EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
CERN - SPS DIVISION

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

For the supply of power units for the 400 l/s sputter-ion pumps of the 400 GeV Proton Synchrotron (SPS)

Reference : SPS/AMR/RBF/EEK/D-21

Prévessin - 22nd December, 1977

CONTENTS

FIGURE CAPTIONS

1. Introduction and General Information

The construction of a 400 GeV Proton Synchrotron as an extension to the present CERN facilities has been completed.

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 is about 3000 m. The systems are of the all-metal type and have to operate at pressures below 10^{-7} torr. Low pressure pumping is achieved by sputter-ion pumps.

The present specification covers the supply of additional power units for 400 ℓ/s sputter-ion pumps.

All conditions related to quantities, delivery time, manufacturing programme and progress reports, additional work or modifications, etc., are contained in the enclosed Tender Form and the Note on Special Conditions.

The tender documents also include a Technical Questionnaire. Detailed replies to the questions therein are indispensable for the evaluation of the tender.

One prototype of the power supply must be approved by CERN before the start of production.

The contractor shall not start mass production before having received in writing instructions from CERN that such a production may start.

The shape of the power supply output characteristic is important and can be achieved by using a transformer of the stray field magnetic leakage type.

Figure 1 gives a typical schematic diagram for a power supply for a 400 ℓ/s pump.

2. Performance Requirements

2.1 Output characteristics

In Fig. 2 the specified voltage versus current characteristics are given. Note that the output voltage polarity is negative.

The characteristics of power supply proposed by the tenderer must fall inside the band indicated. For currents lower than those corresponding to the maximum power, the width of the band for the voltage is 0.6 kV (± 0.3 kV with respect to the nominal characteristic).

2.2 Operation at reduced voltage

By reducing the voltage applied to the sputter-ion pumps it is possible to improve the performance of the pumps at high operating pressures.

By adding a special transformer winding to the power supplies, periodical operation at reduced voltage shall be possible. The output voltage at zero load for this condition shall be 2/3 of the normal voltage output.

2.3 Current read-out

A voltage that is a linear function of the pump current shall be provided in all supplies for reading the pump current at distance (see Section 3.2.4).

2.4 Protection circuit

A protection circuit isolating the high voltage transformer from the mains shall be provided for the following anomalies:

- interruption in the high voltage cable to the pump,
- sparking in the high-voltage line,
- output current exceeds a preset level (see Section 3.3).

2.5 External control and status indications

The supplies will be controlled exclusively from distant panels. Provision for this must be included in the supplies in the form of com-

manding relays and input connectors. Furthermore, status indications in the form of closed or open contacts have to be provided (see Section 3.4).

3. Technical Specification

3.1 High Voltage part

3.1.1 General information

The high voltage generator shall provide a d.c. voltage with load characteristics as specified in Section 2.1.

No regulation of the H.V. circuit with respect to mains variations is requested but amplification effects of mains variations are to be avoided.

A transformer with a specially adjusted magnetic shunt circuit and followed by a full wave bridge rectifier is prescribed. The output voltage shall be adjustable within $\pm$ 10% of its nominal value (e.g. by fixed taps on the primary side of the shunt transformer).

3.1.2 Ripple

The output ripple of the supply voltage shall not exceed 1.5 kV peak to peak at 300 mA load current. Adequate storage capacitors shall be used to achieve this degree of filtering.

3.1.3 Series resistor

In order to limit the discharge current to a safe value in case of a short circuit, a 50 Ω series resistor shall be provided. This resistor also serves to terminate the high voltage coaxial cable with respect to high frequency noise (see Fig. 1). Therefore, a low-inductance resistor shall be used. Its power rating must correspond to the maximum supply current.

3.1.4 Discharging of the storage capacitor

To ensure discharging of the capacitor after switching off the unconnected supply, a bleeder resistance must be provided. The voltage of the unconnected supply shall drop to 5% or less of its initial value in

3 seconds after being switched off. With the H.V. cable connected (60 nF), which can be up to 700 m long, this value shall not increase by more than 2 seconds.

3.1.5 Earthing resistor

In the 400 ℓ/s pump supplies a 10 Ω resistor is to be mounted between the H.V. rectifier zero lead and the earth point of the supply (see Fig.1).

The power rating of this resistor shall correspond to the maximum supply current.

3.1.6 Measurement of the high voltage

For the 400 ℓ/s pump supplies a high voltage dividing resistor shall be incorporated, in order to provide a reading of the high voltage in an external control unit.

The preferred measurement signal is 0.2 V/kV with a source impedance of maximum 1 kΩ. The required precision is ± 3%. This output voltage shall be present on the front panel connector (measurement output no. 4 in Fig. 1).

A protection shall be provided to ensure that the output voltage can never exceed 25 V with respect to ground.

3.2 Current discriminator and current outputs

3.2.1 Shunt

A shunt on the low voltage side of the high voltage generator shall permit measurement of the supply current. The preferred shunt resistance is 10 Ω.

The shunt voltage shall be presented in the front panel connector, but it shall also be used for an overcurrent protection, a high current warning signal and a filtered current read-out (see Section 3.2.4).

3.2.2 Over current protection

The interrupt circuit is to be tripped when the current in the pump has reached a preset value. The trip level shall be adjustable with a screwdriver from the rear panel of the unit, between 100 mA and maximum output current. A test point for monitoring a reference voltage proportional to this setting shall also be provided on the back panel.

This circuit shall also provide a status indication for the external control panel (see Section 3.4.2). A warning light on the front panel shall flash after tripping.

