

Technical Specifications (In-Cash Procurement)

Technical Specification of PBS26 TCWS Solenoid Mounting Boxes

The Purpose of this document is to define the design, manufacture, assembly, testing, supply and delivery requirements for the TCWS solenoid mounting boxes

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1 Purpose

The Purpose of this document is to define the design, manufacture, assembly, testing, supply and delivery requirements for the TCWS solenoid mounting boxes.

2 General Scope

TCWS systems are composed of:

- 26PHVV: Primary system in charge to cool the Vacuum Vessel,
- 26PHBD: Primary system in charge to cool the Plasma Facing Components,
- 26PHNB: Primary system in charge to cool Neutral Beam Components (necessary for the heating of the Plasma),
- 26CVBD: Chemical and Volume Control System in charge to maintain proper chemistry of 26PHBD water as well as to compensate for water expansion/contraction in the 26PHBD due to water temperature increase/decrease,
- 26CVNB: Chemical and Volume Control System in charge to maintain proper chemistry of 26PHNB water as well as to compensate for water expansion/contraction in the 26PHNB due to water temperature increase/decreases,
- 26DY00: Drying system in charge to perform drying of the Vacuum Vessel, Plasma Facing Components and Neutral Beam Components in order to allow their replacements in case of failure during operation (to guarantee dry conditions in order to fulfil radioactive waste management requirement),
- 26SA00: Sampling system in charge to allow monitoring of water chemistry of the different systems of TCWS as well as to perform tritium and hydrogen monitoring,
- 26DR00: Drain and Vent system collecting fluids from systems listed above.

ITER project follows a stage approach (i.e. not all systems are installed at the same time but rather in several stages, each stage being defined to validate major design assumptions) and the TCWS subsystems are divided to:

- Systems installed at First Plasma: 26PHVV, 26DR00 and 26DY00 as well as part of 26PHBD (Captive Part) and part of 26SA00,
- Systems installed at Second Plasma: part of 26PHBD (Non-Captive Part), 26PHNB, 26CVBD, 26CVNB and the remaining part of 26SA00.

The scope of this document covers the First Plasma system, knowing that the concept and requirements provided here are identical to the ones that will be applied for Second Plasma system.

In the frame of TCWS system solenoid mounting boxes, the split is roughly 40 % (for First Plasma) and 60 % (for second Plasma). In the rest of the document, TCWS system refers only to First Plasma systems.

3 Definitions

ANB	Accredited Notified Body
AOC	Award of Contract
BOM	Bill of Material
CVCS	Chemical & Volume Control System
DRR	Delivery Readiness Review
DRS	Draining & Refilling System
DYS	Drying System
ELM	Edge Localized Modes
IBED	Integrated Blanket, ELM, Diverter
I&C	Instrumentation and Control
IO	International Organization (ITER)
MIP	Manufacturing and Inspection Plan
NBI	Neutral Beam Injection
NDE	Non-Destructive Examination
PBS	Plant Breakdown Structure
PHTS	Primary Heat Transfer System
PIA	Protection Important Activity
PIC	Protection Important Component Note: In scope of this document, the Protection Important Components are identical with the SIC components
PNI	Part Number of ITER
QA	Quality Assurance
QAP	Quality Assurance Program
QC	Quality Control
SIC	Safety Important Class
TCWS	Tokamak Cooling Water System
VV	Vacuum Vessel

4 General Design Basis

4.1 TCWS Introduction

The TCWS is the primary coolant system of the ITER machine with the functionality to remove the heat generated by the plasma and transferred to dedicated components of the machine and to release it to the secondary coolant system. The TCWS has the following main functions:

- To remove the heat load transferred from the Plasma to the Vacuum Vessel and in-vessel components (e.g. Blanket modules, Diverter, and In-Vessel Coils) with pressurized water (< 130 °C and 4.0 MPa),
- To provide the decay heat cooling,
- To provide hot water (up to 240 °C and 4.4 MPa) and hot nitrogen gas (up to 390 °C and 3.1 MPa) for baking of Vacuum Vessel and In-Vessel Components,
- To confine the activated corrosion products and the tritium potentially contained in the water.

The Tokamak Cooling Water System (TCWS) is comprised of the First Plasma systems and the Second Plasma systems.

The First Plasma systems consist of:

- Vacuum Vessel Primary Heat Transfer System (VV PHTS)
- Draining and Refilling System (DRS)
- Drying System (DYS)

The Second Plasma systems consist of:

- Integrated Blanket, ELM, Diverter Primary Heat Transfer System (IBED PHTS)
- Neutral Beam Injection Primary Heat Transfer System (NBI PHTS)
- Chemical & Volume Control System (CVCS)
- Sampling System

The captive items of the IBED PHTS as well as part of the Sampling System will be installed together with the First Plasma systems.

For additional information regarding TCWS refer to the document [RD12] “TCWS System Description Document (SDD) ([94WLDK](#))”.

4.2 Overall Scope of Supply

1. The purpose of the solenoid mounting box is to provide a physical protection shielding for the solenoid valve and the associated manifold (for scaffolding or equipment installation/removal) as well as to minimize operator time in the room for maintenance activity (solenoid valve and manifold are fitting on a mounting plate which can be clamped to the box on site).
2. The Supplier shall submit a proposal to provide the following equipment requested in this specification:

- a. Solenoid valve mounting boxes,
 - b. Any items required for mounting of the solenoid valves inside the associated solenoid mounting box (such as mounting plate, bolts, etc.)
 - c. Installation of the solenoid valves in the solenoid mounting boxes (including any associated wiring, terminals and compressed air tubing inside the box)
3. Solenoid valves shall be provided by IO as free issue material.
 4. The estimated number of solenoid mounting boxes to be produced and supplied under this contract is in Table 1.

Solenoid mounting boxes	Amount
Individual mounting box for 3/2 solenoid (see Appendix A)	125
Individual mounting box for 5/3 solenoid (see Appendix A)	30
Common mounting box for 6 solenoids (see Appendix A)	40

Table 1: Estimated amount of solenoid mounting boxes

5. The estimated numbers are provided on non-committed basis. The IO may order more or less items as required.
6. The scope of work includes but is not limited to the following:
 - a. Design and manufacturing of the equipment
 - b. Equipment qualification of the SIC equipment, such as preparation of the Qualification Program, execution of tests or analyses, production of the Qualification Report, etc. For equipment already qualified to IO condition, the qualification activity may be restricted to production of qualification reports demonstrating compliance with IO requirements.
 - c. QA/QC activities, such as preparation of Quality Plan, Manufacturing and Inspection Plan (MIP) and test procedures, execution of tests/checks, etc.
 - d. Packing and Shipment activities, such as obtaining necessary approvals from authorities, packaging, insurance, delivery to ITER site, preparation of handling and storage documentation, preparation of as-built documents and manufacturing dossier etc.
7. On-site installation and the on-site tests are excluded from the scope of work.

4.3 Applicable Documents

- [RD1] EDH Part 4: Electromagnetic Compatibility (EMC) ([4B523E](#))
- [RD2] ITER Site Meteorology ([2UT36S](#))
- [RD3] Propagation of the Defined Requirements for Protection Important Components Through the Chain of External Interveners ([BG2GYB](#))

- [RD4] ITER Quality Assurance Program (QAP) ([22K4QX](#))
- [RD5] Requirements for Producing a Quality Plan ([22MFMW](#))
- [RD6] Requirements for Producing an Inspection Plan ([22MDZD](#))
- [RD7] Procedure for management of Nonconformities ([22F53X](#))
- [RD8] List of ITER-INB Protections Important Activities ([PSTTZL](#))
- [RD9] IO / In-Cash Contractor Documentation Exchange and Storage Working Instruction ([G8UMB3](#))
- [RD10] Procedure for the Management of Diagrams and Drawings in pdf format using the SMDD Application ([KFMK2B](#))
- [RD11] Procedure for the Management of Deviation Request ([2LZJHB](#))
- [RD12] TCWS System Description Document (SDD) ([94WLDK](#))
- [RD13] TCWS Load Specification ([SIZE5MR](#))
- [RD14] ITER Procurement Quality Requirements ([22MFG4](#))
- [RD15] ITER Project Management Plan (PMP) ([2NCR3F](#))
- [RD16] Collection of Input Data to support Qualification Plan in charge of TCWS electro-mechanical equipment supplier ([YST3YH](#))
- [RD17] ITER Radiation Protection Professional Guidelines for the Nuclear Pressure Equipment in Application of Order dated 12 December 2005 ([2LTQ96](#))
- [RD18] Provisions for Implementation of the Generic Safety Requirements by the External Actors/Interveners ([SBSTBM](#))
- [RD19] Propagation of the Defined Requirements for Protection Important Components Through the Chain of External Interveners ([BG2GYB](#))
- [RD20] Surveillance Plan for PBS 26 - Cooling Water System ([CAJTAL](#))
- [RD21] Working Instruction for the Delivery Readiness Review (DRR) ([X3NEGB](#))
- [RD22] Release Note Template ([QVEKNQ](#))
- [RD23] Delivery Report Template ([WZPYVZ](#))
- [RD24] Package & Packing List Template ([XBZLNG](#))
- [RD25] Template - Equipment Storage & Preservation Requirements Form ([WU9636](#))
- [RD26] ITER Numbering System for Components and Parts ([28QDBS](#))
- [RD27] Deviation Request - Material chemical composition for TCWS instrumentation ([43QW66](#))

