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EXTERNAL REFERENCE / VERSION

Technical Specifications (In-Cash Procurement)

55.NE.X0 - Technical specification - FWC for qualification and supply of port-cell electrical harnesses

Technical specification - FWC for Test, prototyping and manufacture of port-cell electrical harnesses for diagnostics [Port Cell Connectors] (55.NE.X0)

Table of Contents

1 Preamble

This Technical Specification is to be read along with the General Management Specification for Service and Supply (GM3S) [1] that constitutes a full part of the technical requirements. In case of conflict, the content of the Technical Specification supersedes the contents of [1].

2 Purpose

This is technical specification for the Framework Contract dedicated to the qualification tests, manufacturing and delivery of the ITER Diagnostics Ex-Vessel Electrical Connector harnesses for use inside the Port-Cells. These Connector harnesses belong to the 55.NE.X0 – Diagnostics Ex-Vessel Electrical Systems.

The Contractor is expected to select and propose COTS components based on technical inputs from the IO, specified in detail in the Task Orders. This specification provides general outlook and requirements towards generic harnesses. During execution of the Framework Contract specific Task Orders will be raised for:

1. Qualification tests of connectors proposed by the supplier to be used with cable types defined by the IO
2. Supply of the previously qualified connectors to the IO in numbers specified within a given task order

The detailed definition of the required qualification tests, manufacturing activity including dedicated requirements, deliverables and expected duration will be described in the specific task order to be raised with the framework contract in question.

The technical specifications are mapped with technical requirements identification numbers.

This technical specification is to be read in combination with the General Management Specification for Service and Supply (GM3S) [1] that constitutes a full part of technical requirements.

In case of conflict, the content of the Technical Specification supersedes the content of [1].

3 Acronyms & Definitions

3.1 Acronyms

The following acronyms are the main ones relevant to this document.

AACH:	Automatic Assembled Connector Harness
ALARA	As Low As Reasonably Achievable
CCL:	Cable Collection List
CH:	Connector Harness
COTS	Components Off-the Shelf
DA:	Domestic Agency
EMC:	Electro-Magnetic Compatibility
GM3S:	General Management Specification for Service and Supply
IO:	ITER Organization
IO-TRO:	ITER Organization Technical Responsible Officer
MP:	Mounting Plate
PBS:	Plant Breakdown Structure

PMCH: Plate Mounted Connector Harness

PIA: Protection Important Activity

PIC: Protection Important Component

SSD: See System Design

SAACH: Semi-Automatic Assembled Connector Harness

For a complete list of ITER abbreviations see: ITER Abbreviations (ITER_D_2MU6W5).

3.2 Definitions

Sub-connector (or Electrical module): shall mean an electromechanical device composed by a bulkhead, that provides a stable platform for male/female contacts and a backshell which provides strain relief, support and environmental sealing against external factors such as electromagnetic interference (EMI) and radio frequency interference (RFI). Refer to Figure 3-1

Manual Sub-connector: shall mean male sub-connectors (with male terminals) with specific features to allow quick and manual mating/de mating operations (e.g. clips).

Mechanical Sub-connector: shall mean male/female sub-connectors (with male/female terminals) to be mounted on a plate.

Connector Harness: shall mean the ensemble of a sub-connector and its related cable tail.

Mounting plate: shall mean the metallic plate where a connector harness is mounted on.

Automatic Assembled Connector: consists of at least two Plate Mounted Connectors Harness that can be mated/de mated with hands-on assisted maintenance tools (e.g. electrical bolt runner or similar device).

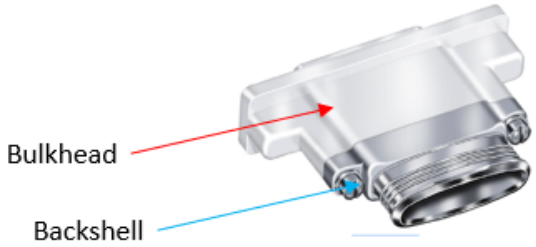

Figure 3-1: Bulkhead and Backshell

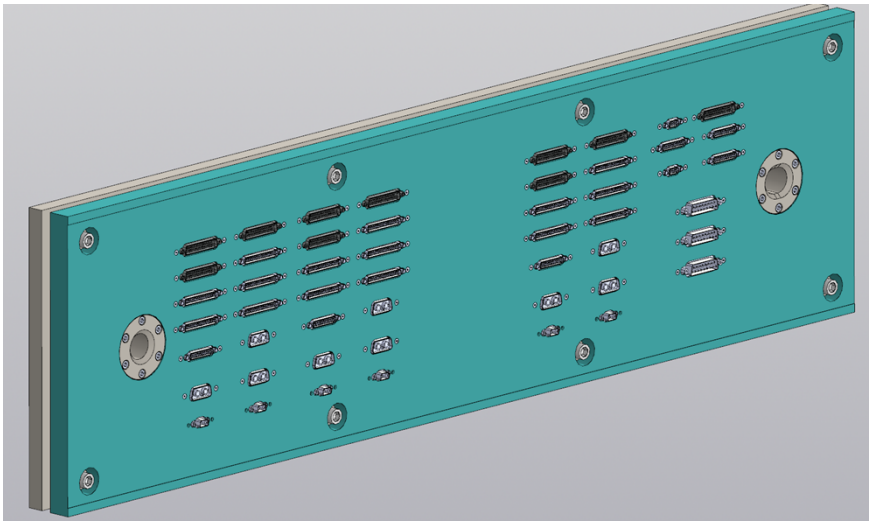

Figure 3-2: Plate with Mounted Connector Harness (with cables not shown)

4 Applicable Documents

The following documents constitute the applicable documents under the scope of this Technical Specification which provide additional details for better understanding of the technical requirements defined. These documents shall be provided at the tender stage.

It is the responsibility of the Contractor to identify and request for any documents that would not have been transmitted by IO, including the list of following reference documents.

This Technical Specification takes precedence over the referenced documents. In case of conflicting information, this is the responsibility of the Contractor to seek clarification from IO.

Upon notification of any revision of the applicable document transmitted officially to the Contractor, the Contractor shall advise within 4 weeks of any impact on the execution of the contract. Without any response after this period, no impact will be considered.

