

Splicer Assembly - Technical inputs for Market Survey

1. Introduction

The Splicing Device (SD) is a high-voltage (HV) joint that connects wires from a superconducting magnet to the cable transmitting signals to the connector at Tokamak's wall.

During the assembly process of the splicing device, several activities demand a significant amount of care and attention. The so called HV Paschen test of the SD will determine the correctness of the assembly quality.

The primary role of the Splicer Assembly is to permit the individual HV Paschen test of the SD and mitigate the risk of SD damage during assembly. HV Paschen test requires pressures levels inside the Splicing assembly down to $1e^{-2}$ [mbar].

IO has generated an initial design of the Splicer Assembly, incorporating all necessary features. This design will be shared with the supplier for potential enhancements and adjustments.

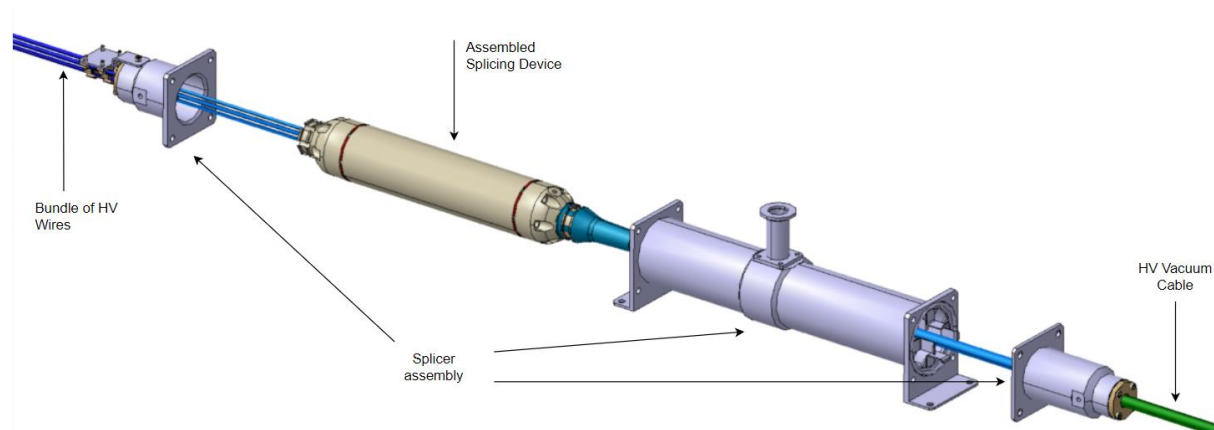


Figure 1.1 Overview of the Splicing Device and Splicer assembly.

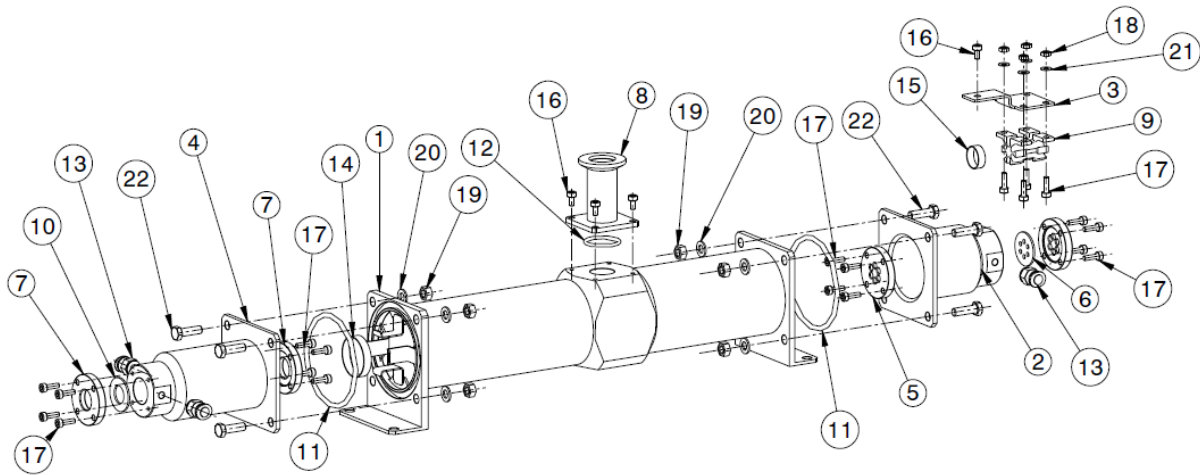


Figure 1.2 Detail of the preliminary IO design of the Splicer.

