European Organization for Nuclear Research
Organisation européenne pour la recherche nucléaire

DO-34691/EP/CMS

Price Enquiry

Technical Specification

Supply of Assembled Heavy-Copper Flex PCBs for Power Distribution

Abstract

This Technical Specification concerns the supply of 6567 assembled heavy-copper flexible PCBs (FPC) in 49 different variants to be used in the High-Granularity Calorimeter (HGCAL) Phase-II upgrade of the Compact Muon Solenoid (CMS) experiment at CERN.
The delivery is expected to be split in two stages: a first batch of 1930 FPCs covering 28 the variants shall be delivered within six weeks from notification of award of the Contract. Following this, a second batch of the remaining 4637 FPCs covering 32 variants shall be delivered in the following five months. Prototypes shall be requested if the proposed materials or fabrication processes have not been tested by CERN previously.

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Table of Acronyms

Acronym	Definition
CMS	Compact Muon Solenoid experiment
FAT	Factory Acceptance Tests
FPC	Flex printed circuit board
HGCAL	High-Granularity Calorimeter
LHC	Large Hadron Collider
MIP	Manufacturing and Inspection Plan
PCB	Printed Circuit Board
SAT	Site Acceptance Tests

1. INTRODUCTION

The Contract will be performed in accordance with the General Conditions of CERN Contracts (CERN/FC/6674-II). However, this Technical Specification prevails over the General Conditions of CERN Contracts with regard to the particular provisions specified in this document, and this without prejudice to any other provision in the General Conditions of CERN Contracts.

Capitalised terms in the body text are defined either in the General Conditions of CERN Contracts or in the present document.

1.1 Introduction to CERN

CERN, the European Organization for Nuclear Research, is an intergovernmental organization with over 30 Member States[1]. Its seat is in Geneva but its premises are located on both sides of the French-Swiss border (https://maps.web.cern.ch/). CERN's mission is to enable international collaboration in the field of high-energy particle physics research and to this end it designs, builds and operates particle accelerators and the associated experimental areas. At present, more than 10 000 scientific users from research institutes all over the world are using CERN's installations for their experiments. Further information is available on the CERN website: http://cern.ch.

The accelerator complex at CERN is a succession of machines with increasingly higher energies. Each machine injects the beam into the next one, which takes over to bring the beam to an even higher energy, and so on. The flagship of this complex is the Large Hadron Collider (LHC) (see Figure 1).