- [RD28] Procedure for ITER CAD Data Exchanges ([2NCULZ](#))
- [RD29] Procedure for the Usage of the ITER CAD Manual ([2F6FTX](#))
- [RD30] Procedure for CAD Management Plan ([2DWU2M](#))
- [RD31] Specification for CAD data Production in ITER direct contracts ([P7Q3J7](#))
- [RD32] CAD Manual 07 – CAD Fact Sheet ([249WUL](#))
- [RD33] Chemical composition and impurity requirements for materials ([REYV5V](#))
- [RD34] Procedure for Analyses and Calculations ([22MAL7](#))
- [RD35] Instructions for the Storage of Analysis Models ([U34WF3](#))
- [RD36] Instructions for Structural Analyses ([35BVV3](#))
- [RD37] Allowable values and limits in service level C and D for ITER mechanical components ([3G3SYJ](#))
- [RD38] Equipment Specification for piping materials used in the design of process piping system ([SJE6S7](#))
- [RD39] EDH Part 5: Earthing and Lightning Protection ([4B7ZDG](#))
- [RD40] TCWS AVN Solenoid Shielded Box – Assembly Drawing ([38BMTF](#))
- [RD41] TCWS AVN Solenoid Wall Mounted – Assembly Drawing ([3DK59Z](#))
- [RD42] TCWS Double Solenoid Shielded Box – Assembly Drawing ([6UKZZW](#))
- [RD43] 02 ITER CAD supplier package ([6XS6JU](#))
- [RD44] AUTOCAD guidelines ([U65T95](#))
- [RD45] CAD Manual 10 - ISO Drawing Standards ([24MZWV](#))

4.4 Codes, Standards and Directives

The design and manufacture of the TCWS solenoid valves shall comply with the latest editions of the applicable standards listed in this section. Refer to Section 10 for clarification regarding applicable standards for the equipment qualification.

- [RD46] Order dated 7 February 2012 relating to the general technical regulations applicable to INB – EN ([7M2YKF](#))
- [RD47] IEC 60068 series: Environmental testing of electrotechnical products
- [RD48] IEC 60529: Degree of protection provided by enclosures
- [RD49] IEC/IEEE 60780-323: Nuclear facilities - Electrical equipment important to safety - Qualification

- [RD50] IEC 60980: Recommended practices for seismic qualification of electrical equipment of the safety system for nuclear generating stations
- [RD51] IEEE 344: Seismic Qualification of Equipment for Nuclear Power Generating Stations
- [RD52] IEEE 572: Qualification of Class 1E Connection Assemblies for Nuclear Power Generating Stations
- [RD53] IEEE 627: Qualification of Equipment Used in Nuclear Facilities
- [RD54] Directive 2014/68/UE of the European Parliament and Council dated 15 May 2014 on the harmonization of the laws of the member states relating to the market availability of pressure equipment (PED)
- [RD55] International Chamber of Commerce (ICC) Incoterms® 2020. ICC Publication No.723E, 2020 Edition
- [RD56] Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits.
- [RD57] NF C 15-100 - Cabling, Electrical installations rules, calculation notes, operation procedure

The supplier may select other standards as long as it can be demonstrated that they are fit for the intended use.

4.5 Environmental Conditions

1. The ITER project site is located at Saint-Paul Lez Durance in France. Three different plant conditions are expressed:
 - Normal conditions: This corresponds to the normal operation of the plant and for which all systems are requested to operate properly. These conditions are encountered during the whole life of the plant (14 years of nuclear operation and 10 years of commissioning operation),
 - Incident conditions: This corresponds to a degraded operation of the plant due to likely failure to happen. All TCWS solenoid valves are requested to operate properly. These conditions are encountered several times during the whole life of the plant (up to twice per year for the loss of HVAC room cooling using conservative assumptions),
 - Accident conditions: This corresponds to a highly degraded operation of the plant due to unlikely failures or highly hypothetical failure. Safety classified TCWS solenoid valves are requested to operate properly during accident conditions (with accepted partial degradation of performance). The accident conditions are encountered only once during the whole life of the plant. The negative effect of ageing on component shall be taken into account; that means the safety classified equipment shall operate properly throughout the whole life of the plant.

2. Environmental conditions to be assumed during Incident Condition (Cat II) and Accident Condition (Cat III/IV) are defined in [RD16] "Collection of Input Data to support Qualification Plan in charge of TCWS electro-mechanical equipment supplier (YST3YH)"
3. For additional information regarding Accident Conditions refer to [RD13].
4. Environmental conditions at ITER are further detailed in the document [RD2] "ITER Site Meteorology ([2UT36S](#))".
5. Applicable environmental conditions for components in scope of this technical specification are summarized in Table 2.
6. In regard to conditions identified with (*), the approach could be either design against the condition (for example using proper IP class) or mitigation (for example by implementing fire insulation).
7. In regard to seismic acceleration, it is assumed that the natural frequency of the equipment is ≥ 33 Hz.
8. It shall be considered that the ambient temperature in case of fire accident can reach 400 °C.
9. Table 2 provides the conditions applicable to the solenoid valves and solenoid mounting boxes in scope of this technical specification.

	Normal Conditions	Incident Conditions	Accident Conditions
Ambient Room temperature	18 °C - 35°C	5 °C - 100°C	5 °C - 130°C
Ambient Room humidity	20% RH – 60% RH	0% RH – 100% RH	0% RH – 100% RH
Ambient Room pressure	86 kPa – 106 kPa	90 kPa – 125 kPa	100 kPa – 200 kPa
Static Magnetic field (Modulus)	15 mT – 150 mT		
Transient Magnetic field (Modulus)	2.5 mT/s – 35 mT/s		
Total Ionizing dose (TID, silicon based)	1 kGy – 10 MGy		
Dose rate (Ionizing radiation dose, silicon based)	1 Gy/h – 3.5 kGy/h		

	Normal Conditions	Incident Conditions	Accident Conditions
Vibration generated in the process pipes	YES $\leq 13 \text{ mm/s}$, 10 Hz to 500 Hz $\leq 0.7 \text{ g}$, 10 Hz to 500 Hz		
Seismic	NO	YES (2.5 g)	YES (6.5 g)
Flooding - submergence*	NO	NO	NO
Fire*	NO	NO	YES

Table 2: Environment conditions applicable in the field (process area)

10. Equipment manufacturer is requested to comply with IO radiation protection guidelines provided in [RD17].

4.6 Safety Classification

1. The TCWS First Plasma solenoid valves and the associated solenoid mounting boxes are either:
 - Safety classified (SIC), if they contribute to a safety function
 - Non-safety classified (Non-SIC), if they do not contribute to any safety function.

4.7 Seismic Classification

1. The solenoid mounting boxes are requested to be SC1 (S) in order to maintain their integrity and structural stability in the event of an earthquake during and after the seismic event SL-2.
2. The seismic qualification shall be provided by the supplier.
3. Qualification by analytical calculation is acceptable for mechanical integrity verification.
4. It is assumed that the natural frequency of the equipment is $\geq 33 \text{ Hz}$.
5. The equipment shall be qualified for the zero period acceleration $> 6.5 \text{ g}$ for the seismic event SL-2.

4.8 Design Life

1. The TCWS First Plasma solenoid mounting boxes as well as all associated components (small mechanical items, terminals etc.) shall be designed for a minimum of 10 years required for the installation, testing and commissioning period and shall have in addition an operation lifetime of 14 years of nuclear operation as specified in the document [RD16] “Collection of Input Data to support Qualification Plan in charge of TCWS electro-mechanical equipment supplier (YST3YH)”.
2. Total designed lifetime shall be a minimum of 24 years.

5 Quality Assurance

1. The components in scope of this document are assigned to Quality Class QC-1.
2. The Supplier shall have an ISO 9001 accredited quality system or equivalent.
3. For the Protection Important Components (PIC) of the nuclear facility, the Manufacturer or any of its Subcontractors shall implement a specific management system for work on protection important activities, on the basis of activities defined and executed by the Manufacturer and its Sub-contractor. This system could be included in the Quality Assurance (QA) Plan.
4. The list of critical quality activities shall be provided by the Manufacturer for acceptance by the IO prior to release of the Supply Order.
5. The Manufacturer's QAP shall be applied to the entire product and services as defined under this Specification. For reference the ITER QAP is the document [RD4] "ITER Quality Assurance Program (QAP) (22K4QX)" and [RD15] "ITER Project Management Plan (PMP) (2NCR3F)".
6. A Manufacturer's Project Specific Quality Plan meeting the specifications as defined by the document [RD5] "Requirements for Producing a Quality Plan (22MFMW)" shall be submitted for IO approval.
7. The Manufacturer's Project Specific Quality Plan shall meet the requirements of the IO procedure for such a plan.
8. The Manufacturer shall ensure that all of their subcontractors that provide any part of the Product or services as defined by this Specification are in compliance with the QA requirements under the relevant QA classifications.
9. Similar control of quality activities for all levels of subcontractors supplying material or services is requested when inspection or certification is required.
10. The Quality Plan shall identify:
 - a. The critical quality activities
 - b. The specific allocation of resources, duties, responsibilities, and authority
 - c. The details of all suppliers/subcontractors and how interfaces will be managed
 - d. The specific procedures, methods, and work instructions to be applied
 - e. The specific methods of communication, both formal and informal, to be established between working groups

5.1 Traceability

1. The Manufacturer shall have traceability procedures in place that will guarantee traceability between materials delivered and from the beginning of manufacturing.
2. These procedures shall be submitted to and approved by the IO prior to the start of any manufacturing.

