

D R A F T



EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

CERN - LABORATORY II

Invitation to tender II-33/ME

VACUUM SYSTEMS INSTALLATION

T E C H N I C A L S P E C I F I C A T I O N

Assembly and leak testing of the vacuum system
of the 300 GeV proton accelerator

Reference: Lab. II/ME-VA/BA/TW/9470

1000 044
7 73
2500
2406
34
80 mm

Geneva, 8 October 1973



CONTENTS

	<u>Page</u>
1. INTRODUCTION	1
1.1 General information	1
1.2 Scope of the tender	1
2. TECHNICAL DESCRIPTION	2
2.1 Accelerator ring	2
2.1.1 Normal $\frac{1}{2}$ -periods	3
2.1.2 Long Straight Sections	4
2.2 Beam transfer lines	4
2.3 Vacuum system components and sub-assemblies	5
2.3.1 Quick disconnect joints	5
2.3.2 Intermagnet gaps	6
2.3.3 Sputter-ion pumps	6
2.3.4 Rough pumping stations	7
2.4 Assembly tolerances in normal periods	8
3. PREPARATORY WORK PERFORMED BY CERN	9
3.1 Ring tunnel	9
3.1.1 Normal periods	9
3.1.2 Long Straight Sections of the ring	10
3.2 Beam transfer lines	10
4. WORK TO BE PERFORMED BY THE CONTRACTOR	11
4.1 Normal $\frac{1}{2}$ -periods	11
4.2 Normal sections of beam transfer lines	12
4.3 Long straight sections of the ring and special sections of beam transfer lines	13
4.4 Minor work spread over large areas of the vacuum system	13

	<u>Page</u>
5. OPERATOR QUALIFICATIONS	14
5.1 Work supervisor, senior technician	14
5.2 Fitters-leak test operators, technicians	14
5.3 Assistants	15
6. LEAK RATES AND LEAK TEST EQUIPMENT	15
6.1 Leak rates	15
6.1.1 Minimum detectable leak and response time of leak detectors	16
6.2 Leak detector	17
6.2.1 Output recorder	18
7. TIME SCHEDULE	19
7.1 Accelerator ring	19
7.2 Injection line	20
7.3 West extraction line	20
7.4 North extraction line	20
8. QUALIFYING TESTS FOR STAFF	21
LIST OF DRAWINGS	22
APPENDIX I	
APPENDIX II	
DRAWINGS	

1. INTRODUCTION

1.1 General information

The construction has started of a large European proton accelerator as an extension to the present CERN facilities.

The total circumference of the new accelerator ring is about 7000 m. The total length of the transfer lines for injection and ejection of protons will be about 4000 m. Both the ring and the beam transfer line vacuum systems will mostly be composed of tubes of rather small cross-section. The systems will be of the all-metal type and will have to operate at pressures below 10^{-7} torr.

Rough pumping of the vacuum system will be achieved by pumping stations equipped with a turbomolecular pump. For the low pressure pumping sputter-ion pumps have been selected.

1.2 Scope of the tender

The present call for tenders concerns:

- the assembly of the vacuum systems in the accelerator ring and in the beam transfer lines with the exception for certain special equipment,
- the vacuum leak testing of all the vacuum systems in the accelerator ring and in the transfer lines.

CERN reserves the right to place separate contracts for the work in the ring and for the work in the beam transfer lines.

During the peak of the installation activity, vacuum system installation and leak testing will have to be carried out simultaneously at not less than six different locations. For each location a complete installation and leak test team shall be made available by the contractor.

All conditions related to the volume of work, the time schedule, progress reports etc. are contained in the enclosed Tender Form and Special Conditions. The tender documents also include a Technical Questionnaire. Detailed replies to the questions therein are indispensable for the evaluation of the tender.

Tenderers must be prepared to present for interviews and practical tests, at the latest three weeks after opening of the tenders and notification by CERN, not less than ten candidates deemed suitable by the tenderer for work at CERN within the frame of a contract (see Section 8).

A demonstration that the tenderer has considerable experience of the type of work described in the present specification and that the candidates presented for interviews and tests have the required qualifications, are necessary prerequisites to the grant of a contract.

2. TECHNICAL DESCRIPTION

2.1 Accelerator ring

The tunnel is situated under ground and therefore access is only possible via lifts. The distance from the tunnel to the surface varies between 20 and 60 m along the ring. The width of a standard section of the tunnel is 4 m (see drawing no. 8090.2709.1). The ring is divided in six so-called superperiods of equal length. At roughly the centre of each superperiod there is an access point to the ring tunnel.

Every superperiod is divided in 18 periods of equal length, determined by the lattice of focusing magnets called QF and QD. Among these periods there are 14 normal periods which are virtually identical from the point of view of equipment. In two of the periods the equipment deviates slightly from that of a normal period. The remaining two periods are special periods. In these, the equipment varies strongly with the position along the ring. The two special periods are always grouped together at the centre of a superperiod and form a long straight section (LSS). These sections contain, in particular, the systems for injection, acceleration, extraction and dumping of the protons.

The normal periods can be divided in two half periods. The half period constitutes a basic element for the work covered by the present specification.

In summary the ring consists of 180 normal half periods, 12 half periods with some special equipment and 6 long straight sections.

The length of a half period is 32 m and that of a LSS 131 m.

Drawing no. 8002.010.1 shows schematically (not to scale) the equipment installed in each of the six superperiods and drawing no. 8095.0308.4 shows the distribution of the main machine systems around the ring.

2.1.1 Normal $\frac{1}{2}$ -periods

Drawing no. 8095.0055.0A shows to scale the equipment in a normal period (two $\frac{1}{2}$ -periods). The main equipment in a $\frac{1}{2}$ -period consists of:

- four bending magnets of approximately 6,5 m length each (two magnets of type MBA and two of type MBB),
- one focusing magnet of approximately 3,2 m length (of type QF or QD),
- one short straight section equipped with one beam observation station and one small dipole magnet for correcting purposes. In addition, certain short straight sections are equipped with special correcting elements, such as quadrupoles, sextupoles, etc.
- vacuum system components including quick disconnect joints and sputter-ion pumps (VSP). Some $\frac{1}{2}$ -periods contain also rough pumping stations (VPTM), sometimes in connection with sector valves (VVS).

The cross-sections of the vacuum chambers at different positions in the normal period are also indicated in drawing no. 8095.0055.0A.

2.1.2 Long Straight Sections

In the LSS, the bending magnets are replaced by special equipment or by simple straight tubes of circular cross-section.

The special equipment occurs in the form of large vacuum tanks or special magnets installed and usually also assembled and tested by CERN.

The circular pipes foreseen between the special components varies in outer diameter from 86 mm to 273 mm. In these tubes are inserted some elements with great flexibility (consisting of assemblies of metal bellows) to permit ease of mounting and displacement of certain components without breaking the vacuum.

The six LSS have each a well defined function, i.e.:

- LSS no. 1 : injection
- LSS no. 2 : extraction (north experimental area)
- LSS no. 3 : acceleration
- LSS no. 4 : beam dumping
- LSS no. 5 : reserve
- LSS no. 6 : extraction (west experimental rea).

The equipment in LSS 6 is identical to that in LSS 2.

Drawings no. 8095.4006.0 and 8095.4007.0 show a typical equipment layout in an extraction region. The abbreviations used in these drawings are explained in drawing 8002.010.1.

2.2 Beam transfer lines

The total length of the transfer lines covered by the present specification amounts to approximately 4000 m. One distinguishes between the following lines:

- TT 10 (approximately 850 m of vacuum channel for injection of protons into LSS 1),

- TT 60 (approximately 2400 m of channel, split in several branches, for extraction of protons from LSS 6 to the west experimental area which is situated within CERN Laboratory I),
- TT 20 (approximately 600 m of channel for extraction of protons from LSS 2 to the entrance of the north experimental area to be built later within CERN Laboratory II).

A transfer line consists of a lattice of focusing magnets and, in addition, horizontal and vertical bending magnets at the tunnel bends. A certain number of elements for correcting and observing the beam are also incorporated. Long sections of the transfer lines consist of straight pipes of circular cross-section (O.D. 159 mm).

Drawing no. 8096.0092.0 shows as an example of a transfer line, the layout to scale of the line TT 10. Drawing no 8096.0061.1 shows a few elements in the TT 10 line, in more detail. (A guide to the abbreviations in these drawings are given in Appendix I.)

2.3 Vacuum system components and sub-assemblies

2.3.1 Quick disconnect joints

The entire vacuum system with exception for a few special items and long sections of simple circular piping in the transfer lines is equipped with quick disconnect type joints.

These joints (see drawing 8095.0130.1) consist of flat-faced flanges of conical cross-section. An aluminium gasket with a double knife edge is compressed between the flanges by a clamp in two halves. The clamping is achieved by tightening two bolts to a prescribed torque. Drawing no. 8095.0309.2 shows an aluminium gasket with three tongues for easy positioning when sealing vertical joints.

The flanges on the sputter-ion pumps (VPS) and the beam observation stations (BPH and BPV) are coated with vitreous ceramic to provide electrically insulating breaks in the system.

Normal sections of the vacuum system are equipped with joints of the following nominal dimensions (referring to the outer diameter of the largest tube accepted by the joint):

- \emptyset 70 mm (for certain pumps and valves)
- \emptyset 159 mm (for most of the vacuum chambers)
- \emptyset 219 mm (for certain enlarged portions of the system)
- \emptyset 273 mm (for special systems in the LSS).

The specified torques on the bolts of the various clamps for making up the seals are in the range 0.6 - 3.0 mkg. Hand-operated torque wrenches provided by CERN, may be used for making up the quick disconnect joints.

2.3.2 Intermagnet gaps

Drawings 8095.0189.2, 8095.0307.1 and 8095.0190.2 show typical layouts (to scale) of intermagnet gaps inserted between main magnets. One distinguishes in the drawings a quick disconnect joint, a short tube carrying a sputter-ion pump and the flexible metal bellows used to facilitate the assembly work. Parts of the drawings were shaded to permit easy distinction between the vacuum system and other parts of the machine.

2.3.3 Sputter-ion pumps

The low pressure pumping of the vacuum system in the normal periods is achieved by about 700 sputter-ion pumps of 25 l/s pumping speed. Drawing no. 8095.6003.3 shows the main dimensions of such a pump. The weight of the pump is 13 kg. It is made available in the tunnel, sealed under vacuum. The contractor shall remove the blank-off flange before fitting the pump. The pump is hanging on its pumping port on the vacuum system, without additional support.

The special tanks of the long straight sections are pumped by sputter-ion pumps of 400 l/s pumping speed and weighing 140 kg. These pumps are also mounted hanging on the pumping port. The joint on this port is a bolted joint using a copper gasket. Certain of these pumps will have to be fitted by the contractor.

2.3.4 Rough pumping stations

The rough pumping stations include a low pressure stage in the form of a turbomolecular pump and a high pressure stage consisting of a two-stage rotary vane pump.

The station is mounted on a frame which also carries a frequency converter for the turbomolecular pump as well as the vacuum piping and valves connecting the two stages.

A normal mass spectrometer type leak detector can be connected between the low and the high pressure stages via a permanently installed valve. Another valve permits isolation of the high pressure stage when the leak detector is connected. During leak testing the pumps of the leak detector thus serve as backing pumps for the turbomolecular pump.

With this arrangement one uses the turbomolecular pumps as a baffle between the detector and the clean vacuum system. In particular during the testing of big tanks one also reduces the response time of the leak detector testing equipment.

Drawing 8095.3001.2 shows a typical rough pumping station installation in normal periods. In this case the station is equipped with two roughing valves permitting the station to be used on either side of the straight-through valve (sector valve) which is inserted in the short straight section. At other positions, where there is no sector valve, a single roughing valve is used.

In normal periods of the machine about 70 roughing stations are installed. Approximately another 50 stations are fitted to special equipment.

All roughing stations and associated valves will be fitted by CERN.

During the assembly work on the vacuum system, the final roughing and valving systems may not become available in time for the first pump down and leak testing to be performed by the contractor. In this case mobile roughing stations, equivalent to the final stations, will be made available to the contractor by CERN.

The mobile stations can be connected to a spare "70 mm" pumping port (see drawing no. 8094.0051.4).

2.4 Assembly tolerances in normal periods

The main machine components, such as magnets equipment in the short straight sections and all supports needed will be prealigned in the tunnels by CERN. Flanges to be clamped together will thus be centered to within ± 4 mm with respect to each other. The remaining offset shall be absorbed by the flexible metal bellows inserted in the vicinity of joints (see also Appendix II).

The nominal distance between sealing surfaces of flanges before clamping is 4 mm. The tolerance is ± 2 mm in this case. Flanges on equipment brought to the tunnels are protected by thin disks of aluminium, backed by foam plastic. These disks are sealed by adhesive tape. Before closing a joint, the protective disks are removed. The clearance now available will be adequate for insertion of the gasket with no or little compression of the nearby bellows.

Small sputter-ion pumps are turned to the right position by using eye sight when the joint on the pumping port is being made.

Big sputter-ion pumps are positioned by the bolts in the pumping port flange.

All "159 mm" joints in the beam line have their bolts facing the corridor of the tunnel to give easy access. The clamps are lined up by eye sight.

3. PREPARATORY WORK PERFORMED BY CERN

All vacuum equipment has undergone vacuum leak testing and other specified acceptance tests before being brought to the tunnels.

3.1 Ring tunnel

3.1.1 Normal periods

- The main magnets of types MBA, MBB, QF and QD are mounted and aligned on their supports in the tunnel. These magnets are equipped with complete vacuum chambers which cannot be demounted from the magnets and which are terminated by flanges. The flanges are covered by thin protective discs held in place by adhesive tape.
- The short straight sections are assembled outside the tunnel on supporting structures permitting transport of the complete sections to the tunnel where they are mounted and aligned. Flanges for connection to adjacent equipment are protected as in the case of the main magnets.
- At the position of every short straight section one single phase (220 V, 10 A) and one three phase (220/380 V, 16 A) mains outlet are available.
- Extension cords from these mains outlets to the working areas will be provided.
- Special trailers are provided for accessories to the vacuum system and for equipment needed for the installation work. These trailers can be manoeuvred by hand or by electric tractors provided by CERN and including CERN drivers. The tractors and the trailers, even when fully loaded, fit under MBA and MBB magnets so that the tunnel corridor can be kept free for the vehicle transporting, e.g. the main magnets to their final positions (see "Conditions applicable to installation work carried out on the site of CERN-Laboratory II").

On the special trailers CERN will thus provide, at convenient locations within the normal $\frac{1}{2}$ -period being installed, the following equipment:

- metal gaskets and clamps for the vacuum joints to be made in the tunnel,
- 25 l/s sputter-ion pumps,
- tools, cleaning agents and cleaning tissues for the installation work,
- helium for leak testing,
- nitrogen for venting,
- plastic foil, for global leak tests, as well as minor accessories for the test work,
- compact leak detectors with output recorders provided by CERN or the space required for compact leak detectors with recorders, provided by the contractor (see also Section 6.2),
- rough pumping stations for sections to be leak tested (these stations always remain on the trailer and are immediately operational after connection to a pumping spare "70 mm" port on the vacuum system and to the mains).

3.1.2 Long straight sections of the ring

The installation work will, as far as possible, be prepared to the same extent as in the normal $\frac{1}{2}$ -periods. All equipment will thus be brought by CERN to the final positions in the straight sections, but the fitters may have to carry out simple alignment of the chambers during installation.

3.2 Beam transfer lines

The installation work will, for major parts of the beam transfer lines, be prepared to the same extent as in normal periods of the ring. Exceptions are branch-off points and areas in the immediate vicinity of the ring. In these areas the degree of preparation by CERN will be similar to that anticipated in the long straight sections.

4. WORK TO BE PERFORMED BY THE CONTRACTOR

4.1 Normal $\frac{1}{2}$ -periods (ref. drawing 8095.0055.0)

- The vacuum joints between the five main magnets (one QF or QD, two MBA and two MBB magnets) and the joint between the last bending magnet and the short straight section must be assembled.
- The two or three 25 l/s sputter-ion pumps must be installed but not connected to the power supply (a full normal period is equipped with five sputter-ion pumps).
- All spare pumping ports (five "size 70" ports per full period) must be closed by a blank flange and clamp except for one port used for the mobile rough pumping station and for the leak detector.
- The two "size 159" flanges at the ends of the $\frac{1}{2}$ -period must be provisionally closed by a special blank-off disk and a clamp.
- The mobile rough-pumping station and the leak detector must be connected.
- The section under test must be rough pumped and the performance of the leak detector checked using a calibrated leak.
- The signal of the calibrated leak must be recorded on the output recorder of the leak detector.
- All accessible areas of the section under test (i.e. joints, bellows, pumping mainfolds, sputter-ion pumps) must be surrounded by reasonably gas tight plastic foil bags.
- The plastic bags must be successively filled with helium to a slight over-pressure which is maintained for 10 minutes.
- Every leak test must be recorded on the output recorder. On the recording must be introduced the identification number of the area tested.
- In case of a leak, the bag must be removed and the detector left to recover. Thereafter the leaky area must be surrounded by a new bag to protect it as far as possible against helium escaping in the tunnel. The leak shall not be located at this stage unless its size prevents continuation of the test work.
- At the end of the leak testing the section must be vented to dry nitrogen through a valve on the mobile rough-pumping station.

- The rough-pumping station and the leak detector must be removed. The spare "size 70 mm" flange used to connect this equipment must be closed by a blank flange and a clamp. (This joint will be leak tested at a later stage.)
- The blank-off disk inserted between the half-period just tested and areas tested earlier must be removed and replaced by a normal gasket. The blank-off disk at the other end of the half-period must be replaced by a normal protective disk.
- All equipment required for the assembly and test work in the subsequent $\frac{1}{2}$ -period such as leak detectors, test gas, tools, etc., must be brought there on the corresponding trailers, pulled by hand.

It is estimated that the assembly and leak test work in the normal periods of the ring represents about 50 % of all the assembly and leak test work in the ring and in the transfer lines.

4.2 Normal sections of beam transfer lines

- The quick disconnect joints at the extremities of every component must be assembled.
- Bellows assemblies (see drawing no. 8096.0061.1) must be fitted as required.
- The 25 l/s sputter-ion pumps must be fitted (one pump approximately every 25 m).
- Spare ports must be blanked off.
- All quick disconnect joints and all easily accessible components must be leak tested globally using the normal procedure established in Section 4.1.
- In the long sections of O.D. 159 mm piping only the transversal welds, which occur every 6.5 m and which will be made by CERN, are to be leak tested.

4.3 Long straight sections of the ring and special sections of beam transfer lines

The work to be performed in these areas cannot yet be specified in detail. The contractor will have to participate in the assembly and leak test work as required.

