

Result of the Third Visual Inspection of In-pool Components in HANARO

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1. Introduction

The visual inspection has been carried out every five years for the components of the reactor structure assembly, reactor control units, and beam tubes in HANARO since the first inspection in October 2000 [1]. It is a part of the in-service inspection (ISI) program to assess the status of in-pool components which are classified into ASME safety category III for the safe operation of the reactor [2]. VT-3 Examination is applied to the verification of the mechanical and structural integrity according to IWA-2210 in ASME SEC. XI [3]. The focus of this inspection is to examine the surface condition of the components for corrosion, erosion, wear, debris, and fastening status of wire-locking on large sized bolts. This paper summarizes the result of the third visual inspection performed in August 2010

2. Methods and Results

2.1 Inspection Scope

The items of the visual inspection for in-pool components in HANARO are as follows (Fig. 1).

Reactor structure assembly and beam tubes

- Wire locking of fastening bolts at inlet plenum, grid plate, reflector vessel, chimney, and expansion joint clamp of beam tubes
- Outer surface (including welding joint) of inlet plenum, grid plate, reflector vessel, neutron detector housing, and beam tube assemblies
- Inner and outer surface (including welding joint) of chimney
- Clearances between top of hexagonal flow tube and inner shell
- Clearances between hexagonal flow tubes

Shutoff (SO) Units

- Hydraulic cylinder, vent screen, and ring bolt
- Track and carriage
- Connection between piston rod and carriage
- Connection between absorber rod and carriage
- Top of absorber rod
- Shroud tube

Control Absorber (CA) units

- Upper track and carriage
- Damper cylinder

- Connection between upper carriage and upper tie rod
- Upper tie rod
- Connection between middle carriage and upper tie rod
- Middle track and carriage
- Connection between middle carriage and lower carriage
- Lower track and carriage
- Connection between absorber rod and carriage
- Top of absorber rod
- Shroud tube

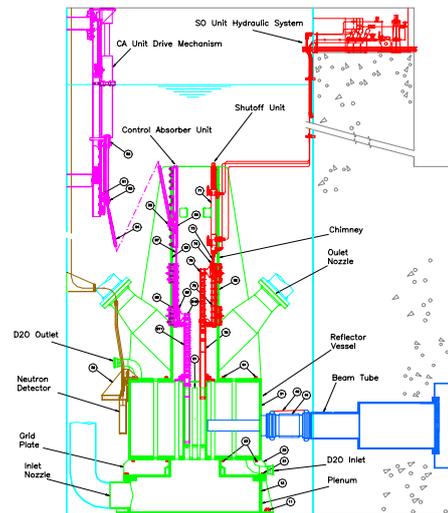


Fig. 1. Side view of the in-pool components

2.2 Inspection tools

A remotely controllable underwater camera has been used for the visual inspection in the pool (Fig. 2). It can be controlled and monitored at the top of the reactor pool with the normal level of the pool water.



(a) Underwater camera (b) Camera controller and monitor

Fig. 2. Inspection tools

2.3 Inspection procedure

According to article 9 in ASME SEC. V, the examination procedure should be demonstrated to be adequate [4]. So an 18% grey card with a fine line 1/32 in. (0.8mm) or less in width was used for validating the procedure. The resolution test of underwater camera using gray card was performed before and after the examination. Level II personnel performed VT-3 examination according to the visual inspection procedure and level III personnel evaluated the results.

2.4 Results

There was no defect of the surface and welding joint of reactor structure and beam tubes. It was also found that the locking conditions of the clamping bolts have been kept well. Clearances of hexagonal flow tubes were the same conditions as those of installation stage. The mechanical and structural integrity of shutoff units and control absorber units were also maintained well and no remarkable defect was found. Fig. 3 shows several pictures of examined components such as flow tube, shroud, absorber, expansion joint of beam tube, neutron detector housing, vent screen, ring bolt, track, and carriage.

3. Conclusions

As one of the in-service inspection, the third visual inspection of in-pool components in HANARO was successfully performed in August 2010 without observing any abnormal conditions. According to the VT-3 procedure, the mechanical and structural status of components, such as clearances, settings, physical displacements, loose or missing parts, debris, corrosion, wear, and erosion was checked out. The next visual inspection of in-pool components will be carried out in 2015.

REFERENCES

- [1] Y. G. Cho, S. I. Woo, J. H. Lee, J. S. Ryu, Y. C. Park, J. S. Woo, and B. J. Jun, "Ageing Management Program for Reactor Components in HANARO", IGOOR9(9th Meeting of The International Group on Research Reactors), 2003.
- [2] Y. G. Cho, "Visual Inspection Procedure for Reactor Components", HANTAP-05-OD-ROP-SI-56-1, HANARO Operation Procedure, KAERI, Sep. 22, 2000
- [3] ASME, "Visual Examination", ASME Sec. XI, IWA-2210, 1998
- [4] ASME, "Visual Examination", ASME Sec. V, Article 9, 1998

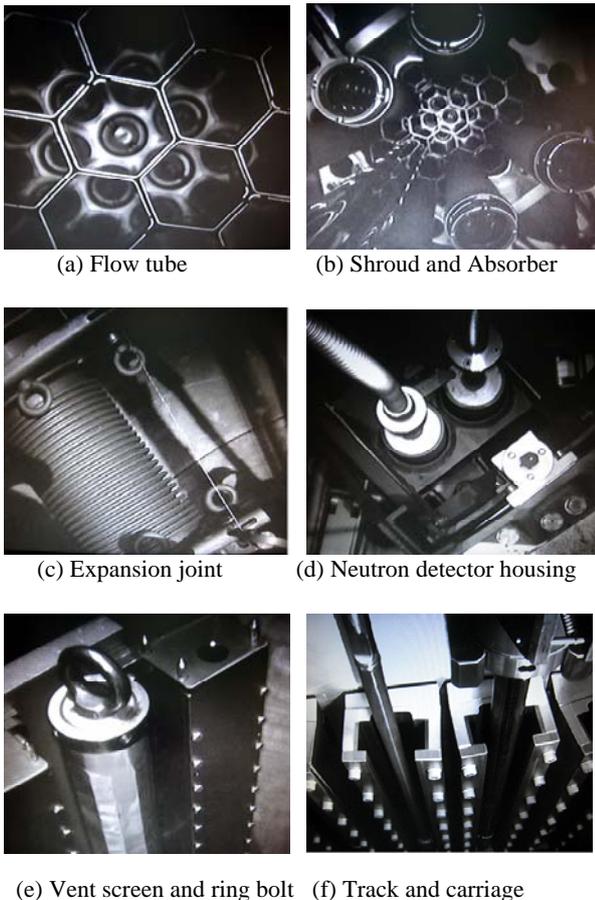


Fig. 3. Pictures of in-pool components examined