3. Traceability shall be maintained by procedural methods that cover receipt, identification, storage, and transfer to production, temporary storage and for use in production.
4. The manufacturer responsibilities are as follows:
 - a. The Manufacturer shall be fully responsible for quality with respect to all services, materials, manufacturing, and testing, etc.
 - b. The Manufacturer shall be responsible for imposing all technical and quality requirements as applicable to all the Manufacturer's sub-contractor furnishing hardware or services in accordance with all applicable Specifications.
 - c. The technical and quality requirements of all applicable specifications shall be passed down to all levels of subcontractors. These include, but are not limited to requirements for handling, packaging, shipping, storage, and inspections and testing.
 - d. Manufacturer shall identify to all its Subcontractors all applicable QA requirements imposed by the supply order and this Specification, shall ensure Subcontractor's compliance thereto, and shall include the requirements in procurement documents.
 - e. The Manufacturer shall conduct internal audits of its own facilities and external audits of its subcontractor.
 - f. QA and QC activities by the IO shall not relieve the Manufacturer and their sub-contractors from responsibility to perform all inspections and tests required by the contract and governing codes and standards.

5.2 Third Party

1. The IO has the option to use a third party to evaluate the Manufacturer's quality assurance program.
2. In such a case, the third party shall be the technical organization that is responsible for the approval and monitoring of the Manufacturer's quality assurance system and the direct inspection of the product.
3. The Manufacturer shall provide access and information required by the third party to perform the necessary evaluations and tests to fulfill its responsibilities.

5.3 Qualification of NDE Personnel

1. Personnel for non-destructive examination (NDE) must be approved by a Notified Body or a third-party recognized by a Member State.
2. All NDE personnel qualifications shall conform to the following requirements:
3. Personnel shall be qualified in accordance with NF EN ISO 9712.
4. The third party or ANB shall check that the qualifications of the personnel responsible for NDE are valid in terms of time and appropriateness for the work to be carried out.

5.4 Equipment Calibration

1. Measuring and Test Equipment shall be calibrated and calibration records maintained according to a calibration program based on a recognized standard.
2. The measuring and test equipment shall have a current Certificate of Calibration traceable to a national recognized testing laboratory.
3. Certificates of Calibration shall be submitted to the IO.
4. All heat treatment equipment shall be calibrated and all personnel performing heat treatment shall be qualified to do so.

5.5 Technical Qualifications

1. When a technical qualification is required, the Manufacturer must demonstrate that the manufacturing operations selected for the component subject to this technical qualification will ensure that the risks of heterogeneity among its mechanical and chemical characteristics are controlled.

5.6 Manufacturing and Inspection Plan (MIP)

1. The MIP prepared by the Manufacturer shall meet the requirements of the ITER document [RD6] “Requirements for Producing an Inspection Plan ([22MDZD](#))”.
2. The MIP is a listing of the chronological sequence of manufacturing operations affecting quality encompassing the whole scope of the subcontract and ranging from verification of materials, manufacture, inspection and test to delivery.
3. For PIC elements, the MIP also clearly identifies the PIA. It shall comply with the requirement defined in [RD18], [RD19], [RD20] and [RD46]. A list of the PIA for ITER is presented in the document [RD8] “List of ITER-INB Protections Important Activities ([PSTTZL](#))”.
4. The MIP will be used to monitor quality control and acceptance tests. It is permissible for the Manufacturer to submit multiple MIPs that are more sufficient and manageable to the particular operation.
5. Prior to Manufacturing operations, the MIP shall be generated in accordance with the procedure provided in Section 4 of ITER Manufacturing and Inspection Plan (MIP) and shall be sent to the IO for approval. This requirement is to be passed down to all levels within the procurement chain.
6. The level of detail in a MIP shall be sufficient to prevent the inadvertent by-passing of critical operations and to enable adequate planning, monitoring and verification of critical operations.
7. This document shall be submitted to the IO for approval.
8. The document, when approved by all parties shall be provided to the Manufacturer at least 10 days prior to the start of fabrication.

9. The IO may add hold, witness or require notification points to the MIP and identify tests or inspections that must be witnessed by the IO representative.
10. The Manufacturer shall indicate intervention points that must be witnessed by the IO representative with a “W” code at the appropriate locations in the MIP. The MIP template is provided in the document [RD6] “Requirements for Producing an Inspection Plan ([22MDZD](#))”.
11. The IO approved MIP is a prerequisite to the Manufacturer proceeding with the work as defined.
12. It is permissible for the IO to indicate partial approval to authorize operations that would be constrained due to issues with subsequent operations.

5.7 Access to Manufacturer’s Premises

1. The Manufacturer shall grant access rights to the IO, US ITER, and the Autorité de Sûreté Nucléaire (ASN) organization as well as to their selected representatives to its facilities, records, proprietary processes and/or information and those of its Subcontractors for the purposes of surveillance of defined requirements during the construction/manufacturing.
2. This surveillance shall also include the examination of all protection important activities and the follow-up and verification of all corrective actions which are to be implemented.
3. The Manufacturer shall inform the IO of all locations where fabrication will be done.
4. Source surveillance activities may be conducted at the Manufacturer’s facility or any sub-tier supplier facility that the IO determines necessary to ensure quality objectives are met.
5. Representatives of the IO, US ITER, and the ASN require the same access to execute their own inspections or observations. Such surveillance may include auditing and monitoring of production processes, in-process inspection and controls, chemical or physical certifications, final inspection and tests, preparation for shipment, and review of certification data.
6. Proprietary processes or restricted access areas shall in no way prevent such surveillance.
7. Surveillance visits can be announced on short notice.
8. Source surveillance by the IO, US ITER, and the ASN representatives shall not constitute product acceptance by the IO and shall in no way relieve the Manufacturer of the responsibility to furnish acceptable items.

9. To ensure the safety of the IO, US ITER, and the ASN representatives who visit the Manufacturer's or their supplier's facilities, the Manufacturer shall provide relevant information about facility safety procedures including, for example, safety glasses, hearing and respiratory protection, emergency preparedness, rally point, and general safety rules; and shall review typical workplace hazards with the representative(s) upon their arrival.
10. The IO, US ITER, and the ASN representatives who visit the Manufacturer's or their supplier's facilities shall be bound by appropriate confidentiality obligations to be agreed upon in advance.

5.8 Quality Records

1. Records shall be maintained to show objective evidence of quality.

5.8.1 Document Retention Requirements

1. Documentation records shall be maintained in accordance with the Manufacturer's QA program to show objective evidence of quality.
2. No quality records shall be destroyed or otherwise disposed of prior to completion of the work and the IO shall have an opportunity to acquire possession of such records prior to their disposal.
3. After completion and delivery of the Product to the IO, the Manufacturer shall maintain the records for a period of ten years.
4. The IO shall have an opportunity to acquire possession of such records prior to disposal.
5. Documents shall be annotated with the IO supply order number or other numbering system traceable to it for identification.

5.8.2 Test Sample Retention Requirements

1. Any test coupons and specimens used for acceptance per lot shall be kept by the Manufacturer for a period of up to ten (10) years.
2. The IO shall have an opportunity to acquire possession of such test samples prior to disposal.

5.8.3 Nonconformities and Deviation Requests

1. Nonconformities are the product or process which does not fulfil or fails in meeting IO specified requirements. The management of the nonconformities regarding the design and the manufacturing of the product is described in the document [RD7] "Procedure for management of Nonconformities ([22F53X](#))".
2. The Manufacturer shall ensure that they implement a system compliant with this document to control the nonconformities. The nonconformities reports shall be opened, identified, solved, closed and recorded in line with the IO agreement.

3. Deviation requests are requests for deviation from a formal agreement between the Manufacturer and the IO. The Deviation requests shall be issued by the Manufacturer or by the IO.
4. The procedure for the management of Deviation Request and the responsibilities of the stakeholders are described in the document [RD11] “Procedure for the Management of Deviation Request ([2LZJHB](#))”.
5. If the conformity assessment of the NPE/PE is not completed because of NCR from the Manufacturer and/or its subcontractor(s) and supplier(s), the Manufacturer shall have the related activities or parts redone at its own cost.

5.9 Procurement Quality

1. For procurement Quality requirements reference the document [RD14] “ITER Procurement Quality Requirements ([22MFG4](#))”.

6 Safety Assurance

6.1 Propagation of Safety Requirements

1. The IO informs the Manufacturer that some equipment in scope of this specification is considered protection important components (PIC).
2. The documents important for the safety are presented in Section 4.3.
3. Under Order 7 February 2012, the PICs require control and guaranty of the quality of the PICs during the design and manufacturing phase to ensure its safety functions can be maintained in all postulated situations. This is accomplished through the guidelines provided for in the Management of Propagation of Nuclear Safety Requirements in the Contractor Chain [RD3] regarding:
 - a. Policy on Protection of the Interests
 - b. Quality management system
 - c. Supervision
 - d. Execution and supervision of the PIA
 - e. Skills and qualification of the interveners
 - f. Records
 - g. Non conformities
 - h. Lessons learned
 - i. Safety demonstration
4. In the contracts passed down to the subcontractors, it is clearly stated that in addition to technical requirements, defined requirements on Protection Important Components (PIC) and Protection Important Activities (PIA) has to be monitored by the IO.
5. The subcontractor must possess a quality system in agreement with the importance of the equipment being delivered and in particular for the follow-up of the PIA corresponding to the PIC to be provided under the contract. This system shall be included in the MIP or Quality Plan.

6.2 Documentation

1. The Manufacturer must ensure that each PIA and the related technical controls:
 - a. are documented to demonstrate a priori that they comply with the Defined Requirements,
 - b. are traced to check a posteriori that they comply with the Defined Requirements
2. This applies to every PIA and technical control performed by the Manufacturer or any of its subcontractors.
3. Throughout the execution of this work, the Manufacturer must keep up to date records of the results of implemented PIA and their technical control, the related action of verification and the assessment.