Table 1 List of Applicable Documents

Ref	Title	IDM Doc ID	Version
[1]	General Management Specification for Service and Supply (GM3S)	82MXQK	1.4
[2]	Order related 7 February 2012 relating to the general technical regulations applicable to INB-EN	7M2YKF	1.7
[3]	Codes and Standards for ITER Mechanical Components	25EW4K	5.0
[4]	ITER Dimensional Metrology Handbook	46FN9B	2.1
[5]	ITER Requirements Regarding Contractors Release Note	22F52F	5.0
[6]	Procedure for the Usage of the ITER CAD Manual	2F6FTX	1.1
[7]	Procedure for the CAD Management plan	2DWU2M	2.3
[8]	ITER Numbering System for Components and Parts	28QDBS	5.1
[9]	ITER Procedure for Identification and Controls of Items	U344WG	2.2
[10]	Internal Regulations	27WDZW	3.1
[11]	Required Scheduling Standards	7A4588	3.2

Ref	Title	IDM Doc ID	Version
[12]	Quality Requirements for IO Performers	22MFG4	6.3
[13]	IO QA Deviation Request Template	2LRNQP	4.0
[14]	Suppliers Deviation Request Template	2LRNQP	4.0
[15]	Procurement Requirements for Producing a Quality Plan	22MFMW	4.0
[16]	ITER Configuration Management Plan	27LHHE	3.3
[17]	Procedure for implementation of a Manufacturing and Inspection Plan	22MDZD	3.7
[18]	Manufacturing Inspection Plan Template for Manufacturing Database (MDB)	VGDUSJ	2.3
[19]	Working Instruction for Manufacturing Readiness Review	44SZYP	5.1
[20]	ITER Quality Assurance Program,	22K4QX	8.5
[21]	Procedure for management of Deviation Request	2LZJHB	8.1
[22]	MQP L0 ITER Policy on Safety, Security, Quality and Environment Protection	43UJN7	4.0
[23]	Procedure for management of Nonconformities	22F53X	9.1
[24]	Guideline for Identification of the Protection Important Activities	SBYJXD	1.4
[25]	Guideline for identification (Symptoms) of Counterfeit, Fraudulent and Suspect Items (CFSI)	XKUKAX	1.0
[26]	Quality Classification Determination	24VQES	6.0
[27]	NCR Database - Introduction & How to for Suppliers and Contractors	SM2JWP	3.10
[28]	Root Cause Analysis Leaflet	2X4E9A	1.1
[29]	Protection Important Activities and Defined Requirements for All ITER Mechanical PIC Equipment	338G4B	5.0
[30]	Chemical composition and impurity requirements for materials	REYV5V	3.0
[31]	Provisions for Implementation of the Generic Safety Requirements by the External Actors/Interveners	SBSTBM	2.3
[32]	MQP L3 Procedure for Qualification of Commercial-Off-the Shelf Items in the ITER Project	4QPQRW	1.1
[33]	55.NE.X0 - Technical Description for the Port Cell Connectors	X56WGD	3.0
[34]	55.NEX0 Qualification Plan for Port Cell Connectors	4JU59A	1.6

5 Scope of Work

55NEX0-PCBJT-1-I.

The main purpose of the 55.NE.X0 Ex-Vessel Electrical Services is to transmit signals from the in-vessel and in-port plug diagnostic sensors to the cubicles containing the back-end electronics for each diagnostic. The system comprises

1. power and instrumentation and control (I&C) cabling,
2. power distribution boards,
3. cubicles for power and signals located in the ITER Tokamak Building (Bld. 11) and the Diagnostics Building (Bld. 74)
4. Electrical Connector harnesses in the port-cell and interspace environment.

55.NE.X0 is a complex system with a large number of interfaces with "tenant" systems, i.e. diagnostics systems using the services provided by 55.NE.X0 itself.

End of information

55NEX0-PCBJT-2-I.

This Contract is focused on item number of the electrical connector harnesses to be installed in Port Cells. The activities within this Framework scope include:

- Sampling & Qualification
- Manufacturing and Delivery

, which may be released under two or more Task Orders as per IO needs.

End of information

An overview of the scope of the work covered by Framework Contract described in this Technical Specification can be summarised in the following points:

55NEX0-PCBJT-3-I.

The Contractor shall select electrical connectors compliant to the requirements and appropriate to the cables mentioned in the data sheets provided by ITER. It is expected that standard COTS solutions will be proposed. The standard qualification process of COTS to protect IP would be respected as per [32].

End of information

55NEX0-PCBJT-4-I.

The Contractor shall perform qualification tests on these connector harnesses samples according to a pre-defined qualification procedure, including (and not limited to) electrical tests, seismic tests, fire tests, impact tests etc.; some of these tests may be destructive;

End of information

55NEX0-PCBJT-5-I.

The Contractor shall communicate possible technical issues and features that may be relevant for operation and installation of the connectors, provide technical feedbacks, solve technical problems, implement mitigation actions to answer comments/remarks from ITER to obtain final approval;

End of information

55NEX0-PCBJT-6-I.

The Contractor shall provide technical assistance in the preparation and participate as main stakeholder of Manufacturing Readiness Review (MRR), in accordance with the relevant ITER procedures, by preparing relevant documentation in time as per Table 5 with good quality, for what regards the technical scope of this contract.

End of information

55NEX0-PCBJT-7-I.

The Contractor shall manufacture the electrical connectors in accordance with the requirements mentioned in this technical specification and specific task orders, and deliver to IO upon completion.

End of information

55NEX0-PCBJT-1-R.

NOTE: There are Safety Important Components (SIC) within the scope of this work, i.e. SIC connector harnesses, and therefore there are Protection Important Activities (PIA) related to these components (refer to Section 15.4). SIC connector harnesses shall be technically identical as non-SIC one. If any specific PIA is required, its identification shall be performed before start of the activities (e.g. at KOM).

End of requirement

6 Estimated Duration

55NEX0-PCBJT-2-R.

The Framework contract duration shall be for a period of 4 years with an option to extend up to 6 years, commencing from the Kick-Off Meeting (KOM). No work shall be carried out prior to the KOM. Task Orders would be issued with detailed schedule for specific scope of work upon which the duration of each is dependant.

End of requirement

Optional task(s) are also foreseen in the contract, as described in more details in the following Sections.

55NEX0-PCBJT-3-R.

The KOM meeting date, herein called T0, shall be within 4 working weeks from the entry into force of the Contract.

End of requirement

It is the sole discretion of the IO to release or not the foreseen Option(s).

Involved people can be based off-site, with possible visits to the IO work site to be agreed.

7 Work Description

7.1 Component Description

55NEX0-PCBJT-4-R.