3.2.3 High pressure warning

A circuit similar to that used for the overcurrent protection shall flash the warning light (Section 3.2.2), but not cut the high voltage, when the current exceeds a certain level.

This level shall be adjustable with a screwdriver through the front panel between 20 and 150 mA pump current. This circuit shall also provide a status indication for the external control panel (see Section 3.4.2).

3.2.4 Current read-out

The shunt voltage shall be wired to the front panel connector, for reading the current in an external control unit (see Fig.1).

The shunt voltage shall, in addition, be presented both at the front and rear panel connectors via twisted wires and a low pass filter. The filter shall be of the double RC type, with limiting resistors as indicated in Fig. 1. The capacitors shall not be electrolytic, but of low leakage type, preferably polycarbonate. The d.c. voltage rating shall be 100 V.

3.2.5 Protection of outputs

Under no circumstances may the outputs have voltage levels above 25V with respect to ground. The manufacturer shall include protections in the form of diodes and/or Zener diodes to satisfy this requirement.

In order to avoid coupling between high voltage transients and the

control circuits, the layout must be such that the high voltage card and wiring must be physically separated from the rest of the circuitry.

3.3. Trip circuit and interlocks

3.3.1 Circuit breaker

The mains are to be connected to the H.V. transformer via a mains circuit breaker. To prevent short perturbations in the mains supply from interfering with the controls section of the unit, the design should be such that a break in the 220 V supply of less than 100 $\pm$ 10 mS should have no effect on the output status, however, any interruptions with a duration of greater than 110 mS must result in the switch-off of the unit by the opening of the circuit breaker.

The following alarms will act in the indicated way on the circuit breaker :

Alarm	Action
1 High voltage cable open	H.V. switched off immediately Restarting not possible
2 Over current level reached	H.V. switched off if level exceeded for longer than 2 sec.
3 Sparking detected	H.V. switched off if sparking lasts longer than 200 msec.

The circuit breaker must be a very reliable relay. When switching off occurs due to an alarm, a warning light on the front panel shall start to flash with a frequency of approximately 3 Hz. Simultaneously, the "H.V. ON" light shall be switched off.

The relay contacts connected to the front and the rear connectors shall provide indication on which of the three alarms has caused the trip. The interrupt-control must therefore be powered separately from the H.V. circuit. Resetting of the interrupt circuit and the associated status signals is accomplished by activating the "OFF" command.

3.3.2 Cable interlock

The H.V. cable to the sputter-ion pump is equipped with two extra wires which are shorted at the pump. With the cable disconnected, it shall not be possible to operate the supply or reset the alarm circuitry. These wires shall be used to directly actuate a control relay.

3.3.3 Detection of sparking

Sparking is detected as transients in the supply current. Care must be taken that the interrupt works only on heavy sparking and not on ripple or starting transients (2 seconds detecting time).

3.4 Remote control and status signals

3.4.1 Control of the unit

The unit will not have front panel switches, it will be switched on and off through the front panel connector or through the rear panel connector. The switching shall be of the arm/disarm type, with contact closures providing the commands.

If the front panel connector is connected to an external control box, ON/OFF commands through the rear panel connector shall not be accepted. Status and current readings can be obtained through both connectors at the same time. For external control, two wires per action are provided. In summary, the following actions are foreseen:

Action	
1. H.V. ON 2. H.V. OFF (and reset) 3. Switch to low voltage 4. Switch to high voltage	Action executed when the two corresponding wires are shorted for 400-1000 millisecs.

The contact closures will normally be made with relays or push button-switches inside the external control units. The contacts will have a maximum rating of 50 V and 200 mA. The voltage of both contacts with respect to earth may never exceed 25 Volts. If for some reason the manufacturer wants to use higher voltages, a photodiode switch of a type to be agreed by CERN must be included in the power supply, such that

the interface is free of voltages with respect to earth in excess of 25 V (measured with a 50 MHz oscilloscope).

3.4.2 Status signals

Status indications from the supply have to be transmitted to the external control units. The indications are to be presented as isolated contacts that are opened or closed, with one side to a common return lead.

The contact ratings for these signals shall be 50 V, 3W with a common mode voltage of maximum 25 V with respect to earth.

The following status indications are required :

ON	1
OFF	1
Front panel control (Section 3.4.1)	1
Trip (open cable)	1
Trip (overcurrent)	1
Trip (sparking)	1
Low voltage mode	1
"H.V. ON", no "High Current" warning and "Voltage High" (combined status bit, Section 3.2.3)	1
Total	8

Status signals are available both at the front and rear panel connector. The status indication at rear panel and front panel must be independent and electrically isolated. Preferably this should be achieved by fitting two contacts to the indicator relays, one of which is wired to the front panel connector, the other to the rear panel connector.

3.4.3 Supply for external control unit

In order to operate the supply with a simple external control unit, the front panel connector shall provide an A.C. voltage that will be used to power the external control unit. The voltage shall be 35 V r.m.s. (± 10 %) with centre tap and be floating with respect to earth. The cur-

rent taken from this source will not exceed 300 mA.

3.5 Safety

The power supplies shall in all respects comply with the CERN safety codes, and shall in particular include the following features:

- All elements, mounted and accessible on the front or on the rear panel (except the high voltage connector) must be free of high voltage even under abnormal operating conditions.

- A sign, warning of the high voltage, shall be fitted on the rear panel of the supply.

- An interlock shall be provided for the H.V. output (Section 3.3).

- The high voltage shall decay after switch-off as described in Section 3.14.

