteria had been met to support decisions on whether or not testing should proceed as planned. The primary reviews of the test conditions and instrumentation performance against the test requirements were performed by PSI in accordance with the specific Test Procedures for the setup and conduct of each test. Review of the compliance with test acceptance criteria was done at PSI by the GE Site QA Representative, and this was communicated to others at GE through frequent discussions/communications between PSI and GE personnel by telephone/fax/e-mail. These communications, which occurred as frequently as once per day during the actual performance of the tests, assured that decisions regarding performance of subsequent tests considered evaluation of the test performance against the acceptance criteria, thereby achieving the purpose of the ATRs for which the one or two week schedule was established.

The delayed schedule for the DTRs, although not desirable, has met the PANDA and SBWR program objectives.

Corrective Action

ATRs which contain all information specified for these reports in the Test Specification and Test Plans have been issued for all S-Series and M-Series PANDA tests. DTRs which contain all information specified for these reports in the Test Specification and Test Plans are to be complete by 1 August 96 for all PANDA tests.

Preventive Action

No additional testing is planned in support of the SBWR certification. For any additional SBWR test programs in the future, practicable schedules for the reports will be established considering the needs of the program and the scope of the reports, and the test specifications will be written accordingly. These schedules will recognize that the ATRs are not the primary means to confirm that test acceptance criteria have been met.

MFN-101-96
July 8, 1996

GE RESPONSES TO NONCONFORMANCES

Nonconformance 96-01-02

Contrary to the above, (1) when abnormal occurrences (subsequently causing matrix testing to be suspended and re-evaluated) were detected during testing, no nonconformance reports were generated to document these events; (2) PSI Procedure "Data Base Modification" (issued in March 1996) was being used by PSI testing personnel to perform activities that introduced deviations from the test control process already specified by PQAP-TC, and from the nonconformance identification process established in PQAP-NC; and (3) PSI Procedure "Data Base Modification" had not been identified or described as a Quality Assurance Procedure governed by PPCP-QA-01, i.e., as a procedure comprising the bases of the QA system implemented by PSI and GE in meeting the requirements of NEDG-31831, even though it was being used to perform quality related activities affecting PANDA test results.

Response

Background

Item (1)

During the performance of the PANDA tests several nonconformance reports (NCRs) were written to address abnormal occurrences. The attached table lists NCRs which were written during the PANDA Test Program. Some of these NCRs were written following testing in response to Surveillance Inspection Reports prepared by the GE Site QA Representative in accordance with Section 5.6.7 of PQAP-TC. NCRs No. P-001 through P-013 were in the PANDA Test File at the time of the NRC inspection. GE and PSI consider the attached list to be complete in addressing all nonconformances identified to date in the course of PANDA testing and data evaluation and reporting.

The changes to the PANDA M-series test matrix were initiated following the performance of the first M-series test, Test M3. The results for this test were very consistent with pretest calculations, and all requirements in the Test Plan and Test Procedure including the Test Acceptance Criteria were met except as noted in NCR Nos. P-007, P-011, P-012 and P-013. The changes to the matrix introducing Tests M3A and M3B were to investigate alternative approaches for configuring the PCC pools to assure the PCC pool level response was as prototypical as possible and to improve ability to perform heat balances on each of the three PCCs. This PCC heat balance capability was investigated in Tests M3A and M3B to address instrumentation problems noted in NCR P-012.

No other changes to the M-series matrix were a consequence of nonconformances identified per PQAP-NC. These other matrix changes are done to maximize the usefulness of the remaining tests.

Item (2)

PSI's Data Base Modification (DBM) Procedure (ALPHA-602) was issued on 5 February 1996, not March 1996. It is a procedure, controlled per PQAP-DC, which was developed by PSI to assure that modifications to the PANDA Data Base were done in a way which assured the quality of the final data while retaining the original data. An example of an application of the DBM procedure was to address troublesome output of the oxygen sensors when the measured oxygen partial pressure was below the lower limit of the measurement range (0.0012 bar). When the oxygen partial pressure was less than 0.0012 bar, the over flow signal was 1e38. DBM No. 1 documented the changing of the data for the oxygen sensors for Test M3 from 1e38 to 0.0012 bar when the oxygen partial pressure was less than 0.0012 bar, to assure the data in the data base were the best values possible.

GE RESPONSES TO NONCONFORMANCES

Nonconformance 96-01-02

Response

Background

Item (2), (Continued)

This DBM Procedure does not introduce deviations from the existing PANDA Project Control Plan and Quality Control Procedures including, PQAP-TC and PQAP-NC procedures, but rather supplements them. ALPHA-602 references PQAP-TC, PQAP-V, and PQAP-R. ALPHA-602 has not been used in place of PQAP-NC; that is, the PSI DBM Procedure has not been used as a substitute for preparation of nonconformance reports according to PQAP-NC. If there has been a need for a nonconformance report identified by GE or PSI, it has been prepared as noted above. One of these nonconformance reports, NCR No. P-017, led to implementation of a data base modification, DBM No. 14.

ALPHA-602 gives very specific guidelines and controls for modifications to the test data, which assure that the original data records are maintained. The need for these modifications have been identified during the detailed post-test data evaluations, and in some cases (one to-date), as noted above, a nonconformance report is prepared when appropriate. In all other cases to-date, however, the modifications were not introduced to address a nonconformance.

Item (3)

Nothing in the GE PANDA Project Control Plan or QA Procedures precludes introduction of additional lower level procedures such as ALPHA-602 which help to assure the quality of the test performance or the test data handling. These additional implementing procedures provide more detailed controls to help assure compliance with the necessarily broader and more generic controls of the PQAP procedures. Members of the NRC inspection team acknowledged during the audit that application of the ALPHA-602 procedure was resulting in an improvement in data quality.

Corrective Action

Considering the additional clarification provided above, GE believes no additional corrective action is required. All nonconformances in the PANDA Test Program identified, to-date, have been documented per PQAP-NC. The PSI DBM Procedure ALPHA-602 is not in conflict with the higher level PQAP procedures, and changes to the PQAP procedures are not required for the implementation of ALPHA-602.

Preventive Action

None

PANDA NCR Number	Summary Description
P-001	Steady-state conditions not reached during shakedown test SD-1
P-002	Zero stability for flowmeters MV.P3C and MV.GRT
P-003	MV.GRT accuracy during first steady-state test, S2
P-004	Year input to DAS was 1994 instead of 1995
P-005	PCC header insulation not tight during Tests S7, S8 and S9
P-006	PCC pool level measurement error of 0.1m
P-007	MV.P3C and MV.GRT measurements during Test M3
P-008	Shutdown of control rack during Test M3A
P-009	Control of RPV heater power during Test M2
P-010	Control of RPV heater power during repeat of Test M2
P-011	Main steam line flow measurements out of range for Test M3
P-012	PCC2 feed flow measurement out of range for Test M3
P-013	Power spikes during switching of heater banks in Test M3
P-014	Schedule for ATRs and DTRs for Integral Systems Tests
P-015	Power oscillations during Test M3B
P-016	MPG.D2.2 and MPG.D2.3 failed or unavailable during Test M3B
P-017	Bypass leakage line pressure and flow measurement during Test M6/8

MFN-101-96
July 8, 1996

GE RESPONSES TO UNRESOLVED ITEMS

Unresolved Item No. 96-01-03

The team was concerned that GE concluded in the October 1994 Readines Review Report (without providing any justification or taking any compensatory or corrective actions) that the PANDA facility as-built measurement activities performed by Elektrowatt were satisfactory, while at the same time acknowledged that Elektrowatt had not been audited by either GE or PSI as a supplier of services affecting quality.

Response

Electrowatt (EWI) is recognized in Switzerland as a supplier of engineering services in support of Swiss Nuclear Plants. The attached "Certificate of Good Performance" for EWI from KKL dated 7 Dec 1995 provides some evidence of this by documenting the type of work performed by EWI on the Leibstadt Nuclear Power Plant.

Although GE or PSI has not performed a general audit of EWI, the attached report from EWI, dated 2 July 1996, entitled "PANDA Geodetic As-Built Measurements", shows that EWI is well qualified for doing this specific type of work.

Unresolved Item No. 96-01-04

The GE disposition of the recommendations and specific action items identified during the October 1991 PANDA design review regarding facility design, quality assurance programmatic aspects, and technical issues could not be verified at PANDA.

Response

The records of closure of the October 1991 Design Review of the PANDA and LINX test programs exist in GE Design Record File (DRF) No. DR0-00007 which was closed in May, 1994. This DRF is separate from the PANDA Test Program DRF No. T10-00005 which is currently open. These DRFs can be reviewed by the NRC in San Jose, as necessary.

MFN-101-96
July 8, 1996

GE RESPONSES TO UNRESOLVED ITEMS

Unresolved Item No. 96-01-05

The extent and level of effectiveness of quality assurance oversight by GE over its SBWR program international technical associates was identified as *Unresolved Item No. 96-01-05.*

Response

This unresolved item is related to the TRACG analysis work related to the PANDA Test Program done by International Technical Associates (ITAs) under GE's supervision. This work was not done under the PANDA Project Control Plan, but was done under the GE QA Program.

GE ITAs have participated in the PANDA analysis activities, using the GE analysis code TRACG. These organizations and individuals included: PSI, KEMA and Jaime Morales of IIE. ECN was not involved. In these activities, a controlled version of the TRACG code was employed. The code configuration is controlled at GE, and the ITAs have access only to the executable code version. The individuals performing the work were trained in the use of TRACG by GE, and frequent interactions occurred with the responsible GE engineer during the course of the work.

All work performed at PSI and IIE has undergone verification according to GE procedures with final review and management approval by GE. The Design Record Files for all work done are maintained at GE.

KEMA has an approved quality assurance program and has been audited by GE. Work done by KEMA engineers was performed and verified under the KEMA quality assurance requirements. This work culminated in the KEMA report "Post Test Calculations of PANDA PCC Steady State Tests" which was reviewed by a GE technical expert and approved by GE management. Outputs from the KEMA work (including the reports) are maintained in a Design Record File at GE. The next page provides details of ITA TRACG analysis activities related to PANDA and the GE control actions.

MFN-101-96
July 8, 1996

Details of ITA TRACG Analysis Activities for PANDA and GE Control Actions

PSI:
Developed TRACG PANDA input deck and performed pre-test and post-test calculations.

GE Control Actions:
P. Coddington of PSI spent 3 months at GE (learning to use TRACG under the guidance of GE experts) prior to use of TRACG for PANDA applications.
Input model reviewed by GE Technical Review Team.
Input deck verified by J. Morales of IIE following GE EOPs, and reviewed by GE responsible engineer.
TRACG code configuration controlled by GE; PSI only has executable version.
Design Record Files maintained by GE.
Post-test analysis input verified by GE and PSI.
GE management signoff on verification packages.
Continuous GE/PSI interactions during post-test analysis - e-mail and telephone calls on daily basis. GE responsible engineer spent 1 month at PSI during this period.

KEMA:
Developed initial conditions for tests and performed pre- and post-test analysis of steady-state tests.
Performed verification of these activities.

GE Control Actions:
KEMA has an approved QA program and has been audited by GE. KEMA work was performed and verified under KEMA program.
The Design Record Files for this analysis are maintained by KEMA. Work outputs are maintained in a DRF by GE.
Initial conditions for PANDA tests and results of pre- and post-test analysis were reviewed and approved by GE.
Frequent technical interactions occurred between KEMA and GE during the period of analysis, including 4 meetings of 2-3 days length. The GE responsible engineer visited KEMA and met with the responsible KEMA engineers.

IIE:
Jaime Morales of IIE performed verification of the PANDA input deck.

GE Control Actions:
Morales spent several months at GE prior to his activities on PANDA. He was trained in the use of TRACG by working with an experienced GE engineer. He was also provided with GE EOPs pertaining to verification. Verification results were reviewed and approved by GE responsible engineer. During the course of the work, there were frequent interactions with the GE responsible engineer, including 4 meetings of 2-3 days in length. The GE responsible engineer also visited IIE and met with Morales at Cuernavaca.

(IIE engineers under the direction of J. Morales also developed a processor for TRACG which develops nodalization diagrams from the input data. The nodalization diagrams generated by this input processor have been displayed in the PANDA analysis reports. These are to aid the reader in following the nodalization and have no impact on the results.)

KERNKRAFTWERK LEIBSTADT AG

KKL

E W I
Elektrowatt Ingenieurunternehmung AG
Bellerivestrasse 36

8034 Zürich

Ihre Zeichen:	Ihre Nachricht vom:	Unsere Zeichen:	5325 Leibstadt,
		HE/WGA	07. December 1995

CERTIFICATE OF GOOD PERFORMANCE

Between 1970 and 1985, Electrowatt Engineering Services Ltd. (EWI) has been intensely involved, first in site preparation, general station layout and other planning work, and later in the actual implementation of the 1'000 MWe Leibstadt Nuclear Power Station, the largest in Switzerland. This station - which is equipped with a boiling water reactor - has been built by a supplier consortium made up of Brown Boveri & Co. Ltd. (BBC, today ABB) and General Electric Technical Services Company (GETSCO). It has a cumulated load factor in the order of 85 % since going on the grid by the end of 1984. Its power rating has been gradually increased twice during recent years.

Originally, EWI prepared the bid invitation documents for this station and evaluated the various turnkey bids technically and commercially, on behalf of the Leibstadt Study Consortium and assisted in contract negotiations with the bidders.

In late 1973, the Kernkraftwerk Leibstadt AG (KKL) signed the contract with the supplier consortium and commissioned EWI to perform design, engineering, procurement, construction and erection supervision as well as start up of the balance of plant systems, buildings and structures (outside of the station's nuclear island). These included cooling water systems (wet main cooling tower with circulating water system, station service water system, emergency service water system), water treatment plants (for make up of cooling tower and demineralized water), water supply and disposal systems (for potable water, fire fighting water, sewage water treatment), electrical systems such as main station transformers, 380 kV switchyard, 50 kV indoor switchgear station, and emergency diesel generator plants with individual auxiliary cooling towers. The scope also included associated buildings and a variety of other civil structures. EWI covered within its scope also the numerous resulting interfaces with the nuclear and turbine islands, designed and supplied by Brown Boveri & Co. Ltd. and GETSCO.

Under this comprehensive contract, but within the station's nuclear island, EWI designed, engineered, supplied and started up also all the required systems and facilities for the treatment of the station's generated liquid radioactive liquids and the conditioning of the resulting slurries, concentrates and solid wastes, including a special building for their long term intermediate storage, in solidified form, suited for later disposal in a low level waste repository.

For all the these balance of plant systems, buildings and structures, including the radioactive waste treatment, conditioning and storage systems and buildings, EWI also prepared the necessary detailed start up procedures as well as all the operation and maintenance manuals for the station operators and maintenance personnel.

Furthermore, EWI's civil engineering department acted as a subcontractor for BBC, Mannheim, Germany, and performed statical and partly dynamical calculations of all the station's buildings and civil structures. This department's designers and draftsmen also prepared all the necessary drawings and other documents, needed by the civil contractors (e.g. form drawings, rebar lists, etc.) and later supervised the actual erection of all the buildings and civil structures.

On behalf of the Kernkraftwerk Leibstadt AG (KKL) and its leading partner Electrowatt Ltd., other EWI engineers and specialists, under a different contract, were also assigned the technical project management during the implementation of the Leibstadt Nuclear Power Station. These tasks included among others: Necessary liaison with involved federal, cantonal and communal authorities, involved in the licensing and approval of many of the station's systems, preparation of technical and financial decisions on behalf of the project's Technical Committee, preparation of safety studies and reports, coordination of the numerous contractors involved at the site, organization and supervision of the overall construction site management, supervision of contracts with main equipment suppliers and civil contractors, settlement of disputes with the supplier consortium, preparation of budgets and time schedules, overall project time and cost control, selection and training of the station's lead operating personnel, design reviews, quality assurance and quality control for systems, components and civil structures, public relations.

EWI specialists also performed calculations in the area of the nuclear fuel cycle and were involved in the in core and the out of core fuel management of the Leibstadt nuclear power station.

Between 1970 and 1985, engineers, technicians, draftsmen and other specialists of Electrowatt Engineering Services Ltd. (EWI) in the technical fields of mechanical, process, electrical, instrumentation / control and civil engineering as well as in quality assurance /quality control, procurement, construction / installation supervision, time and cost control, documentation control and other specific areas have spent almost 2 million working hours towards the successful completion and operation of the Leibstadt Nuclear Power Station.

We hereby certify that Electrowatt Engineering Services Ltd. (EWI), of Zurich, Switzerland, have rendered services of high professional standard and that all their engineers and specialists have worked to our full satisfaction.

KERNKRAFTWERK LEIBSTADT AG

Brandn i.V.

General Electric Nuclear Energy
San José

Quality Report

PANDA

Geodetic As-Built Measurements
Paul Scherrer Institute (PSI)
Switzerland

Engineers + Consultants

Electrowatt Engineering Services Ltd., CH-8034 Zurich, Switzerland

2. July 1996

Table of Contents

Appendices

1. Introduction

The as-built survey of the PANDA Project was performed during the period October 1 to 12, 1993 by the Surveying Department of Electrowatt Engineering Services Ltd. in Zurich. The client was the Paul Scherrer Institute (PSI) in Villigen with Mr. G. Varada (Project Manager) and Mr. Th. Biedermann (Head of Surveying Group).

2. Geodetic Survey

The following geodetic survey was carried out:

- Installation and measurements of triangulation network:
  Based on the two centre-points of the Drywell (bottom), total 10 benchmarks with coordinates, accuracy of coordinates ± 0.4 mm (mean ellipses of error).
- Installation and measurement of elevations:
  Based on the elevation ± 0.000 m of the bottom of Drywell, total 10 levelling points (bolts) on difference levels (Drywell, Netwell and PRV), accuracy of elevation ± 2 mm (standard deviation).
- Setting out of main axes in Drywell and Wetwell, accuracy ± 2 mm.
- Measurement of the piping systems, nozzles and connecting piece in position and elevation.
- Measurement of internal and external diameters of tanks and pipes at different levels.
- Measurement of internal diameters in Drywell, Netwell and RPV.
- Documentation and protocol of all results in tables and drawings.

3. Survey Staff

All geodetic work for the PANDA Project was carried out by professional specialists trained in geodetic survey, experienced and qualified to perform geodetic measurements in nuclear establishments. Survey work was performed by this team in the following nuclear power plants:

- Leibstadt: During the construction and erection in 1974 to 1984 (see Nucon documentation)
  Setting out of filtered containment venting systems (1992 -93)

- Beznau I: Replacing of two steam generators (1993)
- Beznau II: Survey work for Sidrent (filtered containment venting system, 1990)
- Mühleberg: Replacing of Recirculation Loops in Drywell (1986)

The PANDA Project as-built measurements were performed by the following persons:

- René Huser — Head of Surveying Department, Electrowatt Engineering Services Ltd. (EWI), Senior Survey Engineer, Graduate Engineer of Surveying HTL/STV Postgraduate studies in Machine Survey at the Polytechnic Institute of Aachen (Germany)

  Planning, implementation and specification of work for the PANDA Project, supervision of all survey work during the measurements, computation and documentation.
- Andreas Bruppacher — Graduate Engineer of Surveying HTL/STV and Patented Engineer Surveyor of Swiss Government (Appendix 2).

  Leader of survey team for the Project
- Thomas Gfeller — Graduate Surveyor Technical Draftman

4. QM Management

Electrowatt Engineering Services Ltd. is EN ISO QM9001 certified (Appendix 1).

5. Surveying Instruments and Equipment

For carrying out the measurements, the following surveying instruments and equipment, which are owned by EWI, were used:

- *Instruments:*
  - 1 Electronic precision theodolite KERN E2 , No. 352'051
  - 1 Mekometer ME5000 precision distance meter KERN, No. 357'072
  - 1 Level WILD NA 2 with parallel plate micrometer WILD GPM3
  - 1 Precision level WILD N3, No.
  - 1 1m Subtense Bar KERN, No. 382'711

- *Equipment:*
  2 Industrial levelling staffs, 2 m long
  8 Mekometer reflectors with targets
  2 precision tapes with mm - scale

All instruments and some of the equipment were tested and calibrated on ISO QM9001. Some of the Quality Test Certificates are shown in Appendix 3.

6. Testimonials for Mr. René Huser

Testimonials for Mr. René Huser are summarised in Appendix 2 from the following companies:

- Sulzer Thermtec, Winterthur (Switzerland), June 28, 1996
- Nucon AG, Bülach (Switzerland), June 28, 1996

During the construction phase of the nuclear power plant in Leibstadt, an audit was carried out by General Electronic Technical Services Company (GE). On March 2, 1981 Messrs. R.K. Stoner and Franzen from GE tested Mr. R. Huser's knowledge in surveying matters. After this test Mr. R. Huser was qualified to carry out the geodetic measurements for the installation of Reaktor Pressure Vessel (RPV) and other nuclear components.

Electrowatt Engineering Services Ltd.
Business Unit Building and Construction Planning

René Huser	Günter Baumgarten
Head of Surveying Department	Project Engineer

Appendix 1 Certificate EN ISO 9001

SCES SCHWEIZERISCHER ZERTIFIZIERUNGSDIENST
SERVICE SUISSE DE CERTIFICATION
SERVIZIO SVIZZERO DI CERTIFICAZIONE
SWISS CERTIFICATION SERVICE

Swiss Accreditation Service
Swiss Federal Office of Metrology, SAS
SCES 013

TÜV SCHWEIZ

TÜV (Schweiz) AG
certification body for quality systems
a company of TÜV Südwest Group and the SW Swiss Ordonance Enterprise Thun

CERTIFICATE

The TÜV (Schweiz) AG hereby
certifies that

Electrowatt Engineering Services Ltd., CH-8034 Zurich, with the branch offices of CH-3014 Berne, CH-6003 Lucerne and CH-1951 Sion

has established and applies
a quality system for

Engineering and consultancy services in the fields of Energy, Transport, Environment, General Planning and Information Technology

An audit was performed **23.-25. 4.1996** , Report No. **AB-95 QZ 323**

Proof has been furnished that the requirements according to

EN ISO 9001

are fulfilled.

The certificate is valid until

1999

Certificate Registration No.

96-323-017

Thun, 30. 4. 1996
TÜV (Schweiz) AG

TÜV (Schweiz) AG	Governing board	Certifying Body

Appendix 2

Testimonials of Mr. René Huser

- Sulzer Thermetec
- Nucon

Diploma of Mr. A. Bruppacher as Patented Engineer Surveyor of Swiss Government

SULZERTHERMTEC

Ein Unternehmen des Sulzer-Konzerns
A company of the Sulzer Corporation

Ihr Zeichen
Ihre Nachricht vom
Unser Zeichen 0396/Zd/cst
Telefon 052/262 69 87
Telefax 052/262 00 39
Winterthur 28. Juni 1996

Elektrowatt Ingenieurunternehmung AG
Herrn René Huser
Bellerivestrasse 36, Postfach
8034 Zürich

Vermessungsarbeiten in Kernkraftwerken

Sehr geehrter Herr Huser

Gerne bestätigen wir Ihnen zu handen Ihrer Kunden die Durchführung von Vermessungsarbeiten in schweizerischen Kernkraftwerken:

> Vom Fachbereich "Vermessung" der Firma Elektrowatt Ingenieurunternehmung AG, Zürich, unter der Leitung von Herrn René Huser wurde bisher mehrfach Vermessungsaufträge in Kernkraftwerken für Sulzer Thermtec durchgeführt.
>
> Diese anspruchsvollen Aufträge umfassten jeweils die Planung, Durchführung und Auswertung sämtlicher Vermessungsarbeiten im Zusammenhang mit Umbau- und Nachrüstungsprojekten, z. B.:
>
> - Austausch der Reaktor-Umwälzschleife (KKW Mühleberg)
> - Dampferzeuger - Austausch (KKW Beznau I)
> - Nachrüstung von Brennelementen-Kompaktlager (KKW Leibstadt).
>
> Die gesamten Aufträge und insbesondere auch die Einsätze vor Ort wurden jeweils unter der persönlichen, fachlich kompetenten Leitung von Herrn Huser abgewickelt.

Wir hoffen, Ihnen mit diesen Angaben gedient zu haben.

