Kraftwerk Union

REAKTORTECHNIK

GKM II - M - Condensation Tests

Hand out
for the Meeting in Bethesda
February, 1980

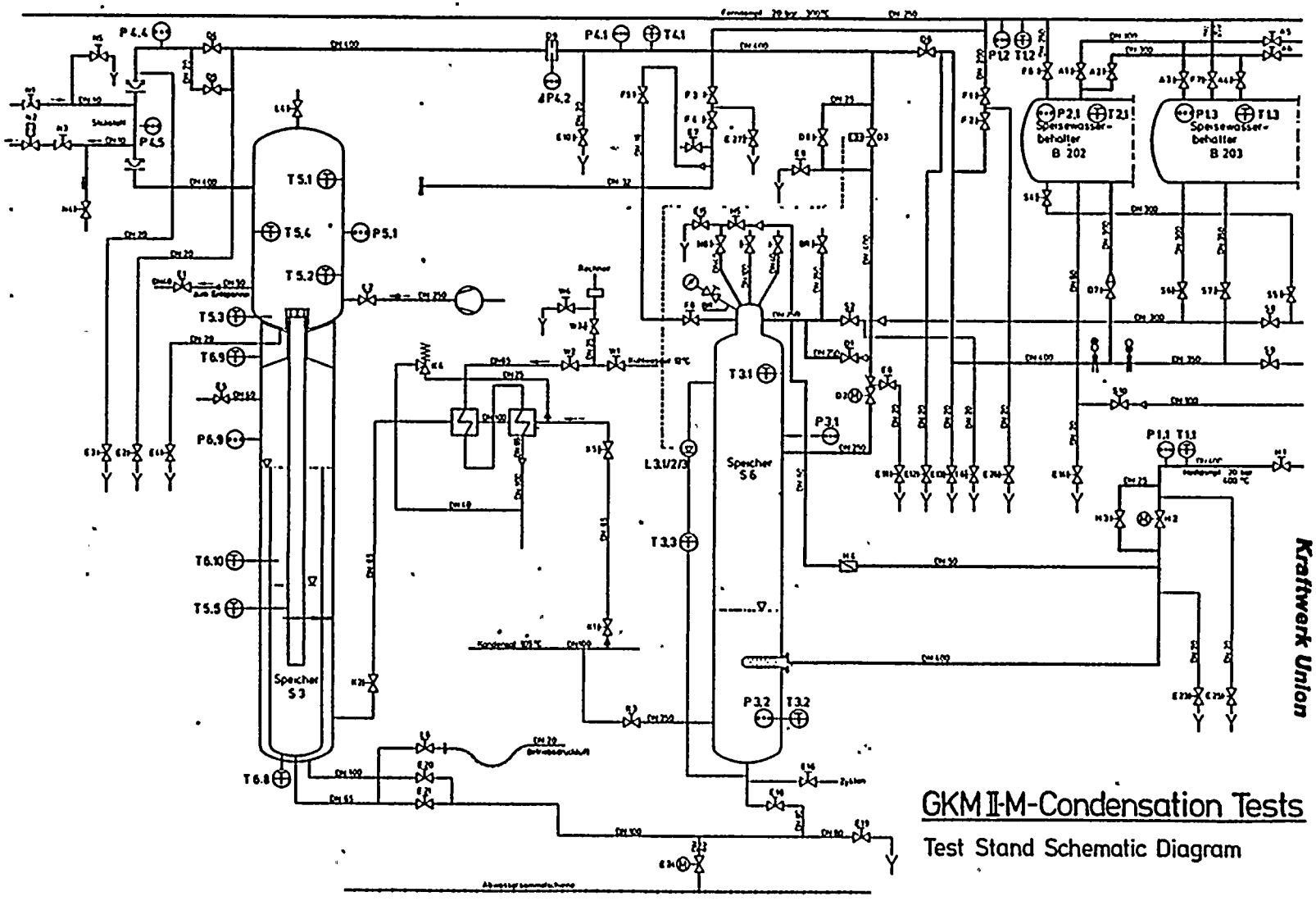
GKM II-M Test Matrix

Test Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Break Size (mm)	Ø 210 (RCL)	*	*																		
	Ø 190 (MSL)			*	*	*	*	*	*	*	*										
	Ø 110 (1/3 MSL)											*	*								
	Ø 80 (1/6 MSL)													*	*	*	*	*	*	*	*
