MB/GS/gf

SI/Note MAE/72-3
20.12.1972

PSB DIPOLES

Brief summary of the details and parameters

A. Arn, M. Battiaz, G. Schnell

1. Short description

In the PSB six types of small dipoles are installed (see part 2).

- Type 1 : 15 normal correction dipoles with horizontal and vertical field, placed in the ring.
  One unit consists of 4 dipoles.
  Cores are laminated.
  Their characteristics are given in part 3.

- Type 2 : 2 flat correction dipoles with horizontal and vertical field, placed in the ring.
  One unit consists of 4 dipoles.
  Cores are laminated.
  Their characteristics are given in part 3.

- Type 3 : 1 d.c. operated correction dipole with horizontal field, placed at the beginning of the transfer line.
  One unit consists of 4 dipoles.
  The characteristics are given in part 3.

- Type 4a : 7 d.c. operated correction dipoles with horizontal or vertical field, respectively placed in the transfer line and in the spectrometer line.
  One unit consists of 1 dipole.
  The characteristics are given in part 3.

- Type 4b : 3 dipoles, same as type 4a, but water-cooled.

- Type 5 : 2 pulsed ejection dipoles with vertical field, placed in the ring.
  One unit consists of 4 dipoles.
  The characteristics are given in part 3.

- Type 6 : 1 pulsed ejection dipole with vertical field, placed in the ring between the two type 5 units. The unit consists of 4 dipoles.

  The characteristics are given in part 3.

- Type 7 : 2 dipoles as type 4a, situated in the spectrometer line.

  The characteristics are given in part 3.

The electrical connections of the coils of the various dipoles are shown in part 3.

The valid drawings are listed in part 4.

For each type there exists a number of spare parts listed in part 4.

Remark : After having studied the tenders of the firms, we decided to revise the construction and to fabricate the dipoles under CERN's responsibility. Therefore the original specification is no longer valid in all details.

Apart from CERN workshops, two firms were involved :

- A. Besson, Nyon (coils of type 1)
- Usines Jean Gallay, Genève (all cores, all supports).

Reference : PSB Handbook, 1973

2. POSITIONS OF THE DIFFERENT TYPES IN THE PSB RING AND TRANSFER

The following fig. 1 shows the position of the different types together with their standard nomenclature.

3. CHARACTERISTIC PARAMETERS, FIELD DIAGRAMS AND ELECTRICAL CIRCUITRY OF THE DIFFERENT DIPOLES

- Characteristic parameters and field diagrams :

Type 1	horizontal field	fig. 2
" 1	vertical field	" 3
" 2	horizontal field	" 4
" 2	vertical field	" 5
Types 4a, 4b, 7		" 6
Type 5		" 7
" 6		" 8

- Electrical circuitry

Type 1	cabling	fig. 9
" 2	"	" 10
Types 3, 4a, 7		" 11
Type 4b		" 12
" 5		" 13
" 6		" 14

