

Technical Specifications (In-Cash Procurement)

Technical specification Summary for MCTB Cryolines

Technical specification Summary for MCTB Cryolines (CFN)

SUPPLY & WORKS

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SUPPLY & WORKS**Acronyms**

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

Abbreviation	Description
BoM	Bill of Materials
BW	Butt-weld
CRO	Contract Responsible Officer
CTB	Coil Terminal Box
DoD	Drop-off Devices
GM3S	General Management Specification for Service and Supply
FAT	Factory Acceptance Test
FOI	Factory Outlet Inspection Report
IO	ITER Organisation
IVB	Isolation Valve Box
KOM	Kick-off Meeting
LIV	Loss of Insulation Vacuum
MCTB	Magnet Cold Test Bench
MIP	Manufacture and Inspection Plans
MLI	Multi-layer insulation
MTO	Material Take Off
NDT	Non Destructive Test
JC	Johnston Coupling
OVJ	Out Vacuum Jacket
PF	Poloidal Field Magnet
PRO	Procurement Responsible Officer
PP	Process Pipe
SAC	Site Acceptance Certificate
SAT	Site Acceptance Test
SHE	Supercritical Helium
SRV	Safety Relief devices
TF	Toroidal Field Magnet
TACB	Test Auxiliary Cold Box
TS	Thermal shield
VB	Vacuum Barrier

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1 Introduction

A magnet cold test bench (MCTB) is under development for ITER TF and PF1 magnet cold testing. A dedicated cryogenic system (PBS name 98.MB.CS) will be developed. It primarily includes a test auxiliary cold box (TACB) and cryolines.

The objective of this document is to define the technical specification governing the design, manufacturing, transportation, installation and site acceptance tests of MCTB cryolines, including support structural, and interface components.

As illustrated in Figure blow, MCTB cryolines will link cryoplant with TACB (and its extension IVB) and CTB to provide cryogens for the tests. It consists of:

- **98.CS.TM**: Main Cryoline (~150m)
- **98.CS.TA**: Cryojumpers connecting CS.TM to TACB interfaces (~10m)
- **98.CS.TB**: Cryoline connecting IVB to CTB interface (~10m)

2 Scope of Work

The overall scope of work including:

- Supply MCTB cryolines (Design, manufacture and Shippment)
- Installation at ITER site
- SAT – Site Acceptance tests

2.1 Scope of Supply

Components to be supplied are shown below:

Sr. No.	Parts & components
1	Internal Process Pipes with hoses, bellows etc.
2	Internal sliding and fixed supports etc.
3	Vacuum barriers
4	MLI insulation of PPs & thermal shield blankets
5	OVJ and external bellows
6	Vacuum ports, DoDs, and their fasteners & accessories
7	Cryojumpers with JC Couplings at interfaces
6	Interface parts and materials
8	External supports and structural
9	Transport frames, skids, accelerator meters etc.
10	Installation Tools & Kits
11	Spare parts