Pool Temperature	24°C (75 F)			*	*									*	*						
	32°C (90 F)	*	*			*	*	*	*			*	*			*	*	*	*		
	55°C (130 F)									*	*									*	*
Drywell Air Content	100 %	*	*	*	*	*	*			*	*	*	*	*	*	*	*			*	*
	85 % (approx.)							*	*									*	*		
Repeat Test			*		*		*		*		*		*		*		*		*		*

Kraftwerk Union

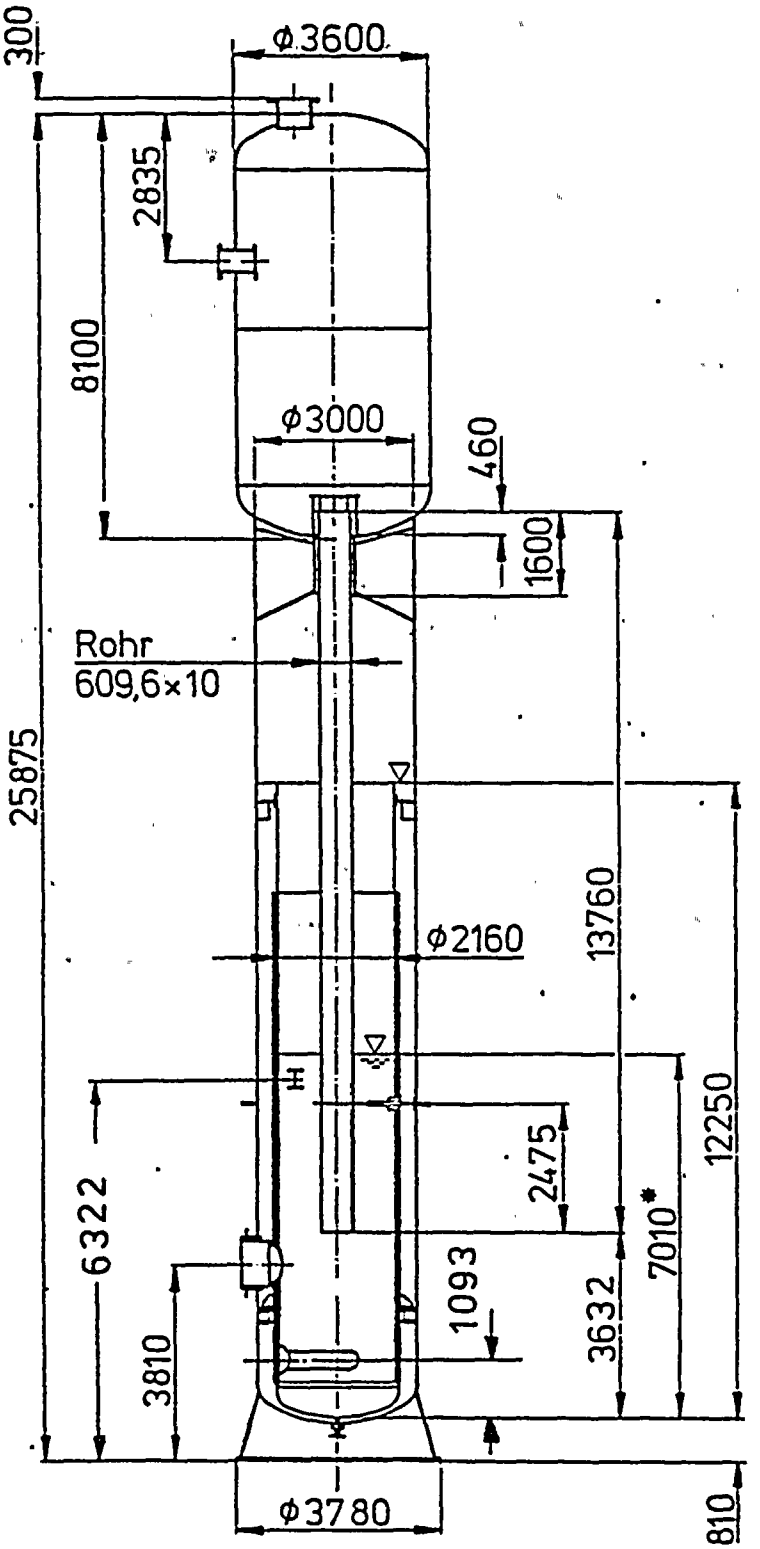
TEST PERFORMANCE AND TEST RESULTS TO DATE

