Discussion on Personnel Qualification System of Korea Electric Power Industry Code (KEPIC)

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1. Introduction

The technical requirements of KEPIC related to design and inspections for pressure vessels have been developed on the basis of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC), Korea Electric Association (KEA) that is KEPIC maintenance organization is trying to find and improve unreasonable requirements based on the acquired experiences for the continuous construction and operation of NPPs.

In the administrative requirements, KEPIC, unlike ASME, adopted not only mechanical field but also electrical field related to NPPs. Furthermore, the qualifying system for services such as Nondestructive Examination, Heat Treatment, Design and Equipment Qualification Organization was adopted to improve safety and reliability for NPPs.

2. KEPIC Certification Program

2.1 Operational background of KEPIC certification program

The KEPIC certification program is a system that the qualified organizations and personnel by KEA (Korea Electric Association) in accordance with KEPIC requirements perform their appropriate code activities for nuclear safety-related items so as to achieve the safety and reliability goals of electric power facilities, especially nuclear power plants. The KEPIC certification program has been established by referring and modifying certification programs of foreign codes and standards which had previously been applied to domestic industries.

•Correcting the problem that unauthorized foreign certification programs in Korea were applied.
•Easy acquisition of certificates and related information through the program operated by domestic certification and accreditation body.
•Economizing costs needed for acquisition and holding of one or more foreign certificates.

2.2 Scope of KEPIC certification program

A. Organization Certification
- plant owner & designer, manufacturer, installer & constructor, material organization, and service organization,
- authorized inspection agency (AIA),
- pressure relief device testing laboratory,
- equipment qualification (EQ) testing organization.

B. Personnel Qualification
- authorized nuclear inspector/supervisor,
- registered professional engineer (RPE)
- nondestructive inspector.

Fig. 1. Scope of KEPIC Certification Program

2.3 Certification for authorized inspection agency/authorized inspector(Supervisor)

The pressure equipment manufacturer and installer shall be inspected by an authorized inspector who is employed by the Authorized Inspection Agency (AIA). It is necessary for Authorized Inspector and Authorized Inspector Supervisor to take the training program and pass the qualifying examination. And then AIA makes application for their registration to KEA. Scopes are KEPIC-MNX, MIX, SNB, MGB, MGE, MBB. KEPIC-QAI is based on the ASME QAI-1 as the main reference standard and refer to the related contents of the NB Rules and Regulations prescribed by the NBBI.

Table I: Comparison of KEPIC and ASME (AIA)

Description	KEPIC	ASME
Applicable Standard	KEPIC-QAI	ASME QAI-1
Organizations	Independent Organization to Owner, Certificate Holder, and Material Organization	-Enforcement Authority -Insurance Company

Accreditation Body	KEA	ASME
Government Acceptance	Accepted by Regulatory Body, if required	State Government Enforcement

Table 2: Comparison of KEPIC and ASME (ANIS/ANI)

Description	KEPIC	ASME
Applicable Standard	KEPIC-QAI	ASME QAI-1
Standard Establishment·Revision	KEA	ASME
Accreditation body	KEA	NBBI
Other Requirements	Similar except for follows	

The main differences between KEPIC and ASME authorized inspector (supervisor) qualification requirements are as follows.

2.3.1 Authorized nuclear inspector supervisor
▪ Education and experience
- KEPIC :
o shall satisfy one of the following requirements.
(a) graduate of a 4 year accredited engineering or science college or university plus 5 years of experience in quality assurance, including testing or inspection (or both) of equivalent manufacturing, construction, or installation activities. At least 2 years of this experience should be associated with nuclear facilities. or if not, the individual shall have training sufficient to acquaint him thoroughly with the safety aspects of a nuclear facility.
(b) High school graduate, plus 10 years of experience in general quality assurance or engineering, or equivalent manufacturing, construction, or installation activities. Five years of this experience is required in quality assurance, including testing or inspection (or both) of equivalent construction and installation activities. At least 2 years of this experience should be associated with nuclear facilities. or if not, the individual shall have training sufficient to acquaint him thoroughly with the safety aspects of a nuclear facility.
(c) at least 5 years KEPIC-MN related work, which includes inspection under the provisions of the KEPIC-MN.
o shall include the service with at least three nuclear survey teams as a member or as an observer
- ASME :
o shall have been engaged for at least 2 yr of diversified inspection experience in the construction of ASME BPV Code Section Ⅰ, Section Ⅲ or at least 2 yr in the administration of shop inspection services under the reference codes and standards.
o shall include either of the following:
(a) service with at least two nuclear survey teams as a member or as an observer or
(b) serving as a member or observer on one ASME nuclear survey team, plus documented satisfactory completion of a course promulgated by ASME on the conduct of nuclear surveys and administration of ASME nuclear accreditation programs.