With the expression “Connector harness” for both non-SIC and SIC components, the Contractor shall consider the assembly of the following components

a. a mechanical sub-connector consisting of:
   - connector shell
   - electrical contacts
   - housing for contacts
   - backshell with strain relief (carrying the external cables onto the bulkhead)
   - other internal components depending on the selected design (eyelets, fasteners etc.)

b. the external cables exiting the connector’s backshell;
c. the cable braids that protect the external cables;
d. termination of the cable as specified in a delivery Task Order

55NEX0-PCBJT-8-I.

Other components which are needed to complete the mechanical assembly of the connector (mounting plate, mating mechanism, frame etc.), as indicated below in, are designed and manufactured through other sources, outside the scope of this Contract.

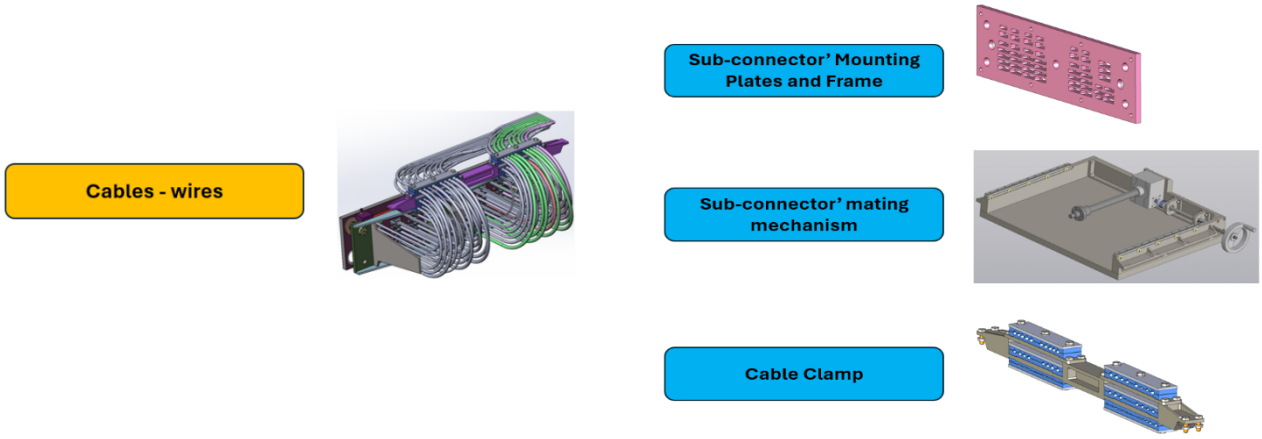

Figure 7-1 Components of connector mechanical assembly interacting with the connector harnesses (the components are out of this Contract Scope)

End of requirement

7.1.1 Port-Cell non-SIC Connector harnesses

55NEX0-PCBJT-5-R.

Port-Cell non-SIC Connector harnesses shall be made of several different types of commercial or custom sub-connectors (e.g. coaxial, fibre-optic, electrical low-power and signal connections, power connections). Sub- connectors shall be manual or mechanical type as defined in section 3.2.

End of requirement

55NEX0-PCBJT-6-R.

The contractor shall provide the quantity of non-SIC connector harnesses required for the qualification tests in accordance with the amount specified in the task order upon its execution.

End of requirement

55NEX0-PCBJT-7-R.

The contractor shall deliver the quantity of connector harnesses required for IO Operation in accordance with the amount specified in the task order upon its execution.

End of requirement

55NEX0-PCBJT-9-I.

22 batches, each containing approximately 1200 connectors, are expected. In this number approximately 80% will be multipin electrical connectors, 15% coaxial connectors, 5% fibre optical connectors. Each of these groups if subdivided further by types.

The quantities and dates set forth here are provided solely for the workload and cost estimation purpose and indicative only. All the actual quantities shall be governed by the task orders issued under this framework contract.

End of Information

55NEX0-PCBJT-10-I.

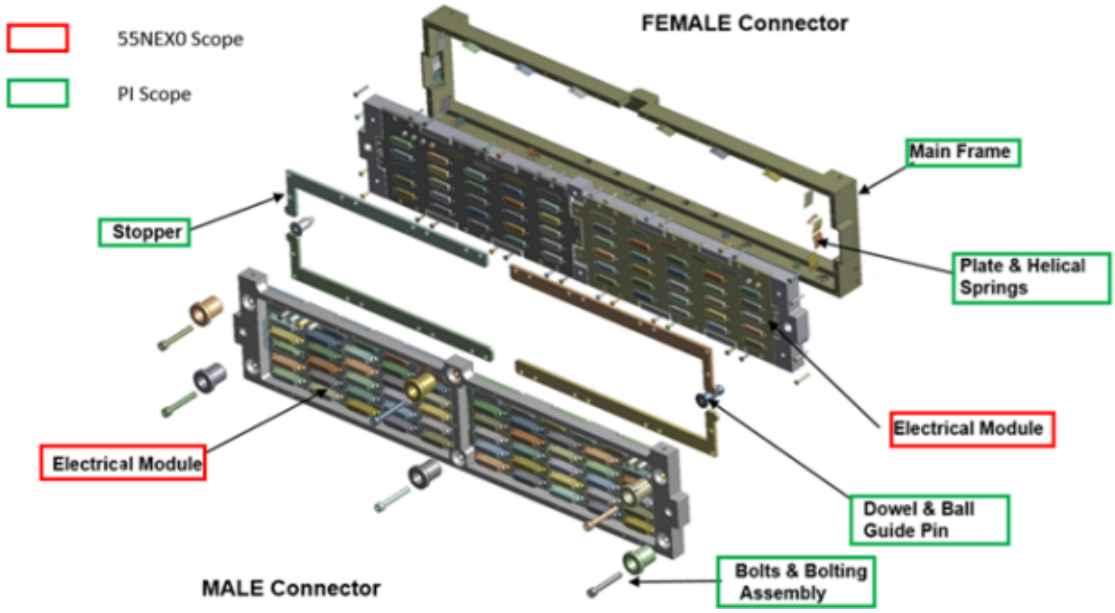

Figure 7-2. Representation of a sub-connector for 55.NEX0 scope, with the scopes marked. This specification concerns the elements marked in red.

Majority of the connector will be of panel-mounted variety, to be mounted on Automatic Assembled Connectors. An example of an exploded view of an Automatic Assembled Connector where the connector harnesses covered by this Framework will be used is given in Figure 7-2. The connector harnesses will be mounted on the the mounting plate, which is then coupled to the external Connector frame. The frame is to be fixed/installed to a supporting structure (e.g. floor,

rail, etc.). The further requirements for connector alignment tolerance and other feature derive from this planned application.

End of information

55NEX0-PCBJT-11-I.

General technical information regarding non-SIC connector harnesses and design drivers is available in [33].

