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EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

TECHNICAL SPECIFICATIONS FOR THE 18 KV- SWITCHGEAR IN THE P.S. POWER HOUSE "SOUTH"

The European Organization for Nuclear Research (CERN) is constructing a 25.000 million electron volt Proton-Synchrotron at Meyrin near Geneva.

For the nuclear physics experiments to be performed with this machine a number of magnetic lenses, bending magnets, bubble and cloud chambers will be installed. The power supplies needed for all these various components will be located in the P.S. Power House "South".

The following specifications are concerned with the 18 kv-bus-bar systems, switches and circuit breakers required in the P.S. Power House "South".

PS/486

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Attached to these specifications are the following drawings :

No. 156-1-2 : Power Distribution System in P.S. Power House "South" (Variant I)
No. 156-2-2 : " " " " " " " (" II)
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S E C T I O N I

General Information about the Project and Description of Equipment to be tendered for

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1. General Information about the Project

1.1. Characteristics of consumers in the P.S. Power House "South"

The P.S. Power House "South" which is, at present being planned will be used for housing switchgear, transformers and motor generator sets required for powering the magnets of bubble chambers, cloud chambers and beam transport equipment, such as bending magnets and magnetic lenses. The driving motors of the motor generator sets are of the synchronous type and the generators will supply direct current at voltages ranging from 100 to 600 V. To give an idea of the extent of the project, the number and size of motor generator sets is listed in the following table :

Item	Number of sets	Approx. Motor rating -kw	Number of Generators coupled with Motor	Motor supply voltage - V	Generator rating V =	Amps
1	4	100	2	380	100	415
2	7	400	2	380 or 3000	200	830
3	8	400	1	380 or 3000	400	830
4	2	3000	2	6000	600	2500

Ample space will be made available to increase later on the quantity of item 1 from 4 to 6 and the quantity of item 2 from 7 to 11.

The motor characteristics are not yet fixed, nor is the mode of starting known. It can also be seen from the table that with respect to the voltage at which the motors of items 2 and 3 will operate, two variants are being considered. This implies that two different arrangements of switchgear and transformers have to be studied.

1.2. The Power Supply to the P.S. Power House "South"

The power which will be available for the P.S. Power House "South" is 10 Mw at 18 kv. This will be supplied from the CERN Main Power House by two cables of 3 x 150 mm^2 cross section each. One of these cables is intended to be used exclusively for the power-supply of the two large motor generator sets, whereas the other one will supply power to the remaining machines, to a large compressor used in conjunction with a bubble chambers, and to the services, such as lighting, cranes etc.

1.3. Two variants of Power Distribution Systems for the Power House "South"

As already mentioned above, the selection of the transformers and of the primary switchgear will depend on which voltage is finally chosen for the 400 kw synchronous motors. This voltage has not yet been fixed; it can only be said that it will either be 380 V or 3000 V. In the following two paragraphs the alternative systems will be described in detail.

1.3.1. System using 380 V for all motors up to 400 kw

A one-line diagram of this system is shown in the attached drawing No. 156-1-2. There is on the upper left the incoming cable I which through on-load isolator (1) is connected to 18 kv-bus-bar section I. Then follow the primary breakers (3) and (4) of the transformers for the two large motor-generator sets. The on-load isolator (5) will normally be open but can, in case of failure of any of the in-coming cables, be used for coupling bus-bar

section I with bus-bar section II. Bus-bar section II is normally connected to the supply cable II by the on-load isolator (2). Through the primary breakers (6), (7) and (8) this section feeds three transformers of which each one has a capacity of 2 Mva. The first one, from left to right, supplies power to the motor-generator sets item 3 (400 kw), the second one takes care of the motor-generator sets item 2 (400 kw) and to the third one are connected the motor-generator sets item 1 (100 kw), one large compressor and all services.

Due to the rather severe short circuit conditions which have to be anticipated, it is not intended to parallel the 2 Mva-transformers at their secondaries. But provision will be made for interconnecting the secondary bus-bar sections in case of failure of any of the three transformers.

