

## The Development of a Snubber Management System for Welds in Nuclear Power Plants

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### 1. Introduction

As the increment of operating year of nuclear power plants in Korea, the possibility of deterioration of equipment is higher. Therefore, in-service inspection for the equipment becomes important, which is conducted to confirm the integrity of the equipment periodically. There are snubbers, spring hanger, anchors, rigid supports for the structures which support the static and/or dynamic loads such as thermal load, pressure, impact and vibration from components and pipings of nuclear power plants. Snubbers constrain the displacements generated by loads transmitted to components and systems abruptly. However, they allow displacement generated by temperature change freely.

When the loss of function of snubber during normal operation, the thermal load and pressure transmit directly to structures such as pipings and components, and additional loads, which were not considered during the design stage, act on the structures. Therefore, according to regulatory requirement to confirm the stability of supporting system, the inspection for the snubber is reflected to in-service inspection (ISI) and in-service test (IST) plans. In order to comply with the regulatory requirement, KHNP has performed the ISI and IST and inspected the snubbers. However, there is no system to observe the present situations and conditions of snubbers because the records of snubbers have not been systematically managed in nuclear power plants in Korea.

The development of a system for managing the present situations, inspection results and conditions of snubbers is introduced in this paper.

### 2. Development of a Snubber Management System in Korea

#### 2.1 Present administrative situation for snubbers in Korea

In compliance with the Bulletin 2016-9 and 2016-11 in regulatory requirements of Korean Nuclear Regulatory Body, the snubber has been inspected. There are total 8,429 snubbers, which consist of 1,736 hydraulic snubbers and 6,690 mechanical snubbers, in 24 Korean nuclear power plants. The characteristics classified with power plant are as follows: The Westinghouse type plant such as Kori Unit 1 and 2 has hydraulic snubbers fabricated by Paul Munroe in U. S. A. The plants constructed since Hanbit Unit 3 and 4 have the hydraulic snubbers manufactured by LISEA in

Germany. Hanul Unit 1 and 2 has the snubbers provided by manufactures of French (Hydraulic : QUIRI, Mechanical : Vibrachoc) as other French-designed plants. The snubbers equipped in Hanul Unit 1 and 2 are mainly hydraulic type differently from other plants.

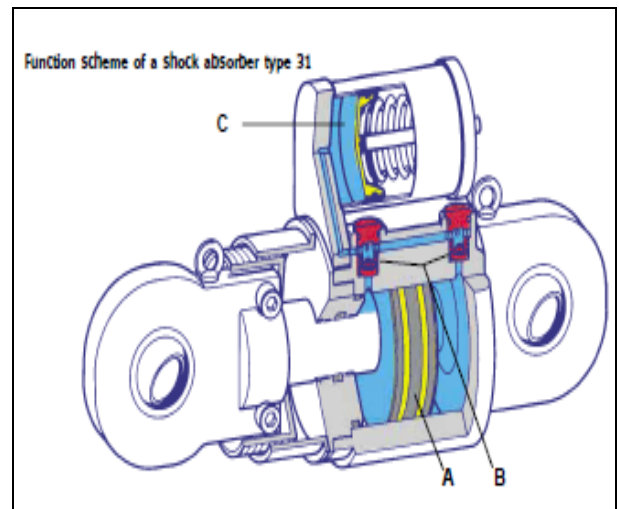


Fig. 1 Hydraulic snubber

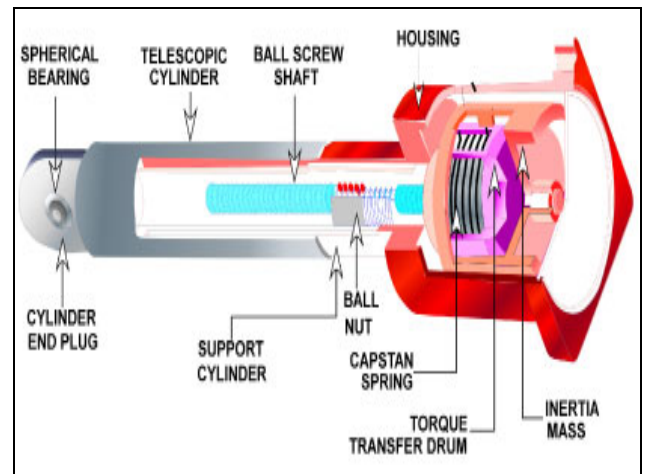


Fig. 2 Mechanical snubber

#### 2.2 Management of situation for snubber system

It was very hard to understand the entire situation of snubbers at a glance because there was no management tool for snubbers as described before. Therefore, KHNP has been developed a snubber management system to show the present situation, inspection results and condition of snubbers.