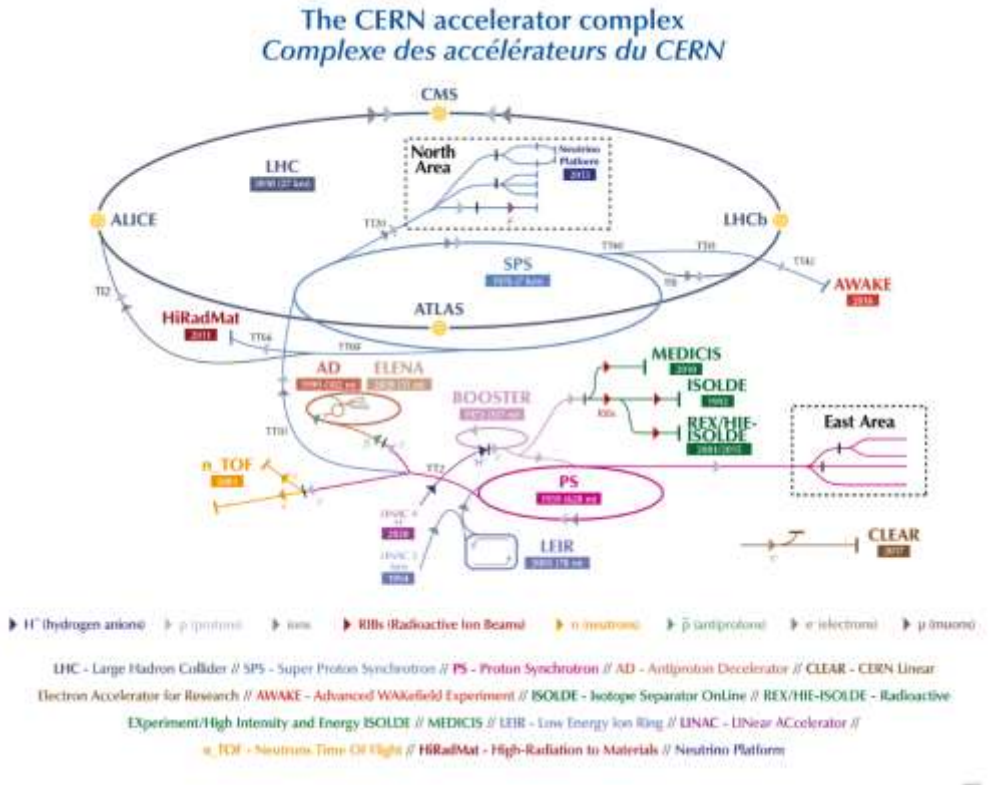

Figure 1: CERN Accelerator Complex

[1] http://home.web.cern.ch/about/member-states

1.2 Introduction to the CMS HGCAL

The Compact Muon Solenoid, or CMS (https://home.cern/science/experiments/cms) is one of the particle physics experiment at the LHC at CERN. The CMS detector is designed to study particles produced in high-energy proton-proton and heavy ion collisions to seek answers to fundamental questions such as: "understanding why the world is the way it is, why some particles weigh more than others and what constitutes the dark matter in the Universe". The CMS detector is located 100 m underground at the French village of Cessy near Geneva. The experiment is in operation and the data now being collected by CMS are distributed to institutes around the world to be analyzed. The CMS collaboration (hereafter "the CMS collaboration") involves more than 4300 particle physicists, engineers, technicians, students and support staff from 179 universities and institutes in 41 countries.

Since 2008 CMS has been upgraded in various ways, improving some of the detector elements and associated readout electronics. The so-called "Phase II" of the CMS upgrade program is a large-scale replacement of several major elements, and the introduction of some new layers, in order to be able to operate efficiently in the more challenging environment provided by the HL-LHC. One of the new systems is called High-Granularity Calorimeter (HGCAL), which will replace the current endcap calorimeters entirely.

2. SCOPE OF THE SUPPLY

CERN intends to place a contract (the "Contract") for the supply of 6567 assembled heavy-copper FPCs in 49 different variants (in whole or in part, the "Supply").

The successful bidder (the "Contractor") shall provide the Supply as defined in this Technical Specification.

2.1 General Description

The shape of the different variants of the Supply is similar but vary mainly in length from around 75 mm-long up to 972 mm-long. The outer dimensions are shown as a reference in Table **1**, but please refer to the Gerber files to optimise the panel utilization for each variant. Table 1 also shows the dimensions of a test coupon that shall be included in the free space between designs. The test coupons shall be clearly identified in the top marking so they can be linked to the FPCs they represent. The test coupons shall be provided as bare FPCs, without components or stiffeners.

All variants require two layers of copper, polyimide core, polyimide coverlay for the external insulation and halogen-free FR4 stiffeners. The required copper thickness for each variant is listed in Table **1**.

Furthermore, all variants require the assembly of components using standard reflow technology. CERN may optionally procure the components from the Contractor or may procure them separately and free-issue them to the Contractor for assembly.

2.2 Content of the Supply

The Supply shall include:

- *Technical deliverables* listed in Table **1** as specified in § 3, including test coupons from the production panels