- After a mains failure or an interrupt of a duration greater than 110 mS, the H.V. shall be re-established by external control signals only.

- The power supply shall be housed in an earthed metal case (see Section 4.5).

- The high voltage circuit should be constructed as in Section 3.2.5.

Information on the CERN safety codes can be obtained upon request.

4. General Design Specification

4.1 Input power

The supplies will be powered by single phase 220 V/50 Hz. The mains voltage will be constant within 10% of its nominal value and have a maximum of 7 % harmonic distortion.

A facility that keeps the supply in the "ON" state in the event of short mains interruptions is required. The supply must stay on when the interruptions are shorter or equal to 110 msecs (See section 3.3.1).

A three conductor power cable, 1 m long, must be furnished with each supply unit. It must be fitted with a CERN standard mains plug as specified on the attached drawings (Fig. 8) which will be supplied by CERN.

4.2 Components and component ratings

CERN insists that only first quality, professional grade components be used in the supplies. The manufacturer must check that all proposed components are in current production. Semi-conductor devices must be of the silicon type as far as it is compatible with circuit considerations.

Only stranded wires with adequate insulation shall be used throughout the power unit. The mounting of electrical components shall be done on printed circuit boards wherever possible and the use of terminal boards avoided.

All components must be operated well within their specified limits. CERN reserves the right to refuse particular components if there are doubts as to their reliability and to impose components of its own choice.

For the high voltage transformer a sealed or impregnated type shall be used. The open circuit output voltage should be 2,200 V r.m.s. and the short circuit current 800 mA r.m.s. The insulation of the high voltage part or of critical components (H.V. wiring, H.V. transformer) must be tested with 12 kV r.m.s. 50 Hz, applied for one minute.

The indicator lights shall be of the L.E.D. type.

All relays shall be of a closed type and precautions must be taken to suppress transients due to contact bounce.

4.3 Connectors

The power supplies must be equipped with all necessary external connectors. The manufacturer shall use connectors and pins already standardized by CERN, which will be supplied free of charge. The control connectors shall be of the following type :

front : CERN 50 BSF - slide
rear : CERN 50 BSF - screw

Both the front and rear panel controls connectors shall be of the Hyfen/Burndy 50-pin type (see also attached data sheet).

A high voltage connector, Fischer type D 105-A-036-5, will also be supplied by CERN.

The connector contacts are summarized in Tables I-III.

4.4 Maintenance

Great importance will be attached to a design which facilitates maintenance and repair of the pump power supplies. All parts and components must be easily accessible for replacement and there must be enough test points provided for rapid checking of the operation and localising of faults.

Whenever possible, the circuit shall be divided into functional sub-groups easily replaceable by spare units.

All integrated circuits must be mounted on DIP sockets.

In order to facilitate the servicing, component reference numbers must be printed on the circuit boards. All wiring in the unit must be done by marked, preferably colour-coded, wires.

4.5 Mechanical design details

The power supplies will be installed in CERN standard 19-inch racks (see enclosed drawing). The height of the supplies is to be 5 units (see Fig. 7).

The layout and the mechanical design of the units must be carefully studied. In particular the distance of high potential points from surrounding chassis parts and the insulation of these points shall be chosen to guarantee safe operation.

Furthermore, the power supply must be covered with perforated sheet metal to guarantee full protection for the operating personnel, while still allowing air to circulate.

Care must be taken to limit the external magnetic stray field of the supply. The A.C. magnetic field at 5 cm distance of the sheet metal protection shall be lower than 50 Gauss peak to peak.

Handles shall also be provided on the front and rear of the unit to facilitate transport.

4.6 Operating temperature range

The units will be operating in a building where uncooled air is present around the rack (15 to 35°C).

The equipment must be designed to allow continuous operation at maximum power dissipation with the temperature of the environment in the range 20°C to 60°C. The supplies will be tested for 24 hours in an oven that is maintained at 60°C with a free airflow around the supply.

The layout of the circuits must be such that air can flow freely, vertically, through the unit. No cooling fans shall be used.

4.7 Surface treatment

All metal chassis parts must undergo a protective surface treatment. Equally, all printed circuit boards shall have a protective surface cover.

The front panel shall be natural anodized aluminium and the text shall be black printed or engraved.

CERN reserves the right to discuss the detailed front panel layout, inscriptions, colours of indicator lamps, etc., with the manufacturer before placing the order. In particular a threaded brass insert (M5-female) has to be provided in the front panel for the mounting of an external control unit. (See fig. 7A)

A "label holder" shall be fitted to the front panel. This item will be supplied by CERN.

4.8 Instruction manuals and drawings

At the time of delivery of the first batch of H.V. supplies, the contractor must supply at least 10 copies of an instruction manual, containing a detailed technical description of the supply and all relevant information on how to use it. A complete set of copies of drawings, showing wire coding and connector contacts, must be attached to each instruction manual.

In addition one complete set of transparent copies of the drawings must be supplied.

4.9 Identification number

All power units shall carry an individual identification number on the back of the unit. This number shall also appear on the factory test report (see Section 5.3).

5. Tests

5.1 Qualifying tests

The manufacturer has to supply one prototype pump power supply for qualifying tests at CERN. The prototype must in all respects fulfil the CERN specification.

CERN will provide the required instrumentation and personnel to perform the tests. However, the manufacturer shall have the possibility to delegate one of his engineers to be present during the qualifying tests. The maximum duration of the qualifying tests is estimated at one week.

CERN will keep the prototype power supply as a reference for the whole period of acceptance tests on series produced units.

