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A Study on the Remote Measuring Scheme for Modularization of RVI

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1. Introduction

Assembled reactor vessel internals(RVI) at the construction site are complicated and required long time. Therefore, most of their work items are on the critical path of construction schedule. Performed mock-up test to extend of the fabricated portion at manufacture's shop or field erection shop was recommended to contribute meeting the target schedule.

As one of such efforts, core support barrel(CSB), lower support structure(LSS) and core shroud(CS) can be integrated into one module. CSB, LSS/CS module and upper guide structure(UGS) are shown in Figure. 1.

This scheme can reduce the critical path of construction schedule about 8~12 weeks.[1]

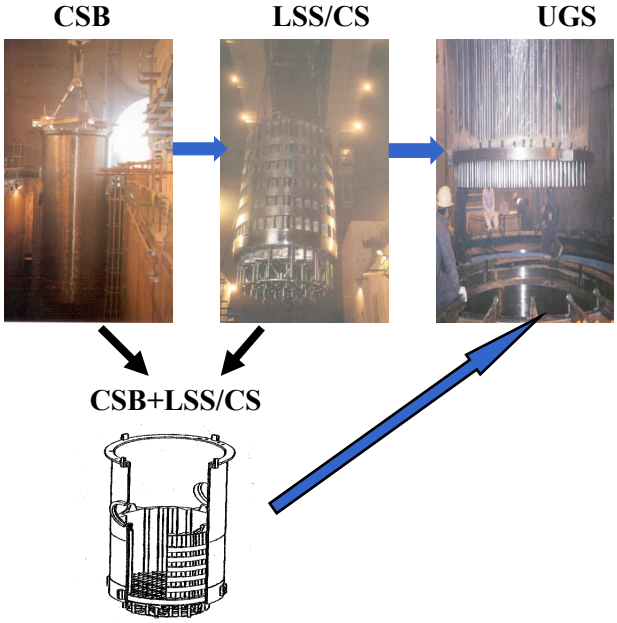

Figure. 1 Layout for RVI Module

However, the installation of RVI module is required new technology to measure gaps and tolerance between reactor vessel and core support barrel. This gaps and tolerance are shown in Figure. 2. The measurement of gaps was recommended an automatically remote method.

As a part of development of construction technology for modularization of RVI[2], Korea Hydro & Nuclear Power Co., Ltd.(KHNP) is researching technology of remote precision measurement for modularization of RVI.

To develop of technology for remote precision measurement of RVI has been researched concepts and design of a sensor for remote precision measurement.[3]

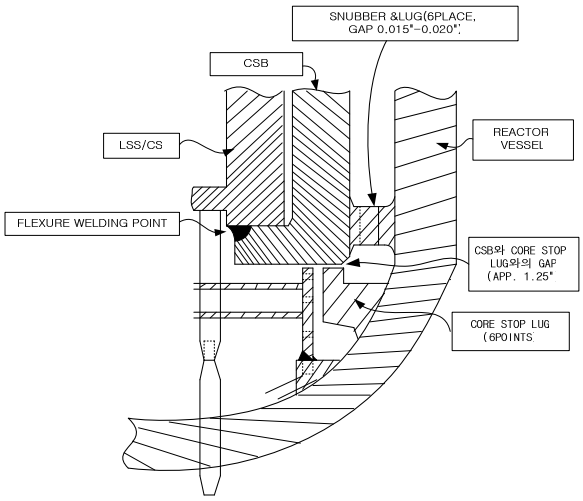

Figure. 2 A Gap of Snubber and Lug

2. Selection of Digital Probe

In this section, concepts and design of a sensor for remote precision measurement are described to apply a method of automatically remote measurement. This is considered that very special conditions and characteristic environment in RVI.

2.1 Concepts of a sensor for remote precision measurement

We studied for roughly six months that homepages and catalogs of precision measurement sensors of worldwide fame to investigate the most suitable sensor for remote precision measurement in RVI. The most important thing is that a concept of remote precision measurement sensor is minimized changes of design and blueprints of the existed RVI.

The first, we investigated contact and non contact sensors. In comparison with contact and non contact sensors, contact sensors ware ascertained that were suitable of more than non contact sensors. because accuracy and resolution of contact sensors are excellent and outer diameter of probe head is short. So that changes of design and blueprints of existed RVI can be minimized.