1.3.2. System using 3 kv for 400 kw-motors

This system is shown on drawing No. 156-2-2. It differs from the first system in so far as four transformers are connected to bus-bar section II. Two of these transformers have ratings of 2 Mva and a secondary voltage of 3 kv, whereas the other two have ratings of 800 kva and a secondary voltage of 380/220 V. One of the 800 kva transformers will be used for the compressor and for the services and to the other one the motor generator sets of 100 kw rating are connected. These two transformers can also be paralleled on the secondary side.

An additional on-load isolator (8) will be inserted in bus-bar system II between the 800 kva-transformers and the 2 Mva-transformers in order to have the possibility of feeding the latter by either of the two supply cables.

2. Characteristics of the Supply Network

2.1. Voltage and Frequency Conditions

At the CERN Main Power House the supply voltage has been found to vary within the limits

17500 .... 17900 volts

The voltage drop in the cables leading from the CERN Main Power House to the P.S. Power House "South" can be neglected.

The frequency will generally be 50 c/s ± 0,4 o/o. Short-term variations of ± 2 o/o (for as long as 30 minutes), however, have also to be considered. Deviations of up to 5 o/o may exceptionally occur.

2.2. Short-circuit conditions

For the present specification it is only important to know the currents resulting from a three-phase short-circuit on the 18 kv bus systems I and II. They will reach the following values :

Part of system	$\hat{I}s$ Amps	Is Amps	Iss Amps
Entrance of 18 kv-supply cables I and II	30 000	15 800	15 800
18 kv bus-bar systems I and II, tie-switches and transformer primaries	34 000	18 000	16 500

$\hat{I}s$: peak value of initial short-circuit current

Is : r.m.s. value of initial short-circuit current (a.c. component)

Iss : r.m.s. value of sustained short-circuit current

CERN is connected to a very low-impedance network. It can, therefore, be assumed that at the supply cable entrances Is will be identical with Iss. On the 18 kv bus-bars conditions are somewhat different. There the synchronous machines will, through the transformers, initially feed into the short-circuit. This effect will, however, last for only a short time. All the machines will be isolated from the bus-bar by their individual over-current protection devices. The sustained short-circuit current on the 18 kv bus-bar will, therefore, exclusively be maintained by the supply network.

3. Extent of Project to be tendered for and Supplementary Information

3.1. Equipment to be tendered for

The equipment to be tendered for comprises all 18 kv switchgear which, in the diagrams No. 156-1-2 and 156-2-2, is enclosed by a dotted line, i.e. cable entrances with on-load isolators, bus-bar systems I and II with tie switches, circuit-breakers for the out-going lines with their accessories and all end boxes of the in-coming and out-going cables. In addition tenderers should quote for the supply and installation of the inter-connecting cable of bus-bar systems I and II and of the primary transformer leads. The approximate lengths and type of these cables is specified in section II.

The arrangement represented in diagram No. 156-1-2 will, in the following, be called Variant I" and the one shown in diagram No. 156-2-2 will be called "Variant II". Separate tenders must be submitted for these two variants.

3.1.1. Exceptions

Not included in this scheme are :

a. All power transformers and their secondary switchgear

b. Any external components used for remote control of the switchgear.

c. The source of DC-power for auxiliary and control circuits (if, however, 220 or 380 V a.c. is used for electrical operation of on-load isolaters and circuit breakers, the necessary voltage transformer has to be included in the offer).

d. All masonry work.

3.2. Performance of equipment

3.2.1. Performance with respect to short-circuit conditions

The equipment must be designed to meet the short-circuit conditions already specified in paragraph 2.2. of this section with particular reference to:

a) making and breaking capacity

b) thermal stress

e) mechanical strength.

The minimum making capacity of on-load isolators and circuit-breakers must be equal to the peak value of the initial short-circuit current $\hat{I}s$ occuring at the point where the breaker or isolator is installed. The breaking capacity of the on-load isolators is given by the combined rating of the power transformers connected to the system, i.e. 13 Mva in Variant I and 12,6 Mva in Variant II. Since the characteristics of the over-current protection devices of the synchronous motors are not yet known, the selection of circuit-breakers with regard to breaking capacity must be based on the r.m.s value of the initial short-circuit current Is.

The selection of the material with regard to thermal stress, espacially of cables, current transformers, on-load isolators, etc., must be based on the r.m.s. value of the initial short-circuit current flowing during the short-circuit period.