Freundliche Grüsse

SULZER THERMTEC AG
Nuklear Service und Armaturen
Service und Montage *Service*

ppa R. Zahnd

R. Zahnd

Sulzer Thermtec AG CH-8404 Winterthur, Schweiz Telefon 052 262 61 18
Sulzer Thermtec Ltd CH-8404 Winterthur, Switzerland Telefax 052 262 00 39

nucon

Nucon AG
Solistrasse 88
CH-8180 Bülach
Tel (+41) 1-860 69 70
Fax (+41) 1-860 61 22
MWSt Nr. 252 482

EWI Elektrowatt Engineering
Bellerivesrasse 36
8034 Zürich

Bülach 28 Juni 1996
unser Zeichen Vejc/KKL 2144

Dear Sirs

We herewith confirm that we have been a consortium partner during the construction of the turn key part of KKL Nuclear Power Plant.

Furthermorer we confirm that during the construction period, between 1974 and 1984, Mr. Rene Huser of EWI has performed geodetical surveys for the consortium partners. These surveys were performed at the site for areas, civil structures like Reactor Building and Reactor Auxiliary Building, and for major components of the primary part of the plant like Reactor Pressure Vessel with internals, Primary Containment and ECCS Equipment.
We expect we informed you sufficiently.

Sincerely yours,
NUCON AG:

J.C. Vordegnal
Managing Director.

SCHWEIZERISCHE EIDGENOSSENSCHAFT

patent

DAS EIDGENÖSSISCHE JUSTIZ-
UND POLIZEIDEPARTEMENT ERTEILT HERRN

ANDREAS BRUPPACHER

GEB. 1965, VON HORGEN

AUF GRUND DER ABGELEGTEN REGLEMENTARISCHEN
PRÜFUNGEN DEN TITEL

PATENTIERTER INGENIEUR-GEOMETER

UND ERMÄCHTIGT IHN DAMIT ZUR AUSFÜHRUNG
VON GRUNDBUCHVERMESSUNGEN IM GANZEN
GEBIETE DER EIDGENOSSENSCHAFT

BERN, DEN 28. SEPTEMBER 1993

DER PRÄSIDENT
DER EIDGENÖSSISCHEN
PRÜFUNGSKOMMISSION

DER VORSTEHER DES
EIDGENÖSSISCHEN JUSTIZ- UND
POLIZEIDEPARTEMENTES

Appendix 3 Calibration Certificate of Surveying Instruments:

- Mekometer ME5000, No. 357'072
- Electronic Theodolite KERN E2, No. 352'051
- 1 m Subtense Bar KERN 1 m, No. 382'711
- Precision tape (Stamm and Lufkin)

Calibration Certificate for Kern Mekometer ME 5000

Determination of the addition constant

Instrument No.: 357020

Temperature : 22°C

Addition constant: -0.07 mm

This addition constant is valid for the measurement with the standard Mekometer reflectors. It is set to 1/10 mm within the instrument (see fig. 17 in the Mekometer Manual).

The preset value of this instrument at the micro switches is 57.9 mm, corresponding to a 0-correction of the measured distance.

It is advisable, to recheck the addition constant every year, or when measurements with highest accuracy are required.

Leica AG Heerbrugg
Instrument Service LSG

Date: 23. Aug 1994

Certified: Manager Instrument Service

Leica

Leica

EICHUNG ELEKTRONISCHER DISTANZMESSER

BESTIMMUNG DER ADDITIONS- UND MULTIPLIKATIONS-KONSTANTEN UND UEBERPRUEFEN DER GENAUIGKEIT

INSTRUMENTENTYP: ME 5000 INSTRUMENTENNUMMER: 357072
DATUM: 18.5.93 BEOBACHTER: D.MUELLER
TEMPERATUR (C): 18.9 DRUCK (MB): 971.0
EINGEGEBENE TEMPERATURKORREKTUR (PPM): 0.00
WETTER: schoen

STRECKE	MESSUNG	GEW.	KOR.MESSUNG	BASISDIST	V
	M		M	M	MM
0 - 1	30.0081	1.00	30.00807	30.00814	0.07
0 - 2	100.0084	1.00	100.00845	100.00848	0.03
0 - 3	179.9985	1.00	179.99867	179.99876	0.09
0 - 4	299.9992	1.00	299.99956	299.99941	-0.15
0 - 5	470.0026	1.00	470.00318	470.00313	-0.05
0 - 6	520.0084	1.00	520.00906	520.00908	0.02
1 - 2	70.0003	1.00	70.00030	70.00034	0.04
1 - 3	149.9904	1.00	149.99055	149.99062	0.07
1 - 4	269.9910	1.00	269.99134	269.99127	-0.07
1 - 5	439.9945	1.00	439.99500	439.99499	-0.01
1 - 6	490.0003	1.00	490.00089	490.00094	0.05
2 - 3	79.9901	1.00	79.99019	79.99028	0.09
2 - 4	199.9908	1.00	199.99099	199.99093	-0.06
2 - 5	369.9940	1.00	369.99449	369.99465	0.16
2 - 6	420.0002	1.00	420.00073	420.00060	-0.13
3 - 4	120.0006	1.00	120.00072	120.00065	-0.07
3 - 5	290.0040	1.00	290.00429	290.00437	0.08
3 - 6	340.0097	1.00	340.01009	340.01032	0.23
4 - 5	170.0037	1.00	170.00392	170.00372	-0.20
4 - 6	220.0096	1.00	220.00982	220.00967	-0.15
5 - 6	50.0060	1.00	50.00599	50.00595	-0.03

ADD.-KONST. = -0.05 MM ST.ABW.= 0.06 MM
MULT.-KONST.= 1.00000135 (1.4 PPM) ST.ABW.= 0.23 PPM

MITTL.FEHLER EINER BEOBACHTUNG MIT DEM GEWICHT 1 :
A PRIORI : 1.00 MM
A POSTERIORI : 0.13 MM
MITTL.FEHLER EINER BELIEBIGEN BEOBACHTUNG :
A PRIORI : +-(1.00 MM + 0.00 PPM)
A POSTERIORI : +-(0.13 MM + 0.00 PPM)

DISTANZUNBEKANNTE SIND DIE "BASISDISTANZEN" 0-1 ... 0-4,0-6
FESTE DISTANZ IST DIE "BASISDISTANZ" 0-5.

KOR.MESSUNG = (MESSUNG+T&D-KORR+ADD.KONST.)*(MULT.KONST.)

MEKO V05.85 18-MAY-93 13:03:57

MESSBLATT NR. 088.830.0360

INSTR. NR. 57072 VIS. [signature] DAT. 17.5.93

ME 5000 OSZILLATOR-TEST — Frequenzstabilität

118.200.0902

		Anzeige am ME 5000 SOLL	Anzeige am Frequenznormal IST	Abweichung Meko. zu Frequenznormal (± Vorzeichen beachten)	
Mekometer auf Batterie. Ablesung nach ~ 10 Minuten		479.35817	479.35798	,190	Δf1
Nach 1 Std. Dauerbetrieb, aus- und einschalten und Frequenzen eintragen. 5x nacheinander wiederholen. Alle Δf Werte von Δf1 ÷ Δf6 sollen < 150 Hz sein	1	478.68530	478.68510	,200	Δf2
	2	478.01242	478.01219	,230	Δf3
	3	478.01242	478.01220	,220	Δf4
	4	478.01242	478.01219	,230	Δf5
	5	478.01242	478.01219	,230	Δf6
> 150 Maximale Abweichung der Werte Δf2 - Δf6 < 70 Hz				30	Δf2÷f6
				= 70	Hz

● Diese Werte auf Messblätter übertragen: 088.830.0298, 088.830.0326

(Beispiel - Muster)

088.830.0326 (Beispiel)

MESSPROTOKOLL

Anzeige ME 5000: 480.03405 MHz (SOLL Frequenz)

Anzeige Frequenznormal: 480.03418 MHz (IST Frequenz)

Differenz Δ f (SOLL-IST) = 0.00013 MHz

Massstabsfaktor = 0.99999973

088.830.0298 (Beispiel)

Anzeige ME 5000: 480.03405 MHz (SOLL Frequenz)

Anzeige Frequenznormal: 480.03418 MHz (IST Frequenz)

Differenz Δ f (SOLL-IST) = 0.00013 MHz

Massstabsfaktor = 0.99999973

Mekometer auf Batterie. Ablesung nach ~ 10 Minuten		Anzeige am ME 5000 SOLL	Anzeige am Frequenznormal IST
		480.03405	480.03418
Nach 1 Std. Dauerbetrieb, aus- und einschalten und Frequenzen eintragen. 5x nacheinander wiederholen. Alle Δf Werte von Δf1÷Δf6 sollen < 150 Hz sein	1	478.01242	478.01247
	2	478.01242	478.01248
	3	478.01242	478.01247
	4	478.01242	478.01248
	5	478.01242	478.01246

Maximale Abweichung der Werte Δf1 - Δf6 < 70 Hz

Arecib aerial.

```
Modulator range      :  470.438923  486.241236  MHz = 14.80331

          Frequency to set (MHz)  :  480

          Frequency step in kHz   :  5

       Frequency Stepping  (U)p  (D)own or (B)reak

Synthesizer Frequency with code   92736000 -->    480.000000 MHz
stepping down with new code       92735001 -->    479.994986 MHz
stepping down with new code       92734010 -->    479.989972 MHz
stepping down with new code       92733011 -->    479.984958 MHz
stepping down with new code       92732020 -->    479.979943 MHz
```

10

Weitere Ueberprüfungen im 6 bis 12 monatigem Rhythmus

MESSPROTOKOLL

Datum:
Instrumenten-Nr:
Vergleichsnormal:

Anzeige ME 5000: 479.35817 MHz (SOLL-FREQUENZ)
Anzeige Frequenznormal: 479.35798 MHz (IST-FREQUENZ)
Differenz Δf (SOLL-IST): 0.00019 MHz

Massstabsfaktor m = $1 + (\frac{1}{\text{ISTFREQUENZ}} \cdot f) =$ 1.000000396

Neuer Korrekturfaktor m = 1.000000396 gültig ab [illegible]

Müller

MESSPROTOKOLL

Datum:
Instrumenten-Nr:
Vergleichsnormal:

Anzeige ME 5000: MHz (SOLL-FREQUENZ)
Anzeige Frequenznormal: MHz (IST-FREQUENZ)
Differenz Δf (SOLL-IST): MHz

Massstabsfaktor m = $1 + (\frac{1}{\text{ISTFREQUENZ}} \cdot f) =$

Neuer Korrekturfaktor m = gültig ab ....

MESSPROTOKOLL

Datum:
Instrumenten-Nr:
Vergleichsnormal:

Anzeige ME 5000: MHz (SOLL-FREQUENZ)
Anzeige Frequenznormal: MHz (IST-FREQUENZ)
Differenz Δf (SOLL-IST): MHz

Massstabsfaktor m = $1 + (\frac{1}{\text{ISTFREQUENZ}} \cdot f) =$

Neuer Korrekturfaktor m = gültig ab ....

Leica

12 PRUEFPROTOKOLL

Artikel: DE 5000 Reparateur: D. Müller

Fabr.-Nr: 357072 Dat./Vis.: 17.5.93

PA-Pkt.	Prüfmerkmal	Soll	Ist
1	Mechanik und Optik		
1.1	Kabelanschlüsse	repariert	✓
1.2	Stehachse und Kippachse		✓
1.3	Klemmen		✓
1.4	Feinstellschraube		✓
1.5	Horizontierlibelle/Bel.		✓
1.6	Optisches Lot		✓
1.7	Fokussierung		✓
1.8	Okular		✓
1.9	Fernrohr-Bildqualität		✓
1.10	Horizontierteil		✓
1.11	Sauberkeit der optischen Teile		✓
2	Bedienungselemente des Messteils und deren Funktion		
2.1	Funktionsschalter, Start/Stop-Taste		✓
2.2	Range-Schalter low/high		✓
2.3	Wählschalter Meter/Fuss		✓
3	Datentransfer (ASB)		
3.1	Ansteuerung		✓
3.2	Registrierung		✓
3.3	Programmieren des Synthesizers		✓
4	Messgenauigkeit		
4.1	Dauertest "Schnaufen"	0.2 mm	—
4.2	Modulationskurve Spez.: Power	nachjust. + Zoom V	✓
4.3	Frequenzmessung ± 150HZ	(± 0.3ppm)	+ 190 Hz
4.4	Additionskonstanten-Messung	MK ± 1.5ppm	✓
4.5	Justierung Strichplatte		✓
4.6	Vergleich low/high-range	0.2 mm	✓
5	Aeusserer Zustand		
5.1	Bedienungs- und Befestigungselemente		✓
5.2	Oberflächenbehandlung		✓

Leica AG
Kanalstrasse 21
8152 Glattbrugg

Leica

Kunde: Elektrowatt	Datum: 17.02.93
Wartungsvertrag-Nr.: —	Gerätetyp: E2
Servicetechniker: J. [illegible]	Fabr.-Nr.: 352 051

Mechanisch - Optische Prüfung

Lemo Dosen: ✓	Horizontierunterteil: ✓		
Kreistrieb: ✓	Klemme	V: ✓	H: ✓
Gang Stehachse: ✓	Fein-Grobtrieb	V: ✓	H: ✓
Gang Kippachse: ✓			
Optisches Lot: ✓	Beleuchtung Strichplatte: ✓		
Fokus. Trieb: ✓	Beleuchtung Displays: ✓		

Sauberkeit der Optik

Okular:	Strichplatte: ✓
Fokus. Linse: ✓	Strichplattentyp: ECDS
Optisches Lot: ✓	Objektiv: ✓
Kollimator: ✓	Display: ✓

Justierungen

Indexfehler: 0cc (00 d/2=12cc)	Zielachsfehler: 2cc (00 d/2 ±12cc)
Kippachsschiefe: 7cc (±24cc)	Optisches Lot: ✓
Libelle: ✓	

Vektorsignale

Horizontal: (93 ... 113)	max: 102	min: 94
Vertikal: (93 ... 113)	max: 105	min: 99

AD - Signale

Sollwerte LCD2 (000 000) ± 5	links: 000	rechts: 001

Kompensator Nullpunkt (Komp. Bereich <=500cc)

LCD1 Zielachse (|d1|+|d2|<=5cc)	1.Lage 000	2.Lage 003
LCD2 Kippachse (|d1|+|d2|<=5cc)	1.Lage 000	2.Lage 003

Datenübertragung

PC>Theo.	✓	Theo. >PC	✓	ASB Version:	2.5.3 87	ASB Nr.:	4

Beurteilung

☒	Gerät vollständig in Ordnung
☐	Gerät sollte gelegentlich bei Leica AG überprüft werden
☐	Gerät muss sofort bei Leica AG repariert werden

EZ 352051 *17.02.93*

```
IMMM Pruef-Programm  ••• ASB-E2-I •••                    V. 1.0 / 28.4.1989 MMMM;
:                                                                                :
:       PRUEFUNG DES DATENTRANSFERS UEBER ASB BEIM THEODOLITEN E2-I              :
:                                  IMMMMMMMMMMM Pruefpunkt 2 MMMMMMMMMMMMM;       :
:    Pruefpunkte:                  :               ON-LINE - DATEN        :      :
:                                  :                                      :      :
:            <1>  =  Version und : Vertikalwinkel      :   12+299.9993   :      :
:                                  :                                      :      :
:            <2>  =  Vertikalwin: Horizontalrichtung :   11+318.9149   :      :
:                    Horizontalr:                                         :      :
:                    Kompensator: Komp.  ZA-Richtung :  60-.0016        :      :
:                    ASB-Schalte:        KA-Richtung :  61+.0010        :      :
:                    Masseinheit:                                         :      :
:                    Status Komp: ASB-Schalter       :        4         :      :
:                    Korrektur I:                                         :      :
:                                : Masseinheit        :      50+0        :      :
:            <3>  =  Horizontalk:                                         :      :
:                                : Status Kompensator :      51+3        :      :
:            <4>  =  Data Hold O:                                         :      :
:                                : Korrektur Index    :  37+.0000        :      :
:            <5>  =  BeschreibenHMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM<      :
:                                                                                :
:   F1-Help   F2-Text   F3-Menue   F10-Exit                                      :
HMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM<
```

Institut für Geodäsie und Photogrammetrie ETH - Hönggerberg 8093 Zürich

MESSZEUGNIS

Länge von Basislatten Messkeller

Auftraggeber:	Leica AG Kanalstrasse 21 CH - 8152 Glattbrugg	Auftrag Nr. 59295

Latte	Basislatte 1 m	Nr. 382711
Datum der Messung	27.01.1993	
Operateur(e)	H. Oesch	
Temperatur	20.7 °C	

Resultate und Genauigkeit

Basislänge Seite 1	1000.078 mm
Basislänge Seite 2	1000.081 mm
Messunsicherheit	+/- 0.002 mm

Bemerkungen	Messung der Basislänge mit Laser - Interferometer
Beilagen	Messprotokoll

Zürich, den 28.01.1993

Der Leiter Messkeller Für die Institutsleitung

H. Oesch H. ...

QUALITÄTSPRÜF-ZERTIFIKAT
QUALITY TEST CERTIFICATE

Kern SWISS

NORM / STANDARD

DIN 55 350-18-4.2.2

LIEFERANT / SUPPLIER

Kern & Co CH 5001 Aarau

KUNDE / CUSTOMER

BESTELLUNGS-NR. KUNDE / CUSTOMER ORDER NO. | DATUM / DATE

ARTIKELBEZEICHNUNG / ARTICLE DESIGNATION

Basislatte 1 m

ARTIKEL-NR. / ARTICLE NO.

115.315.0000

AUFTRAGS-NR. KERN / ORDER NO. KERN

SERIE-NR. / SERIAL NO.

382711

LIEFERMENGE / QUANTITY SUPPLIED

1 Stk.

LIEFERSCHEIN-NR. / DELIVERY NOTE NO. | DATUM / DATE

BEIGEFÜGTE PRÜFDOKUMENTE / ENCLOSED TEST DOCUMENTS

BEMERKUNGEN / NOTES

IST-Mass:
Seite 1: 1000,081 mm ✓
Seite 2: 1000,083 mm

Prüfmittel:
SIP Längenmessmaschine
Typ: Mul-1000

Wir bestätigen, dass die Lieferung geprüft worden ist und den Bestellgrundlagen entspricht.
We herewith confirm that the goods have been tested and correspond with the particulars of the order.

ORT / CITY: Aarau

DATUM / DATE: 10.5.90
Rev. 10.1.92

STEMPEL UND UNTERSCHRIFT / STAMP AND SIGNATURE

Kern & Co. AG
Prüfabt. Mechanik
R. Kuhn

Office fédéral de métrologie
Ufficio federale di metrologia
CH-3084 Wabern-Bern, Lindenweg 50, ✆ 031-54 10 61

Elektrowatt AG, Zürich

Auftrag Nr. 11031

Betrifft: 1 Stahlbandmass 20 m (Lufkin)

Bei einer Raumtemperatur von 20° ± 0,3° C wurden am flach aufliegenden Band, vom Nullpunkt ausgehend bei einer Spannung von 50 Newton folgende Abstände ermittelt:

Intervall	Gem. Wert	Intervall	Gem. Wert
0 - 1 m	1000.0 mm	0 - 11 m	10999.9 mm
2 m	2000.0	12	12000.0
3	3000.1	13	12999.8
4	4000.0	14	13999.7
5	5000.1	15	14999.9
6	5999.9	16	15999.7
7	7000.1	17	16999.7
8	7999.9	18	17999.7
9	9000.0	19	18999.8
10	9999.8	20	19999.6

Das Band wurde mit OFMET 1979/2444 bezeichnet.

Für die Messung:
H. Schürch

Eidg. Amt für Messwesen
Der Direktor:
O. Piotrowski

Wabern, 9. August 1993
Sr/Gb

EIDG. AMT
FÜR MASS UND GEWICHT
BUREAU FÉDÉRAL
DES POIDS ET MESURES
UFFICIO FEDERALE
DEI PESI E DELLE MISURE

Prüfschein - Bulletin de vérification
Bolletino di verifica

No. 1/19692

für - pour - per

GRAB + WILDI AG, 8023 ZUERICH 1

U/Zeichen: Sr/Kl

betreffend:
concernant:
concernente:

1 Stahlbandmass (Stamm) 20 m mit mm Teilung

Bei einer Raumtemperatur von 20 °C wurden am flachaufliegenden Band vom Nullpunkt ausgehend, bei einer Spannung von 50 Newton (5 kg Gewicht), folgende Abstände ermittelt.

Intervall	Gem. Wert	Intervall	Gem. Wert
0 - 1 m	999.8 mm	0 - 11 m	10998.7 mm
0 - 2 m	1999.8 mm	0 - 12 m	11999.1 mm
0 - 3 m	2999.4 mm	0 - 13 m	12998.4 mm
0 - 4 m	3999.9 mm	0 - 14 m	13998.9 mm
0 - 5 m	4999.3 mm	0 - 15 m	14998.6 mm
0 - 6 m	5999.5 mm	0 - 16 m	15998.7 mm
0 - 7 m	6999.1 mm	0 - 17 m	16998.2 mm
0 - 8 m	7999.5 mm	0 - 18 m	17998.4 mm
0 - 9 m	8999.0 mm	0 - 19 m	18998.1 mm
0 - 10 m	9999.1 mm	0 - 20 m	19998.5 mm

Das Band wurde mit AMG 77 / 2369 bezeichnet.

Eidg. Amt für Mass und Gewicht
Der Direktor

Wabern, 9. August 1993

P. 01 - 2. 70 - 5000 - 2434

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 11, 1996

MFN 119-96

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, California 95125

SUBJECT: STAFF EVALUATION OF GENERAL ELECTRIC'S (GE's) TEST AND ANALYSIS PROGRAM DESCRIPTION, NEDC-32391, REVISION C

Dear Mr. Quinn:

In response to your letter dated March 4, 1996, the staff has prepared the enclosed report on its evaluation of the GE's Simplified Boiling Water Reactor (SBWR) Test and Analysis Program Description (TAPD).

Overall, the staff notes that GE has made significant progress in addressing previous issues and questions identified by the staff in the Draft Safety Evaluation Report (DSER) and the requests for additional information (RAIs). The staff concludes that, with the exception of the PAR and PIRT issues, TAPD Revision C can be accepted as a framework for the SBWR testing program and the TRACG qualification process if it is fully implemented as described. However, a final approval of the adequacy of the test program for qualification of the TRACG code and for design certification of the SBWR is not possible without completing a detailed review of the test data, scaling report, TRACG licensing topical reports, and GE's analysis thereof.

You are requested to review the enclosed report to determine if it contains any GE proprietary information and provide your response within 30 days of the date of this letter.

If you have any questions regarding this matter, please contact Son Ninh at (301) 415-1125.

Sincerely,

Theodore R. Quay

Theodore R. Quay, Director
Standardization Project Directorate
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 52-004

Enclosure: Introduction
and Background

cc w/enclosure:
See next page

Mr. James E. Quinn
GE Nuclear Energy

Docket No. 52-004

cc: Mr. Robert H. Buchholz
GE Nuclear Energy
175 Curtner Avenue, MC-781
San Jose, CA 95125

Mr. Steven A. Hucik
GE Nuclear Energy
175 Curtner Avenue, MC-780
San Jose, CA 95125

Mr. Tom J. Mulford, Manager
SBWR Design Certification
Electric Power Research Institute
3412 Hillview Avenue
Palo Alto, CA 94304-1395

Mr. Rob Wallace
GE Nuclear Energy
1299 Pennsylvania Avenue, N.W.
Suite 1100
Washington, DC 20004

Enclosure to be distributed to the following addressees after the result of the proprietary evaluation is received from Simplified Boiling Water Reactor:

Mr. Brian McIntyre
Westinghouse Electric Corporation
Energy Systems Business Unit
Box 355
Pittsburgh, PA 15222

Director, Criteria & Standards Division
Office of Radiation Programs
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460

Mr. Sterling Franks
U.S. Department of Energy
NE-42
Washington, DC 20585

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 1, 1996 MFN 175-96

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, CA 95125

SUBJECT: GE NUCLEAR ENERGY RESPONSE TO NRC NOTICE OF NONCONFORMANCE AND UNRESOLVED ITEMS IDENTIFIED DURING SBWR PANDA INSPECTION

Thank you for your letter dated July 8, 1996, in response to our letter to Mr. James E. Quinn dated May 10, 1996, concerning the NRC inspection at the PANDA Test Facility. We have reviewed your response to Unresolved Items 99900403/96-03, 96-04, and 96-05, and generally found them responsive to the concerns raised in the Unresolved Items. We will review all the relevant information maintained in your San Jose offices during a future inspection.