4. These records shall be made available to the IO upon request.
5. Upon completion of the work, all documentation related to the design and other activities of a PIC shall be provided to the IO.

7 Project Management

1. The Manufacturer shall designate a Project Manager within 5 working days after award of contract who will be responsible for the overall design, manufacture, factory testing, installation, performance testing, schedule, cost control and resolution of disputes and discrepancies.
2. The Manufacturer shall also identify specific individuals responsible for each aspect of the Work.
3. The Manufacturer's proposal shall provide an outline of the management structure and resumes of the team members for the project.

7.1 Project Schedule

1. The Manufacturer shall provide a schedule within 15 working days after the kick-off meeting.
2. The schedule shall identify the submittals to and approvals from IO of the Manufacturer's and Subcontractors' specifications, drawings, procedures, and other types of documents as appropriate.
3. As a minimum, the schedule shall include task descriptions with start and finish dates for each task.
4. Separate detailed task breakdowns shall be provided for design, procurement, qualification, fabrication, and factory testing phases and end with a Scheduled Jobsite Delivery Date.
5. The schedule shall be in a Critical Path Method style with logic ties that identifies each activity and is capable of tracking percentage complete for verification of progress.
6. The schedule shall be compatible with the overall master project schedule developed by the IO and is subject to the IO's approval.
7. The schedule shall include all work activities identified within the Specification.
8. The schedule shall include milestones for design, qualification, fabrication, factory testing, and delivery of the equipment to allow for IO to monitor the progress of the Work and to schedule its interface activities with the Manufacturer.
9. The schedule shall include all documents and deliverables listed in the Specification.
10. The project schedule must be provided to the IO for approval prior to implementation of any Work.
11. The Manufacturer shall consider potential schedule conflicts due to previous or pending commitments to supply services or material to other customers.
12. Anticipated deviations from the schedule shall be identified to IO as soon as possible to evaluate the impact of changes on the master project schedule.

7.2 Project Kick-off Meeting

1. The Manufacturer shall participate in a Project Kick-off Meeting.
2. The Project Kick-off Meeting shall be scheduled at a mutually agreeable time and place as soon as practical after AOC, but not before the Draft Schedule and Draft Quality Plan are submitted by the Project Manager to the IO representative.
3. The Kick-off Meeting shall include the Manufacturer's Project Manager and other principal participants as requested by the IO. The primary purpose for the Project Kick-off Meeting is to confirm that the meeting participants understand the terms and conditions of the subcontract, technical specification and drawings.
4. The following topics shall be discussed:
 - a. Scope and content of the Quality Plan, Manufacturing and Inspection Plan, and Assembly Procedures.
 - b. Expectations for satisfying quality standards, documentation requirements, timeframe to reply to IO comments, delivery arrangements, acceptance criteria, and payment schedules.
5. The Manufacturer shall prepare written draft Project Kick-off Meeting Minutes that document the agreements and commitments resulting from the Project Kick-off Meeting discussions.

7.3 Project Status Reports

1. The Manufacturer shall submit every two weeks written and electronic progress reports to the IO Representative that reflect the status of the engineering, qualification, fabrication and delivery phases of the Work.
2. The progress reports shall be submitted by IDM.
3. These reports shall discuss the following:
 - a. Completion of all scheduled activities
 - b. Actual and projected delays of all activities
 - c. Inclusion of any additional schedule activities
 - d. Proposed changes in project management or key project personnel
 - e. Status of key existing engineering, procurement or manufacturing issues that may impact quality, performance, or delivery
 - f. Anticipated or approved deviations from the Specification
 - g. Other issues pertinent to project schedule or milestone completions
 - h. Open items

7.4 Communication Protocol

7.4.1 Engineering/ Design Review

1. The Manufacturer shall make available to the IO notice, drawings, design calculation reports, documents and other data ("Design Data") and technical assistance sufficient to allow the IO to conduct a design review of the equipment to be supplied under the Supply Order.
2. The Design Review shall have maximum duration of up to 10 consecutive work days depending of the type of documents.
3. The deadline for IO comments submission shall be decided during the Project Kick-off Meeting for every type of deliverable.
4. The Manufacturer shall send all drawings and other documents of engineering/ design nature directly to the IO's Project Manager or the Engineering Representative using the exchange folder in IDM following [RD9] and SMDD following [RD10]. When the documents are reviewed/ approved by the IO, the Manufacturer is notified of the status of the documents by receiving an email notification (action available directly in IDM).
5. At the end of the design review, the document can be finally approved without comments (ACC), approved with comments (COM) or refused (REF). If the document is approved with comment or refused, the Manufacturer shall have five working days to update the document according to these comments and to re-submit it for approval following the process described above.
6. In carrying out this Design Review, the IO shall be entitled to engage consultants to give assistance provided that these consultants shall have first entered into a Proprietary Information Agreement directly with the Manufacturer.
7. All matters related to engineering/design shall be discussed directly between the IO's and the Manufacturer's engineering representatives.
8. Any correspondence of an engineering/design nature shall be exchanged between the same engineering representatives.
9. Copies of such correspondence shall be sent to the Project Coordinator. Personnel from both the Manufacturer and the IO who receive engineering/design information, including design change requests, shall forward such information to the IO Project Manager or his designee.
10. Engineering Representatives from both the Manufacturer and the IO shall determine the method and frequency of meetings and conference calls related to engineering/design matters.
11. The IO's Project Manager and Engineering Representative shall attend Project Management meetings to represent engineering/design matters.

7.4.2 *Action Item List*

1. The Manufacturer shall create and maintain a list of open action items assigned to the Manufacturer or the IO.
2. The list shall identify the action to be taken, category (critical or noncritical), responsible Party or individual, and the date the required action is to be completed.
3. Due dates shall be met in order to maintain project schedules and proper work sequence.
4. If any Manufacturer or IO individual believes that there are necessary actions which are not reflected on the list, the individual shall contact the appropriate project coordinator with a request to add the action.
5. It is not the intent of the Action List to document all requirements in the Supply Order.
6. The bases for making entries on the Action List are:
 - a. Actions which are not identified specifically enough in the Supply Order to convey the action plan
 - b. Actions which need to be tracked to insure timely response
 - c. Actions which need to be sequenced with other work. The lack of entries on the Action List does not relieve either the Manufacturer or the IO from fulfilling their obligations under the Supply Order.

7.4.3 *Documents Transmittal List*

1. The Manufacturer shall maintain a Document Transmittal List which documents the transmittal of drawings, calculation reports, procedures, and any other document which the Manufacturer is required to send to the IO pursuant to the Supply Order.
2. The Document Transmittal List shall document:
 - a. The total population of drawings or documents to be submitted, categorized by component
 - b. Type of document being transmitted
 - c. Specific identification
 - d. Actions required by IO pursuant to the Supply Order
 - e. The due date for such IO action
 - f. Consequences if the due date is not met
 - g. Indication if planned subsequent revisions are forthcoming. Current copy shall be included with the monthly project status report.

7.4.4 Periodic Conference Calls

1. The Manufacturer Representative and the IO Representative shall hold conference calls, at a time to be mutually agreed upon, to discuss the progress and status of the Work.
2. Such discussion shall include, but not be limited to, work schedule, status of action items, resolution of technical problems, and contractual or commercial issues.
3. The Manufacturer shall prepare and send draft minutes of the conference calls to the IO representative within 5 days of the meeting.

7.4.5 Manufacturing Facilities

1. The IO reserves the right to visit and inspect the manufacturing facilities prior to the signature of the contract with the successful tenderer.
2. After the Kick off meeting or MRR, PE/NPE network of the IO will plan an evaluation audit of the Manufacturer, its subcontractors and/or suppliers in all main premises where the construction activities of pressure equipment will take place.
3. Evaluation audit could be repeating in case of contractual or regulatory changes or extension of contract with Contractor.

8 Supply Chain Management

8.1 System

1. The Manufacturer shall possess an effective supply chain management system covering, but not limited to:
 - a. Supply orders management
 - b. Inventory and data management,
 - c. Flow management
 - d. Storage management
 - e. Manufacturing documentation management
 - f. Shipment management.

8.2 Manufacturer Procurement

1. The Manufacturer shall monitor internal supply orders to ensure material specifications and delivery dates are met.

8.3 Detection of Counterfeit, Fraudulent and Suspect Items

1. The Manufacturer shall possess an effective process to detect counterfeit, fraudulent and suspect items in the whole chain of supply, including subcontractors and sub-suppliers.

8.4 Identification and Tagging

1. All materials and packages shall be clearly marked and labelled in accordance with the IO standards set out in section 9, the Framework Agreement, and/or supply order.

9 Labelling and Nameplates

1. All solenoid mounting boxes must have a nameplate attached to them at a visible place, furnishing the following minimum information:
 - a. Manufacturer's name
 - b. Model number
 - c. Serial number
 - d. Tag number
 - e. PNI (Part Number of ITER)
2. Labels/nameplates shall be written in English only. The proposed arrangement of the labels/nameplates (material, colour, size and engravings) shall be submitted to the IO for approval.
3. Components inside cubicles, panels, boxes, etc., shall be properly labelled with individual component identification number (or item number) with a corresponding description.
4. This number shall be the same as indicated in the pertaining documents (wiring diagrams, equipment lists, etc.).
5. Marking paint or ink shall not contain harmful amounts of chlorides, metals, or metallic salt, such as zinc or copper that can cause corrosive attack on heating.
6. The IO review and approval is required prior to use of any marking paint or ink.
7. Stamping shall not introduce a notching effect, therefore low stress stamping with round edges is recommended.
8. If any method of marking other than hard-stamping or engraving is used, the Manufacturer shall ensure that confusion between different materials is not possible, e.g. by separate handling (time and/or place) or stamped bands.
9. In addition, the Supplier shall follow PED regulation in regard to nameplate for pressure accessories and pressure vessels.