All components (buses, current transformers, on-load isolators, etc.) must be capable of withstanding the dynamic stress resulting from the peak value of the initial short-circuit current $\hat{I}s$ occuring at the point where they are installed.

3.2.2. Performance with respect to repetitive operation

The switchgear must be designed to perform the following duty without becoming liable to failure or unusual wear :

1. On-load isolators of 18 kv-cable entrances I and II and tie switches : These will be operated infrequently.

2. Primary breakers of 3,5 Mva transformers :
These might be subject to rather severe conditions; they may occasionally be operated once or twice within one hour. They must, after fast repetition of several making and breaking operations at full load, still be capable of clearing a short-circuit which might occur.

3. Primary breakers of 2 Mva- and 800 kva transformers :
These will, under normal conditions, be operated not more than twice a day (2 breaking and 2 making operations at full load).

3.3. Arrangement of Equipment and Type of switchgear

The attached drawing No. 156-3-2 shows a plan-view of the P.S. Power House "South". It also indicates the location of the transformers in each variant and the space reserved for the switchgear. The item numbers correspond with those used in drawings No. 156-1-2 and No. 156-2-2. It can be seen from the drawing that the switchgear will be arranged in two separate groups located in line about 12 metres apart. The first unit will comprise cable entrance I, bus bar system I, the two feeder breakers for the large motor generator sets and the tie-switch used for interconnecting bus-bar systems I and II. The second unit will contain cable entrance II, bus bar section II and the primary breakers of the 2 Mva- and 800 kva-transformers. The switchgear must be arranged strictly in the sequence indicated in diagrams No. 156-1-2 and No. 156-2-2.

The area where the switchgear will be installed will also be used as working space by people not familiar with the installation. The switchgear must, therefore, be of the metal-clad type. Open switchgear mounted in individual cells would not be permissible. In order to facilitate operation and maintenance CERN would prefer breakers and switches of the withdrawable type which, when withdrawn, make it impossible to accidentally touch any live part of the fixed portion.

No restrictions are made with regard to the arc extinguishing medium of the circuit-breakers, but the breakers must be designed to satisfy the conditions specified in paragraph 3.2. of this section.

3.4. Control Facilities and Interlocking

3.4.4. Control

All on-load isolators and circuit-breakers will be operated pneumatically or electrically. Each breaker and isolator must have its individual "on" and "off" push-buttons and position indicating device. But provision must also be made to control them remotely by means of position signalling control switches. These switches are, however, not included in this scheme.

3.4.2. Interlocking

Mechanical or electrical interlocking must be provided to make it impossible to open access doors to the breakers and isolators or to withdraw or insert the breakers or isolators when these are in the "on"-position.

3.4.3. D.C. power for Controls and Auxiliaries

D.C. power at 48 V will be made available in sufficient quantity to operate pneumatic valves, interlocking and protection devices. It will, however, not be sufficient for electrical operation of the heavy on-load isolators and circuit breakers. If these are operated electrically alternating current at 220 V or 380 V should be used. The necessary voltage transformer must, in this case, be included in the tender.

3.5. Protective Devices and Measuring Facilities

Diagrams No. 156-1-2 and No. 156-2-2 indicate how the various parts of the system, especially the individual loads, will be protected and it is also shown which measured quantities will be indicated at the various points.

3.5.1. Protective Devices

In system I each large motor forms with its transformer one unit. Motor and transformer will have one common differential protection system. The current transformer measuring primary current is the only component which forms part of this differential protection, and will be housed in the cubicle of the primary circuit breaker (preferably on the withdrawable portion). The primary breakers must have a trip coil to be used in conjunction with a no-volt release which is actuated when the voltage on bus-bar system I (measured at cable entrance I) fails, with the differential protection, with the earth-leakage protection and with the Buchholz protection of the transformer.

In system II the primary breakers of the transformers will have a combined over-current and over-load protection on all three phases. Over-current protection will be provided by a set of secondary "definite time-limit" over current relays and for the over-load protection secondary thermal relays will be used. The primary breakers must have a trip coil to work in conjunction with the over-current and thermal relays and with the Buchholz protection of the transformers. They must, moreover, have the necessary auxiliary contacts for tripping the secondary breaker in case the primary breaker is switched off due to over-current, over-load or due to a fault in the transformer detected by the Buchholz protection.

