

## Introduction to the KEPIC Nuclear Quality Assurance Certification Program and Feasibility Study of Certification Program for Repair & Replacement Organization

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### 1. Introduction

The Korea Electric Power Industry Code (KEPIC) is a set of integrated standards applicable to the whole phases of design, manufacturing, installation, operation, testing, inspection and maintenance of electric power facilities and components so as to ensure their safety and reliability. It is maintained and developed by Korea Electric Association (KEA).

KEPIC certification program is a system for qualifying the organization in accordance with KEPIC requirements so as to achieve the safety and reliability goals of Nuclear Power Plants (NPPs). The organizations certified by KEA can perform their appropriate code activities for nuclear safety-related items.

KEA is finding its new roles for contributing to safety and reliability of NPPs in operation. It is one of those activities that KEPIC experts are studying a new certification program for repair and replacement organization of NPPs, which has been being operated by the National Board of Boiler and Pressure Vessel Inspectors (NBBI) in USA, but isn't adopted by Korean nuclear industries.

### 2. Introduction to KEPIC

#### 2.1 Generals

The KEPIC has been developed on the basis of referring to the prevailing U.S. codes and standards such which had been already applied to the electric power facilities in Korea. It has been developed by the adaptation of foreign reference standards.

#### 2.2 Structure of KEPIC

In the technical requirements, KEPIC is almost identical to the reference standards such as American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC) in mechanical field, and standards of Institute of Electrical and Electronics Engineers (IEEE) in electrical field.

In administrative requirements, KEPIC has been developed based on ASME BPVC Sec.III NCA "General Requirements" and modified to be suitable for the domestic industrial circumstances and situation in Korea. They have established KEPIC's own certification system for nuclear safety-related items

including nuclear certification, authorized inspection, registered professional engineer (RPE), etc. They have adopted the ISO 9000 quality system and the authorized inspection system for non-nuclear safety related and thermal power items.

Table.1 Reference standards of KEPIC

Part	Subpart	Reference Standards
KEPIC-Q (Quality Assurance)	QAP: Nuclear Quality Assurance	ASME NQA-1
	QAI : Authorized Inspection	ASME QAI-1
	QAR : Registered Professional Engineer	ASME Sec.III. App.XXIII
	QAE : Research Reactors	ASNI/ANS 15.8
	QAO : the operational phase of Nuclear Power Plants	ANSI/ANS 3.2
KEPIC-M (Mechanical)	MN : Nuclear Mechanical Components	ASME Sec.III. Div.1
	MG : Non-nuclear Mechanical Components	ASME Sec.VIII, HEI, API
	MC : Cranes	ASME NOG-1, CMAA 70
	MH : Nuclear Air & Gas Treatment	ASME AG-1
	MD : Materials	ASME Sec.II
	ME : Non-destructive Examination	ASME Sec.V
	MQ: Welding	ASME Sec.IX
	MI : In-service Inspection	ASME Sec.XI
	MO : In-service Testing	ASME OM
	MF : Qualification of Mechanical Equipment	ASME QME-1
	MB : Power Boilers	ASME Sec.I
	MT : Turbine & Generators	Manufacturer's Spec., ASME PTC 6
	MP : Performance Test	ASME PTC
	MM : Maintenance	ASME PCC
KEPIC-E (Electrical)	EN : Nuclear Electrical and I&C	IEEE, ANSI, ISA, etc.
	EM: Measuring & Control Equipment	IEEE, ISA, IEC, etc.

	EE : Electric Equipment	NEMA, IEC, ANSI, etc.
	EC : Cables & Raceways	ASTM, NEMA, IEEE, etc.
	ET : Transmission, Transformation and Distribution	IEC, IEEE, etc.
KEPIC-S (Structural)	SN : Nuclear Structures	ASME Sec.III, ACI 349, etc.
	SG : Non-nuclear Structures	ACI 318, AISC, etc.
	ST : Extra-Provisions for Structures	ASCE 4, 7
	SW : Structural Welding	AWS D1.1, D1.3
KEPIC-N (Nuclear)	NF : Nuclear Fuels	RCC-C, ASTM, etc.
	ND : Design of Nuclear Power Plants	ANS 51.1, etc.
	NR : Radiation Protection Design	ANS 6.4, etc.
	NW : Radioactive Waste Control	ANS 55.1, etc.
	NP : Probabilistic Safety Assessment	ASME RA-S, ANS 58.21
KEPIC-F (Fire)	FP : Fire Protection	NFPA 801, 803, 804, 805, etc.
KEPIC-G (Environmental)	GG : Air Pollution	None
	GS : Noise/Vibration	None
	GW : Water-treatment	None