The review and reply to your response to Notice of Nonconformance 99900403/96-01-01 and Nonconformance 99900403/96-01-02 is being handled by the appropriate NRC technical staff and you will receive a response under a separate cover letter in the future.

Sincerely,

Robert M. Gallo

Robert M. Gallo, Chief
Special Inspection Branch
Division of Inspection and Support Programs
Office of Nuclear Reactor Regulation

Docket No. 52-004 & 99900403/96-01

cc w/encls: See Next Page

cc: Mr. Rob Wallace
GE Nuclear Energy
1299 Pennsylvania Avenue, N.W.
Suite 1100
Washington, DC 20004

Mr. Brian McIntyre
Westinghouse Electric Corporation
Energy Systems Business Unit
Box 355
Pittsburgh, PA 15222

Director, Criteria & Standards Division
Office of Radiation Programs
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460

Mr. Sterling Franks
U.S. Department of Energy
NE-42
Washington, DC 20585

Mr. John E. Leatherman, Manager
SBWR Design Certification
GE Nuclear Energy
175 Curtner Avenue, MC-781
San Jose, CA 95125

Mr. Steven A. Hucik
GE Nuclear Energy
175 Curtner Avenue, MC-780
San Jose, CA 95125

Mr. Frank A. Ross
Program Manager, ALWR
Office of LWR Safety & Technology
U.S. Department of Energy
NE-42
19901 Germantown Road
Germantown, MD 20874

Mr. Tom J. Mulford, Manager
SBWR Design Certification
Electric Power Research Institute
3442 Hillview Avenue
Palo Alto, CA 94304-1395

Panthers References

DJ ROGERS

GE Nuclear Energy

April 29, 1994

MFN NO. 064-94
Docket No. STN 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Richard W. Borchardt, Director
Standardization Project Directorate

Subject: Readiness Assessment Report for the PANTHERS-PCC

Attached is the final Readiness Assessment Report for the PANTHERS-PCC test program at SIET. The assessment team concluded that personnel scheduled to be involved in performance of the upcoming PANTHERS-PCC tests are technically capable to conduct the tests in accordance with the test requirements. The team also provided several recommendations which would improve the quality of documentation supporting the tests.

Prior to the initiation of matrix testing in June, GE will conduct a reassessment to ensure that the one open item has been resolved and review whether recommendations have been implemented.

Sincerely,

J. E. Leatherman
Manager, SBWR Design Certification
M/C 781, (408) 925-2023

Attachment (1 copy)

cc: M. Malloy, Project Manager (w/2 copies of Attachment)
F. W. Hasselberg, Project Manager (w/1 copy of Attachment)

GE Nuclear Energy

175 Curtner Avenue
San Jose, CA 95125

April 29, 1994

PANTHERS-PCC

Readiness Assessment Report

Assessment Team

T.R. McIntyre	GE-NE (Assessment Team Leader)
P.F. Billig	GE-NE
T.L. Cook	DOE
R.E. Camp	Contractor for DOE
V. Cavicchia	ENEL SpA representing EPRI

Approved: T.R. McIntyre
T.R. McIntyre
Project Manager, SBWR Test & Analysis
GE Nuclear Energy

EXECUTIVE SUMMARY

On April 12-14, 1994, a team from GE, DOE and EPRI conducted a readiness assessment for the PANTHERS-PCC test program at SIET. The purpose of the assessment was to assure the technical adequacy of the facility and personnel to conduct the upcoming tests in accordance with the test requirements. A specific goal was to ensure that all preparations are either complete or proceeding so that testing may be initiated with high confidence that quality results will be obtained.

The assessment covered a broad area and was subdivided into eleven subjects. These subjects were: (1) Quality Assurance, (2) Facility Assessment, (3) Instrumentation and Data Acquisition System, (4) Data Reduction, (5) Test Plan & Procedures, (6) Control System, (7) Shakedown Tests, (8) Personnel, (9) Pre-test Analyses, (10) Test Schedule, and (11) Occupational Safety and Health.

The Assessment Team concluded that personnel scheduled to perform the upcoming PANTHERS-PCC tests are technically capable to conduct the tests according to established requirements. Procedures and associated quality assurance practices are in place and adequate to control the work. While the facility is not complete, the remaining work is identified and followed by project and test program management. This work is expected to be successfully completed to facilitate the scheduled tests in conformance with test requirements.

The Assessment Team also provided several recommendations which would improve the quality of documentation supporting the tests. These recommendations are presented throughout the report and are given in capital letters for ease of identification.

PANTHERS-PCC Readiness Assessment Report

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Background

As part of the Simplified Boiling Water Reactor (SBWR) design process, full-size prototype heat exchangers for the Passive Containment Cooling System (PCCS) and the Isolation Condenser System (ICS) will be tested by SIET and ENEA at the Performance ANalysis and Testing of HEat Removal Systems (PANTHERS) Test Facility in Piacenza, Italy. The Passive Containment Cooler (PCC) and Isolation Condenser (IC) were designed by Ansaldo SpA. The component procurement is the responsibility of ENEL. Ansaldo Componenti has constructed and delivered the PCC to SIET and is currently fabricating the IC.

The objectives and requirements for the PANTHERS program are presented in the PANTHERS Test Requirements & Test Specification (GE document 23A6999, Rev. 1).

PANTHERS-PCC is the designation of the program applicable to the testing of the PCC prototype.

An informal assessment was conducted at SIET in November 1993. Topics in that assessment are repeated here for completeness.

1.2 Purpose

The assessment was conducted on April 12-14, 1994 at the SIET office in Piacenza (Via Nino Bixio, 27). The purpose of this readiness assessment was to assure the technical adequacy of the facility and personnel to conduct the upcoming PANTHERS-PCC tests in accordance with the test requirements. The specific goal was to ensure that all preparations are either complete or proceeding so that testing may be initiated with high confidence that quality results will be obtained.

The PANTHERS-IC Test Program was outside the scope of this review except where components of that program will be used in PANTHERS-PCC (e.g., IC Pool).

1.3 Assessment Team

The readiness assessment was conducted by a team of engineers from GE, the U.S. Department of Energy (DOE), and the Electric Power Research Institute (EPRI), as identified on the cover to this report. In addition, T.M. Lee from the U.S. Nuclear Regulatory Commission (NRC) staff served as an observer.

1.4 Methodology

The readiness assessment was carried out by review of facility documents, observation of the physical conditions of the test loop, and interviews with facility personnel, (see Section 2.0 for detailed workscope).

The assessment was divided into horizontal and vertical reviews. The horizontal review consisted of determining the overall readiness of the facility, its personnel, and documentation. The vertical reviews examined part of the facility in more detail (e.g., a single instrument line, data calculation, etc.) to verify the technical adequacy and correctness of the work.

The Assessment Team split into two working groups for portions of the assessment. T.R. McIntyre and T.L. Cook performed the assessments described in Sections 2.1, 2.5, 2.6, and 2.8. P.F. Billig, R.E. Camp, and V. Cavicchia performed the assessments for Sections 2.2, 2.3, and 2.4. All other sections were assessed by the committee as a whole.

1.5 Assessment Support

The following people provided major support to the assessment:

- ENEA

  P. Masoni - PANTHERS Responsible Test Engineer
  R. Martinelli - SBWR Project Manager
  G. Bianchini - PANTHERS TRACG Analyst

- SIET

  C. Medich - Director Nuclear Area
  G. Cattadori - Assistant to the Director
  A. Musa - Quality Assurance Manager
  S. Botti - PANTHERS Project Manager
  R. Silverii - PANTHERS Instrumentation
  A. Achilli - Experience Manager
  Other SIET personnel were present on a part-time basis and provided support.

- GE

  J.R. Fitch - SBWR TRACG Analyst
  S. Kanobelj - GETSCo-Genoa

2.0 SPECIFIC REVIEWS PERFORMED

2.1 Quality Assurance

a. *Quality Assurance (QA) Plan and Conformance with the Plan*

SIET is accredited as a nuclear laboratory by SINAL, a consortium of Italian laboratories who have established joint quality assurance (QA) standards. A copy of the accreditation certificate is included as Attachment A.

The SIET QA Plan, Document 00001-QQ, Rev. 2, and Procedures 00002-PP (Document Control), 00003-PP (Instrumentation Control), 00006-PP (Quality Assurance Procedure), 00008-PP (Instrumentation Interface), and 00096-ED (Project Document List) were reviewed as part of this assessment. All were consistent and under revision control with changes to the text noted by bars in the margins with adjacent revision numbers.

It was determined that the QA Plan was (1) approved by GE (letter, May 1993 from D.A. Kaye) and (2) confirmed to be applied satisfactorily by a GE QA audit in September 1993. The QA Plan is in substantial accordance with International Standard ISO 9001, and European Standards ENI-EN-45.001, ISO 49, and UNI 70.002. This latter standard is no longer in use, and will be deleted from the references at the next revision of the QA Plan. The QA Plan is likewise in substantial conformance with Standard NQA-1.

The SIET QA philosophy is to effectively control quality in four main areas: Documentation, Instrumentation, Organization, and Test Operations (see detailed descriptions below):

- **Documentation**

  Document 00096-ED, Rev. 3 was reviewed. This document lists all project documents by revision, originator, checker, and approver, as well as the requirements for external review, approval, and distribution. Dates of document issue or required issue date are also included.

  The procedure for review and issue of documents (Procedure 00002-QQ) was reviewed. Copies of verifier comments and resolution are required to be filed in the Design Record File (DRF). In a later review, this process was confirmed to be performed according to the procedure (Section 2.5d). NOTE: Final approval, including authority by approver to reject comments, is granted to the approver by the QA Plan.

- **Instrumentation**

  Instrument control is codified in Procedures 00003-PP and 00008-PP. During the November 1993 GE/DOE assessment, it was recommended that additional verification signatures be added to instrumentation calibration sheets, as well as other appropriate QA records. Several examples of this actually occurring were reviewed by the Assessment Team, but a requirement has not, as yet, been added to the Instrumentation Control procedures.

  OPEN ITEM: A REQUIREMENT FOR INDEPENDENT VERIFICATION OF ALL DOCUMENTATION THAT CAN EFFECT A NUMERICAL TEST RESULT SHOULD BE ADDED TO APPROPRIATE PROCEDURES.

- **Organization**

  The Assessment Team reviewed the organization chart and personnel records supporting qualification of assigned personnel. Qualification records for two incumbents were checked and confirmed to meet minimum job requirements. The organization chart was up-to-date. Additional comments may be found in the Personnel assessment (Section 2.8).

- **Test Operation**

  The technical and QA pre- and post-test check lists were reviewed. Specific observations are noted in Section 2.5b.

b. *Procedure for Incorporating Changes from the QA Manual into Lower Tier QA Documents*

The Assessment Team reviewed the procedure for how a change to the QA Plan was incorporated into lower tier documents. The method was determined to be consistently and well applied. It is the responsibility of the QA organization, and specifically the SIET QA Manager, to assure that documentation is consistent. However, no formal procedure exists.

RECOMMENDATION: SINCE NO PROCEDURE EXISTS, AND THE QA MANAGER IS RESPONSIBLE FOR THIS ACTIVITY, THIS RESPONSIBILITY SHOULD BE SPECIFICALLY ADDED TO THE JOB RESPONSIBILITIES OF THE QA MANAGER IN PROCEDURE 00006-PP.

c. *Procedure to Assure Consistency Between Information that Can be Found in More Than One Document (e.g., instrument lists)*

As noted in the preceding paragraph, it is the responsibility of the SIET QA Manager to assure that documents are consistent. During the

November assessment, a programmatic weakness in the assurance of consistency between documents was identified. In response to this, the PANTHERS Document Plan 00096-ED-91, Rev. 3 (March 25, 1994) has directed the organization to eliminate duplication of technical information between documents (to the maximum extent possible). This elimination is to be performed at the next revision of each document. Where duplication of information is necessary (e.g., P&ID and Instrument Lists), it is the responsibility of the using engineer to be aware of the duplication and assure consistency when changes are made. Additionally, where appropriate, exact word-for-word duplication is to be used, with an appropriate reference. This latter requirement was verified to be occurring in the consistency between the QA Plan and the Test Plan & Procedures (Section 2.5b).

d. *Procedure for Verification of QA Documents*

Verification requirements are codified in document control Procedure 00002-QQ. Assessment results are documented in Section 2.5a. No open items were identified.

2.2 Facility Assessment

a. *Facility As-built Documentation Including Fabrication Drawings (as available)*

The status of all of the PANTHERS-PCC documents being prepared by SIET is given in the PANTHERS Document Plan 00096-ED-91, Rev. 3 (March 25, 1994). The scope of this document was described in Section 2.1a. The PANTHERS-PCC Test Plan & Procedures (TP&P) is scheduled to be revised on May 31, 1994. This is in accordance to the commitment to re-issue the TP&P just prior to matrix testing after all of the shakedown testing has been completed.

The Document Plan lists which documents require approval by ENEA (e.g., Test Plan, Quality Assurance Plan, etc.). For those documents, the ENEA Responsible Test Engineer shows his approval by letter to SIET and stamp & signature on the document. Evidence of this practice was found.

The latest PANTHERS-PCC P&ID was reviewed (SIET Document 00209-DD-93, Rev. 2, March 28, 1994). Evidence of sign-off by the preparer and checker was found. The issue date was in agreement with the Document Plan.

While no as-built piping isometrics were available during the review, as-designed piping isometrics were available. All of these drawings had been issued as general design drawings and were in the process of being checked against the facility prior to re-issue as as-builts. They had been issued earlier in order to support the pre-test analyses and are scheduled in the Document Plan to be revised by April 30.

Section 2.2d provides a detailed review of one of the piping isometrics.

The large tanks (condensate, vent, etc.) were constructed by an outside contractor and as-built drawings were available. The drawings are stamped by SIET, given a document number, and listed in the Document Plan. Evidence was found of review by SIET with two signatures. Small discrepancies were documented on one drawing (Pool Supports) and the master was retained by the SIET responsible manager. The differences were not considered significant enough by SIET to impact the tests; however, the basis for determining whether a discrepancy is significant was not specified. If large differences should be found, the drawings would be returned to the vendor for correction. Therefore, it is not clear how the deviations of information on vendor documents from the as-built condition are consistently recorded.

RECOMMENDATION: SIET SHOULD MAINTAIN A MASTER VENDOR DRAWING FILE THAT CAN BE USED TO COLLECT AND RECORD SUCH DEVIATIONS. THE MASTER VENDOR DRAWINGS SHOULD BE RETAINED AS PART OF THE DESIGN RECORD FILE. THIS WILL AVOID QUESTIONS ON THE "AS-TESTED CONFIGURATION".

b. *Status and Procedures to Finalize Documentation for Unavailable or Incomplete Documents*

The piping isometric drawings need to be reissued to document the as-built dimensions. All of these revisions are scheduled for April 30, as given in the Document Plan. The SIET PANTHERS Project Manager is in the process of reviewing the drawings against the completed piping.

c. *Physical Condition of the Test Facility*

After a tour of the facility, excluding the control room and DAS, the Assessment Team concluded that it is near ready for testing. All of the piping is in place and insulated. Most of the instruments are installed, tubed to the measurement points (if applicable), and connected to DAS cabling. In general, only the cabling for the instruments that had been used during shakedown tests were verified (Section 2.3e). The major remaining work is to install the pool instrumentation, connect the pool and PCC instrumentation and close the pool.

d. *Vertical Review: Compliance of As-built Piping Drawings*

The Assessment Team confirmed the compliance of as-built piping drawings for key systems by tracking the line for one system through the facility. The drain lines from the PCC to the condensate tank were chosen for the vertical review. The piping isometric (Drawing 24.02.13, Rev. 1, December 13, 1993) was compared against the PANTHERS-PCC P&ID. All of the instrument and valve labels and pipe sizes agreed.

The Assessment Team walked through the piping, instrumentation and valving on the facility and compared it against the isometric drawing. All instrumentation lines were labeled with the SIET instrument number, PANTHERS-PCC test instrument number and the date of last calibration. One thermocouple was chosen at random for a more detailed review. The instrument chosen was SIET No. TCK 38 or PANTHERS No. T5001 and is located below the tee junction on the PCC drain line. The date of last calibration was April 19, 1993. It was connected to DAS line # 22. A check of the calibration records at the instrumentation laboratory showed agreement with the instrument numbers and calibration date. While the instrument list did not identify when the instrument was due for calibration, all test instruments require re-calibration after one year. Therefore, it is readily apparent when re-calibration is due. The specific instrument calibration sheet in the calibration shop for each instrument does give the calibration due date. The manager of the instrument shop told the Team that he reviews the calibration records about once a week and at least each month to see which instrument will soon require calibration. In addition, the Test Procedures include a step in the pre-test checklist to check that all instruments are calibrated. The Team feels that these two independent checks will ensure that no tests are run with instruments out of calibration. NOTE: one exception to this rule exists – the thermocouples, which have been brazed on the PCC tubes, cannot be removed for shop calibration. This information may be validated during test performance by comparisons to nearby measurements, and the Team finds this to be acceptable.

Most of the instrumentation on the drain line were pressure taps for the delta-P measurements. Each of the taps had labels designating which delta-P instruments used the tap, as well as an indicator of "+" or "-" for whether that instrument used the tap for an upper (+) or lower (-) delta-P input. All of the labels were in agreement with the isometric.

While the isometric reviewed was not a final as-built, the Team did review it for accuracy to the installed as-built condition. As stated above, SIET plans to reissue the isometric at the end of April following a check against the actual facility. The Team did find the following discrepancies and incompletions which will need to be incorporated during the revision:

- The pressure tap below the tee junction is given as the distance from the exterior of the horizontal pipe of the junction. The figure does not indicate what the diameter of that pipe is, although SIET identified it as 6 inches. Because of the presence of the insulation, the Team recommends that the instrument location should be referenced to the centerline of the pipe and a note added that the tee shown is 6 inches on all sides.

- Vent and drain lines and valves F507 & F508 are shown on the drawing but are not installed and, therefore, should be deleted from the drawing.
- Thermocouple T5002 is not located where shown on the drawing.
- The vertical leg below the tee junction has small bends not shown on the drawing.

To increase precision on the delta-P tap locations, SIET measured their elevations by marking a column away from the test setup at the same elevations as the taps. This was done by using clear hose filled with water up to the tap elevation with one end at the tap and the other end at the column. The difference in elevations of the marks then corresponds to the delta-P tap elevations. The Assessment Team examined both the column and the log of the measurements. There were three signatures on the log. When an elevation differed between the design value and measured value, the measured value was incorporated in the drawing.

A spot check was performed for one instrument location (DP019 top) and was in agreement with the drawing.

e. *Release and Control of Design Information for Procurement*

Procurement specifications for the major components (i.e., vent tank, condensate tank, etc.) were reviewed. These specifications were prepared by SIET prior to ordering and contained all of the necessary information for the vendor.

f. *Procurement Specifications*

A representative procurement specification for one of the tanks was reviewed in detail. It listed all design requirements and included a sketch of the tank showing location of supports and nozzles.

g. *Compliance to Controls on Facility Documentation*

The key facility documents showed signatures by the preparer, checker, and the SIET Director Nuclear Area. As instructed by the QA Plan, the director decides who will be responsible for checking each document.

h. *Adequacy of Verification on Facility Documentation*

The multiple signatures demonstrates adequacy of verification (see Section 2.3g).

i. *Procedures (where applicable) for Turning Over the PCC from Ansaldo Componenti (ACO) to SIET*

There are no formal turnover procedures for SIET to receive the test unit. The four-party agreement among GE, Ansaldo, ENEA and ENEL describes the responsibilities for each participant. ENEL funds ACO to build the PCC, which is then given to ENEA for testing at SIET. The final task for ENEL/ACO was the hydro-test at SIET after installation. Even though SIET conducted the test, the responsibility rested with ACO. After the successful completion of the hydro-test, ENEL accepted the component, and ENEA/SIET accepted the delivery of the unit. SIET had copies of the as-built drawings of the PCC from ACO, but there was no evidence of a formal transfer of the unit.

RECOMMENDATION: A FORMAL TRANSFER OF THE PCC FROM ACO/ENEL TO ENEA/SIET SHOULD BE DOCUMENTED.

j. *Status and Adequacy of Spare Parts On Site or Deliverable Times*

See Section 2.3g.

k. *Evidence of Permanent Labels on Facility Components (e.g., valves) and Applicable Instruments (e.g., pressure transducers)*

Key facility components, such as valves and spectacle flanges, had metal tags attached giving the part number specified by the PANTHERS-PCC P&ID. The instrument lines had tags giving the facility instrument number, the test instrument number (on P&ID), and the date of last calibration.

2.3 Instrumentation and Data Acquisition System

a. *Calibration Procedures*

All of the PCC instruments are calibrated by SIET at their calibration laboratory on site. The procedures used conform to industry standards. Primary standards are traceable to the Italian equivalent of the U.S. National Bureau of Standards.

b. *Compliance to Controls on Calibration*

SIET has been certified to calibrate the instruments. Calibration documents are kept in the calibration laboratory.

c. *Adequacy of Documentation and Verification on Instrument Installation and Calibration (including assurance that all instruments will be re-calibrated before expiration of the calibration)*

The instrument log in the calibration laboratory records which facility instrument is used in the test by listing the facility instrument number with the PANTHERS-PCC P&ID instrument number. The installed instruments are also identified with both labels. The installation is independently checked and evidence of verification can be found in the instrument lists in the TP&P. Procedures to ensure current calibration are described above in Section 2.2d.

The instrument are not re-calibrated until the calibration expires. There is no requirement to check the calibration of instruments immediately following the testing unless its calibration expires. However, SIET plans to use quick reviews of instrument readings prior to each test to confirm that the instruments are functioning properly.

RECOMMENDATION: SELECTED CRITICAL INSTRUMENTS SHOULD HAVE THEIR CALIBRATION CHECKED AT THE END OF THE TEST PROGRAM TO DEMONSTRATE THAT KEY DATA ARE CORRECT. INSTRUMENTS CHOSEN SHOULD BE THOSE WHOSE PERFORMANCE CANNOT BE EVALUATED BY COMPARISON TO READINGS FROM NEIGHBORING INSTRUMENTS (E.G., DELTA-P ACROSS AN ORIFICE).

d. *Identification of Critical Instruments for Testing*

The Responsible Test engineer from ENEA has identified which instruments are critical for each test series. This identification will be included in the next revision of the TP&P.

e. *Vertical Review: History and Layout of a Specific Instrument*

The Assessment Team traced the history and layout of the drain line thermocouple (T/C) T5001 through the following stages:

- **Procurement**

  The procurement of the PANTHERS instruments is documented in the SIET Technical Report 00159-RF-92. The report gives what instruments were procured, the criteria for the selection, and the purchase specification. The T/C supplier (TERMICS) confirmed in writing that the instrument will satisfy the purchase specification requirements. When the instrument arrived at SIET, it was assigned a facility number (in this case, TCK 38).

- **Calibration**

  Data sheets are maintained for each facility instrument. The sheets for TCK 38 were reviewed and found to be in agreement with the instrument tag as to calibration date.

- **Installation**

  TCK 38 is installed at Location T5001 on the PCC drain line below the tee junction. Cable 22 was used. The cable number agreed with that listed on the instrument sheet.

- **Connection to Control Room**

  According to the instrument sheet, Cable 22 is connected to Pod 5, Channel 8 of the Data Acquisition System (DAS). The Team traced the cable to that location. The signal is then sent to the central processing unit of the DAS at Slot 88, which was shown on the DAS monitor in the control room. While this instrument did check out, the cable work for others is still in progress. When it is complete, all of the cabling will be verified and documented. To date, most instruments that have been checked are those required for the shakedown testing.

- **Field Test**

  This instrument had been checked on March 29, 1994.

- **Data Recording**

  Instrument T5001 was correctly listed on the DAS as coming on Slot 88 from the facility.

f. *DAS Validation and Control*

In January, SIET decided to use a different DAS than previously chosen. Three personal computers (PCs) are now used in the DAS. One PC records the mechanical instruments, one the thermohydraulic instruments and the third does the data reduction calculations. This system was chosen because (a) it is more accurate and reliable, (b) SIET had previous experience using it during the shakedown tests, and (c) SIET wanted to separate the PANTHERS DAS from the DAS used in other programs.