1. DESCRIPTION OF THE TEST FACILITY AND TEST PERFORMANCE
    - 1.1 MSL BREAKS
    - 1.2 RCL BREAKS
2. INSTRUMENTATION
    - 2.1 OPERATING
    - 2.2 TEST
3. MATRIX OVERVIEW
4. TRANSIENT TIME HISTORIES OF THE MAIN PARAMETERS
    - 4.1 STEAM MASS FLUX
    - 4.2 AIR CONTENT
    - 4.3 DRYWELL & WETWELL PRESSURE TIME HISTORIES
    - 4.4 POOL TEMPERATURES
5. DYNAMIC POOL PRESSURES
    - 5.1 COMPRESSED PRESSURE TIME HISTORIES
    - 5.2 EVALUATION PROCEDURE
    - 5.3 FREQUENCY DISTRIBUTIONS
    - 5.4 MEAN AND MAXIMUM VALUES
    - 5.5 MAIN PARAMETRIC INFLUENCES
6. BRACING LATERAL LOADS
    - 6.1 EVALUATION PROCEDURE
    - 6.2 FREQUENCY DISTRIBUTIONS
    - 6.3 MEAN AND MAXIMUM VALUES
    - 6.4 DIRECTION DISTRIBUTIONS
7. FILM
    - 7.1 VENT CLEARING
    - 7.2 CONDENSATION