2.3 KEPIC Committee

KEPIC committees have a KEPIC Policy Committee, 11 technical committees, and 36 subcommittees. Special committees and project committees can be organized if required. Working groups support KEPIC draft review tasks of subcommittees. Each committee is composed of chairman, vice-chairman, members, and a secretary.

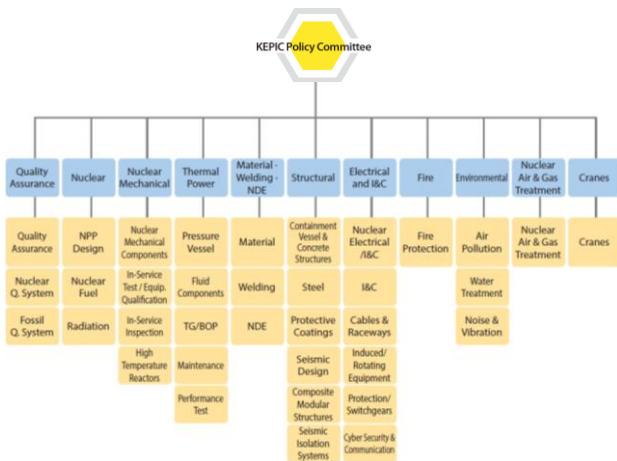


Fig.1 Structure of KEPIC Committees

2.4 Endorsement of Korean government

The Ministry of Science and Technology, previous Korean regulatory body, endorsed the 1995 edition of KEPIC to be used as applicable standards for the construction of NPPs by the Ministerial Notices in 1996. KEPIC has been applied to the construction of the Hanul NPPs unit 5&6 since 1997. And then, KEPIC is being completely applied to the construction of Shin-Kori NPPs in Korea and that of Barakah NPPs in UAE.

Table.2 Endorsement of KEPIC by Government's Notices

Regulatory Body	Notice No.	Notice Title	Applicable KEPIC
Nuclear Safety and Security Commission	2014-31	Guidelines of Application of Technical Standards for Assessment of Continued Operation of Nuclear Reactor Facilities	Adoption of KEPIC-MO
	2016-10	Regulation on Safety Classification and Applicable Codes and Standards for Nuclear Reactor Facilities	Adoption of KEPIC-MN, EN, SNA, SNB (2000 Ed. ~ 2009 Add.) Adoption of KEPIC-SNC, SND (2000 Ed. ~ 2005 Ed.)
	2016-11	Regulation on In-Service Inspection of Nuclear Reactor Facilities	Adoption of KEPIC-MI (2000 Ed. ~ 2009 Add.)
	2016-12	Standards for Safety Valves and Relief Valves of Nuclear Reactor Facilities	Adoption of KEPIC-MN
	2016-13	Detailed Requirements Quality Assurance of Nuclear Reactor Facilities	Adoption of KEPIC-QAP (2000 Ed. ~ 2011 Add.)
	2016-14	Regulation on In-Service Test of Safety-related Pumps and Valves	Adoption of KEPIC=MOA, MOB, MOC, MOD (2005 Ed.)
Ministry of Trade Industry & Energy	2017-26	Electro-technical Regulations	Substitutive Application of KEPIC for Thermal Power Plants

### 3. KEPIC Nuclear Quality Assurance Certification Program

#### 3.1 Introduction to KEPIC certification program

KEPIC certification program is a system that the qualified organizations certified by KEA 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 NPPs.

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. Main characteristics of the program distinguished with that of foreign codes and standards are as follows:

- Correcting the problem that unauthorized foreign certification programs in Korea had been 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.