5.2 Tests during fabrication

The contractor must decide which tests he thinks are necessary during the manufacturing of the pump supplies. CERN would like to discuss these tests beforehand but does not wish to impose a test programme.

5.3 Test in the factory on finished pump supplies

The contractor shall execute final tests on all pump supplies in the factory. These tests must at least include all tests listed in Section 6.1.

For at least one supply in each delivery batch the contractor must execute, in addition, the tests listed in Section 6.2.

The contractor must prepare standard test forms which have to be filled in for each supply during the factory tests. The detailed layout of the test forms shall be approved by CERN.

5.4 Acceptance tests at CERN on delivered pump supplies

Acceptance tests will be performed at CERN.

All the units will undergo tests numbers: 1, 2, 3, 4 and 5 listed in Section 6.1.

A number of units, will in addition undergo all other tests in Section 6.

6. Test Programme

6.1 Basic tests

1) Visual inspection
2) Electrical inspection (lights and relays) and check on the safety features.
3) Measurement of output characteristic of the supply together with input power and ripple as function of the output current (at least 4 measuring points). The effect of 10% mains variations is to be checked at each point. The measurements can be done on a dummy load. Check on operation for a mains power failure of less than 90 ms and also check that the unit switches off if the mains failure is greater than 110 ms.
4) Check on the behaviour of the interrupt circuit and the precision of the current read-out voltage (at least 4 measuring points).

5) Check of remote controlled operation and status signals.

6) Test of insulation of H.V. part at 12 kV r.m.s. 50 Hz for 1 minute.

6.2 Additional tests

1) H.V. safety check (discharging time after switch-off, cable and spark interrupt).

2) Reliability test in the form of continuous operation at maximum power output for 24 hours, with the pump supply placed in an oven in which the air can circulate freely and in which the temperature is maintained at 60°C.

7. Failure to meet the tests

7.1 Failure to meet the qualifying tests

If a prototype unit fails to meet the specification, the manufacturer must improve or alter the design until the required performance is obtained. Modifications to the prototype unit must be completed at the latest one month after the beginning of the qualifying tests.

In case the prototype is not accepted after this time, CERN reserves the right to impose alterations necessary to obtain the specified performance.

7.2 Failure to meet factory tests

Any pump supply that fails in the tests in the factory, must without delay be repaired or replaced by the contractor free of charge.

If one of the pump supplies of a delivery batch fails in the factory tests, listed under Section 6.2, the contractor must execute these tests on all the other supplies of that delivery batch.

7.3 Failure to meet acceptance tests

Pump supplies that fail at CERN will be returned to the factory and must without delay be repaired or replaced by the contractor free of charge.

Following the successful completion of the acceptance tests on all power supplies, the units will be provisionally accepted in accordance with the Special Conditions.

TABLE I

400 LITRES/SEC SPUTTER-ION PUMP SUPPLIES

FRONT PANEL CONNECTOR PIN ALLOCATION

50 BSF		
no	Control Functions	Comments
1-2	ON -command	
3-4	OFF-command	
5-6	go to low voltage command	
7-8	go to high voltage command	
9	ON	} status contacts
10	OFF	
11	n.c.	
12	trip open cable	
13	trip over current	
14	trip sparking	
15	n.c.	
16	ON + high volt + low pressure	
17	return status (9-16)	
18	guard	
19	+ filter signal	
20	- filter signal	
21-22	front panel control link	
23	17,5 V/AC	
24	centre tap	
25	17,5 V/AC	
26	n.c.	
27-28	voltage measurement	
29-34	n.c.	
35	low voltage	← status contact
36	high voltage	← status contact
43	return status (low voltage)	
44-45	n.c.	
46-47	(pump size determination) link	
48-49	(pump size determination) link	
50	earth	

TABLE II

400 LITRES/SEC SPUTTER-ION PUMP SUPPLIES

REAR PANEL CONNECTOR PIN ALLOCATION

50 BSF		
no	Control Functions	Comments
1-2	ON -command	
3-4	OFF-command	
5-6	go to low voltage command	
7-8	go to high voltage command	
9	ON	} status contacts
10	OFF	
11	n.c.	
12	trip open cable	
13	trip over current	
14	trip sparking	
15	front panel control	
16	ON + high volt + low pressure	
17	return status (9-16)	
18	guard	
19	+ filter signal	
20	- filter signal	
21-22	n.c.	
23	n.c.	
34	n.c.	
25	n.c.	
26	n.c.	
27-28	n.c.	
29-34	n.c.	
35	low voltage	← status contact
36-42	n.c.	
43	return status (low voltage)	
44-47	n.c.	
48-49	n.c.	
50	earth for cable screen	