End of Information

7.1.2 Port-Cell SIC Connector harnesses

55NEX0-PCBJT-8-R.

These are electrical connector harnesses identical to those of 7.1.1, but with the fundamental difference that they are classified as Safety Important Components (SIC). By definition, these connector harnesses are designed to withstand severe mechanical loads and simultaneously keep functionality.

End of requirement

55NEX0-PCBJT-9-R.

The contractor shall provide the quantity of SIC connector harnesses required for the qualification tests in accordance with the amount specified in the task order upon its execution.

End of requirement

55NEX0-PCBJT-12-I.

The contractor shall provide the quantity of SIC connector harnesses required for the qualification tests in accordance with the amount specified in the task order upon its execution.

The quantities set forth below are provided solely for the cost-estimation purpose and indicative only. All actual quantities shall be governed by the task orders issued under this framework contract.

Batch#01: Approximately 20 connector harnesses required for SRO belonging to this batch.

Batch#02: Approximately 40 connector harnesses (similar to Batch#01 in terms of types and quantity while signals carried may vary) required for DT phase.

End of Information

55NEX0-PCBJT-10-R.

The same mechanical and electrical features as those outlined for non-SIC connector harnesses apply, unless explicitly stated otherwise. Full features and technical information regarding SIC connector harnesses is available in [33].

End of requirement

7.2 Technical Requirements of Non-SIC connector harnesses

7.2.1 General requirements

55NEX0-PCBJT-13-I.

The length of the cables attached to this connector will vary case-by-case in a range from 5-300m and the cable shall be provided by the IO.

End of Information

55NEX0-PCBJT-11-R.

Backshell configuration. The straight backshell cable entries shall be used.

End of requirement

55NEX0-PCBJT-12-R.

The actual length of the cable tails after the harness is assembled shall be equal to their nominal length (the value shall be specified by the IO in a specific task order) with a precision of -0/+200 mm, or -0/+1% of the cable length, whichever value is higher.

End of requirement

55NEX0-PCBJT-13-R.

The number of pins/sockets per sub-connector shall be specified on a case-by-case basis. The relevant information is provided in Table 2 as reference.

End of requirement

55NEX0-PCBJT-14-R.

55NEX0's connector harnesses shall be constituted by sub-connectors that will respect and combine the design criteria outlined in the following requirements. Meeting these requirements will be confirmed either by implementation in the design or by qualification tests.

End of requirement

55NEX0-PCBJT-15-R.

Maintenance free. The sub-connectors and the connectors shall be maintenance-free.

End of requirement

55NEX0-PCBJT-16-R.

The sub connectors shall be at least compatible with the cables collected in the below Table 2:

Table 2 Max. admissible amount of wires and AWG

AWG	T1 (Twisted Pair*)	TN/TK Thermocouple	T2 Twisted Pair**	Instrumentation and control	Cx/Cy Coaxial, Triaxial	MU Power	FM/FS Fiber	Nx Ethernet

24	32	32	50	50	-	-	Up to 12 cores	8
22	32	32	50	50	-	-		8
20	32	32	50	50	1	16		-
18	10	10	16	12	1	16		-
17	10	10	16	12	1	16		-
16	10	10	16	12	1	16		-
14	4	-	6	6	1	6		-
12	-	-	6	6	1	6		-
10	-	-	-	4	-	4		-
8	-	-	-	4	-	4		-

*with individual shields

**without individual shields

End of requirement

55NEX0-PCBJT-14-I.

The following expected external cable diameter ranges per cable family are provided for information as per Table 3.

Table 3 Expected External Cable Diameter Ranges

Cable type	**Min External cable Diameter [mm]**	**Max External cable Diameter [mm]**
T1 - Twisted pairs with individual and overall shields	5.4	21.0
T2 - Twisted pairs with overall shield without individual shields	4.9	20.1
TN - Type N Thermocouple Nicrosil-Nisil with individual and overall shields	5.4	17.4
TK - Type K Thermocouple Chromel/Alumel with individual and overall shields	5.8	17.5
Cx - Coaxial	2.8	11.0
Cy - Triaxial	6.4	15.2
FM - Multimode fiber	5.3	15.5
FS - Singlemode fiber	8.8	8.9
MS - Multiwire with overall shield	6.1	28.4
Nx - Ethernet	6.5	7.9

MU - Power cable	5.7	20.0

End of Information

55NEX0-PCBJT-15-I.

The expected coaxial/triaxial cable types are listed below. A comprehensive list of requirement shall be made available by IO at a later stage.

- RG11
- RG58
- RG59
- RG174
- RG178
- RG213

End of Information

55NEX0-PCBJT-17-R.

CE Markings shall be implemented in accordance with European directives requirements.

End of requirement

55NEX0-PCBJT-16-I.

Crimping is preferred while wiring to the terminals.

End of information

55NEX0-PCBJT-18-R.

Cables individual shields shall maintain their electrical continuity while passing through the connector. An individual shield shall be terminated and installed as a dedicated pin in the connector.

End of requirement

7.2.2 Design features

55NEX0-PCBJT-19-R.

Low-friction mated sub-connectors. The plate-mounted sub-connectors applied on mounting plates shall be designed to minimise the mating force while maintaining the shell contact resistance as 25mOhm and meeting the EMC requirement. This is to be validated in the qualification test as defined in qualification plan [34].

End of requirement

55NEX0-PCBJT-20-R.

Quick sub-connectors. The cable-mounted connectors shall be equipped with a quick connect fitting, used to provide a fast, make-or-break connection.

End of requirement

55NEX0-PCBJT-21-R.

Blind mate sub-connectors. The sub-connectors shall be blind mate. Therefore, the mating action shall happen via a sliding or snapping action, which can be accomplished without wrenches or other tools with misalignment of ±1 mm between male and female sub-connector.

End of requirement

55NEX0-PCBJT-22-R.

Scoop proof. The sub-connectors shall be scoop-proof, i.e. equipped with a longer shell design on the half (plug or receptacle) of a sub-connector. The longer shell allows the pin contacts, which protrude from the face of the sub-connector, to be recessed sufficiently so as not to be damaged if the mating shell is scooped into it during mating process.

End of requirement

55NEX0-PCBJT-23-R.

Positive locking. The sub-connectors shall be equipped with a mechanism that prevents the fastener to get loose due to constant exposure to vibrations.

End of requirement

55NEX0-PCBJT-24-R.

Mounting. The Supplier shall be able to offer the connectors with the following mounting methods and directions:

- Rear panel-mounted
- Front panel-mounted
- Cable mounted

The exact distribution of types will be given at supply task orders.

