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The Large Hadron Collider Project ***IT-3143/AT/LHC***

Invitation to Tender

Technical Specification for the Manufacture and Supply of HTS BSCCO 2223 Ag-Au Tape

Abstract

This Technical Specification concerns the manufacture and supply of High Temperature Superconducting (HTS) multifilamentary BSCCO 2223 tape with Ag-Au alloy matrix. Either a total length of 28 km with a minimum current carrying capacity of 85 A under self-field conditions at 77 K, or a total length of 34 km with a minimum current carrying capacity of 66 A under self-field conditions at 77 K is required.

The delivery of the tape is expected to be spread over a period of one year from October 2003.

March 2003

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Terms and Definitions

Term	Definition
EDMS	Engineering Data Management System
QAP	Quality Assurance Plan

1. INTRODUCTION

1.1 Introduction to CERN

The European Organization for Nuclear Research (CERN) is an intergovernmental organization with 20 Member States*. It has its seat in Geneva but straddles the Swiss-French border. Its objective is to provide for collaboration among European States in the field of high energy particle physics research and to this end it designs, constructs and runs the necessary particle accelerators and the associated experimental areas.

At present more than 5000 physicists from research institutes world-wide use the CERN installations for their experiments.

1.2 Introduction to the LHC Project

The Large Hadron Collider (LHC) is the next accelerator being constructed on the CERN site. The LHC machine will mainly accelerate and collide 7 TeV proton beams but also heavier ions up to lead. It will be installed in the existing 27 km circumference tunnel, about 100 m underground, that previously housed the Large Electron Positron Collider (LEP). The LHC design is based on superconducting twin-aperture magnets which operate in a superfluid helium bath at 1.9 K.

1.3 Subject of this Technical Specification

The LHC will be equipped with about 8000 superconducting magnets. The total current of about 3.4 MA will be transferred via current leads housed in cryostats located in the LHC tunnel, right and left of each of the eight interaction points.

In view of the large amount of current to be carried into the cryogenic environment and the potential savings in liquefaction power made possible by the use of High Temperature Superconducting (HTS) material, the LHC leads rated for currents ranging from 600 A to 13000 A will incorporate this material in the form of BSCCO 2223 tapes. In order to reduce its thermal conductivity, the silver alloy matrix of the tape is doped with gold.

The tapes are assembled into stacks prior to delivery to the leads manufacturer. The stacks, about 0.35 m long, will be made at CERN. In the current lead design, the stacks are helium gas cooled. They operate in a gradient of temperature comprised between 50 K and 4.5 K.

This Technical Specification concerns the manufacture, supply and test of the BSCCO 2223 tape. The LHC current leads project requires a total length of BSCCO 2223 tape between 28 km and 34 km. The BSCCO 2223 tape shall be supplied to CERN assembled into spools each with a minimum tape length of 100 m. The 28 km supply corresponds to a minimum critical current of the tape of 85 A in self-field at 77 K. The 34 km supply corresponds to a minimum critical current of the tape of 66 A in self-field at 77 K.

* CERN Member States are: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, The Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland and the United Kingdom.

The Contractor shall assure that the tape of the several spools has the same chemical composition, geometrical dimensions and electrical, thermal and mechanical properties. He shall as well assure uniformity of the tape properties along its length. The Contractor shall use the delivery of the first spools, in October 2003, to finalize the manufacturing process. This process shall then be frozen before the manufacturing of the rest of the production commences.

In view of the important role of the BSCCO 2223 tape in the LHC project, the Contractor shall assure the traceability of all materials and equipment involved by means of a consistent documentation of manufacturing data and test results, in accordance with a quality assurance program.

2. SCOPE OF THE TENDER

2.1 Scope of the supply

The total supply shall consist of 28 km or 34 km (see section 4.4) of multi-filamentary bare BSCCO 2223 Ag-Au tape, hereafter referred to as BSCCO tape, with a purchase option for an additional amount of up to 3 km in length. The supply will consist of the following subtasks:

- Procurement of all necessary raw materials, components and tooling.
- Complete design, manufacturing and operation of the required testing facilities.
- Manufacture of the BSCCO tape.
- Test, inspection and quality control of the BSCCO tape according to this Technical Specification.
- The supply, in the form of both paper and electronic data files, of all reports and records of inspections and tests carried out within the scope of this Technical Specification, according to forms and formats agreed with CERN.
- Packaging and safe transport of the BSCCO tape to CERN.