2.3.2 Authorized nuclear in-service inspector supervisor
▪ Basic qualifications
- ASME :
o qualified as an Authorized Nuclear Inspector Supervisor (additional items)

2.3.3.1 Authorized nuclear inspector supervisor (Concrete)
▪ Basic qualifications
- ASME :
o shall have qualified as an Authorized Nuclear Inspector Supervisor in accordance with 1-2.1. (additional items)
▪ Education and experience
- KEPIC :
o shall qualify for consideration by meeting one of the following requirements.
(a) graduate of a 4 year accredited engineering or science college or university, plus 5 years of experience in quality assurance, including testing or inspection (or both) of equivalent fabrication or construction activities. At least 2 years of this experience should be associated with the construction or inspection of concrete structures similar to those used in nuclear facilities.
(b) high school graduate, plus 10 years of experience in general quality assurance or engineering, or equivalent fabrication or construction activities. Five years of this experience are required in quality assurance, including testing or inspection (or both) of equivalent construction and installation activities. At least 2 years of this experience shall be associated with the construction or inspection of concrete structures equivalent in complexity to those used in nuclear facilities.
- ASME :
o shall have been engaged in at least 1 yr in design, construction, or inspection of concrete structures similar to those used in nuclear facilities.

2.3.3.2 Authorized nuclear inspector (Concrete)
▪ Education and experience
- KEPIC :
o shall meet one of the following requirements.
(a) A minimum of 2 years of experience in design, construction, or inspection of major concrete structures
(b) Satisfactorily completed an accelerated course acceptable to KEPIC-SN, and the KEA, in the fundamentals of concrete construction and inspection, plus six months of field training in concrete inspection under the Authorized Inspection Agency.
- ASME :

o shall have been engaged for at least 1 yr in design, construction, or inspection of concrete structures similar to those used on nuclear facilities or satisfactorily completed an accelerated course in the fundamentals of concrete construction and inspection.

2.3.4 Authorized nuclear inspector of Boilers and Pressure Vessels

▪ Education and experience

- KEPIC :

o shall meet one of the following requirements.

(a) graduate of a 4 year accredited engineering or science college or university, plus 1 year of experience in design, construction, operation or, inspection activities for power boiler and pressure vessels.

(b) graduate of a two year accredited college, plus three years of experience in design, construction, operation or, inspection activities.

(c) high school graduate, plus 5 years of experience in one of following;

1) construction or maintenance for power boiler and pressure vessels
2) operation for power boiler and pressure vessels
3) inspection for power boiler and pressure vessels

- ASME :

o shall have been engaged for at least 80 hr of diversified experience as an Inspector Trainee under the direct supervision of an Authorized Inspector.

o shall comply with the National Board Rules for Inservice and New Construction Commissioned Inspectors (NB-263) and hold a valid Certificate of Competency(where required).

2.4 Qualification for registered professional engineer (RPE)

RPE reviews the nuclear pressure equipment's design documents, such as the design specifications and design reports, and certifies those documents with an RPE stamping of acceptance. The person who intends to be qualified as a KEPIC RPE must possess the appropriate national technical qualification certificate and must be equipped with enough code knowledge and experiences. Scopes are KEPIC-MNX, SNB. KEPIC-QAR is established by the National Technical Qualification Act and ASME III. App. XXIII, ASME Section III Subsection NCA as reference.