10 Equipment Qualification

1. Safety classified components shall be subject to qualification program.
2. The qualification shall demonstrate and document the ability of equipment to perform safety function(s) under applicable service conditions, including incident and accident conditions.
3. Non-SIC components are not requested to be subject to qualification program. However, the Supplier shall provide evidence that Non-SIC components will operate properly taking into account the applicable environmental conditions. The supplier is free to select the most appropriate method for this justification such as analytical calculation, expertise, operating experience, testing or combination of these methods. The evidence of compliance with the environmental conditions shall be submitted to IO for approval.
4. The Supplier shall assess the most cost-effective option for the design and procurement of SIC and Non-SIC equipment (the supplier may segregate SIC and Non-SIC equipment, or provide the same equipment for both cases).

10.1 Normative Framework

1. There are no specific qualification codes and standards imposed by ITER Organization.
2. The codes and standards listed in Section 4.4 shall be used at the discretion of the equipment supplier.
3. Other standards may be selected as long as it can be demonstrated that they are fit for the intended use.

10.2 Qualification Method

1. Qualification program shall be defined by the supplier.
2. The supplier shall select the most appropriate method for the qualification (type testing, operating experience, analysis or combined methods).
3. Proper justification of the selected qualification method shall be provided.
4. Analysis methods may be used to supplement the demonstration of qualification.
5. The analyses and calculations shall respect the requirements identified in [RD34], [RD35], and [RD36].
6. The solenoid valves are subject to dedicated qualification program managed by the solenoid valve supplier. The qualification of solenoid valves is not in scope of this technical specification.
7. The supplier shall demonstrate that all installation requirements defined by the solenoid valve supplier have been fulfilled and the qualification of solenoid valves has not been jeopardized.

10.3 Service Conditions

1. For the qualification of solenoid boxes as well as for the associated electrical connections the following service conditions shall be taken into account:
 - a. Duration of the commissioning phase: 10 years at 40 °C,
 - b. Duration of the nuclear operation phase: 14 years at 35 °C,
 - c. Frequency and duration of the incident conditions (see Section 4.5):
 - i. 50 occurrences of 1 hour duration at 90 °C/ 1.2 bar abs with humidity 100 %,
 - ii. 15 occurrences of 11 hour duration at 100 °C/ 1.2 bar abs with humidity 100 % followed by 13 hours of linear temperature decrease to 18 °C.
 - d. Duration of the accident conditions (see Section 4.5):
 - i. One occurrence of 10 min duration at 130 °C/ 2 bar abs with humidity 100 %,
 - ii. One occurrence of 24 hour duration with linear temperature decreases from 130 °C to 18 °C.
2. For the irradiation qualification, the total dose rate given in Table 2 corresponds to the dose accumulated over 20 years of operation with 4700 h of pulse operation. If the required total dose cannot be withstood by the proposed components, qualification at a lower dose might be acceptable if it is cost-effective and design is done to minimize operator work duration on site (in order to minimize the dose received by the operator during the replacement of the components).
3. Details of different pressure/temperature profiles can be found in reference [RD16].

10.4 Qualification Preservation

1. Modifications to the equipment made during or after completion of the qualification programme shall be tracked, documented and evaluated to determine whether additional qualification steps are required.
2. The Supplier shall ensure traceability of materials in order to justify how material properties of the model equipment is representative of the series production equipment.
3. Special attention shall be paid to organic material (and more generally to non-metallic material) due to their sensitivity regarding environmental conditions.
4. The Supplier shall determine all critical manufacturing activities that could impact equipment performance/operability in order to justify that the model solenoid valve is representative of the series production equipment.
5. The Supplier shall determine requirements on transport, storage and installation which may impact the solenoid valve performance.
6. Any modification to the qualified equipment shall be evaluated and traced in a unique document (so called Reference File) referencing justification of acceptance regarding qualification issue.

7. If the evaluation concludes that additional qualification steps are not required, the evaluation, including supporting information, shall be included in the qualification documentation.
8. Otherwise, steps shall be taken to verify and document that modified equipment is qualified. Corresponding evidences (e.g. result of complementary tests, analysis) shall be added to the original qualification documentation.

10.5 Qualification Documentation

1. The qualification program as well as its outcome shall be documented to demonstrate the ability of equipment to perform its safety function(s) during its qualified life and applicable design basis events.
2. All activities that are required to maintain qualification during the qualified life shall be included in the documentation.
3. No requirements are imposed on the structure of the qualification file since it will depend on the normative framework chosen by the equipment supplier. However, in any case the qualification file shall include at least the following document types:
 - a. Equipment specification, which shall specify the purpose of the equipment, its scope and limits of the supply, the reference documents, and technical data for all the equipment comprising the supply,
 - b. Qualification program, which shall specify the equipment to be qualified, describe the chosen qualification method and the corresponding activities to be performed to qualify this equipment,
 - c. Test procedure(s) and test report(s) (in case of qualification by testing),
 - d. Calculation note(s) and Analysis report(s) (in case of qualification by analysis),
 - e. Qualification summary report, which shall identify the equipment concerned by the qualification and summarize the actions taken and the results achieved,
 - f. Qualification preservation sheet, which shall describe the requirements and recommendations to ensure that the qualifications are guaranteed during installation, assembly, and operation.
4. All documents which are included in the qualification file shall be submitted to IO for review and approval.

11 Testing and Inspection

1. All materials and equipment shall be factory tested before shipment in accordance with the Manufacturing and Inspection Plan (refer to Section 5.6).
2. No material shall be transported to site until all required tests have been carried out and equipment is certified as ready for shipment.
3. Acceptance of equipment or the exemption of inspection or tests thereof, shall in no way release Supplier of the responsibility for delivering equipment meeting the requirements of the specifications.
4. Supplier shall provide the inspection certificate EN 10204 Type 3.1 for raw materials.
5. Supplier shall perform the standard tests to maintain quality control procedures.
6. The corresponding test certificates shall be submitted for review before starting inspection by the purchaser.
7. Detailed procedures of test and inspection shall be submitted by the Supplier for review before the order has been placed and mutually agreed upon.
8. Supplier shall arrange all the tools, test, and calibration instruments required during inspection and testing and provide all the facilities or assistance for inspection and testing.
9. All the test and measuring instruments shall be calibrated in a standard laboratory and the supplier shall produce valid calibration documents for the purposes of verification. The calibration shall be traceable to any of the approved national laboratories.

12 Design Requirements

12.1 General Requirements

1. The Supplier shall make provisions for personnel or equipment protection, that are deemed necessary by applicable standards or by best engineering practices.
2. The design and engineering deliverables shall be submitted to IO for approvals. The design deliverables shall be submitted in pdf as well as in native formats.
3. Any deviation request shall be presented to IO and shall be processed as mutually agreed upon in the interest of the project.

12.2 Selection of Material

1. General requirements for chemical composition and impurities for materials in ITER are defined in [RD33].
2. The use of cobalt shall be minimized and therefore a low cobalt material shall be used for the mounting box enclosure (cobalt content below 0.2 % of the total weight).
3. General material requirements defined in [RD33] are not applicable to the small parts and components such as bolts, nuts etc. in accordance with “Deviation Request - Material chemical composition for TCWS instrumentation” [RD27]. If low cobalt material can not be provided for these components, the Supplier shall specify the associated mass in order to consolidate the IO deviation request [RD27].
4. Halogenated materials shall be forbidden for any components (including painting) within the scope of this document. Any exceptions must be approved by IO.
5. The Supplier shall provide an information about halogen content for each component type in his scope of supply.
6. Fire resistance material with no or low flammability shall be selected to the extent practical.

12.3 Compressed Air Supply

1. Following compressed air parameters shall be considered:
 - a. Design pressure: 12 bar abs (11 bar g)
 - b. Design temperature: 60 °C
 - c. Nominal pressure: between 6 bar abs to 8 bar abs (5 bar g to 7 bar g)
 - d. Oil content: $\leq 0.01 \text{ mg/m}^3$
 - e. Dew point: $\leq 40 \text{ °C}$
 - f. Particles:

- $0.1 \mu\text{m} < d \leq 0.5 \mu\text{m}$: $\leq 400\,000$ particles/m³
- $0.5 \mu\text{m} < d \leq 1.0 \mu\text{m}$: $\leq 6\,000$ particles/m³
- $1.0 \mu\text{m} < d \leq 5.0 \mu\text{m}$: ≤ 100 particles/m³

12.4 Solenoid Valves

1. Solenoid valve data sheet is provided in Appendix B: Solenoid Valves – Data Sheet.
2. There are two types of solenoids:
 - a. 3/2 solenoid which are used to control single-action actuators,
 - b. 5/3 solenoids which are used to control double-acting actuators. 5/3 solenoids consist of two 3/2 solenoids. A mechanical distribution device connecting both solenoids is installed outside the solenoid box and therefore it is not considered in this document.
3. Dimension drawing of the 3/2 solenoid valve is provided in Appendix C: Solenoid Valves – Dimension Drawing of 3/2 Solenoid.
4. Weight of the 3/2 solenoid valve is 6.25 kg.

12.5 Electrical Design Requirements

1. The solenoid valves shall operate with the rated voltage 230 V AC.
2. The power supply will be provided by IO.
3. The maximum inrush current shall not exceed 0.4 A.
4. The maximum holding current shall not exceed 0.25 A.

