Summary of Compliance to the Regulatory Guide 1.152 Revision 4

Non-Proprietary Version

April 2024

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0	April 2024	All	Initial issue

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1.0 INTRODUCTION

This document provides the results of the Mitsubishi Electric Total Advanced Controller (MELTAC) platform compliance evaluation to the requirements of Regulatory Guide 1.152 Revision 4 “CRITERIA FOR PROGRAMMABLE DIGITAL DEVICES IN SAFETY-RELATED SYSTEMS OF NUCLEAR POWER PLANTS” These compliance evaluations are contained in Compliance Matrices (CM) presented in sections 4.3.

This document supports the “Safety System Digital Platform - MELTAC - Topical Report” (JEXU-1041-1008).

2.0 REFERENCES

Table 1 References

No.	Document Name	Document Number	Revision
1	Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants	10 CFR 50 Appendix B	Current
2	Criteria for Programmable Digital Devices in Safety Systems for Nuclear Power Generating Stations	IEEE Std. 7-4.3.2	2016
3	Safety System Digital Platform – MELTAC– Topical Report	JEXU-1041-1008	Current
4	MELTAC Platform ISG-04 Conformance Analysis	JEXU-1041-1015	Current
5	MELTAC Software Program Manual	JEXU-1041-1016	Current
6	Summary of Compliance to the IEEE Std. 603 and IEEE Std. 7-4.3.2	JEXU-1041-1018	Current

3.0 ACRONYMS

Table 2 Acronyms

Acronyms	Terms
CCF	Common Cause Failure
CM	Compliance Matrices
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
DI&C	Digital instrumentation and control
FPGA	Field Programmable Gate Array
F-ROM	Flash Read Only Memory
IC	Integrated Circuit
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input/Output
IPL	Interposing Logic
MELTAC	Mitsubishi Electric Total Advanced Controller
PDD	Programmable Digital Device
PIF	Power Interface
WDT	Watchdog Timer

4.0 MELTAC PLATFORM COMPLIANCE TO REGULATORY GUIDE 1.152 REVISION 4

4.1 Scope

Regulatory Guide 1.152 Revision 4 includes some application specific requirements which are dependent on a plant design. Application specific requirements are identified in each CM and are not evaluated. Only those requirements applicable at the platform level are reviewed against the MELTAC platform.

4.2 Compliance Matrices

The compliance evaluations for the MELTAC platform against the requirements of Regulatory Guide 1.152 Revision 4 have been completed in a matrix format and are provided in sections 4.3.

The following are the columns included in the compliance matrices and content of each column.

Section	The section of the standard being evaluated.
Title	Indicates the title of the evaluated section.
Assessment	Contains the evaluation of the section requirements against the characteristics of the MELTAC platform.
Reference	Identifies the document numbers and applicable sections which support the evaluation provided in the “Assessment” column. No section is given if the entire document is applicable to the evaluation.

4.3 Regulatory Guide 1.152 (Rev.4) Evaluation

Table 3 Regulatory Guide 1.152 (Rev.4) Compliance Matrix

Section	Subsection	Item	Title	Assessment	References <Document Number Sections>
a	-	-	Exceptions	-	-
	(1)	-	-	-	-
		1.1	-	No requirement.	None
		1.2	-	No requirement.	None
b	-	-	Clarification	-	-
	(1)	-	System Integrity	-	-
		1.1	-	The assessment to Clause 5.5 and Annex D of Institute of Electrical and Electronics Engineers (IEEE) Std 7-4.3.2-2016 refers to "Summary of Compliance to the IEEE Std. 603 and IEEE Std. 7-4.3.2 (JEXU-1041-1018)"	JEXK-1041-1018 4.4
		1.1.1	-	No requirement.	None
		1.1.2	-	No requirement.	None
		1.1.3	-	No requirement.	None
		1.2	-	No requirement.	None

Table 3 Regulatory Guide 1.152 (Rev.4) Compliance Matrix

Section	Subsection	Item	Title	Assessment	References <Document Number Sections>
		1.2.1	-		JEXU-1041-1008 4.1.5.2, 4.1.5.5, 4.1.5.7

Table 3 Regulatory Guide 1.152 (Rev.4) Compliance Matrix

Section	Subsection	Item	Title	Assessment	References <Document Number Sections>
		1.2.2	-	The items contained within this section are addressed in each sub-section.	None
		1.2.2 (a)	-	This is an application specific requirement that is dependent on a plant design. Therefore this requirement is not addressed for the MELTAC platform.	None
		1.2.2 (b)	-	This is an application specific requirement that is dependent on a plant design. Therefore this requirement is not addressed for the MELTAC platform.	None
		1.2.2 (c)	-	This is an application specific requirement that is dependent on a plant design. Therefore this requirement is not addressed for the MELTAC platform.	None
		1.2.2 (d)	-	This is an application specific requirement that is dependent on a plant design. Therefore this requirement is not addressed for the MELTAC platform.	None
		1.2.2 (e)	-	This is an application specific requirement that is dependent on a plant design. Therefore this requirement is not addressed for the MELTAC platform.	None
		1.2.3	-	The items contained within this section are addressed in each sub-section.	None
		1.2.3 (a)	-	No requirements beyond IEEE std. 7-4.3.2.	None
		1.2.3 (b)	-	The evaluation of whether the self-diagnostics achieve the same acceptance criteria applied to the manual periodical channel operability test, which is an application-specific item, is performed at the application level.	None