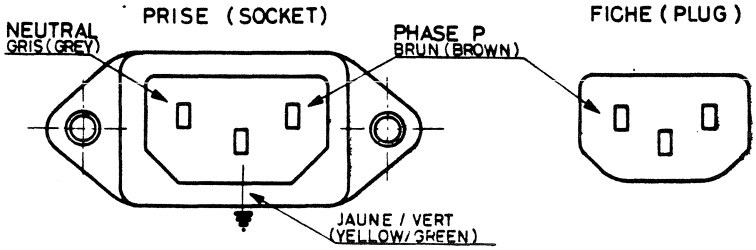
3

CONNECTOR TYPE : EUROPE 220 V / 6 A

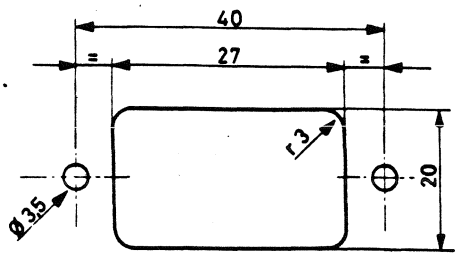
LAB II abb'n : 3PEASM 3PEAPF

MATCHING CABLE

cable type : 3 x 1.5 mm^2
LAB II abb'n : PH3



FRONT VIEW



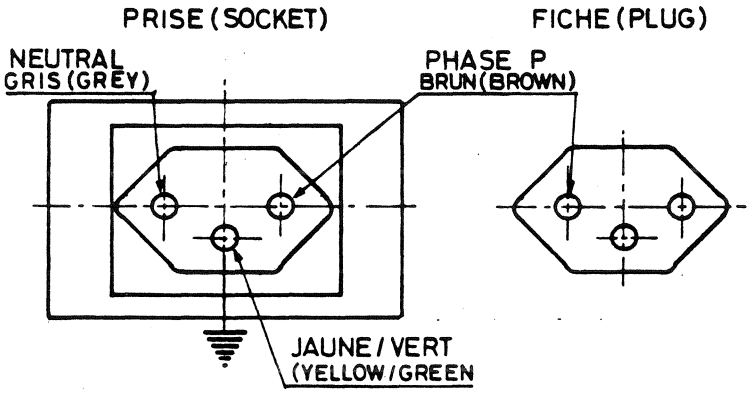
3

CONNECTOR TYPE : FELLER 250 V / 10 A

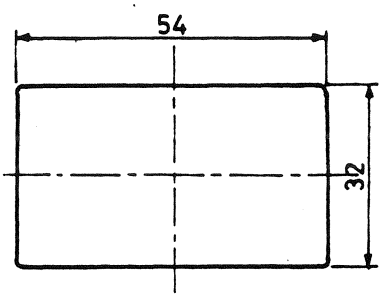
LAB II abb'n : 3PFASF 3PFAPM

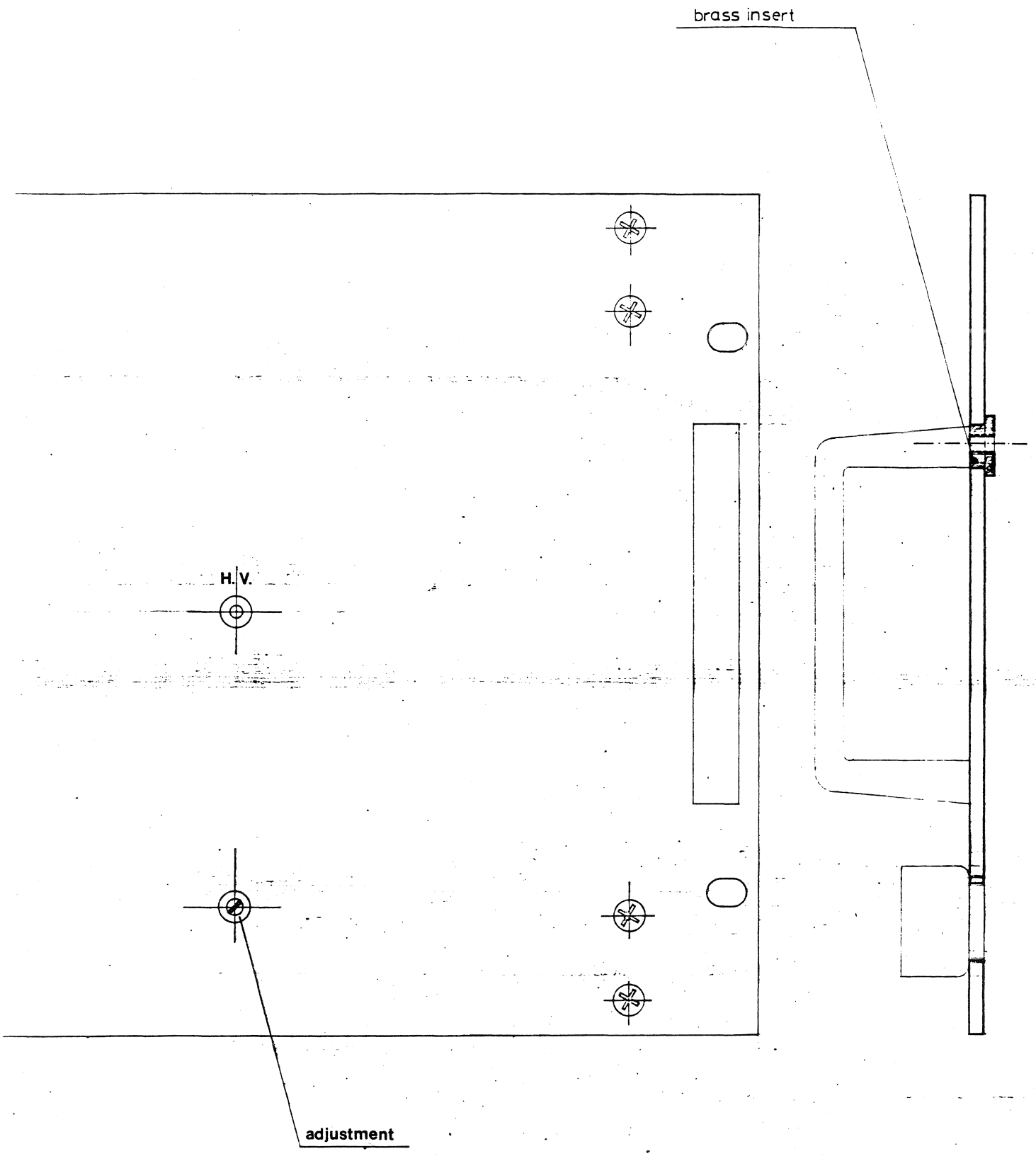
MATCHING CABLE

cable type : 3 x 1.5 mm^2
LAB II abb'n : PH3



FRONT VIEW





PROPOSED FRONT PANEL LAYOUT Fig. 7a

STANDARD 19" PANELS

RECOMMENDATIONS

19" panels should conform to the dimensions given below (or IEC 297)