End of requirement

55NEX0-PCBJT-25-R.

Strain relief on the backshells. The sub-connectors shall be equipped with strain relief on the backshells (strain relief on cable level).

End of requirement

55NEX0-PCBJT-26-R.

Sub-connectors bulkheads shall be equipped with the guiding features easing the mating operation

End of requirement

55NEX0-PCBJT-27-R.

Connectors' modules shall have **keyways** on their connection interface, to avoid misconnections, between non-relative male and female modules.

End of requirement

7.2.3 Material requirements

55NEX0-PCBJT-28-R.

Material impurities. The sub-connectors are to be made of materials with controlled impurities. Material certificates shall be provided for IO approval before start of manufacturing. General industrial good practices apply in the materials selection.

Table below provides the expected list of materials to be used for different components of the connectors. The supplier may propose the materials outside of the list but needs IO approval to use them and must be able to demonstrate that the relevant requirements are met.

Component Breakdown	Allowed Material	Max. Composition Limits (wt%)
Shell/Backshell	Stainless Steel 316L	Co ≤ 0.05; Nb ≤ 0.01; Ta ≤ 0.01; Ti ≤ 0.10
	Aluminum 6061-T6	Si ≤ 0.8; Fe ≤ 0.7; Cu ≤ 0.4; Mn ≤ 0.15; Mg ≤ 1.2; Cr ≤ 0.35; Zn ≤ 0.25; Ti ≤ 0.15
	Brass	Fe≤ 0.35 %; Ni≤ 0.5 %; Al≤ 0.05 %
Connector Thermocouple Sockets	Nisil	Si ≤ 4.4; Mg ≤ 0.1
	Nicrosil	Cr ≤ 14.2; Si ≤ 1.4; Mg ≤ 0.1
Connector standard Sockets	NiFe Alloy 52	C ≤ 0.05; Si ≤ 0.30; Mn ≤ 0.60; Cr ≤ 0.25; Co ≤ 0.50; P ≤ 0.025; S ≤ 0.025; Al ≤ 0.10
Connector Plug Insulation	PEEK	N/A
	EPDM	N/A

Strain Relief	EPDM	N/A
Internal Cable Insulation	Halogen-Free Polyimide (Kapton, Upilex, Apical, etc.)	N/A
Internal Conductor	Beryllium Copper	N/A
Heat Shrink	EPDM	N/A

End of requirement

55NEX0-PCBJT-29-R.

The connector's and their materials and cables shall comply with **Fire retardancy** as per NFC 32070 C1 and EN 50575 (minimum Euroclass of Cca-1sb-d1a1)

End of requirement

55NEX0-PCBJT-17-I.

Cables for these connectors shall be fire resistant as per: NFC 32070 CR1 or IEC 60331.

End of information

55NEX0-PCBJT-30-R.

The connector's and their materials and cables shall comply with **Low Smoke** as per: IEC 61034.

End of requirement

55NEX0-PCBJT-31-R.

The connector's and their materials and cables shall comply with **Zero Halogen** content as per IEC 60754-1.

End of requirement

55NEX0-PCBJT-32-R.

The connector's and their materials and cables shall comply with **Non Toxicity** as per IEC 60754-2.

End of requirement

55NEX0-PCBJT-33-R.

Sub-connectors shall be made of low-activation materials, as outlined at [30].

End of requirement

55NEX0-PCBJT-34-R.

The connector's and their materials and cables shall comply with **Radiation resistance** up to a total integrated dose of 1 MGy as per IEC 60544-2.

End of requirement

7.3 Technical Requirements of SIC connector harnesses

55NEX0-PCBJT-35-R.

The same technical specification as those required for non-SIC connectors harnesses apply to SIC connector harnesses unequivocally.

End of requirement

The additional safety requirement that outlined from non-SIC connector harnesses is the SIC connector harness shall be normally functional under the Category IV events, which is,

55NEX0-PCBJT-18-I.

Fire proof. For information - the SIC connector harnesses will be protected by a fire-proof protection box. More in particular, as per EN2591-318, the box shall sustain 2h under a 805° C flame without electrical perturbation, plus 14 minutes with no flame propagation. The qualification and production of this fire protection box is out of scope of this contract.

End of Information

55NEX0-PCBJT-36-R.

The SIC sub-connectors shall remain operational during the LOCA III event occurring within 10s with a rapid temperature rise of 140°C, accompanied by a pressure gradient of 60kPa and humidity levels up to 100%.

End of requirement

7.3.1 Qualification requirements

55NEX0-PCBJT-37-R.

Temperature rating. The sub-connectors shall be rated for operation up to 200°C.

End of requirement

55NEX0-PCBJT-38-R.

The supplied connector harnesses dedicated to fibers optic, coaxial, triaxial, ethernet, power cables shall be low leak connectors. The exact leaks values will be provided by the IO in the dedicated Task Orders.

End of requirement

55NEX0-PCBJT-39-R.

Mating force. Mating forces, per each sub-connector, shall not exceed 220 N.

End of requirement

55NEX0-PCBJT-40-R.

Vibrations survivability. The connectors shall be able to survive vibrations coming from assembly and operation as per qualification plan [34].

End of requirement

55NEX0-PCBJT-41-R.

IP Rating. The connector's backshells and bulkheads shall be IP67/68 rated, to prevent the connector's functionality in case of flooding and/or liquid leaks.

End of requirement

55NEX0-PCBJT-42-R.

The sub-connectors shall be able to accept multiple (one or more than 1) cables per sub-connector.

End of requirement

55NEX0-PCBJT-43-R.

EMI Shielded. Sub-connectors shall be shielded against EMI/EMC electromagnetic interference.

End of requirement

55NEX0-PCBJT-44-R.

Most of the sub connectors shall be used for Low Voltage signals (<=1000V). The sub connectors shall be at least compatible with the Low Voltage signal characteristics collected in the below Table 4.

The test voltage for power cables shall be 2U+1000 VAC for 1 minute (minimum 1500 VAC), the exact values for signal connectors shall be specified in a dedicated qualification task order.

Table 4 Signal characteristics

Type	Max Current	Max Voltage DC [V]	Max RMS Voltage AC [V]
Twisted pairs	5 A	500	707
Power/Control	20 A	1000	1000
Power	30 A	400	350
Coaxial (50 Ω)	-	1000 (3000 in case of impedance mismatch)	1000 (3000 in case of impedance mismatch)
Coaxial (75 Ω)	-	1000 (3000 in case of impedance mismatch)	1000 (3000 in case of impedance mismatch)
Triaxial (50 Ω)	10 microA	600	600
Triaxial (75 Ω)	10 microA	600	600
Thermocouple	0.5 A	50	142

End of requirement

8 Common Activities

8.1 General

55NEX0-PCBJT-45-R.