Table 3 Regulatory Guide 1.152 (Rev.4) Compliance Matrix

Section	Subsection	Item	Title	Assessment	References <Document Number Sections>
		1.2.3 (c)	-	The self-diagnostic function for software is executed in memory, and its feasibility can be confirmed by the memory integrity check. The execution confirmation of the self-diagnostic function for hardware is possible only through the actual operation of the target hardware. These confirmations will be planned and performed at the application level. There is no automatic test equipment for self-diagnostics in the MELTAC platform.	JEXU-1041-1008 4.1.7.2
		1.2.3 (d)	-	Periodic verification of self-diagnostics will be planned and executed at application level.	None
		1.3	-	In the MELTAC platform, the Power Interface (PIF) module is the priority module. Priority functions are implemented in the Interposing Logic (IPL) part of the PIF module. The IPL is composed of discrete Integrated Circuits (ICs) whose operations are not dependent on software, and the implemented logic is 100% testable. Therefore, the operation of the IPL is predictable and repeatable, and there are no potential Common Cause Failure (CCF) hazards inherent in the priority function itself. However, the possibility of introducing hazards through the implementation of the priority function into the Digital instrumentation and control (DI&C) system will be evaluated at the application level.	JEXU-1041-1008 4.1.2.4
	(2)	-	Independence	-	-
		2.1	-	The assessment to Clause 5.6 of IEEE Std 7-4.3.2-2016 refers to "Summary of Compliance to the IEEE Std. 603 and IEEE Std. 7-4.3.2 (JEXU-1041-1018)"	JEXU-1041-1018 4.4

Table 3 Regulatory Guide 1.152 (Rev.4) Compliance Matrix

Section	Subsection	Item	Title	Assessment	References <Document Number Sections>
		2.1.1	-	(continue)	JEXU-1041-1015 3.1.10, 3.1.11

Table 3 Regulatory Guide 1.152 (Rev.4) Compliance Matrix

Section	Subsection	Item	Title	Assessment	References <Document Number Sections>
		(continue) 2.1.1	-		

Table 3 Regulatory Guide 1.152 (Rev.4) Compliance Matrix

Section	Subsection	Item	Title	Assessment	References <Document Number Sections>
		2.1.2	-		JEXU-1041-1008 4.4.2 JEXU-1041-1015 3.1.19

Table 3 Regulatory Guide 1.152 (Rev.4) Compliance Matrix

Section	Subsection	Item	Title	Assessment	References <Document Number Sections>
		2.1.3	-	No requirements beyond IEEE std. 7-4.3.2.	-
		2.2	-	No requirements beyond IEEE std. 7-4.3.2.	-
		2.2.1	-	(continue)	JEXU-1041-1015 3.1.4, 3.2.6

Table 3 Regulatory Guide 1.152 (Rev.4) Compliance Matrix

Section	Subsection	Item	Title	Assessment	References <Document Number Sections>
		(continue) 2.2.1	-	(continue)	

Table 3 Regulatory Guide 1.152 (Rev.4) Compliance Matrix

Section	Subsection	Item	Title	Assessment	References <Document Number Sections>
		(continue) 2.2.1	-		JEXU-1041-1008 4.3.2.4
	(3)	-	Control of Access	-	-
		3.1	-	No requirements beyond IEEE std. 7-4.3.2.	None
		3.2	-	No requirements beyond IEEE std. 7-4.3.2.	None
		3.3	-	The items contained within this section are addressed in following sub-section.	None
		3.3.1	-		JEXU-1041-1016 3.2
		3.4	-		None
	(4)	-	Common Cause Failure	-	-

Table 3 Regulatory Guide 1.152 (Rev.4) Compliance Matrix

Section	Subsection	Item	Title	Assessment	References <Document Number Sections>
		4.1	-	No requirements	None
		4.2	-	Since it is dependent on plant's instrumentation and control system designs whether the consequence of potential software CCFs is acceptable or not, the D3 analysis is prepared for each plant-specific application as needed. Interface parts to the diverse actuation system, which are PIF modules, distribution modules and isolation modules, are not subject to any software CCFs because no software elements are included in these modules.	JEXU-1041-1018 4.4 (Clause 5.16)
	(5)	-	Use of Commercial Digital Equipment	-	-
		5.1	-	The MELTAC Platform is not commercial digital equipment. It is produced and supplied under a 10CFR50 Appendix B QA Program.	JEXU-1041-1018 4.4 (Clause 5.17)