Purposes of remote precision measurement in RVI, the first is calculated the thickness of shims of reactor

core stabilizing lug, the second is measured gaps of reactor core stabilizing lug and CSB snubber lug.

2.2 Proposal of Specifications of a sensor for remote precision measurement

This paper proposed specifications of a sensor for remote precision measurement.

Proposal of Specifications of a sensor for development of RVI modularization is shown in Table.1

Table.1 Proposal of Specifications of a Sensor for Remote Precision Measurement

Shape of sensor	Probe
Type of sensor	Contact, Digital
Outer diameter of probe Head	⌀ 8mm or below
Length of probe head	117.6mm or over
Backward space of CSB snubber lug hole	From hole enterance 147.3mm or below
Measured range	50mm or over
Resolution	25.4 ㎛ or below
Accuracy	±12.7 ㎛ or below
Operation temperature	No relation
Distance of remote measurement	Minimum 25m or over
Driving power	Electric or Pneumatic
Numbers of synchronous measurement	Minimum 72 points or over
Operation tool	Computer based

2.3 Design of a sensor for remote precision measurement

A perfectly satisfactory sensor of Table. 1 is not existed but we select a sensor short of measured range.

Therefore we must research for a solution of unsatisfactory specifications. A solution is block gauge.

Gauge block on a sensor for remote precision measurement is applicable to extend measured range.

Before remote precision measurement, gauge block was adhered on measured position for extension of 35mm.

Also, we design fixing tool for setting of a sensor for remote precision measurement.

A Fixing device combined with a sensor for remote precision measurement is shown in Figure. 3 and a concept for remote precision measurement in RVI is shown in Figure. 4.

Figure. 3 Fixing Device Combined with a Sensor for Remote Precision Measurement

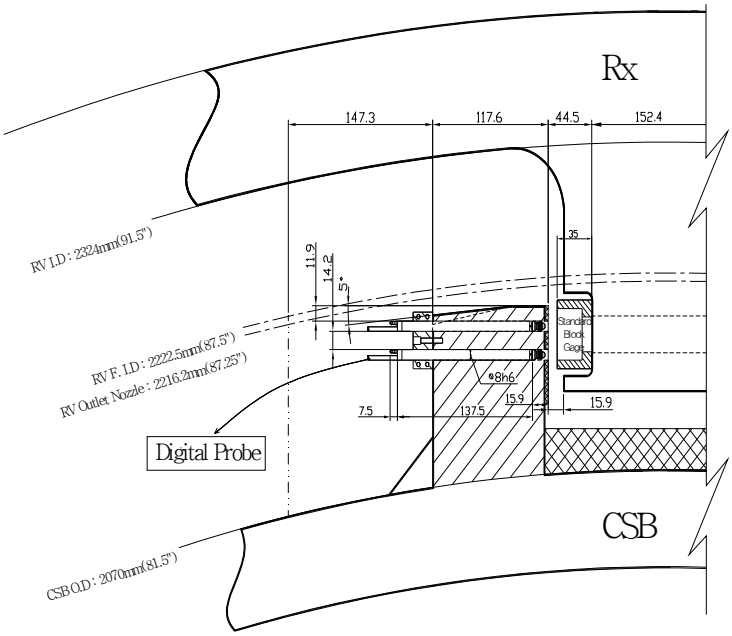

Figure. 4 A Concept for Remote Precision Measurement in RVI

3. Conclusion

Reactor is the most key element of nuclear power plants and an installation period of reactor is for about 8 ~ 10 months to be required so that a purpose of this paper is to reduce an installation period of this part.

Technology for remote precision measurement of RVI can be developed by design and development of model system, and this model system is in needed the most suitable of a sensor for remote precision measurement in consideration of very special conditions and characteristic environment in RVI.

A proposed sensor for remote precision measurement on this paper will be useful for development of model system.

REFERENCES

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[2]NETEC(KHNP), Constuctibility Study Report for Development of Next Generation Reactor, KHNP(NETEC), TR. A99NJ13.P2002.Shin2, pp. 633-672, 2002.

[3]ABB-CE, Support Work Agreement Work Order Delivery H-4, KEPCO, 1995.