Recurrent and regular Progress Meetings (frequency will be agreed based on the workload) will be held to report on progress, issues, plans etc.

End of requirement

55NEX0-PCBJT-46-R.

The Contractor shall provide 2D diagrams, drawings and 3D models in applicable format as IO requests for testing samples and final manufacturing of the components.

To ensure the correct identification and tagging of components within this scope of work, the Contractor shall follow the [8] and the [9].

End of requirement

55NEX0-PCBJT-47-R.

The Contractor shall promptly investigate and respond the relevant technical inquiries by IO, offering detailed clarifications and recommendations.

End of requirement

55NEX0-PCBJT-48-R.

The manufacturing of connector harnesses testing samples is under the scope of this contract, as specified in the following Sections and relevant Task Orders. These testing samples are to be considered specific to the work specified in the relevant qualification test Task Order and not supplied to IO under a supply Task Order.

End of requirement

55NEX0-PCBJT-49-R.

The Contractor shall produce a compliance matrix demonstrating compliance with the requirements in this specification and relevant Task Order.

End of requirement

55NEX0-PCBJT-50-R.

Requirement Study: the Contractor shall familiarize with the requirements set forth in this Technical Specification and Task Orders, related to the design of these connector harnesses and with the correspondent cable data sheets provided by IO; the output of this step is the list of compatible commercially available connector series (or commercial variations/adaptions) for IO preliminary selection.

End of requirement

8.2 Qualification task orders

55NEX0-PCBJT-51-R.

Sampling: the contractor shall prepare the test samples with requested series and quantity as per relevant Task Order. The contractor shall perform possible variations/adaptations agreed with IO in this step.

End of requirement

55NEX0-PCBJT-52-R.

Qualification Tests: The contractor shall give test activities schedule at the KOM of the given Task Order. IO shall have the right to witness all or a part of the tests. The Contractor shall follow the qualification test sequence and carry out tests according to the following list as per Qualification plan [34]. The contractor shall produce respective qualification reports and shall carefully demonstrate that the required steps laid down in [34] are followed.

End of requirement

55NEX0-PCBJT-53-R.

Refinement: the contractor shall discuss intermediate results with IO before the production of final report. If necessary, refinement of the tests in terms of minor parameter change, or additional information to show (e.g. temperature during the test, environmental monitoring, etc.) shall be implemented.

End of requirement

55NEX0-PCBJT-54-R.

Finalization: the contractor shall produce the final report of the full tests performed and refined according to the previous steps, underlying the adherence to the procedure, carefully justifying the possible deviations, presenting the results. The output of this step is the upload in IDM of the test report.

End of requirement

55NEX0-PCBJT-55-R.

Revision: the Contractor shall answer the comments of IO reviewers on IDM, by amending the report and refining the tests if necessary. The report is then re-uploaded in IDM. The output of this step is the approval of the test report in IDM. Several review iterations may be needed to successfully accomplish this step.

End of requirement

8.3 Supply task orders

55NEX0-PCBJT-56-R.

MRR: before starting manufacturing under a supply Task Order, the contractor shall produce an approved set of documents, including (but not limited to): Detailed Schedule; Manufacturing Readiness Review Plan; Factory Acceptance Test Plan; Drawings; Quality Plan.

These documents (in approved status) shall constitute the input package for the Manufacturing Readiness Review (MRR) of connector harnesses under a given Task Order. The output of this step is the production of the MRR meeting minutes document. The supplier is not required to

prepare and approve new general documents between subsequent Taks Orders if no significant changes occurred (existing documents can be referred to in different MRR inputs).

End of requirement

55NEX0-PCBJT-57-R.

Close MRR Chits and actions: the Contractor shall proceed to the closure of the MRR (and related actions/chits identified during the review, if any) in order to start the manufacturing. The output of this step is the approval of the MRR close-out report (MRR closure) and therefore the authorisation to proceed to the manufacturing of this group of connector harnesses. **The formal approval by IO of all preceding activity outputs and chits resolutions constitute a hold point (HP) for the contract.** This means that any other or successive activity related to this group of connector harnesses shall not be started/continued until the HP is released.

End of requirement

55NEX0-PCBJT-58-R.

Manufacturing: the Contractor shall manufacture the totality of Connector harness as the given task order. The complete manufacturing dossier, including manufacturing drawings, materials certificates, test results and all relevant information shall be submitted to IO IDM for formal review and approval. The IO reserves the right to perform a visit at the Contractor's premises to witness the manufacturing. The output of this step is the notification of readiness for Factory Acceptance Tests (FATs).

End of requirement

55NEX0-PCBJT-59-R.

Factory Acceptance Tests (FATs): the Contractor shall proceed to execute the FATs according to the approved procedure agreed upon MRR. The tests shall be documented and results uploaded in IDM. The output of this step is the approval of the FAT test results. Partial FATs for subsets of manufactured items can be organized while other subsets are still in manufacturing. **This step constitute a hold point (HP) for the contract**. This means that any other or successive activity related to these connector harnesses shall not be started/continued until the HP is released. The release of the Hold Point happens by the formal approval of the above-mentioned document in IDM.

End of requirement

55NEX0-PCBJT-60-R.

Shipping and Delivery: the Contractor shall provide the documentation required by Delivery Readiness Review (DRR) before performing the shipping, also provided in §12.3. Shipping can happen for subsets or types of connector harnesses, as agreed with IO.
The output of this step is the delivery to IO. Until the items are shipped to the IO they shall be stored in clean and dry conditions as defined approved Storage and Preservation Plan.

End of requirement

55NEX0-PCBJT-61-R.

SAT Response: IO will perform the Site Acceptance Tests (SATs) on the delivered items produce a document summarising the results of the SATs. The Contractor shall participate in raising and solving Non-Conformance Reports (NCRs).

End of requirement

55NEX0-PCBJT-62-R.

Additional Inspection Test plan (ITP) for MRR and Transportation Quality Plan for DRR shall be required specially for the port cell SIC Connector Harnesses.

End of requirement

9 Documentation and Test Reports

55NEX0-PCBJT-63-R.

All documents shall be in the English language and each document shall be provided as an electronic file in PDF format. IO may request to provide some underlying information (e.g. test results) in other common file format, if relevant.

End of requirement

9.1 Material acceptance

55NEX0-PCBJT-64-R.