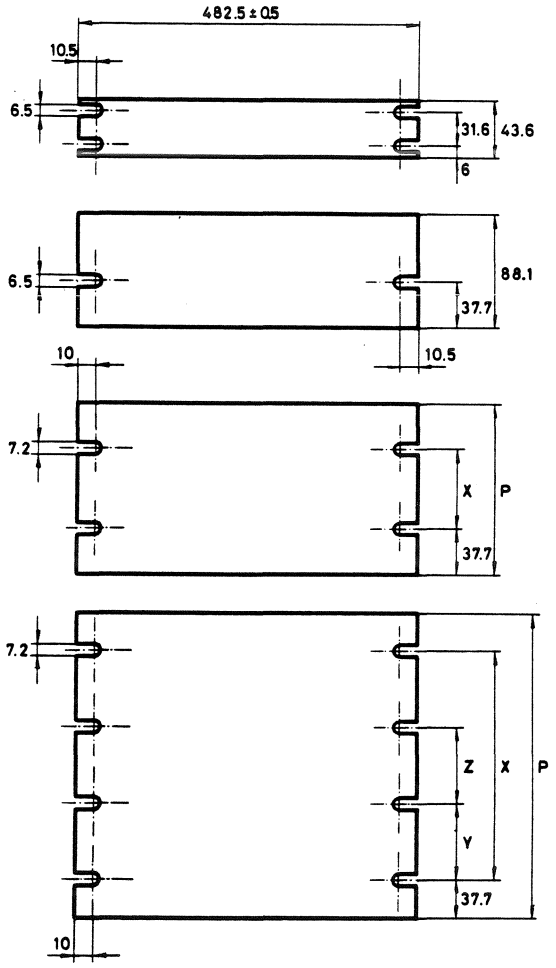
material : 4 mm hard aluminium (Peraluman 30, hard)
finish : natural anodising or paint RAL 9006
text : black

SIZE 1

SIZE 2

SIZE 3 - 4 - 5 - 6 - 7

SIZE 8 - 9 - 10 - 11 - 12 - 13 - 14



panel size	P	X	Y	Z
3	132.5	57.0	-	-
4	177.0	101.6	-	-
5	221.5	146.0	-	-
6	266.0	190.5	-	-
7	310.4	235.0	-	-
8	354.8	279.4	101.6	76.2

panel size	P	X	Y	Z
9	399.2	323.8	101.6	120.6
10	443.7	368.3	101.6	165.1
11	488.1	412.6	133.3	146.0
12	532.6	457.1	133.3	190.5
13	577.1	501.6	146.0	209.6
14	621.6	546.1	177.8	190.5

REMARK

panel design sheets, scale 1:1, are obtainable from the electronics drawing office.