The following minimum work to be performed by the contractor can be foreseen:

- Assembly of all joints (159 mm, 219 mm and 273 mm) introduced between components.
- Assembly of large bellows assemblies.
- Alignment of certain components.
- Fitting of certain sputter-ion pumps.
- Leak testing of all joints and minor components fitted by the contractor.
- Certain leak testing of special equipment.

4.4 Minor work spread over large areas of the vacuum system

One of the teams set up by the contractor for assembly and leak testing is likely to become fully employed in repairs and in complementary leak testing.

For instance, certain components are likely to be damaged during the installation. These have to be changed and possibly leaks need to be located. Furthermore, as large numbers of completed normal $\frac{1}{2}$ -periods are joined together a few more joints remain to be tested.

5. OPERATOR QUALIFICATIONS

5.1 Work supervisor, senior technician

A supervisor for all work performed under the contract shall be furnished by the contractor and be permanently stationed on the CERN site. The supervisor shall also act as the linkman between CERN and the contractor. Because of the anticipated relatively small size of the Contractor's work force it is expected that the supervisor participates in the actual installation work. This participation will also permit the supervisor to rapidly become fully familiar with the different phases of the work.

The supervisor shall be a senior technician in the mechanical field and have good knowledge of English or French.

He shall have several years of experience in:

- handling of very clean components for high vacuum systems or similar systems,
- installation of large and complicated vacuum systems or equivalent systems,
- mass spectrometer type leak testing on components and on complete systems,
- supervision of several technicians for installation and leak testing.

5.2 Fitters -leak test operators, technicians

The fitters- leak test operators shall be able to perform both installation and leak test work. This category is referred to as technicians.

These technicians should be junior technicians in the mechanical field. Skilled workers with long experience could eventually also be accepted. All these technicians shall be able to receive instructions in English or French.

Technicians shall have several years of experience in:

- installation work on large, clean high vacuum systems of the all-metal type,
- mass spectrometer type leak detection on small and large systems,
- locating of small and big leaks on large systems by means of mass spectrometer type leak detectors,
- routine maintenance and performance tests on mass spectrometer type leak detectors,
- simple alignment and adjustment operations on mechanical components using jigs and theodolites.

Technicians shall be able to work independently and preferably have some experience in the supervision of semi-skilled workers assisting in the installation and leak test work (see also Section 5.3).

5.3 Assistants

The contractor may, if he so wishes, use assistants to the technicians to prepare material for installation and leak testing.

These assistants shall at least have the qualification level corresponding to semi-skilled workers in the mechanical field. They shall have a few years of suitable experience.

6. LEAK RATES AND LEAK TEST EQUIPMENT

6.1 Leak rates

No tolerable leak rate is specified for leak tests on components or systems. All leaks detected shall be reported. Even a small leak could indicate a weak point which could eventually develop into a serious failure.

In the absence of a specified tolerable leak rate, the leak testing equipment must at all times be used to its performance limit.

The minimum detectable leak of the leak detectors used shall be lower than 2×10^{-10} std cm³/s of helium (see also Section 6.1.1).

6.1.1 Minimum detectable leak and response time of leak detectors

For determination of the minimum detectable leak of a detector the procedure given in the AVS^{*)} tentative standards (AVS 2.1.1963) should be followed.

That is:

$$\text{minimum detectable leak} = \text{calibrated leak rating} \times \frac{\text{minimum detectable signal}}{\text{signal due to leak}}$$

where

- the calibrated leak rating is expressed in standard cm³/s (1 std cm³/s = 0.76 torr l/s),
- the minimum detectable signal is the sum of drift and noise, measured according to a procedure also given in the AVS standard. (The minimum detectable signal should be expressed in scale divisions of the most sensitive range);
- the signal due to the leak should be expressed in the same scale divisions as the minimum detectable signal.

The noise (and thus the minimum detectable signal and leak) is coupled with the response time of the detector to helium. The response time must therefore always be quoted together with the minimum detectable leak.

*) American Vacuum Society

The clean-up time after a helium leak has been shut off is easier to measure than the response time of the detector. The clean-up time is taken to be the time needed for the signal to fall to 37 % of its initial value. It can be assumed that the response time differs little from the clean-up time. The clean-up time may therefore be used instead of the response time for leak detector performance evaluations.

6.2 Leak detector

All leak tests shall be performed with mass spectrometer type leak detectors, tuned to helium.

The leak detector shall be of the compact, portable type with the following maximum dimensions (including external power and read-out units but not including output recorders):

- height : 530 mm
- width : 410 mm
- length : 910 mm

At least five leak detectors of this type shall be made available by the contractor for the duration of the contract.

The contractor is free to propose any leak detector with which he has good experience, and which fulfils the following basic requirements:

- minimum detectable leak smaller than 2×10^{-10} std cm³/s of helium,
- helium clean-up time shorter than 2 seconds,
- only manual test cycles possible,
- filament in the analyser head protected against sudden pressure increases,
- analyser head equipped with spare filament (switching to spare filament possible without breaking vacuum),

- analyser filaments replaceable without the use of special skills,
- analyser head and low pressure gauge head easy to clean,
- diffusion pump inlet protected by fast acting valve.

CERN may wish to take over certain leak detectors at the end of the installation period.

6.2.1 Output recorder

During all leak tests the output signal from the detector shall be recorded on a strip chart recorder. Such recorders are to be furnished by the contractor and shall be permanently attached to each leak detector.

The recorder shall fulfil at least the following requirements:

- Full scale indication on the recorder corresponding to full-scale indication on the detector output meter;
- rise time for full scale deflection equal to about 1 s;
- two paper speeds should be available, one producing not more than 25 cm of recording per hour and another producing at least 10 but not more than 25 cm of recording in 10 minutes.

The tenderer should mention in the tender the make of recorder proposed, together with all relevant data for this recorder.

CERN would like to acquire one recorder with each detector that is taken over at the end of the contract.

7. TIME SCHEDULE

The planning sheet attached to the Special Conditions in the tender documents summarizes the planning for the construction and installation of the main machine items.

7.1 Accelerator ring

Installation of the magnets in normal machine periods starts at the earliest mid-August 1974. The focusing magnets are installed first and aligned. Thereafter follow the bending magnets at a rythm normal $\frac{1}{2}$ -period per working day. The short straight section components will as far as possible be fitted immediately afterwards and at the same rate.

The installation and leak testing of the vacuum system shall, in the normal $\frac{1}{2}$ -periods, progress at the same rate as the magnet installation. To reduce the interference between the installation teams the vacuum installation shall lag two machine periods behind the magnet installation.

At the beginning of the installation all machine components will enter the ring tunnel at access point no. 3 and the installation will, after completion of superperiod no. 3, progress in the direction of point no. 2. Point no. 1 will be reached in December 1974.

From this date there will be a halt in the installation work until the boring of the second half of the tunnel is completed. Installation of the remaining 2/3 of the vacuum system in the ring will start at point no. 4 in April 1975 and progress in the direction of point no. 5. All normal periods shall be installed by August 1975.

For the long straight sections the following tentative installation schedules apply:

LSS 1 : July 1975 - October 1975
LSS 2 : December 1974 - March 1975
LSS 3 : February 1974 - May 1975
LSS 4 : August 1975 - October 1975
LSS 5 : June 1975 - September 1975
LSS 6 : July 1975 - November 1975

7.2 Injection line

The 850 m of vacuum channel in the injection line (TT 10) shall be installed from July 1975 to October 1975. A first part, near the CERN Lab. I installations, will however be installed already in January 1975.

7.3 West extraction line

The west extraction line (TT 60) covers with the different branches 2400 m of vacuum channel to be installed in two parts covering the total period from August 1975 to March 1976. Further work will be required in the west experimental area from January 1976 to June 1976.

7.4 North extraction line

The north extraction line (TT 20) reaches the surface 600 m from the branch-off point in LSS 2.

The installation and leak test contract will cover only this part of the line which shall be installed from January 1975 to May 1975.

Possible additional work in the experimental zone around the north extraction line may become the object of amendments to the contract. Much of the installation and test work in this area will take place during the years 1976-1978.

8. QUALIFYING TESTS FOR STAFF

Following the opening of the tenders CERN may ask tenderers to arrange interviews with up to 10 persons proposed to work as technicians at CERN. One of the candidates presented shall possess the qualifications necessary for supervision of the contractor's staff employed at CERN and for the liaison function between the contractor and CERN.

CERN attaches great importance to the requested interviews not only for determining the qualifications of individuals but, in particular, to ensure that the tenderer and CERN agree on the qualification levels to be required for the different categories of the Contractor's staff.

The interviews may take place on the tenderer's premises and will last not more than two days. The tenderer shall provide suitable room for the interviews and the associated practical tests of the use of leak detectors, etc.

The interviews must take place not later than three weeks after they were called for.

LIST OF DRAWINGS

8095.0308.4	Schematic layout of the SPS with TTs
8090.2709.1	Detailed layout, normal section
8002.010.1	Tentative layout of super-periods 1-6
8095.0055.0A	Layout of normal period
8095.3002.1	QD short straight section
8095.4006.0	Vacuum installation in period 161-181
8095.4007.0	Vacuum installation in period 181-201
8096.0092.0	Tunnel d'injection TT 10 - installation de vide
8096.0061.1	Espace entre BCT et MBIV (tunnel d'injection TT 10)
8095.0189.2B	Intermagnet gap QF - MBA
8095.0190.2B	Intermagnet gap MBA-MBA
8095.0307.1	Intermagnet gap MBB-MBB - top view
8095.0130.1	Connexion rapide à 4 segments
8095.0309.2	Joint Ø 180 (principe)
8095.6003.3	Sputter-ion pump 25 l/s
8095.3001.2	Roughing station with sector valve in QD short straight section.
8094.0051.4	Layout of a mobile rough pumping station

EQUIPMENT ABBREVIATIONS TT 10B BEAM MONITORING DEVICES

BBS Mini scanner
BCT Current transformer
BSG Sem grid
BSP Sem position
BSPH Sem position, horizontal
BSPV Sem position, vertical
BTV Light screen monitor

M MAGNETIC DEFLECTION DEVICES

MB Bending magnet, general
MBIH Bending magnet, ISR type, horizontal deflection
MBIV Bending magnet, ISR type, vertical deflection
MD Dipole, general
MDIH Correcting dipole, inject. BT line, horizontal defl.
MDIV Correcting dipole, inject. BT line, vertical deflection
MDV Correcting dipole, vertical deflection
MK Kicker magnet, general
MKI Kicker magnet, injection
MSI Septum magnet, injection

Q QUADRUPOLE

Q Quadrupole, general
QD Quadrupole, defocussing
QF Quadrupole, focussing
QID Quadrupole, injection transfer line, defocussing
QIF Quadrupole, injection transfer line, focussing
QIID Quadrupole, injection transfer line, ISR type, defoc.
QISK Quadrupole, injection transfer line, skew

Data sheet for metal bellows (compensators) for the 300 GeV proton accelerator

1.5.1973

(The figures in brackets are not fixed parameters)

	Drwg.no. 8095.0147.3C	Drwg.no. 8095.0199.3B	Drwg.no. 8095.0210.4B	Drwg.no. 8095.0206.4B
<u>Type:</u>	corrugated	corrugated	corrugated	corrugated
<u>Size:</u>	I.D. = 165 mm \pm 0.5 O.D. = (185 mm \pm 0.5)	I.D. = 165 mm \pm 0.5 O.D. = (185 mm \pm 0.5)	I.D. = 102 mm \pm 0.5 O.D. = (120 mm \pm 0.5)	I.D. = 102 mm \pm 0.5 O.D. = (120 mm \pm 0.5)
<u>Length:</u>				
Total free *	67 mm \pm 2	31 mm \pm 1	67 mm \pm 2	31 mm \pm 1
Active free	57 mm \pm 2	21 mm \pm 1	57 mm \pm 2	21 mm \pm 1
Active installed	61 mm \pm 2	23 mm \pm 1	61 mm \pm 2	23 mm \pm 1
<u>Gauge:</u>	(0.15 mm)	(0.15 mm)	(0.15 mm)	(0.15 mm)
<u>Convolutions:</u>	10	4	10	4
<u>Movements:</u>				
Compression	8 mm	4 mm	8 mm	4 mm
Extension	8 mm	4 mm	8 mm	4 mm
Lateral off set	\pm 6 mm	\pm 2 mm	\pm 6 mm	\pm 2 mm
Angular off set	\pm 4°	\pm 2°	\pm 4°	\pm 2°

*) Important: After attachment of the bellows to the end pieces the total free lengths shall be reduced by 2 mm, see also drawings no. 8095.0104.2 B, 8095.0105.2 B, 8095.0116.2 B, 8095.0209.2 A, 8095.0201.2 B and 8095.0204.2 B.

(Data Sheet cont'd.)

The following applies to all types of bellows:

<u>Pitch</u>	:	Given by free active length divided by number of convolutions
<u>Number of layers of the wall</u>	:	One
<u>Material</u>	:	Austenitic nickel-chromium steel, of low carbon content and with high stability (preferably grade AISI 304 L, 316 L or equivalent).
<u>Working pressure</u>	:	Internal : $\leq 10^{-7}$ torr (high vacuum) External : atmospheric pressure
<u>Test pressure</u>	:	(identical to working pressure)
<u>Max. temperature</u>	:	150°C (drying after cleaning)
<u>Spring rate</u>	:	1-3 kg/mm for axial movements (without vacuum), maximum 10 kg/mm for lateral off sets (without vacuum)
<u>Cycle life required</u>	:	(400)
<u>Frequency of cycles</u>	:	(manual installation or equivalent)
<u>Medium in contact with bellows</u>	:	Internal : vacuum/hard X-ray radiation External : air/plastic protection shield
<u>End cuffs</u>	:	bordered type (without reinforcement)
<u>Attachment of end pieces</u>	:	lip welding by TIG, plasma or EB
<u>Leak tightness</u>	:	to helium mass-spectrometer sensitivity of 2×10^{-10} std cm ³ /s
<u>Other information</u>	:	Longitudinal welds on the bellows (if any) must be of the butt-weld type. All welds must be fusion type without filler rod. Deflections causing plastic deformation of the overall bellows are allowable, hence linearity and hysteresis are not important.

CERN

Laboratory II

CALL FOR TENDERS II-33/ME

VACUUM SYSTEMS INSTALLATION

SPECIAL CONDITIONS OF THE CALL FOR TENDERS

1. GENERAL

- 1.1 The supply of services covered by this call for tenders is intended for the 300 GeV accelerator, which is now being constructed in CERN Laboratory II. The so-called stage C of the construction programme, as referred to in the drawings of the Technical Specification, has been adopted.
- 1.2 This new laboratory, located next to the present laboratory at Meyrin, Geneva, Switzerland, is situated partly in the Department of the Ain (France) and partly in the Canton of Geneva. The map enclosed shows the geographical location of the machine and its auxiliary equipment.
- 1.3 There is no railway branch-line leading to CERN. The nearest stations are those of Geneva and Meyrin (Switzerland), and Gex (France). The laboratory can be easily reached by the French and Swiss road networks.

2. DISPATCH OF TENDERS

- 2.1 Tenders must be submitted in one of CERN's official languages (English or French). They may also be submitted initially in the national language of the bidders, provided that a translation into French or English arrives at CERN not later than two weeks after the closing date of the tender.
- 2.2 Tenders will be considered on the express condition that they are submitted on the official form and the price list attached to the call for tenders.

3. PRICES

- 3.1 All prices must be quoted in Swiss francs and must be net and free of tax and customs duty.
- 3.2 The bidder shall be bound by the tender for a period of 150 calendar days from the final tendering date.
- 3.3 In general, the prices requested shall be strictly in accordance with the provisions of the Specification. Further information may be obtained from CERN, if necessary. After submitting his tender, the bidder may in no circumstances plead insufficient information.
- 3.4 The prices submitted in the tender form shall include:
 - the cost of providing equipment, tooling and appliances (except those expressly stated as being made available by CERN);
 - the cost of consumable items (office material, petrol, etc.);
 - protective clothing (including cleaning of this clothing at regular intervals);
 - salaries, including bonuses of all kinds, social security, transport, etc.;
 - overheads, profit, risk allowances, etc.;
 - depreciation of equipment.
- 3.5 The tender prices shall take all the difficulties involved in the work into account. In particular, in order to allow for the fact that the reliability of demountable high vacuum joints depends strongly on the skill and the care taken during the assembly work. The supplementary costs resulting from the distance between the work site (tunnels) and the access ways shall also be included in the prices.

4. QUANTITY ESTIMATES

- 4.1 The total price in the tender (based on a unit price) shall be given for the installation and the leak testing of 180 complete normal half periods. As a variant the unit price of such a half period without the short straight section installed shall be given.
- 4.2 The tenderer shall give the price per hour for each proposed category of personnel as well as for the use of leak detectors made available by the contractor.

- 4.3 There will be a certain number of well defined sections of the vacuum system other than the normal $\frac{1}{2}$ -periods of the ring. The unit price for the installation and leak testing of the normal $\frac{1}{2}$ -periods and the rates per hour shall constitute the bases for negotiations with the contractor for determination of the required number of man-hours and the unit price of the work in the other sections.
- 4.4 Special work like some of the work anticipated in the long straight sections, and minor activities scattered over large sections of the vacuum system shall be paid at the agreed rates per hour.
- 4.5 All material to be delivered by CERN will be made available to the contractor near the work sites in the tunnels.

5. PRICE REVISION

- 5.1 CERN requests that, for all work carried out until 1 July, 1975, all prices in the tender be fixed and not subject to the application of a price variation formula.
- 5.2 On the tender form, the bidder shall clearly give a price variation formula in the following form to be applicable to the prices in the tender for work carried out after the above date:

$$P = P_o \left(0.20 + 0.80 \frac{S}{S_o} \right)$$

where S_o represents the indice for wages published by government bodies on the tender date and where S represents the arithmetic mean for the same indice during the period in which the work subject to the application of the formula is carried out.

6. WORK ORDERS

- 6.1 Before any work is begun, a Work Order, to be regarded as an official order, signed by the CERN representative and accompanied by detailed working drawings prepared by CERN together with, if necessary, the designations of the equipment to be used, shall be issued for each section of the installation, such as the assembly and testing of a certain number of normal periods or of a long straight section.

- 6.2 These orders shall show either the estimated cost of the work calculated by CERN on the basis of the tender, or a lump sum agreed upon by both parties.
- 6.3 The contractor shall be required to check CERN's working drawings and the quantity estimates, to which he shall signify his agreement. Work for which the price has been estimated shall be the subject of a mutually agreed quantity estimate after completion.
- 6.4 All orders shall be invoiced separately, after inspection and acceptance by CERN on the work performed.
- 6.5 CERN may have to issue Work Orders for work not included in the tender or the Specification. An amendment to the contract shall be made in respect of any such work before it is performed.