Item No.	Part Number	Revision	Material	Quantity	Weight
1	SD_SUPPORT#AUUYZ5	--A	316L	1	1.207kg
2	RESIN_CHAMBER_HV_WIRES#AUUZ5X	--A	316L	1	0.395kg
3	HV_WIRES_SHIELD_CONNECTOR_PLATE#AUUZ72	--A	316L	1	0.016kg
4	RESIN_CHAMBER_CABLE#AUUZ3Y	--A	316L	1	0.408kg
5	HV_WIRES_GASKET_CAP#AUV4YL	--A	316L	2	0.028kg
6	HV_WIRES_GASKET#AUV52H	--A	Viton (Fluoro Elastomer)	2	7.559e-004kg
7	CABLE_GASKET_CAP#AUV8LH	--B	316L	2	0.025kg
8	SD_SUPPORT_KF16-19-40_NOZZLE#AUV4SM	--A	316L	1	0.063kg
	Welded Flange KF 16/19/40				
9	HV_WIRES_SHIELD_CONNECTOR#AUV8HT	---	316L	1	0.027kg
10	CABLE_GASKET#AMWK58	--B	Viton (Fluoro Elastomer)	2	6.011e-004kg
11	SD_O-RING_SUPPORT_DIN56_EP3#AUV4UN	---	-	2	0kg
12	SD_O-RING_KF_NOZZLE_DINT20-EP2#AUV4WK	---	-	1	0kg
13	PNEUMATIC_CONNECTOR_QSM-M5-6#ANPCR5	---	-	4	0kg
14	AXOCLAMP_AXCL-02#AMWUN7	---	316L	1	0.002kg
15	CIRCULAR_CLIP_TBD#AMWVAD	---	Nylon	1	1.262e-004kg
16	CYLINDER_HEAD_SCREW_ISO_4762_M3X6#48SG8X	---	Steel 8.8	5	8.208e-004kg
17	CYLINDER_HEAD_SCREW_ISO_4762_M3X10#3ZNKKX	---	316L	20	0.001kg
18	HEXAGON_NUT_ISO_4032_M3#YQYV38	---	316L	4	3.953e-004kg
19	HEXAGON_NUT_ISO_4032_M5#YEAQTG	---	Steel 8.8	8	0.001kg
20	WASHER_ISO_7089_5#VUM5YR	---	-	8	0kg
21	WASHER_ISO_7089_3#WAQFHC	---	A2_304L	4	1.185e-004kg
22	HEXAGON_BOLT_ISO_4017_M5X16#26YGSK	---	stainless steel	8	0.004kg

Figure 1.3 BOM of components occurring in the preliminary assembly **Error! Reference source not found..**

2. Splicer features

To mitigate the risks to the magnet system that may result from SD assembly errors or mishandling & cables/ wires insulation damage, the features listed below need to be integrated into the Splicer design.

Vacuum chamber function for a HV Paschen-tightness test

The HV Paschen test enables the detection of failures in HV insulation. During this test, the vacuum pressure inside the chamber is varied. If the insulation is faulty, it may lead to the development of small-current vacuum arcs, which can be detected by the measuring instrument.

Nozzle, interface to the pumping system is removable in the preliminary IO design, but this is not a requirement.