Table 1: List of FPC variants and quantities

Name	**Copper thickness [µm]**	**Size-x [mm]**	**Size-y [mm]**	**Quantity batch 1**	**Quantity batch 2(remaining)**
BB10V-1D	70	83.16	59.46	395	0
BB10V-1D-M	70	83.16	59.46	270	0
BB10V-2D-DC	70	36	74.74	200	0
BB10V-2MHB-N-1	70	121.16	402.6	80	0
BB10V-2MSL-N-1	70	114.9	389.22	70	0
BB10V-2MHT-M-1	70	121.16	402.6	60	0
BB10V-2MFI-M-1	70	135.16	429.38	32	0
BB10V-3M00-N-1	70	114.8	383.86	60	0
BB10V-3MSR-M-1	70	114.8	454.86	100	0
BB10V-3M00-N-2	70	114.8	485.85	224	0
BB10V-3M00-M-2	70	114.8	485.85	134	0
BB10V-4M00-N-1	100	114.8	551.49	15	725
BB10V-4MHB-N-1	100	121.16	635.82	25	455
BB10V-4MFI-N-1	100	135.16	662.76	10	160
BB10V-4M00-M-1	100	114.8	551.49	15	410
BB10V-4MHT-M-1	100	121.16	635.82	10	202
BB10V-4MFI-M-1	100	135.16	662.76	10	130
BB10V-5M00-N-1	100	114.8	719.14	20	180
BB10V-5M00-M-1	100	114.8	719.13	20	250
BB1V5-1H4L-FE-F	100	90.75	743.05	30	0
BB1V5-2H3L-FE-F	100	90.75	743.08	45	0
BB1V5-3H2L-FE-HB	100	102.5	706.92	15	325
BB1V5-2tH2L-FE-F	100	134.76	495.92	15	0
BB1V5-3H2L-FE-FS	100	90.75	811.5	15	330
BB1V5-1H1L-FE-F	100	90.75	240.13	15	250
BB1V5-3H1L-HE-F	100	83.75	576.71	15	0

BB1V5-2H2L-HE-F	100	83.75	576.68	15	0
BB1V5-1H3L-HE-F	100	83.75	576.64	15	0
BB10V-3MFI-M-1	70	135.16	495.12	0	130
BB10V-3MHB-N-2	70	121.16	570.18	0	55
BB10V-4M00-N-2	100	114.9	559.99	0	20
BB10V-4MSL-N-1	100	114.8	622.5	0	55
BB10V-4MSR-M-1	100	114.8	622.5	0	20
BB10V-4M00-M-2	100	114.8	653.49	0	20
BB10V-4MHT-M-2	100	121.17	737.82	0	30
BB10V-4MSR-M-2	100	114.8	724.5	0	20
BB10V-4MFI-M-2	100	135.06	764.76	0	40
BB10V-5MFI-N-2	100	135.16	830.4	0	20
BB10V-5MHT-M-2	100	121.16	803.46	0	40
BB10V-6M00-N-1	100	114.8	886.77	0	70
BB10V-6MHB-N-1	100	121.16	971.1	0	70
BB10V-6M00-M-1	100	114.8	886.77	0	120
BB10V-6MHT-M-2	100	121.16	971.1	0	85
BB10V-6M00-N-2	100	114.8	886.77	0	30
BB1V5-1H3L-FE-F	100	90.75	575.41	0	70
BB1V5-2H2L-FE-F	100	90.75	575.44	0	70
BB1V5-3H1L-FE-F	100	90.75	575.47	0	70
BB1V5-3H2L-FE-F	100	90.75	743.11	0	85
BB1V5-3bH2L-FE-F	100	134.69	670.61	0	100
BB-TestCoupon		30	9	To be placed in the production panel or roll in the free space between designs	

CERN reserves the right to purchase additional quantities of any variant in addition to the quantities specified in Table **1**.

- *Activities* as specified in § 4:
  - On the Contractor's site:
    - Prototyping, if required by CERN (see § 4.1.1);
    - Production manufacturing and assembly (see § 4.1.2);

  - Testing (see § 4.2);
  - Packing, and shipping (see § 4.1.3);

- *Documentation* as specified in § 5:
  - Factory Acceptance Test report (see § 5.1.1);
  - Panelised Post-CAM Gerber files (see § 5.1.2).

- *Options*:
  - Passive components that are not provided by CERN;
  - Additional quantities of FPCs.

2.3 Components provided by CERN

The following components, present in variants BB10V-1D and BB10V-1D-M, shall be provided by CERN and shall not be procured by the Contractor:

- DHS-10-3.5 (designators BR5 and BR6 in the bill of materials), listed in the "Components provided by CERN" category.

The bidder shall quote, as an option in the Tender Form, the price of the other passive components. CERN reserves the right to order these components directly from the Contractor or to order them separately and free-issue them to the Contractor.