7. CONDITIONS OF PAYMENT

CERN proposes the following conditions of payment:

- 10% (ten per cent) of the total value of the contract upon signature of the contract against a joint and several banker's guarantee;
- 80% (eighty per cent) in proportion to the progress of the work;
- 10% (ten per cent) upon completion of the contract.

8. WORKING HOURS - PERSONNEL

8.1 In the Technical Questionnaire, the bidder shall state the normal working hours of his personnel on the CERN work sites which are used as a basis for the calculation of his prices. CERN may have to impose certain working hours compatible with other installation activities on the site.

8.2 The public holidays officially recognized by CERN are the following:

- 1 January
- Good Friday
- Easter Monday
- Ascension Day
- Whit Monday
- "Jeûne Genevois" (the Thursday following the first Sunday in September)
- 24 December
- 25 December
- 31 December

In addition, the laboratory normally will be closed between 25 and 31 December. Other public holidays imposed on the contractor by national legislation has to be recuperated by overtime at no extra cost to CERN.

- 8.3 In the Technical Questionnaire, the bidder shall state the amount of annual leave (number of working days) that his personnel is entitled to have. The procedure for defining the dates of annual leave for the contractor's personnel working at CERN shall form part of the contract.
- 8.4 A Work Order drawn up beforehand and signed by the CERN representative shall be issued for any work which, at CERN's request, has to be performed outside the normal working hours. This work, which shall be checked by means of daily statements, shall be paid for on the basis of unit prices, taking into account the increase coefficients requested in the tender form.
- 8.5 The above increases shall not be paid for work which, through the fault of the contractor, has had to be performed during the night, or on a Sunday, or on a public holiday, or outside the normal weekly hours of work. The contractor shall be deemed to be at fault if, for example, work which should have been completed during the day-time within the normal weekly hours of work in accordance with the programme drawn up with the contractor, has had to be continued during the night, on a Sunday, or on a public holiday by reason of the contractor's actions. The same shall apply if work completed during the course of a working day, in normal working hours, exhibits defects which, for safety reasons, must be corrected immediately.
- 8.6 The numbers and the qualifications of the personnel allocated to work on the normal $\frac{1}{2}$ -periods of the ring shall be given in the Technical Questionnaire.
- 8.7 It is expected that in total up to six teams of the same composition as that used for the work on the normal periods will be required simultaneously during the peak of the assembly and test work. The contractor shall be prepared to put at least this number of teams at the disposal of CERN. It is assumed that only one senior technician, acting as supervisor of all these teams and as linkman between the contractor and CERN, will be required.
- 8.8 The bidder shall also provide information on the additional personnel which could be made available in the event of an increase in the work-load at any time during the programme.

9. REPORTING

- 9.1 The work supervisor stationed at CERN shall constantly keep the responsible CERN staff informed about the progress of the contractor's work and of any incidents which could perturb this work or which, in the contractor's opinion, could be harmful to the project (see also "Conditions applicable to installation work carried out on the site of CERN - Laboratory II").
- 9.2 The progress of the work shall be reported weekly by simple markings on schematic layouts of the machine of the type shown on the enclosed sample sheet 'FEUILLE TYPE'. Such sheets have been prepared for all sections of the machine. Besides these markings, indicating which joints have been closed and leak tested etc., the sheet shall also carry any other remarks relating to the work in a particular section.
- 9.3 To each reporting sheet or to a group of such sheets shall be attached the relevant recording of the leak detector output. The leak test recording shall carry markings which permit identification on the recorder trace of each test made.
- 9.4 The contractor shall keep a record of the hours worked. This record shall show not only the total numbers of hours worked but also how the work has been divided between different activities, e.g. normal periods, injection line, special work. Records shall be submitted monthly to the responsible CERN staff who has to approve each record before it can serve as a basis for an invoice to CERN (see Section 6).

10. CHANGES IN THE CONSTRUCTION PROGRAMME

- 10.1 Changes of the start of the installation and leak test work on certain systems may occur due to changes in the construction programme. CERN will notify the contractor as early as possible of any such changes. The time schedule for the whole project annexed to the Specification, is to be considered as tentative.
- 10.2 Delays occurring in the installation and leak test work which is already under way and for which a total price has been agreed shall immediately be reported to the responsible CERN staff who shall remove the causes of the delay or shift the work to other areas. Only in case this should not be feasible, will the waiting time be paid at the agreed normal rate per hour and CERN shall have no other obligations towards the contractor.

11. INSPECTION BY CERN

11.1 CERN staff will regularly inspect the installation and leak test work of the contractor. CERN inspectors will at times assist during the performance of the different operations to be performed by the contractor. The inspectors will also check the reports submitted by the contractor.

11.2 When the CERN inspectors are satisfied that the installation and leak test work in a particular area has been executed in accordance with the terms of the contract, the work will be accepted and the relevant reports signed by CERN.

12. ADJUDICATION

12.1 The bidder shall be bound by the tender for a period of 150 calendar days from the final tendering date.

12.2 The selection of the contractor will be based on the total price and the hourly rates quoted as well as on the replies to the Technical Questionnaire.

12.3 The contract shall be awarded solely for the work described in the Specification.

12.4 CERN estimates that the specified work in the complete normal periods constitutes about 50% of the total work to be performed.

12.5 The contract shall be drawn up on the basis of the prices given in the tender form and the quantity estimates made by CERN (see also Section 4.). It is nevertheless pointed out that the quantities actually ordered by CERN may be increased by up to 30% in relation to these quantities, on the basis of an amendment to the contract.

12.6 The drawings, specifications and quantity estimates attached to the call for tenders are not final, and CERN reserves the right to negotiate modifications after the contract is concluded.

13. WORK SCHEDULE

13.1 The work schedule which the bidder is required to observe is based on the assumption that CERN will have awarded the contract before 31 March 1974.

13.2 The attached programme schedule gives all the information needed to prepare the tender. It is absolutely essential that these dates be strictly observed. The work is scheduled to begin in September 1974, and to be completed in June 1976.

14. PENALTIES

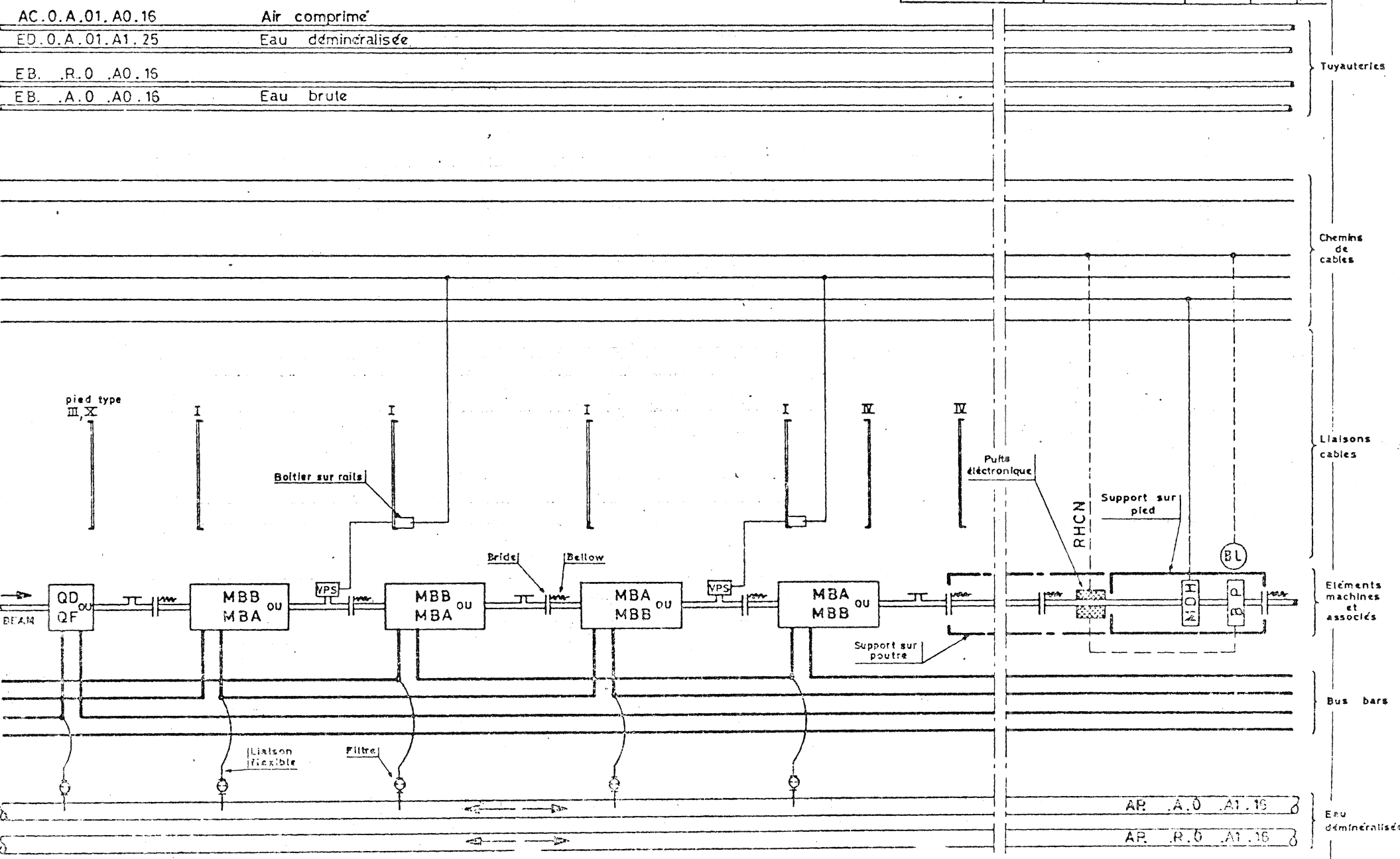
The work schedule to be defined in the contract will be part of the over-all construction programme of the project. CERN attaches the greatest importance to the observance of the dates given in this schedule. The penalties for late execution shall be specified in the contract and shall apply as from these dates.

15. DOCUMENTS TO BE SUBMITTED WITH THE TENDER

The following documents, completed and signed by the firm, shall be submitted:

- Tender form
- Technical Questionnaire
- Specification for leak detector(s)
- Specification for output recorder(s).

out Schematics	Detailed Layout	Dessiné	
		Nom	Date
J2_10	8090_2	Griegor	13.5.73
	8090_2		
			A
			B
			C
			D
			E
			F



20.9.76

VACUUM SYSTEMS INSTALLATION

Work schedule (DRAFT)

(start end 1976)

Item

North area

TT 20

West area

TT 60 (2nd part)

TT 60 (1st part)

TT 70 (2nd part)

TT 70 (1st part)

LS 56

LS 55

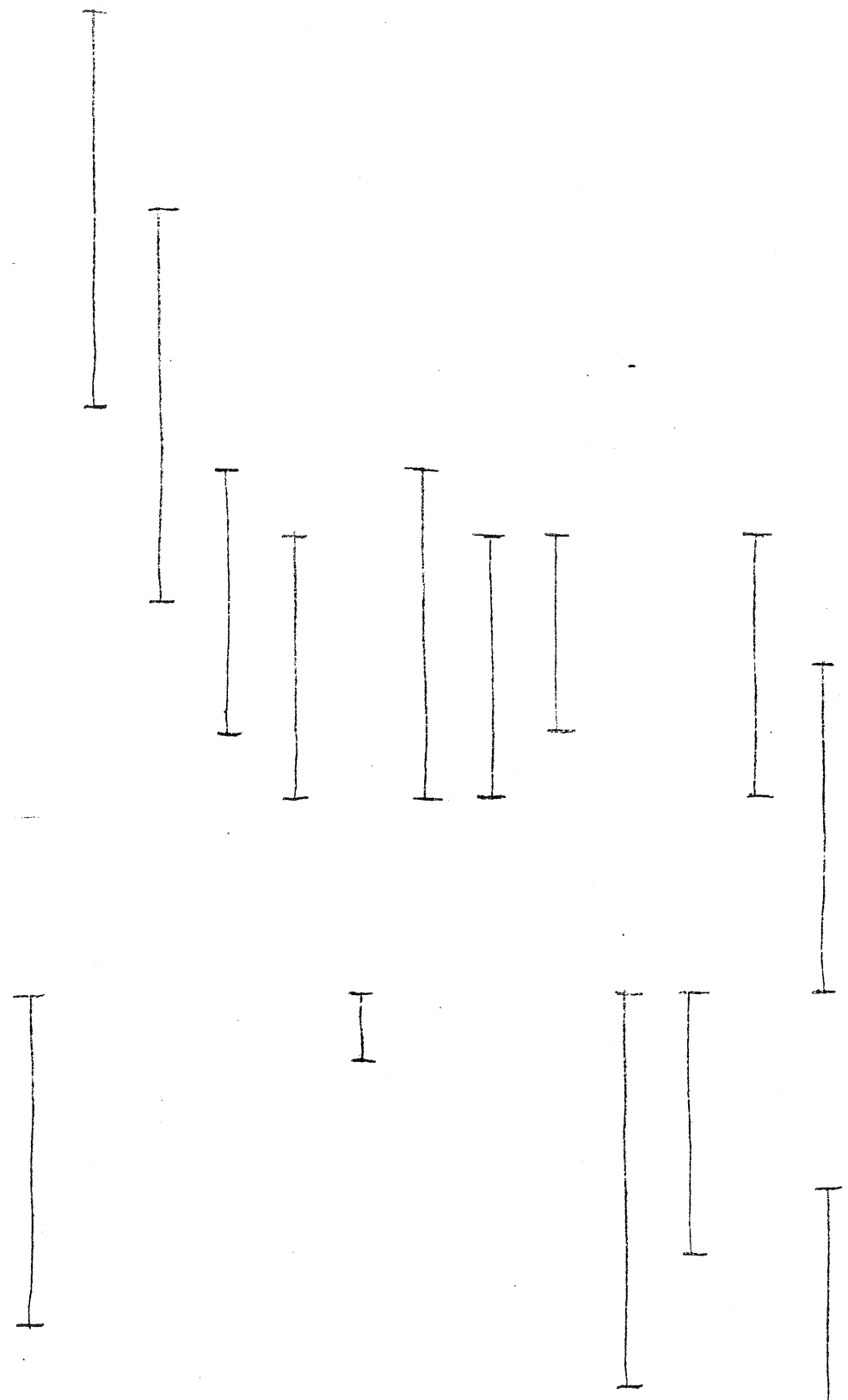
LS 54

LS 53

LS 52

LS 51

Normal periods, ring



Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun

1976

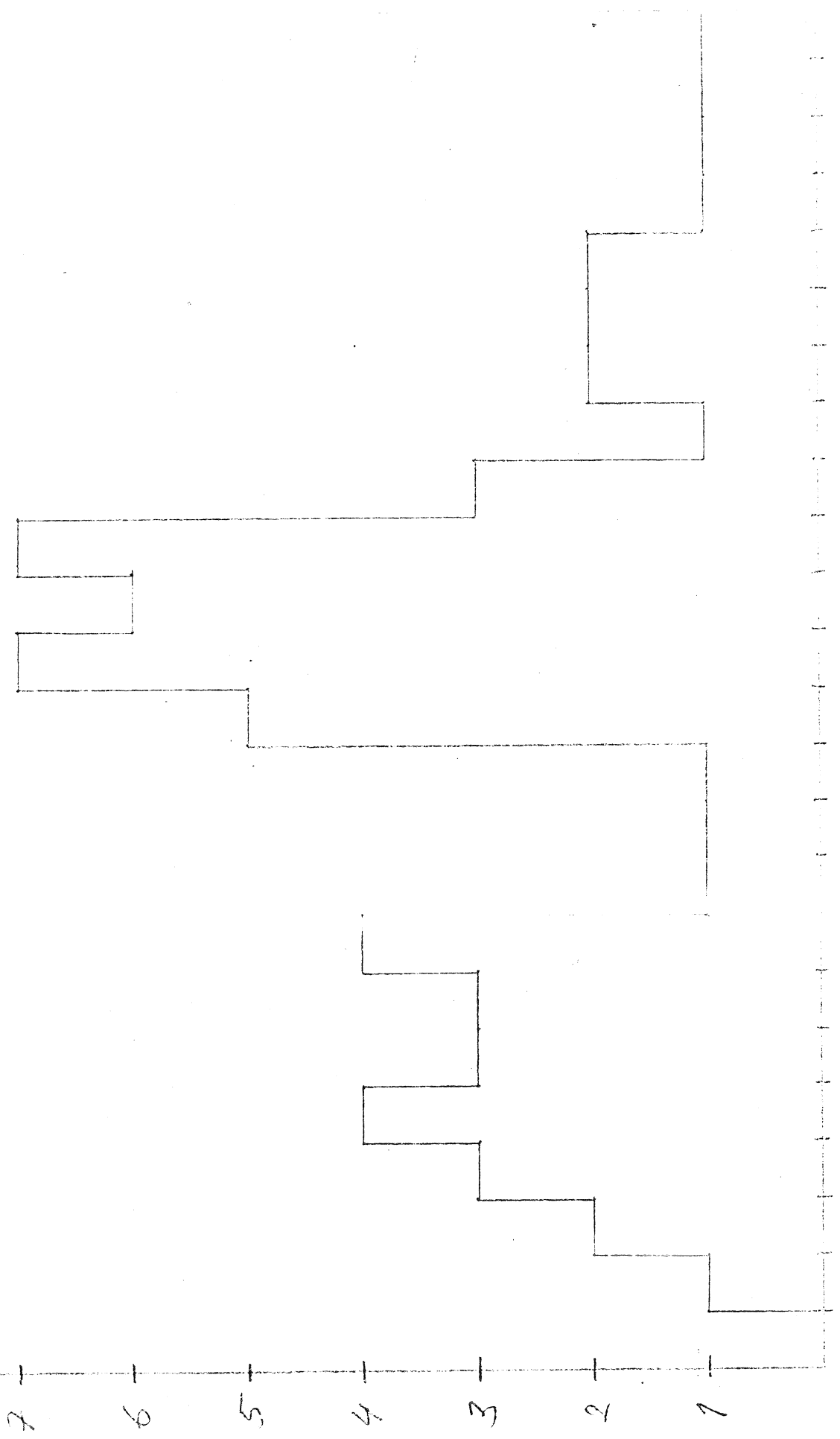
20/7/66 Mac + 11.1.1966

VACUUM SYSTEMS INSTALLATION

(DRAFT of labour requirements,
annex to work schedule)