3. GENERAL CONDITIONS FOR TENDERING AND CONTRACTING

Please refer to the commercial documents for more complete information.

To be selected as qualified bidder, the firm shall have:

- A minimum of 3 years in-house experience in manufacturing long lengths (100 m minimum) of BSCCO silver alloy tape.
- In-house experience in manufacturing long lengths (100 m minimum) of BSCCO silver-gold alloy tape whose characteristics satisfy the chemical, geometrical, electrical and mechanical requirements specified in section 4 of this Technical Specification.
- In-house expertise, in terms of qualified personnel and equipment, in the execution of the tests specified in section 5 of this Technical Specification.

In addition, tenders will only be considered from firms having delivered to CERN long lengths (70 m minimum) of BSCCO tape which has subsequently been successfully soldered together into stacks and tested at CERN.

3.1 Tender procedure

3.1.1 Pre-tender discussions

The Bidder is strongly encouraged to contact CERN and discuss details of this Technical Specification before submitting a tender. In particular, CERN wishes to ensure that no doubt exists as to the interpretation of this Technical Specification.

3.1.2 Alternative solutions

If the Bidder finds that any part of this Technical Specification is difficult, or costly to meet, he is free to propose an alternative solution, provided that the deviations from this Technical Specification, together with the reasons and advantages, are clearly indicated in the Tender. Such alternative solutions shall always be made in addition to a conforming bid, which shall comply fully with this Technical Specification.

CERN reserves the right to accept or reject the proposed alternative solutions without justification.

3.1.3 Preliminary programme

The Bidder shall propose a preliminary manufacturing plan with the Tender, based on the specified CERN provisional delivery schedule. This plan shall describe the complete manufacturing process and all tooling, machines and equipment, including a flow chart, diagram and narrative. If the plan includes proprietary information, the Contractor shall take all necessary measures to allow disclosing that information to CERN. If needed, CERN is prepared to enter in a non-disclosure agreement. The implementation of any changes to the manufacturing plan after the commencement of the manufacturing is subject to prior written approval by CERN.

3.1.4 Subcontractors

The Bidder shall declare in his Tender any services he may wish to subcontract for testing. Refer to the commercial documents for more details. If awarded the Contract, the Bidder shall restrict himself both to the subcontractors and the amount mentioned in the Tender. If, for some reasons, he wants to change any subcontractor, or the scope of subcontracted work, or the amount subcontracted, he shall obtain CERN's prior agreement in writing.

3.1.5 Technical Questionnaire

The Technical Questionnaire attached to this Technical Specification shall be completely filled in and returned with the Tender Form, otherwise the Tender will not be considered as complete and will be discarded.

3.1.6 Presentation of Tender

The Bidder may be required to make a formal presentation of his Tender at CERN at his own expense and shall be ready to do so within a week of notification.

3.1.7 Country of origin

Please refer to the commercial documents for specific conditions concerning the country of origin of the equipment or services to be supplied.

3.2 Contract execution

3.2.1 Responsibility for design, components and performance

The Contractor shall be responsible for conformity with this specification of all items supplied, irrespective of whether they have been chosen by the Contractor or suggested by CERN. CERN's approval of the design and component choice does not release the Contractor from his responsibilities in this respect.

3.2.2 Contract follow-up

3.2.2.1 Contract engineer

The Contractor shall assign an engineer to be responsible for the technical execution of the Contract and its follow-up throughout the duration of the Contract.

3.2.2.2 Progress report

The Contractor shall supply, within one month of award of the Contract, a written programme detailing the manufacturing and testing schedules. The programme shall include preliminary dates for inspections and tests.

A written progress report shall be sent to CERN every month until completion of the Contract.

3.2.2.3 Design approval and production

A complete manufacturing file, including drawings of the tape and of the spool used for the delivery of the tape, shall be submitted to CERN for approval within one month after notification of award of the contract. CERN will give its approval or refusal, in writing, within 2 weeks. This file shall contain detailed information on:

- Characteristics of the tape (tape dimensions, number of HTS filaments, filaments size, filling factor, matrix chemical composition, matrix porosity, final density of the oxide core, n value, length of tape per spool),
- Geometrical, electrical, mechanical and thermal properties of the tape. In particular the following properties should be reported:

  -The critical current of the tape as a function of temperature, in the range 4.2 K - 77 K, in self-field conditions.

  -The critical current of the tape as a function of an external magnetic field, parallel and perpendicular to the tape surface, of up to 2 T at different temperatures in the range 4.2 K-77 K. The critical current corresponding to a field in the range 0-100 mT shall be clearly indicated.