3.5.2. Measuring Facilities

The voltmeters at cable entrances I and II are the only instruments to be incorporated in the present scheme. The voltage transformer at cable entrance I will, in addition, feed in parallel one external voltmeter and the Watt-meters, power factor meters and reactive power integrators belonging to feeders (3) and (4) which are installed at a distance of about 20 metres in the control cubicles of the large motor-generator sets. The current transformers on the breakers (3) and (4) too, must be of sufficient capacity to work in conjunction with these instruments.

To the voltage transformer at cable entrance I will also be connected a voltage-sensitive time relay which trips the breakers (3) and (4) in case of power failure on supply cable I.

3.6. Standards

3.6.1. National Standards and Safety Regulations

The equipment should be designed and executed according to Swiss standards and safety regulations. If this is not possible, or if conformity with these standards cannot be shown, it should be indicated which other standards and safety regulations apply.

3.6.2. CERN Colour Code

A colour code has been established within CERN to distinguish phases and polarities in control and power circuits. This code must be strictly adhered to :

a) Direct current systems :

Positive	:	red
Negative	:	blue
Mid-point	:	white

b) Alternating current

Phase "R"	:	deep orange
Phase "S"	:	green
Phase "T"	:	violet
Neutral	:	grey

c) Colours applying to a.c. as well as to d.c. systems

Unspecified phase or polarity	:	brown
Earth connections	:	black

d) Colours of push-buttons and signal lamps

"Off"	:	red
"On"	:	green
Fault indication	:	yellow

Should it be too difficult to adhere completely to this colour code (due, for instance to non-availability of cables and insulated wires in the proper shade) each conductor should be marked in the appropriate colour, at least near its terminals.

3.6.3. Standardized components

The following few components have become standard and should, therefore, be given preference :

a) Volt- and ampère meters :

SIEMENS type AHq (size 72 x 72 mm)
SIEMENS type ABq (size 96 x 96 mm)
SIEMENS type AQq (size 144 x 144 mm)

b) Secondary definite time-limit over-current relay :

BROWN BOVERI type S

c) Secondary thermal relay

BROWN BOVERI type ST

d) Voltmeter change-over switch

KRAUS AND NAIMER type C16007E

e) Signal Lamps

RAFI L.No. 2230 S1

4. Delivery and Erection

Delivery of the equipment can start on the 2nd January 1960. It is expected that the erection can begin immediately upon arrival of the equipment. The whole installation should be ready to go into operation at the latest by the end of February 1960.

S E C T I O N II

Specification of Equipment

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P a r t A

18 kv- Switchgear

A. 1. Arrangement of Switchgear according to Variant I

The numbers of the sub-headings correspond with the item numbers used in the attached diagram No. 156-1-2.

Item	Qty	Description	Remarks
		1. Entrance of cable I and bus-bar System I	
1.1.	1	On-load isolating switch, three-pole, electrically or pneumatically operated, with "on" - "off" push-button control and position indicating lamps, designed for : Rated voltage 20 kv Service voltage 18 kv Test voltage 64 kv Max. current in service 400 Amps Max. asymmetric short circuit current 30 ka	

Item	Qty	Description	Remarks
1.2.	1	Voltage transformer, 3-phase, with moulded resin, oil or compressed air as insulating medium : Rated voltage 20 kv Service voltage 18 kv Test voltage 64 kv Accuracy class 0,5 Will feed in parallel 2 voltmeters 2 wattmeters 2 Power factor meters 2 active power integrators 1 voltage sensitive time relay	I.E.C.
1.3.	3	Single-pole high-rupturing capacity fuses for the protection of the voltage transformer item 1.2.	
1.4.	1	Electro-dynamic voltmeter to be used in conjunction with voltage transformer item 1.2. Scale : 0 ... 20 kv	SIEMENS type ABq or type AQq to be used
1.5.	1	Voltmeter change-over switch for indication of voltage between all three phases, to be used in conjunction with item 1.4.	KRAUS AND NAIMER type C16007E to be used

Item	Qty	Description	Remarks
1.6.	2	Sets of fuses, screwed type, one set to be used for the protection of items 1.4. and 1.5., the other set to be used for the protection of external instruments	
1.7.	1	Bus-bar system, three-phase, three-conductors with all necessary supports and fittings.	
		2. Entrance of cable II and bus-bar System II	
2.1.	1	Same as item 1.1.	
2.2.	1	Voltage transformer, 3-phase, with moulded resin, oil, or compressed air, as insulating medium : Rated voltage 20 kv Service voltage 18 kv Test voltage 64 kv Accuracy class 0,5 Will feed in parallel 2 voltmeters	I.E.C.
2.3.	3	Same as item 1.3.	
2.4.	1	Same as item 1.4.	