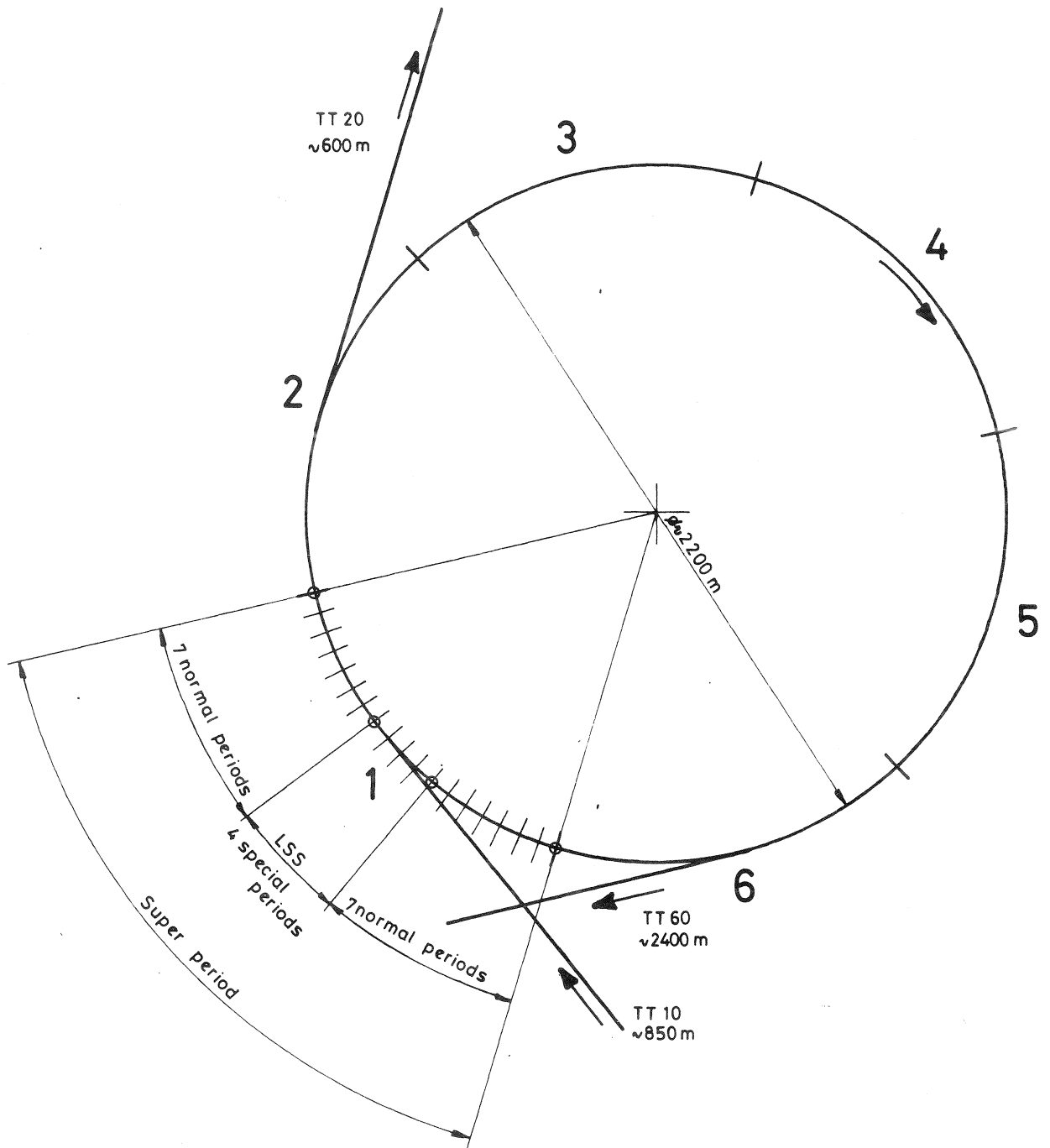
PC of
SIMULT.

work
sites

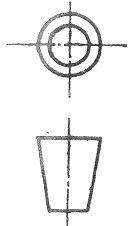


Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug

Ce dessin ne peut être utilisé à des fins commerciales sans autorisation écrite
 This drawing may not be used for commercial purposes without written authorisation



DRAWING FOR TENDER
 Not to be used for construction
 DESSIN POUR SOUMISSION
 Ne pas utiliser pour exécution

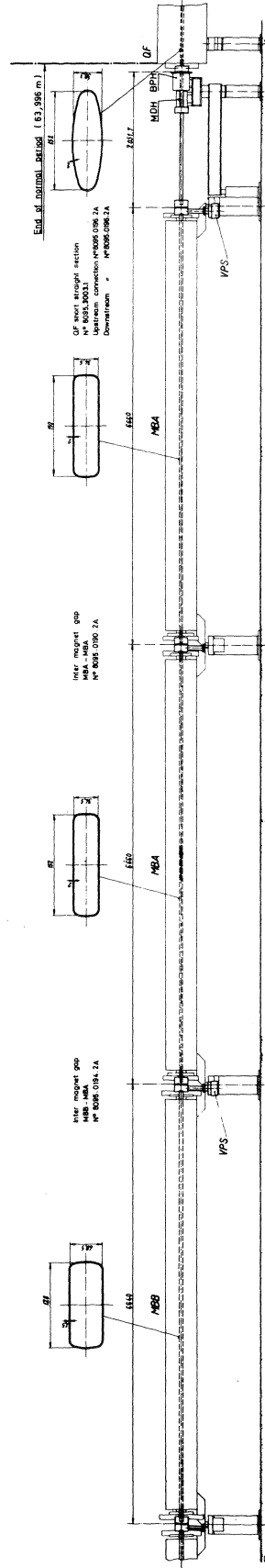
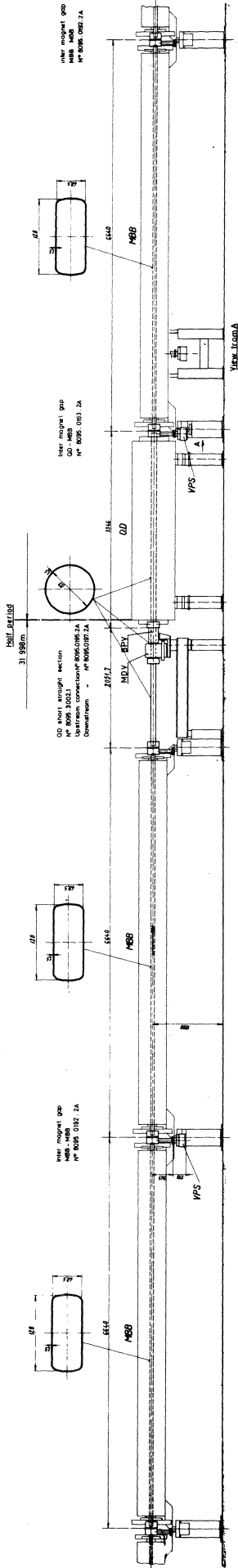
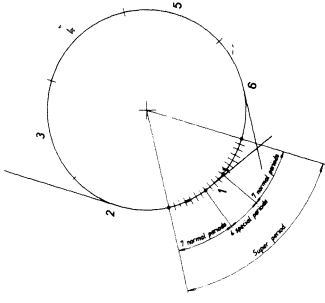
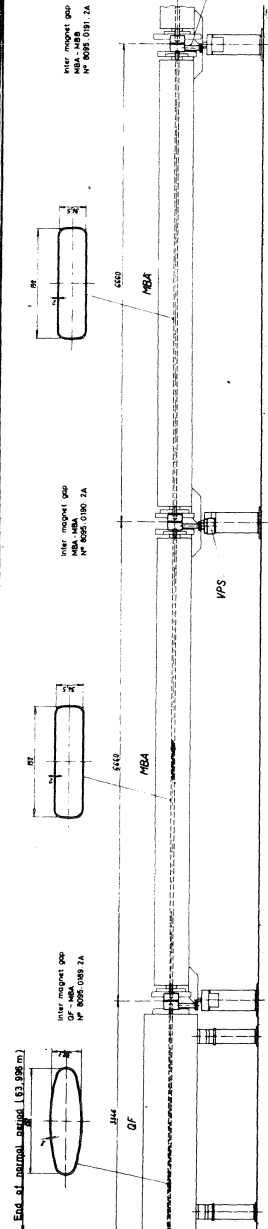


First angle projection
 Projection européenne

Ensemble Assembly		S/ensemble S/assembly		Nom-Name		Date	Issue
(Extracted from 8095.0055.0A)				Echelle Scale		Dessiné Ramillon	73.09.25
Schematic layout of the SPS with TTs.				Contrôlé			
							A
							B
							C

ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
 EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
 CERN LAB ..II.. CH-1211 GENÈVE 23

8095.0308.4



VPS - Spooling unit number 25.1/3

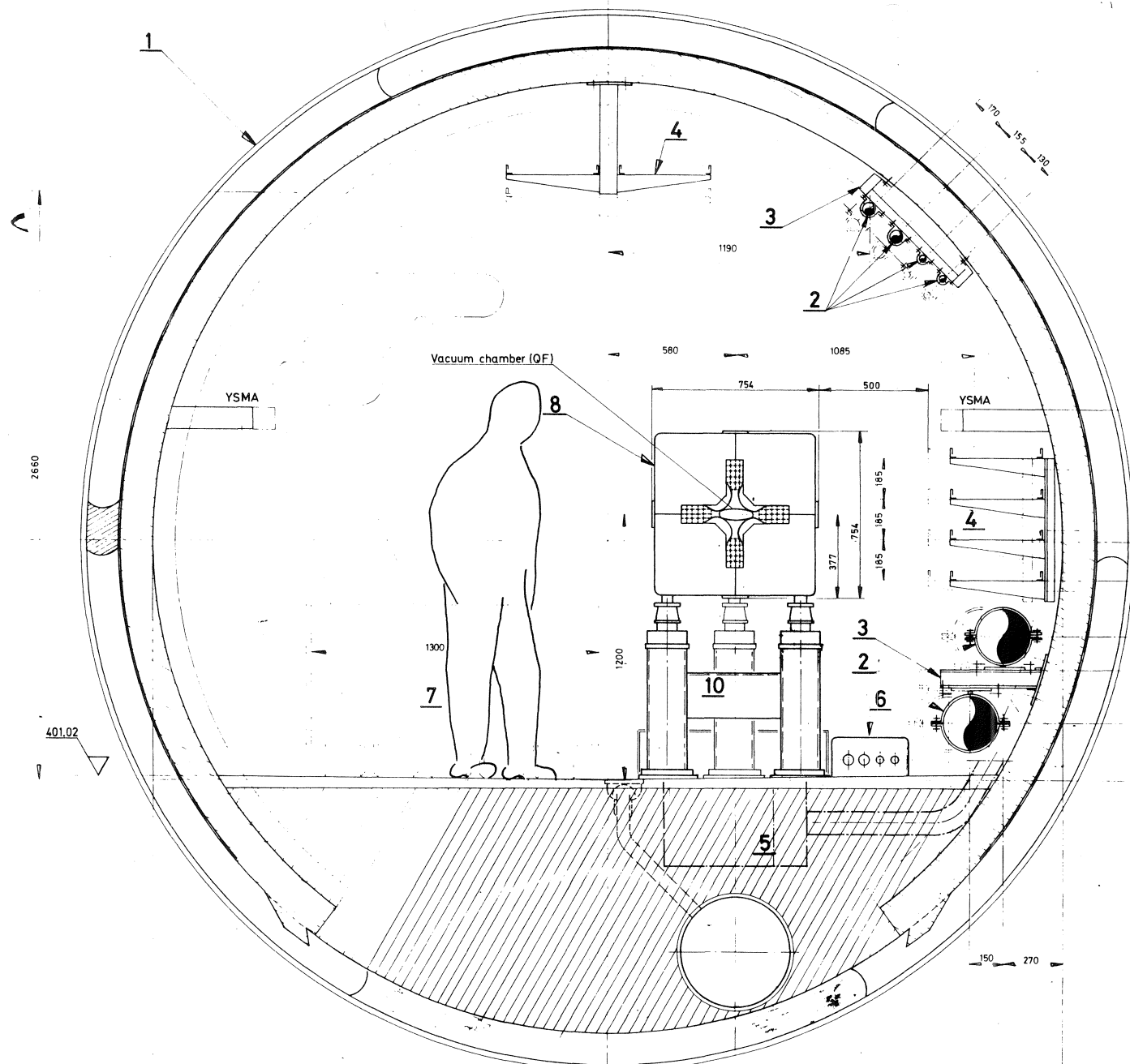
Note: The external diameter of the cross sections of the present column are shown in when under vacuum.

Length of one period = 63.996 m

REVISION	
NO	DESCRIPTION

PROJECT DATA	
PROJECT NO.	
CLIENT	
DATE	
DRAWN BY	
CHECKED BY	
SCALE	
TITLE	

REVISIONS TO THIS DRAWING ARE SHOWN IN THE REVISION TABLE.



REP.	N° PLAN	Indice	DATE	TITRE DU PLAN
1	LOS 1 209 17		12.10.72	TUNNEL PRINCIPAL (Section courante)
2	8105.2108.0	A	18.9.72	TUNNEL PRINCIPAL . FLUIDES DISTRIBUTION
3	8105.9006.1	A	19.10.72	TUNNEL PRINCIPAL .SUPPORTS DE TUYAUTERIES
4	8103.5102.0	A	5.2.73	TUNNEL PRINCIPAL .CHEMINS DE CABLES
5	8032.1.19.0	B	24.11.72	PUITS ELECTRONIQUE
6				MAGNET BUS BARS
7	8011.5005.1		9.8.72	VEHICULE TRANSPORT D'AIMANT
8	8012.1003.0	A	5.12.72	QUADRUPOLE MAGNET
	8012.1006.0	A	4.12.72	
10	8014.0032.1		25.1.73	SUPPORT D'AIMANT

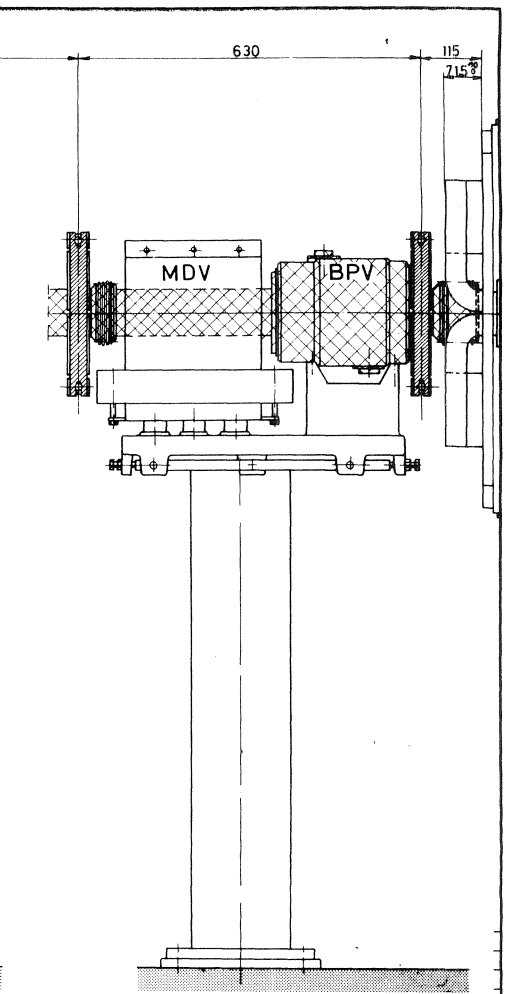
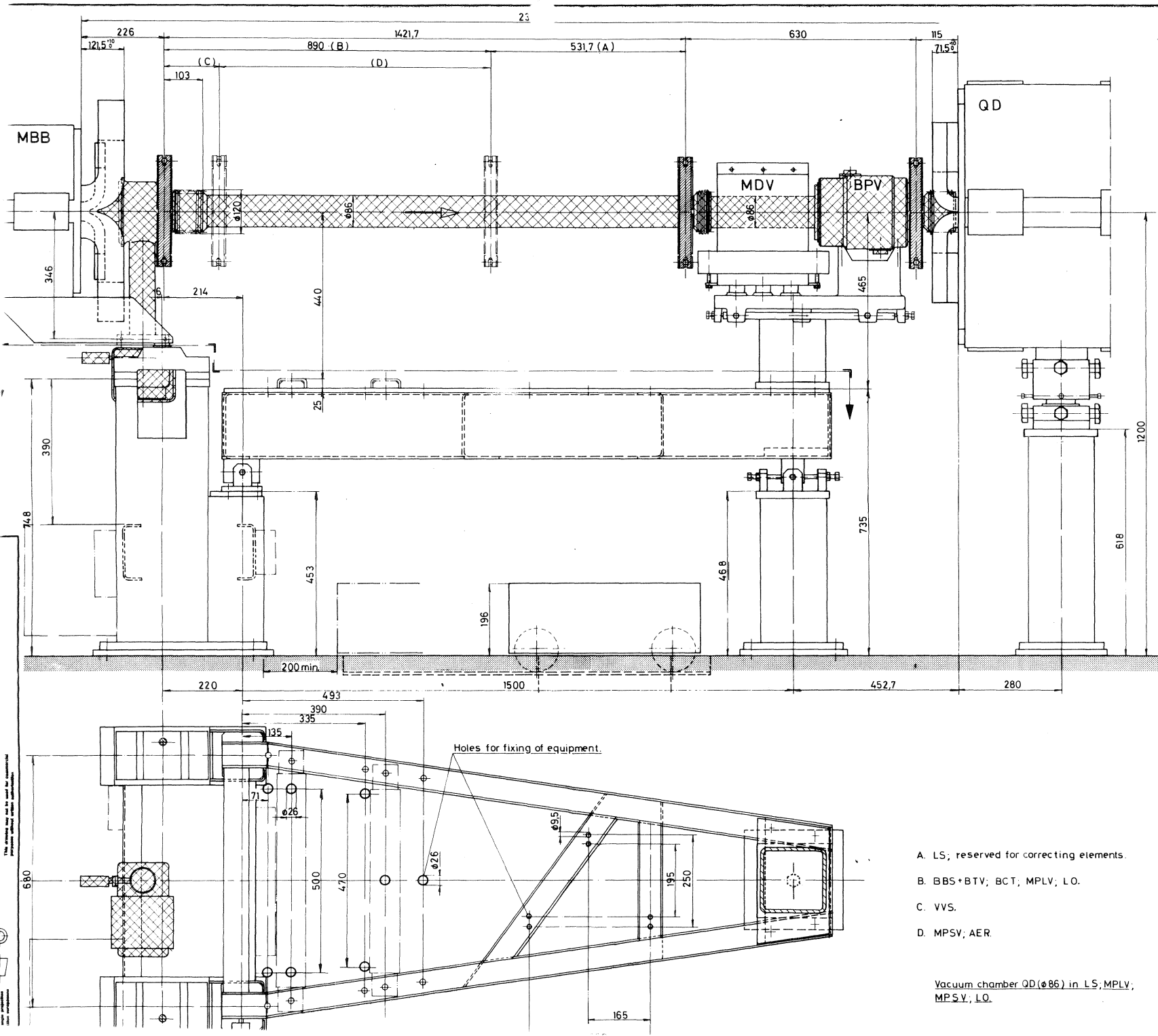
.CUT THROUGH RING TUNNEL AND FOCUSING MAGNET IN NORMAL PERIOD.