  -The critical current of the tape as a function of stress and strain at 4.2 K and 77 K (stress applied at room temperature and 77 K).

  -The thermal conductivity and the electrical resistivity of the tape in the range 4.2 K - 77 K.

- The detailed description of the set-up and methods which will be employed for the geometrical, electrical and mechanical measurements requested in this Technical Specification.

- The available information on thermal cycling, aging and radiation effects.

The series production shall be preceded by the production of a 100 m long tape. Production of the series shall not start before CERN has given its formal approval of the pre-series in writing.

3.2.3 Deviations from this Technical Specification

If, after the Contract is placed, the Contractor discovers that he has misinterpreted this Technical Specification, this will not be accepted as an excuse for deviation from it and the Contractor shall deliver equipment in conformity with this Technical Specification at no extra cost.

During execution of the Contract, all deviations proposed by the Contractor from this Technical Specification, the Tender, or any other subsequent contractual agreement, shall be submitted to CERN in writing. CERN reserves the right to reject or accept such proposals without justification.

3.3 Factory access

During the Contract period and in normal working hours, CERN representatives shall have free access to the manufacturing sites, including any subcontractor's premises, to inspect the manufacturing progress and to witness any testing. The place of manufacture, as stated in the Tender, may only be changed after written approval by CERN.

4. BSCCO TAPE

The tape consists of a composite of fine BSCCO 2223 filaments in Ag-Au alloy matrix. It is manufactured with the Powder In Tube (PIT) process according to which the ceramic powder after synthesis is packed into a silver alloy tube and sealed to form a "billet". After deformation processing, the billet is transformed into a monofilamentary wire. A number of monofilamentary wires formed from individual billets are bundled together in a silver-alloy tube, extruded, rolled and heat-treated in a controlled atmosphere to form the final superconducting multi-filamentary tape.

The tape can be produced in various lengths which may result from breakages during the manufacturing process or on purpose. A continuous length of unbroken tape satisfying the chemical, geometrical, electrical and mechanical requirements of this Technical Specification is hereafter called a unit length.

4.1 Main characteristics of the tape

The tape shall consist of superconducting filaments in a silver-gold alloy matrix doped with magnesium (see section 4.1.2). The minimum number of filaments shall be 55.

4.1.1 Filament composition

The filaments composition shall be $(Bi,Pb)_2Sr_2Ca_2Cu_3O_X$, $x \approx 10$ (BSCCO 2223).

4.1.2 Matrix composition

The matrix shall consist of a silver alloy doped with gold. The percentage of gold in the matrix shall be in the range from 4 to 5.3 weight percentage, corresponding to a range from 2.2 to

3 atomic percentage. The exact composition of the alloy shall be such as to satisfy the electric al and mechanical requirements as specified in the following sections.

4.2 Tape geometrical dimensions

The tape shall have a width of 4 ± (0.2) mm.

The tape shall have a thickness of 0.2 ± (0.02) mm.

4.3 Filling factor

The maximum filling factor[1] of the tape shall be 35 %.

4.4 Critical current

The critical current, I_C, is defined as the current at which an electrical field of 1 μV/cm is reached in a given length of tape at 77 K and in self-field conditions (1 μV/cm electrical field criterion, see section 5.1.1). The critical current of the tape at 77 K and in self-field shall be:

- either at least 85 A ($I_C \geq 85$ A), in which case 28 km are required,
- or at least 66 A ($I_C \geq 66$ A), in which case 34 km are required.

The Tenderer shall state which of the two critical currents he can guarantee (hereafter called I_C (guaranteed)) and tender for the corresponding total required length.

4.5 Unit length

The tape unit length shall be between 100 m and 300 m. The unit length shall have homogenous geometrical, chemical, electrical and mechanical properties corresponding to the requirements of this Technical Specification. If one or both extremities of the tape result to be degraded due to manufacturing or packaging procedure, the corresponding lengths shall not be counted in the total unit length (see section 8.2).

4.6 Mechanical properties

4.6.1 Minimum strength

The minimum strength of the tape at any temperature from 4.2 K to room temperature shall be 75 MPa. The minimum strength is defined as the tensile stress producing a maximum degradation of 5 % of the critical current measured at 77 K and in self-field (see section 4.4).

4.6.2 Bending radius

The minimum bending radius of the tape shall be ≤ 50 mm. The minimum bending radius is defined as the radius producing a maximum degradation of 5 % of the critical current measured at 77 K and in self-field (see section 4.4).