3. SPECIFICATION OF THE TECHNICAL DELIVERABLES

The Supply shall include the technical deliverables, listed with their respective quantities for the two batches in Table **1**, as specified in the present section. In addition, a prototype shall be required before the start of production if CERN has not tested the materials or fabrication processes in the past.

This section describes the general technical specifications that apply to all variants of the Supply. The specific shape, holes and vias location, stiffeners location, bill of materials and placement of components are provided in a separate compressed file for each one of the variants. The compressed files contain the Gerber files, NC drill files, Bill of Materials and Pick and Place information.

The extension of the Gerber files is described in Table 2.

Table 2: Gerber files extension

Layer Extension	Layer Description
.GTO	Top Overlay
.GTP	Top Paste
.GTS	Polyimide+adhesive top
.GTL	Top copper layer
.GBL	Bottom copper layer
.GBS	Polyimide+adhesive bottom
.GM7	Outline and cutouts
.GM12	Stiffener (thickness to be set after full stackup confirmation)

3.1 Technical Deliverable

3.1.1 Description and purpose of the flex PCBs

The heavy-copper FPCs will be used for low-voltage power distribution inside the HGCAL sub-detector. The shape of the different variants is similar but vary mainly in length from around 75 mm-long up to 972 mm-long. All variants require two layers of copper with polyimide core, polyimide coverlay for the external insulation and halogen-free FR4 stiffeners in selected locations. The required copper thickness for each variant is listed in Table **1**.

3.1.2 Operational and Environmental Conditions

The Supply will be located in the experiment area and shall be capable of operating continuously for a minimum of 10 years in the following ambient conditions without degrading the performance ratings stated in this Technical Specification:

- In ambient air temperature that varies between –35 °C and + 40 °C;
- In relative humidity from < 0.01 % to 60 %;

3.1.3 Specific Material Requirements

The Supply shall comply with the following specific material requirements:

- Halogen-free, epoxy-adhesive polyimide (PI) coverlay;
- Halogen-free, epoxy-adhesive or adhesiveless flexible copper clad laminates (FCCL) with Polyimide (PI) film;
- Acrylic-free adhesives;
- Halogen-free FR4 stiffeners.
- Changes in the materials during production are not allowed, unless these have been approved in writing by CERN in advance of their implementation.

3.1.4 Coverlay specifications

In addition to the material requirements specified in § 3.1.3, the coverlay shall comply with the following:

- The thickness of the polyimide film shall be equal to or greater than 25 µm;
- The coverlay registration, defined as the offset between the centre of the coverlay opening and the centre of the exposed pad, shall be less than or equal to 150 µm.

3.1.5 Stackup

In addition to the material requirements specified in § 3.1.3, the stackup shall comply with the following:

- 2 copper layers;
- Minimum finished copper thickness as specified in Table **1** for each variant;
- The thickness of the central Polyimide film shall be 25 µm or larger;
- Plated through-hole vias with a finished hole size of 0.6 mm;

- The minimum thickness of the holes and vias plating shall be 20 µm;
- The overall thickness of the FPC shall be lower than 0.75 mm;
- The overall thickness of the FPC including the stiffener shall be equal to 2.6 mm +/-100 µm;
- The stackup shall be subject to approval by CERN before fabrication;
- Changes in the stackup during production are not allowed, unless these have been approved in writing by CERN in advance of their implementation.

3.1.6 Holes size

The holes size specified in the Gerber files are finished hole diameter.

The finished hole size tolerance is ±0.076 mm (±3 mil) for all hole sizes.

3.1.7 Identification, Markings and Labelling

The top side of the FPCs shall be marked as specified in the corresponding Gerber layer (Top Overlay, file extension .GTO) for each of the variants listed in Table **1**. There are no prints on the bottom side.

The marking shall be done using white Silkscreen. Other processes such as laser marking shall be discussed before production.

The marking shall include a 5-digit serial number including the following information:

BNNNN

B: Batch

N: Number in batch

The number shall be unique per circuit (circuits in the same panel shall not have the same number). The numbers need not be contiguous (in the case of a circuit failing the Factory Acceptance Tests (see § 5.1.1) that number need not be replaced).