Item	Qty	Description	Remarks
2.5.	1	Same as item 1.5.	
2.6.	2	Same as item 1.6.	
2.7.	1	Bus-bar system, three-phase, three-conductors with all necessary supports and fittings.	
		3. Primary gear of transformer T 1	
3.1.	1	Isolating switch, three-pole, manually operated, designed for : Rated voltage 20 kv Service voltage 18 kv Test voltage 64 kv Max. current in service 120 Amps Max. asymmetric short circuit current 34 ka To be used for isolating circuit-breaker item 3.2. from bus-bar system I	Only required if circuit breaker item 3.2. is of the non-withdrawable type
3.2.	1	Circuit breaker, three-pole, electrically or pneumatically operated with "on" - "off" push-button control, position indicating lamps and no-voltage release coil to work on 48 V d.c., designed for :	

Item	Qty	Description	Remarks
		Rated voltage 20 kv Service voltage 18 kv Test voltage 64 kv Max. current in service 120 Amps Max. asymmetric short circuit current 34 ka r.m.s. value of initial short-circuit current 18 ka	
3.3.	3	Round-bar double-core current transformer Rated voltage 20 kv Service voltage 18 kv Rated primary current 125 Amps Max. asymmetric short circuit current 34 ka Accuracy class 0,5 One core will be used in conjunction with : 1 ammeter 1 wattmeter 1 power factor meter 1 active power integrator The other core will be used in conjunction with the differential protection of transformer and synchronous motor. The length of the secondary connections will be approximately 20 metres	6 single-core transformers may be offered alternatively I.E.C.

Item	Qty	Description	Remarks
		4. Primary gear of transformer T 2	
4.1.	1	Same as item 3.1.	
4.2.	3	Same as item 3.2.	
4.3.	1	Same as item 3.3.	
		5. Tie-switch of bus-bar systems I and II	
5.1.	1	On-load isolating switch, three-pole electrically or pneumatically operated, with "on" and "off" push-buttons and position indicating lamps, designed for : Rated voltage 20 kv Service voltage 18 kv Test voltage 64 kv Max. current in service 220 Amps Max. asymmetric short circuit current 34 ka	
		6. Primary gear of transformer T 3	
6.1.	1	Isolating switch, three-pole, manually operated, designed for : Rated voltage 20 kv Service voltage 18 kv Test voltage 64 kv	Only required if circuit breaker item 6.2. is of the non-withdrawable type

Item	Qty	Description	Remarks
		Max. current in service 65 Amps Max asymmetric short circuit current 34 ka To be used for isolating circuit breaker item 6.2. from bus-bar system II	
6.2.	1	Circuit-breaker, three-pole, electrically or pneumatically operated, with "on" - "off" push-button control, position indicating lamps and no-voltage release coil to work on 48 V d.c., designed for : Rated voltage 20 kv Service voltage 18 kv Test voltage 64 kv Max. current in service 65 Amps Max. asymmetric short circuit current 34 ka r.m.s. value of initial short circuit current 18 ka	
6.3.	3	Current transformers Rated voltage 20 kv Service voltage 18 kv Rated primary current 75 Amps Max. asymmetric short circuit current 34 ka To be used in conjunction with over-	Accuracy class to be specified by tenderer

Item	Qty	Description	Remarks
		current relays, item 6.4., and with thermal relays item 6.5.	
6.4.	3	Secondary definite time-limit over current relays	BROWN BOVERI Type S
6.5.	3	Secondary thermal relays, with thermal characteristic adapted to transformer T 3.	BROWN BOVERI Type ST
		7. Primary gear of transformer T 4	
7.1.	1	Same as item 6.1.	
7.2.	1	Same as item 6.2.	
7.3.	3	Same as item 6.3.	
7.4.	3	Same as item 6.4.	
7.5.	3	Same as item 6.5.	
		8. Primary gear of transformer T 5	
8.1.		Same as item 6.1.	
8.2.		Same as item 6.2.	
8.3.		Same as item 6.3.	