To be accepted, the material shall be proven to conform the requirement as type 3.1 as per [30] and EN 10204: 2004 or ISO 10474:2013. The material certificate shall be submitted to IO for approval.

End of requirement

9.2 Qualification test and FAT reports

55NEX0-PCBJT-65-R.

Qualification test report shall provide the results of all measurements performed on test samples.

End of requirement

55NEX0-PCBJT-66-R.

For each lot of electrical connectors produced, FAT shall be performed at the Contractor's premises according to an approved procedure, before the components are packed and shipped. Cleaning shall be repeated or realized after the test.

End of requirement

55NEX0-PCBJT-67-R.

FAT test report shall provide the results of all measurements performed on each lot.

End of requirement

55NEX0-PCBJT-68-R.

A particular attention shall be paid to the traceability of the measurement. For this purpose, these Qualification test and FAT reports shall include:

a. Blank material identification
b. Lot identification
c. Sample identification
d. Name of the inspection agency, where applicable
e. Test method and measurement sensitivity
f. Test equipment calibration report
g. Test and retest results together with required values
h. Identification of any non-conformity report raised

End of requirement

10 Identification and Marking

55NEX0-PCBJT-69-R.

An agreed methodology for traceably identifying individual electrical connector throughout their processing to IO shall be defined.

End of requirement

55NEX0-PCBJT-70-R.

Any method of physically marking the electrical connector shall not introduce damage or stress which might subsequently affect the electrical performance or be in conflict with other requirements.

End of requirement

11 Cleanliness

55NEX0-PCBJT-71-R.

Final cleaning shall ensure effective cleaning without damage to the surface finish, material properties or metallurgical structure of the materials.

End of requirement

55NEX0-PCBJT-72-R.

During cleaning, particular attention shall be given to the removal of weld spatter, debris and other foreign matter, particularly from the coolant passages and sealing surfaces.

End of requirement

55NEX0-PCBJT-73-R.

The Contractor shall submit to the IO the proposed cleaning procedure for approval/acceptance.

End of requirement

55NEX0-PCBJT-74-R.

Cleanliness test shall be performed at FAT, taking particular account the requirements of RF6000 of RCC-MR 2007.

End of requirement

55NEX0-PCBJT-75-R.

The demonstration of meeting the above cleaning requirements represents a Hold Point (HP).

End of requirement

12 Delivery

55NEX0-PCBJT-76-R.

The Contractor shall deliver all components to IO listed in the given Task Order under this framework contract.

End of requirement

12.1 Labelling and Traceability

55NEX0-PCBJT-77-R.

All components and the main subcomponents shall be clearly marked in a permanent way and in a visible place with the IO official numbering system according to the document "ITER Numbering System for Components and Parts"[8]. A detailed 'IO component identification standard' together with printed label templates and RFID tagging standards will be provided by IO.

End of requirement

12.2 Packing and Handling

55NEX0-PCBJT-78-R.

The Contractor shall produce approved packing, handling and transportation plan and supply accordingly appropriate packaging, adequate to prevent damage during shipping lifting and handling operations.

End of requirement

55NEX0-PCBJT-79-R.

Shock absorbing material shall be used as needed.

End of requirement

55NEX0-PCBJT-80-R.

Any special IO or regulatory transportation requirements shall be documented and provided to the Contractor prior to shipment.

End of requirement

55NEX0-PCBJT-81-R.

To prevent damage and possible contamination during transit, the packaging of components shall be done as soon as possible after acceptance testing and final cleaning at the contractor's premises. Cleaning and packaging operations may be witness by IO.

End of requirement

12.3 Shipment and Delivery

55NEX0-PCBJT-82-R.

Each shipment shall be accompanied by a Delivery Report shall be prepared by the Contractor during DRR, stating as a minimum:

- The packing date;

- The full address of the place of delivery and the name of the person responsible to receive the package, as well as of the Contractor's name and full address;
- Contractor Release Note;
- Packing List;
- Delivery Report
- Certificate of Conformance
- Any additional relevant information on the status of the components.

End of requirement

55NEX0-PCBJT-83-R.

The Delivery Report shall be signed by a representative of the IO and its Contractor. The signature by the IO of the Delivery Report prior to shipment represents a Hold Point (HP).

End of requirement

55NEX0-PCBJT-84-R.

The components shall exclusively be delivered to the ITER Site under the responsibility of the Contractor. ITER Global Logistic Provider (DAHER) is the preferred service supplier.

Before the shipment, a Release Note shall be prepared and approved by the IO.

End of requirement

55NEX0-PCBJT-19-I.

Upon receipt of the package, the IO shall open the package and make a visual inspection of its content to check:

- The integrity of the package, including identifying visible damage;
- The number and type of components contained in the shipment;
- The enclosed documentation;
- The integrity of the components.

End of information

55NEX0-PCBJT-85-R.

The Contractor shall bear the risk of loss or damages to the components during the execution of this Contract up to the successful reception at IO.

End of requirement

55NEX0-PCBJT-86-R.

The components shall be handed over to the IO when they have been delivered in accordance with this Technical Specification and all related documentation have been accepted by the IO, have satisfactorily passed the tests, or commissioning, as the case may be, and a Certificate of Final Acceptance has been issued (Final Acceptance). The Certificate of Final Acceptance shall be signed by both the IO and the Contractor, after the definitive acceptance of each component and its related documentation.

Ownership of the components shall be transferred from the Contractor to the IO upon Final Acceptance at the ITER Site.

End of requirement

55NEX0-PCBJT-87-R.

The transfer of ownership to the IO shall not relieve the Contractor of its obligations under this Contract in case of non-conformities of the components for the duration of the warranty period.

End of requirement

55NEX0-PCBJT-88-R.

The Contractor shall provide a standard commercial warranty covering repair or replacement of the components up to 2 years after the Final Acceptance of the components.

End of requirement

13 Responsibilities

13.1 Contractor's Responsibilities

55NEX0-PCBJT-89-R.

In order to successfully perform the tasks in these Technical Specifications, the Contractor shall:

- Strictly implement the IO procedures, instructions and use templates as identified in Section7;
- Provide experienced and trained resources to perform the tasks;
- Contractor's personnel shall possess the qualifications, professional competence and experience to carry out services in accordance with IO rules and procedures;
- Contractor's personnel shall be bound by the rules and regulations governing the IO ethics, safety and security rules.

End of requirement

13.2 IO's Responsibilities

The IO shall:

- Nominate the Responsible Officer to manage the Contract;
- Organise recurrent meeting(s) on work performed;
- Conduct review on work performed and deliverables in accordance with the timelines stipulated in the give task order.