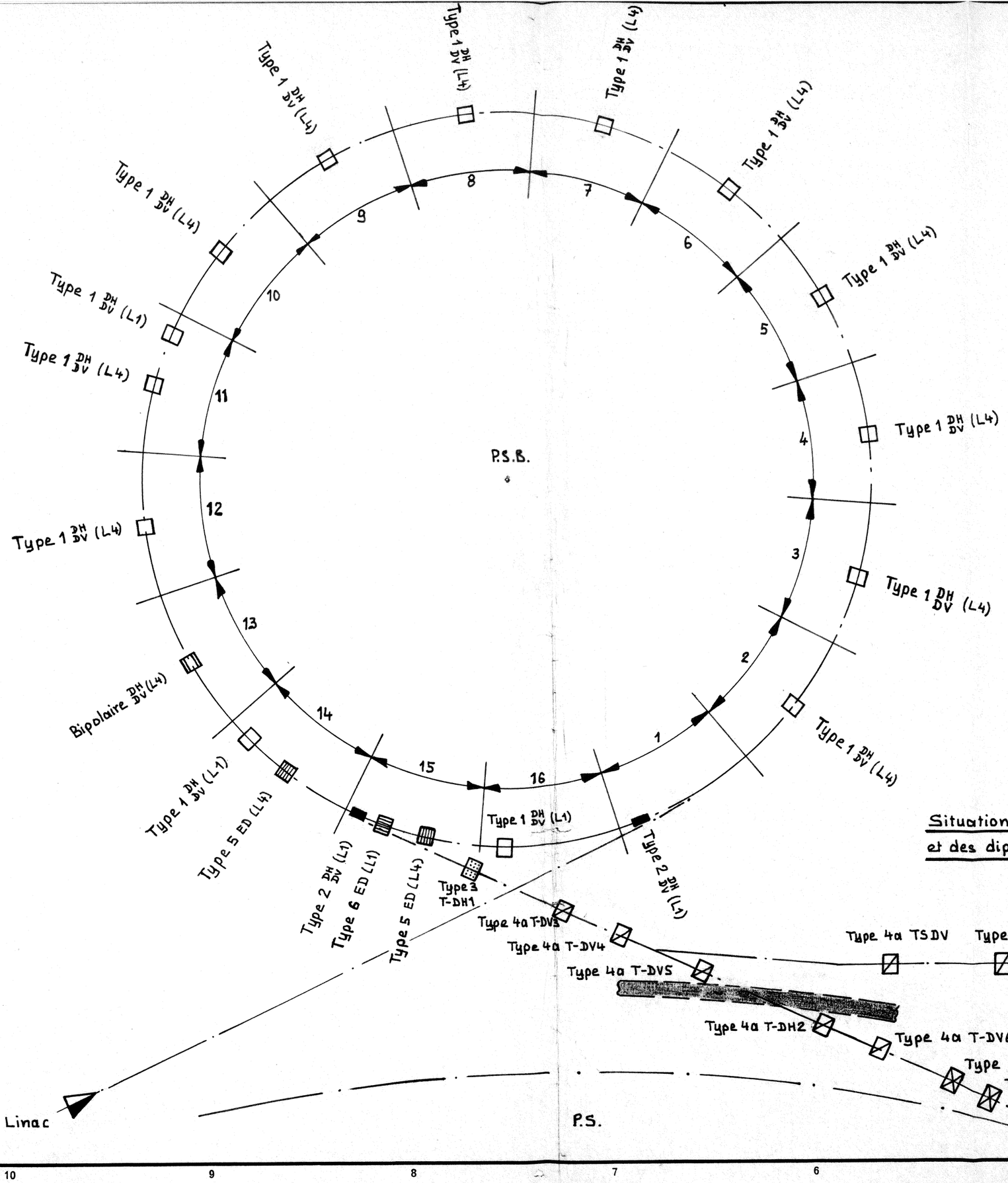
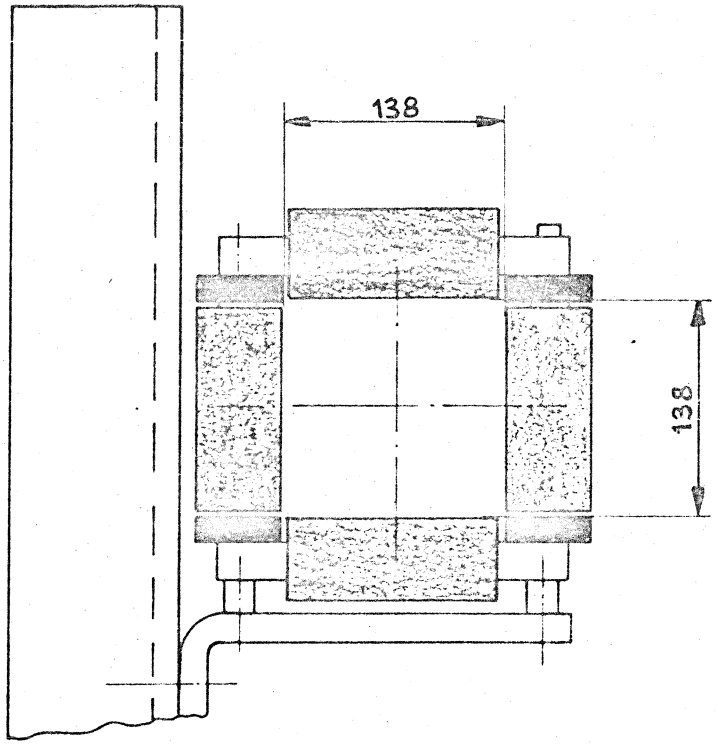


Fig. 1.