Item	Qty	Description	Remarks
8.4.		Same as item 6.4.	
8.5.		Same as item 6.5.	
		9. Accessories	
9.1.		All necessary construction material for the items 1.1. ... 8.5, such as steel supports, metal blinding, wiring for instruments, controls and interlockings, terminal boards for the connection of external metering and control equipment, earth connections, etc.	

A. 2. Arrangement of switchgear according to Variant II

The numbers of the sub-headings correspond with the item numbers used in the attached diagram No. 156-2-2.

Item	Qty	Description	Remarks
1.1. : 7.5.		Same quantities, same specification and same characteristics as Variant I items 1.1. ... 7.5.	
		Additional equipment :	

Item	Qty	Description	Remarks
		8. Tie switch on bus-bar system II between transformers T 4 and T 5	
8.1.	1	On-load isolating switch, three-pole, electrically or pneumatically operated with "on" - "off" push-buttons and position indicating lamps, designed for : Rated voltage 20 kv Service voltage 18 kv Test voltage 64 kv Max. current in service 130 Amps Max. asymmetric short circuit current 34 ka	
		9. Primary gear of transformer T 5	
9.1.	1	Isolating switch, three-pole, manually operated, designed for : Rated voltage 20 kv Service voltage 18 kv Test voltage 64 kv Max. current in service 26 Amps Max. asymmetric short circuit current 34 Ka To be used for isolating circuit breaker item 9.2. from bus-bar system II.	Only required if circuit breaker item 9.2. is of the non-withdrawable type.

Item	Qty	Description	Remarks
9.2.	1	Circuit breaker, three-pole, electrically or pneumatically operated, with "on" - "off" push-button control, position indicating lamps and no-voltage release coil to work on 48 V. d.c., designed for : Rated voltage 20 kv Service voltage 18 kv Test voltage 64 kv Max. current in service 26 Amps Max. asymmetric short circuit current 34 ka r.m.s. value of initial short-circuit current 18 ka	
9.3.	3	Current transformers Rated voltage 20 kv Service voltage 18 kv Rated primary current 30 Amps Max. asymmetric short circuit current 34 ka To be used in conjunction with over-current relays item 9.4 and thermal relays item 9.5.	Accuracy class to be specified by tenderer
9.4.	3	Secondary definite time-limit over-current relays	BROWN BOVERI Type S
9.5.	3	Secondary thermal relays, with thermal characteristic adapted to transformer T 5	BROWN BOVERI Type ST

Item	Qty	Description	Remarks
		10. Primary gear of transformer T 6	
10.1.	1	Same as item 9.1.	
10.2.	1	Same as item 9.2.	
10.3.	3	Same as item 9.3.	
10.4.	3	Same as item 9.4.	
10.5.	3	Same as item 9.5.	
		11. Accessories	
11.1.	-	All necessary construction material for items 1.1. ... 10.5, such as steel supports, metal blinding, wiring for instruments, controls and interlockings, terminal board for the connection of external metering and control equipment, earth connections, etc.	

P a r t B

18 kv-cables and cable end boxes for cable entrances I and II, for interconnection of bus-bar systems I and II and for interconnection of the power transformers with their primary gear.

B. 1. Arrangement of switchgear according to Variant I

Item	Qty	Description	Remarks
1	155 metres	Three-core screened H-type cable, paper insulated, mass impregnated, lead sheathed with flat steel wire armouring sector-shaped stranded copper conductors Rated voltage 20 kv Cross section 3 x 150 mm^2	Total length approxiamte only
2	5	Cable end boxes for out-door installation to be used in conjunction with the cable item 1.	
3	9	Cable end boxes for in-door installation to be used in conjunction with the cable item 1.	