The test coupons shall be marked in the top layer so they can be uniquely identified and traced to the production panel or range of serial numbers contained in that panel or roll.

3.1.8 Finishing

The FPC finish shall be ENIG.

3.1.9 Components assembly

The components listed as “mounted” in the Bill of Materials of each variant shall be mounted in the top side of the FPC. The Contractor shall buy the components if these are ordered from the Contractor by CERN.

The components listed as “not mounted” shall be ignored and shall not be a part of the assembly.

3.2 Technical Requirements for the Prototypes

The Contractor shall deliver 10 pieces of variant BB10V-6MHT-M-2 as prototypes if these are requested by CERN. The purpose of the prototypes is to evaluate that the materials and fabrication process satisfy CERN's requirements so corrective actions can be taken early in the process if necessary. Therefore, the scope and necessity of the prototypes will be discussed with the Contractor.

4. SPECIFICATION OF THE ACTIVITIES

The Supply shall include the activities listed in the present section. These activities shall comply with the requirements specified below.

4.1 Activities at the Contractor's Premises

During the Contract, CERN shall have free access, during normal working hours, to the Contractor's premises, including manufacturing and assembly sites and Subcontractor's premises. The change of manufacturing place is subject to prior written approval by CERN.

4.1.1 Prototype Manufacturing Activities

If requested, the Contractor shall manufacture the prototype units according to the requirements specified in § 3. They shall be tested in accordance with § 4.2.

The Contractor shall submit the Panelised Post-CAM Gerber files for each variant, which shall be subject to CERN's approval before the Contractor starts the fabrication.

Manufacturing of the production units will be subject to prior written acceptance of the prototype(s) by CERN (see § 7.3), if they were requested.

4.1.2 Production Manufacturing Activities

The Contractor shall produce production units in the quantities and according to the requirements specified in § 3. They shall be tested in accordance with § 4.2.

The Contractor shall submit the Panelised Post-CAM Gerber files for each variant, which shall be subject to CERN's approval before the Contractor starts the fabrication.

Manufacturing of batch 2 units will be subject to prior written acceptance of the batch 1 production units by CERN (see § 7.3).

In case of differences between the units of the two batches, CERN may request the Contractor to modify the units concerned in order to remedy such differences.

4.1.3 Packing and Shipping

The Contractor shall be responsible for the packing and, if requested by CERN for the transport to CERN. In this case, the Contractor shall take up a dedicated all-risk transport insurance for the Supply concerned in accordance with the provisions of DAP Incoterms 2020 conditions, CERN Meyrin (CH).

In all cases, the Contractor shall comply with the packing and shipping instructions available under: https://procurement.web.cern.ch/system/files/document/packing-and-shipping-instructions_0.pdf and, in particular, ensure that the Supply is packed in a way that guarantees the absence of any

contamination and that no damage or any possible deterioration in performance due to transport conditions can occur.

4.2 Tests

The Contractor shall carry out Factory Acceptance Tests (FAT) as specified below.

The Contractor shall compile the FAT results in a FAT report (see § 5.1.1) to be submitted to CERN for written approval prior to shipment of the Supply.

The required FAT are described in the table below.

The Contractor shall have all necessary test equipment required to complete the FAT. No test equipment will be provided by CERN.

The FAT shall be carried out for every panel for batch 1 and every production lot for batch 2.

If more than 2% of any production lot is lost, either during production or because it fails the FAT, the Contractor shall pause production and notify CERN. No compensation shall be payable to the Contractor for any pause in production. Re-start of production shall be subject to CERN's written approval.