LAB II / 19" STANDARD RACK

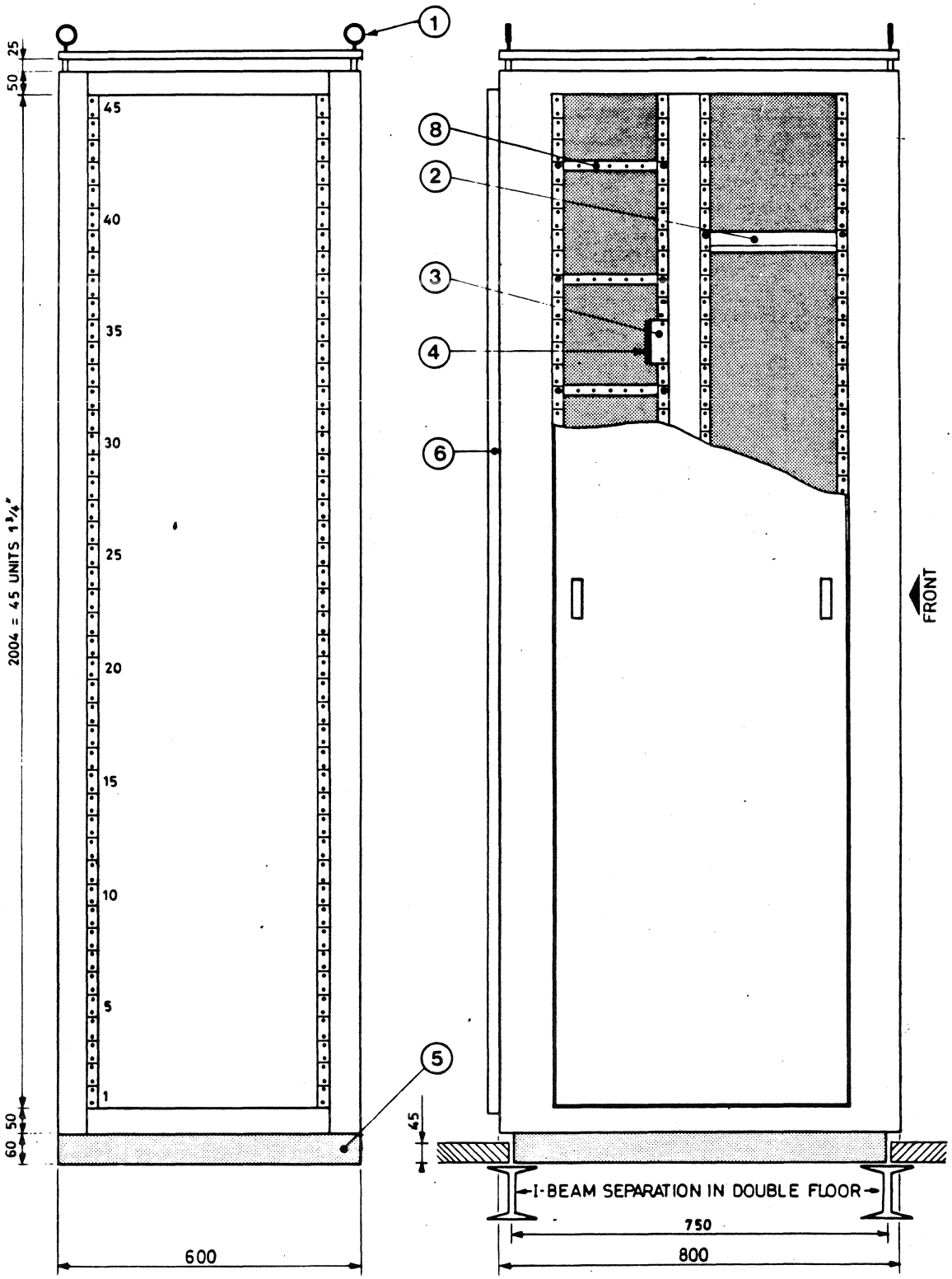
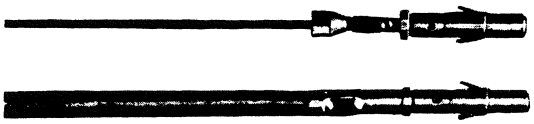
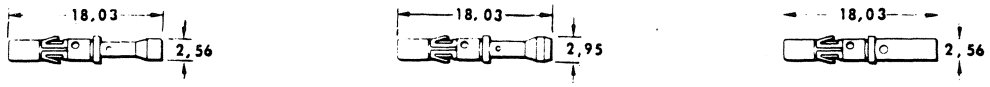


Fig. 6

GENERAL SPECIFICATION SHEET FOR BANTAM AND HYFEN CONTACTS

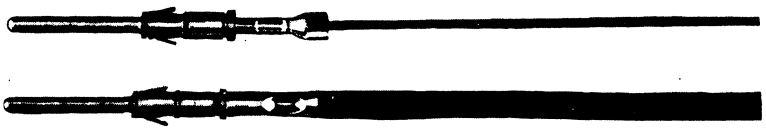
FEMALE CONTACTS

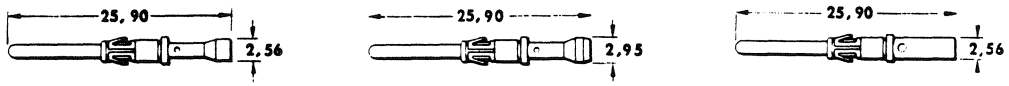




size	wire section mm^2	isolation Ø	colour	scem number	Burndy reference	LAB II abb'n
24	0.15-0.25	0.9-1.6mm	violet	09.21.05/410.0	RC-24M- 9-D28	PINB24F
20	0.32-0.52	1.2-1.6mm	grey	09.21.05/430.0	RC-20M-13-D28	PINB20F
16	0.52-1.50	max. 3 mm	green	09.21.05/450.0	RC-16M-23-D28	PINB16F

MALE CONTACTS





size	wire section mm^2	isolation Ø	colour	scem number	Burndy reference	LAB II abb'n
24	0.15-0.25	0.9-1.6mm	violet	09.21.05/400.0	RM-24M- 9-D28	PINB24M
20	0.32-0.52	1.2-1.6mm	grey	09.21.05/420.0	RM-20M-13-D28	PINB20M
16	0.52-1.50	max. 3 mm	green	09.21.05/440.0	RM-16M-23-D28	PINB16M

REMARKS : tools and mounting instructions see chapter 5.

Fig. 5

GENERAL SPECIFICATION SHEET FOR HYFEN/BURNDY CONNECTORS

ELECTRICAL CHARACTERISTICS

contact rating	:	13 A
operating voltage	:	750 V ac max.
operating temperature	:	-55^0 C to $+125^0$ C
insulation resistance	:	5000 MΩ min.
test potential	:	1 minute duration, 2000 V ac 50 Hz
contact retention in insert	:	7 kp min.

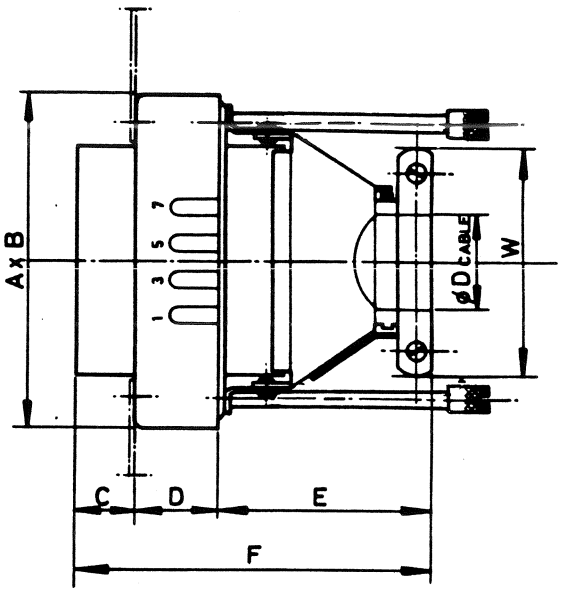
MECHANICAL CHARACTERISTICS

26 AND 50 PIN CONNECTORS

SCEM nr. :