Situation des dipoles de correction du P.S.B. et des dipoles d'éjection de la ligne de transfert.

SI. 1.04. 1014.3

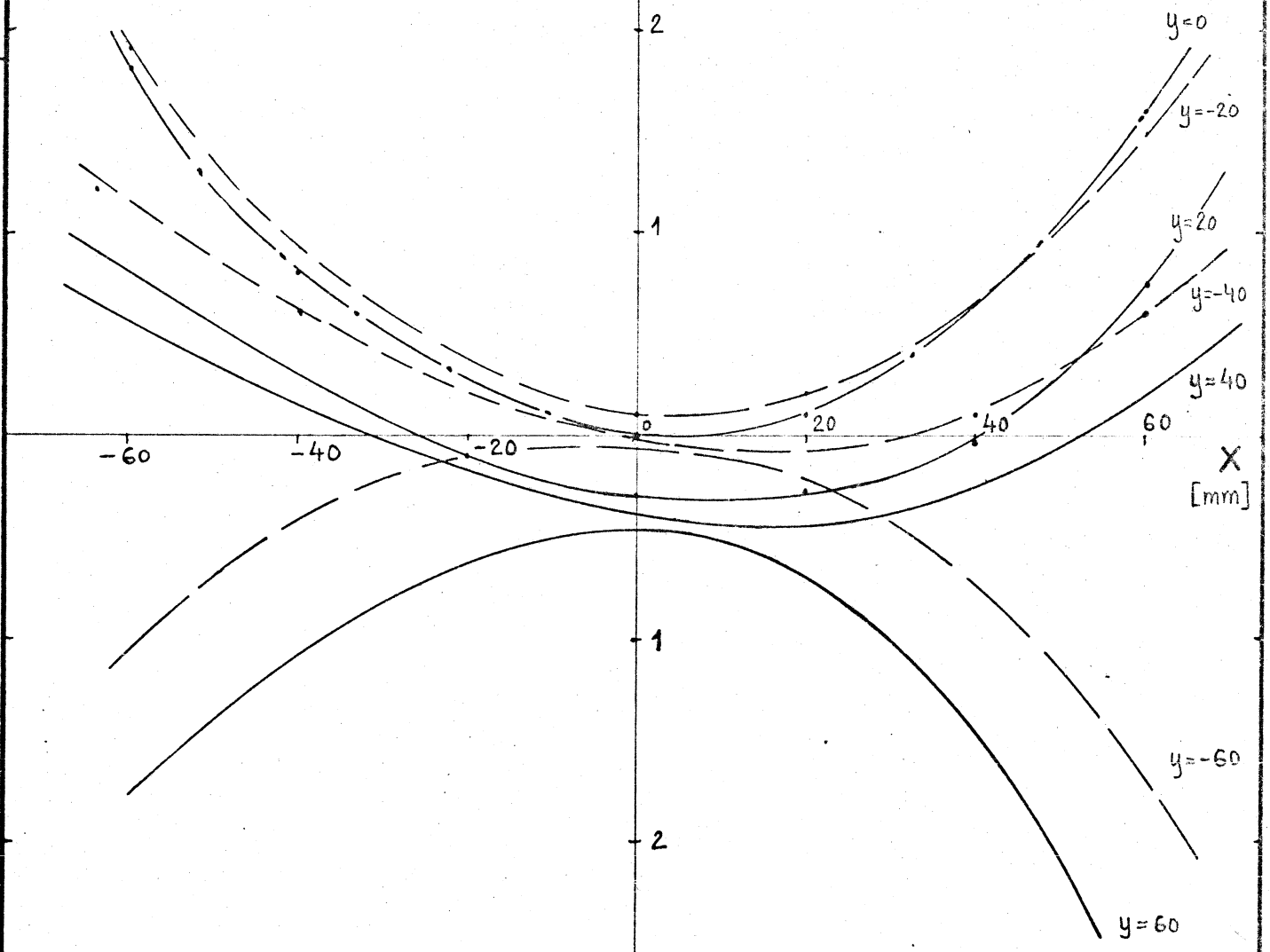


Type 1

R - DH,V
R_H = 1,12 Ω
R_V = 1,12 Ω
L_H = 74,5 mH
L_V = 66,3 mH
B_{oH} = 0,021 T
B_{oV} = 0,021 T
I = 12 A
$\delta_{H,V}$ = 2 mrad à 0,8 GeV.
W = 400 kg
$\ell_{m.}$ = 0,325 m
$\ell_{eq.}$ = 0,46 m