Table 3: Factory Acceptance Tests

Item	Description	Requirement	Measurement	Result
1- Laminate	a- Copper finished thickness	Greater or equal than the thickness specified in Table **1**	Microsection on test coupon from panel.	Acc / Rej
2- Coverlay	a- Coverlay thickness	Polyimide film thickness greater or equal than 25um	Microsection on test coupon from each production panel.	Acc / Rej
	b- Coverlay colour	To match agreed colour	Optical inspection	Acc / Rej
	c- Coverlay applied on both sides of the FPC	Present in bottom and top	Optical inspection	Acc / Rej
	d- Coverlay registration	Maximum 150 µm from centre of the hole/pad	Optical inspection	Acc / Rej
3- Silkscreen/ marking	a- Colour	White	Optical inspection	Acc / Rej
	b- Serial number	Present in the marking	Optical inspection	Acc / Rej
4- Surface finish	a- Finish type	ENIG	Optical inspection	Acc / Rej
5- Electrical test	a- Continuity and isolation	100% pass	Flying probe test on all circuits	Acc / Rej
6- Board dimensions	a- Distance between farthest holes	Matching Gerber to ± 0.2 mm		Acc / Rej
	b- Board cutouts	Matching Gerber files	Optical inspection	Acc / Rej
	c- FPC thickness	To match stackup defined before fabrication to ± 0.075 mm		Acc / Rej
	d- FPC + Stiffener thickness	2.6 mm ± 0.1 mm	To be measured and 100% pass at all stiffeners position	Acc / Rej
7- Hole size	a- Finished hole size	Matching Gerber files to +/-0.076 mm	Microsection on test coupon corresponding to the panel.	Acc / Rej
	b- Holes wall copper thickness	Minimum 20 µm	Microsection on test coupon corresponding to the panel.	Acc / Rej

5. SPECIFICATION OF THE DOCUMENTATION

The Supply shall include the documentation related to the Supply (§ 5.1) and the documentation related to the performance of the Contract (§ 5.2). This documentation shall comply with the requirements specified below.

5.1 Documentation Related to the Supply

The documentation related to the Supply shall include:

- Factory Acceptance Test (FAT) report.
- Panelised Post-CAM Gerber files.

5.1.1 Factory Acceptance Test report

The Contractor shall submit a FAT report in accordance with the schedule defined in § 7.1, including:

- All tests performed;
- All test results;
- All non-conformities;
- All modifications performed;
- Production yield per variant and per production lot.
- The serial number of each circuit.

5.1.2 Panelised Post-CAM Gerber files

The Contractor shall submit the final Panelised Post-CAM Gerber files used for fabrication.

5.2 Documentation Related to the Performance of the Contract

The Contractor shall submit documentation related to the performance of the Contract including:

5.2.1 Quality Plan

The Contractor shall submit a Quality Plan in accordance with the schedule defined in § 7.1. The Quality Plan shall be prepared along the guidelines stated in ISO 10005:2018, *Quality management – Guidelines for quality plans*.

5.2.2 Progress Reports

The Contractor shall submit progress reports including:

- The actual progress in comparison to the scheduled progress (see § 7.1);
- Any yield issue for any variant where the yield falls below 98%, where yield refers to total loss in a production lot including losses during production and failures during the FAT;
- Any unexpected delay in purchasing the necessary laminates or components.

5.3 Creation, Updating and Control of Documents

The Contractor shall apply professional standards and codes in matters of document editing, design/drawing process, design reviews and approval, naming conventions and tagging, quality assurance/control.

The full documentation supplied in the framework of the Contract (including all drawings and schematics) shall be in English.

The Contractor shall submit all documents produced exclusively in the following electronic formats:

- Gerber files in Extended Gerber format or RS-274X;
- Text documents in Microsoft Word® or PDF® format;
- Schedule for the delivery of each variant in PDF® format.

6. APPLICABLE RULES, NORMS AND STANDARDS

The Supply shall comply with Laws. For the purpose of the Contract, Laws shall include all relevant rules, norms and standards and, and in particular:

6.1 Requirements

- All materials shall be halogen free.

6.2 Norms and Standards

- IPC-A-600 (Class 3) *Acceptability of Printed Boards*;
- IPC-A-610 (Class 3) *Acceptability of Electronic Assemblies;*
- IPC-6013 (Class 3) *Qualification and Performance Specification for Flexible Printed Boards;*
- IPC-4101/126 *Specification for Base Materials for Rigid and Multilayer Printed Boards – Slash Sheet 126: Polyimide (Non-Halogenated) Laminates and Prepregs for Flexible and Rigid-Flex Circuits*
- IPC-4204/11 *Specification for Finished Electrical Insulating Materials – Slash Sheet 11: Polyimide (Non-Halogenated) Coverlay and Adhesive Films for Flexible Printed Circuits;*

7. PERFORMANCE OF THE CONTRACT

7.1 Schedule

The Contractor shall deliver the Supply in accordance with the following schedule, starting from the date of notification of award of the Contract to the Contractor. If CERN requires prototypes, it will order these prior to placing the Contract. The Bidder shall deliver prototypes within four weeks of placement of an order by CERN. The Bidder may propose, in its bid, a detailed schedule for the production run (T_2 onwards), number of batches and delivery date of each batch, provided that all the Supply must be completely delivered within five months after T_2.