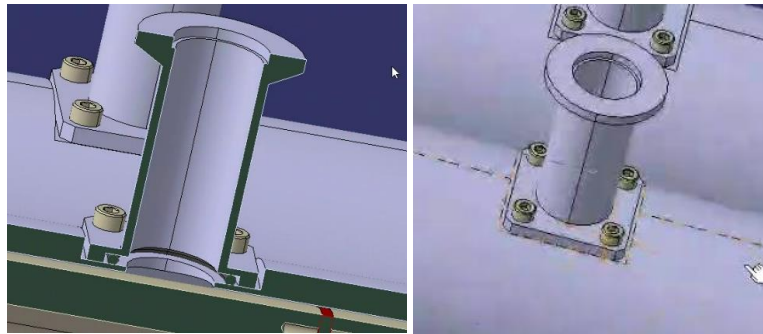


Figure 1.4 View of nozzle for connecting the pumping system.

Wires-side

Small, sealing chamber will be filled with a resin through pneumatic fittings. Injection can be made with a syringe. Gaskets on both sides of the sealing chamber will prevent the silicone from leaking. Wires inside the sealing chamber are not shielded.

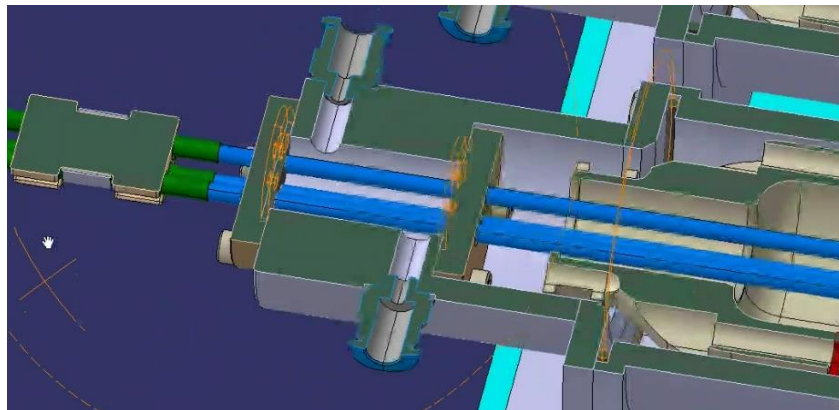


Figure 1.5 Cross-sectional view of the sealing chamber at the HV Wires side.

Cable-side

Same principle as for wires-side. The cable enters the chamber with the other jacket.

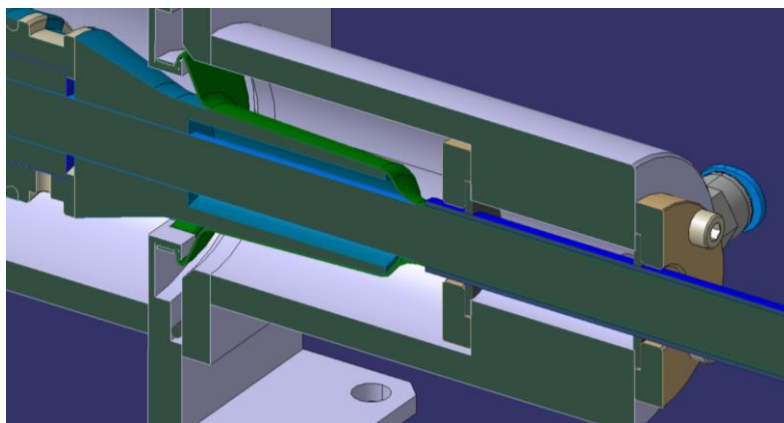


Figure 1.6 Cross-sectional view of the sealing chamber at the cable side.

EMC screening and GND Shield potential transition

On wires-side

A metallic edge clip securely hold wires in circular distribution and brings the HV Wires shield potential to the case of the Splicer, metallic case envelops fully the SD.

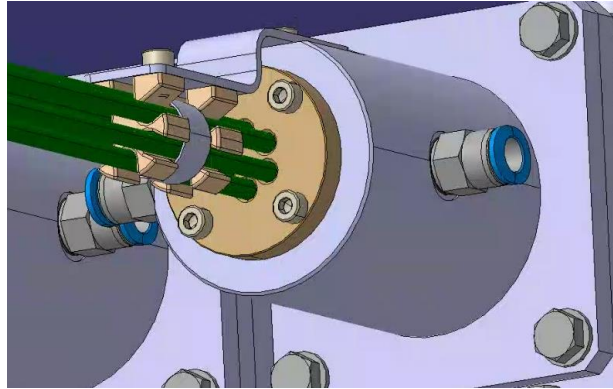


Figure 1.7 HV wires shields connection to the edge clip and the Splicer case.