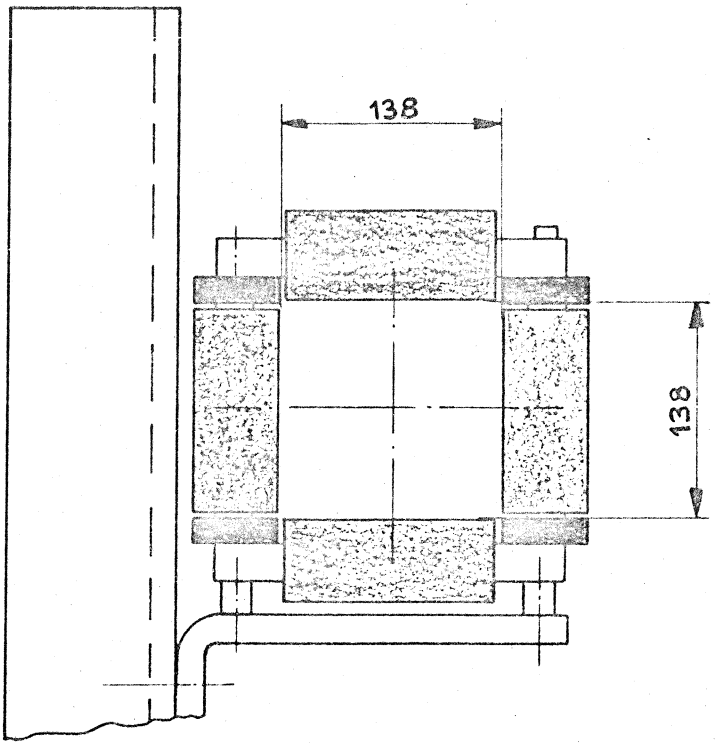
Fig.2 Horizontal

$$\varepsilon_{\%} = \frac{\int B_o ds - \int B ds}{\int B_o ds}$$



SI. 1.04. 1015.4

Mesures faites sur 1 dipôle

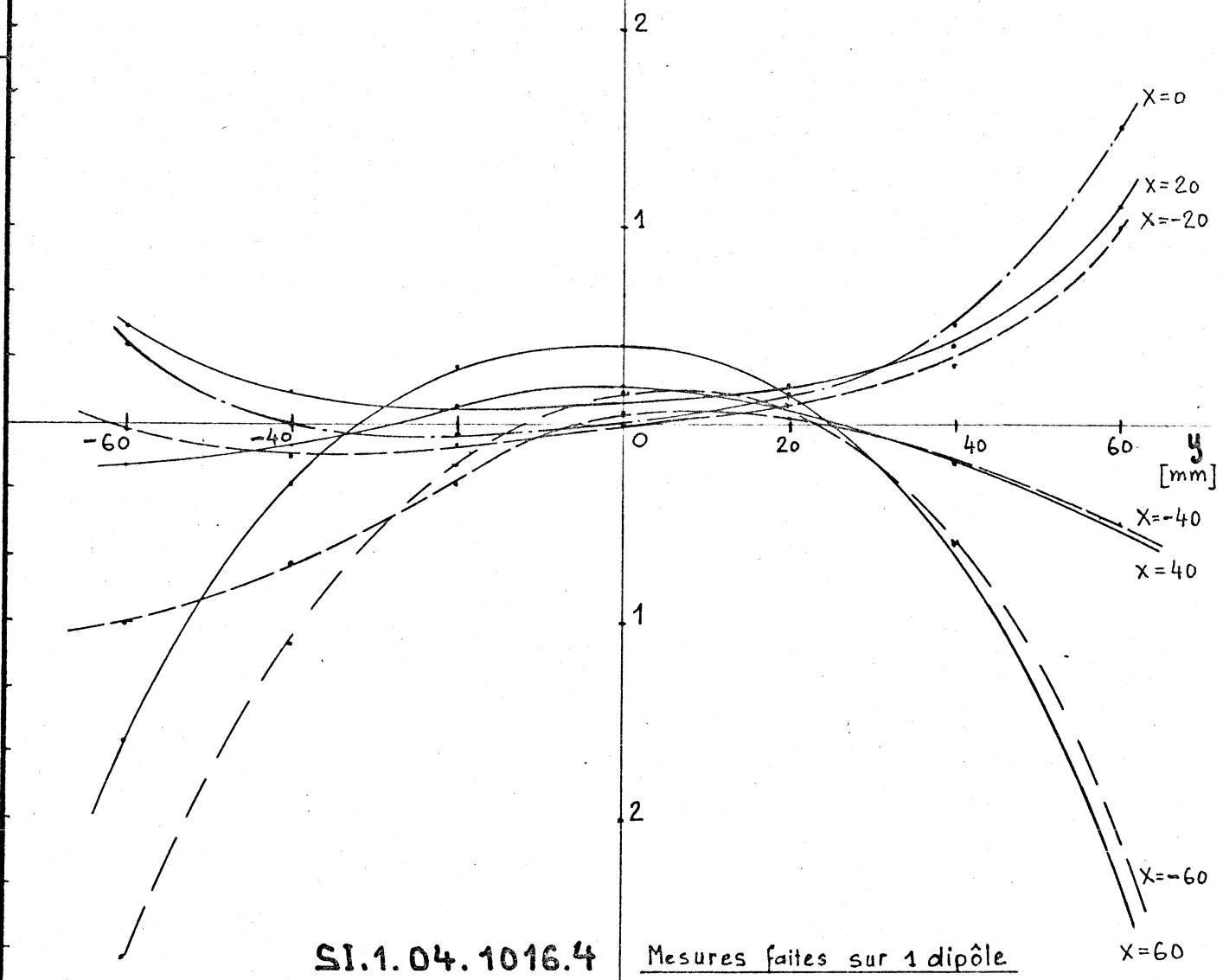


Type 1

R - DH,V
R_H = 1,12 Ω
R_V = 1,12 Ω
L_H = 74,5 mH
L_V = 66,3 mH
B_{oH} = 0,021 T