The equations used to convert the electrical signals to engineering units are given in the TP&P. SIET is currently validating and verifying the DAS software and is scheduled to complete this task at the end of April.

RECOMMENDATION: CALCULATIONS USED FOR VERIFICATION OF COMPUTER CALCULATIONS, CONVERSION CONSTANTS, ETC. SHOULD INCLUDE DOCUMENTATION OF WHO PERFORMED AND WHO CHECKED THE CALCULATION.

g. Status and Adequacy of Spare Instruments On Site or Deliverable Times

The availability of spare parts and maximum time for procurement of more has been determined and is documented in the table provided in Attachment B.

2.4 Data Reduction

a. Documentation and Verification of Software Configuration

The equations used to convert the test data to other parameters (e.g., flow rates, water levels, etc.) are given in the TP&P. SIET is currently validating and verifying the data reduction software and is scheduled to complete this task at the end of April.

b. Vertical Review: Software Agreement with the Calculated Parameter

Since software installation and validation is still in process, the Assessment Team concluded that a review of the procedure was more appropriate. The procedures that SIET will follow to document and verify the software were found to be adequate. After installing the software and checking it, SIET plans to validate the software by sending known parameter values from the data collecting PC to the data reduction PC, recording the PC calculated value, manually calculating what the value should be, and then comparing the manually calculated value to that of the PC. Two checks for each calculated value will be performed. This results in an independent check of the DAS reduction software and satisfies QA requirements. The results of this task will be documented in the DRF.

2.5 Test Plan and Procedures

a. Adequacy of Test Plan to Satisfy Test Objectives

The Test Plan and Procedure (TP&P), SIET Document 00089-PP-91, was reviewed against GE Test Specification 23A6999, Rev. 1, to evaluate this objective of the assessment. It was confirmed that the test objectives in the TP&P conform exactly with the objectives in the test specification. The revision level of the TP&P is consistent with that shown in the Project Document list. As noted previously, the TP&P is in the process of being revised to incorporate lessons learned during the shakedown test period. The revision process for the TP&P was reviewed in detail and is described in Section 2.5d.

The TP&P consists of three sections: (1) Test Plan, (2) Test Procedures, and (3) Quality Assurance Requirements. Spot checks of the Test Plan uncovered no discrepancies with the test requirements. Test Procedures are given in the format of checklists to be completed while conducting the tests. In general, these checklists are concise, logical, and complete, and are being updated during the shakedown test process. For recent shakedown tests, the test checklists from the TP&P have not been used, but updated checklists incorporating lessons learned from previous tests have been provided to test personnel. The process is described in detail in Section 2.5d. Assessment of the QA section of the TP&P is given in Section 2.5b.

During review of the TP&P and supporting documentation, three minor discrepancies were noted:

- A discrepancy of 5 mm in a dimension on PCC pool drawing 24-02-63 was found. The test engineer knew the resolution to the situation, but it was not noted on the drawing. This situation is analogous to the situation described in Section 2.2a with regard to vendor drawings. The same recommendation applies here.

- No documentation of the review of the TP&P by GE, as required by the Project Document list, was in evidence. The SIET and GE engineers confirmed that comments were received and incorporated during face-to-face meetings.

- It was the understanding of the Assessment Team that the volume of the prototype SBWR PCC pool had changed "slightly" from the 173 m^3 value given in both the TP&P and Test Specification, but no resolution of the importance of this change to the facility scaling was in evidence.

OBSERVATION: THERE SEEMS TO BE A MINOR WEAKNESS IN DOCUMENTATION OF THE GE/SIET INTERFACE. BOTH SIET AND GE ENGINEERS WERE AWARE OF THE ABOVE ITEMS, BUT DOCUMENTATION OF THEIR RESOLUTION COULD NOT BE FOUND IN THE DRF OR OTHER PROJECT FILES. GE AND SIET SHOULD BE MORE DILIGENT IN DOCUMENTATION OF MINOR ITEMS AND VERBAL AGREEMENTS.

Overall, the TP&P was assessed to be sufficient to meet the test objectives.

b. Compliance of Document with QA Procedures

This item was assessed by review of Section 3 of the TP&P versus the SIET QA Plan 00006-QQ-92. Quality requirements in the TP&P were word-for-word duplicates of the QA Plan, with section-by-section references for assurance of consistence. This process was consistent with that described in Section 2.1c. The QA Plan includes a requirement for a pre-test QA checklist, and the test specific checklist was included in the TP&P.

Section 7.2 of the QA Plan included a revision (Rev. 2) which was confirmed to be consistent with the TP&P QA requirements, giving further validation that the change control measures described in Section 2.1b are being properly employed.

c. *Evidence of Administrative Controls on Tests*

Administrative controls on testing are assured through the use of a plant test log and checklist test procedures that will be included in the DRF.

- **Plant Log**

  Plant test logs are kept by the test engineer for all facility evolutions. Logs are typewritten, and signed-off by the test operator. A single logbook includes items from all tests and facility activities. Test logs for two different facility activities were reviewed in detail.

  Notes from a test facility characterization activity which calibrated Orifice Plate F2002 were reviewed. The notes were complete and logical. Original calculations were in the DRF.

  Additionally, a DAS verification activity was reviewed. Included in the test log were the date of the evolution, the personnel involved, activity description observations (nothing out-of-the-ordinary, in this case), and a listing of "enclosures", which gave the results of the verification.

  Evidence of verification was included on the enclosure.

  Copies of the test procedure checklists for Shakedown Test C-04 were found in the log (originals were filed in the DRF). Steps were confirmed by dual initials (performer and checker) on the checklists. The technicians identified in the test log as supporting the test were confirmed to have appropriate qualifications on file in the personnel qualification file.

- **Design Record File**

  The DRF section for Shakedown Test C-04 was reviewed. It included a summary report on apparent test conclusions. Data (on 3 1/2 in. floppy disks) were included in the DRF. File information necessary to read the magnetic information was written on each disk, and each disk was signed-off by the test engineer and test director. Originals of the QA Pre-test Checklists were included. Changes to the Test Procedures for this run (see

Section 2.5d) were also included, as was a letter notifying site personnel on the date for the test - a safety item.

RECOMMENDATION: THE DATA DISKS IN THE DRF SHOULD BE WRITE-PROTECTED.

A deviation form was included in this DRF section, since one of the three test objectives for Test C-04 was not met. During the performance of the test, the test director determined a better way to provide the specific level control function being demonstrated. The test was aborted, and a deviation form (analogous to a non-conformance report) prepared. The proposed resolution (accepted) was to run an additional shakedown test (C-04.1), using the modified control procedure and algorithm.

As noted in the previous section, the original test conduct checklists were included in the DRF.

d. *Process of Preparation, Review, and Revision of Test Procedures*

This area was assessed by review of the original (master) copy of SIET Procedure 00098-PP-91, the Test Plan and Procedure. The file included the original verification cover sheet, with original signatures (in black ink). Both ENEA and SIET original approvals were in evidence.

The document was stored with other original SIET nuclear research documents in a locked cabinet in the separately locked original file room. All originals are logged in and out of the storage area.

The method for incorporation of changes was discussed. During shakedown testing, verified override packages are being prepared and provided to the test performers. This override document forms the basis of the pre-test briefing. Formal evidence of the briefing, including the attendees of the briefing, is included in the DRF.

This procedure is being followed late in the shakedown program due to the number and extent of process improvements identified during the shakedown program to date. While a revision of the TP&P will be produced, incorporating the appropriate changes prior to the start of matrix testing, it has been judged that the effort to do this during the shakedown program is not warranted. The Assessment Team concurs with this position, and judges the process being used to be satisfactory.

The procedure was illustrated by review of documentation from the DRF of Test C-04. This DRF contained a package of checklists, which superseded the checklists in the TP&P. Critical (i.e., "must have for success of the test") instrumentation was identified. Verification of the superseding checklists was included.

The Assessment Team then questioned how it will be assured that all of the changes identified will be included in the TP&P revision. A single, current "red-line" markup of the TP&P does not exist. Instead, each section has a responsible individual, who is responsible for updating his own section. It is the responsibility of the TP&P approver to assure that all individuals have made their own inputs. The approver will then call a meeting to resolve any inconsistencies or issues, and compile a total list of changes. The entire document will then be verified.

The Assessment Team concluded that this process was different than the way they would have proceeded, but finds it to be technically adequate.

e. *Identification of Test Prerequisites, Initial Conditions, and Acceptance Criteria*

Test prerequisites and initial conditions are codified in the TP&P through the use of checklists. Acceptance criteria for the shakedown testing are typically qualitative (e.g., does the system work) rather than quantitative, and therefore somewhat subjective in nature. As noted in previous sections, in those cases where quantitative output was generated (i.e., facility characterization testing), it was well documented. For example, during the DAS verification testing, the results were compared with the overall linearity requirement of 3% - the acceptance criteria in the Test Specification.

For matrix testing, Chapter 11.1 of the TP&P gives a table of specific acceptable ranges of independent test variables.

RECOMMENDATION: THE TP&P DOES NOT CURRENTLY HAVE A DEFINITION OF REQUIREMENTS THAT DEFINE "STEADY STATE". SUCH A DEFINITION SHOULD BE INCLUDED IN THE TP&P.

RECOMMENDATION: AT THE CONCLUSION OF MATRIX TESTING, THE PLANT LOGS SHOULD BE ADDED TO THE DRF FOR COMPLETENESS.

f. *Procedures to Resolve Unexpected Results or Unanticipated Behavior During Testing*

As noted in Section 2.5d, the TP&P contains a procedure for response to unexpected results. In this case, a deviation form is prepared. This form is very similar to a nonconformance report, and requires elucidation of the deviation, recommended resolution, and approval or disapproval of the resolution by appropriate management personnel.

2.6 Control System

a. *Adequacy to Satisfy Test Procedures*

Assessment of control system adequacy was performed by a visit to the plant control room. SIET Drawing 00209-DD-93 (PANTHERS facility P&ID) was reviewed to gain an understanding of critical control parameters and methods. Facility controlled parameters include steam mass inlet flow rate, air mass inlet flow rate, and PCC inlet pressure and temperature (controlled via condensate tank exhaust pressure and desuperheating injection flow rate, respectively). All parameters are controlled from the main control room via digital automatic controllers, and air-operated valves, except for desuperheating flow, which uses manual control from the main control room.

Several facility trim valves are manually controlled in-plant, by radio directed technicians.

All control functions are physically separate from data acquisition functions. Information from the DAS is used for definition of input conditions, not control system data.

At this time, the facility has yet to operate in the steam condensing mode required of matrix testing. Capability of the control system to establish and maintain appropriate steady-state conditions will be confirmed during Shakedown Tests H-04 and H-05, scheduled for late May.

None of the Assessment Team members are experts in control systems; however, their joint technical judgment is that the system approach and hardware installed are rational and should be adequate.

b. *Documentation of Verification of Controls*

Since the control system is designed only to maintain steady-state conditions, performs no control function that would affect test results, and is totally independent of the DAS, verification of control function is not required for PANTHERS testing.

2.7 Shakedown Tests

a. *Results of Conducted Shakedown Tests and Compliance with QA Procedures*

After each shakedown test, an apparent test report (ATR) is prepared to determine if the test satisfied the test objectives. The Assessment Team conducted a detailed examination for Test C-04. The Team confirmed that the test was in compliance with the QA requirements. As a result of Test C-04, SIET has decided to use a different procedure to control water level in the condensate tank (see Section 2.5c for details).

As a result of the shakedown tests to date, most of the facility has been tested, excluding the PCC unit. The remaining facility controls to be tested are those to control the pressure in the vent tank. These will be covered during Tests H-04 and H-05.

b. *Status of Remaining Shakedown Tests*

The remaining shakedown tests are C-03, C-04.1, H-01, H-04, and H-05. The schedule for these are given in Section 2.10.

2.8 Personnel

a. *Responsibility Assignments (including backups for key roles)*

The PANTHERS Organization Chart was reviewed to familiarize the Assessment Team with the organization and personnel assignments. The organization chart was up-to-date and consistent with actual practice. All positions have incumbents, which were keyed to job responsibilities and minimum qualification requirements.

Critical operations positions have an incumbent, backed up by one other individual having similar skills and training. Management positions are generally backed up with delegation of responsibility and/or authority to the next higher management level.

b. *Adequacy of Training or Background to Meet Responsibility Requirements*

Several incumbents' records were reviewed and found to be consistent with requirements. Minimum job requirements were spot checked and found to be reasonable for the position descriptions.

2.9 Pre-Test Analyses

a. *Status and Schedule for Completing Pre-Test Analyses*

The Pre-test Analyses report is scheduled for submittal to the NRC on May 11, 1994. A draft of the report was circulated during the April 12-14 meeting.

b. *Adequacy of Controls and Verification*

GE performed a one-over-one verification of the ENEA TRACG deck in accordance with GE Engineering Operating Procedure (EOP) 42-6.00, "Independent Design Verification".

GE performed an independent analysis using the PCCS model from one of the base SBWR TRACG decks. This model and the overall text of the pre-test analysis report were reviewed in late April 1994.

2.10 Test Schedule

a. *Evidence of Test Schedule and Agreement with SBWR Program Integrated Schedule*

The current test schedule was presented at the April 12-14 meeting (Attachment C). It is not in a typical schedule format, as no logical relationships are identified. However, the schedule is referenced to one maintained by GE in San Jose in which logical ties are preserved. Differences between it and the SBWR certification schedule at GE are due to the following:

- SIET has decided to mount the pool instrumentation on a rigid frame rather than wires strung between the walls. The closure of the pool has been rescheduled to after the instrumentation installation because it is easier to work with the wall down. The earlier method required the pool to be closed prior to instrument installation. The combined time to install the instrument and close the pool remains the same, so this change does not impact the test schedule.

- As described above, part of Test C-04 will be repeated as Test C-04.1. The schedule shows this as occurring on April 12-13, but it has been delayed three weeks in order to support the readiness assessment and complete the analysis of Test C-04. It is not on critical path.

While the presented schedule does not indicate interrelationships, those relationships are documented by ENEA. After the assessment, ENEA noted that the Task List (Attachment C) was derived from a program (MACPROJECT II) which can present schedules in different formats. However, the program needs, as input, the identification of all the tasks, with their duration and the logic relationships with the other tasks.

b. *Detailed Action Plan to Track Critical Path and Maintain Schedule*

SIET maintains a detailed Action Plan which lists all remaining tasks to be completed prior to matrix testing along with their expected dates. The plan is periodically updated and the date of the last update is indicated. The list is used by appropriate plant personnel and the SIET project manager tracks progress. The Assessment Team reviewed the list and, by spot checking, found it to be consistent with the test schedule.

2.11 Occupational Safety and Health

a. *Evidence of Facility Safety Plan*

There is no written facility safety plan. A full-time facility safety engineer is on site and is responsible for conducting annual training, interfacing with regulatory bodies, conducting briefings on specific hazards as needed, and maintaining records pertaining to facility and personnel safety.

b. *Safety Training Requirements*

There is annual training for all personnel and there are written procedures used in specific hazardous environments and for certain protective equipment (i.e., electrical switching equipment and fire protection equipment). Briefings are held to discuss specific hazards such as working in a plant with live steam.

c. *Compliance with SIET Safety Plan and Italian Statutes*

Outside safety experts were retained to train the SIET Safety Engineer. An assessment was made to ensure compliance with Italian regulations. Authorities were notified of high levels of PCB's in site transformers and of potential asbestos problems. These authorities have conducted their inspections and implemented appropriate measures.

Evidence of compliance with the SIET Safety Plan was demonstrated by the workers using hard hats while on the shop floor. In addition, all visitors were issued hard hats when touring the facility.

3.0 CONCLUSION

3.1 General Assessment

The readiness Assessment Team has concluded that personnel scheduled to be involved in performance of the upcoming PANTHERS-PCC tests are technically capable to conduct the tests in accordance with the test requirements. Procedures and associated quality assurance practices are in place and adequate to control the work. The facility is not complete; however, remaining work is identified and followed by project and test program management. The Team concludes that the remaining work can be reasonably expected to be completed as required to perform the tests as currently scheduled and in conformance with test requirements.

3.2 Recommendations

The Assessment Team has provided several recommendations in the above sections which will improve the quality of documentation supporting the tests.

ATTACHMENT A

SIET LABORATORY ACCREDITATION CERTIFICATE

April 29, 1994

Sistema Nazionale per l'Accreditamento di Laboratori

CERTIFICATO DI ACCREDITAMENTO

Numero di Accreditamento

0031

Si certifica che

Il Laboratorio SIET

Società Informazioni Esperienze Termoidrauliche

Via N. Bixio 27 - 29100 Piacenza - PC

è accreditato dal SINAL per l'esecuzione delle prove il cui dettaglio è riportato nelle schede che accompagnano questo certificato e che riportano il numero di accreditamento sopra citato. Le schede possono subire variazioni nel corso del tempo.
L'accreditamento comporta la verifica della competenza tecnica del Laboratorio relativamente alle prove accreditate e del suo Sistema Qualità, in conformità alle prescrizioni della norma UNI CEI EN 45001 e dei criteri applicabili delle norme UNI CEI EN serie 29000.
L'accreditamento resta in vigore fino al Febbraio 1996, come previsto dalla convenzione stipulata fra SINAL ed il Laboratorio in oggetto sempre che il Laboratorio conservi la conformità alle prescrizioni del Regolamento Generale e delle regole particolari SINAL applicabili alla fattispecie.

Il Direttore

Il Presidente

SINAL

ACCREDITATION CERTIFICATE

ACCREDITATION NUMBER
0031

It is certified that:

SIET Laboratory

is accredited by SINAL for test performances whose details are reported in the documents enclosed to this certificate which report the acccreditation number above mentioned. These documents can be modified in the course of time.
Accreditation implies the check of Laboratory technical competence in relation to accredited tests and of its Quality Systems, in compliance with prescriptions of UNI CEI EN 45001 standard and of applicable criteria of UNI CEI EN, series 29000, standards.
Accreditation remains in force up to February 1996, as provided by the convention drawn up by SINAL and the involved Laboratory, as far as this Laboratory maintains the compliance with prescriptions of General Regulations and of particular SINAL rules applicable in the case in point.

PANTHERS-PCC Readiness Assessment Report

ATTACHMENT B

PANTHERS-PCC SPARE PARTS

April 29, 1994

PCCSPARE.XLS

PANTHERS-PCC SPARE PARTS

february 23, 1994

ITEM	SPARES AVAILABLE AT SIET	MAX. TIME REQUIRED FOR PROCUREMENT
PIPING & FITTINGS	SOME	2 WEEKS
VALVES	SOME (SPEC. TO BE VERIFIED)	3 MONTHS
FLOW DEVICES	NONE	1 WEEK
PRESSURE TRANSDUCERS	SOME (SPEC. TO BE VERIFIED)	2 MONTHS
FLUID TEMPERATURE THERMOCOUPLES	16	2 WEEKS
PLATE WALL THERMOCOUPLES	42	2 WEEKS
STRAIN GAGES	3	2 MONTHS
ACCELEROMETERS	1	2 MONTHS
THERMORESISTANCES	57	1 MONTH
LVDTs	1	2 MONTHS
CABLES	SOME	IMMEDIATE
DAS CARDS	NONE	1 MONTH
DAS PC	AVAILABLE	1 WEEK

made by R. Silveri

ATTACHMENT C

PANTHERS-PCC TEST SCHEDULE

April 29, 1994

	Activity	Slack	Actual Start	Actual Finish	% Done
Assembling					
	Module delivery	1	7/11/93	8/11/93	100
	modules positioning	1	9/11/93	15/11/93	100
	Bolts verification	1	16/11/93	18/11/93	100
	vent & drain pipe delivery	9	24/11/93	24/11/93	100
	modules lifting up	1	19/11/93	22/11/93	100
	PCC covers delivery	5	23/12/93	23/12/93	100
	Pool Gaskets	1	23/11/93	3/12/93	100
	Riser distributor etc. delivery	-1	3/12/93	23/12/93	100
	Vent/drain pipe welding	3	2/12/93	10/12/93	100
	Modules positioning	3	13/12/93	16/12/93	100
	SJET Welding	4	20/12/93	23/12/93	100
	Riser, distributor, etc welding	0	22/12/93	29/12/93	100
	Closing of the loop	0	30/12/93	30/12/93	100
PCC instr.					
	I001 Welding T/C	40	31/12/93	3/1/94	100
	I003 Gasket delivery	39	15/1/94	15/1/94	100
	I002 Welding S/G	40	4/1/94	11/1/94	100
	I004 Gasket installation	28	1/2/94	1/2/94	100
	PCC cleaning	30	25/1/94	28/1/94	100
	I005 Close Headers	0	14/3/94	21/3/94	100
	I006 PCC instrumented	0	21/3/94	21/3/94	100
Pool instr.					
	P001 Pool Panel Preparetion	1	22/3/94	23/3/94	100
	P003 Install Instr. Frame Structure	1	24/3/94	8/4/94	100
	P004 Install pool sensors	0	12/4/94	21/4/94	0
	P002 Close pool	0	22/4/94	3/5/94	0
	P005 Pool penetration for Pool instr	0	4/5/94	9/5/94	0
	PCC cleaning	0	10/5/94	10/5/94	0
	P006 Finish pool instr	0	10/5/94	10/5/94	0
Shakedowns					
	S001 DAS for H02	6	1/11/93	14/12/93	100
	H02 configuration	20	1/11/93	25/11/93	100
	Hydrotest	16	22/3/94	22/3/94	100
	S002 Execution H02	11	8/12/93	21/12/93	100
	S003 DAS for C04	12	21/12/93	29/3/94	100
	Air Filters	15	10/4/94	13/4/94	90
	S005 Complete thermal insulation	78	19/1/94	25/1/94	100
	S004 Execution of C04	12	30/3/94	1/4/94	100

	Activity	Slack	Actual Start	Actual Finish	% Done
	S013 Analysis of H02 results	73	16/12/93	6/1/94	80
	S015 Analysis of C04 results	12	5/4/94	11/4/94	60
	S004 Execution of C04.1	12	12/4/94	13/4/94	0
	S006 DAS for C03	12	14/4/94	18/4/94	0
	S007 C03 execution	12	19/4/94	21/4/94	0
	S008 DAS for H01	-1	11/5/94	11/5/94	0
	S010 Complete DAS	-1	12/5/94	17/5/94	0
	S009 H01 execution	-1	18/5/94	23/5/94	0
	S015 Analysis of C04.1 results	20	14/4/94	20/4/94	0
	S016 Analysis of C03 results	19	22/4/94	28/4/94	0
	S014 Analisys of H01 results	2	24/5/94	30/5/94	0
	S011 H04 execution	-1	24/5/94	27/5/94	0
	S012 H05 execution	-1	30/5/94	2/6/94	0
	S017 Analysis of H04 results	2	31/5/94	6/6/94	0
	S018 Analysis of H05 results	0	3/6/94	8/6/94	0
Testing					
	T001 Test for SBWR certification	0	9/6/94	5/7/94	0
	T002 Start Test report	0	9/6/94	5/7/94	0
	T003 Draft test report	0	6/7/94	2/8/94	0
	T007 Complete PCC tests	0	6/7/94	13/12/94	0
	T004 Review	0	3/8/94	9/8/94	0
	T005 Close open items	0	10/8/94	23/8/94	0
	T006 Issue final report	0	24/8/94	12/9/94	0

cc: JEQ
SBWR Proj File

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

#170-94

December 21, 1994

APPLICANT: GE Nuclear Energy (GE)

PROJECT: Simplified Boiling Water Reactor (SBWR)

SUBJECT: SUMMARY OF THE VISIT ON OCTOBER 16, 1994, AT THE SOCIETA INFORMAZIONI ESPERIENZE TERMOIDRAULICHE (SIET) PERFORMANCE ANALYSIS AND TESTING OF HEAT REMOVAL SYSTEM (PANTHERS) TEST FACILITY FOR THE SBWR DESIGN

On October 16, 1994, the U.S. Nuclear Regulatory Commission staff visited the SIET facility in Piacenza, Italy to informally observe testing in the PANTHERS passive containment cooling system (PCCS) for GE's SBWR design.