[1] The filling factor is defined as the ratio of the superconductor cross section to the total cross section

4.6.3 Winding radius on the spool

The tape unit length shall be delivered to CERN wound on a spool. The smallest winding radius on the spool shall be such that when a short length of tape is cut from it, the resulting tape can be straightened without degradation of any of its properties.

4.6.4 Surface condition

The silver alloy surface of the tape shall be clean and free from any residues and/or surface defects, slivers, folds, flaws, laminations or inclusions. It shall not present any trace of soldering material deposited for measurements performed at the Contractor's premises. The Contractor shall ensure that, after delivery, the two surfaces of the tape can be soldered, along their complete length, to another tape or to a copper support without having to undertake any intermediate mechanical or chemical operation.

The Contractor shall ensure that the tape surface is free from oxidation that could take place during the tape manufacturing, storage or transport.

4.6.5 Mechanical integrity

The Contractor shall ensure that the BSCCO tape does not contain any defects (cracks, voids, intrusions, bubbles, blisters, etc.), created during the manufacturing or testing process, either in the superconducting filaments or in the silver-gold alloy matrix, that could locally degrade its critical current.

The Contractor shall ensure that there are not defects in the tape matrix that could allow penetration of liquid cryogen into the HTS filaments.

4.7 Endurance to thermal cycling

The tape shall be able to withstand without degradation of any of its properties a minimum number of 500 thermal cycles from ambient temperature to liquid helium temperature.

5. TESTS

The Contractor shall perform a number of tests on the BSCCO tape as described in the following sections.

Together with the manufacturing file (see section 3.2.2.3), the Contractor shall submit to CERN for its approval, a detailed description of all test procedures, test set-up, recording equipments and model tests certificates that he proposes to use.

5.1 Test to be carried out at the Contractor's premises

The Contactor shall document all chemical, metallurgical, electrical, mechanical, dimensional and surface measurements.

CERN reserves the right to be present, or to be represented by an organization of its choice, to witness any tests carried out at the Contractor's or his subcontractors' premises. The results of these checks and tests shall be reported in the Traveller documents (see Annex A) to be released before shipment.

5.1.1 Electrical tests

For each unit length, the critical current of the BSCCO tape shall be measured in liquid nitrogen at a temperature of 77 K and in self-field conditions. The cryogen temperature shall be measured by means of a pressure sensor or an appropriate temperature sensor with an accuracy of ± 0.5 K. If a pressure sensor is used, the pressure measurement shall be representative and accurate enough to obtain the required accuracy of the temperature measurement. No correction is requested for self-field effects. The critical current shall be measured minimum every 50 cm length. The minimum critical current of each resolution length shall be I_C (guaranteed) and the variation in nominal current of each resolution length shall be ≤ ± 10 %. The Contractor shall record the voltage-current characteristic with increasing current up to a voltage corresponding to an electrical field of at least 2.5μV/cm. The critical current corresponding to electrical fields of 1 μV/cm and 2.5μV/cm shall be reported. CERN recommends a direct and continuous d.c. critical current measurement of the unit length (standard four-terminal technique). The Contractor shall determine the n-value over the length of the tape in the range from 0.05 μV/cm to 2.5 μV/cm. The n-value shall be calculated as the slope of the logarithmic plot of the voltage versus current. The current shall be measured with a resolution better than 0.1 A and an absolute precision better than 0.5 %.

The Contractor shall measure the matrix electrical resistivity of a short length of tape, taken from each unit length, at room temperature and at 77 K. The electrical resistivity value shall be of the order of 2 μΩ·cm @ room temperature and 1 μΩ·cm @ 77 K[2].

5.1.2 Geometrical tests

The Contractor shall measure the width and thickness of the unit length with a maximum pitch of 10 mm.

The Contractor shall measure the total unit length with an accuracy of ± 0.1 m.

5.1.3 Mechanical tests

The Contractor shall measure the mechanical properties (bending radius, tensile stress according to section 4.6.1 and Young's modulus) of a short length of tape and repeat the measurement on one sample of each unit length to assure uniform properties during the production. The minimum tensile strength shall be measured with a uni-axial tensile test at room temperature along the longitudinal axis of the tape. In order to confirm the uniformity of the material according to the selected process, CERN will extract 5 short lengths of tape from the first batch. These samples will be sent to the Contractor for measurement of the mechanical properties listed above.