GKM II-M-Condensation Tests

Test Stand Schematic Diagram



GKM II-M-Condensation Tests

Test Tank

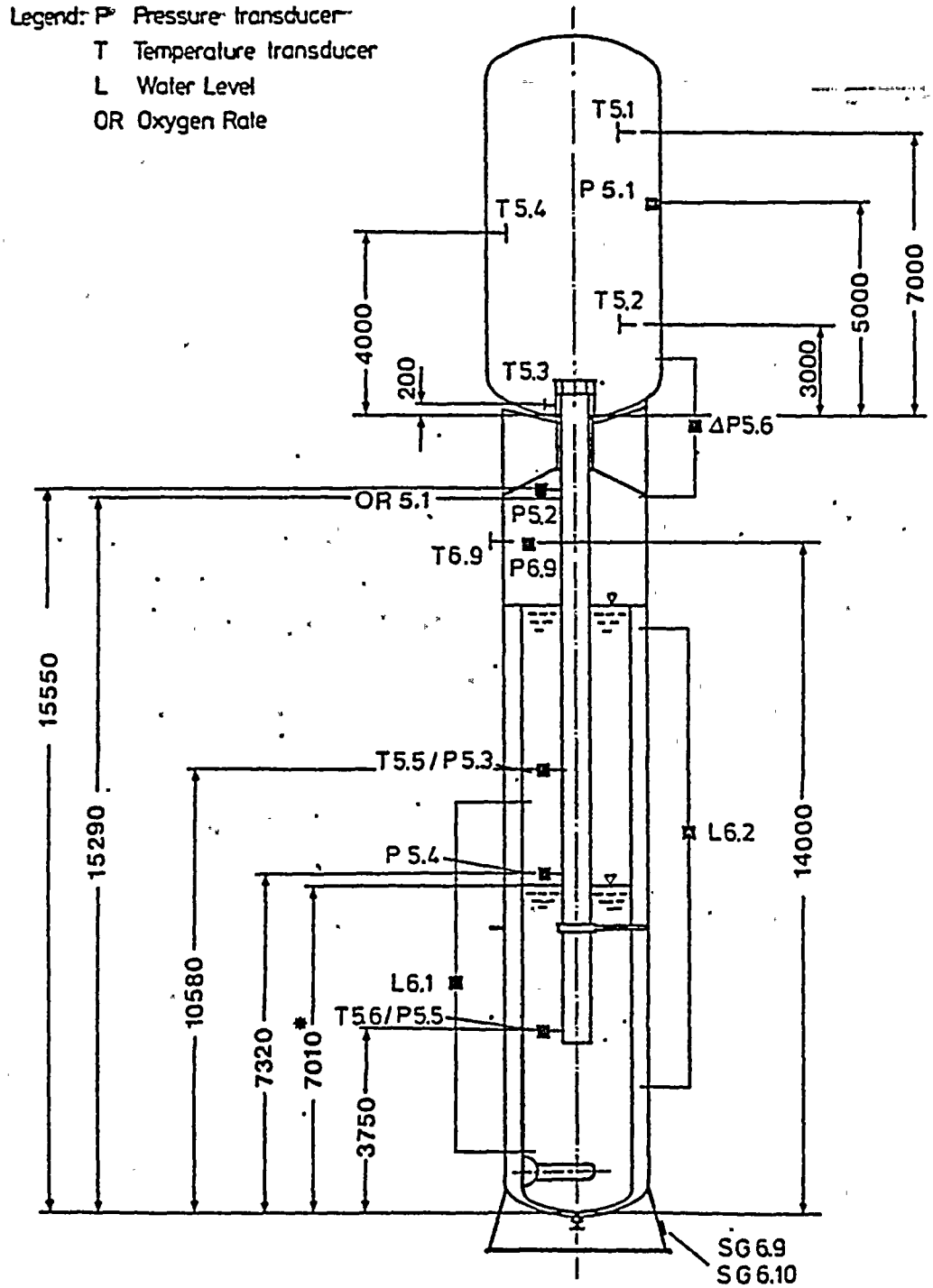
*Normal Water Level

Fixed Parameters	SSES Single Cell	GKM II-M Test Vessel
Drywell Volume including Vents [1]	77.9 m^3	75.6 m^3
Wetwell Free Air Volume [1]	48.4 m^3	47.0 m^3
Drywell/Wetwell Air Volume Ratio [1]	1.61	1.61
Pool Area		
- small cell at containment wall	3.7 m^2	3.7 m^2
mean value	5.8 m^2	-
Downcomer Dimensions		
Length	13.86 m	13.76 m
O. D.	0.6096 m	0.6096 m
Wall Thickness	9.5 mm	10 mm
Downcomer Submergence [1]	3.66 m	3.66 m
Downcomer Clearance (exit to pool bottom)	3.35 to 3.54 m	3.63 m [2]