On cable-side

On cable side, a groove will allow to clamp the cable shield to the case of the SD. The groove is metallic and in contact with the Splicer body.

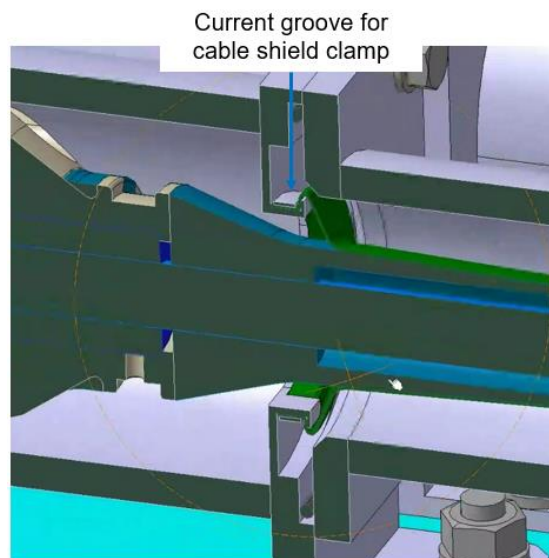


Figure 1.8 Cable shield clamped to the dedicated groove.

This system ensures the continuity of the GND Shield potential from the HV Wires side to the HV Vacuum Cable.

Strain relief

On wires-side

An edge clip securely hold wires in circular distribution. The strain relief function is less critical on the wire side than on the cable side.

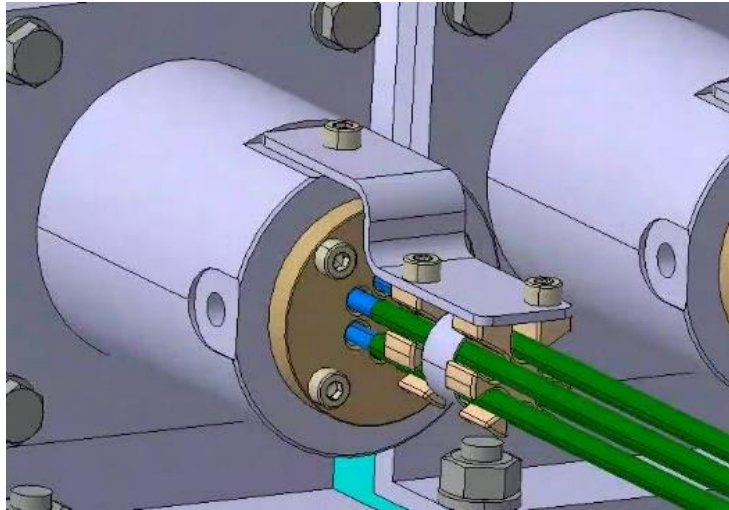


Figure 1.9 Strain relief at the HV Wires side.

On cable-side

The outer jacket of the cable enters the chamber, the weak point to cable bending is protected.

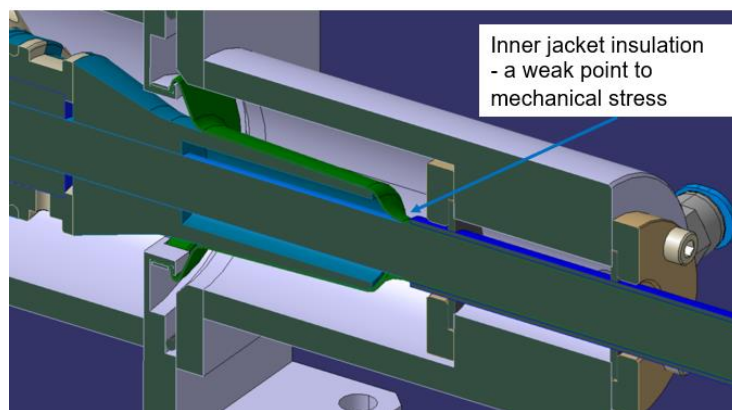


Figure 1.10 Strain relief at the cable side.