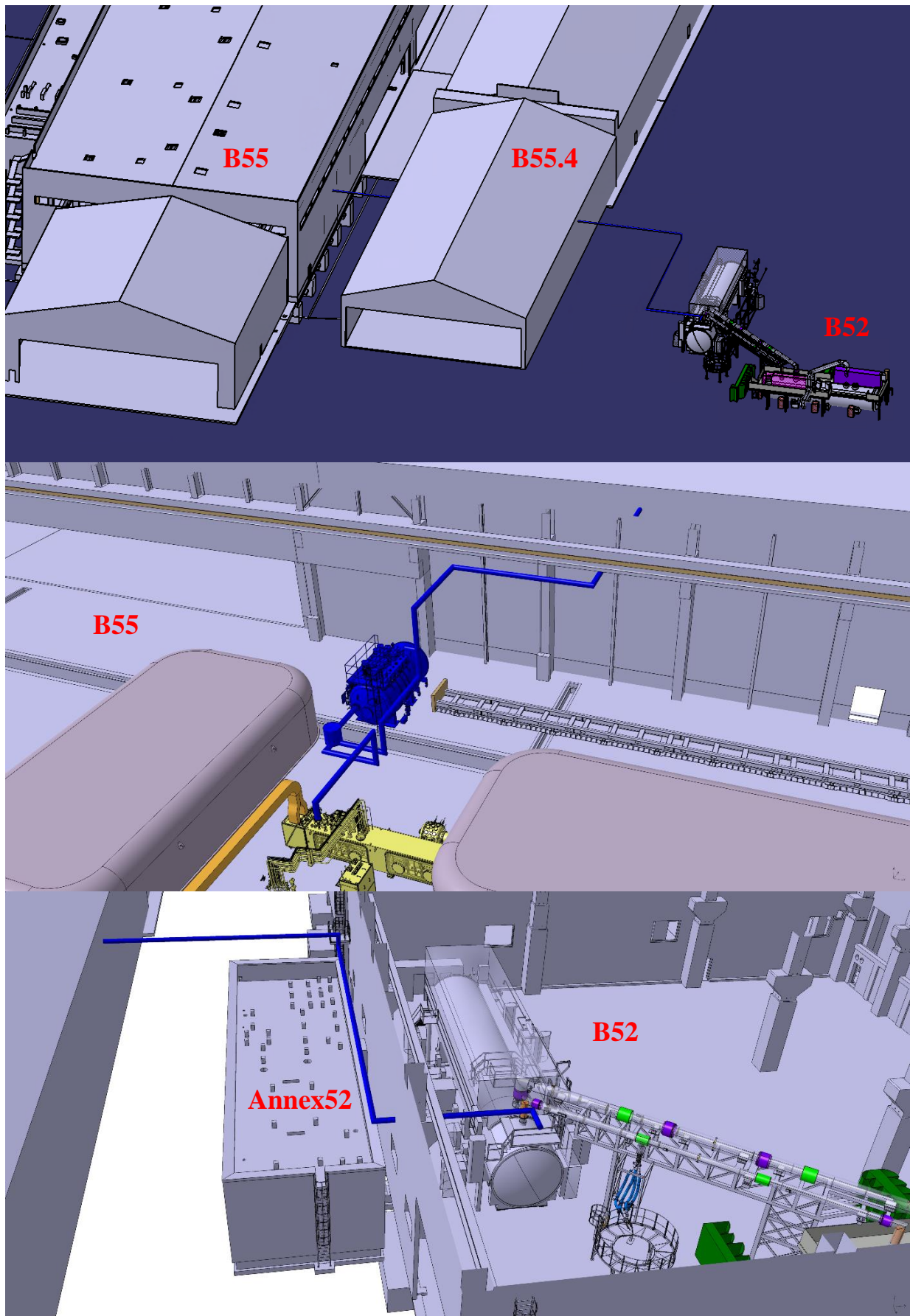
2.2 Scope of Installation

The scope of the installation of this contract shall cover welding of inter-spools, installation of external support structural, and interface connections with equipment.

2.3 Scope of SAT

SAT will be performed after completion of all interface connections. SAT includes: Warm acceptance tests (contractor) and cold acceptance tests (IO).

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*Figure 1 MCTB Cryoline 3D Layout*

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Classifications	Class
Safety Classification	NSC- Non Safety Function
Vacuum Classification	VQC-4
Quality Classification	QC-2
PED Classification	Article 4.3 and CAT-1
Seismic Classification	Eurocode 8

2.4.2 Main Design Parameters

Cryoline & Cryojumpers	ID PP	DN	Nominal Operation			Design	
			Pre	Tem	Flow	P_Design	T_Design
			[barg]	[K]	[g/s]	Bar diff	[K]
CS.TM	C	40	5.00	4.5	200	-1/21	4.5-323
CS.TM	D	65	1.35	5.5	200	-1/11	4.5-323
CS.TM	H	25	4.00	50	15	-1/11	20-323
CS.TA	C	32	5.00	4.5	100	-1/21	4.5-323
CS.TA	C'	32	5.00	4.5	100	-1/21	4.5-323
CS.TA	D	65	1.35	5.5	200	-1/11	4.5-323
CS.TA	D'	65	1.35	5.5	200	-1/11	4.5-323
CS.TB	CC	40	5.00	4.5	200	-1/21	4.5-323
CS.TB	CD	65	1.35	5.5	200	-1/21	4.5-323
CS.TB	H	25	4.00	50	15	-1/11	20-323

2.4.3 Load cases

Load combinations are list in the table with conformed design codes:

No.	Load Cases	Load Combinations	Reference
1	Normal_Indoors	G + NT + NP	EN13480 - Normal
2	Normal_Outdoors	G + NT + NP + WN	EN13480 - Normal
3	Transportation	G + TA	EN13480 - Occasional
4	Test_Indoor	G + TP	EN13480 - Test
5	Test_Outdoor	G + TP + WN	EN13480 - Test
6	Incidental	G + NT + LIV-1	EN13480 / Eurocode 8
7	Incidental	G + NT + LIV-2	EN13480 / Eurocode 8
8	Incidental	G + NT + NP + SL	EN13480 / Eurocode 8

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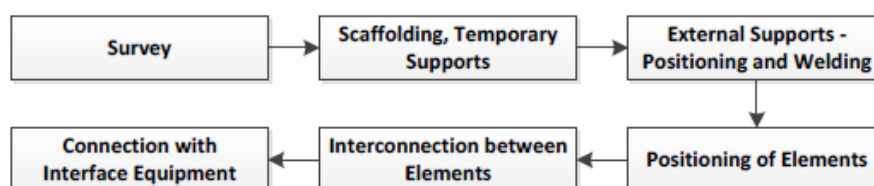
2.4.4 Interface requirements

MCTB cryolines have external process and building interfaces with different ITER systems including internal interfaces between cryolines and cryojumpers.

2.5 Installation requirements

The contractor shall be responsible for the installation of all MCTB cryolines, including pipe spool interconnections, connection with equipment, and external support installation with buildings.

The major steps in installation phase of cryoline are summarized in following flow-chart. This phase includes final installation of cryoline elements and its external supports including connection to interface equipment.



Major steps of mechanical installation

2.6 SAT requirements

Site Acceptance Review (SAR) will be conducted to verify the completion of necessary documentation as per document deliverable list so that SAC can be issued to the contractor. The warranty period will start after issue of SAC.

2.6.1 Warm Acceptance Certificate

The acceptance criteria for the release of Mechanical Acceptance Certificate.

2.6.2 Cold Acceptance Certificate

The acceptance criteria for the cold acceptance tests.

3 Timeline

The procurement process will start by Q4 – 2023 with contract award Feb. 2024.

- Delivery to FOS, Marseille, France, Jan. 2025
- Installation completed, May. 2025
- SAT – Warm tests, June. 2025.