Major observations from the visit are as follows:

Testing in PANTHERS is well under way, and considerable data has been acquired on PCCS heat exchanger performance. The testing is under the supervision of both GE and European Nuclear Energy Association (which is a partner in ownership of SIET Laboratories), and is being performed by a SIET team different from that operating the SPES-2 facility. It is difficult to generalize on the basis of observation of a single test; however, the test operations crew demonstrated the same sort of competence and professionalism in PANTHERS testing as has been noted previously for the operation of SPES-2. The specific test observed involved measurement of heat transfer capability of PCCS unit with a steam-air mixture. In addition to degradation of heat transfer by the non-condensible gas, the water level in the PCCS surrounding the heat exchanger was lowered very gradually to determine the effect of that parameter on heat transfer performance. Very little effect of the lowered water level was observed until a significant fraction (>50 percent) of the tube surface was uncovered. Observation of these activities was very valuable in providing preparation for future test observation when isolation condenser testing is in progress.

This summary was prepared based on input from Dr. Alan Levin.

Son Q. Ninh, ~~Project~~ Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of Nuclear Reactor Regulation

Docket No. 52-004

cc: See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

MA/196-95

September 25, 1995

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, CA 95125

SUBJECT: NRC INSPECTION REPORT NO. 99900404/95-02

Dear Mr. Quinn:

This letter addresses the inspections at the Gravity Driven Integral Full-Height Test for Passive Heat Removal (GIRAFFE) Test Program at the Toshiba Nuclear Engineering Laboratory in Kawasaki City, Japan, and at the Societa' Informazioni Esperienze Termoidrauliche (SIET S.p.A.) Performance Analysis and Testing of Heat Removal System (PANTHERS) Test Facility in Piacenza, Italy, conducted by Richard P. McIntyre of the Nuclear Regulatory Commission's (NRC's) Special Inspection Branch, Juan D. Peralta of the Quality Assurance and Maintenance Branch, John A. Kudrick, Michael R. Snodderly and Andrzej Drozd of the Containment Systems and Severe Accident Branch, Alan E. Levin of the Reactor Systems Branch, and Son Q. Ninh and James H. Wilson of the Standardization Project Directorate. The inspection at GIRAFFE was conducted June 8 through 14, 1995, and the inspection at PANTHERS was conducted July 19 through 21, 1995. The details of the inspections were discussed with management at each test facility and with members of your staff present during the inspection and at the exit meetings on June 14, 1995, at GIRAFFE and on July 21, 1995, at PANTHERS.

The purpose of the inspections was to determine if testing activities performed at the GIRAFFE and PANTHERS facilities to support design certification of the GE Nuclear Energy (GE-NE) simplified boiling water reactor (SBWR) design were conducted under the appropriate provisions of NEDO-11209-04A, "GE Nuclear Energy Quality Assurance Program Description," Revision 8, the most recent revision that has been approved by the NRC. The pertinent provisions of NEDO-11209-04A were implemented at GIRAFFE by TOGE110-T01 (AS 50128-E), "GIRAFFE Quality Assurance Plan (TOGE110 Test Programs)," Revision 1 (December 1994), and at SIET PANTHERS by "Quality Plan Relative to Nuclear Area Orders," Revision 2.

Areas examined during the NRC inspections and our findings are discussed in the enclosed inspection report. The inspections consisted of an examination of procedures and representative records, interviews with personnel, and observations by the inspectors.

The results of the inspection indicate that GE-NE, in general, was adequately implementing the SBWR Project quality assurance program at GIRAFFE and at SIET PANTHERS and no nonconformances were identified. However, an Unresolved Item concerning the appropriateness of GE-NE's acceptance of design services, including related hardware, provided by ANSALDO to the PANTHERS test facility, was identified during the inspection.

ANSALDO, under contract to GE-NE, designed, fabricated and supplied both Passive Containment Cooling System (PCCS) and Isolation Condenser (IC) system prototypic heat exchangers installed in the PANTHERS facility for design certification testing. However, based on conversations with GE-NE during the inspection, it appears that GE-NE did not perform an audit of ANSALDO's facilities for placement on their Approved Suppliers List to ensure that design and fabrication activities had been adequately conducted under a suitable quality assurance program.

The response requested by this letter is not subject to the clearance procedures of the Office of Management and Budget as required by the Paperwork Reduction Act of 1980, Public Law No. 96-511.

In accordance with 10 CFR Part 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be placed in the NRC's Public Document Room.

Should you have any questions concerning this inspection, we will be pleased to discuss them with you.

Sincerely,

Robert M. Gallo, Chief
Special Inspection Branch
Division of Inspection and Support Programs
Office of Nuclear Reactor Regulation

Docket No.: 52-004

Enclosure: Inspection Report No. 99900404/95-02

cc w/encls: See Next Page

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ORGANIZATION:	GE Nuclear Energy San Jose, California
REPORT NO.:	99900404/95-02
CORRESPONDENCE ADDRESS:	Mr. James E. Quinn, Projects Manager LMR and SBWR Programs GE Nuclear Energy 175 Curtner Avenue San Jose, California 95125
ORGANIZATIONAL CONTACT:	Mr. Kenneth W. Brayman, Manager Quality Assurance Systems (408) 925-6587
NUCLEAR INDUSTRY ACTIVITY:	GE Nuclear Energy (GE-NE) is engaged in the supply of advanced boiling water reactor designs to utilities. GE-NE also furnishes engineering services, nuclear replacement parts, and dedication services for commercial grade electrical and mechanical equipment.
INSPECTIONS CONDUCTED:	June 8 through 14, 1995, at Toshiba's GIRAFFE, and July 19 through 21, 1995, at SIET PANTHERS.
TEAM LEADER:	Richard P. McIntyre (signed) 9/14/95 Date Vendor Inspection Section (VIS) Special Inspection Branch (PSIB)
OTHER INSPECTORS:	Juan D. Peralta, HQMB John A. Kudrick, SCSB (GIRAFFE only) Michael R. Snodderly, SCSB (GIRAFFE only) Andrzej Drozd, SCSB (SIET PANTHERS only) Alan E. Levin, SRXB (SIET PANTHERS only) Son Q. Ninh, PDST (GIRAFFE only) James H. Wilson, PDST (SIET PANTHERS only)
REVIEWED:	Gregory C. Cwalina, Section Chief, VIS (signed) 9/21/95 Date
APPROVED:	Robert M. Gallo, Chief, PSIB (signed) 9/25/95 Date
INSPECTION BASES:	10 CFR Part 50, Appendix B and 10 CFR Part 21
INSPECTION SCOPE:	To determine if activities performed to support the design of the SBWR and, specifically, testing activities performed at the GIRAFFE Test Facility at the Toshiba Nuclear Engineering Laboratory in Kawasaki City, Japan, and at the Societa' Informazioni Esperienze Termoidrauliche (SIET S.p.A.) PANTHERS Test Facility in Piacenza, Italy, were conducted under the appropriate provisions of NEDO 11209-04A, Revision 8, the most recent GE-NE Quality Assurance Program Description that has been approved by the NRC.
PLANT SITE APPLICABILITY:	None

Enclosure 1

1 INSPECTION SUMMARY

1.1 Unresolved Item

- Unresolved Item 99900404/95-02-01 was identified and is discussed in Section 3.7.2 of this report.

2 STATUS OF PREVIOUS INSPECTION FINDINGS

No previous inspections have been conducted at these test facilities.

3 INSPECTION FINDINGS AND OTHER COMMENTS

3.1 GE-NE SBWR Quality Assurance Program

Chapter 17 of the SBWR standard safety analysis report (SSAR) describes the GE-NE quality assurance (QA) program for the design phase of the SBWR program. The QA program is identified as "Nuclear Energy Business Operations Quality Assurance Program Description", NEDO-11209-04A, Revision 8, the latest revision approved by the NRC. NEDO-11209-04A applies to all GE-NE activities affecting quality of items and services supplied to nuclear power plants and establishes GE-NE's compliance with the provisions of Appendix B to 10 CFR 50.

NEDG-31831, "SBWR Design and Certification Program Quality Assurance Plan," dated May 1990, was developed by GE-NE to fulfill the QA requirements of the SBWR reactor design and certification program. NEDG-31831 meets the requirements of ANSI/NQA-1-1983 and its NQA-1a-1983 addenda as endorsed by the NRC in Regulatory Guide 1.28, Revision 3. Additionally, NEDG-31831 provides that design and testing work performed by international technical associates will be performed to their internal QA programs acceptable to the regulatory authorities of their respective countries as evaluated by GE-NE for compliance with the provisions of NQA-1-1983.

3.1.1 GIRAFFE

In its September 26, 1994 response (MFN 113-94) to RAI 900.67, GE-NE stated that GIRAFFE/Helium tests to be performed by Toshiba in support of SBWR design certification would be conducted in accordance with Japanese National Standard JEAG 4101-1990, "Guide for Quality Assurance of Nuclear Power Plants." GE-NE also stated that JEAG 4101-1990 meets the intent of Appendix B to 10 CFR 50 and American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME) NQA-1-1983. Subsequently, in an attachment to a letter dated April 27, 1995 GE-NE provided a description of the Toshiba QA plan, TOGE110-T01 (AS 50128-E), "GIRAFFE Quality Assurance Plan (TOGE110 Test Programs)", Revision 1 (December 1994), which would govern the PCCS heat removal test program using the GIRAFFE facility.

TOGE110-T01 summarizes the Toshiba GIRAFFE test QA plan which implements the applicable provisions of JEAG 4101-1990, and those in the following Toshiba documents: (1) Toshiba Energy Systems Group (ESG) Standard Code No. 4401

(1991), "Quality Assurance Fundamental Code", (2) 4401-1, "Nuclear Quality Manual," Revision 0, and (3) AS-50092, "Quality Assurance Program For Simplified Boiling Water Reactor," Revision 1.

During a January, 1995, audit GE-NE identified several deficiencies associated with Toshiba's implementation of the QA program governing SBWR GIRAFFE Testing. These deficiencies, including recommended actions, were documented in five Corrective Action Requests (CARs) in GE-NE Audit Report No. ARP 95-1, "Quality Assurance Audit of SBWR GIRAFFE Test Program by Services & Projects Quality - January 24-26, 1995," dated February 22, 1995.

During the inspection, the team assessed the extent and effectiveness of the corrective actions taken by GE-NE/Toshiba to resolve the QA issues identified by GE-NE in Audit Report No. ARP 95-1 and reviewed the applicable procedures that govern the implementation of the Toshiba QA program at the GIRAFFE test facility. Specifically, the team evaluated the effectiveness of the QA program and controls, as described above, in governing the implementation of Toshiba/GE-NE activities related to the overall GIRAFFE test program, including the soundness of the data obtained during PCCS testing. The team concluded that Toshiba, in conjunction with GE-NE, had taken adequate corrective measures to resolve the audit findings and achieve a satisfactory level of compliance with the applicable NQA-1 provisions. Also, based on reviews of documentation in the GIRAFFE Design Record File (DRF), the team confirmed that the GIRAFFE QA program set forth in TOGE110-T01, in conjunction with the pertinent criteria in JEAG 4101-1990 and AS-50092, provided sufficient evidence of QA implementation at a level appropriate to Design Certification testing. Although no QA-related nonconformances were identified, the team made several technical observations related to potential inadequacies in testing methods, objectives and/or acceptance criteria. These observations are discussed below.

3.1.2 SIET PANTHERS

In a September 8, 1994, letter to the NRC, GE-NE transmitted a copy of SIET Document No. 00006-QQ-92, "Quality Plan Relative to Nuclear Area Orders," Revision 2, which would govern the performance of separate-effects tests on the full-size heat exchangers in the SBWR IC System and in the PCCS at SIET's PANTHERS test facility. SIET currently holds accreditation from the Italian national registration body, Sistema Nazionale per L'Accreditamento di Laboratori (SINAL), as a technically competent laboratory in relation to its compliance to the pertinent Italian and European standards.

00006-QQ-92 was developed by SIET to fulfill the requirements of the American Society of Mechanical Engineers (ASME) NQA-1-1993 and of the International Atomic Energy Agency (IAEA) Document No. 50-C-QA, Revision I, in conjunction with the applicable provisions of Document No. 00001-QQ, "SIET Quality Manual," as they pertain to work orders in the nuclear area.

In February, 1995, GE-NE conducted a quality assurance audit to examine the effectiveness of the SIET's QA program, as delineated in the quality plan documents, for implementing the requirements of NEDG-31831 at the PANTHERS test facility. Test Specification 23A6999, "Isolation Condenser & Passive

Containment Condenser Test Requirements," Revision 4, provides that testing be conducted in accordance with the requirements of NEDG-31831.

GE-NE identified deficiencies associated with SIET's implementation of the QA program governing SBWR PANTHERS testing. These deficiencies, including recommended actions, were documented in two Corrective Action Requests (CARs) in GE-NE Audit Report No. ARP 95-3, "Quality Assurance Audit of SBWR PANTHERS Test Program by Services & Projects Quality - February 6-8, 1995," dated March 10, 1995.

During the inspection, the team reviewed DRF documentation which summarized the status of the resolution of the audit open items. These documents provided a detailed account of the findings and the extent and effectiveness of the corrective actions taken by GE-NE/SIET to resolve them. These documents also addressed the closure of recommendations which had remained open from an April 1994 readiness assessment, conducted by GE-NE, EPRI, and DOE, the results of which had been documented in "PANTHERS-PCC Readiness Assessment Report," dated April 29, 1994.

Based on the review of QA-related documents found in the PANTHERS DRF, including: (1) 00006-QQ-92, (2) the Contract/Agreement between ENEL S.p.A., Ente Nazionale Energie e Ambiente (ENEA), ANSALDO S.p.A., and GE-NE, (3) GE-NE facsimile dated July 18, 1995 on "Status of CARS and Recommendations from QA Audit," and (4) pertinent QA implementing procedures, the team concluded that activities performed to support design certification testing at the SIET PANTHERS facility were being conducted in accordance with the appropriate provisions of NQA-1-1983.

During the inspection exit meeting, however, the team questioned GE-NE/SIET related to the final configuration of the PANTHERS DRF (discussed in Section 3.4.2.1 below) and on certain NQA-1 Basic Requirements which had not been specifically addressed in the 00006-QQ-92 document.

Although not evident in the implementation of its QA program, the team noted that SIET's 00006-QQ-92 did not specifically address NQA-1 Basic Requirements 3, "Design Control," 4, "Procurement Document Control," and 8, "Identification and Control of Items." The team requested that SIET review its position on the bases of the exclusion from the QA program and that SIET review 00006-QQ-92 to ensure a level of compliance in these areas commensurate with actual SIET activities in design certification testing in the nuclear area.

3.2 <u>Test Control</u>

3.2.1 GIRAFFE

The GIRAFFE heat removal performance tests are controlled by Toshiba's TOGE110-T07, "GIRAFFE Heat Removal Performance Tests - Test Plan and Procedure" (TP&P), Revision 2. The GIRAFFE TP&P was developed as required by, and in accordance with, Toshiba's TOGE110-T01, "GIRAFFE Quality Assurance Plan," Revision 1, and GE-NE's, Document Number 25A5677, "GIRAFFE Helium Test Specification," Revision 1. The team reviewed the GIRAFFE TP&P which will be used to conduct the heat and pressure loss measurement tests, helium leak tests, shakedown tests, helium tests H-1 through H-4 and tie-back tests T-1 and T-2. The team confirmed that test objectives, quality assurance requirements, facility description and control, data acquisition and analysis, initial conditions, prerequisites, instructions, acceptance criteria, and post test activities for the conduct of the tests were included in the TP&P. The test procedures used for the testing were found to be acceptable.

3.2.1.1 Witness of Matrix Test H-3

One objective of the inspection team was to verify that tests are performed in accordance with written test procedures. The team had planned to witness Matrix Test H-3 on June 13, 1995. However, the test was postponed due to rain, as the excessive heat loss from the facility during rain prevents obtaining meaningful data. Toshiba agreed to conduct a H-3 demonstration test that the team could witness even though the data would not meet their acceptance criteria.

The team observed the H-3 demonstration test which was conducted in accordance with its TP&P. The inspection team witnessed that the specified test parameters and initial conditions had been properly established. The team also witnessed a demonstration, by GE-NE's sub-contractor Kokan-Keisoku, of how non-condensable gas measurements would be taken and measured. Non-condensable gas measurement is governed by a separate procedure, titled, "GIRAFFE Non-Condensable Gas Measurements," DRF No. T15-0013, Revision 3, dated May 30, 1995, which was approved by GE-NE and Kokan-Keisoku. The observed activities confirmed the use of appropriate test control measures.

3.2.1.2 GIRAFFE Test Results

The team reviewed the preliminary test results for H-1, H-2 and an aborted H-3 test. Several observations resulted from this review. The most notable was the lack of drywell to wetwell vacuum breaker actuation. After reviewing the test matrix, the team believes that one of the more important aspects of the test is the investigation of the facility's behavior when lighter than air non-condensables are reintroduced into the drywell. For the SBWR, vacuum breaker actuation will occur immediately after the core is initially quenched and steaming stops.

The tests conducted thus far appear to have inadequately modeled this aspect of the test matrix and as they focused primarily on the pressure response of the drywell. The apparent inadequate modeling is of concern because the team's understanding was that the main objective of these tests was to investigate the integral impact of lighter than air non-condensables on the PCCS. An important aspect of this impact is the reintroduction of helium into the drywell and whether or not the helium will accumulate in the upper regions of the PCCS. Therefore, the tests should demonstrate whether or not the PCCS will return smoothly to steady state operation. In the team's opinion, this aspect of the operation cannot be demonstrated without actuation of the vacuum breaker.

GE-NE's position is that the reintroduction of lighter than air non-condensables to the drywell is adequately modeled by the initial conditions of the test. In other words, the maximum amount of helium that can be introduced into the PCCS will be established at the beginning of the test. Nevertheless, the team still believes that the issue of adequate modeling of vacuum breaker actuation should be addressed in GE-NE's data evaluation report. As the staff believes that the concern warrants further evaluation by GE-NE, a request for additional information (RAI) will be forwarded to GE-NE and resolution of this issue will be pursued by the staff accordingly.

3.2.1.3 GIRAFFE Power Scaling

Until the team arrived on site, the available documentation indicated that reactor pressure vessel (RPV) bundle power was scaled to the surface area of the PCC tubes. The ratio of SBWR's PCC tube's surface area to that of GIRAFFE's is 690. This means that GIRAFFE is powered at 1/690th of the SBWR's rated power. In response to a specific question on the scaling ratio, GE-NE stated that for the H series tests the RPV bundle power would be based on the ratio of the vessels' volume rather than the surface area of the PCC tubes. The GIRAFFE volumes have been scaled to 1/400th of SBWR's.

GE-NE further indicated that the change had occurred within a week of the team's inspection. Changing the scale from 1/690 to 1/400 dramatically affects RPV bundle power level by changing it from 41 kW to 66 kW. While the increase in power will lead to more conservative results, a change of this magnitude at such a late stage raises questions regarding test planning.

The team believes that two conclusions can be drawn from this change. First, the scaling analysis, referenced in NEDO-32391, "SBWR Test and Analysis Program Description," Revision B, does not address the PCCS. It is due to this scaling omission that such a fundamental consideration was not revealed until June 1995. Second, this situation illustrates that a thorough understanding of the phenomena is required to properly evaluate the test results. Performing a scaling analysis based either on the surface area of the PCC tubes or on the volume of the vessels appears to have merit. However, both cannot be correct.

To better understand the issue, the team reviewed a letter from Toshiba to GE-NE dated May 31, 1995, on the GIRAFFE RPV bundle power. The letter indicated why vessel volume rather than PCC heat transfer area should be used as the scaling base. The conclusion reached by Toshiba, and now supported by GE-NE, indicates that the scale should be based not only on surface area but also on the volume ratios and total gas mass. Toshiba indicated that the final scale factor should be the smallest value resulting from the above parameters. In the case of GIRAFFE, this results in a ratio of 1/400 rather than 1/690.

GE-NE representatives indicated that the proper scale will be confirmed by a comparison of the test results from the various scaled tests of GIRAFFE, PANDA, and PANTHERS. The team believes that it is inappropriate to rely on a comparison of test results to prove or disprove such an important parameter and a more systematic approach is necessary.

Additionally, there was another parameter that the team also believes is as important as the ones mentioned above. This parameter is the rate of gas transfer between the drywell and the PCC. Unfortunately, this also requires accurate simulation of the drywell internals. This has not been accomplished by any of the system test facilities. Therefore, absent a scaling analysis, this factor must be considered as an uncertainty contributor.

The team discussed the need for GE-NE to address this issue. In a future revision to NEDO-32391, should consider expanding the scaling analysis to include the PCC so that scaled dimensions may be better understood and an uncertainty band assigned to the gas flow rate between the drywell and PCC. In the interim, GE-NE was requested to determine the impact of using a scaling ratio greater than or less than the selected value of 400 on the evaluation of the results to obtain a better understanding of the significance of the issue. The possibility exists that the design is robust enough and the net effect would thus be negligible. Finally, the comparison of the various scaled tests would then support the findings of the above approaches. The team believes that the concern warrants further evaluation by GE-NE. A request for additional information (RAI) will be forwarded to GE-NE and resolution of this issue will be pursued by the staff accordingly.

3.2.1.4 GIRAFFE Heat Loss to the Environment

The team reviewed how heat loss from the facility's major components was determined. GIRAFFE is an outdoor facility and to minimize heat loss electrical heaters, hereafter referred to as microheaters, have been installed on all the major components except the RPV. These microheaters, which are wire strips wrapped around the insulation of the suppression chamber (SC), drywell and the gravity driven core cooling system (GDCS) vessels, significantly reduce the thermal gradient across the vessel wall thereby reducing the amount of internal energy lost to the environment. The microheater power levels were reverified during a shakedown test (to recalibrate the facility) and were selected to avoid superheated conditions.

The shakedown test determined the power level to be used, during the H series of testing, by filling and heating the RPV with pure steam to a saturation temperature corresponding to the maximum pressure expected during testing. The RPV bundle heaters were then adjusted until steady state conditions were achieved. This required a power level of 8 kW and thereby established the heat loss of the RPV.

The drywell was then filled with steam and connected to the steam filled RPV. With the microheaters set at predetermined power levels, the RPV bundle power was adjusted until steady state conditions were reached. A drywell heat balance was achieved when an additional 12 kW were supplied to the RPV bundle heater, 8 kW were supplied to the drywell microheaters, and 1 kW to the line connecting the RPV and the drywell.

The GDCS was then added to the configuration using the same process. The GDCS heat loss was found to be 7.7 kW. Summing the heat losses from these three major vessels yielded a total heat loss of 36.7 kW. It should be noted that the microheater power was maintained constant during this test. Originally, power to the microheaters was to be controlled by maintaining a near zero differential temperature across the vessel. However, this approach was not successful and actually produced some degree of superheat inside the vessel. As a result, constant heater power is now supplied to both the drywell and GDCS microheaters.

This shakedown test procedure was varied for the suppression chamber. For the other vessels, the thermal conditions are near constant and substantially above ambient conditions. The suppression chamber, however, is only slightly above ambient. As a result, a small change in ambient temperature has a relatively greater effect on the heat loss from the suppression pool.

The heat loss was determined for two different pressure/temperature conditions to establish an approximate heat-loss curve. During a performance test, the microheater power was initially set at a value from the heat-loss curve. However, microheater power was reduced to compensate for a gradual rise in SC pressure after PCCS venting to the SC had occurred. Microheater power was reduced enough to maintain a constant SC temperature. During initial PCCS venting, the SC pressure was allowed to increase due to the addition of non-condensables with no change in heater power but this transfer of mass and energy from the drywell to the SC along with the initial microheater power setting resulted in a gradual pressure rise in the SC. This gradual rise in SC pressure is considered nonprototypic by GE-NE. The team is concerned that the conspicuous lack of vacuum breaker cycling during the H2 test may have been an anomaly in the experiment caused by the effect of the microheaters on the pressure in the SC.

During the inspection, GE-NE committed to providing a basis for microheater adjustment in the SC. Since the team believes the concern warrants further evaluation by GE-NE, a request for additional information (RAI) will be forwarded to GE-NE and resolution of this issue will be pursued by the staff accordingly.