5.1.4 Filling factor

The Contractor shall measure the filling factor of a short length of tape and repeat the measurement on one sample of each unit length to assure uniform properties (± 5 %) during the production.

[2] H.Fujishiro and al, Thermal and electrical properties of Ag-Au and Ag-Cu alloy tapes for metal stabilizers of oxide superconductors, Cryogenics, 1993, Vol 11, 1086-1090
M.Putti and al, The thermal conductivity of silver and silver alloy sheaths for Bi-2223 tapes, Physica C 1835-1838, EUCAS 2001, Part III, 1835-1838

5.2 Tests carried out at CERN

CERN will perform microstructural examinations, critical current measurements, thermal conductivity measurements in the range 5 K-70 K, electrical resistivity measurements and mechanical tests on some short lengths of BSCCO tape to check the conformity of the HTS material with this Technical Specification. These measurements will be repeated on short lengths of tape extracted from different batches.

5.3 Information and documentation management

5.3.1 Planning and scheduling

Planning and scheduling activities shall be performed according to the procedure defined in the LHC QAP document No LHC-PM-QA-301.01, "Planning and Scheduling Requirements for Institutes, Contractors and Suppliers".

5.3.2 Quality control records

All specified tests and measurements carried out during all stages of production, from raw material procurement up to delivery, shall be recorded in specific files ("Travellers", see Annex A), collected in the MTF (Manufacturing and Test Folder), according to the procedure defined in the LHC QAP document No LHC-PM-QA-309.00, "Fabrication and Inspection of Purchased Equipment". The Travellers of each batch of BSCCO tape shall include the tape characteristics and the results of the geometrical, electrical and mechanical tests. Each unit length shall be identified with a code number to be agreed with CERN. This code shall identify unit lengths which have undergone together the series of heat treatments.

Copies of these Travellers shall be submitted to CERN for archiving in the CERN central database.

6. APPLICABLE DOCUMENTS

Please refer to the cover letter or Instructions to Bidders for the complete list of enclosed documents that form part of this Invitation to Tender.

Please note that the quality assurance documents, CERN standards and Purchasing documents referred to in this Technical Specification are on the enclosed CD-Rom entitled "CERN Official Documents".

6.1 Standards

The following standards are applicable for the execution of the Contract:

- IEC 61788-3 Superconductivity, “DC critical Current of Bi-2212 and Bi-2223 oxide superconductors”
- IEC 60050-815 Superconductivity, “International electro-technical vocabulary (Part 815)-superconductivity”
- IEC 61788-5 Superconductivity, “Matrix to superconductor volume ratio measurement” (applicable for filling factor measurements)
- IEC 81788-6 Superconductivity, “Mechanical properties measurements”

7. QUALITY ASSURANCE PROVISIONS

The Contractor shall plan, establish, implement and adhere to a documented quality assurance programme that fulfils all the requirements described in this Technical Specification and drawn up according to the Quality Assurance Plan for the LHC Project.

Please note that the quality assurance documents, CERN Standards and Purchasing documents referred to in this Technical Specification can be found on the enclosed CD-Rom entitled "CERN Official Documents".

The list of relevant topics covered by the LHC Quality Assurance Plan, together with the corresponding documents, is given in Table 2 below. Copies of these documents are included with the Invitation to Tender.

Table 2 - LHC QAP topics and documents

Topic	Document Title	Doc. Number
Policy and Organisation	Quality Assurance Policy and Organisation	LHC-PM-QA-100.00
Planning	Planning and Scheduling Requirements for Institutes, Contractors and Suppliers	LHC-PM-QA-301.01
Change Control	Configuration Management - Change Process And Control	LHC-PM-QA-304.00
Manufacturing and Inspection	Manufacturing and Inspection of Equipment	LHC-PM-QA-309.00
	Handling of Non-conforming Equipment	LHC-PM-QA-310.00
	LHC Part Identification	LHC-PM-QA-206.00

7.1 Quality Control

The Contractor shall be able to demonstrate that he has ISO 9001 series certification, or an equivalent quality control certification, which is appropriate to the subject of this Technical Specification.

8. DELIVERY

8.1 Provisional delivery schedule

The batches of tape shall be delivered to CERN according to the delivery schedule given in the commercial bidding documents.

8.2 Packing and transport

Each unit length shall be delivered assembled on a spool. No shipment shall be carried out without written consent from CERN. The Travellers related to each spool of tape in a shipment (see Annex A) shall be sent to CERN by electronic means prior to shipment, and CERN will give his approval within two weeks of their reception provided the data are acceptable. Certificates of conformity of each spool of tape shall as well accompany the shipment. The design of the spool shall be the same for all deliveries.