DRAWING FOR TENDER
Not to be used for construction
DESSIN POUR SOUMISSION
Ne pas utiliser pour exécution

TUNNEL RADIUS 946,630 m
MACHINE RADIUS 947,210 m

N°	Designation	Ref.	Matiere	Mesure	N°	Designation	Ref.
1
2

STAGE "C"	400 GEV	Echelle	73-0
DETAILED LAY OUT		1/10	
NORMAL SECTION			



Situation when no special equipment in short s.s.

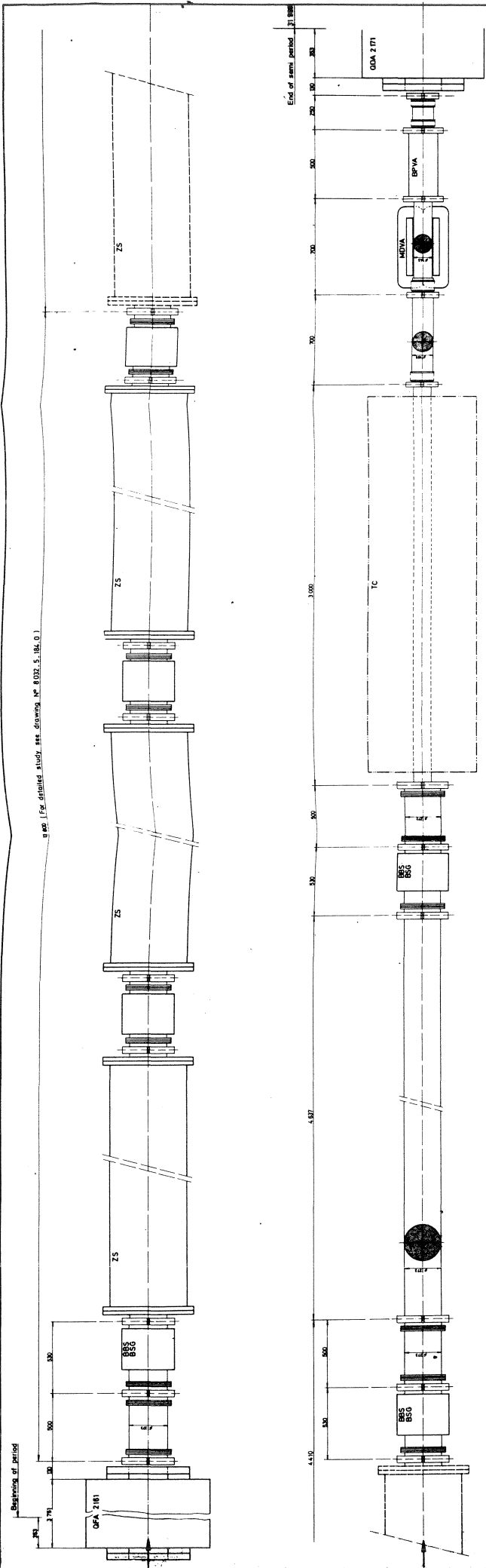
- A. LS; reserved for correcting elements.
- B. BBS+BTV; BCT; MPLV; LO.
- C. VVS.
- D. MPSV; AER.

Vacuum chamber QD(Ø86) in LS, MPLV, MPSV, LO.

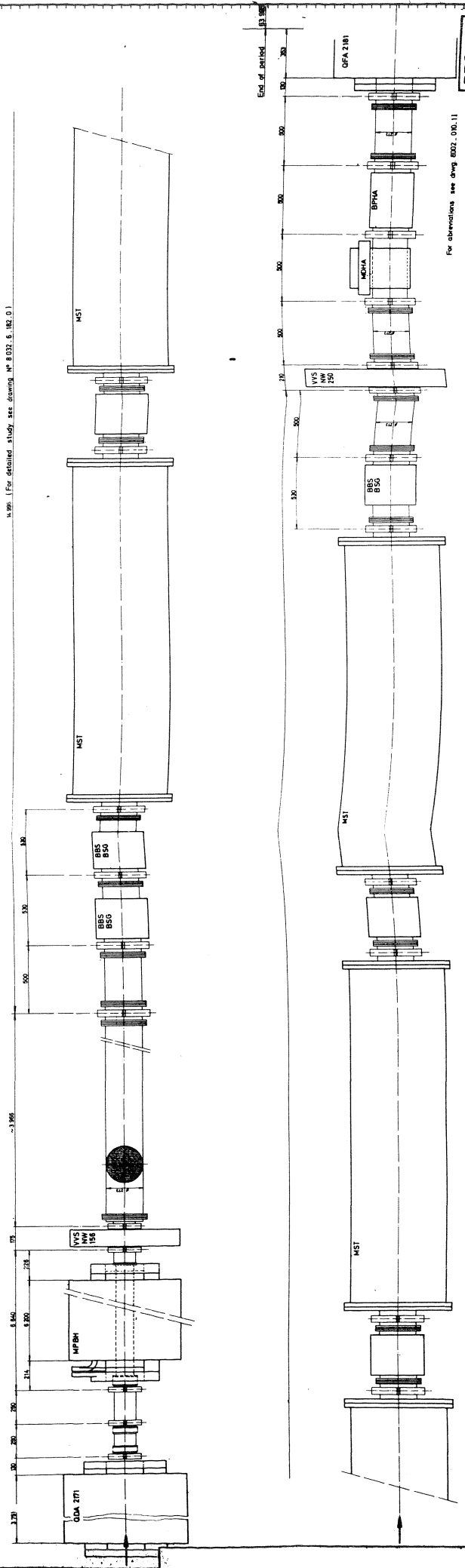
DRAWING FOR TENDER
Not to be used for construction
DESSIN POUR SOUMISSION
Ne pas utiliser pour execution

N°		Description		Unit	Material	Notes	Quantity
II	I	Roughness	Surface finish	mm	Material	Notes	Quantity
II	I	Surface finish	Surface finish	mm	Material	Notes	Quantity
II	I	Surface finish	Surface finish	mm	Material	Notes	Quantity

0.00 (For detailed study see drawing № 8.032.5.18.0.1)

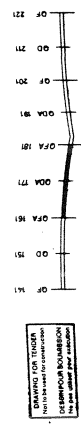


0.00 (For detailed study see drawing № 8.032.5.18.0.1)



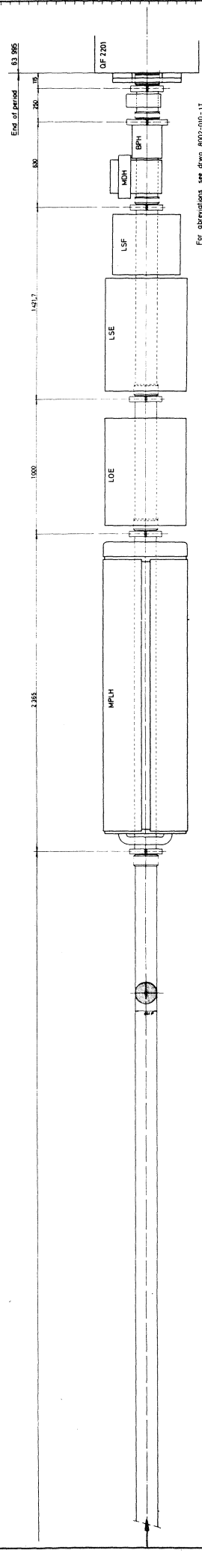
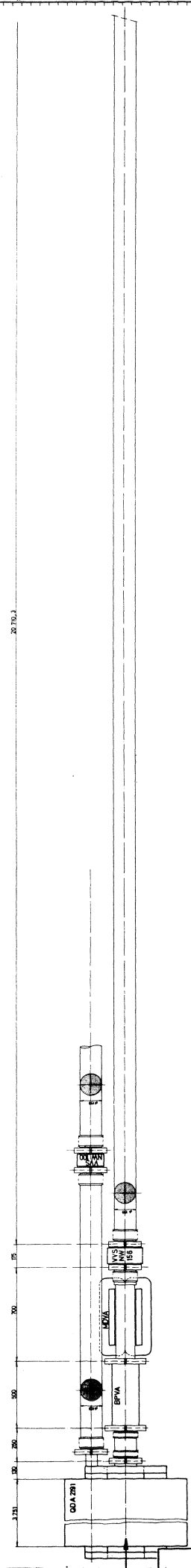
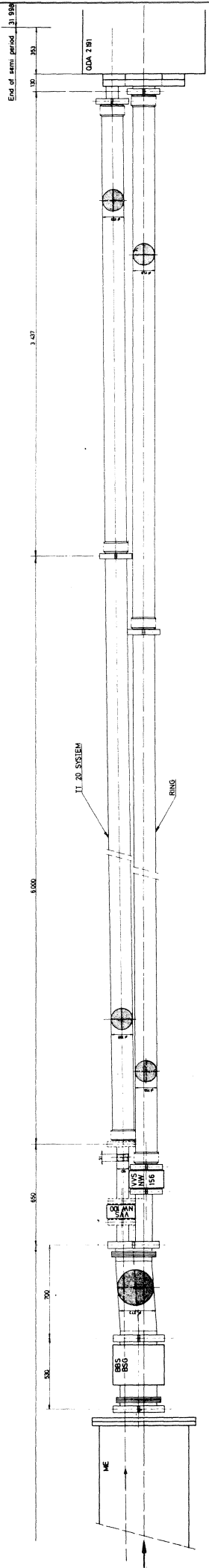
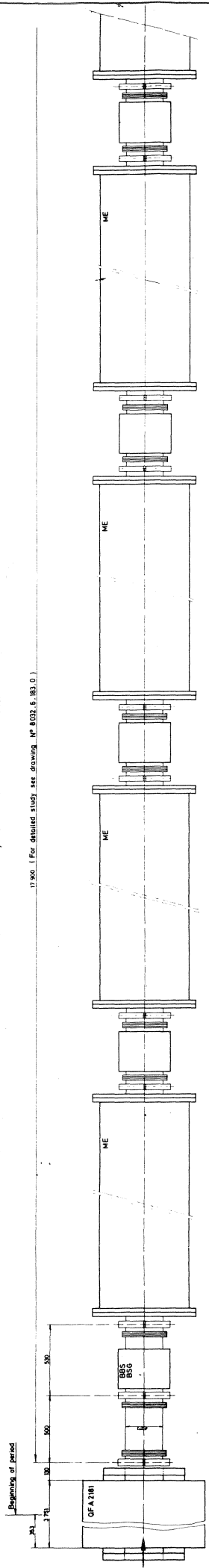
For abbreviations see drawing 8.002.000.11

PROJET	
NOM	LSS 7
OBJET	Vacuum installation in period 181
DATE	181
DESIGNER	
CHECKER	
APPROVED	



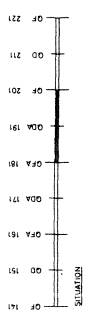
WARNING FOR THE USER
 Not to be used for construction
 (drawing for information only)

17 900 1 For detailed study, see drawing № 8095.6.183.0.1

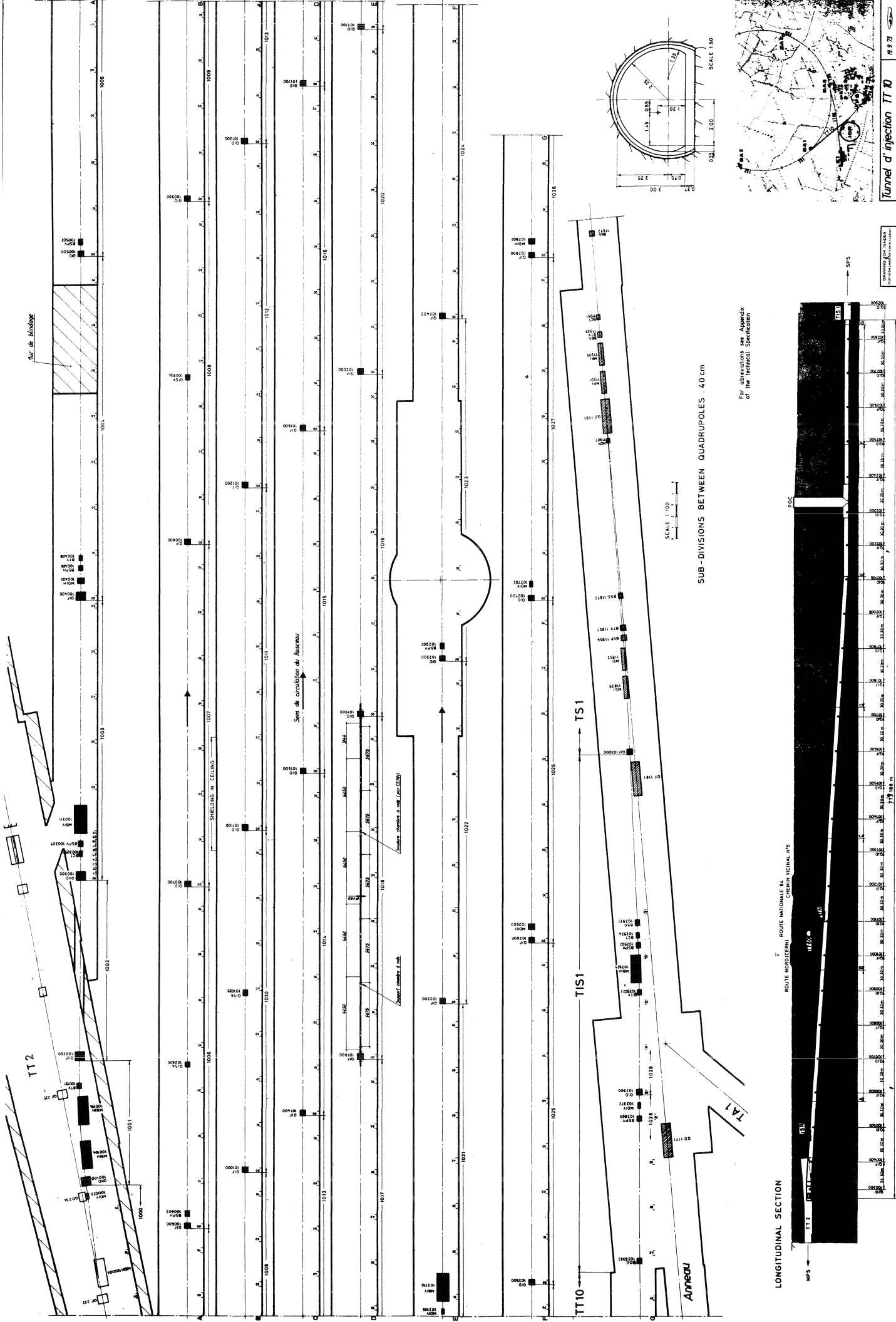


For abbreviations see drawing 8002-010-11

PROJECT	
LSS 2	110
Vacuum section	110
in period	110
№ 8095.6.183.0.1	110
8095.4007.0	110
CERN LAB II	CH-1211 GENEVE 23



DRAWING FOR TENDER
FOR THE SUPPLY OF
EQUIPMENT FOR THE
RECONSTRUCTION
OF THE CERN LAB II



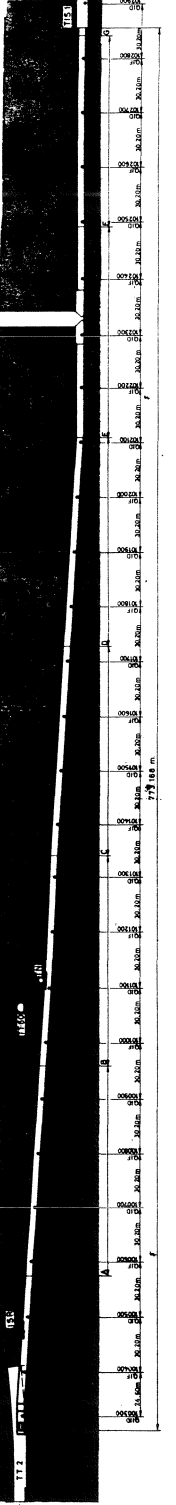
For abbreviations see Appendix of the Technical Specification

SUB-DIVISIONS BETWEEN QUADRUPOLES 40 cm

SCALE 1/100

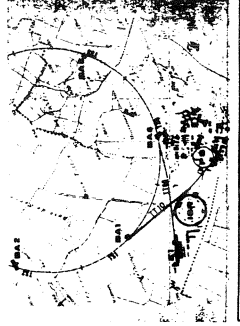
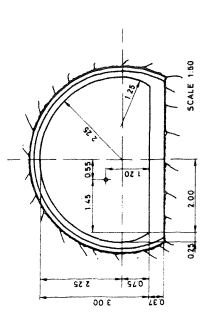
LONGITUDINAL SECTION

ROUTE NATIONALE 84
CREMAIN VICINAL N°5



SCALE 1/1000

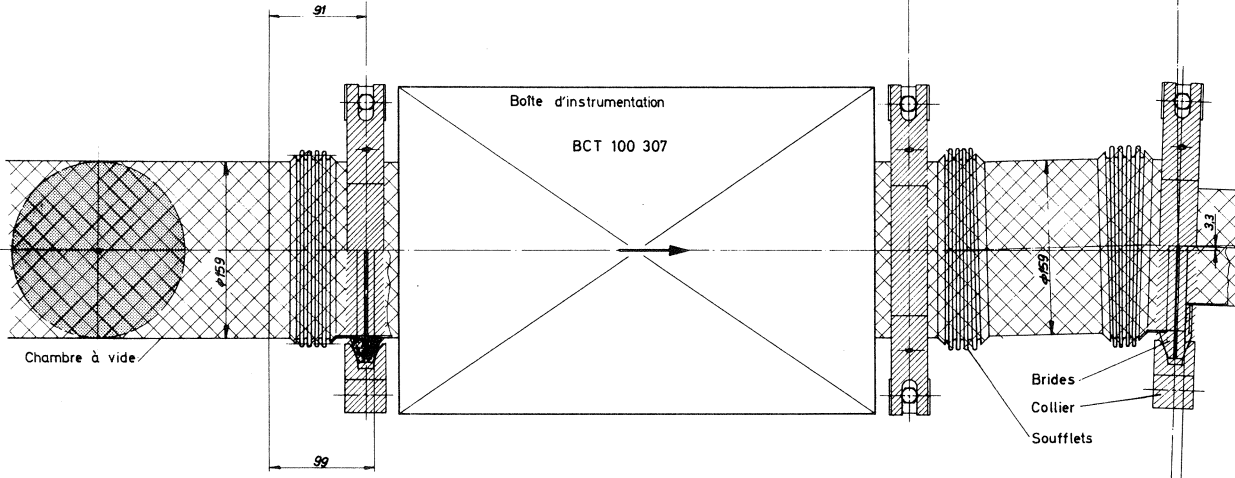
FOR DETAILS SEE DRAWINGS
E51-111-01 8035-9-LT1-2-3 / A, B, C
8033-1-1-0 8035-9-LT1-2-0 / A, B, C



