HARWELL

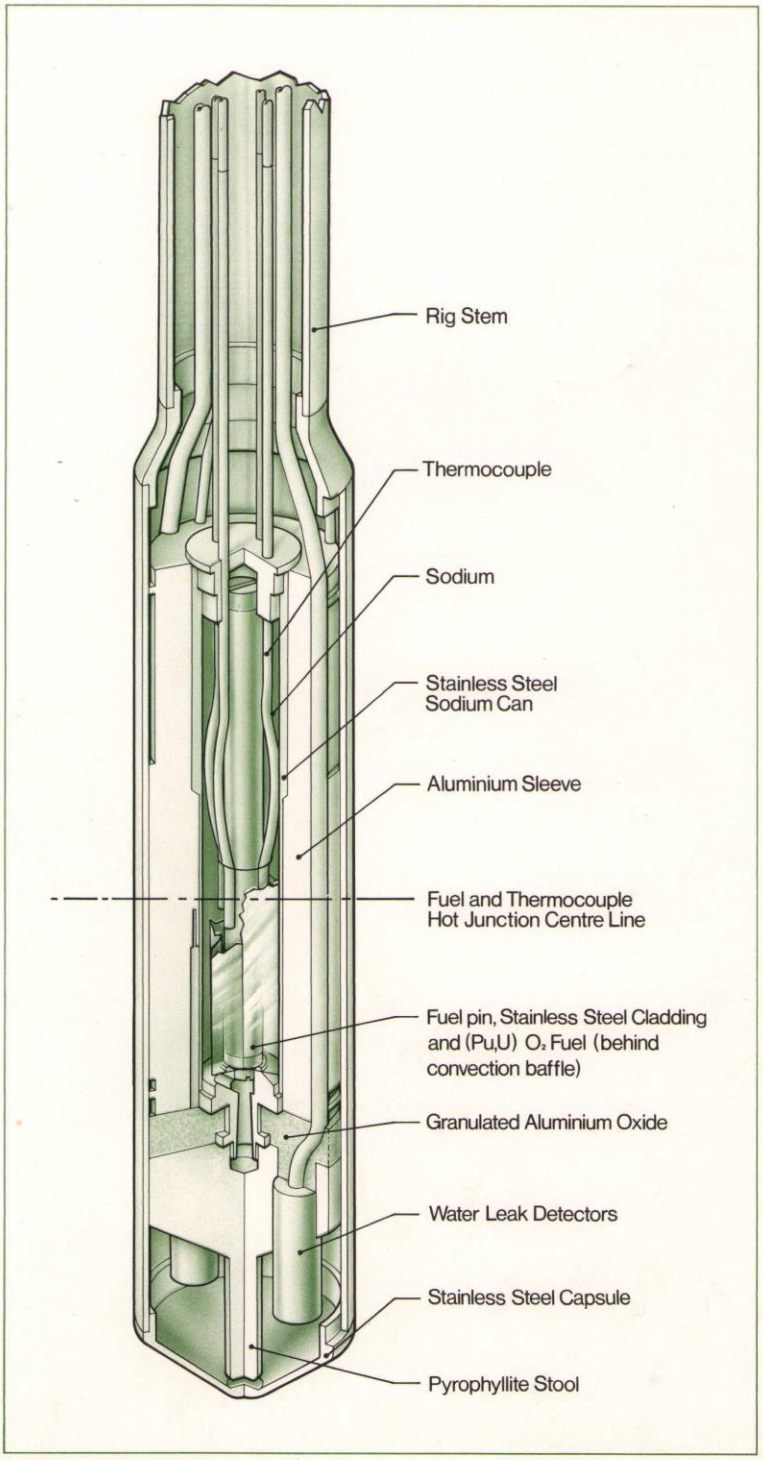
Research Reactors Division

Operational Power-Transient Experiments

A rig is available for experiments aimed at determining the effect of a fairly small, randomly timed, power transient on an oxide fuel pin during an otherwise steady irradiation. Such a transient might occur during the operation of a power reactor and, although not severe enough to require the reactor to be immediately shut down, might affect subsequent fuel performance. The complete experiment entails irradiations of similar fuel pins with and without power transients during their irradiation period.

