Technical Verification Method of Several CGI Dedication Components for the Class 1E Electric Power Source

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1. Introduction

Since the last 1980s, according to the reduction of new nuclear power plant construction market, many equipment suppliers abandon their nuclear quality assurance system of nuclear safety-related items. It was more difficult to purchase. Therefore, rapidly growing demand for nuclear power plant safety-related items can be purchased only common grade items. Therefore, General components is growing interest in use instead of safety-related items with regard to the functionality and performance. Thus, the General Components of a grade raised to buy and then give consistency to the management of relevant agencies of the United States federal laws, quality assurance requirements and guidelines to create, complement and, in the domestic equivalent of the NPP guidelines apply being. CGI Dedication target is a components of SRDC(Safety-Related Divisionalized Cabinet) which is one part of RMS applied in Shin-Kori 1•2, shin-wolseong1•2, According to the guidelines, it accomplished a CGI Dedication in about three kind components. In this paper, according to CGI Dedication Program from in the process which is accomplished it presents a technical verification method in about performance and functionality of the components.

2. Methods and Results

CGI Dedication acceptance of the EPRI NP-5652 is presented in the alternative, or a combination of 4 methods to determine the acceptance, 10 CFR 21 in the four kinds of ways: Method 1 (the special test / inspection) and the remaining three kinds of mandatory performance how is the necessary complement to perform[1][2][3]. In this paper, Fig. 1 also shown in the three kind of power connection components(Surge Protector, Noise Filter, Fuse) against the part about the performance and features a special test/inspection methods are presented, the results are derived.
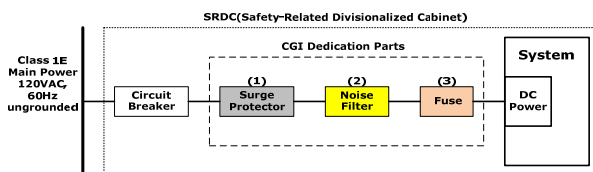

Fig. 1 Diagram of SRDC Electric Power Source

CGI Dedication components of the performance and functionality verification of the technical methods and procedures in Fig.2 , such as is performed.
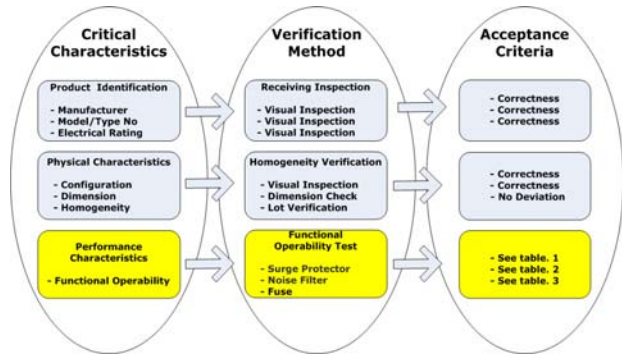

Fig. 2 Procedure of Technical verification

2.1 Surge Protector

Commercial grade Surge Protector was used through the procedure of the CGI Dedication program may be used in safety-related items, Surge protector's technical verification of the performance and features process is ongoing such as Fig. 3 .
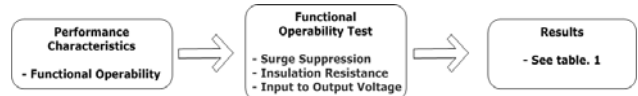

Fig. 3 Critical verification method of surge protector

TSP/SDF120(Manu. : PSI)is used as a surge protector and performance characteristic is as follow: maximum urge capacity: 65kA/Mode, 130kA/Phase, dual surge protection circuit, a written history: ANSI / IEEE C62.41 Cat C1 wave is more than 1000. Therefore, Functional Operability Test for the Surge Suppression and Insulation Resistance, Input to Output Voltage Test is performed. Surge Suppression of the IEEE C62.41, 45 according to the Surge Combination, Ringwave be verified through testing[4].
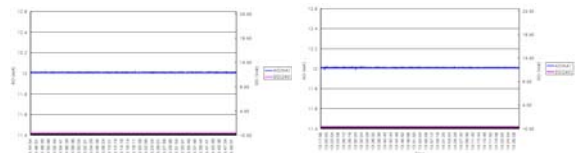

Fig. 4 Combination   Fig. 5 Ringwave

Surge suppression test procedure is as follows.
1. Surge Combination test is accomplished on condition of ±3.0KV peak /1.5kA.
2. Surge Ring wave test is accomplished on condition of ±3.0kV peak.

The result was confirmed analog output value when analog input value is 12mA and shown in Fig. 4, Fig. 5.