2045 jusqu'au prochain collier

502

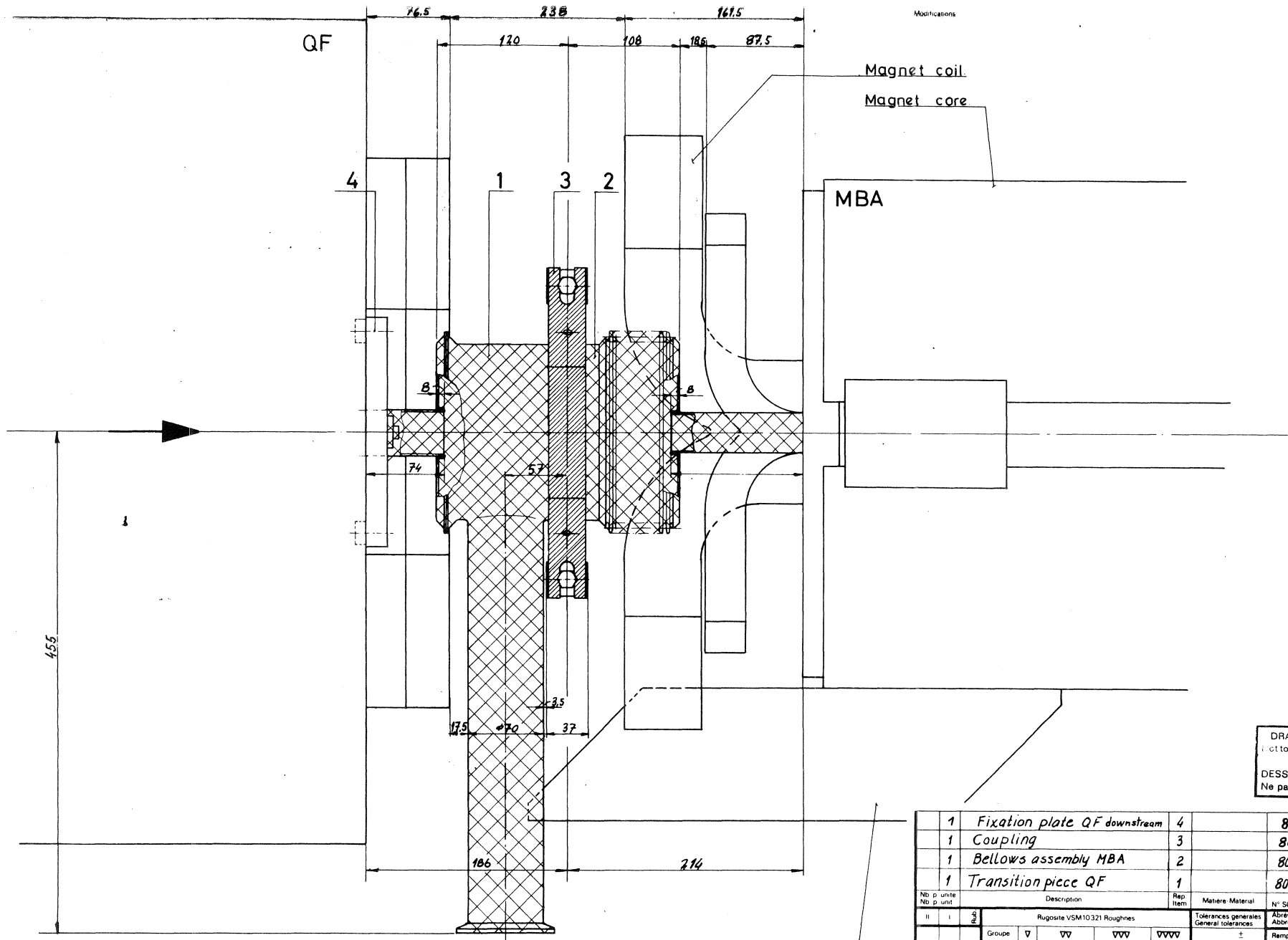
250



Vue en élévation

DRAWING FOR TENDER
Not to be used for construction
DESSIN POUR SOUMISSION
Ne pas utiliser pour exécution

No. in unit		Description		Ref. No.	Marking-Material	Notes	Material	Notes	Material	Notes	Material	Notes	Material	Notes	Material	Notes	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Assemble		Assembly		Material		Material		Material		Material		Material		Material		Material	
Tunnel d'injection TT 10										Scale		Date		By		No.	
Espace entre BCT et MBIV										1:25		28.2.93					



Length of vacuum chamber in MBA = 6448 ± 2
 QF = 3134 ± 2

DRAWING FOR TENDER
 Not to be used for construction
 DESSIN POUR SOUMISSION
 Ne pas utiliser pour exécution

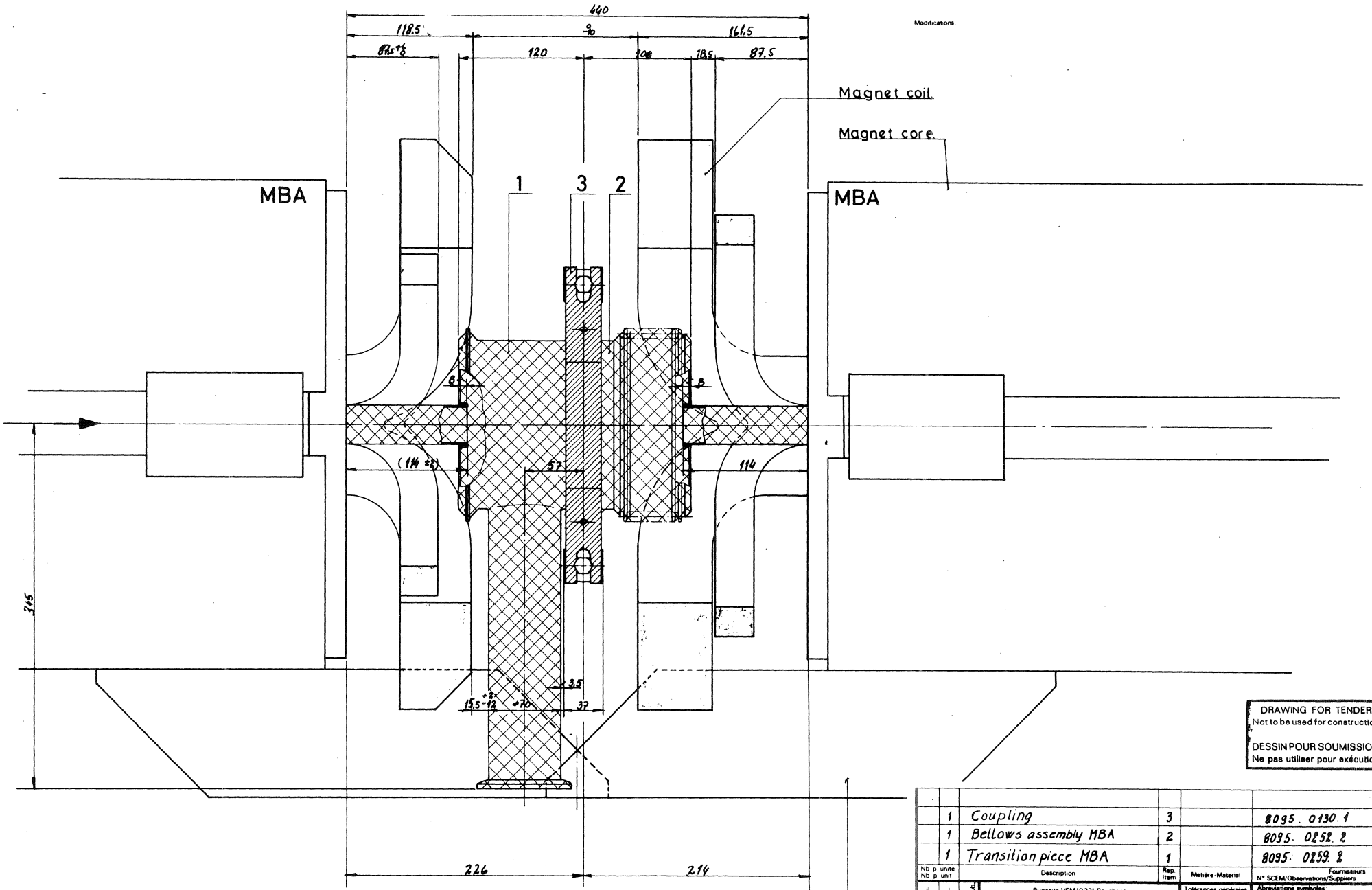
Nb p. unite	Description	Rep Item	Matiere-Material	N° SCEN/Observations/Suppliers																																																																																																															
4	Fixation plate QF downstream			8095.0300.2																																																																																																															
3	Coupling			8095.0130.1																																																																																																															
2	Bellows assembly MBA			8095.0252.2																																																																																																															
1	Transition piece QF			8095.0261.2																																																																																																															
<table border="1"> <tr> <td>II</td> <td>I</td> <td>g</td> <td colspan="5">Rugosite VSM10321 Roughnes</td> <td>Tolerances generales</td> <td colspan="2">N° SCEN/Observations/Suppliers</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>General tolerances</td> <td colspan="2">Abbreviations symbols</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td colspan="2">Abbreviations symbols CERN</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td colspan="2">Remplace N°</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td colspan="2">Remplace par N°</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td colspan="2">Reduction N°</td> </tr> <tr> <td colspan="3">Ensemble Assembly</td> <td colspan="2">S/ensemble</td> <td colspan="2">S/assembly</td> <td colspan="2">Nom-Name</td> <td>Date</td> </tr> <tr> <td colspan="3"></td> <td colspan="2"></td> <td colspan="2"></td> <td colspan="2">Echelle Scale</td> <td>Dessine</td> </tr> <tr> <td colspan="3"></td> <td colspan="2"></td> <td colspan="2"></td> <td colspan="2">Contrôle</td> <td>23.1.73</td> </tr> <tr> <td colspan="3"></td> <td colspan="2"></td> <td colspan="2"></td> <td colspan="2">12.5</td> <td>Mis à jour Ramillon 6.6.73</td> </tr> <tr> <td colspan="3"></td> <td colspan="2"></td> <td colspan="2"></td> <td colspan="2"></td> <td>Mis à jour Gomp 20.8.73</td> </tr> </table>					II	I	g	Rugosite VSM10321 Roughnes					Tolerances generales	N° SCEN/Observations/Suppliers									General tolerances	Abbreviations symbols										Abbreviations symbols CERN										Remplace N°										Remplace par N°										Reduction N°		Ensemble Assembly			S/ensemble		S/assembly		Nom-Name		Date								Echelle Scale		Dessine								Contrôle		23.1.73								12.5		Mis à jour Ramillon 6.6.73										Mis à jour Gomp 20.8.73
II	I	g	Rugosite VSM10321 Roughnes					Tolerances generales	N° SCEN/Observations/Suppliers																																																																																																										
							General tolerances	Abbreviations symbols																																																																																																											
								Abbreviations symbols CERN																																																																																																											
								Remplace N°																																																																																																											
								Remplace par N°																																																																																																											
								Reduction N°																																																																																																											
Ensemble Assembly			S/ensemble		S/assembly		Nom-Name		Date																																																																																																										
							Echelle Scale		Dessine																																																																																																										
							Contrôle		23.1.73																																																																																																										
							12.5		Mis à jour Ramillon 6.6.73																																																																																																										
									Mis à jour Gomp 20.8.73																																																																																																										
ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH CERN CH-1211 GENEVE 23																																																																																																																			
			LAB. II		8095.0189.2B																																																																																																														

Ce dessin ne peut être utilisé à des fins commerciales sans l'autorisation écrite de l'Organisation Européenne pour la Recherche Nucléaire.
 This drawing may not be used for commercial purposes without written authorisation.

First angle projection
 Projection européenne

Ce dessin ne peut être utilisé à des fins commerciales sans autorisation écrite. This drawing may not be used for commercial purposes without written authorization.

First angle projection. Projection sur plan.



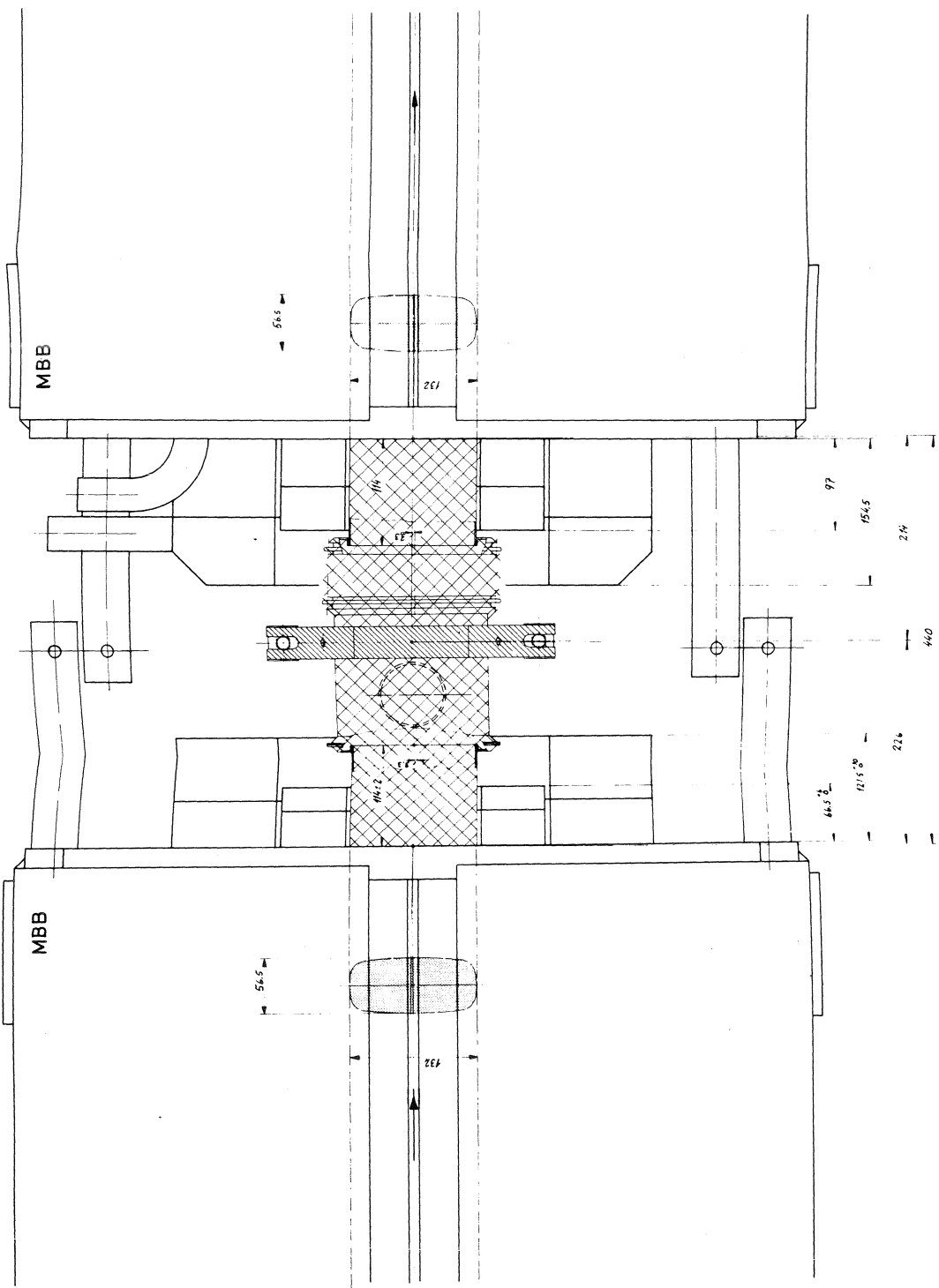
Modifications

DRAWING FOR TENDER
 Not to be used for construction
 DESSIN POUR SOUMISSION
 Ne pas utiliser pour exécution

Length of vacuum chamber in MBA = 6448 ± 2

1	Coupling	3	8095.0130.1								
1	Bellows assembly MBA	2	8095.0252.2								
1	Transition piece MBA	1	8095.0259.2								
No p. unite / ND p. unit		Description	Rep. Item	Matiere / Material	N° SCEM / Observations / Suppliers	Fournisseurs					
II	I	Rugosite VSM10321 Roughness	Tolérances générales / General tolerances								
Groupe		V	VV	VVV	VVVV	Remplace N°					
Classe		N10	N9	N8	N7	N6	N5	N4	N3	N2	Remplace par N°
Ra (µm)		12.5	6.3	3.2	1.6	0.8	0.4	0.2	0.1	0.05	Reduction N°
Ensemble / Assembly		S/ensemble / S/assembly				Nom / Name	Date				
Emission		Inter magnet gap MBA - MBA				Echelle / Scale	1:2.5				
Dessine		ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE / EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH				Dessine / R. Grip	22.1.73				
CERN		CH-1211 GENÈVE 23				Contrôle	Mis à jour / Hamilton	4.6.73			
LAB. II		8095.0190.2B				Mis à jour / Grip	22.2.73				

Caution ne peut être utilisé à des fins
 constructives sans autorisation écrite
 This drawing may not be used for commercial
 purposes without written authorization