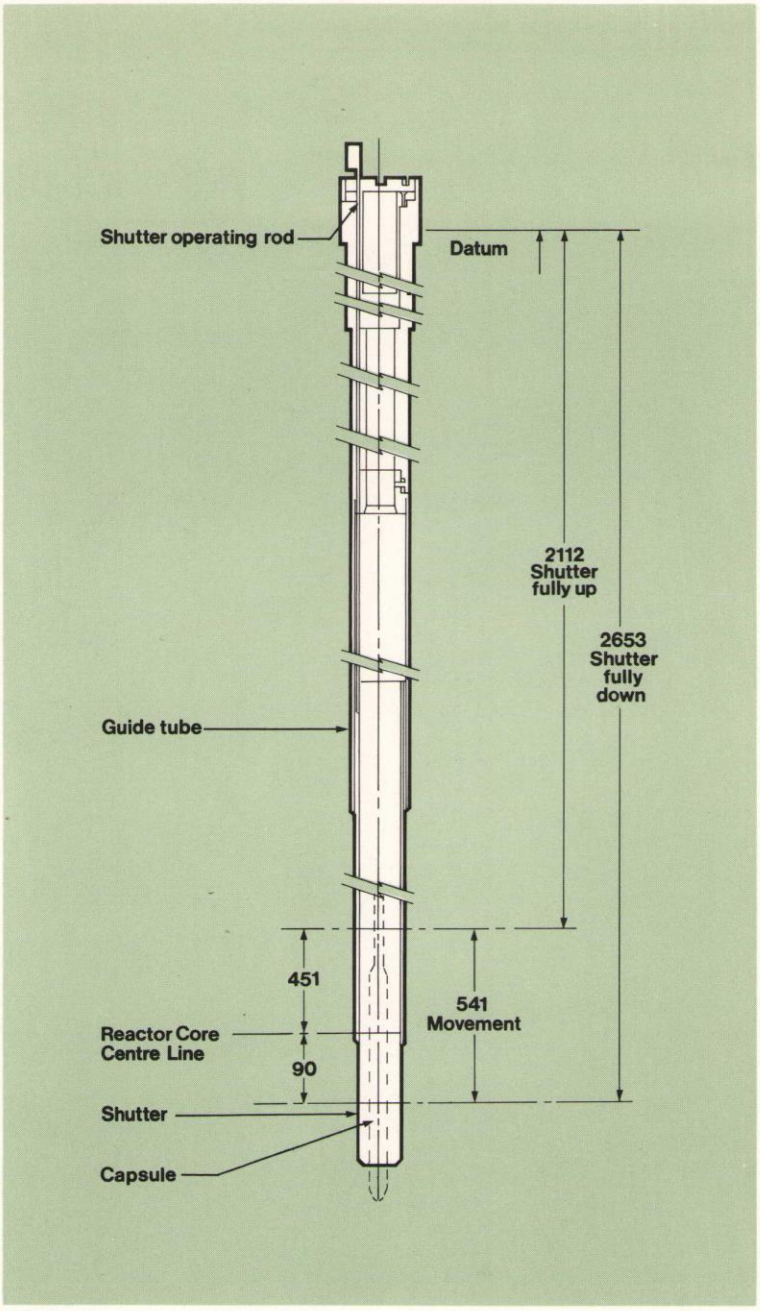
When steady conditions are re-established after the transients, irradiations are contined to the planned level of fuel burn-up. The fuel-pin performance is then assessed by post-irradiation examination.

Standard rack-type stem rigs are used so that the steady-state irradiations can be carried out without the need for special arrangements. The stem rig comprises a capsule containing the fuel pin attached to a metal stem which is suspended from the rig head, and which can be raised and lowered by a rack-and-pinion mechanism. By this means the height of the capsule within the reactor can be varied to maintain a constant heat output from the fuel by compensating for both fuel burn-up and changes in the reactor neutron flux.

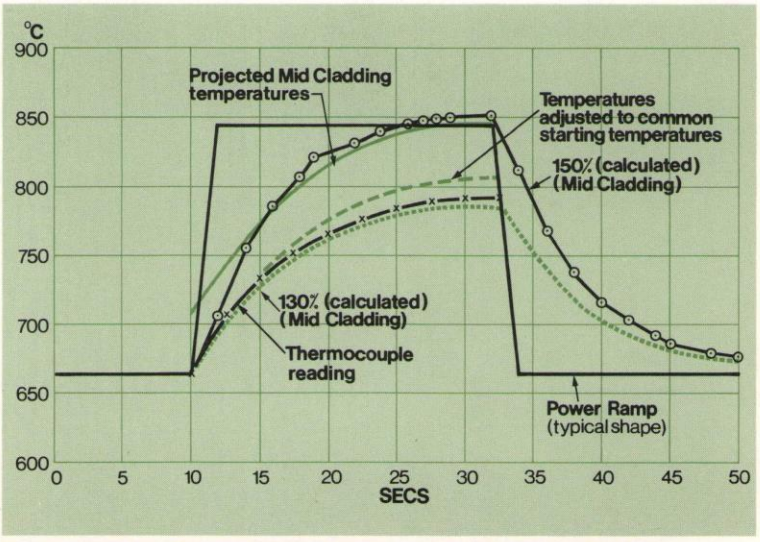


Rig and capsule.

In order to subject the fuel pin to the required transient, rigs are transferred to a higher neutron flux for one or two reactor cycles and the steady-state power maintained in the new position by a neutron shutter placed around the specimen capsule. The higher-flux position thus has to be a larger-diameter hole than that used for the steady-state irradiation, and an adaptor plug provides support for a moving neutron-flux shield. This can be raised vertically clear of the specimen capsule to enhance the neutron flux by the required amount to cause the planned power and temperature transient. Transients of 3 x steady power level are possible.



Shutter.



Transient curves – 2 second power ramp, kept for 20 secs @ 150% power.

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