

A FRAMATOME ANP

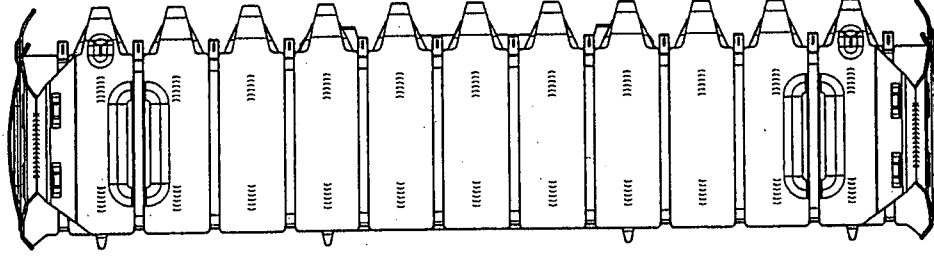
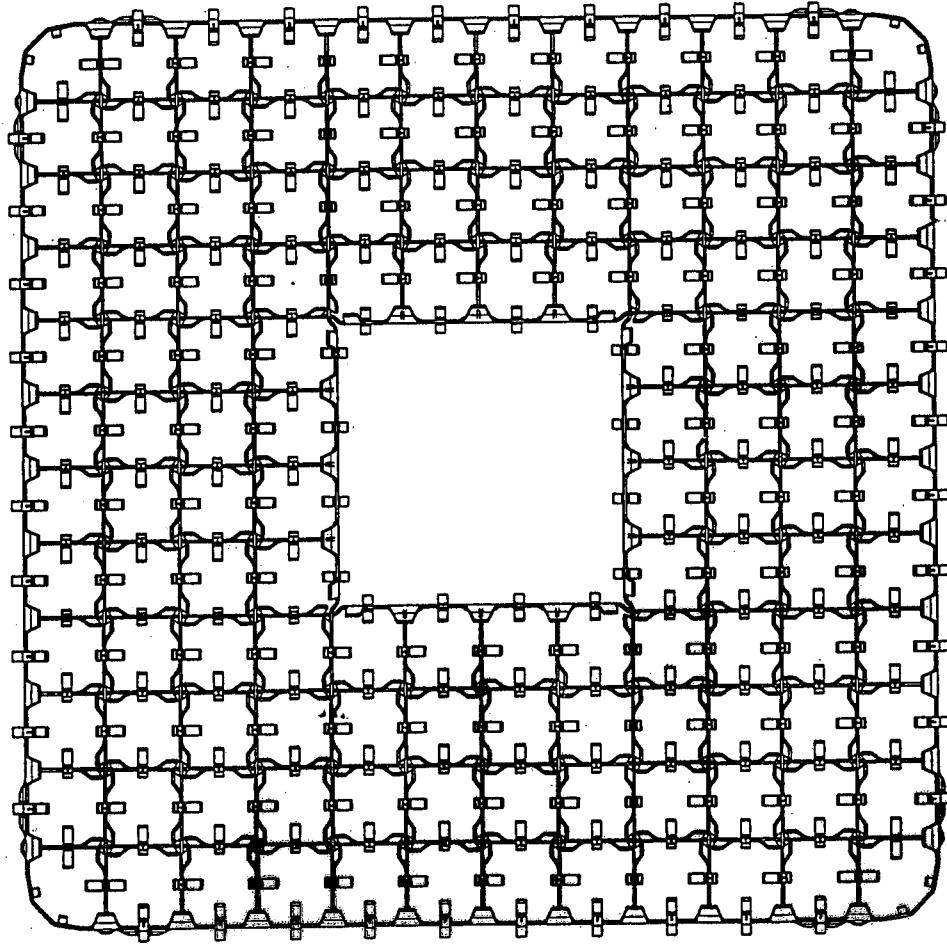
Preliminary Thermal Hydraulic Test Program for ATRIUM™12 Fuel Assembly

