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SPECIFICATIONS FOR PROTOTYPE IN-CORE
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SPECIFICATIONS FOR PROTOTYPE IN-CORE FLUX MONITORS

INTRODUCTION

A direct means of monitoring and indicating the neutron flux in a reactor core is required to maintain neutron-flux equilibrium and to eliminate hot spots, flux peaking and flux oscillations.

The following operating specifications for an in-core flux monitor are based upon the recognized requirements and operating characteristics for Hanford reactors.

OBJECTIVE

The objective of the following specifications is to present the criteria for development, application, and evaluation of prototype in-core flux monitor systems.

SPECIFICATIONS FOR IN-CORE FLUX MONITORS

1. Minimum range of neutron flux level to be monitored:	2 decades
2. Maximum neutron flux to be monitored:	2×10^{14} nv
3. Normal level of neutron flux while operating:	5×10^{13} nv
4. Normal gamma-ray intensity:	10^8 R/hr
5. Maximum time for the continuous-indicating flux detector to respond to 63% of a $\frac{1}{4}$ decade change in neutron flux level:	60 seconds
6. Maximum response time for a wire traverse flux monitor:	Established by the half life of the neutron-induced gamma-ray activity of the traverse wire.
7. Maximum ambient temperature for continuous-indicating detectors:	50C
8. Maximum ambient temperature for wire-traverse system:	
(a) Water-cooled channel	50C
(b) Normal reactor process-tube channel:	150C
(c) Normal pressurized process-tube channel:	350C
(d) Air-graphite channel:	600-1000C
9. Locations of the flux-traverse wire for continuous-indicating detectors	Front to rear
10. Locations of the flux-profile indices to be built into the wire-traverse system:	$\frac{1}{12}$ and $\frac{11}{12}$ of the front-to-rear dimension of the active core.
11. Locations of the continuous-indicating flux detectors:	$\frac{1}{6}$, $\frac{1}{3}$, $\frac{1}{2}$ or center line, $\frac{2}{3}$, and $\frac{5}{6}$ of the front-to-rear dimension of the active core.
12. Entry point of the signal cables of the continuous-indicating flux detectors and the guide tubes of the wire-traverse monitor:	Front face

13. Preparation of reactor process-tube channels for the continuous-indicating flux detectors is to provide:
- (a) 1" ID, dry, water-cooled channels.
 - (b) Spiral gamma-ray shielding pieces at the front face for signal leads and wire-traverse guide tubes.
 - (c) Neutron-beam shielding at the front face.
 - (d) Means for charging and discharging the detectors, lead wires and wire-traverse guide channels.
14. Each process-tube channel for the continuous-indicating flux monitors is to include:
- (a) Five flux-detectors.
 - (b) One wire-traverse guide tube.
 - (c) Two wire-traverse indices.
15. Minimum number of process-tube channels to be employed for in-core monitoring: 5
16. Wire-traverse guide tubes included in process-tube channels with uranium charges shall:
- (a) Cause minimum disturbance to flow characteristics.
 - (b) Be replaceable. Preferably, replacement of the guide tube shall not be required to charge or discharge uranium.
17. The continuous-indicating flux-monitor system is to provide:
- (a) Continuous visual indications with adjustable alarm trips (high and low) for each detector.
 - (b) A selection-switch system permitting ratio comparisons of any two detectors.
 - (c) Records of each detector by means of a multi-point recorder with provision for obtaining relative or ratio recordings of selected pairs of detectors to determine deviations.
18. Neutron-flux profiles from the wire-traverse system are to be displayed with an X-Y recorder with the active-core length as the X coordinate and the neutron-flux level as the Y coordinate. Indices resulting from absorbers causing perturbations in the neutron flux will appear at 1/12 and 11/12 of the active-core dimension (see #10 above).

The above specifications may required modification as the development program progresses. It is the intent at this time to allow as much freedom for research and development as possible, and yet to specify the minimum and maximum requirements as presently known.

Comments, suggestions, and additions are welcome; please call the author on 2-5336.

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