Surge Protector's Insulation Resistance shall be measured and recorded. Acceptance criteria of the insulation resistance should be R> 100MΩ. Input to Output Voltage Test shall be measured and recorded when input voltage 120VAC was supplied. Test results shown in Table. 1.

Table. 1 The result of Surge Protector test

CGI Model. No. (Manu.)	Test Requirement and Acceptance Criteria				Result Accept /Reject
	Surge Suppression	Insulation Resistance	Input/Output Voltage Test		
		R > 100MΩ	Input	Output	
TSP/SDF 120(PSI)	**See, Fig. 4 Fig. 5**	**550 MΩ**	**121.2**	**121.1**	**Accept**

2.2 Noise Filter

Noise filter's technical verification of the performance and features process is ongoing such as fig. 4.
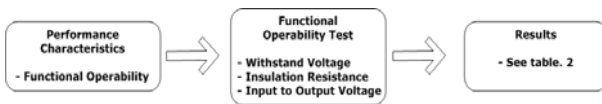

Fig. 4 Critical verification method of noise filter

ES1-T10(Manu. : dongiltech) is used as a noise filter and performance characteristic is as follow: lated 250VAC lated voltage, 10A lated current, leakage current 0.5Ma, Excellent filtering characteristics for both differential mode and common mode. Therefore, functional operability test for the High-frequency conducted emissions and withstand voltage, Insulation Resistance, Input to Output Voltage Test is performed. High–frequency conducted emissions testing is performed on a 10kHz~10MHz bandwidth, is verified. The result was shown in Fig. 5.
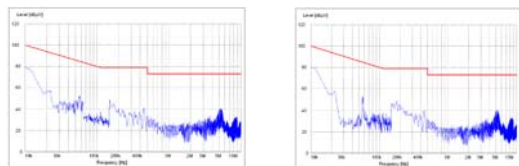

Fig. 5 High-frequency conducted emissions (10kHz ~10MHz), Line and Neutral

The Withstand Voltage shall be tested at 1500VAC for one(1) minute and the results was recorded. Insulation Resistance shall be measured and recorded. Input to Output Voltage Test shall be measured and recorded when input voltage 120VAC was supplied. Test results shown in Table. 2.

Table. 2 The result of Noise Filter test

CGI Model. No. (Manu.)	Test Requirement and Acceptance Criteria				Result Accept /Reject
	Withstand Voltage	Insulation Resistance	Input/Output Voltage Test		
	T > 1 min	R > 100MΩ	Input	Output	
ES1-T10 (Dongiltech)	**Over 1 min**	**171.46GΩ**	**120 V**	**120 V**	**Accept**

2.3 FUSE

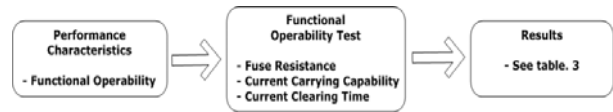Fuse's technical verification of the performance and features process is ongoing such as Fig. 6.

Fig. 6 Critical verification method of fuse

5SA2 31(Manu. : SIEMENS) is used as a fuses and performance characteristic is as follow: 500Vac, 6A. functional operability test for the Resistance, Current Carrying Capability, Current Clearing Time is performed. Resistance shall demonstrate continuously. The fuse resistance is shall not exceed 1Ω. Current Carrying shall be applied 110% current of the fuse rating, and the fuse carrying capacity shall be measured and recorded. Current Clearing Time shall be applied 500% current of the fuse rating, and the fuse clearing time shall be measured and recorded. Test results shown in Table. 3.

Table. 3 The result of Fuse test

CGI Model. No. (Manu.)	Test Requirement and Acceptance Criteria			Result Accept /Reject
	Resistance	Current Carrying	Clearing Time	
	R < 1Ω	T > 15 min.	T < 0.5 sec.	
5SA2 31 (siemens)	**0.0526**	**17 min**	**under 0.5 sec**	**Accept**

3. Conclusion

CGI Dedication is a very important factor for Safety-related systems of nuclear power generating plants. In this paper, we present to the commercial items of a technical verification depending on the nature of the components by using other methods of verification, nuclear safety-related items can be more reliable alternative. According to the digitization of nuclear power plants, dedication items are being diversified. Therefore, Continued research is needed to verify the performance of commercial components.

REFERENCES

[1] EPRI NP-5652, "Guideline for the Utilization of Commercial Grade Items in Nuclear Safety Related Application", 1988
[2] EPRI NP-6406, "Guidelines for the Technical Evaluation of Replacement Items in Nuclear Power Plants",1989
[3] 10 CFR 21, "Reporting of Defects and Noncompliance", 1995.
[4] Reg. Guide 1.180, "Guidelines for Evaluating Electro-magnetic and Radio-Frequency Interference in Safety-Related instrumentation and control system",