Dr. Uebelhack / Dr. Wehle / Dr. Wörsdörfer

Preliminary Thermal Hydraulic Test Program for SWR 1000 ATRIUM 12 Fuel Assembly



Spacer of ATRIUM 12 Fuel Assembly



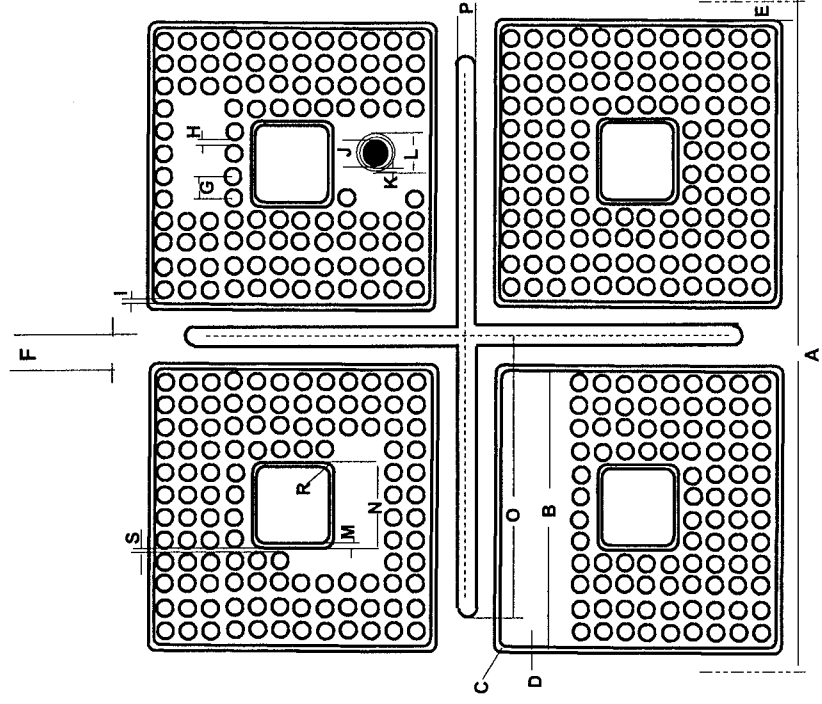
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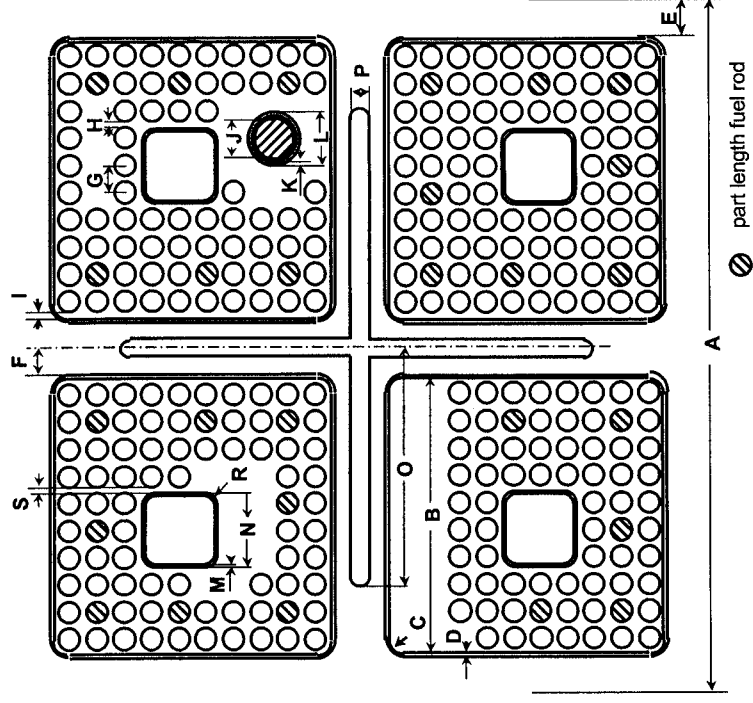
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FRAMATOME ANF

Core Cell Geometry of SWR-1000 Compared to Conventional BWR



SWR 1000



Conventional BWR

Core Cell Geometry of SWC-1000 Compared to Conventional BWR

> Fuel rod diameter, cladding thickness, pellet diameter, fuel rod pitch	equal
> Fuel channel side length	+ 16%
> „Central“ water channel	4x4 compared to 3x3 ;
> Control rod pitch	+ 19%
> Control rod span	+20%

SWR 1000 ATRIUM 12 Fuel Assembly

Preliminary Thermal Hydraulic Design

- > *Pressure Drop Performance*
 - *Loss Coefficients derived from ATRIUM 10A/B Loss Coefficients*
- > *Critical Power Performance*
 - *Modification of XL 10A1 (Critical Power Correlation of ATRIUM 10A/B)*
due to expected Critical Power of ATRIUM 12 determined by Subchannel Analysis (RINGS)
- > *Determination of Additive Constants*