13 Layout and Installation Requirements

1. Solenoid valves are not insulated. For SIC solenoid valves, the solenoid mounting box - depending on its location - might be fire insulated and in this case, ITER will provide the temperature to be considered in the box for the solenoid valve due to lack of air circulation.
2. The solenoid mounting box shall be designed taking into consideration the physical dimensions of all items located inside it in accordance with the associated BOM.
3. The acceptance criteria for seismic calculation and validation shall follow the requirements provided in [RD37].
4. Supplier shall use the IO preliminary design and realize the detail design taking into account:
 - a. The capacity to minimize operator time in the room for maintenance activity (solenoid valve and manifold are fitting on a mounting plate which can be clamped to the box on site),
 - b. The capacity of this solenoid mounting box to act as physical protection regarding typical on-site threat such as scaffolding or equipment installation/removal,
 - c. The capacity of the box to maintain its integrity in regard to loads generated by seismic events (SL-1 and SL-2),
 - d. The box shall provide the necessary means to ensure wall-mounted attachment,
 - e. The box shall provide the necessary means to allow IO to install, if necessary, fire protection insulation around the box to protect the SIC solenoid valves installed inside it,
 - f. The box shall provide the necessary means for transportation and handling for the final installation on site.
5. The supplier is free to select material suitable with environmental condition and consider, if required, all necessary coating.
6. In case of coating, supplier shall ensure the compliance of this coating against environmental condition (especially irradiation), as well as in regard to the chemical content (cobalt and halogen).
7. Boxes shall be provided with copper bar for earthing of cables' individual shielding.
8. Refer to Appendix A for drawings of the solenoid mounting boxes. The drawings shall be used as a guidance only. It is a responsibility of the Supplier to provide a final design of the boxes.
9. Boxes shall be provided with a removable top part where the cable glands will be located. The holes for the cable glands shall not be made by the supplier since the holes dimensions are in relation with the external diameter of the chosen cables by IO. The holes for the cable glands will be machined on site by IO and the cable glands will be provided and installed by IO.

10. Solenoid mounting boxes for 6 solenoids shall be provided with lifting eyes. The lifting eyes shall be removable after installation and supplier shall provide the proper screws in order to cover the holes.

13.1 Cabling and Wiring

1. Terminals shall be provided inside the solenoid mounting box for connection of the external cables. Terminals shall be qualified for specific requirements in the areas where will be installed (for example high radiation). Internal wiring of the solenoid valves to these terminals shall be in the Supplier's scope of delivery.
2. Internal wiring design shall be in compliance with applicable European Directives and NF C 15-100 requirements.
3. Installation of the external cables is not in scope of the Supplier.
4. The default cable entry position for the solenoid box is from the top. However, it will be finalized during supply order.
5. Cable and wire ducts shall be designed for easy access for maintenance, modification and trouble shooting.
6. Separate cable ducts shall be considered for internal and field wires/cables.
7. The supplier shall provide screws on top cover and on the bottom part of the solenoid mounting box in order to ensure electrical bonding with external equipotential bonding network (see [RD1] for details).
8. Cables, wires, terminals and cable ducts shall comply with the material requirements specified in Section 12.2 regarding the halogen contents.

13.2 Compressed Air Distribution

1. Process compressed air (inlet) is provided to the box through piping TP-304L A312, DN25 Schedule 40S (see [RD38] for detail). Number of pipes is one (1) for the individual solenoid box and up to two (2) for the Common mounting boxes
2. Process compressed air (inlet) piping end-connection is butt-weld in accordance with requirements of ASME B16.25.
3. Solenoid compressed air (outlet) shall be provided from the box through tubing TP-304L A-312, 3/8 inch thickness 0.889mm (see [RD38] for detail). Number of tubing is one (1) per solenoid.
4. Solenoid compressed air (outlet) tubing end-connection shall be butt-weld in accordance with requirements of ASME B16.25.
5. Necessary extra length of 100 mm shall be provided at the inlet and outlet of the box to facilitate on-site welding operation.

14 Documentation Requirements

14.1 List of Documents to Be Provided by the Supplier

1. The Supplier shall provide to the Client complete technical data with the drawings and documents listed in Table 3.
2. The drawings in PDF format shall be exchanged in the System for the Management of Diagrams and Drawings (SMDD) as defined in [RD10].

Document	Comment
Documents to be provided and approved by IO before start of the manufacturing:	
Quality Plan	
Manufacturing and Inspection Plan	
List of PIA	
Traceability Procedure	
Qualification File	Only for SIC components (refer to section 10.5)
Component Data Sheet	
Detail drawings (dimensions, connections details, solenoid mounting, component list)	
Installation, Operation and Maintenance Manual	
Pickling/Passivation procedures	
Technical Qualifications for activities requesting such qualification	If required by a design code, a design standard or a European directive.
V&V of Software used for the design and manufacture	
Spare Part list	
Documents to be provided and approved by IO before delivery of the equipment:	
Qualification of NDE personnel	
End of Manufacturing Report	
Inspection certificate EN 10204 Type 3.1	
Certificates of Calibrations for Measuring and Test	

Equipment	
Cleaning Procedures	
Certificate of Conformity for EMC as well as any applicable EU directive	
Storage, Packing and Transportation Procedures	
Documents to be provided as part of the delivery of the equipment:	
Instrument Tag	

Table 3: List of documents to be provided by the Supplier

14.2 CAD Requirements

- For the CAD design tasks, contractor is invited to select any of the following scheme:
 - IO recommends synchronous collaboration scheme, where the contractor will work directly connected in the IO ENOVIA Database.
 - Considering the limited CAD work scope, contractor could chose asynchronous collaboration scheme where contractor will work “File-based”, possibly using a “Multi-CAD” approach.
- See detailed information about synchronous collaboration scheme (in chapter 4.1) and asynchronous collaboration scheme (in chapter 4.2) in the [RD31].

14.2.1 CAD Data

- If contractor selects Synchronous collaboration scheme, the execution of the CAD 3D models and drawings shall be performed in CATIA V5 (R31) software.
- If contractor selects Asynchronous collaboration scheme, the choice is given to the contractor to produce its CAD data in CATIA or other CAD software allowing the usage of 3D models in the ITER Digital Mock-Up after a possible conversion through a CAD neutral format (e.g. step). In such case, the contractor shall be responsible for the consistency and accuracy of the models conversion from the originating CAD system to the CATIA V5 data passed to ITER IO, and shall submit to IO DO its consistency check procedure for acceptance. The contractor shall also provide the first draft of the CAD data one month prior design review for the assessment of the data reconciliation in ITER database system.
- The contractor is requested to indicate in his offer his plans to manage the conversion of the produced CAD models and their provision to IO. This will be basis on the Design Collaboration Implementation Form (DCIF) to be produced by IO DO before contract signature.

4. If the CATIA software is selected by the contractor, they shall use the CATIA version indicated in the latest version of the ITER CAD Manual released by IO DO, CATIA V5 (R31 currently) [RD32] and install ITER CAD supplier package [RD43].
5. The contractor shall ensure that all CAD Data (Models and Drawings) delivered to IO comply with [RD29]. Full or partial applicability of the CAD Manual will be considered based on the selection of the CAD software (CATIA or MultiCAD) and will then be detailed within the DCIF.
6. The CAD data identified as input in this document will be transferred through the appropriate Data Exchange Task (DET) performed by the IO to the contractor at the kick-off date, as specified in the [RD28]
7. The contractor shall submit the drawings and diagram in the SMDD for the IO approval according to the procedure [RD10]
 - If contractor performs the drawings in any CAD tools other than CATIA. The drawings title blocks and other specification comply with the section 2.3 (Drawing features) of the [RD44]
 - ISO drawing standards are given in the [RD45]
8. Any deviation from these requirements shall be defined in a Design Collaboration Implementation Form (DCIF) prepared and approved by DO.

14.2.2 Finite Elements Calculation Tasks

1. The calculation models if they are Finite Element Models (FEM) shall be submitted to the IO with the results of the calculations in the frame of the design review.
2. The models shall be submitted through IO's Document Management System (hereafter called IDM) following the process of exchanging and storing stated in the working instruction [RD9].

15 Maintenance

15.1 Preventative Maintenance

1. The Supplier shall identify any parts requiring periodic replacement (such as filters, fluids, etc.) and any parts that wear (for example gaskets, seals, etc.).
2. Potential ageing mechanisms and their effects shall be identified.
3. The Supplier shall list all preventative maintenance activities, such as periodic inspections, cleaning, adjustments, tightening and lubrication.
4. Need for special tools or expertise in order to perform the preventative maintenance shall be minimized as much as possible.

15.2 Spare Parts

1. The Supplier shall provide a comprehensive list of recommended spare parts for preventative and corrective maintenance, taking into consideration the designed lifetime and environmental conditions as specified in Section 4.

16 Obsolescence Management

1. The Suppliers shall have in place a policy of technical continuity with regards to product lifecycle management.
2. The Suppliers shall indicate in their proposal:
 - a. End date of the commercial availability of the product version,
 - b. End date of the commercial availability of the spare parts,
 - c. End date of the product support by the original equipment manufacturer.

17 Packaging and Transportation

17.1 Cleaning

1. During cleaning, particular attention shall be given to the removal of wire strands, debris and other foreign matter, particularly from sealing surfaces.
2. Final cleaning shall ensure effective cleaning without damage to the surface finish, material properties or metallurgical structure of the materials.