3.2.2 SIET PANTHERS

The team reviewed test control-related aspects of the SBWR PANTHERS test program. Most of the material reviewed was from the PANTHERS PCCS tests, which used a prototypic, full-scale PCCS heat exchanger, with the objective of acquiring thermal-hydraulic performance data to confirm the applicability of heat transfer models developed from single-tube condensation experiments, and for validation of computer models for SBWR accident and transient analyses. PANTHERS PCCS testing was completed in late 1994. A small amount of information was also reviewed from the PANTHERS IC test program, which had just begun its shakedown phase of testing. Documentation reviewed included test procedures, test logs, test checklists, and test results as reflected by selected data and Apparent Test Results reports.

The test procedures were well organized and documented. There was evidence of test procedure modifications, which had occurred after the beginning of testing, that required minor P&ID modifications. Each revision was checked by at least two individuals. The tests were identified according to which P&ID version they were performed on. There were instances of particular P&ID

modifications that were not reflected in the test procedures. A review of these cases indicated that the modifications were minor enough to not justify the issuance of a new revision of the test procedures.

Any deviations from the test procedures were identified and listed in a Deviations Log with a clear explanation of the nature of the deviation and undertaken corrective action. The deviations included a pump failure (SLP-09, the test was repeated), a few instances of short Data Acquisition System (DAS) failure to record data (no effect on steady state recording) and software errors in calculating derived parameters (no effect on recorded data). In one instance the steam flow rate was incorrectly measured, but the correct value was calculated from other measured parameters, thus there was no need to repeat the test.

In general, implementation in the area of test control was satisfactory and it appeared that a complete record of facility and test operations had been kept. Checklists for the tests reviewed were properly signed off, verifying that the test procedures were followed. The team did note that changes in some test procedures were made by letter from ENEA's Responsible Test Engineer to SIET's facility operations personnel. In some cases, the specified changes were entered by hand on the procedures and checklists, and signed during test operations; a copy of the letter was also appended to the checklists in the DRF. However, the team also found cases in which the requisite changes had not been entered, nor was there a copy of the letter in evidence. These cases were discussed with SIET and ENEA personnel, who asserted that the changes to the procedures, as indicated in the letter, were in fact implemented.

Aside from the above-noted minor deficiencies, test records were in acceptable condition. Apparent Test Results reports also served to document the test results for GE-NE's use, and provided a means by which to trace relevant documentation for each test.

Although a facility description report had been issued early in the program as a stand-alone document, GE-NE informed the NRC team that the information in that report had been incorporated into the Test Plan and Procedures (TP&P) report for the PANTHERS program. GE-NE further indicated that the TP&P report had not been updated and reissued to reflect changes in the material contained therein, nor to incorporate the final, as-built drawings for the PANTHERS/PCCS facility. Accordingly, the NRC recommended to GE-NE that the TP&P be treated as a "living" document, and that it be updated and reissued to serve as a contemporaneous record reflecting the actual PANTHERS test program and facility configuration (see Section 3.4.2.1). A similar recommendation was made with regard to the Test Specifications for the program.

3.2.2.1 Data Acquisition System (DAS)

The test data was recorded by the DAS. The DAS had implementing software with built-in calibration tables for temperature conversion, and calibration constants for pressure conversion. The data conversion software was independently verified line-by-line. The recorded measurements were physically separated from the measurements used for the control of the facility. Each DAS channel was assigned to a specific instrument ID, and there is a list of instruments IDs and their location in Appendix A of the test report.

Each test has associated files name, which include date of the test, list of DAS channels and instruments IDs, as well as name of the software subroutine used. The test data are stored redundantly on computer hard disk, diskettes and back-up tapes. The team concluded that the retrievability of test data would have been enhanced considerably had a table been included directly identifying recording channels with measurement locations on the P&ID.

3.3 Procurement and Calibration of Test Instrumentation

3.3.1 GIRAFFE

Toshiba's AS-50092 provides that methods shall be establish for assuring that the measuring instruments and testing devices are calibrated and adjusted at established intervals or before use in order to maintain their necessary accuracy. Additionally, TOGE110-T07, "Test Plan and Procedures" for GIRAFFE Heat Removal Performance Tests (January 1995) provides that critical instrumentation be calibrated prior and after matrix testing is completed.

Critical instruments for the GIRAFFE/Helium tests are identified in Table 7.8, "List of Essential Instrumentations," of TOGE110-T07. During a walk-down of the test facility the team confirmed that test-related instrumentation was adequately tagged with instrument identification number and calibration status. The team also verified that instrumentation not intended for use in collecting data during testing had been prominently identified as "N/A" as specified in TOGF110-T07 (this practice had resulted from a recommended action item by GE-NE in ARP 95-1).

While reviewing calibration records in Section 4.5 of the GIRAFFE DRF, the team confirmed that critical instrument had been calibrated prior to initiation of testing using instruments traceable to Japan's Ministry of International Trade and Industry (MITI) standards. In one instance where an instrument had to be sent to an outside organization for calibration, the team found documented evidence of calibration traceable to MITI standards.

Overall, the team found calibration records in the DRF to be well organized thus providing evidence of suitable QA controls exercised over GIRAFFE/Helium test instrument calibration activities as required by TOGE110-T01 and AS-50092.

3.3.2 SIET PANTHERS

PANTHERS Test Specification 23A6999, Revision 4, dated April 28, 1995, requires that all test instrumentation be calibrated against standards traceable to the U.S. National Institute of Standards and Technology (NIST) or equivalent.

In Italy, under the auspices of the Western European Calibration Cooperation (WECC), national calibration standards equivalent to NIST are maintained by the Servizio di Taratura in Italia or Italian Calibration System (SIT). SIT establishes and maintains the accreditation of Italian calibration or metrological institutes, such as, the Istituto Metrologico Gustavo Colonnetti (IMGC), the Istituto Elettronico Galileo Ferraris (IEN), and the Ente Nazionale Energie e Ambiente (ENEA). These institutes then provide calibration services to other laboratories, (e.g. SIET), and companies, certifying the traceability of the institutes' standards to SIT.

During the inspection the team toured the calibration facilities at SIET. The team selected a sample of PANTHERS test instruments and confirmed the adequacy of controls in effect to maintain their accuracy and prevent their inadvertent use during any given test sequence. These controls included a computerized listing of instruments in the facility by SIET-specific identification numbers. For in-house calibration services, SIET issues its own calibration certificates providing traceability to a "primary" standard or reference instrument certified by SIT. A list of calibration procedures, and some examples, were made available and briefly scrutinized by the team. Also, the team was informed that SIET was actively pursuing accreditation by SIT as a primary metrological institute in certain areas of measurement.

Based on the above, the team concluded that Control of Measuring and Test Equipment activities at the SIET PANTHERS test facility were effective and identified this area as a strength in the program.

3.4 As-Built Drawings and Configuration Control

3.4.1 GIRAFFE

Section 5(a), "Design Verification and Validation Control," of TOGE110-T01, in conjunction with Section 4, "Design Control," of JEAG 4101-1990 include provisions that require, prior to the conduct of tests, confirmation that the GIRAFFE test facility satisfies the requirements of the test specification, including its fabrication control and/or installation provisions (i.e. configuration). Also, these documents require that the as-built facility configuration be factually depicted in drawings and/or documents which are to be verified and approved, in accordance with the appropriate procedures, prior to being filed in the DRF.

During the inspection, the team verified that Toshiba had properly established the configuration of the GIRAFFE facility for the GIRAFFE/Helium test program. Drawings of the facility found in Section 3.1 of the DRF were confirmed to be as-builts that were generated as a result of two facility measurement activities performed by Toshiba. The issued as-built drawings contained both as-designed and as-built tolerances on the facility dimensions. The team also reviewed (through a translator) the procedure developed by Toshiba for the preparation of the as-built documentation.

Based on this review, the team concluded that the as-built documentation found in the DRF established the adequacy of Toshiba's as-built verification of GIRAFFE's critical dimensions and parameters in conformance with JEAG 4101-1990 and TOGE110-T01 provisions.

3.4.2 SIET PANTHERS

The PANTHERS design history was well documented in the DRF. The internal (SIET) and external (GE-NE, ANSALDO, ENEL) documents are filed separately. Each volume has an index of documents which includes official correspondence as well as notes from relevant informal discussions and records of teleconferences. Many documents regarding test requirements were available in English. The Contract/Agreement between ENEL S.p.A., Ente Nazionale Energie e Ambiente (ENEA), ANSALDO S.p.A., and GE-NE was included in the files. ENEL/ENEA(SIET) were responsible for the design of the facility excluding the PCC and IC heat exchanger (HX) units, which were designed and delivered by ANSALDO. A copy of the design documentation for the HX units was not included in the PANTHERS/PCC design records.

3.4.2.1 Verification of As-built Dimensions and Elevations

PANTHERS Test Specification 23A6999, Revision 4, dated April 28, 1995, provides that test document control and test plant configuration control activities be performed in accordance with NEDG-31831. At the SIET PANTHERS test facility, the corresponding NEDG-31831 provisions are met via 00006-QQ-92 and implemented through SIET Procedures 0002-QQ, "Procedure for Document Control," Revision 3, 0011-QQ, "Internal Procedure for Test Plant Configuration Control," Revision 0, and 00383-PO, "Methods for the Execution of Dimensional Measurements," Revision 0.

In Audit Report ARP 95-3, and earlier in the "PANTHERS-PCC Readiness Assessment Report," GE-NE had identified some deficiencies related to test procedure deviation, document control, and as-built drawing control practices. As a result of GE-NE recommendations (1) a deviation log was filed in the DRF to formally record test procedure deviations for PCC tests, and (2) 00006-QQ-92, and SIET Procedure 0002-QQ, were revised to include provisions for the incorporation of deviations, and a deviation log, in the DRF to reflect any modifications to Test Procedures that had been authorized by the Experiment Manager.

During the inspection the team examined the following documents: PANTHERS-PCC Document Plan No. 00096ED91, Revision 7 (July 17, 1995), PANTHERS-PCC Drawing No. 24.02.13, "PANTHERS-PCC: Drain Line," Revision 2, PANTHERS-PCC Drawing No. 24.02.28, "PANTHERS-PCC: Vent Line," Revision 3, and PANTHERS-IC Document Plan No. 00398ED95, Revision 2 (July 17, 1995). Additionally, one inspector selected a pressure tab elevation to be checked (the Delta-P tab for measurements on the condensate drain tank, L-L002). Measurements obtained in the field by the team corroborated, within the specified tolerance, the dimensions in the as-built drawing.

Based on the information above, including reviews of drawings in the master vendor drawing file (not yet incorporated into the DRF), the team confirmed that SIET had (1) identified and confirmed critical dimensions of PANTHERS-PCC components during receipt inspections, (2) performed as-built dimension measurements of PANTHERS-PCC components supplied by ANSALDO S.p.A. although the process had not been formally proceduralized, i.e., SIET Procedures 0011-QQ and 00383-PO were initially issued in February and March 1995, respectively, and (3) completed as-built measurements of the PANTHERS-PCC test facility.

Related to the final configuration of the PANTHERS-IC/PCCS DRF, the team requested that, subsequent to the completion of all testing activities at PANTHERS, all test plans, specifications, procedures, documents and drawings be updated to incorporate all changes, deviations and/or test anomalies, thereby establishing the final "as-tested" configurations of the test facility.

3.5 Corrective Actions

3.5.1 GIRAFFE

Requirements on the nonconformance control process are prescribed in Section 10, "Nonconformance Control and the (sic) Corrective Actions," of Toshiba's TOGE110-T01 (AS 50128-E), Revision 1, and in Section 7, "Nonconformance Control and Corrective Action," of Toshiba's AS-50092, Revision 1. Additional requirements on nonconformance control are also found in Section 14, "Test Controls," of Toshiba's TOGE110-T07, Revision 2.

Section 14.3, "Test Nonconformances," TOGE110-07, states that any nonconformance to a pretest control or test procedure shall be treated as a nonconformance, and documented and reported for resolution prior to continuation of the next phase of testing. Additionally, Section 14.4, "Nonconformance Report and Corrective Actions," TOGE110-07, specifies that the nonconformance report (NCR) will include a description, evaluation of the nonconformance and any required corrective actions. It also provides that both the Toshiba and the GE-NE responsible engineers will review and approve the NCR.

Based on a review of GIRAFFE H1 and H2 test results, the team determined that at least two deviations occurred during performance of these tests which required a modification to the initial test condition in the GDCS pool and a change to RPV bundle power. The team determined that NCRs were properly issued, reviewed, and approved in accordance with procedural requirements. The technical justifications for these deviations are being evaluated by the NRC staff and are discussed in detail in Section 3.2.1 of this inspection report.

The team reviewed findings, and associated corrective actions, related to Corrective Action Request (CAR) No. 3 that had been generated during an audit conducted by GE-NE in January, 1995 (Section 3.1.1, above), in order to evaluate the effectiveness of the corrective action program at the GIRAFFE test facility. The team verified that all recommended corrective actions associated with this CAR, including confirmation that all personnel performing verifications for the GIRAFFE Helium test program were trained to Procedure TOGE110-T09, "Verification Plan on the Design Documents of the TOGE110 Test Program," had been effectively implemented by Toshiba. The team also confirmed that documentation of this training was maintained in the GIRAFFE design record file (DRF).

Based on the results of these reviews, the team concluded that Toshiba was implementing an appropriate nonconformance control and corrective action program at the GIRAFFE test facility.

3.5.2 SIET PANTHERS

SIET's corrective action program is described in Section 16 of 00006-QQ-92. The inspection team evaluated the pertinent portions of the Quality Manual which addressed nonconforming equipment and test samples, technical concerns, and the corrective action processes. Additionally, SIET Procedures 00003-QQ, "Instrument Control," and 00007-QQ, "Procedure for Internal Audits," were examined to ascertain their adequacy in addressing nonconformance issues related to instrumentation and internal audit findings, respectively.

See Section 3.1.2, above, for a detailed discussion of SIET corrective actions to the audit findings identified in GE-NE Audit Report No. ARP 95-3, "Quality Assurance Audit of SBWR PANTHERS Test Program by Services & Projects Quality - February 6-8, 1995," dated March 10, 1995.

Based on the results of these reviews, it was concluded that 00006-QQ-92 contains appropriate provisions for the identification and documentation of conditions adverse to quality and for the initiation of corrective actions in a timely manner.

3.6 Quality Assurance Records

3.6.1 GIRAFFE

Requirements on the control of quality records at the GIRAFFE test facility are prescribed in Section 11.0, "Retention of QA Documents," of Toshiba's TOGE110-T01 (AS 50128-E), Revision 1, and in Section 8, "Control of Quality Records," of Toshiba's AS-50092, Revision 1. Additional requirements on QA records retention are also found in Section 12, "Record Retention," and in Section 13, "Quality Assurance Requirements," of GE-NE's Document Number 25A5677, Revision 1, and in Section 6, "Verification of Facility As-Built Configuration," and in Section 18, "Record Retention," of Toshiba's TOGE110-T07, Revision 2.

In order to evaluate the implementation of Toshiba's QA records control process the team reviewed a selected sample of QA documents in the DRF associated with H1 and H2 tests. Reviews included test facility as-built drawings, TP&P, instrument lists, calibration records, test data, nonconformance item reports, audit reports, and personnel training and qualification records. The team determined that these documents were easily retrievable and were properly maintained and controlled.

Based on the results of these reviews, the team concluded that the QA records control process was established and properly implemented for the GIRAFFE Helium test program.

3.6.2 SIET PANTHERS

Specific quality provisions applicable to the PANTHERS facility are identified in SIET document SIET 00001-QQ (Quality Manual). Specifically, Section 12 requires that SIET 00002-QQ, "Procedures for Controlling Documents," be used for all document control activities.

SIET uses a comprehensive set of procedures to update, maintain, and control activities associated with testing at the PANTHERS facility. Section 12 of SIET 00001-QQ also lists types of controlled documents at SIET and states that they are subject to a verification and issue procedure as described in SIET 00002-QQ. SIET maintains documentation of all instructions, procedures, and drawings associated with the PANTHERS facility, as well as changes thereto.

Based on this review, the team concluded that SIET has a program in place that is effective in controlling and documenting instructions, procedures, and drawings associated with SBWR testing activities at the PANTHERS facility.

3.7 Audits

3.7.1 GIRAFFE

The audit program requirements are prescribed in Section 12, "Internal Audit," of Toshiba's TOGE110-T01 (AS 50128-E), Revision 1, and in Section 9, "Audit," of Toshiba's AS-50092, Revision 1.

The team reviewed the results of an internal audit of the GIRAFFE Helium test program conducted in January 1995. The team also reviewed related internal audit documentation including auditors' qualification and certification records, audit checklist, audit report, audit findings and corrective actions. The team verified that the audit was performed by appropriate trained QA personnel not having direct responsibilities in the areas being audited. The qualification and certification records for the lead auditor and his staff were also examined and the team found them satisfactory.

An audit was conducted on January 24, 1995, and covered the areas of Engineering, Technical Office Drawings, Test Activities Plant (Plant Log and Data Log), Instrumentation Laboratory, Training, Personnel Qualifications, Document Control, and Instrumentation Control. The audit report, dated February 3, 1995, identified non-conformances and discussed corrective actions of personnel at the time of the audit Reports of each audit are issued to the Managing Director of SIET, to the Nuclear Activities Director, and to the managers of Engineering, Technical Office, and Instrumentation.

The team noted that no external supplier audits were performed by Toshiba since facility instrumentation such as magnetic flow meters, pressure D/P transmitters, and Helium gas flow meters were to be calibrated internally. Issues related to calibration of this equipment are discussed in Section 3.3.1 above.

While reviewing TOGE110-T01, the team noted one minor discrepancy in the second paragraph on page 7. This paragraph did not state that audit results receive final approval from the Toshiba QA department senior manager. The team discussed this discrepancy with Toshiba and GE-NE staff.

Based on the results of these reviews, the team concluded that Toshiba was implementing an appropriate internal audit program at the GIRAFFE test facility.

3.7.2 SIET PANTHERS

Section 17 of SIET 00001-QQ requires that periodic internal audits be conducted by qualified Quality Office personnel in accordance with 00007-QQ, "Procedures for Carrying Out Internal Audits on the Quality System." Section 17 also specifies that the Quality Office carry out periodic internal audits to ensure that the practices in 00001-QQ and Quality Procedures are being efficiently applied. Audit reports are distributed to interested units and the Managing Director.

SIET requires an annual plan for conducting internal audits at the PANTHERS facility. Annual audits were conducted in 1992, 1993, 1994, and 1995 at PANTHERS. The 1995 audit was conducted on January 24, 1995, and covered the areas of Engineering, Technical Office Drawings, Test Activities Plant (Plant Log and Data Log), Instrumentation Laboratory, Training, Personnel Qualifications, Document Control, and Instrumentation Control. The audit report, dated February 3, 1995, identified non-conformances and discussed corrective actions required by personnel at the time of the audit. Reports of each audit are issued to the Managing Director of SIET, to the Nuclear Activities Director, and to the managers of Engineering, Technical Office, and Instrumentation. Overall, the team concluded that SIET was implementing an appropriate internal audit program for PANTHERS test activities.

However, based on conversations with GE-NE during the inspection, it appears that GE-NE did not perform an audit of ANSALDO's facilities for placement on their Approved Suppliers List to ensure that design and fabrication activities related to the Passive Containment Cooling System (PCCS) and Isolation Condenser (IC) heat exchangers (HX) had been adequately conducted under a suitable QA program.

Since ANSALDO is one of the four parties involved in the PANTHERS technical agreement with GE-NE, this issue is identified as Unresolved Item 95-02-01. GE-NE is requested to provide appropriate justification for not performing an audit of ANSALDO as a supplier of safety-related equipment and services as provided for in its QA program.

4 PERSONNEL CONTACTED

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- ● Kenji Arai, Deputy Manager, Systems Analysis Group
- ● Seiichi Yokobori, Senior Specialist, Core & Fuel Technology Group
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- ○ Alberto Musa, Quality Assurance Manager
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- ○ Carlo Salomoni, Quality Assurance
- ○ Paolo Masoni, Responsible Test Engineer, ENEA

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- ○ Forrest Hatch, Manager, NSPD Quality
- ● Terry McIntyre, Project Manager, SBWR Test Ops
- ● ○ Norman Barclay, Manager, Audit Programs
- ○ Paul Billig, Senior Engineer
- ● Maryann Herzog, GIRAFFE Test Responsible Engineer
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- ● ○ Richard P. McIntyre, Team Leader, Special Inspection Branch
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- ○ James H. Wilson, PDST
- Ted Fujii, Interpreter (State Department)
- ● Kenjiro Ohkuwara, Interpreter (State Department)

● Attended the exit meeting at GIRAFFE on June 14, 1995
○ Attended the exit meeting at SIET on July 21, 1995

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Docket No. 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555-0001

Attention: R. M. Gallo, Chief
Special Inspection Branch
Division of Inspection and Support Programs
Office of Nuclear Reactor Regulation

SUBJECT: SBWR-NRC INSPECTION REPORT NO. 99900404/95-02
UNRESOLVED ITEM 99900404/95-02-01, dated September 25, 1995

REFERENCE: Letter from R. M. Gallo (NRC) to Mr. James E. Quinn (GE), NRC Inspection Report No. 99900404/95-02

This letter addresses the NRC's unresolved item documented in the subject report. The following is GE-NE's response to the subject unresolved item:

The control of GE-NE's International Technical Associates to the SBWR Program is defined in NEDG-13831, SBWR Design and Certification Program Quality Assurance Plan. The following activities were conducted in order to assess the quality program of Ansaldo and the acceptability of test hardware, Passive Containment Condenser / Isolation Condenser (PCC/IC), supplied by Ansaldo Componenti (ACO) for the PANTHERS Test Program:

1. A review (at Genoa, Italy) was performed of Ansaldo's QA Program as applied to the SBWR Program on September 20-21, 1990.

2. GE-NE evaluated Ansaldo's QA Program and determined that it met those portions of NQA-1/1a, 1983 applicable to the SBWR Program. This was documented on October 15, 1990

3. A triennial review (at Genoa and Milan, Italy) of Ansaldo's QA Program was performed September 27-28, 1993.

4. Ansaldo Nuclear Division audited ACO during the fabrication of the PCC/IC units in November 1993.

5. San Jose engineers made six trips to ACO from April 1993 through September 1994 to plan, witness and inspect the fabrication of the PCC/IC units. This included pre-test NDE of the tube-to-header welds on the IC unit during September 1994.

6. Under the Four-Party agreement covering the PANTHERS test program, ENEL funded and managed the manufacture of the PCC/IC units. ENEL conducted two Surveillance's of ACO during the fabrication of the PCC/IC units.

7. ACO is an ASME N-Stamp holder and fabricated the units to the required standards. After the completion of the PCC/IC units, ACO was successfully resurveyed by the ASME in February 1995 for the renewal of their N-Stamp.

Based upon the above activities performed during the design and fabrication of the PCC/IC units GE-NE believes there to be adequate control of the prototypical hardware to assure the configuration of the units and the results of the PANTHERS test data.

This documentation is available at GE-NE for the NRC review and should allow the NRC to close the subject unresolved item. If you have any questions regarding this matter please call Paul Billig on (408) 925-1388 or John Torbeck on (408) 925-6101.

James E. Quinn, Projects Manager
LMR and SBWR Programs

cc:	T. E. Quay	(NRC)	(1 paper copy plus E-Mail)
	P. A. Boehnert	(NRC/ACRS)	(2 paper copies plus E-Mail)
	I. Catton	(ACRS)	(1 paper copy plus E-Mail)
	S. Q. Ninh	(NRC)	(2 paper copies plus E-Mail)
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MFN 252-95

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SBWR Project File		(1 paper copy plus E-Mail)

MTIV 281-95

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 14, 1995

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, CA 95125

SUBJECT: GE NUCLEAR ENERGY RESPONSE TO UNRESOLVED ITEM - NRC INSPECTION NO. 99900403/95-02

Dear Mr. Quinn:

Thank you for your letter dated October 31, 1995, in response to our letter to you dated September 25, 1995, concerning the Unresolved Item identified during the SBWR quality assurance program implementation inspection at the Societa' Informazioni Esperienze Termoidrauliche (SIET) PANTHERS test facility in Piacenza, Italy in July 1995. We have reviewed your reply and found it responsive to the concerns raised in the Unresolved Item.