#### 3.2 Scopes of Organization Certification

The scopes of KEPIC certification program for organization are as follows:

- plant owner & designer, manufacturer, installer & constructor, material organization, and service organization,
- authorized inspection agency (AIA),
- pressure relief device testing laboratory,

KEPIC certification program being similar to ASME's N-type certificate system for pressure equipment (KEPIC-MN), has been extended to class 1E electrical and I&C items (KEPIC-EN), seismic category I reinforced concrete and steel structure (KEPIC-SN), and HVAC (KEPIC-MH). Nuclear safety-related organizations should obtain KEPIC Certificate from KEA in accordance with general requirements of each nuclear standard.

Table 3. Certification organization and work scope

Field	Applicable KEPIC	Organizations	Work Scope
Mechanical	KEPIC-MN	owner, manufacturer, installer, material organization, service organization	Activities for Class 1, 2, 3, MC, and CS components
Electrical and I&C	KEPIC-EN	owner, manufacturer, installer	Activities for Class 1E equipment

Structural	KEPIC-SN	owner, designer, auxiliary item manufacturer, constructor, material org., service organization	Activities for Seismic Category I structures or equipment
HVAC	KEPIC-MH	manufacturer, installer	Safety class air cleaning unit/air conditioning unit and components

#### 3.3 General procedure for KEPIC certificate

The organization seeking the KEPIC certificate would follow the procedure of Table 4.

Table 4. General procedure for KEPIC certificate

Step	Applicable KEPIC	Tasks
1	Deciding items and scope to be certified	Contact KEA for inquiries
2	Collecting related information	Technical specification, purchase order schedule, related KEPIC, etc.
3	Evaluating company's capability	Technical level, facilities, management system, manpower, schedule, etc.
4	Establishing certificate obtaining plan	Objectives, schedule, expediting plan, budget, TFT organizing, etc.
5	Contracting related service	(if needed) authorized inspection, certifying design documents, consulting, etc.
6	Personnel training	Introduction to NPP, KEPIC, QA requirements, etc.
7	Reviewing technical specifications	Materials, design, manufacturing process, documents, record, etc.
8	Establishing QA program	Preparation of QA manual (QAM), working procedures, etc.
9	Performing works (demonstration)	Execution of QAM such as design, procurement, manufacturing, test/inspection, audit, etc.
10	KEPIC survey and obtaining KEPIC certificate	Application to KEPIC certificate and then be surveyed (committee's approval of survey results and then issue of certificate)

### 4. Feasibility Study of Certification Program for Repair & Replacement Organization

#### 4.1 Background

The NBBI established in 1919 to assure the safety and reliability of pressure vessels offers the certificate

of authorization for the repair and replacement of pressure-retaining items.

- R symbol stamp for the repair and/or alteration of boilers, pressure vessels, and other pressure-retaining items.
- VR symbol stamp for the repair of pressure relief devices
- NR symbol stamp for the repair and replacement of nuclear components.

The tendency of putting priority to the safety and reliability of NPPs in operation is getting stronger. A new KEPIC certification program for repair and replacement organization appropriate to domestic status would help improve the safety and reliability of NPPs in operation.

#### *4.2 Works*

KEA organized project committee to study the feasibility of KEPIC certification program for repair and replacement organization.

The project committee is organized with regulatory experts, owners, AIA, members of KEPIC committee, KEPIC consultant and industrial experts experienced in the NBBI certification of authorization.

The goal of this project committee is to study the feasibility of KEPIC certification program for repair and replacement organization and establish the plans for introduction until 2019.

#### *4.3 Major Tasks*

The major scopes of the feasibility study are as followings:

1. Analysis of National Board Inspection Code (NBIC) Part 3, Section 1&5 2017 Ed.
2. Review of the NBBI Certificate of Authorization
3. Research on Domestic Status of Similar Cases.
4. Review of Correlations with Nuclear Law

### **5. Future Works**

The kick-off meeting of project committee was held on December, 2017 and established the detailed promotion plan.

The project committee aims to finish the feasibility study of certification program for repair and replacement organization by reviewing the NBBI NR certificate program, NBIC, Domestic Status, and Correlations with Nuclear law up to the end of 2018. In 2019, a draft prepared by project committee will be deliberated by subcommittee on nuclear quality system and committee on quality assurance.

### **REFERENCES**

- [1] National Board Inspection Code Part 3, The National Board of Boiler and Pressure Vessel Inspectors, 2017
- [2] Brochure of KEPIC Electric Power Industry Code, Korea Electric Association, 2017