Table 3: Comparison of KEPIC and ASME RPE

Description	KEPIC	ASME
Applicable Standard	KEPIC-QAR	ASME Sec.Ⅲ Div.1 App.
Required National Certificate	- An Engineer (refer to table 4) : 7 years of valid application experience at least 2 of which have been in each specialty field for which he performs certifying activities. - A Professional Engineer (refer to table 4) : 3 years of valid application experience at least 2 of which have been in each specialty field for which he performs certifying activities.	- Registered Professional Engineer in at least on state of the United States or Province of Canada : 4 years of varied application experience at least 2 of which have been in each specialty field for which he performs certifying or review activities.
Review	The Owner, Designer, Certificate Holder(Manufacturer) as applicable, shall review the qualifications of the RPE to assure that his qualifications have been maintained.	The Owner, Designer, N Certificate Holder, or N3 Certificate Holder, as applicable, shall review the qualifications of the PE at least once every 3 years to assure that his qualifications have been maintained.
Accreditation Body	KEA	Certificate Holder

Table 4: Certificates of National Qualification for the Application of RPE

Type	Certificates of National Qualification	
	Professional Engineer	Engineer
RPE-MN (Mechanical)	Industrial Machinery, Construction Equipment, Machine Manufacturing Process Design, Welding	General Machinery, Construction Equipment, Machine Manufacturing Process Design, Welding
RPE-SN (Structural)	Civil Engineering Structures, Civil Engineering Execution,	Civil Engineering, Architecture

	Architectural Structures, Architectural Execution	

Table 5: Comparison of Korean and American Professional Engineer System

Description	Korea	USA
A qualifying examination and managing body	Human Resources Development Service of Korea	Each state
Examination	Written test, career screening, interview in that order	EIT(Engineer In Training) examination
Examination requirements	Those who have more than 4 years of experience in the same technology field after acquiring engineer 1st grade	Those who have graduated from a 4 year science and engineering university and passed the EIT examination + Have at least four years of working experience
Maintain and manage qualifications	Completion of supplementary education every five years	Those who have obtained the qualification of the professional engineer can retain the qualification without renewing the qualification after completing four qualifications.
Design document certification system	X	○

2.5 Qualification for nondestructive inspector

The non-destructive inspection is an important process that is classified as a special process in the process of manufacturing, constructing and repairing electric power facilities. KEPIC-MEN has established the non-destructive inspection field with reference to ASME B&PV Code, Section Ⅴ. KEPIC non-destructive Inspection Technical Standard is based on the qualification system according to the National Technical Qualification Act in order to establish the electric power industry's nondestructive inspection qualification system. Also in order to supplement for the characteristics of the electric power industry, with reference to the ASNT SNT-TC-1 applied in the existing electric power industry and the ISO9712 established as the international standard, the criteria for qualification of non-destructive inspector qualification was established.

Table 6: Qualification Requirement of Nondestructive Inspector (KEPIC-MEN)

Level	Qualification Requirement
1	Obtain qualification to be assessed as equivalent to Non-destructive inspection “Craftsman” by the National Qualifications Act
2	Obtain qualification to be assessed as equivalent to Non-destructive inspection “Industrial Engineer” by the National Qualifications Act
3	At least one year of experience in the field of testing after obtain qualification to be assessed as equivalent to Non-destructive inspection “Engineer” by the National Qualifications Act

3. Plan of improvement for KEPIC personnel qualification system

The KEPIC personnel qualification system is under review for being served as more improved and optimized qualification system to Korean nuclear industry and the draft improvement plans will be introduced as follows. First, in the case of Authorized inspection system, it is difficult to apply the requirements of 2.1.4 of KEPIC-QAI that 'Applicants for a new AIA Certificate of Accreditation require an approval of the Regulatory Authority'. Therefore, the related committee removed the relevant requirements in the 2017 KEPIC addenda, and if the national government needs to be managed in the future, the regulatory body should make a revision by notification. In the case of RPE system, the substitute requirements of certifying or review activities were not specified in detail, that it difficult to apply them. To improve this, it is under review to revision of KEPIC-QAR Annex C and operational guidelines, clarifying requirements for renewal of qualifications such as KEPIC education program. It is also under consideration by the KEPIC Subcommittee that permit US certificate such as PE, SE.

REFERENCES

[1] KEPIC QAI, QAR, MEN (2015 Edition)
[2] ASME-QAI-1 (2016 Edition)
[3] ASME Ⅲ. Appendix XXIII (2001 Edition, 2003 Addenda), Qualification and Duties of Specialized Professional Engineers
[4] ASME B&PV Code, Section V (2013 Edition)