B_{oV} = 0,021 T
I = 12 A
$\delta_{H.V}$ = 2 mrad à 0,8 GeV.
W = 400 kg
$l_{m.}$ = 0,325 m
$l_{eq.}$ = 0,46 m

Fig. 3 Vertical

$$\varepsilon_{\%} = \frac{\int B_o ds - \int B ds}{\int B_o ds}$$



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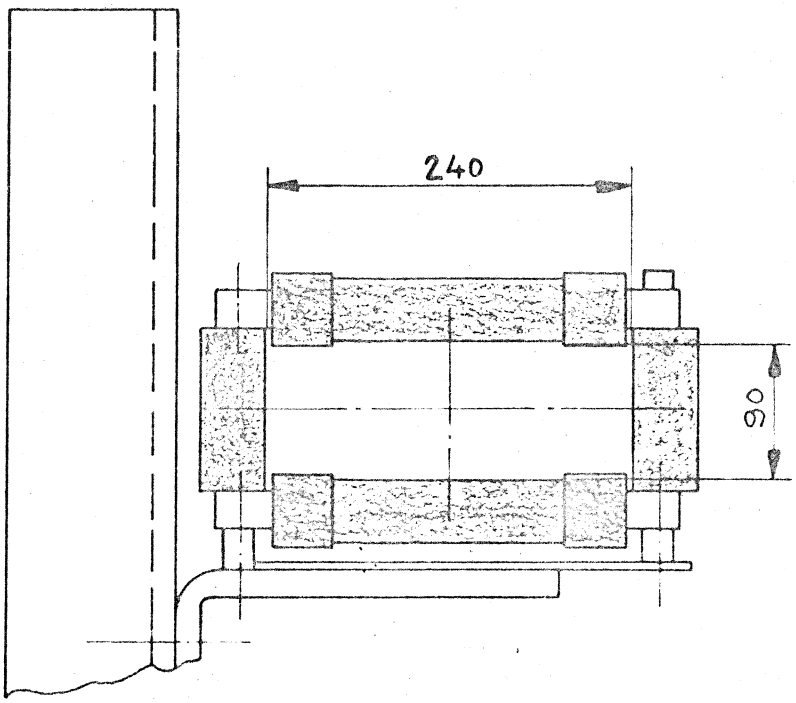
Mesures faites sur 1 dipôle