17.2 Packaging and Handling

1. Any special IO or regulatory transportation requirements shall be documented and provided to the Supplier prior to shipment.
2. Subsequent to the Factory Acceptance Test, the components may need to be partially disassembled to the maximum size that can be shipped. All components requiring re-assembly at the ITER Site shall be clearly labelled and tagged.
3. The supplier shall design and supply appropriate packaging, adequate to prevent damage during lifting and handling operations (e.g. during manufacturing, shipping, storage, etc.).
4. Accelerometers or other sensors shall be fitted to ensure that limits have not been exceeded. Accelerometers shall be fixed onto each box and shall be capable of recording the acceleration along three perpendicular directions.
5. Shock absorbing material shall be used. Seaworthy Packing is mandatory.
6. Each shipment shall be accompanied by a Delivery Report [RD23] prepared by the Supplier.
7. The Delivery Report shall be signed by a representative of the IO and its Supplier. The signature by the IO of the Delivery Report prior to shipment represents a Hold Point (HP).

17.3 Shipment and Transportation

1. The transport of the equipment shall be the responsibility of the Supplier. The delivery shall be performed as DAP Incoterms 2020 [RD55] at ITER site.
2. The components shall be delivered by the logistics service provider (LSP) selected by the Supplier, depending on the DAP Incoterms 2020.
3. If the Incoterm is EXW, DAHER shall be exclusively the LSP in those cases.
4. Before the shipment, a Release Note shall be prepared in accordance with the Release Note Template [RD22] and approved by the IO.
5. Additionally, a native file item level packing list and a delivery report shall be provided to logistics.data@iter.org in accordance with the working instruction for the DRR [RD21].

6. All material shall have a PNI and or Tag Number in accordance with ITER Numbering System for Components and Parts [RD26].
7. IO shall provide the PNI numbers before shipment.
8. Mandatory documents to be provided in accordance with the working instruction for the DRR [RD21] are as follows:
 - a. Contractor Release Note [RD22]
 - b. Delivery Report [RD23]
 - c. Packing List that reflects the content of the CRN [RD24]
 - d. Equipment Storage & Preservation Requirements Form [RD25]
9. DRR documents shall be submitted to ILM and logistics.data@iter.org at least 15 working days prior to the planned shipment date.
10. Upon receipt of the package, the IO shall open in accordance with their assigned receipt inspection level. This inspection shall check:
 - a. Integrity of the package, including identifying visible damage
 - b. Number and type of components contained in the shipment
 - c. Enclosed documentation
 - d. Reading of the accelerometers and/or other sensors
 - e. Integrity of the components
11. In case of anomalies, the IO shall make any additional relevant remark on the inspection.
12. IO will inspect the accelerometers or other sensors mounted on the boxes.
13. If these accelerometers record shocks above 5 g, a thorough inspection of the components shall be performed. A decision on acceptance of the delivery of the components will be made by the IO.
14. For shocks below 5 g, a standard inspection is applicable.

17.4 Delivery Location

1. The final delivery location of the equipment is IO site:

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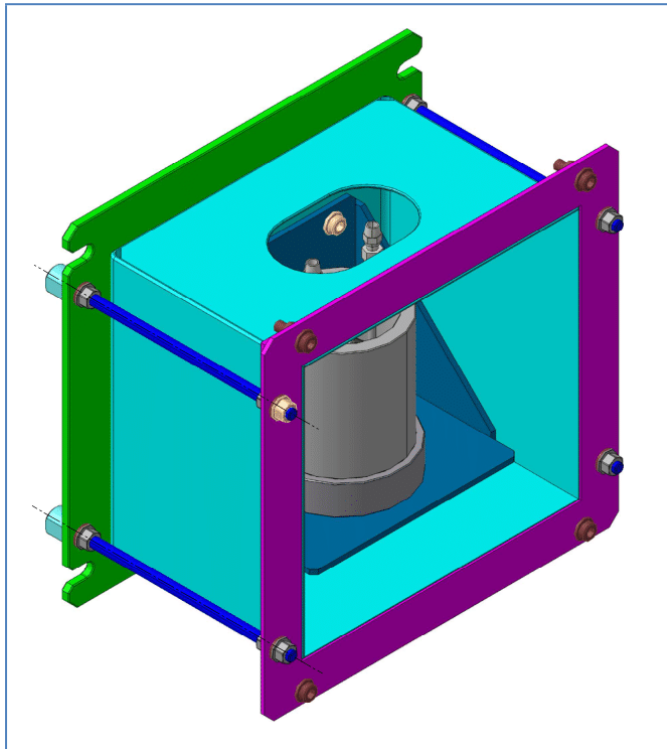
13067 St Paul Lez Durance Cedex

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17.5 Delivery Date

1. A receipt date shall be specified sufficiently ahead of the equipment receipt date to allow adequate time to complete a review of the manual and prepare for installation.

Appendix A: Solenoid Mounting Boxes – Isometric Drawings



Note:

The removable protection panel is not shown for better clarity.

Figure 1: Individual mounting box for 3/2 solenoid - front view

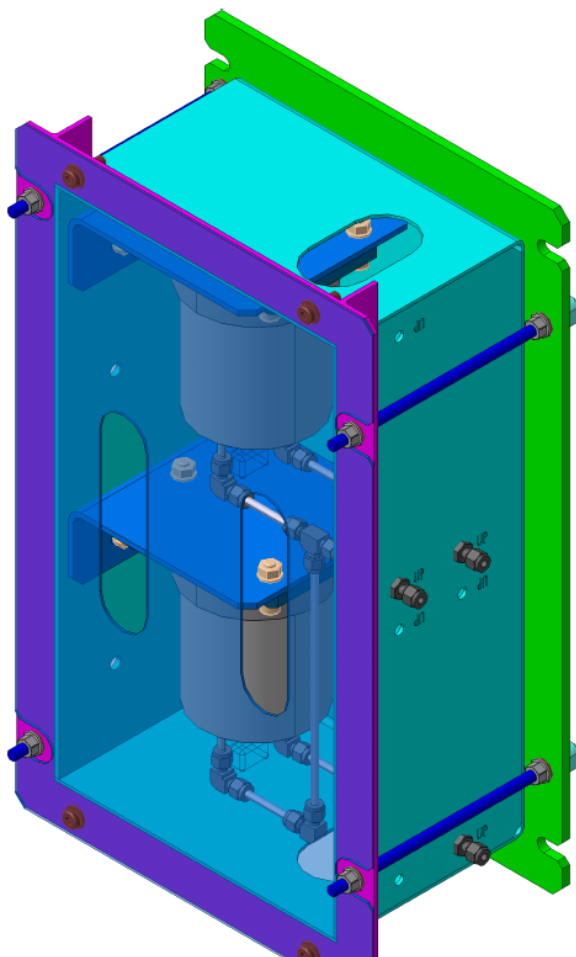


Figure 3: Individual mounting box for 5/3 solenoid - front view

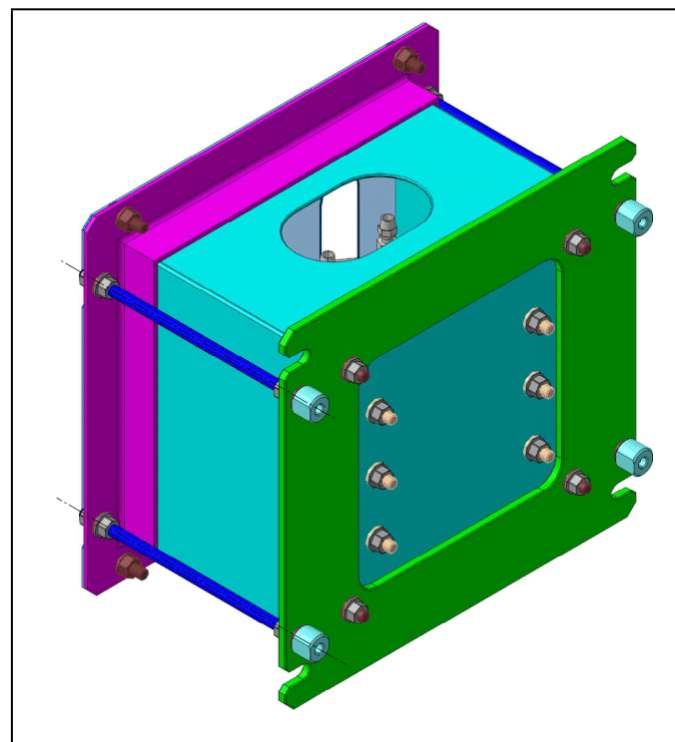
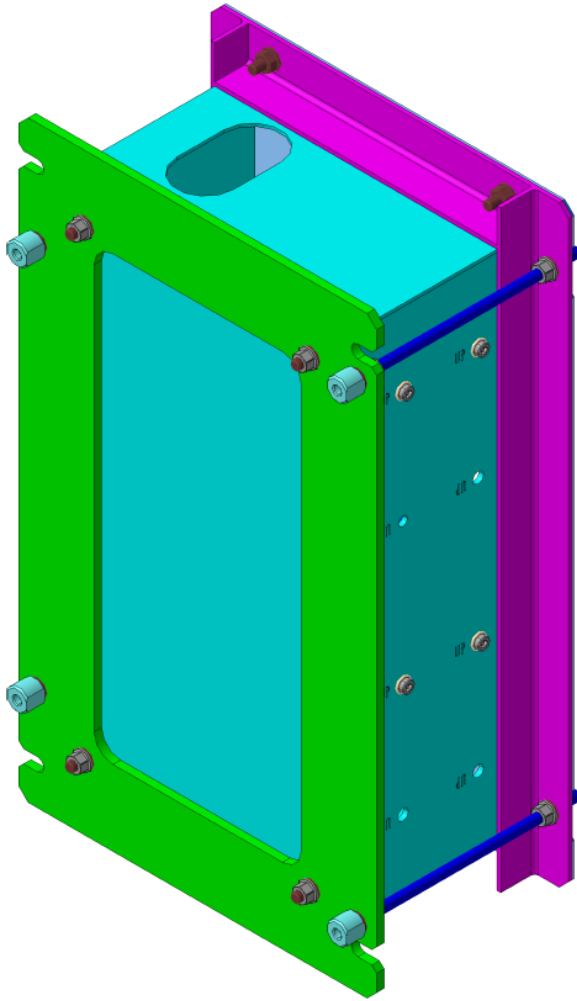