Verification by KATHY Loop Measurements

ATRIUM 12 Fuel Assembly Test Bundle

> Original ATRIUM 12 FA geometry for critical power and pressure drop tests

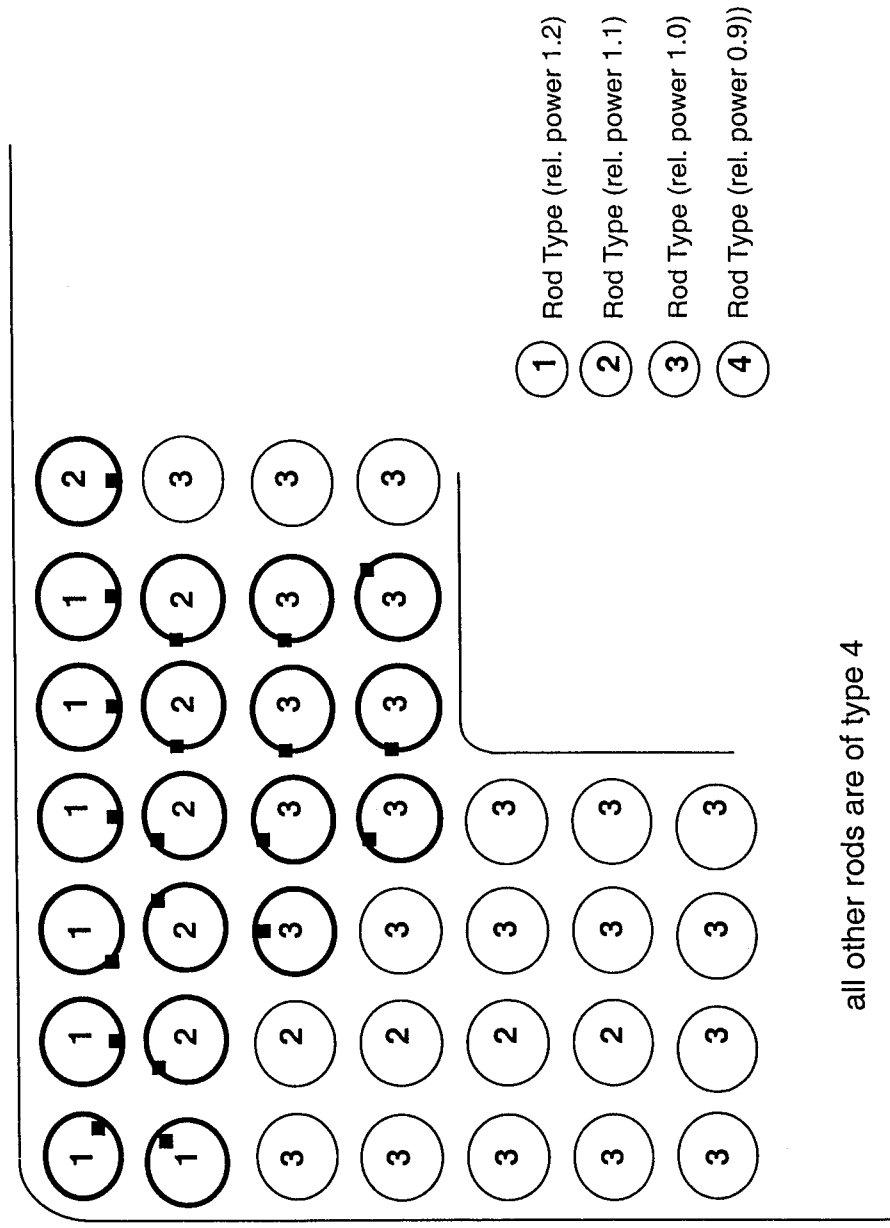
- **same rod diameter**
- **same rod pitch**
- **same water channel geometry**
- **same inner width of FA-Channel**
- **same spacer and spacer pitch**

Axial power distribution for preliminary tests: chopped cosine

ATRIUM 12 Fuel Assembly Test Program

- > ***Critical Power Measurement as a Function of***
 - ***Fuel Assembly Flow (according to power flow map)***
 - ***Core inlet subcooling***
 - ***Pressure***
 - ***Radial Power Distribution (4 Peaking Patterns for preliminary tests)***
- > ***Measurement of Pressure Drop (single and two phase) as a Function of***
 - ***Fuel Assembly Flow***
 - ***Bundle Power***

Peaking Pattern STS-85.1 with Cosine Shaped Axial Power Profile



SWR 1000 ATRIUM 12 Fuel Assembly

Determination of Thermal Hydraulic Performance

- > ***Critical Power***
- > *Establish preliminary critical power correlation (XL-Type) based on test results*
- > *Derive K-Factors (R-Factors) for critical power correlation*
- > *Determine additive constants*
- > ***Pressure Drop***
- > *Determine spacer loss coefficient based on test results*