The Contractor is responsible for the proper packing and safe transport to CERN. He shall ensure that the equipment is delivered safely to CERN in transport conditions protecting the supply from any damage or possible deterioration. Each spool of tape shall be individually packed. The packing shall support the spool of tape and protect the tape from moisture and any damage during handling and transport. In particular, packing and storage conditions shall provide for protection of the tape surface against oxidation and adequate marking or labelling in order to clearly and readily identify the spools and batches of tape. The exterior packaging of each spool shall be identified with the following information:

- material,
- batch identific ation number,
- spool identification number,
- specification number,
- name of manufacturer,
- date of manufacture,
- CERN order number,
- total length (in meters),
- unit length (in meters),
- weight (in kilograms)
- tape critical current,
- number and position of defects in the tape (see section 8.3).

The length, at the extremities of the tape, which is not part of the unit length due to degradation of the tape's properties during assembly and/or packaging operations shall be clearly indicated on each unit length.

8.3 Acceptance and guarantee

Provisional acceptance will be given by CERN only after items have been delivered in accordance with this Technical Specification (including documentation referred to in this Technical Specification), all tests specified have been successfully completed and all test or other certificates have been supplied to CERN.

The Contractor shall guarantee the performance of the tape and shall take full responsibility for any manufacturing faults. Should any of the tests described in this Technical Specification reveal any manufacturing defects or damage occurring during transport, CERN will be entitled to the immediate replacement of the faulty unit length free of charge.

If during the characterization or visual inspection of the unit length the Contractor identifies localized non-conformities (few-millimetre wide blisters, mechanical degradation of the silver alloy matrix, HTS filaments breaks), he shall mark the position of the defects on the tape surface and report to CERN in a written document on the number, type and location of the defects. The delivery of the unit length can take place only after a written approval by CERN following the notification of the problem. If the unit length is accepted by CERN, the Contractor shall procure in the following deliveries an extra length of tape corresponding to 1m times the number of defects free of charge. CERN will accept a maximum number of three defects, each up to 1 cm wide, every 100 m of unit length. The exact position and type of defect shall be reported in the Traveller document (see Annex A). The position of the defects shall be clearly marked on

the unit length. If unmarked defects will be detected at CERN during visual inspection (silver alloy sheath defect) or during measurements (non conformities which compromise the specified tape performance), the unit length will be rejected and shall be replaced by the Contractor free of charge.

The guarantee period is defined in the commercial documents.

9. CERN CONTACT PERSONS

Persons to be contacted for technical matters:

Name/Division/Group	Tel-Fax	Email
Amalia Ballarino	**Tel:** 0041-22-767-3296	Amalia.Ballarino@cern.ch
	Fax: 0041-22-767-6180	
In case of absence:		
Karl Hubert Mess	**Tel:** 0041-22-767-76642	Karl.Hubert.Mess@cern.ch
	Fax: 0041-22-767-6180	

Persons to be contacted for commercial matters:

Name/Division/Group	Tel-Fax	Email
Deborah Abbott	**Tel:** 0041-22-767-5160	Deborah.Abbott@cern.ch
	Fax: 0041-22-767-7450	
In case of absence:		
Ivo Lobmaier	**Tel:** 0041-22-767-8836	Ivo.Lobmaier@cern.ch
	Fax: 0041-22-767-7450	

ANNEX A: EXCHANGE OF INFORMATION

The tests reports on each unit length shall be submitted to CERN for approval before delivery and shall be included in the Traveller document. The Contractor shall identify each batch of raw materials (ceramic powder and silver alloy tubes of different sizes) with information concerning their supplier, their batch number and their material certificate. This information shall be reported in the Traveller document associated to each unit length. The following information shall be included in a data/sheet computer readable file:

- name of manufacturer,
- date of manufacture,
- CERN order number,
- unit length identification number,
- raw materials (see above),
- tape characteristics: tape total length, unit length, tape dimensions, matrix and HTS filaments composition, number and size of HTS filaments, average critical current and average n value at 77 K and in self-field conditions, measured filling factor,
- results of visual inspections and all geometrical, chemical, electrical and mechanical tests,
- date and place of the tests,
- number, type, position and origin of defects identified in the unit length (see section 8.3).

ANNEX B: CD-ROM "CERN OFFICIAL DOCUMENTS"