

Design and Manufacturing of Fuel Basket for Research Reactor

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1. Introduction

The fuel basket is a device as a part of fuel handling system of research reactor. The fuel basket is used to transport a fresh fuel assembly for refueling.

A fresh fuel assembly is loaded into the fuel basket out of the pool water. Next, the fuel basket is move down into the pool platform by using the operation bridge. [1] Then, the fresh fuel assembly is handled by fuel handling tool at submerged condition at all time.

The fuel basket is a transportation means for the fresh fuel assembly under the limited handling condition in the pools.

2. Design

2.1 Structure

The fuel basket consists of storage cell pipe assembly and wire rope. A support block inserted at the bottom of a storage cell pipe to support a fresh fuel assembly. The wire rope is attached to the fuel basket for handling. The end of the wire rope is hung on the hoist of the operation bridge.

The configuration of the fuel basket is presented Figure 1. This fuel basket includes two storage cell pipes for convenience during the commissioning. For normal operation, only one fresh fuel assembly is transported by the fuel basket at each time.

2.2 Safety

The fuel basket is submerged in the pool water for refueling. After refueling work is finished, the fuel basket is lifted up to the pool top. The fuel basket is designed to allow that pool water in the storage cell pipes exits though the holes on the storage cell pipes and the holes on the support blocks during the lift of the fuel basket.

Stainless steel is used for material of the fuel basket to prevent corrosion. And stainless steel has good resistivity against radiation.

As the fuel basket transports a fresh fuel assembly, it is designed to maintain structural integrity under seismic condition.



Fig. 1. Configuration of fuel basket

2.3 Analysis

The fuel basket is designed to withstand seismic load and other loads during earthquake. The structural integrity of the fuel basket is evaluated and ASME Section III, Subsection NF code is applied as a guide for the seismic assessment. [2] Computer Code used for this analysis is ANSYS version 14.0.0. Dead load and seismic load is considered in load condition. As the fuel basket can be placed at the pool top or the pool platform, the analysis is performed with consideration of both cases. It is confirmed through a structural analysis that the fuel basket maintains its structural integrity against the load condition.



Fig. 2. FEM model of fuel basket

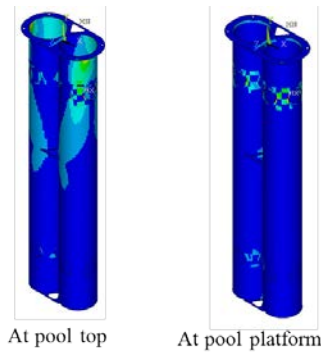


Fig. 3. Analysis results of fuel basket

3. Construction

3.1 Fabrication

Additional attention is paid to the protection of stainless steel from contamination and damage.

3.2 Inspection and Test

The fuel basket is inspected and pre-assembled to verify proper fit, clearance, and integrity.

3.3 Installation

The fuel basket can be placed at the pool top or on at the pool platform. Two interfaces are needed to be check to confirm installation workability of the fuel basket. The first one is a basket hanger which is located at the pool top for installation of the fuel basket. The other one is an opening which exists on the pool platform for installation of the fuel basket. Installation test of the fuel basket is conducted onto both interfaces.

The length of the wire rope of the fuel basket is adjusted during the installation test. Pool and pool structure dimension and operation height of the hoist of the operation bridge are considered to confirm the length of the wire rope.



Fig. 5. Installation test on the pool platform



Fig. 4. Installation test on the basket hanger

4. Summary

Design and manufacturing of the fuel basket are introduced. The fuel basket is for transport of fresh fuel assembly. The fuel basket should be designed, fabricated, and installed with consideration of structural integrity, resistivity to corrosion and radiation, cleaning, and workability.

Acknowledgements

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REFERENCES

- [1] Design and Construction of Operation Bridge for Research Reactor, Transactions of the Korean Nuclear Society Spring Meeting, 2015
- [2] ASME Boiler and Pressure Vessel Code, Section III, Rules for Construction of Nuclear Facility Components, Subsection NF, American Society of Mechanical Engineers, 2004