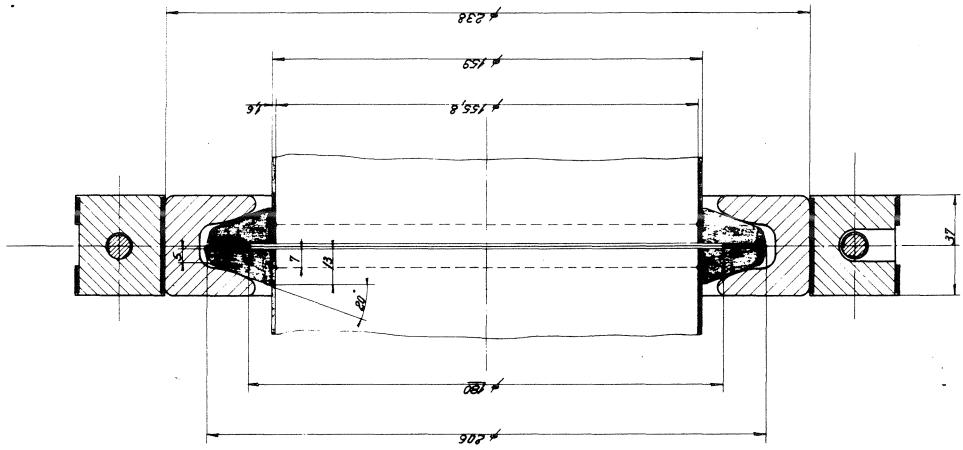
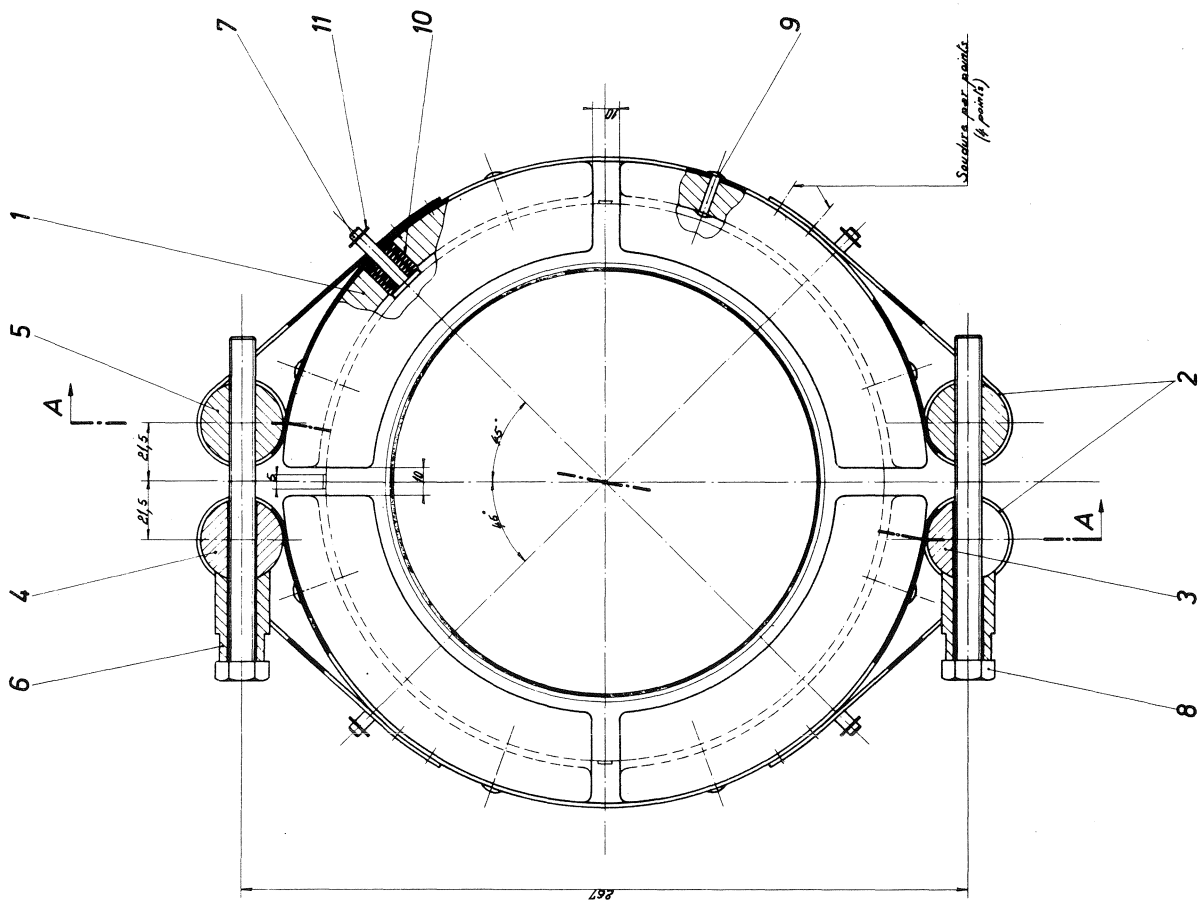
DRAWING FOR TENDER
 Not to be used for construction
 DRESSING POUR SOUMISSION
 Ne pas utiliser pour exécution

No. of sheets		Total sheets		Date		Name	
Sheet No.	Total	Date	Name	Checked	Drawn	Scale	Notes
1	1						
Project: Inter magnet gap MBB-MBB; Top view Drawing No.: 1/1 Scale: 1:1 Author: [Signature] Date: [Date]							

ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
 EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Modifications

Coupe A-A

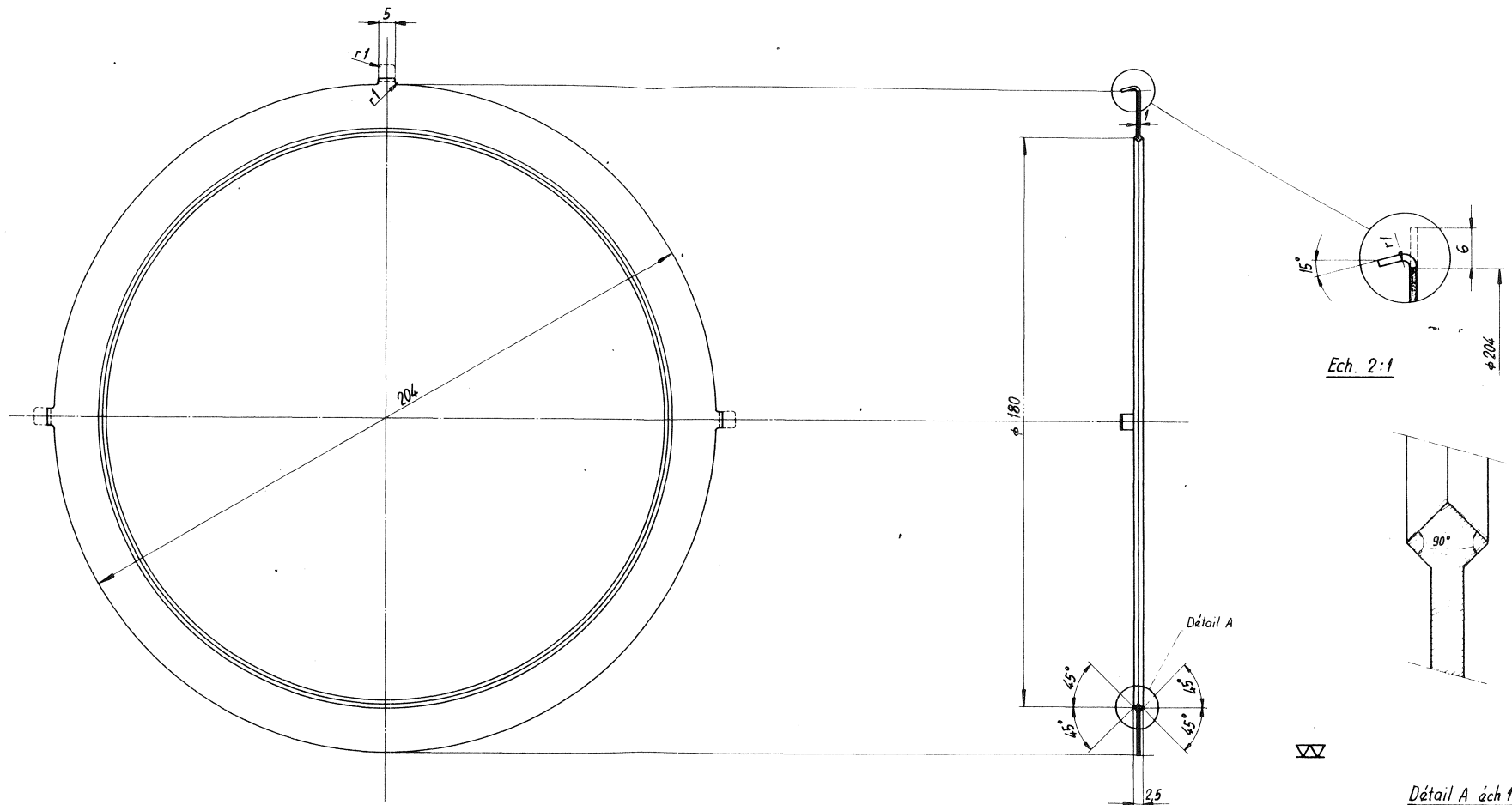


d de scellement = 180 mm
 Longueur développée = 382 mm
 Effort de serrage = 180 daN/mm de joint

Description		Matériau		Norme		Diamètre		Longueur		Masse	
Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
4	Circulips à DIN 8709	11	Ac. res.	11	10	11	10	11	10	11	10
72	Bandelle ressort 15x52x97	10	Ac. res.	10	10	10	10	10	10	10	10
8	Rivet à tête mi-bombée 9,3x16	9	Al. 805	9	9	9	9	9	9	9	9
2	Vis tête épaisse M10x120	8	Ac. min.	8	8	8	8	8	8	8	8
4	Arre	7	Ac. mar.	7	7	7	7	7	7	7	7
2	Entretoise	6	Bz	6	6	6	6	6	6	6	6
2	Masselette	5	Ac. mar.	5	5	5	5	5	5	5	5
1	Masselette	4	Ac. mar.	4	4	4	4	4	4	4	4
1	Masselette	3	Ac. mar.	3	3	3	3	3	3	3	3
2	Segment	2	Ac. mar.	2	2	2	2	2	2	2	2
4	Segment	1	Alliage Al	1	1	1	1	1	1	1	1
		Matériau		Norme		Diamètre		Longueur		Masse	
		Ac. res.		DIN 8709		10		10		10	
		Al. 805		DIN 8709		9		9		9	
		Ac. min.		DIN 8709		8		8		8	
		Ac. mar.		DIN 8709		7		7		7	
		Bz		DIN 8709		6		6		6	
		Ac. mar.		DIN 8709		5		5		5	
		Ac. mar.		DIN 8709		4		4		4	
		Ac. mar.		DIN 8709		3		3		3	
		Ac. mar.		DIN 8709		2		2		2	
		Alliage Al		DIN 8709		1		1		1	

DRAWING FOR TENDER
 Not to be used for construction
 DESSIN POUR SOUMISSION
 Ne pas utiliser pour exécution

0005 0120
 0005 0120
 0005 0120



Ce dessin ne peut être utilisé sans la
 autorisation écrite de l'Organisation
 européenne pour la recherche nucléaire
 (CERN).

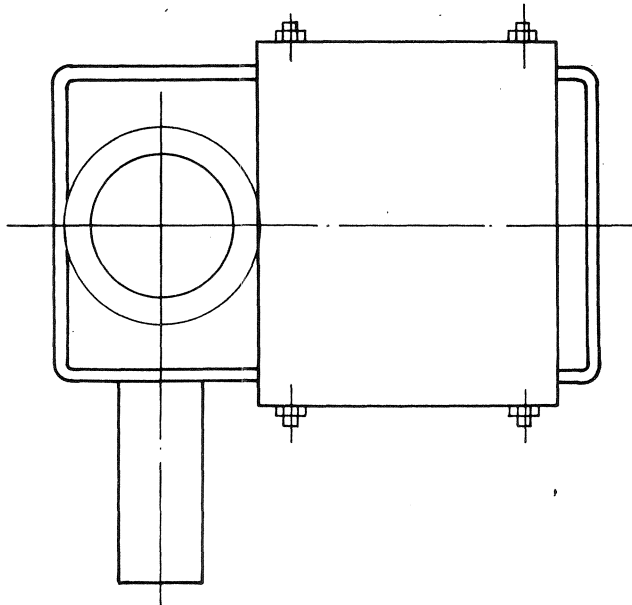
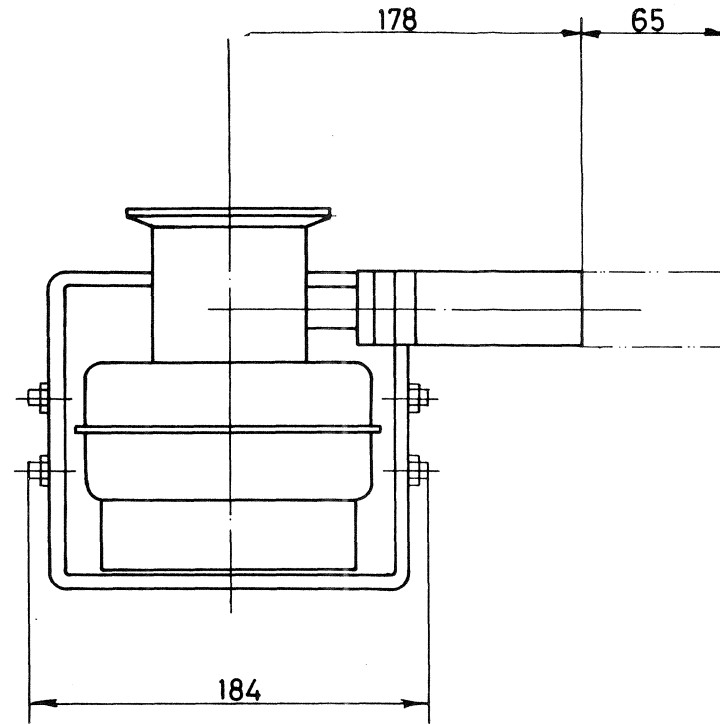
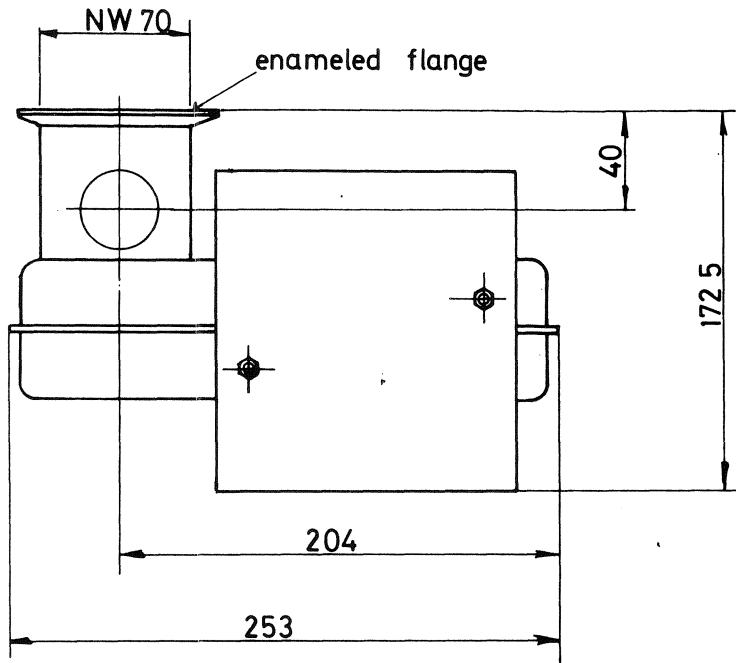
First angle projection
 Projection conique

DRAWING FOR TENDER
 Not to be used for construction
DESSIN POUR SOUMISSION
 Ne pas utiliser pour exécution

Joint φ 204/175 x 1		AL 99.5		Fournisseurs	
No. p. unite	Nb. p. unite	Description	Rep. Item	Matiere Material	N° SCEN Observations Suppliers
II	I	Rugosité VSM 10 321 Roughness		Tolerances generales General tolerances	Abreviations symboles Abbreviations symbols CERN
		Groupe ∇ $\nabla\nabla$ $\nabla\nabla\nabla$ $\nabla\nabla\nabla\nabla$ Classe N10 N9 N8 N7 N6 N5 N4 N3 N2 Ra (µm) 12.5 6.3 3.2 1.6 0.8 0.4 0.2 0.1 0.05		0 à 204 ± 0.2	Remplace par N° Reduction N°
Ensemble Assembly		8095.0130.1	3 ensemble S assembly		Num Name Date
Dessineur		Accelerator Vacuum Installation		Echelle Scale	Dessine <i>Reg R.</i> 73.9.25
Execution		Joint φ 180 (principe)		1:1 2:1 10:1	Contrôle <i>Reg R.</i>
Dessineur		ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH		LAB. II	8095.0309.2
		CERN CH-1211 GENEVE 23			

Ce dessin ne peut être utilisé à des fins commerciales sans autorisation écrite
 This drawing may not be used for commercial purposes without written authorization