26 pins socket	female	09.21.05/100.0
26 pins plug	male	09.21.05/200.0
50 pins socket	female	09.21.05/110.0
50 pins plug	male	09.21.05/210.0

nr.of cont.	A	B	C	D	E	F max	W max
26	46.6	20.0	12.3	18.7	39.2	70.2	26.5
50	74.7	27.4	12.3	18.7	48.4	79.4	49.5



COLOURS

male inserts	:	white contact position numbers
female inserts	:	yellow contact position numbers

104 PIN CONNECTOR

SCEM nr. :

socket	female	09.21.05/120.0
plug	male	09.21.05/220.0

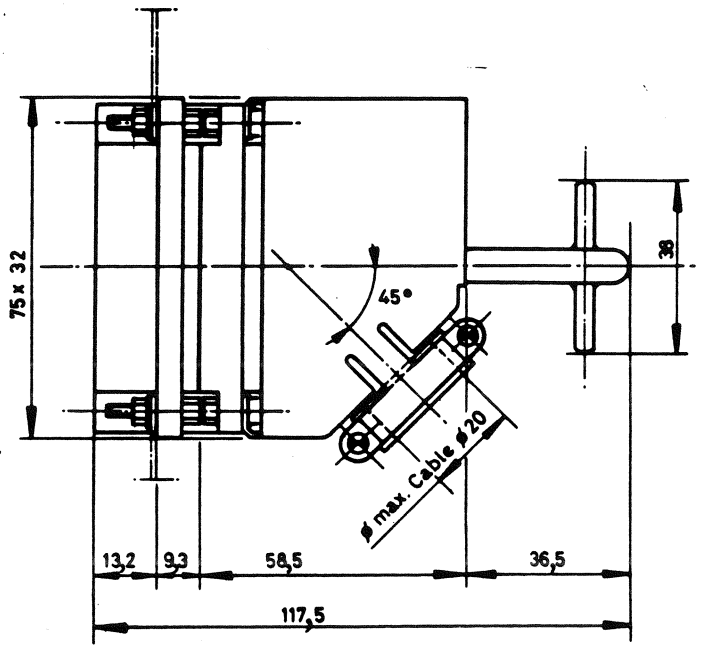


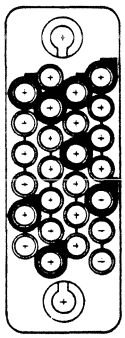
Fig. 4 (cont'd)

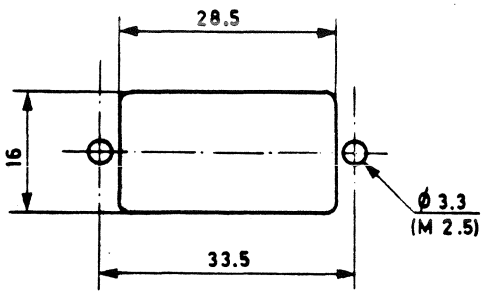
CONNECTOR TYPE : HYFEN 26 pin **26**

LAB II abb'n	:	26BSF	26BPM
Burndy reference	:	MS-26RM-58SGE2	MS-26P-124SGE6

MATCHING CABLES

cable types	:	13 x 2 x 0.25 mm^2	13 x 2 x 0.5 mm^2
LAB II abb'n	:	ND26	NE26



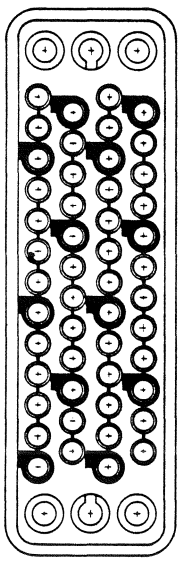


CONNECTOR TYPE : HYFEN 50 pin **50**

LAB II abb'n	:	50BSF	50BPM
Burndy reference	:	MS-50RM-58SGE2	MS-50P-124SGE7

MATCHING CABLES

cable types	:	24 x 2 x 0.25 mm^2	24 x 2 x 0.5 mm^2
LAB II abb'n	:	ND48	NE48



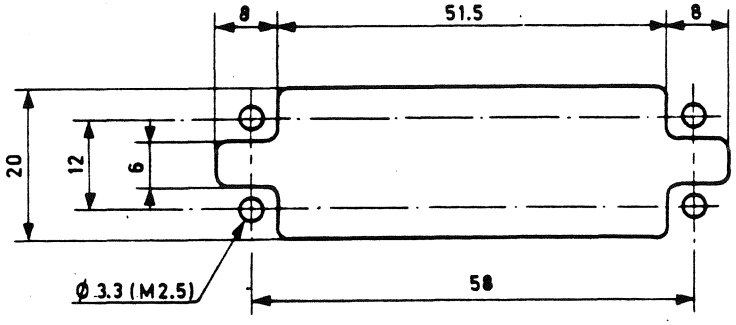


Fig. 4

TABLE III

FISCHER D-105 A - 036-5 connector pin allocation

Pin	Designation	Comments
1	H.V. output	
2	H.V. return	
3	n.c.	
4	"OPEN CABLE" control wire	shorted at pump end of cable
5	"OPEN CABLE" control wire	