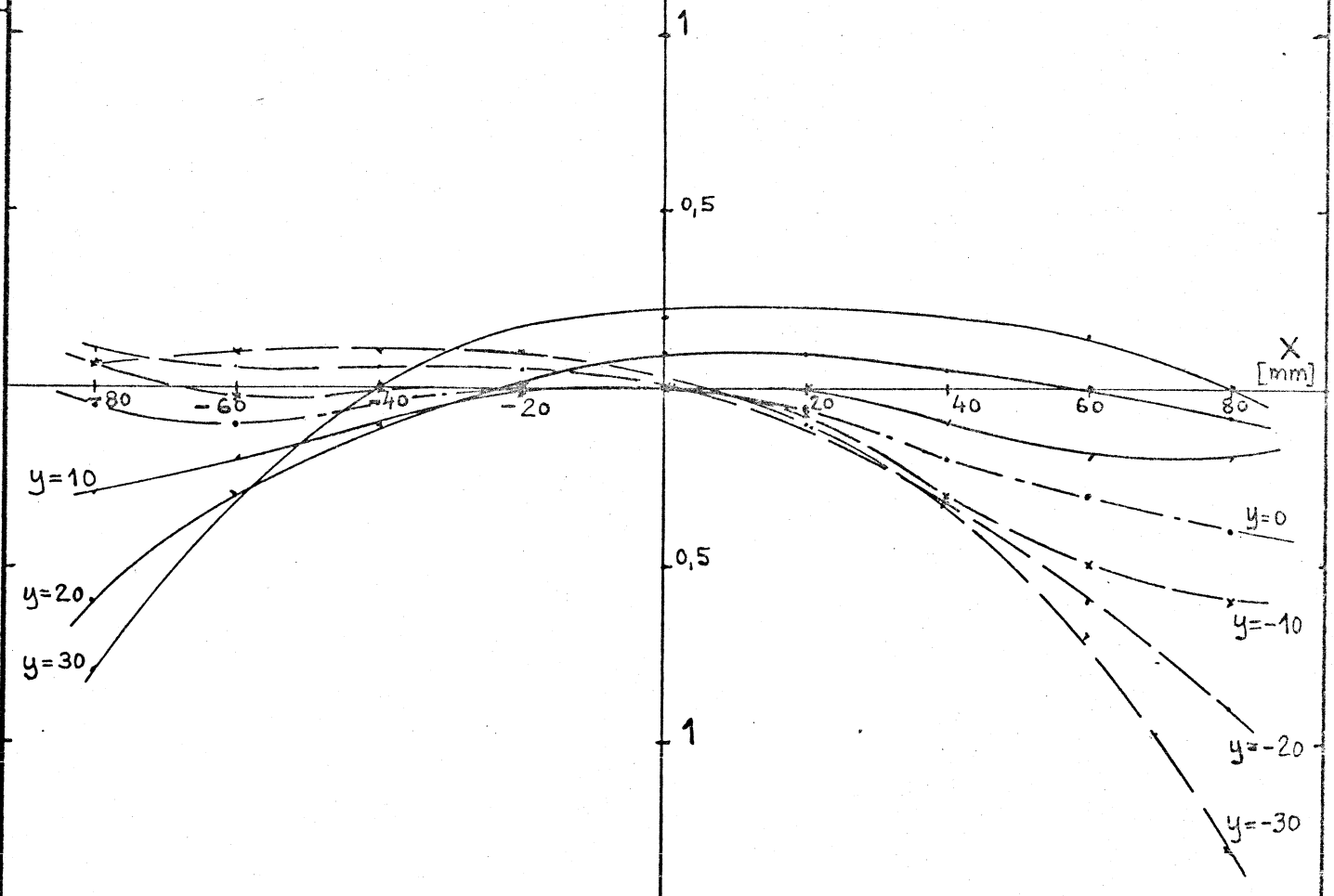


Type 2

R-DH.V
$R_H = 0,4\ \Omega$
$R_V = 0,85\ \Omega$
$L_H = 18$ mH
$L_V = 16$ mH
$B_{0H} = 0,015$ T
$B_{0V} = 0,012$ T
$I = 12$ A
$\delta = 1,35$ mrad à 0,8 GeV
$W^{H,V} = 340$ kg
$\ell_m = 0,3$ m
$\ell_{eq\,H} = 0,435$ m
$\ell_{eq\,V} = 0,544$ m