Permanent load due to SD weight

The diameter of the bracket for the shield clamping has been adjusted in order to get in contact with the silicon strain relief and stop the load of the SD in vertical position.

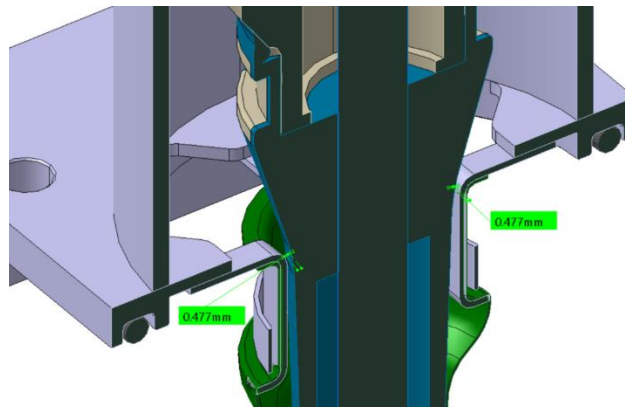


Figure 1.11 Mechanism to stop the load from SD in vertical position.

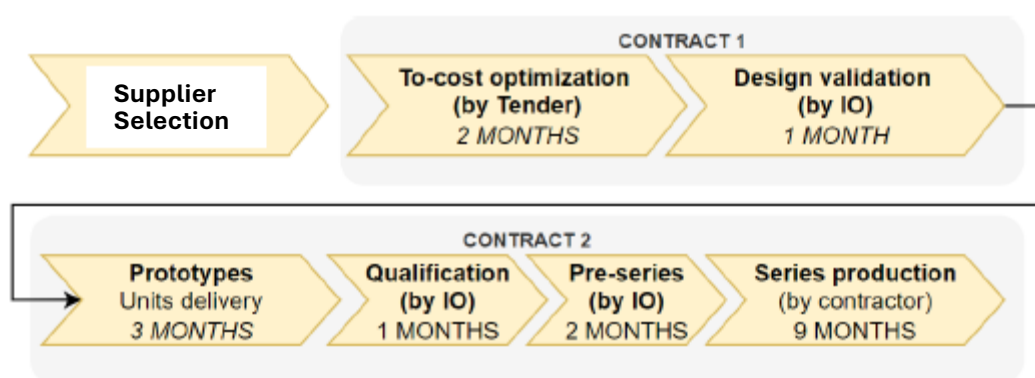
3. Target Price and To-Cost Design Optimization

The ITER Organization (IO) has already carried out a preliminary design of the Splicer Assembly. In prior to start the series production of the Splicer Assemblies, the design still needs to be optimized by the supplier using its knowledge to meet the IO's target price as shown below. This redesign phase is called "To-Cost Design Optimization".

Type of Splice Assembly	Quantity	Target Price
Prototype units	1 unit	Below 1.30kEUR per unit
Pre-series units	18 units	Below 1.30kEUR per unit
Series production	450 units	Below 1.00kEUR per unit

4. Tentative Implementation Schedule

The contract is planned to be divided into two stages/phases/parts as shown below. Manufacturing can be commenced only after the IO's validation on the deliverable of To-Cost Design Optimization.



5. Additional Notes and Disclaimer

- Please send any questions regarding the survey to the contact given in the cover letter via email. The received questions and their answers may be published in a manner that does not identify the questioner.
- If there will be any additional information and modifications to this Market Survey, they will be published at the same web page.
- All information provided in this Market Survey is tentative and subject to change.
- All intellectual property rights and other rights related to the information provided in this survey belong to the IO. Participants in the survey and viewers of the information are permitted to use the obtained information solely for the purpose of preparing responses to the survey and must not use it for any other purposes.
- Participation in this survey does not automatically grant eligibility for future procurement processes. Eligibility for future procurement procedures remains undetermined.

Annex-I

Attachment

Appendix-1: Preliminary Design Drawing

Appendix-2: 3D model data of Preliminary Design