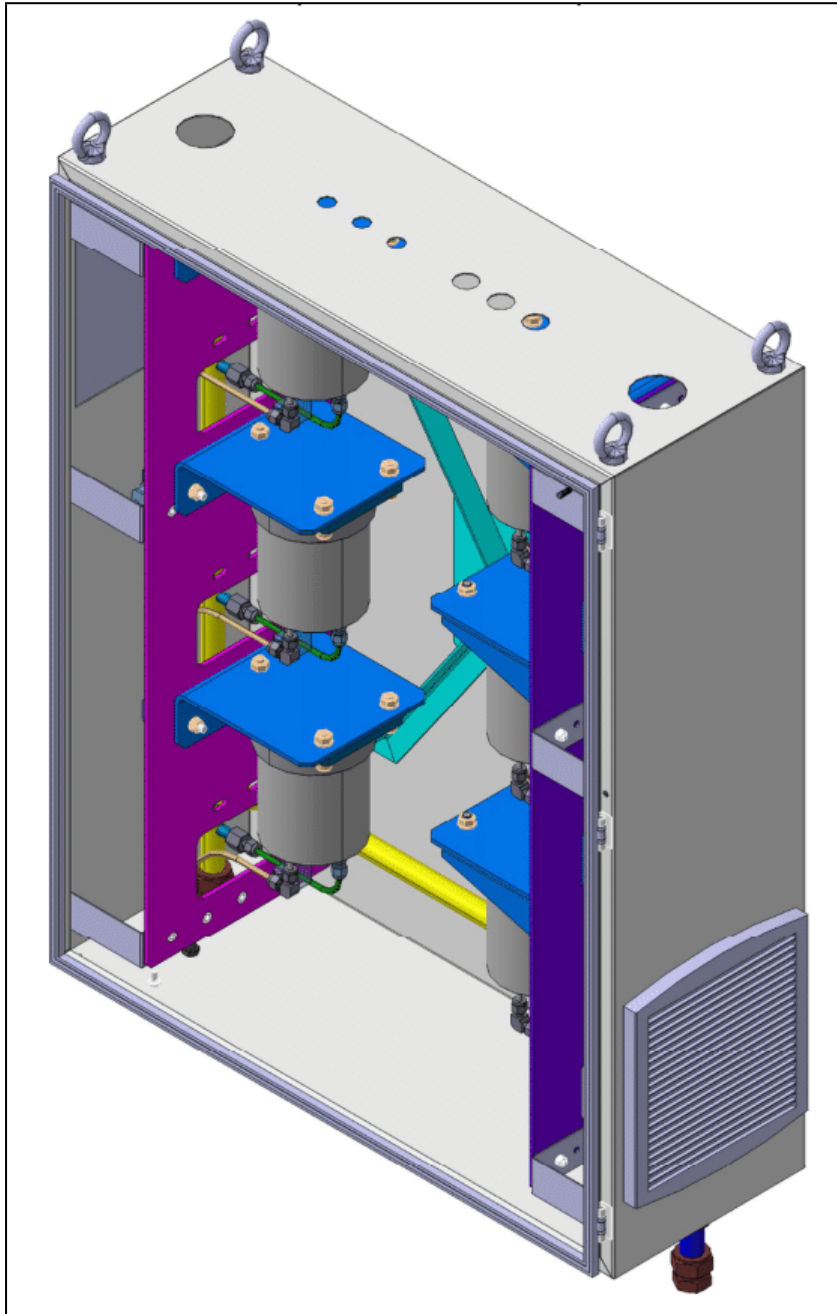
Figure 2: Individual mounting box for 3/2 solenoid - rear view



Note:

The removable protection panel is not shown for better clarity.

Figure 4: Individual mounting box for 5/3 solenoid - rear view



Note:
The front door panel
is not shown for
better clarity.

Figure 5: Mounting box for 6 solenoids - front view

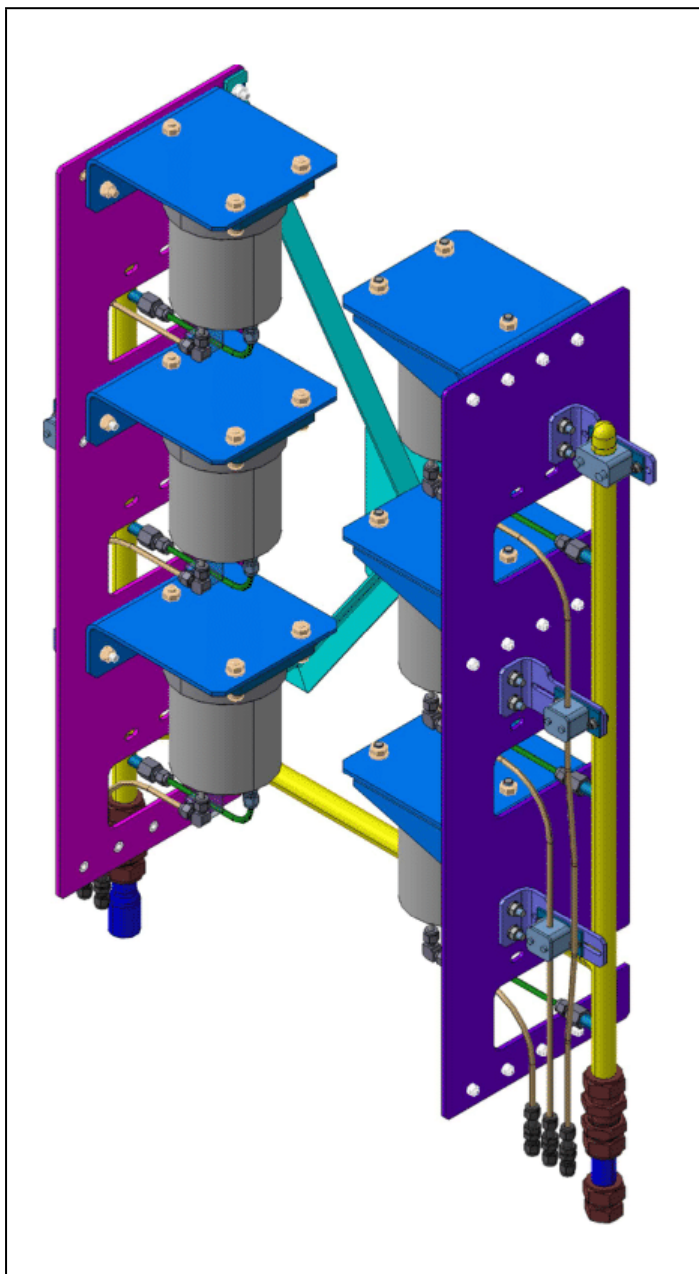


Figure 6: Mounting box for 6 solenoids - internal components

Appendix B: Solenoid Valves – Data Sheet

MAGNETICALLY SHIELDED NUCLEAR QUALIFIED SOLENOID VALVES

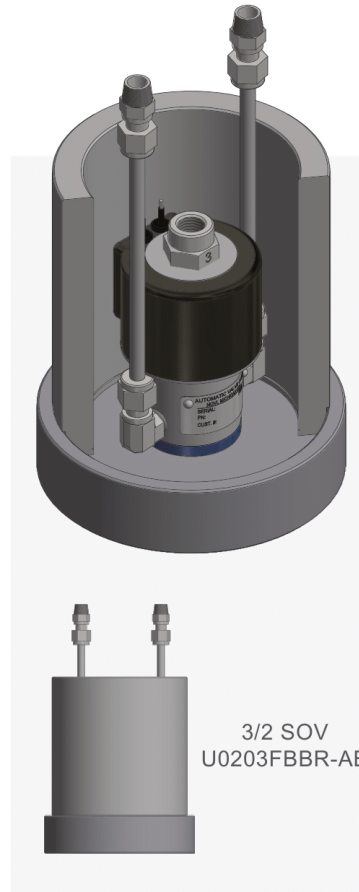
SPECIFICALLY DESIGNED FOR THE ITER TOKAMAK

AVN has developed a fully nuclear qualified SOV (solenoid operated valve) contained within a steel shield for applications in strong magnetic fields such as the ITER Tokamak that can negatively impact solenoid function.

Tested to external magnetic field strength of 146 mT (millitesla).

Valve body and internals are fully nuclear qualified products built to the AVN nuclear QA processes:

- Environmentally qualified to IEEE 323 and IEEE 382
- Seismically qualified to IEEE 344 and IEEE 382
- Built to the Automatic Valve Nuclear QA program meeting 10CFR50 App B, NQA-1, ANSI N45.2, ISO 9001
- Certified to CSA, UL, FM, and SIL standards
- Complete qualification report detailing radiation, seismic, accident, and other testing levels available



(Shield Partially cut-away to illustrate internal SOV)

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Appendix C: Solenoid Valves – Dimension Drawing of 3/2 Solenoid