We will review the implementation of the actions you described in the response letter during a future inspection to determine that full compliance has been achieved.

Sincerely,

Robert M. Gallo, Chief
Special Inspection Branch
Division of Reactor Inspection
  and Support Programs
Office of Nuclear Reactor Regulation

Docket Nos. 52-004 and 99900403

cc: See attached list

GE Nuclear Energy

J. E. Quinn, Projects Manager
LMR and SBWR Programs

General Electric Company
175 Curtner Avenue, M/C 165 San Jose, CA 95125-1014
408 925-1005 (phone) 408 925-3991 (facsimile)

March 4, 1996

MFN 034-96
Docket 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Theodore R. Quay, Director
Standardization Project Directorate

Subject: **SBWR - Redirecting Focus**

GE Nuclear Energy is redirecting the focus of its Simplified Boiling Water Reactor (SBWR) programs from plants of the 670 Mwe size to plants of 1,000 MWe or larger. Consequently, GE will be substantially reducing the level of activity on the current 670 Mwe plant Technology Phase, which has been the focus of GE's SBWR efforts with the NRC over the past 20 months. However, GE wishes to complete key ongoing test and analysis activities to make this data available for other applications of this technology.

In line with redirecting the SBWR focus, GE would like to review with NRC the orderly closure of open NRC activities for the 670 Mwe plant. The Attachment to this letter presents our listing of the open activities and our desired closure objective, output, and schedule. We look forward to discussing the efficient close out of the open items in the manner which can provide the best results for both the NRC and GE.

Sincerely,

RI Buchholz for

qf. James E. Quinn

Attachment: **SBWR Project Redirection - NRC Activity Closure Plan**

cc:	P. A. Boehnert	(NRC/ACRS)	(2 paper copies w/att. plus E-Mail w/att.)
	I. Catton	(ACRS)	(1 paper copy w/att. plus E-Mail w/att.)
	S. Q. Ninh	(NRC)	(1 paper copy plus E-Mail w/att.)
	D. C. Scaletti	(NRC)	(1 paper copy w/att. plus E-Mail w/att.)

Attachment to MFN 034-96

SBWR Project Redirection - NRC Activity Closure Plan

Opened NRC ACTIVITY	NRC OBJECTIVE	NEXT OUTPUT	SCHEDULE FOR NEXT OUTPUT
Review of TAPD Rev C submitted 8/28/95	Agree Testing and Analysis Program Document is complete & resolves prior issues	FSER	5/15/96
Review of Scaling Report Rev 1 submitted 10/13/95	Agree that the methodology used to scale the tests is correct & complete & resolves prior issues	Written status report of preliminary review	3/15/96
Testing Data Reports MFNs 057-95, 058-95, 075-95, 086-95, 109-95, 121-95, 157-95, 194-95, 245-95, 246-95, 273-95, 274-95, 025-96, 024-96, 018-96, 005-96, 004-96 GIR He FINAL DTR 4/26/96 GIR SIT FINAL DTR 5/17/96 PANDA FINAL DTR 5/24/96 PANTHERS IC TR 3/12/96	Agree that the required parameters are properly & completely included	Written letter of concurrence	<6/15/96
PANDA/ ANSALDO QA NRC Inspection 3/5-8/96 & 3/11/96	Confirm that Testing was done in accordance with procedures and meets NQA1	Written report of audit/findings	4/15/96
Test Analyses MFNs 119-94, 270-95, 261-95, 193-95, 185-95, 178-95, 161-95, 159-95, 098-95, 097-95, 006-96.	Closing status	Written summary of status at point of "stop work"	3/15/96

GE Nuclear Energy

MFN 034-96

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J. E. Torbeck		
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SBWR Project File		(1 paper copy w/att. plus E-Mail w/att.)

GE Nuclear Energy

MFN 034-96

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S Spoelstra	8-011-31-22-456-3912
V Cavicchia	8-011-39-68-509-8601
JJ Pena	8-011-34-1-347-4215
K Maubach	8-011-49-721-987-7257
C Witteman	8-011-31-48-841-2128
A Zimmermann	8-011-49-406-396-3661
J Yamashita	8-011-81-29-423-6750
W van der Mheen	8-011-31-26-351-8092
A van Dijk	8-011-31-20-580-7041
G Yadigaroglu	8-011-41-1-632-1166
K Petersen	8-011-49-201-122-4092
H Tonegawa	8-011-81-33-597-2227
F Kienle	8-011-49-69-630-4420
P Masoni	8-011-39-51-609-8639
W Mizumachi	8-011-81-33-597-2227
G Varadi	8-011-41-5-698-2327
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March 14, 1996

MFN 037-96
Docket 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Paul Boehnert
ACRS Staff

Subject: **SBWR - ACRS, Redirecting Focus**

Reference: 1. Letter MFN 034-96, J. E. Quinn (GE) to T. R. Quay (NRC), SBWR - Redirecting Focus, dated March 4, 1996.

As discussed in the Reference 1 letter, GE Nuclear Energy is redirecting the focus of its Simplified Boiling Water Reactor (SBWR) programs from plants of the 670 MWe size to plants of 1,000 MWe or larger. Consequently, GE will be substantially reducing the level of activity on the NRC/ACRS effort as it applies to the 670 MWe plant. However, GE would like to complete key open items.

Specifically, GE would like to receive written ACRS agreement that the TAPD Revision C document submitted August 28, 1995, is complete and resolves the prior ACRS issues, and that ACRS agrees that the methodology used to scale the tests as presented in the Scaling Report Revision 1 submitted October 13, 1995, is correct and complete and resolves the prior ACRS issues.

We would then like to cease ACRS activities on the 670 Mwe SBWR. We believe that ACRS could complete the work and issue the written communications by May 15, 1995. We look forward to discussing this letter with you at your earliest convience.

Sincerely,

James E. Quinn

cc:	T. R. Quay	(NRC)	(1 paper copy plus E-Mail)
	I. Catton	(ACRS)	(1 paper copy plus E-Mail)
	S. Q. Ninh	(NRC)	(1 paper copy plus E-Mail)
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GE Nuclear Energy

MFN 037-96

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SBWR Project File (1 paper copy plus E-Mail)

MHV 061-16

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 12, 1996

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, California 95125

SUBJECT: STATUS OF THE SIMPLIFIED BOILING WATER REACTOR (SBWR) TEST PROGRAMS AND TRACG REVIEW

Dear Mr. Quinn:

In your letter dated March 4, 1996, you indicated that GE was redirecting the focus of its SBWR programs from plants of the 670 MWe to plants of 1,000 MWe or larger. In line with redirecting the SBWR focus, you provided the staff with the proposed schedule for the Nuclear Regulatory Commission (NRC) to review the TAPD Revision C, Scaling Report Revision 1, test reports, test analyses, and to issue the PANDA QA audit report. Specifically, you asked the staff to proceed with the orderly closure of these activities. Following the receipt of your March 4 letter, the staff met with you and conducted a number of conference calls with the intention of understanding GE's closure objectives and the products GE wished to receive from the staff closure activities.

In your letter dated March 13, 1996, you indicated that GE was substantially reducing the level of activity on the TRACG effort as it applies to the 670 MWe plant. Specifically, you requested that the staff stop work on the review of the TRACG application Licensing Topical Report (LTR) NEDE-32178 and provide a summary of the review of this document. With regard to the TRACG Qualification LTR NEDE-32177, you asked the staff for a written feedback on GE responses to the request for additional information (RAIs) and then to stop work on review of this document. With regard to the TRACG Model LTR NEDE-32176 you requested the staff to issue a letter of acceptability of this report by April 12, 1996, a draft safety evaluation report (DSER) by June 12, 1996, and a final safety evaluation report (FSER) by October 1996.

GE's request for orderly closure of the SBWR programs will result in the closure activities competing for resources with other high priority activities such as operating reactor issues. Consequently, the staff can not accelerate the schedule for closeout of open SBWR activities as you requested. The staff, however, developed the following schedule.

SBWR TESTING PROGRAM:

1. The staff will issue its safety evaluation report (SER) on TAPD Revision C by May 15, 1996. This report will describe events since the original submission of TAPD Revision A, the status of the staff's review of the testing performance and it will characterize the staff's opinion of the quality of the test program.

2. The staff will provide the status of its review of the scaling report - what has been reviewed, what remains to be reviewed and comments relevant to these two areas by about May 17, 1996.

3. The staff will issue its report concerning the PANDA QA audit and the Ansaldo QA discussions by about April 30, 1996.

4. Per GE's request, with the exception of the review of the PANTHERS PCC data which will be completed and issued by April 22, 1996, the staff will not perform a detailed review of test reports and test analyses. The evaluation of the GIRAFFE (He and SIT) and Panda data will be limited to the QA program, the test procedures, the test objectives and the acceptability of the test data for purposes of licensing review. If GE meets the scheduled date for the submission of the final data report (DTR) for GIRAFFE He (April 26, 1996), the staff review will be issued by about May 25, 1996. Similarly, for a PANTHERS IC DTR delivered on April 15, 1996, the staff review will be issued around May 15, 1996, and for both GIRAFFE SIT and PANDA DTRs delivered on June 4, 1996, the staff review will be issued by mid-July 1996.

<u>SBWR TRACG</u>

1. The staff will prepare a written status of the review of the TRACG Application LTR by about May 31, 1996.

2. The staff will provide a written status on its review of GE responses to the staff's RAIs of the TRACG Qualification LTR and a summary of the status of the review of this report by about May 31, 1996.

3. The staff will issue a letter of acceptability of the TRACG Model LTR by May 15, 1996. However to proceed beyond this will require completed reviews of all the test data referred to in Item 4 above. Therefore, the staff does not plan to issue a DSER or FSER for the TRACG Model LTR at this time.

If you have any questions regarding this matter, please contact Son Ninh at (301) 415-1125 or Donald McPherson at (301) 415-1246.

Sincerely,

Dennis M. Crutchfield, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 50-004

cc: See next page

Mr. James E. Quinn
GE Nuclear Energy

Docket No. 52-004

cc: Mr. Rob Wallace
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MFN-064

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 29, 1996

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, California 95125

SUBJECT: STAFF EVALUATION OF GE'S PANTHERS-PCC TESTS

Dear Mr. Quinn:

In response to your letter dated March 4, 1996, the staff has performed evaluation of the GE's PANTHERS-PCC tests. The staff determined that data from PANTHERS-PCC tests are of good quality and acceptable as a basis for the qualification of the global passive containment cooling system (PCCS) performance. However, the staff has identified a number of concerns regarding the applicability of the data to evaluate local parameters of the PCC heat exchanger. Enclosed is the staff's detailed discussion of the test data, including a summary of specific findings and observations.

You are requested to review the enclosure of this letter to determine if it contains any GE proprietary information. Please respond to this request within 30 days of the date of this letter in order that the staff makes this information available to the public.

If you have any questions regarding this matter, please contact Son Ninh at (301) 415-1125 or Andrzej Drozd at (301) 415-1246.

Sincerely,

Theodore R. Quay

Theodore R. Quay, Director
Standardization Project Directorate
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 52-004

Enclosure: As stated

Mr. James E. Quinn
GE Nuclear Energy

Docket No. 52-004

cc: Mr. John E. Leatherman, Manager
SBWR Design Certification
GE Nuclear Energy
175 Curtner Avenue, MC-781
San Jose, CA 95125

Mr. Steven A. Hucik
GE Nuclear Energy
175 Curtner Avenue, MC-780
San Jose, CA 95125

Mr. Rob Wallace
GE Nuclear Energy
1299 Pennsylvania Avenue, N.W.
Suite 1100
Washington, DC 20004

Enclosure to be distributed to the following addressees after the result of the proprietary evaluation is received from Simplified Boiling Water Reactor:

Mr. Brian McIntyre
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Energy Systems Business Unit
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Pittsburgh, PA 15222

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Office of Radiation Programs
U.S. Environmental Protection Agency
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EVALUATION OF THE SBWR/PANTHERS-PCC TESTS

1.0 INTRODUCTION

The PANTHERS-PCC tests were conducted to assess the performance of the Passive Containment Cooling System (PCC) of the General Electric (GE) Simplified Boiling Water Reactor (SBWR). The specific objectives of the tests were to demonstrate that the prototype PCC heat exchangers are capable of rejecting design heat loads, to provide a sufficient database to determine the adequacy of TRACG for predicting steady heat rejection of the PCC heat exchangers, and to determine the effects of non-condensible buildup in the heat exchangers (Ref. 1).

The staff conducted an evaluation of the PANTHERS test data. The review focused on the quality of the data acquisition system, adequacy of the test matrix, the applicability of the data to TRACG validation, and on understanding PCC performance. A considerable portion of the staff's efforts consisted of reducing the PANTHERS electronic data files supplied by GE into a format readable by the in-house plotting/analysis software. The result of this effort is a large electronic database of "reduced" files. The data in these files are readily accessible for engineering analysis.

2.0 DATA ACQUISITION SYSTEM AND DATA REDUCTION

2.1 Data Acquisition System

The system consisted of instrumentation to measure pressure, differential pressure, temperature, level, and flow rate. The staff evaluated the PANTHERS data acquisition system and determined that there were no failures of critical thermal hydraulic instruments, that the data are of good quality, and that the measurements are sufficient for performing global mass and energy balances (Ref. 2).

The staff concluded, however, that some limitations of the PANTHERS-PCC instrumentation may affect the evaluation of certain system parameters. One of such limitations is the lack of centerline gas temperature measurements in the HX tubes, an omission which makes it necessary to approximate this temperature when calculating global or local heat transfer coefficients. Additionally, the instrumentation is insufficient to determine local parameters such as flow distribution between the heat exchanger (HX) units, and the flow distribution between individual tubes. Finally, as a result of inaccurate tube wall temperature measurements, the instrumentation is insufficient to determine the heat flux distribution on the inner and outer tube walls. Tube wall temperature measurements are discussed further in Section 4.2.

2.2 Data Reduction

The computer data files, as received from GE were inconsistent in format, contained non-standard delimiting characters between data entries, and used alphanumeric characters to identify failed instruments. The staff undertook an extensive effort to remove this extraneous information and reduce the data files into a readable form. The reduced data files are readable by the in-house utility program (COLBIG) that extracts user specified data from the reduced file and generates an output file with data arranged in a format readable by standard plotting/analysis software. The staff used the XMGR plotting software and the Sun SPARC workstations for visualization and evaluation of the data.

The COLBIG program, PANTHERS data files, and the reduced files have been archived on tape and are maintained by the staff. "Readme" files contained on these tapes explain the format and naming of the data files and use of the COLBIG program. Further explanation of the codes used for instrument identification in the non-reduced files and of the file naming conventions for these files is given in Ref. 3.

3.0 <u>TEST MATRIX</u>

Two categories of PANTHERS-PCC tests were conducted:

1. Steady state tests with steam and steam/air mixtures
2. Transient tests with the vent line closed and with various mixtures of air and helium to study the effect of non-condensible buildup on heat rejection, and simulated loss-of-coolant-accident (LOCA) blowdown tests

A complete matrix of the PANTHERS-PCC tests is given in Ref. 1. The matrix of tests evaluated by the staff is shown in Table 1.

Based on expected operating conditions of the system as described in the GE SBWR Standard Safety Analysis Report (Ref. 4), the staff finds that the PANTHERS-PCC test matrix is well conceived and covers an adequate range of boundary conditions to assess PCC performance. However, there were very few tests run at low pressure compared to the number of tests run at intermediate and high pressure conditions of 330 to 600 kPa (47.8 to 95.7 psia). Whether or not this lack of low pressure data is significant should be determined in the evaluation of the validation of TRACG.

4.0 <u>UNDERSTANDING OF PCC PERFORMANCE</u>

The PANTHERS data allow two global parameters - the total condensation rate and overall HX efficiency - to be determined as a function of the inlet steam/air flow and condensate flow. However, the staff believes that acquiring a good understanding of local parameters constitutes an equally important aspect of the PCC performance evaluation. The knowledge of local parameters is particularly important for the validation of the TRACG code.

In order to get better understanding of the system performance and the behavior of local parameters, system pressures, tube wall temperatures, average heat transfer coefficients, and steam pass-through to the vent line were examined.

4.1 System Pressure Profiles

System pressure at the selected locations were generated for steady state tests T02_3, T38_1, T41_1, T09_10, and T18_2, and are depicted in Figures 1-5. The instrument identification codes (e.g. P4002) are shown on the horizontal axis. The pressure shown for each location in the system was calculated by adding all the static pressure measurements taken at that location and dividing by the total number of measurements to obtain an arithmetic average pressure. The bold error bars represent the total instrument uncertainty (instrument, data acquisition system, and mounting elevation inaccuracy), while the thin lines bars represent the minimum and maximum values measured by that particular instrument (Ref. 3).

As can be seen on all of the pressure plots, the pressure difference (DP) between the inlet and outlet of each heat exchanger is essentially zero. This small DP corresponds to the expected system operation during long-term PCC operation, when the DP across the heat exchangers is expected to be small relative to the system DP. The profiles also show that the upper and lower header pressures for HX module 1 are consistently higher than those for HX module 2. While these differences are relatively small (i.e., approximately 8% of the nominal pressure drop of 10.3 kPa, or 1.5 psid, across the system, taking into account uncertainty), they do indicate a degree of imbalance in the test system. Such imbalance may be due to manufacturing tolerances or the fact that module 1 was the more highly instrumented than module 2.

Except for the T38_1 test, there is a pressure increase between the upstream and downstream steam/air steam inlet locations (instruments P4001 and P4002). A possible cause for this pressure increase can be associated with the injection of the cold liquid water into the flow of superheated steam.

Although the uncertainty and range of measurements for a given location are large, nominal pressure values can be used to characterize the system DP. Using readings taken at the downstream steam inlet (P4002) to the vent tank discharge line (PT001), the system DP for steady state tests T41_1, T09_10, and T38_1 is between 2.75 and 5.17 kPa (0.4 and 0.75 psid). For this mode of operation, the expected pressure drop across the actual system is designed to be less than that required to clear the first main LOCA vent (approximately 17.1 kPa or 2.48 psid) (Ref. 5), and less than the submergence pressure of the PCC vents (assuming most non-condensibles have been purged from the drywell). These observations indicate that nominal test system DPs are representative of those expected during actual system operation.

The apparent pressure recovery from the vent line (P6001) to the vent tank (PI001) evident in all of the staff generated profiles is not seen in the GE pressure profile of test 23_05, as depicted in Figure 6. Differences in the profiles can be explained partially by GE use of differential pressure measurements rather than absolute pressure measurements used by the staff. The available test facility drawings indicate that the submergence of static pressure instrument PI001 below the elevation of instrument P6001 would not account fully for the pressure increase evident in the staff's plots. It is possible that the apparent pressure recovery is due to the large uncertainty in the data, or, since the trend is evident in all of the plots, an inherent bias in the pressure instrument. Therefore, while the cause of the static pressure increase is not readily identifiable, the measurements are within the uncertainty range.

In summary, the staff finds that the inlet pressure and DP across the system bound the conditions and modes of operation expected for the PCC. However, the large uncertainty in the static pressure measurements should be considered when interpreting the data, especially when characterizing pressure conditions at given locations in the test facility. Additionally, because of the smaller scatter of measurements, static pressure instrument P4002 seems to be more appropriate for characterizing the test facility inlet pressure.

4.2 Tube Wall Temperature Profiles

Plots of HX Module 1 inner and outer tube wall temperature at various elevations were generated for tests T41_1, T09_10, T49_1, T51, T53, T76, and T78, and are shown in Figures 7-18. Four tubes in HX Module 1 were instrumented with thermocouples on the inner and outer walls. The staff examined profiles along tubes A1 and Q5. The position of the tubes are given in Ref. 6. The increasing numbers on the horizontal axis on the plots correspond to traversing the tube from top to bottom. To obtain the arithmetic average temperature shown on the plot, the measurement for each tube elevation was calculated by adding all of the thermocouple readings for that location over the duration of the test and dividing by the total number of readings. The error bars shown represent the total instrument inaccuracy (instrument and data acquisition system, Ref. 3).

The plots of all the steady state tests examined (T41_1, T09_10, and T49_1) are shown in Figures 7-12. The observed trend is that the inlet temperatures are lower than the outlet temperatures. Intuitively, one would expect a profile which exhibited higher temperatures at the tube inlet followed by a gradual temperature decrease and flattening of the curve at lower tube elevations as the condensate film thickens. If the data are assumed to be at the extreme of the error bars, the profiles flatten but still do not exhibit the expected behavior. These trends suggest that the tubes were insufficiently instrumented to resolve the temperature profile along the inner wall, what limits the ability to adequately characterize local heat transfer rate.

Tube profiles from tests with steam/air mixtures and the vent line closed (T51 and T53) are given in Figures 13-15 and show a pronounced temperature drop below the tube centerline. This behavior is reasonable, and most likely due to the degradation of heat transfer in the lower tube elevations because of air buildup. The test cases shown in Figures 16-18 were run with helium and air/helium mixtures (T76 and T78) and exhibit the counter-intuitive temperature behavior similar to that seen in the steady state tests. Differences in the profiles between cases with and without helium suggest the migration of the lighter-than-steam helium along the length of the tube or the displacement of air from the lower tube elevations due to the presence of helium. Either of these processes would tend to lessen the effect due to air only and flatten the profile.

The staff has detected heat balance errors and have also questioned the sufficiency of the data for addressing local heat transfer behavior (Refs. 2 and 7). Ongoing staff analyses of the PANTHERS data using the CONTAIN code have led to the conclusion that the facility instrumentation accuracy is sufficient for determining PCC unit global heat rejection rates, but that it lacks the accuracy necessary for validating local heat transfer coefficients.

On the basis of the behavior of the wall temperature along the length of the HX tubes, the data are insufficient for calculating local heat transfer rates. However, this does not invalidate use of the test data for globally verifying system heat flux from knowledge of steam and condensate flow measurements.

4.3 Heat Transfer Coefficients

To investigate the heat transfer phenomena further, the staff calculated average heat transfer coefficients from the PANTHERS data using the simplified model shown in Figure 19. The staff modified and used the computer program "PANTHERS" developed by INEL (Ref. 2).

The heat flux from the tubes inside to the PCC pool is represented by the product of an overall heat transfer coefficient H_{Total} and the temperature difference between the inner tube gas and the pool. The model considers the steady-state conditions, as indicated in Figure 19. The total thermal resistance ($1/H_{Total}$) consists of three thermal resistances in series (characterized by inside and outside film coefficients and the conductivity across the tube wall), as shown in Figure 20. Using the heat flux terms in Figure 19, the tube-side heat transfer coefficient can be expressed as a function of system physical parameters and measured temperatures (except for the gas temperature T_g, which was not measured), as indicated in the bottom equation in Figure 20.

Figures 21 through 27 show the measured temperatures that were used in the heat transfer calculations. Comparison of temperatures for two different tubes indicates that there is no significant variation among the tubes. The introduction of non-condensibles shows a transient tube wall temperature response, as seen in Figures 25, 26, and 27. Figure 25, in particular, clearly shows a time-dependent tube wall temperature response. The first area to respond to the effect of air in the inlet steam is near the bottom of the tube. Both the tube wall temperature and the temperature across the tube wall show the start of a drop at about 12.7 hours. As time goes on, increasingly higher elevations up the tube show similar temperature responses. One possible explanation for this is that a condensate film initially forms near the bottom of the tube and grows upward with time.

Because the gas temperature in the tubes was not measured in the tests, the sensitivity of the heat transfer coefficient to the gas temperature was studied. Figures 28 through 32 show the calculated heat transfer coefficients for the same series of tests. In each of these figures three types of coefficients are plotted: overall (H_{total}), inside (H_{cond}), and outside (H_{Outer}). The straight-line curves are linear fit representations of the time dependent curves. In each figure there are two curves shown for the overall and inside heat transfer coefficients. Curves labeled (T_{sat}) correspond to the approximation that the gas temperature T_g at any elevation inside the tube is the saturation temperature at that elevation. The saturation temperature was estimated from the measured values of pressure. Another approximation would be to assume that T_g is the same as the steam inlet temperature ($T_{stm\ in}$) near the top of the tube.