Table 4: Schedule

	Milestones	Weeks	Indicative Date
T_0	Notification of award of the Contract to the Contractor and submission of final Gerber files by CERN		
	Delivery of Panelised Post-CAM Gerber files for each variant of batch 1	T_0 + 1	02/June/2025
T_1	Acceptance by CERN of the above-mentioned documentation		09/June/2025
	Delivery of FAT report (see §5.1.1) for written approval by CERN	T_1+5	14/July/2025
	Delivery of batch 1 units at CERN	T_1 + 6	21/July/2025
T_2	Authorisation by CERN to proceed on basis of batch 1		4/August/2025
	Delivery of batch 2 units (lot 1) and related technical documentation (see § 5.1.1)	T_2 +5	8/September/2025
	Delivery of batch 2 units (lot 2) and related technical documentation (see § 5.1.1)	T_2 + 10	13/October/2025
	Delivery of batch 2 units (lot 3) and related technical documentation (see § 5.1.1)	T_2 + 15	17/November/2025
	Delivery of batch 2 units (lot 4) and related technical documentation (see § 5.1.1)	T_2 + 22	22/December/2025

7.2 Contract Follow-Up and Progress Monitoring

The Contractor shall assign a person in charge of the technical execution of the Contract and its follow-up, as well as a person in charge of the commercial follow-up, during the whole duration of the Contract. These persons shall be able to communicate (spoken and written) in at least one of the official languages of CERN (English and/or French).

The Contractor shall send to CERN a written progress report (as specified in § 5.2.3) every month until the end of the Contract. All communications and documents shall be in English**.**

7.3 Acceptance of the Supply by CERN

7.3.1 Acceptance of the stackup and materials

The Contractor shall submit to CERN for acceptance the proposed stackup and materials complying with the requirements specified in § 3.1, including their datasheet. CERN will verify the conformity in accordance with clause 22 of the General Conditions of CERN Contracts.

The ordering of components and the start of the production of the Supply shall be subject to CERN’s prior written acceptance of the materials and stackup.

7.3.2 Acceptance of the prototypes

The bidder shall submit to CERN for acceptance the prototypes as specified in § 4.1.1 and according to the schedule defined in § 7.1, if these are ordered by CERN

CERN will verify the conformity of the prototype(s) in accordance with clause 22 of the General Conditions of CERN Contracts.

7.3.3 Acceptance of the Supply

Acceptance of the Supply will be subject to the successful completion of the FAT by the Contractor and the submission and written acceptance by CERN of the FAT report (see § 5.1.1) and all compliant tests results or other certificates requested by CERN.

Acceptance of the Supply shall be subject to the successful completion of the following tests by CERN on its site (SAT):

- Copper thickness (resistivity and microsection on test coupons)
- Visual inspection of assembly
- Visual inspection of coverlay integrity
- Measurement of coverlay registration
- Visual inspection of ENIG finishing
- Measurement of FPC thickness
- Measurement of FPC + stiffener thickness
- Visual inspection of stiffeners position

7.4 Warranty

The warranty period shall be of two years from the date of acceptance (see § 7.3.3).

8. CERN REPRESENTATIVES

All commercial and technical correspondence concerning the Invitation to Tender shall be communicated to the CERN Procurement officer and in copy to the Technical officer. Any communication by or to any other person than the CERN Procurement Service shall not be valid and have no effect.

Procurement officer	**Tel**	**Email**
Joshua Davison	Tel: +41 22 766 4458	joshua.luke.davison@cern.ch
In case of absence:		
Nordine Azizi	Tel: +41 22 767 3570	nordine.azizi@cern.ch
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