1) at high water level (12'/3.66 m submergence)
2) at the deepest point

Comparison of fixed Parameters

Kraftwerk Union



GKM II-M-Condensation Tests

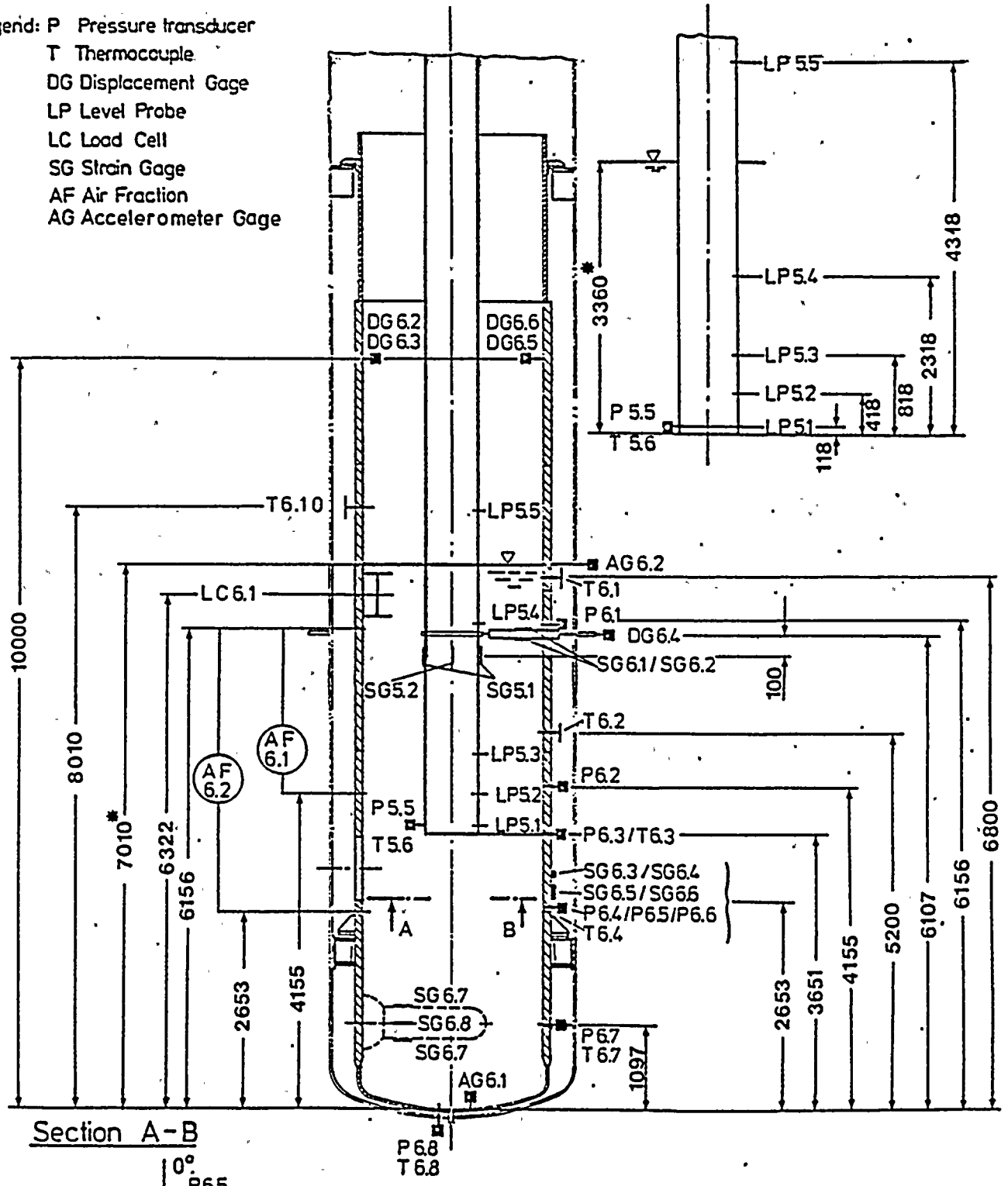
Test Instrumentation

* Normal Water Level

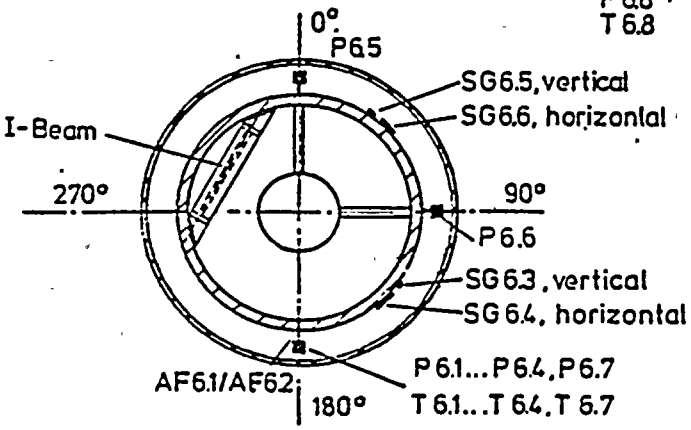
Kraftwerk Union

R 541

Legend: P Pressure transducer
T Thermocouple
DG Displacement Gage
LP Level Probe
LC Load Cell
SG Strain Gage
AF Air Fraction
AG Accelerometer Gage