B. 2. Arrangement of switchgear according to Variant II

Item	Qty	Description	Remarks
1	190 metres	Three-core screened H-type cable, paper insulated, mass impregnated, lead sheathed with flat steel wire armouring, sector shaped stranded copper conductors Rated voltage 20 kv cross section 3 x 150 mm^2	Total length approximate only

Item	Qty	Description	Remarks
2	6	Cable end boxes for out-door installation to be used in conjunction with the cable Item 1.	
3	10	Cable end boxes for in-door installation to be used in conjunction with cable Item 1	

P a r t C

Additional equipment, tools and spare parts

Item	Qty	Description	Remarks
1	1	Compressor plant for the operation of the switchgear specified in Part A consisting of compressors with motors and starters, after-cooler, air-receiver, pressure reducing valve and compressed air distribution system.	Only required if breakers and switches are pneumatically operated.
2	1	Single-phase voltage transformer, with moulded resin, or oil as insulating medium, complete with primary high-rapturing capacity fuses, designed for : Primary voltage 18 kv Secondary voltage 220 or 380 V Required for electrical operation of	Only required if breakers and switches are electrically operated.

Item	Qty		Remarks
		the switches and breakers specified in part A.	
3	1	Movable safety device for earthing bus-bar systems and transformer leads	
4	1	Set of special tools required for servicing and overhauling the equipment specified in Part A	
5	1	Set of small spare parts such as contacts, arc chambers, relays, fuses, air valves (if equipment is pneumatically operated), control push-buttons, signal lamps, relay coils, etc.	Based on 5 years operation

S E C T I O N III

General Form of Tender, Information required, Delivery, Erection and Testing

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1. General Form of Tender and Technical Information required

In order to facilitate adjudication, tenders must be divided into the following three sections :

Section I : General information

Section II : Specification of equipment and prices

Section III : Conditions of sale

Each one of these sections must give the information specified in the following paragraphs.

Tenders which do not comply with this general form, or which fail to give the information asked for will be rejected.

1.1. General Information

This section must give information on the type of switchgear offered, mode of operation and other special design features. It must also be stated to which standards the equipment conforms. To prove this conformity, copies of independent test reports must be attached.

To this section may further be attached all descriptive literature pamphlets and reference lists pertaining to the specified equipment.

1.2. Specification of equipment and prices

In this section the equipment offered must be listed in a similar form as is done in Section II of this specification. Item numbers must strictly be adhered to, and where equipment is added which is not contained in Section II of the present specification, this must be identified by a small letter following the corresponding item number.

The following data and description must be given in Section II :

a) On-load isolators :

Type
Nominal rating
Mode of operation (manual, pneumatical, electrical)
Max. making and breaking capacity
Mechanical strength with respect to short-circuit conditions
Description of design and functioning

b) Circuit-breakers :

Type
Nominal rating
Mode of operation (pneumatical or electrical)
Max. making and breaking capacity
Arc extinguishing medium
Description of design and functioning

c) Voltage- and current transformers :

Type
Proposed voltage or current ratio
Accuracy class
Insulating medium

d) Bus system :

Size of conductors

Mechanical strength with respect to short-circuit conditions

Description of design.

In the case of components not manufactured by the tenderer, the original maker must be mentioned.

The price ex-works of each item must also be quoted in Section II of the tender (other conditions regarding price are specified in paragraph 3 of this section).

1.3. Conditions of sale

This section must contain all information interesting from a commercial point of view, such as :

Delivery programme

Terms of payment

Guarantee.

2. Drawings

Three copies each of the following drawing must be attached to the tender :

a) Outline drawings of the various apparatus giving all essential dimensions

b) Complete one-line diagram of the installation

c) Lay-out drawing of the switchgear indicating the location of the various apparatus and giving all necessary dimensions.

Within 2 months after placing the order, the successful tenderer shall submit the following additional drawings in duplicate :

d) Foundation drawings indicating all trenches and openings for the passage of power and control cables, showing location of foundation bolts and giving all necessary dimensions.

e) Diagram of the auxiliary and control circuits.

Diagram (e) will have to be worked out in close cooperation with CERN.

3. Prices

a) Prices for material ex-works must be quoted against each item of Section II.

b) Costs of transport, insurance and any sales tax which might be imposed must be stated separately.

c) Prices must be quoted without customs duty.

d) The cost of erection and installation must be stated separately for the parts A and B.

4. Delivery and Erection

Tenderers must specify the earliest possible date of delivery of the equipment, the date when the installation could start and the expected duration of the installation (see also paragraph 4 of Section I of the present specification).

5. Inspection and Testing

The equipment will finally be inspected and tested within 2 months after the completion of the erection.