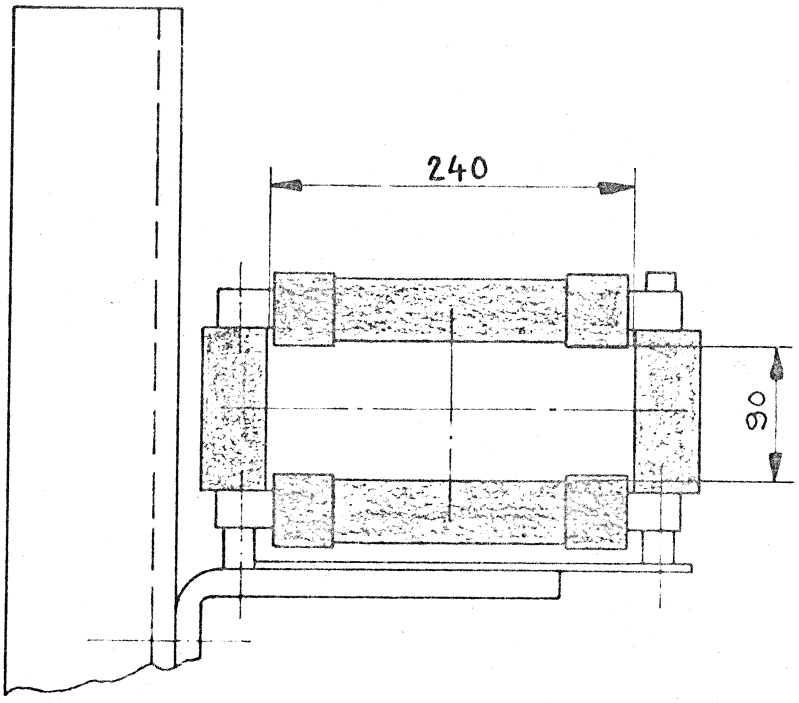
$$\varepsilon_{\%} = \frac{\int B_0 ds - \int B ds}{\int B_0 ds}$$