Fig. 3 Screen for the management of snubber information(example)

Figure 3 shows a screen to input and inquire the snubber situations of entire power plants in Korea. This screen gives the information about the types, procedures, quantities and manufacturers of snubbers. Moreover, the quantities of spare snubbers can be inquired. Therefore, the power plant, in which the spare snubbers are needed, can borrow the snubbers from other plants and the plant can save the procurement time and clear the emergency situation.

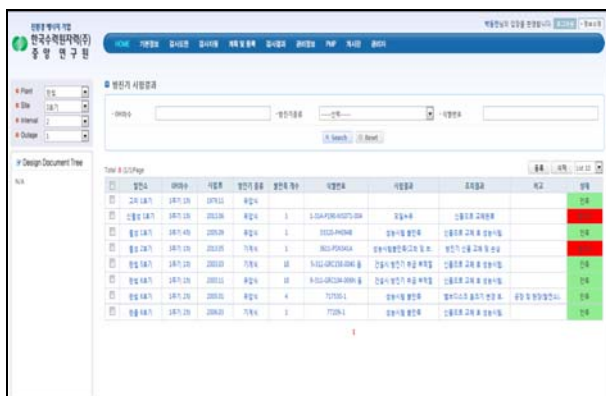


Fig. 4 Screen for inspection results of snubbers(example)

The inspection results for the snubbers in entire nuclear power plants in Korea can be inquired through the screen shown in Fig. 4. The input for the inspection results can be performed only by personnel charged on snubber. The spaces, which show the conditions, are separated to “Satisfied” described with green color or “Unsatisfied” described with red color. Therefore, the snubbers with any problem can be easily distinguished.

As shown by Fig. 5, the conditions of snubbers in entire power plants in Korea can be inquired through map showing conditions of snubbers. The characters in spaces show the inspection dates and the colors in spaces shows the followings:

- Green - Good
- Yellow – Need slight improvement
- Red – Need significant improvement
- Blue – No analysis

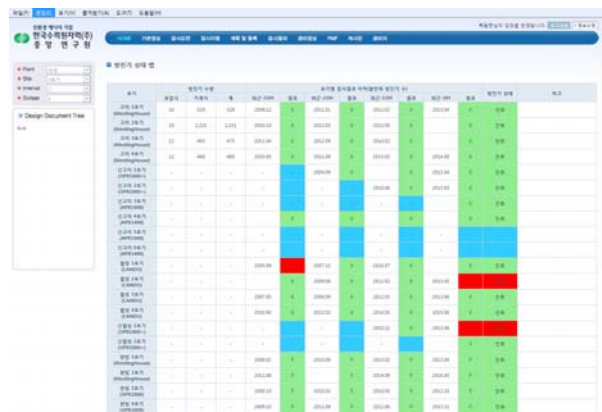


Fig. 5 Map showing conditions of snubbers in entire Korean power plants(example)

### 3. Conclusions

As the increment of operating year of nuclear power plants in Korea, the possibility of deterioration of equipment is higher. Therefore, the security related to the integrity of equipment becomes more important. The snubber takes an important role related to the structural integrity equipped on principal pipings. 100% snubbers are inspected during pre-service inspection and 10% snubbers are inspected during in-service inspection as a sample in nuclear power plants in Korea. KHNP has been developed a snubber management system because there was no management tool for snubbers to show the inspection and maintenance results systematically. The inspection and maintenance results of snubbers can be easily reached by plants, head office and CRI. Moreover, the information related to inspection history and condition of snubber can be effectively inquired. Therefore, the reliance to in-service inspection results can be improved.

### REFERENCES

- [1]ASME Code Subsection XI, IWF-5000, 2000, Inservice Inspection Requirements for Snubbers.
- [2]ASME OM Subsection ISTD, 2000, Preservice and Inservice Examination and Testing of Dynamic Restraints(Snubbers) in LWR NPPs
- [3]KINS, 2004.12, Regulation Guidance and Aging Evaluation for Nuclear Power Plant Snubber PP 2~8
- [4] KHNP CRI, 2011.2 Development of Snubber Service Life Monitoring Guidance for Wolsong #1 NPP.
- [5]USNRC Regulations, 10CFR50.55a, Codes and Standards.
- [6]USNRC NUREC/CR-5870, Results of PWR Snubber Aging Research, 1992
- [7]NRC Inspection Manual, Temporary Instruction 2515/189, 2013.9