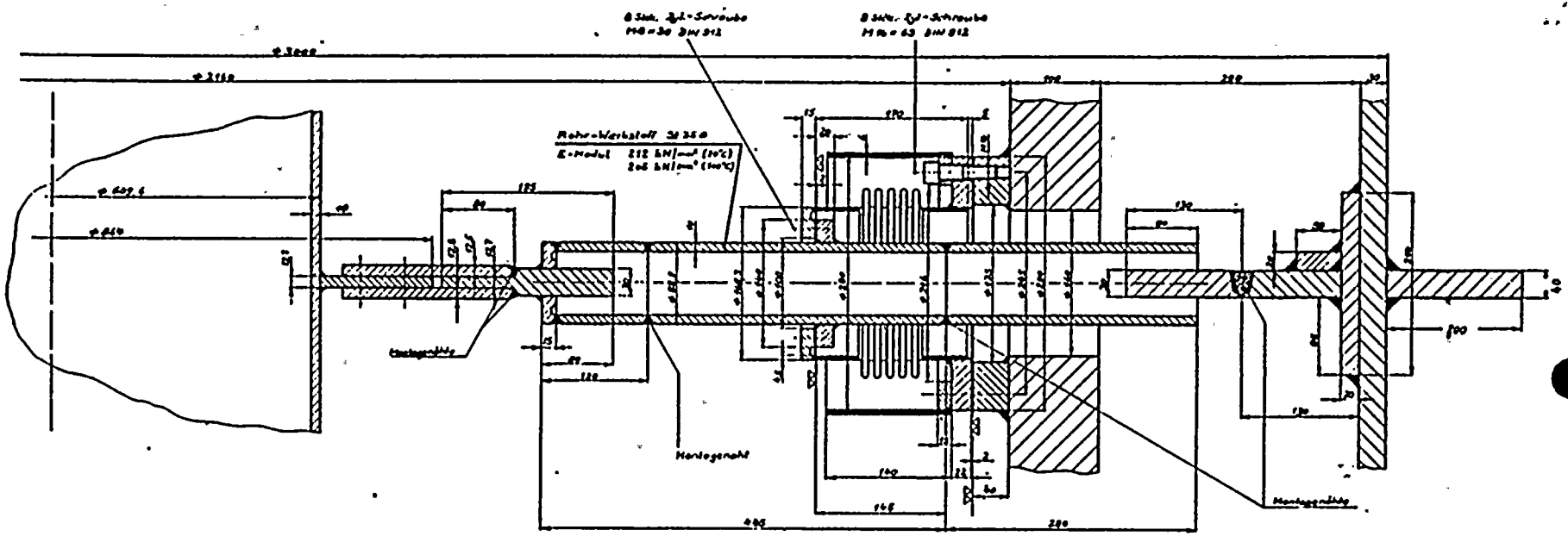
Section A-B

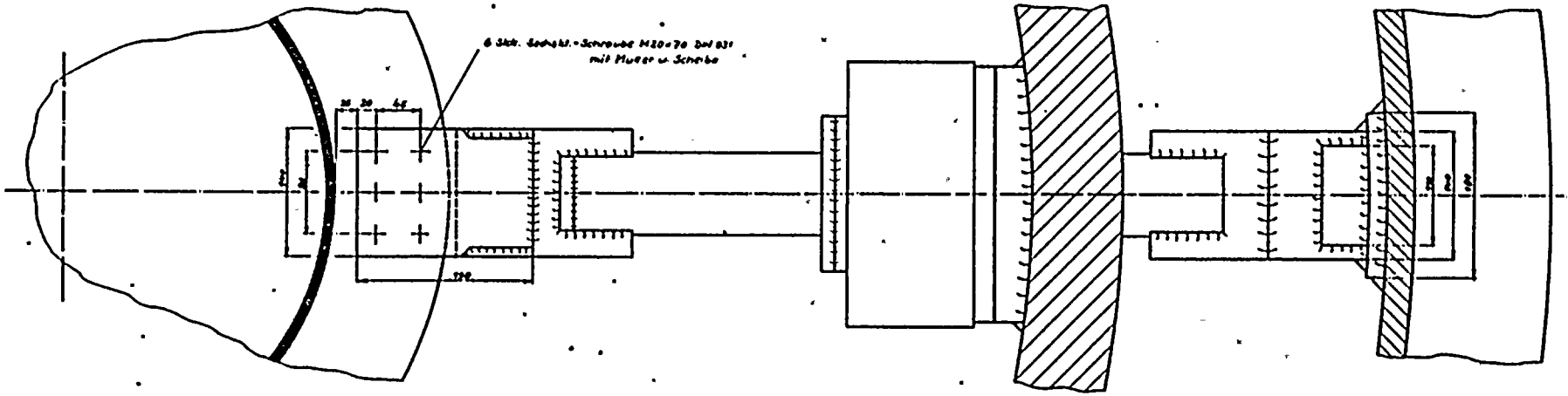


GKM II -M- Condensation Tests

Test Instrumentation

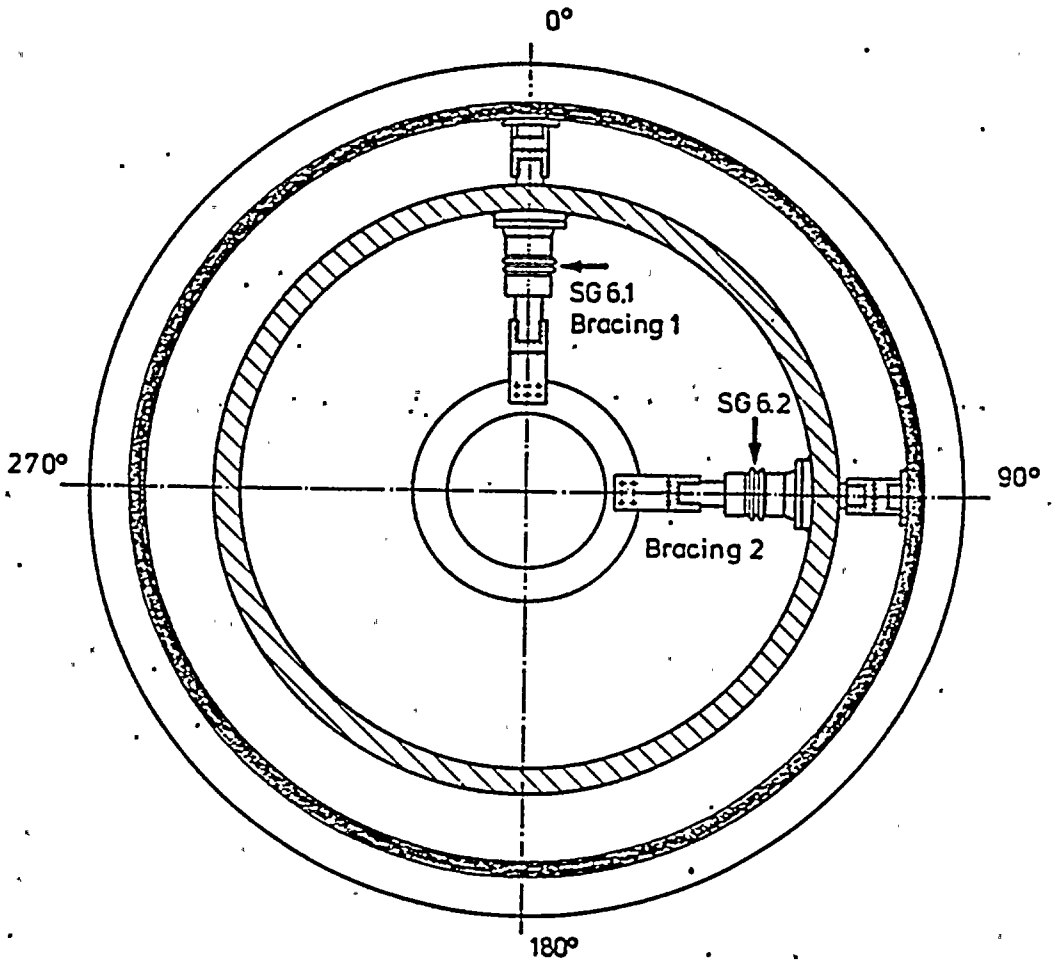
*Normal Water Level





Abt.	R 521	R 522	P 1121
Datum			
Name			

	BAHE-M	Kardrohrstrebe
Stellvertr. Leiter Abteilungsbereich R 523		R 523 - 6 - 11 - 1598