Other approximations to the gas temperature in the tube could also be made (such as the average of the top and bottom header gas temperature measurements). Figure 28 shows estimated heat transfer coefficients for the case of superheated steam. Here, the difference between the T_{sat} and $T_{stm\ in}$ approximations is large (a factor of ~3.0 for H_{Cond} and a factor of ~1.8 for H_{Total}). However, because the use of T_{sat} clearly is not a good approximation with respect to superheated steam, the large difference is understandable. In the case of saturated steam (Figure 29), however, the use of either T_{sat} or $T_{stm\ in}$ is a reasonable approximation. As would be expected, the difference between the two approximations is less pronounced (a factor of ~1.1 for H_{Cond} and a factor of ~1.05 for H_{Total}). Figures 31 and 32 illustrate the effect of non-condensibles on the heat transfer coefficients. For the cases of both air and air/helium mixtures, the heat transfer coefficients undergo a transient before dropping to a lower steady state value.

However, as determined by staff investigations of tube wall temperature profiles, the inner and outer tube wall temperature measurements are inadequate for determining local heat transfer rates. The staff recognizes that GE does not intend to use the PANTHERS data to develop basic correlations, but will use it to choose between available correlations (Ref. 8). The importance of the data for the validation of basic correlations should be determined in the evaluation of the validation of TRACG.

4.4 Steam Pass-Through to Suppression Pool

The steam energy passed through to the vent line was calculated for tests T02_3 and T09_10. This is energy of the steam which was not condensed could be passed through to the suppression pool, resulting in suppression pool heat-up. For their respective flow rates and inlet pressures, tests T02_3 and T09_10 have the highest efficiency (i.e. lowest air content) and therefore represent a best-case scenario for the percentage of steam pass-through. Note that both tests are representative of steam/non-condensible mixtures expected to result from a main steamline break (Table A.3-4, Ref. 1).

Average flow and energy values were taken from the data files to calculate the total air/liquid/steam energy entering the PCC (on a per second basis) and the total energy flowing through the vent line (steam/air). The results are shown in Table 2. As an independent check of the data files, these energies also were calculated by determining the enthalpy at the reported temperatures and pressures, assuming saturated steam and air as an ideal gas, and using reported flow values. Agreement between the values was good.

Note from Table 2 that the total steam energy in the vent line is approximately 16% for both tests. Lower efficiency tests would have higher percentages corresponding to more steam being passed through to the vent line. This suggests that although the heat PCC exchangers are rejecting the required design heat load under prototypical PCC operating conditions, a considerable percentage of the energy entering the system may be passed through to the suppression pool, possibly resulting in suppression pool heat-up. At a meeting between the NRC and GE (Ref. 8), GE indicated that almost complete condensation is expected after 1 hour following a LOCA and, as confirmed by the PANDA tests, non-condensible concentrations are expected to be low during long-term operation.

The implications of the steam pass-through to the suppression pool should be determined in the review of TRACG predictions of the PCCS performance.

4.5 System Temperature Profiles

The average temperature versus location in the system was calculated from the data for tests T41_1, T09_10, and T18_2, with the results shown in Figure 33. For each location, the plotted temperature is an arithmetic average of all the measurements at that location during the test duration. The thermocouple numbers are shown on the horizontal axis below the location name.

As seen in Figure 33, there is a minor temperature increase from the upstream inlet point to the downstream inlet point. While for two of the tests this increase is within the measurement uncertainty, the trend amongst all the tests shown suggests either an inherent bias in the temperature instruments or mixing/evaporation of the desuperheating water between the upstream and downstream taps. For all tests, there is a marked temperature decrease between the downstream inlet point and the junction where the flow divides to enter the separate HX modules. From this point on, the profiles exhibit reasonable behavior and are essentially flat or show a slight decrease in temperature.

The staff calculated the degree of superheat for all locations shown on the plot by determining the saturation temperature from knowledge of the average steam partial pressure at a location. For all tests shown, the steam is superheated by approximately 8°C (15°F) at the two upstream inlet points, but is saturated at the upper headers of the HXs and through the rest of the system downstream of the upper headers. The degree of superheat present in the tests agrees with the value of less than 10°C (18°F) given in Tables A.3-2a,b of Ref. 1 for tests run at saturated steam conditions. Figure 34 shows a plot of superheat vs. location for test T09_10.

On the basis of the observed temperature profiles through the system, no unusual temperature behavior has been detected in the system and the steam superheat conditions are as stated in the test program description. For saturated steam tests, there is some superheat at the first two measurement points in the system, but the steam is saturated at the locations of the upper headers and beyond.

5.0 APPLICABILITY TO TRACG VALIDATION

In Table 5.2-2a of the GE Test Analysis and Program Description, the following parameters are listed as necessary for TRACG qualification:

- Mass flow into the PCC
- Condensation on PCC primary side condensation
- PCC secondary heat transfer
- Parallel PCC modules unit effects

Lack of accurate tube wall temperature measurements makes it difficult to calculate accurately local heat fluxes, and thereby severely limits the ability to qualify TRACG in the areas of primary side condensation and secondary heat transfer. The applicability of the data to code validation efforts is appropriate only if the data were used in conjunction with some other previously established correlations for predicting local effects (Refs. 9 and 10, and also Refs. 11 and 12, final versions of which the staff did not yet receive). As discussed in Section 4.3, GE has indicated that it does not intend to use the data for *developing* basic correlations, but to choose between existing heat transfer correlations. The importance of the data for the *validation* of basic correlations in the context of their use in TRACG should be determined in the evaluation of the TRACG validation.

The absence of instrumentation for determining the flow distribution between individual HX modules limits the ability to qualify TRACG in the area of parallel HX module effects. The PANTHERS data are, however, sufficient for determining the total mass flow into and out of the PCC, which permits accurate measurement of global heat transfer.

6.0 CONCLUSION

Data from the PANTHERS-PCC tests were evaluated by the staff. The evaluation focused on the quality of the data acquisition system, adequacy of the test matrix, on understanding PCC performance, and on TRACG validation.

The test matrix is well conceived and covers an adequate range of boundary conditions, that there were no failures of critical thermal hydraulic instruments, and that the data are of good quality and sufficient for determining the global heat rejection of the test system via thermal-hydraulic flow measurements.

However, the staff notes that there is a lack of low pressure data. The staff also notes that the inner and outer tube wall temperature measurements, because of their inaccuracy, are insufficient for characterizing local heat transfer phenomena. The significance of the lack of low pressure data, and the importance of the tube wall temperature data for the validation of basic correlations in the context of their use in TRACG, should be determined in the evaluation of the TRACG validation.

A summary of specific findings and observations follows:

Data Acquisition System/Data Reduction

- The data are sufficient for determining global mass and energy (via steam and condensate flows) balances.

- Tube centerline gas temperature measurements were not made. However, staff sensitivity studies indicate that this temperature can be approximated reasonably well for determining average heat transfer coefficients.

- The instrumentation is insufficient to determine local parameters such as flow distribution between the HX units, the flow distribution between individual tubes, and the heat flux distribution on the inner and outer tube walls.

- The staff compiled an extensive electronic database of reduced data files which can be processed further with the in-house COLBIG computer program.

Test Matrix

- The test matrix is well conceived and covers an adequate range of boundary conditions to assess PCC performance. However, there is a lack of low pressure data. The significance of this lack of data should be determined in the evaluation of TRACG validation.

Understanding of PCC Performance:

- The heat exchanger and system DPs are in the range expected for PCC performance.

- There is a large uncertainty in the static pressure measurements. This should be taken into account when using the measurement to characterize the pressure at given locations in the test facility, or when comparing the data to TRACG predictions.

- The downstream inlet pressure instrument (P4002) appears to be more appropriate for characterizing inlet pressures than the upstream measurement (P4001).

- The tube wall temperature profiles exhibit counter-intuitive behavior. This "anomaly" in the tube wall temperature measurements makes it difficult to determine accurately the local heat transfer rates from these data.

- A calculation of global heat transfer coefficients indicates that reasonable approximations can be made to the centerline gas temperature in the tubes.

- For the highest efficiency steam/air tests, there is considerable steam pass-through to the vent line. This should be considered in future reviews for steam energy pass-through to the suppression pool and possible suppression pool heatup.
- System temperature profiles show that for saturated steam tests, the steam is superheated by the time it reaches the upper headers.

<u>Applicability to TRACG Validation</u>

- The inability to accurately determine local heat transfer rates from the data limits the ability to qualify TRACG in the areas of primary and secondary side heat transfer. The importance of the data for the validation of TRACG should be determined in the evaluation of TRACG validation.
- The inability to determine the flow distribution between HX modules limits the ability to determine the effects of differences between units.
- The data are sufficient for determining total mass flow into and out of the PCC and, consequently, global heat rejection from the test system.

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Table 1 - PANTHERS Tests Investigated

Test/ Type	Inlet Pressure (kPa)	Steam Flow (kg/s)	Steam Composition	Investigated behavior
T38_1 steady state	176	1.44	saturated steam	P,T profiles
T02_3 steady state	179	1.41	steam/air, x-air=.011	P,T profiles
T41_1 steady state	328	5	saturated steam	P,T profiles, tube wall temp.
T09_10 steady state	330	5	steam/air, x-air=.015	P,T profiles, tube wall temp.
T18_2 steady state	328	5	steam/air, x-air=.074	P,T profiles, tube wall temp.
T23_05 steady state	329	5	steam/air, x-air=.148	P profiles
T49_1 steady state	314	5	superheated steam	P,T profiles, tube wall temp.
T51 transient	350	5	steam/air	Tube wall temp., heat x-fer coefficient
T53 transient	352	5	superheated steam	Tube wall temp., heat x-fer coefficient
T76 transient	360	5	steam/ helium	Tube wall temp., heat x-fer coefficient
T78 transient	336	5	steam/air/ helium	Tube wall temp., heat x-fer coefficient

Table Note: x-air= Air mass flow/air mass flow + steam mass flow

Table 2 - Test T09_10

Steam flow = 5kg/s
Inlet Pressure = 47.8 psia
Air mass fraction = .015 (main steamline break)
Efficiency = 85%

Total inlet energy	13,926 kJ
Total outlet energy	2316 kJ (1.2% air) (98.8% steam)
% total outlet energy of total inlet energy	16.55%
% steam outlet energy of total inlet energy	16.4%
% steam outlet energy of steam inlet energy	16.5%

Table 3 - Test T02_3

Steam flow = 1.41 kg/s
Inlet pressure = 25.5 psia
Air mass fraction = .011 (main steamline break/gravity drain cooling system break)
Efficiency = 79%

Total inlet energy	3822.16 kJ
Total outlet energy	604.08 kJ (.84% air) (99.1% steam)
% total outlet energy of total inlet energy	15.8%
% steam outlet energy of total inlet energy	15.7%
% steam outlet energy of steam inlet energy	15.7%

GE Nuclear Energy

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June 13, 1996

MFN 086-96
Docket 52-004

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Theodore R. Quay, Director
Standardization Project Directorate

Subject: **SBWR - GE RESPONSE TO THE NRC REVIEW OF THE SBWR PANTHERS-PCC TEST PROGRAM**

Reference:
1. *STAFF EVALUATION OF GE'S PANTHERS-PCC TESTS*, NRC Docket No. 52-004, April 29, 1996.
2. *SUMMARY OF MEETING (February 15, 1996) WITH GE TO DISCUSS PANTHERS-PCC TEST DATA EVALUATION FOR THE SBWR DESIGN (PROPRIETARY INFORMATION)*, NRC Docket No. 52-004, May 17, 1996

GE has reviewed the staff's evaluation of the SBWR PANTHERS-PCC test program (References 1 and 2), and is pleased that the staff found that the "tests are of good quality and acceptable as a basis for the qualification of the global passive containment cooling system (PCCS) performance." The enclosure to this letter provides specific details of GE's response to the staff's evaluation.

After reviewing the NRC concerns, we believe the majority to be due to misinterpretation or misapplication of the data, and would be resolved through clarification by GE. We note that the information presented in the Reference 2 meeting does not seem to have been factored into the Reference 1 report.

GE recommends that prior to any future NRC review of SBWR test data, an improved process be developed based on a dialogue between NRC reviewers and GE staff. This would better utilize the limited GE and NRC resources.

If you have any questions regarding this submittal, please call R.H. Buchholz at (408)-925-4584.

Sincerely,

James E. Quinn

cc:	P. A. Boehnert	(NRC/ACRS)	(2 paper copies of letter & report plus E-Mail)
	I. Catton	(ACRS)	(1 paper copy of letter & report plus E-Mail)
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GE Nuclear Energy

MFN 086-96

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Attachment 1
GE EVALUATION OF THE NRC REVIEW OF THE SBWR PANTHERS-PCC TEST PROGRAM

References: 1. *STAFF EVALUATION OF GE'S PANTHERS-PCC TESTS*, NRC Docket No. 52-004, April 29, 1996.
2. *SUMMARY OF MEETING WITH GE TO DISCUSS PANTHERS-PCC TEST DATA EVALUATION FOR THE SBWR DESIGN (PROPRIETARY INFORMATION)*, NRC Docket No. 52-004, May 17, 1996.

The above References document recent NRC staff evaluations of the GE SBWR test program PANTHERS-PCC. Reference 1 gives the staff's evaluation of the raw data from the tests and its interpretation of the results. Reference 2 documents a meeting held on February 15, 1996 among GE, the NRC and its consultants. GE has reviewed both of these transmittals and has the following comments:

A. *STAFF EVALUATION OF GE'S PANTHERS-PCC TESTS* (Reference 1)

GENERAL COMMENT:
GE was pleased that the staff found that the tests are of good quality and acceptable as a basis for computer code qualification. However, a number of concerns regarding details were raised by the staff. This paper states the initial GE position related to these concerns. A complete response will be provided in conjunction with any restart of TRACG qualification. The sections listed below correspond to the same section in Reference 1.

2.1 DATA ACQUISITION SYSTEM:
First it should be noted that GE had reviewed the instrumentation with the NRC and ACRS prior to running these tests and had added instruments (tube wall thermocouples) per their request. In addition, the NRC had a copy of the Test Specification two years prior to the start of testing, and thus had adequate opportunity to comment on and discuss additional instrumentation. All comments received from the NRC were acted upon by GE.

The three major concerns are discussed below:

TUBE CENTERLINE TEMPERATURE:
The staff concludes that the absense of tube centerline temperatures makes it difficult to evaluate global and local heat transfer coefficients. It must be recognized that the objective of the test was not to derive local heat transfer coefficients; this was done in other tests, specifically the single tube tests at UC Berkeley and MIT. Further, for global heat transfer peformance, center line temperatures are not needed. In addition, adding tube centerline temperature readings would not have been a simple matter at PANTHERS. With the test unit submerged in a large prototypical pool, it would have been extremely difficult to install and service these instruments. The pool, as well as the test article, were built to prototypical dimensions and could not be changed. To be meaningful, readings would have been necessary at multiple elevations and in multiple tubes, requiring numerous instruments or a movable instrument. GE did not feel that the unneeded benefits that would have been derived from these measurements, warranted the additional work required. GE therefore decided not to include them in the test requirements which were provided to the NRC.

FLOW DISTRIBUTION BETWEEN HEAT EXCHANGERS AND BETWEEN TUBES:
The staff concluded that there was insufficient instrumentation to evaluate the flow distribution between the two modules and among different tubes within one module. GE disagrees and believes that there was sufficient instrumentation in place to adequately perform this evaluation. Temperature and pressure readings were recorded in the upper and lower headers of both modules. They show that the two units behaved similarly. The NRC evaluation did not include a review of this data. The tube wall T/Cs show that four tubes located at the extreme regions of the module behaved similarly. In steady-state tests with complete condensation, the interfaces between the steam and air regions occur at nearly the same elevation. The NRC evaluation studied these instruments, but the

report only gives the average of the four tubes for a given test, not an evaluation of each of the tubes within a test. We believe a more complete evaluation will confirm GE's position.

INACCURATE TUBE WALL TEMPERATURES:
This is discussed below in the comments on Section 4.2.

2.2 DATA REDUCTION:
The NRC characterizes the data files as inconsistent in format and containing non-standard delimiting characters. Further, the NRC indicates that a significant amount of resources were expended to make conversions into a NRC desired format. GE does not understand the basis for this comment. All of the data files are consistent in format. The format of each file is discussed in Appendix E of the Data Report. In addition to the data files, there were other files which were used by the DAS to define the configuration of the test setup for each test and the constants to be used by the computer subroutines. These configuration files are also discussed in Appendix E of the Data Report and numerous additional discussions have taken place between GE and the NRC on them. Also, as explained in the appendix, all files are in ASCII format, and the data is separated by a comma or semicolon. At GE there has been no problem pulling these files into a standard spreadsheet program (Excel) and using it. Further, several meetings were held with the NRC staff to discuss the data format, and we were under the impression that there would be no coversion required. In the future, before a significant effort is expended to convert data into other formats, other alternatives should be discussed with GE.

3.0 TEST MATRIX:
The list of PANTHERS-PCC tests given in the evaluation does not include the pool water level tests. Also the list incorrectly implies that the LOCA blowdown tests were conducted with the vent line closed, which was not the case.

LACK OF LOW PRESSURE DATA:
A comment is made that there were relatively few tests conducted at low pressure (below 330 kPa). In fact, the breakdown of steady-state tests were as follows: 23 below 300 kPa, 27 from 300 to 330 kPa, and 47 above 330 kPa. Therefore, more tests were run at and below 330 kPa than above which disagrees with the staff's assessment that "there were very few tests run at low pressure compared to the number of tests run at intermediate and high pressures conditions of 330 to 600 kPa." Many tests were run in the range of 300 to 330 kPa because it represented the most likely drywell pressure condition for SBWR. Over half of the steady state saturated steam tests were run below 300 kPa with the lowest one at 137 kPa. Steam/air tests were run with pressures down to 179 kPa. In addition, half of the transient tests (gas buildup and pool water level) began with pressures below 200 kPa. Therefore, there is a large body of data to validate TRACG at lower pressures.

4.1 SYSTEM PRESSURE PROFILES:
The NRC first presented these curves at SIET last December and again at the review meeting in Washington on February 15, 1996. During the meeting in Washington, GE told the staff that a better representation of the pressure profile through the system lines can be obtained by examining the pressure drop measurements rather than the absolute pressure measurements since the relative uncertainties are much less. GE does not understand why the NRC continued their evaluation using the absolute measurements. Many of the comments given below were also given during that February 15, 1996 meeting.

ERROR BARS:
The instrument uncertainties are given in Appendix D of the data report. The values given in Table D1 for the pressure instruments are the absolute uncertainties. Therefore, the total uncertainty is plus or minus that value. The NRC consistently underrepresented the uncertainty by halving it in their plots (or worse). The error bars in Figures 1 to 5 should be around +/- 0.83 psi (5.7 kPa) which would make them almost the entire height of the plot. This comment was given at the February 15 meeting. Therefore, the trends discussed by the NRC are of little use.

Attachment 1
GE EVALUATION OF THE NRC REVIEW OF THE SBWR PANTHERS-PCC TEST PROGRAM

In the third paragraph, the NRC speculates that the injection of desuperheating water into the steam line may have caused the increase in pressure. In fact, the desuperheating water is injected about 3 meters upstream of the first instrument and before the critical flow device and could not be a cause of the pressure increase. The apparent increase is simply due to the instrument uncertainty. In a constant diameter pipe, flow cannot go from a point of low pressure to high pressure.

In the fourth paragraph, the NRC notes that the uncertainties are large but gives no explanation for not using the measured pressure drops. In Figure 6, the NRC plots a GE generated pressure profile with one of theirs and tries to explain differences noting that they can be "explained partially by GE use of differential pressure measurements." In fact, many of the locations in the two plots are not the same which become apparent by a review of the as-built drawings. This comment was given at the February 15 meeting. Therefore, the comparison is inappropriate.

In the last paragraph, the NRC describes the uncertainty of the absolute pressure measurements as large; however, they are in reality quite small considering the range of pressures that the instruments cover. The uncertainties were in fact about 0.5% full-scale and well below the specification requirement of 2%. It is the inappropriate use of this data that causes the uncertainty to appear large.

4.2 TUBE WALL TEMPERATURES:
The NRC claims that these measurements are not useful for determining local heat transfer conditions. While the accuracy is not sufficient to derive new correlations for the local heat transfer coefficients, GE has done studies using the tube wall temperatures and shown that they can be used to validate local heat transfer coefficients. The results from the study was presented at the February 15 meeting and have been documented in the TRACG post-test report for PANTHERS-PCC, which the NRC has not yet reviewed.

In the fourth paragraph, the NRC indicates that there were "heat balance errors" but no details are given to substantiate the statement.

4.4 STEAM PASS-THROUGH TO S/P:
The efficiency reported in the PANTHERS reports is the ratio of the steam condensed to the inlet steam mass. It is unclear what the NRC did to arrive at the conclusion of 16% pass through for two tests which showed 85% and 79% efficiency (i.e., 15% and 21% pass through). The difference may be in the uncertainty of their calculations. In addition, the NRC seems to define high efficiency as lowest air content which is confusing. It should also be noted that the two cases quoted by the NRC represent a low pressure case and a high flow case. More reasonable cases (steam flow per PCC of 2 kg/s and 3 to 3.3 bar) will show higher condensation efficiencies.

4.5 SYSTEM TEMPERATURE PROFILES:
The lower temperature of the upstream instrument relative to the downstream instrument is more likely due to its proximity in the early tests to the air mixing point and not the desuperheating line. The desuperheating line is well upstream of the instrument and more than likely did not impact its reading.

5.0 APPLICABILITY TO TRACG VALIDATION:
The NRC claims that that were no instruments for determining flow distribution between the two modules but fails to evaluate the data in parallel instruments (pressures and temperatures) which confirm the symmetric performance.

6.0 CONCLUSIONS:
Some of the points made in the CONCLUSIONS (e.g., low pressure data), were covered above. In the last point of Understanding of PCC Performance, the NRC incorrectly states that the steam is superheated by the time it reaches the upper header. The correct point is that the small superheat at the inlet pipe(less than 8 degrees C) is removed by the time the steam reached the upper header.

Attachment 1
GE EVALUATION OF THE NRC REVIEW OF THE SBWR PANTHERS-PCC TEST PROGRAM

B. *SUMMARY OF MEETING WITH GE TO DISCUSS PANTHERS-PCC TEST DATA EVALUATION FOR THE SBWR DESIGN (PROPRIETARY INFORMATION)*, (Reference 2)

GENERAL COMMENT: We are disappointed that the information conveyed in this meeting (and in related meetings and telecons) did not appear to be factored into the NRC report.

SPECIFIC COMMENT: In point 1 under the PANTHERS Test Data Evaluation, the NRC discusses potential defects in the heat exchanger design. GE does not recall any discussion of this topic during the meeting and does not understand why it is included in the summary minutes of the meeting.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 11, 1996

MFN 119-96

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, California 95125

SUBJECT: STAFF EVALUATION OF GENERAL ELECTRIC'S (GE's) TEST AND ANALYSIS PROGRAM DESCRIPTION, NEDC-32391, REVISION C

Dear Mr. Quinn:

In response to your letter dated March 4, 1996, the staff has prepared the enclosed report on its evaluation of the GE's Simplified Boiling Water Reactor (SBWR) Test and Analysis Program Description (TAPD).

Overall, the staff notes that GE has made significant progress in addressing previous issues and questions identified by the staff in the Draft Safety Evaluation Report (DSER) and the requests for additional information (RAIs). The staff concludes that, with the exception of the PAR and PIRT issues, TAPD Revision C can be accepted as a framework for the SBWR testing program and the TRACG qualification process if it is fully implemented as described. However, a final approval of the adequacy of the test program for qualification of the TRACG code and for design certification of the SBWR is not possible without completing a detailed review of the test data, scaling report, TRACG licensing topical reports, and GE's analysis thereof.

You are requested to review the enclosed report to determine if it contains any GE proprietary information and provide your response within 30 days of the date of this letter.

If you have any questions regarding this matter, please contact Son Ninh at (301) 415-1125.

Sincerely,

Theodore R. Quay

Theodore R. Quay, Director
Standardization Project Directorate
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 52-004

Enclosure: Introduction
and Background

cc w/enclosure:
See next page

Mr. James E. Quinn
GE Nuclear Energy

Docket No. 52-004

cc: Mr. Robert H. Buchholz
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Mr. Rob Wallace
GE Nuclear Energy
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Washington, DC 20004

Enclosure to be distributed to the following addressees after the result of the proprietary evaluation is received from Simplified Boiling Water Reactor:

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