First angle projection
 Projection européenne

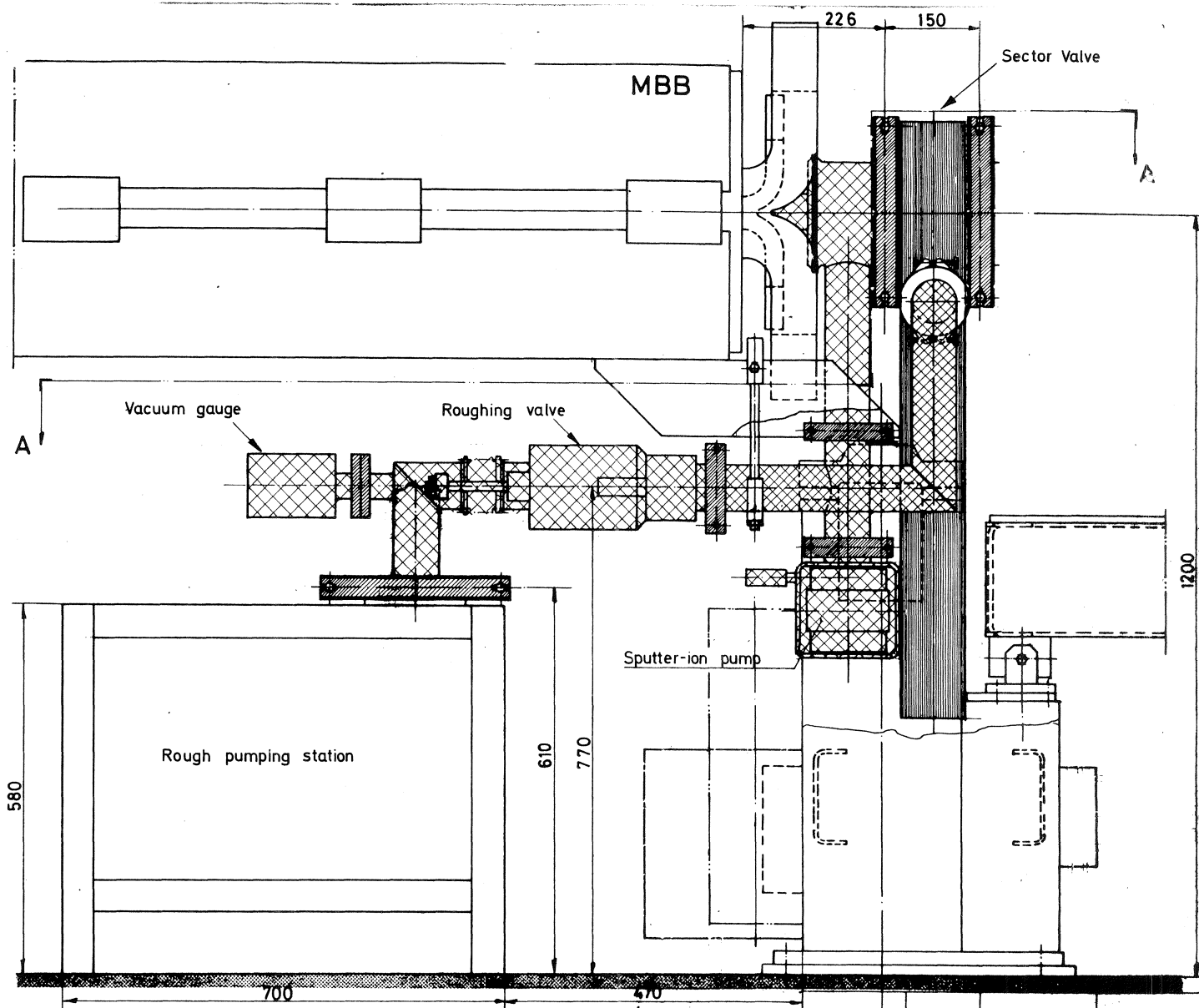
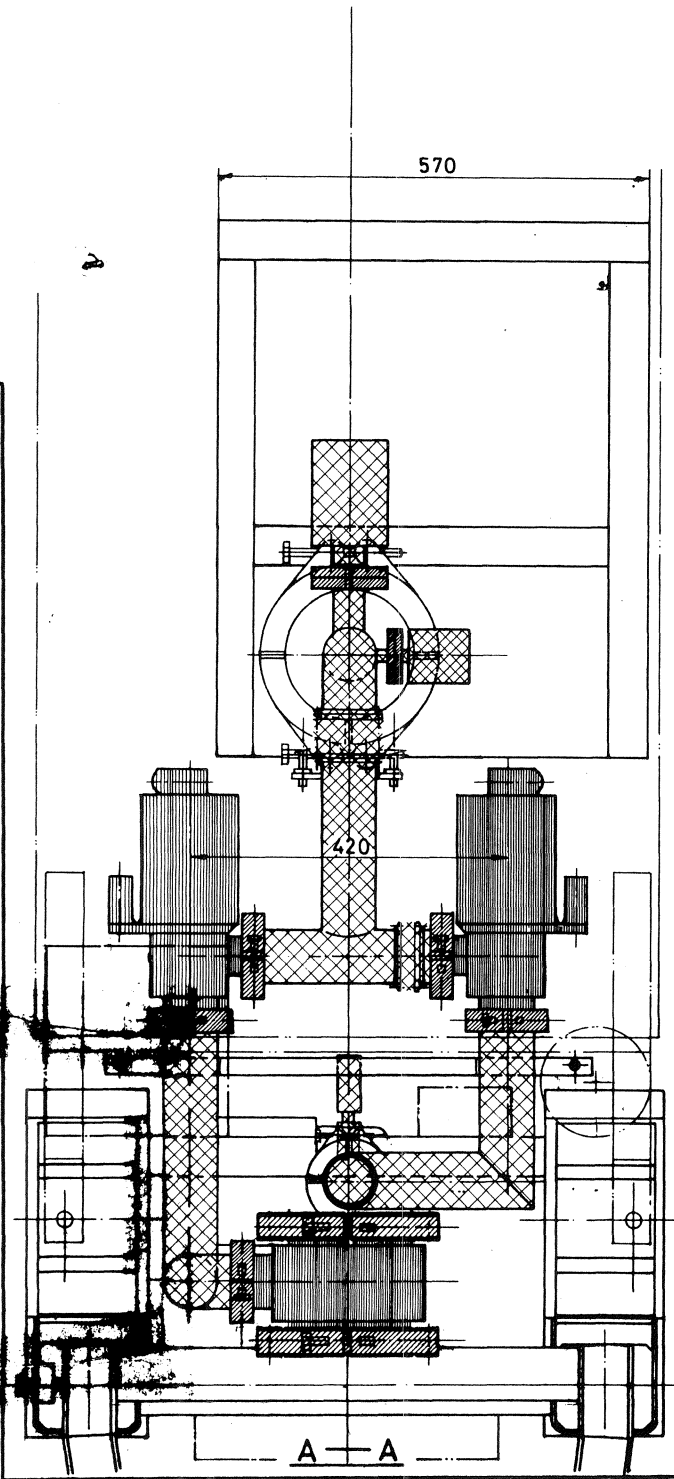


DRAWING FOR TENDER
 not to be used for construction
 DESSIN POUR SOUMISSION
 Ne pas utiliser pour exécution

Nb. p. unité Nb. p. unit		Description				Rep. Item	Matière-Material		Cotes brutes-Rough dimensions		N° SCEM-Observations- Fournisseurs éventuels					
II	I	Sub.	Rugosité - Roughness				Tolérances générales General tolerances (mm)				Abréviations, symboles Abbreviations, symbols		Normes CERN CERN Standards			
		Exécution	Ancien Old	N10	N8	N5	N2	De	0	> 6	> 30	> 120	> 315	> 1000	Remplace N°	
		New	▽	▽	▽	▽	▽	A	± 0,05	± 0,1	± 0,15	± 0,2	± 0,3	± 0,5	Remplacé par N°	
		Ra (µm)	12,5	3,2	0,4	0,05										
Ensemble Assembly						S/ensemble S/assembly						Nom-Name		Date	Issu	
										Echelle Scale		Dessiné Contrôlé		73.027.0		
Sputter-ion pump 25 l/s										1:1						

ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
 EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
 CERN LAB II. CH-1211 GENÈVE 23

8095.6003.3



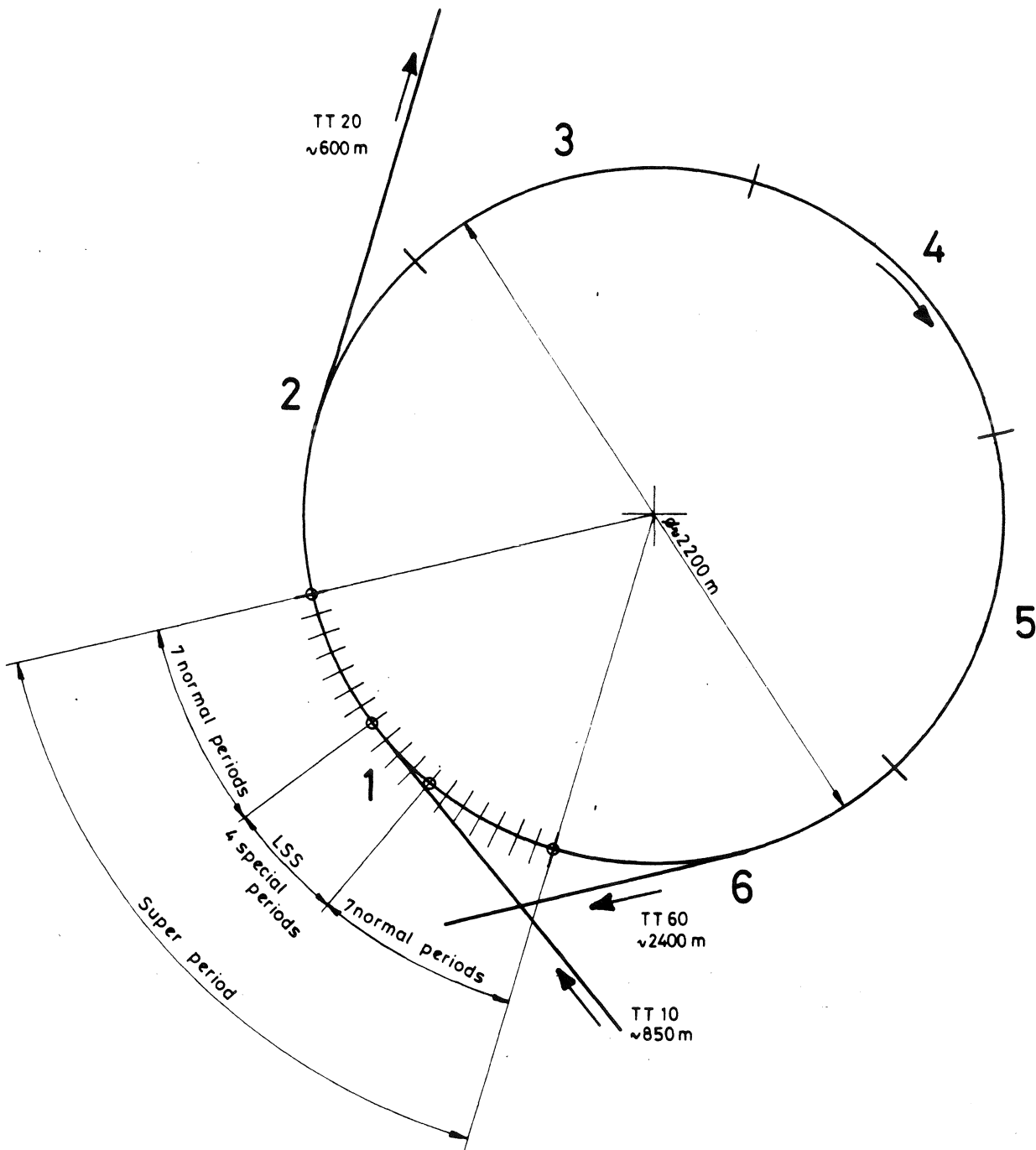
See also: 8095.3001.1
 8095.3001.2
 8095.3001.3
 8095.3001.4
 8095.3001.5
 8095.3001.6
 8095.3001.7
 8095.3001.8
 8095.3001.9
 8095.3001.10
 8095.3001.11
 8095.3001.12
 8095.3001.13
 8095.3001.14
 8095.3001.15
 8095.3001.16
 8095.3001.17
 8095.3001.18
 8095.3001.19
 8095.3001.20
 8095.3001.21
 8095.3001.22
 8095.3001.23
 8095.3001.24
 8095.3001.25
 8095.3001.26
 8095.3001.27
 8095.3001.28
 8095.3001.29
 8095.3001.30
 8095.3001.31
 8095.3001.32
 8095.3001.33
 8095.3001.34
 8095.3001.35
 8095.3001.36
 8095.3001.37
 8095.3001.38
 8095.3001.39
 8095.3001.40
 8095.3001.41
 8095.3001.42
 8095.3001.43
 8095.3001.44
 8095.3001.45
 8095.3001.46
 8095.3001.47
 8095.3001.48
 8095.3001.49
 8095.3001.50
 8095.3001.51
 8095.3001.52
 8095.3001.53
 8095.3001.54
 8095.3001.55
 8095.3001.56
 8095.3001.57
 8095.3001.58
 8095.3001.59
 8095.3001.60
 8095.3001.61
 8095.3001.62
 8095.3001.63
 8095.3001.64
 8095.3001.65
 8095.3001.66
 8095.3001.67
 8095.3001.68
 8095.3001.69
 8095.3001.70
 8095.3001.71
 8095.3001.72
 8095.3001.73
 8095.3001.74
 8095.3001.75
 8095.3001.76
 8095.3001.77
 8095.3001.78
 8095.3001.79
 8095.3001.80
 8095.3001.81
 8095.3001.82
 8095.3001.83
 8095.3001.84
 8095.3001.85
 8095.3001.86
 8095.3001.87
 8095.3001.88
 8095.3001.89
 8095.3001.90
 8095.3001.91
 8095.3001.92
 8095.3001.93
 8095.3001.94
 8095.3001.95
 8095.3001.96
 8095.3001.97
 8095.3001.98
 8095.3001.99
 8095.3001.100

DRAWING FOR TENDER
 Not to be used for construction
 DESSIN POUR SOUMISSION
 Ne pas utiliser pour exécution

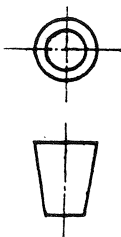
PROJET

Nb. p. unité Nb. p. unit		Description	Rep. Item	Matériau-Material	Codes brutes-Rough dimensions	N° SCB4-Dispositifs- Fourreaux Assemblés														
II	I	Rugosité - Roughness																		
		Tolérances générales General tolerances																		
		<table border="1"> <tr> <th>Dev.</th> <th>0</th> <th>> 4</th> <th>> 30</th> <th>> 120</th> <th>> 315</th> <th>> 1000</th> </tr> <tr> <td>As</td> <td>12,5</td> <td>3,2</td> <td>0,8</td> <td>0,4</td> <td></td> <td></td> </tr> </table>	Dev.	0	> 4	> 30	> 120	> 315	> 1000	As	12,5	3,2	0,8	0,4						
Dev.	0	> 4	> 30	> 120	> 315	> 1000														
As	12,5	3,2	0,8	0,4																
Ensemble Assembly		Sous-ensemble Subassembly		Noms/Noms		Date Date														
				Echelle Scale		<table border="1"> <tr> <td>Dessiné Drawn</td> <td>R. G. G.</td> <td>20.7.75</td> </tr> <tr> <td>Contrôlé Checked</td> <td></td> <td></td> </tr> </table>	Dessiné Drawn	R. G. G.	20.7.75	Contrôlé Checked										
Dessiné Drawn	R. G. G.	20.7.75																		
Contrôlé Checked																				
Roughing station with sector valve in QD short straight section 1:5						<table border="1"> <tr> <td></td> <td>A</td> </tr> <tr> <td></td> <td>B</td> </tr> <tr> <td></td> <td>C</td> </tr> </table>		A		B		C								
	A																			
	B																			
	C																			
ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH CERN LAB II CH-1211 GENEVE 23						8095.3001.2														

Ce dessin ne peut être utilisé à des fins commerciales sans autorisation écrite
 This drawing may not be used for commercial purposes without written authorisation



DRAWING FOR TENDER
 Not to be used for construction
 DESSIN POUR SOUMISSION
 Ne pas utiliser pour exécution

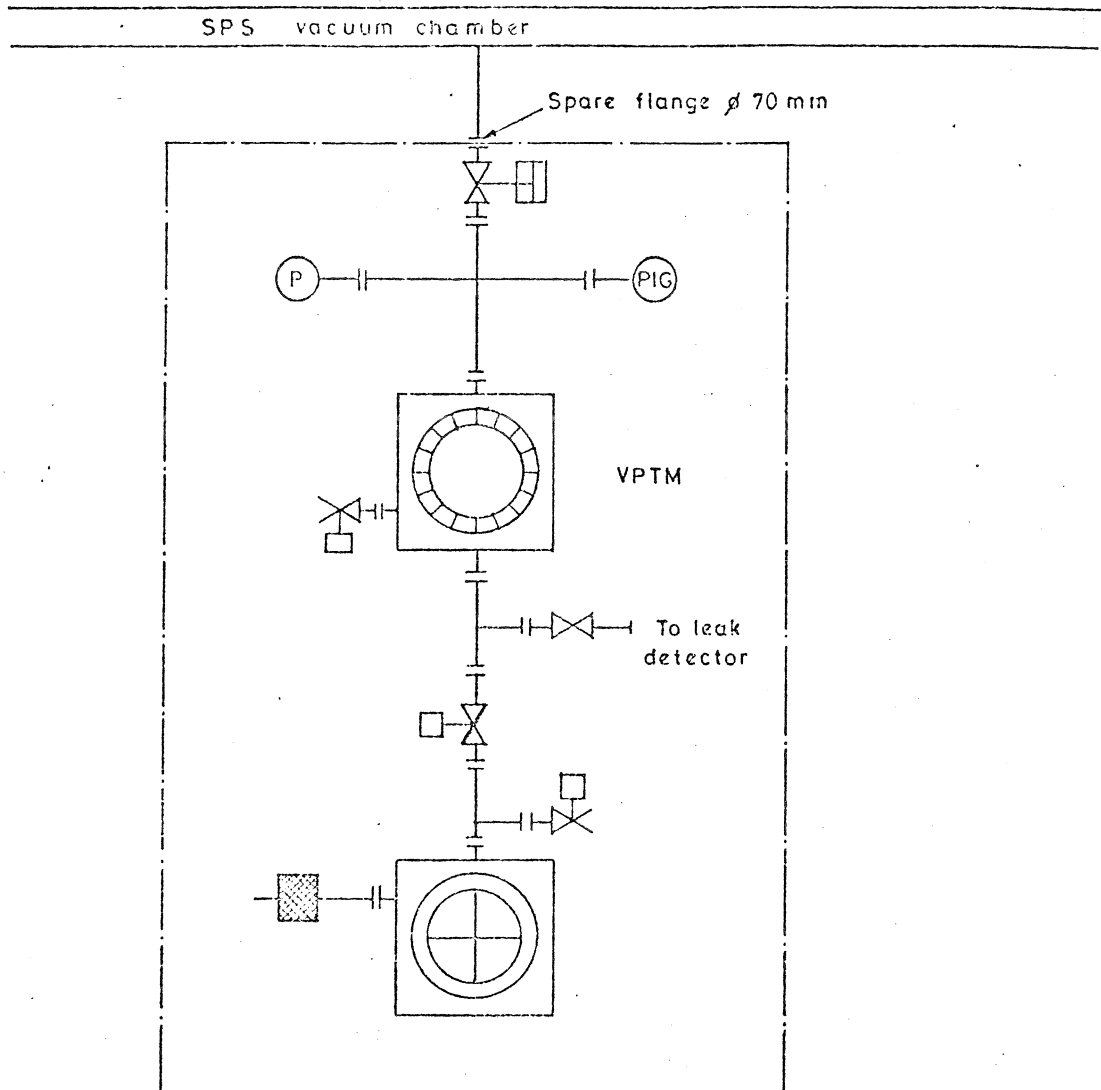


First angle projection
 Projection européenne

Ensemble Assembly	S/ensemble S/assembly	Nom-Name		Date	Issue
(Extracted from 8095.0055.0A)		Dessiné	Ramillon	73.09.25	
Schematic layout of the SPS with TTs.		Echelle Scale	Contrôlé		A
					B
					C

ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
 EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
 CERN LAB II. CH-1211 GENÈVE 23

8095.0308.4



Layout of a mobile rough pumping station