GKM II-M-Condensation Tests

Bracing Configuration

GKM II M TESTING - SUSQUEHANNA SES

200 FRAMES PER SECOND
24" DOWNCOMER DIAMETER
TIME MAGNIFICATION: 8

PART I — VENT CLEARING TEST NUMBER 3
INITIAL MASS FLUX: 250 Kg/(M²S)
INITIAL POOL TEMP: 24°C

PART I — VENT CLEARING TEST NUMBER 18
INITIAL MASS FLUX: 40 Kg/(M²S)
INITIAL POOL TEMP: 33°C

PART II — CONDENSATION TEST NUMBER 15
TIME: 200 SECONDS AFTER TEST START
STEAM MASS FLUX: 16 Kg/(M²S)
POOL TEMPERATURE: 60°C

PART III — CONDENSATION TEST NUMBER 15
TIME: 300 SECONDS AFTER TEST START
STEAM MASS FLUX: 9 Kg/(M²S)
POOL TEMPERATURE: 65°C

GKM II M - TEST EVALUATION TO DATE WITH RESPECT TO SSES POOL BOUNDARY LOADS

1. INTRODUCTORY REMARKS

2. MAIN PHYSICAL PHENOMENA OBSERVED IN THE TESTS

   - GLOBAL BLOWDOWN HISTORY AND PARAMETERS
   - PRESSURE EVENTS IN THE POOL
   - OSCILLATION FREQUENCIES

3. DISCUSSION OF MULTI-VENT SYSTEM WITH RESPECT TO TEST EVALUATION

4. EVALUATION OF TESTS No. 3 TO 10 AND SELECTION OF REPRESENTATIVE PRESSURE TRACES

   - EVALUATION METHOD
   - PRESSURE AMPLITUDES AND FREQUENCIES
   - SELECTION OF TRACES

5. PRELIMINARY SYMMETRICAL POOL BOUNDARY LOADS FOR SSES

6. ANALYTICAL JUSTIFICATION OF THE LOADS AND CORRECTION OF AMPLITUDE FACTORS

AGENDA

SUSQUEHANNA INPLANT SUPPRESSION POOL LOAD TESTS

- INTRODUCTION – PP&L
- TEST PLAN
- TEST MATRIX
- TEST RESULTS

} DR. A. HASHEMI, SRI

  - BOUNDARY PRESSURE LOADS
  - SUBMERGED STRUCTURE LOADS

SUBMERGED STRUCTURES METHODOLOGY FOR STEAM CONDENSATION LOADINGS

- PURPOSE
- CALCULATION PROCEDURE
- CONCLUSION

} T. LUM, BECHTEL

IN-PLANT SUPPRESSION POOL LOAD TESTS

- PRESENT QUENCHER LOAD DEFINITION FOR BOTH POOL BOUNDARY AND SUBMERGED STRUCTURES CONSIDERED VERY CONSERVATIVE
  - o BUBBLES OSCILLATION "IN-PHASE"
  - o BOUNDING APPROACH TO PRESSURE AMPLITUDES AND FREQUENCIES
    - CONSERVATIVE MULTIPLIERS
- EVALUATION OF POTENTIAL LOAD REDUCTION EFFORT SHOWED THAT ACTUAL IN-PLANT TEST DATA WOULD BE REQUIRED.
- SRI DEVELOPED A MECHANISM FOR SIMULATING THE BUBBLE LOADS RESULTING FROM SRV DISCHARGE
  - o AMPLITUDE AND FREQUENCY COULD BE VARIED
  - o ONCE A GIVEN SOURCE WAS CHOSEN IT COULD READILY BE REPRODUCED
- THE SAME SOURCE COULD THEN BE USED IN KARLSTEIN UNIT CELL AND SUSQUEHANNA SUPPRESSION POOL
- WE BELIEVE THAT THE TEST DATA PROVIDES AN EXCELLENT BASIS FOR PURSUING LOAD REDUCTION
- FINAL DECISION ON OUR PURSUING THAT LOAD REDUCTION IS YET TO BE MADE