14 List of Deliverables and due dates

The list of deliverables and due dates for each of the task orders will be outlined in the technical specifications of these specific task orders.

Contractor is requested to prepare their document schedule using the template available in the GM3S Ref appendix II [1].

No element of work or activity shall begin without the prior written notification by the ITER Organization in the form of a Task Order signed by both Parties.

The deliverables will depend on the type of a task, but they shall be well defined before the start of the Task order in question and shall be based on the expertise requested these Technical Specifications. The examples of the deliverables can include, but are not limited to, the following items in Table 5:

Table 5 List of Deliverable Documentation

#	Category	Document Type	Further Description	Expected Stage
P#1	Project Management	Contractor Quality Plan	Contractor shall prepare IO specific quality plan which complies with the procurement requirements of producing a quality plan as §15.3	KOM
P#2	Project Management	Project Execution Plan	As per [1]	KOM
P#3	Project Management	Contract Risk Register	Plan for managing risks associated with implementing the contract	KOM
P#4	Project Management	Detailed Work Schedule (DWS), including documentation schedule	The schedule should be in the form of a fully resourced program based on the Work Breakdown Structure (e.g. Primavera, MS Project), identifying all significant milestones, documentations, deliverables, activities, and their interdependencies, durations and anticipated start and finish dates and the project critical path(s). The detailed schedule proposed at the official Kickoff Meeting by the Contractor, once agreed, will be used as baseline.	KOM
P#5	Project Management	Verification Control Plan (VCP)	The Verification control plan shall consist of a compliance matrix listing all requirements	KOM

P#6	Project Management	Monthly Report	Report of technical progress and issues to be presented at monthly progress meeting.	Monthly
P#7	Project Management	Meeting Minutes	Meeting minutes for Kick-Off meeting and monthly progress meeting, including ad-hoc meetings.	For each meeting
P#8	Project Management	Verification Control Document (VCD)	Requirement Compliance Matrix filled with implementation evidences	Before delivery
T#1	Technical Document	Connector Data sheet	The data sheet shall include electrical and mechanical specifications, dimension specifications, material composition and 2D drawings and 3D models as in §7.1	Requirement Study
T#2	Technical Document	Qualification Test Procedure	Procedure for each sample type of test for qualification as per	Qualification
T#3	Technical Document	Qualification Test Report	Report on qualification test records and results as per §9.2	Qualification
T#4	Technical Document	Inspection and Test Plan	Inspection Plan to control the quality of manufacturing of SIC connectors	MRR
T#5	Technical Document	MRR Chit Resolution Summary	Final Report on chit resolution	MRR
T#6	Technical Document	Clean work plan	Shall specify how cleanliness will be maintained throughout the manufacturing, handling and transportation process	MRR
T#7	Technical Document	Material Certificate	Per batch as per §9.1	MRR
T#8	Technical Document	FAT Plan and procedure	Test procedure for Factory Acceptance	Before FAT
T#9	Technical Document	Certificate of Conformance (CoC)	Standard for COTS	After FAT
T#10	Technical Document	RoHS/REACH Compliance Certificate	Standard for COTS	After FAT
T#11	Technical Document	FAT Report	Test results of FAT	After FAT
T#12	Technical Document	Transportation Quality Plan	As per GM3S[1]	DRR
T#13	Technical Document	Contractor Release Note	As per template provided by the IO	DRR
T#14	Technical Document	Packing List	As per template provided by the IO	DRR

T#15	Technical Document	Delivery Report	As per template provided by the IO	DRR
T#16	Technical Document	Equipment Storage and Preservation Requirement	As per template provided by the IO	DRR

15 Other requirements

15.1 Work Monitoring / Meeting Schedule

Work is monitored through the deliverables defined in the task orders and at recurrent project meetings.

15.2 Acceptance Criteria

55NEX0-PCBJT-90-R.

The deliverables will be posted in the Contractor's dedicated folder in IDM, and the acceptance by the IO will be recorded by their approval by the designated IO representative. This criterion shall be the basis of acceptance by IO following the successful completion of the services.

End of requirement

15.3 Quality Assurance (QA) requirements

55NEX0-PCBJT-91-R.

The organisation conducting these activities should have an ITER approved QA Program or an ISO 9001 accredited quality system.

The general requirements are detailed in Quality Requirements for IO Performers (ITER_D_22MFG4).

End of requirement

55NEX0-PCBJT-92-R.

At minimum 2 weeks prior to the KOM, a preliminary Quality Plan must be submitted for IO approval giving evidence of the above and describing the organisation for this task; the skill of workers involved in the study; any anticipated sub-contractors; and giving details of who will be the independent checker of the activities (see Quality Requirements for IO Performers (ITER_D_22MFG4)).

End of requirement

55NEX0-PCBJT-93-R.

Documentation developed as the result of this task shall be retained by the performer of the task for a minimum of 5 years.

End of requirement

All of the components within the 55.NE.X0 connector harnesses scope are Quality Class 2 (QC 2) with the exception of the SIC connector harnesses, which are Quality Class 1 (QC 1), GM3S [1] section 8 applies in line with the defined Quality Class.

55NEX0-PCBJT-94-R.

The Contractor shall follow the requirements in the ITER Quality Classification Determination [26].

End of requirement

15.4 Safety requirements

ITER is a Nuclear Facility identified in France by the number-INB-174 (“Installation Nucléaire de Base”).

55NEX0-PCBJT-95-R.

For Protection Important Components and in particular Safety Important Class components (SIC), the French Nuclear Regulation must be observed, in application of the Article 14 of the ITER Agreement.

In such case the Contractors and Subcontractors must be informed that:

- The Order 7th February 2012 applies to all the components important for the protection (PIC) and the activities important for the protection (PIA).
- The compliance with the INB-order must be demonstrated in the chain of external contractors.
- In application of article II.2.5.4 of the Order 7th February 2012, contracted activities for supervision purposes are also subject to a supervision done by the Nuclear Operator.

End of requirement

55NEX0-PCBJT-96-R.

For the Protection Important Components, structures and systems of the nuclear facility, and Protection Important Activities the contractor shall ensure that a specific management system is implemented for his own activities and for the activities done by any Contractor and Subcontractor following the requirements of the Order 7th February 2012 [2].

End of requirement

55NEX0-PCBJT-97-R.

The scope under this framework contract does cover PIC components with PIAs, GM3S [1] section 5.3 applies. The PIAs shall be specified in the relevant Task Orders.

End of requirement

15.5 Contract Management

55NEX0-PCBJT-98-R.

Requirement for GM3S [1] section 6 applies in full.

End of requirement