Fig.4 Horizontal



SI.1.04.1017.4

Mesures faites sur 1 dipôle

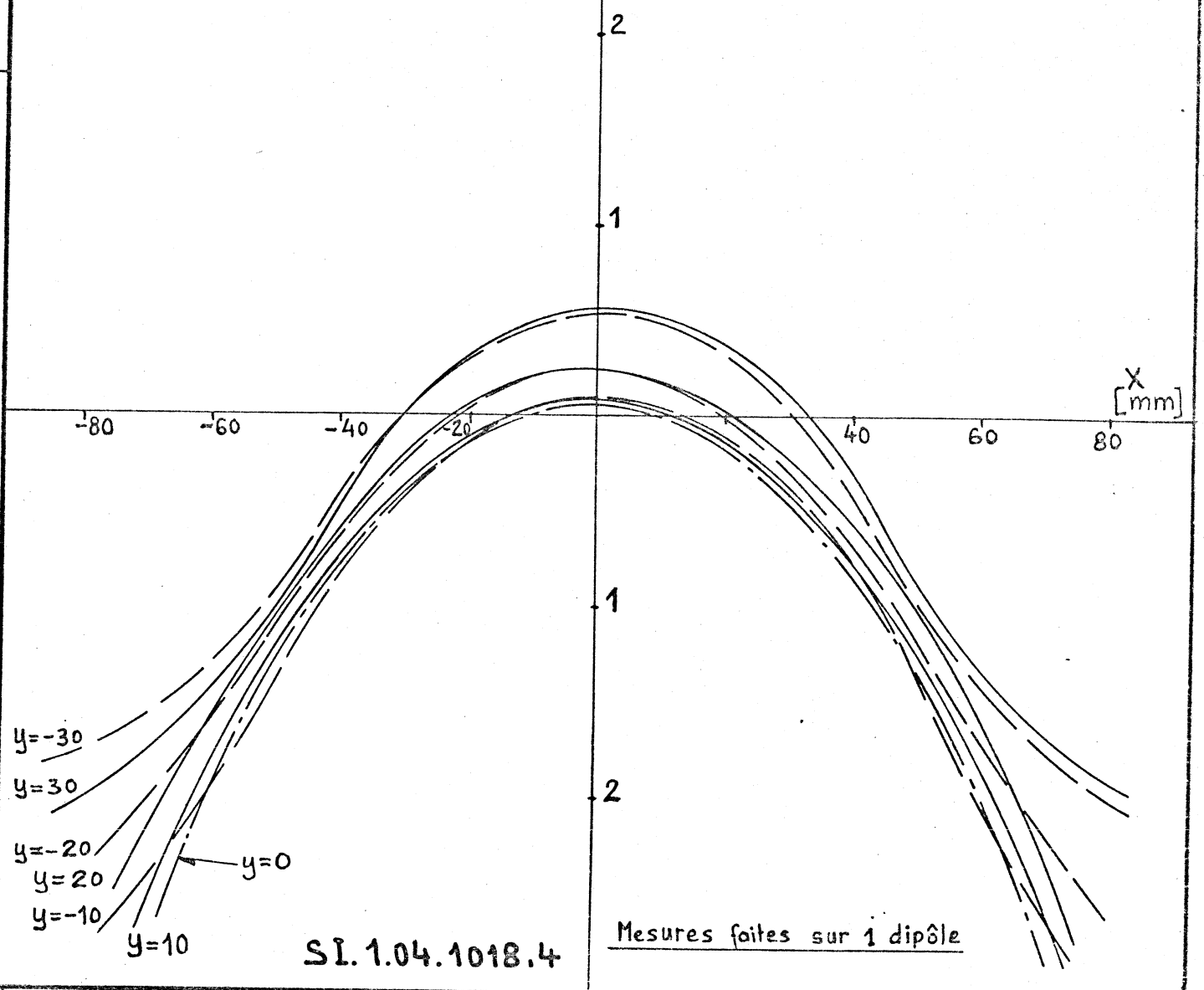


Type 2

R-DH,V
$R_H = 0,4\ \Omega$
$R_V = 0,85\ \Omega$
$L_H = 18$ mH
$L_V = 16$ mH
$B_{oH} = 0,015$ T
$B_{oV} = 0,012$ T
$I = 12$ A
$\delta_{H,V} = 1,35$ mrad à 0,8 GeV
$W = 340$ kg
$\ell_m = 0,3$ m
$\ell_{eq\,H} = 0,435$ m
$\ell_{eq\,V} = 0,544$ m

Fig.5 Vertical

$$\varepsilon_{\%} = \frac{\int B_o ds - \int B ds}{\int B_o ds}$$



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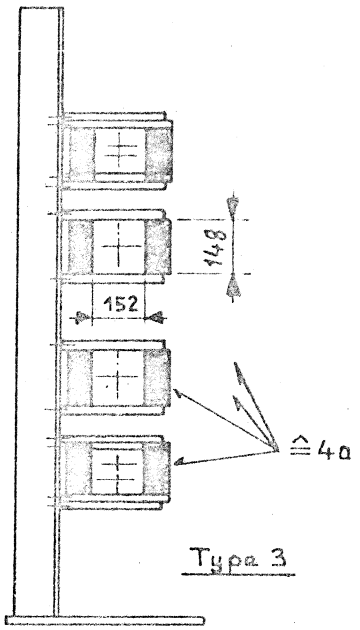
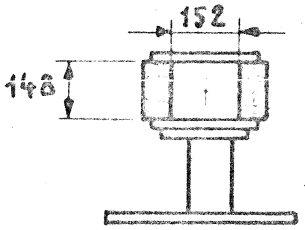
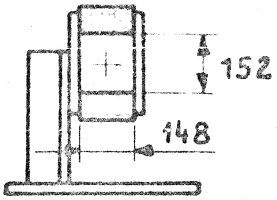
Mesures faites sur 1 dipôle



Type 3



Type 4a,4b&7 (Horizontal)



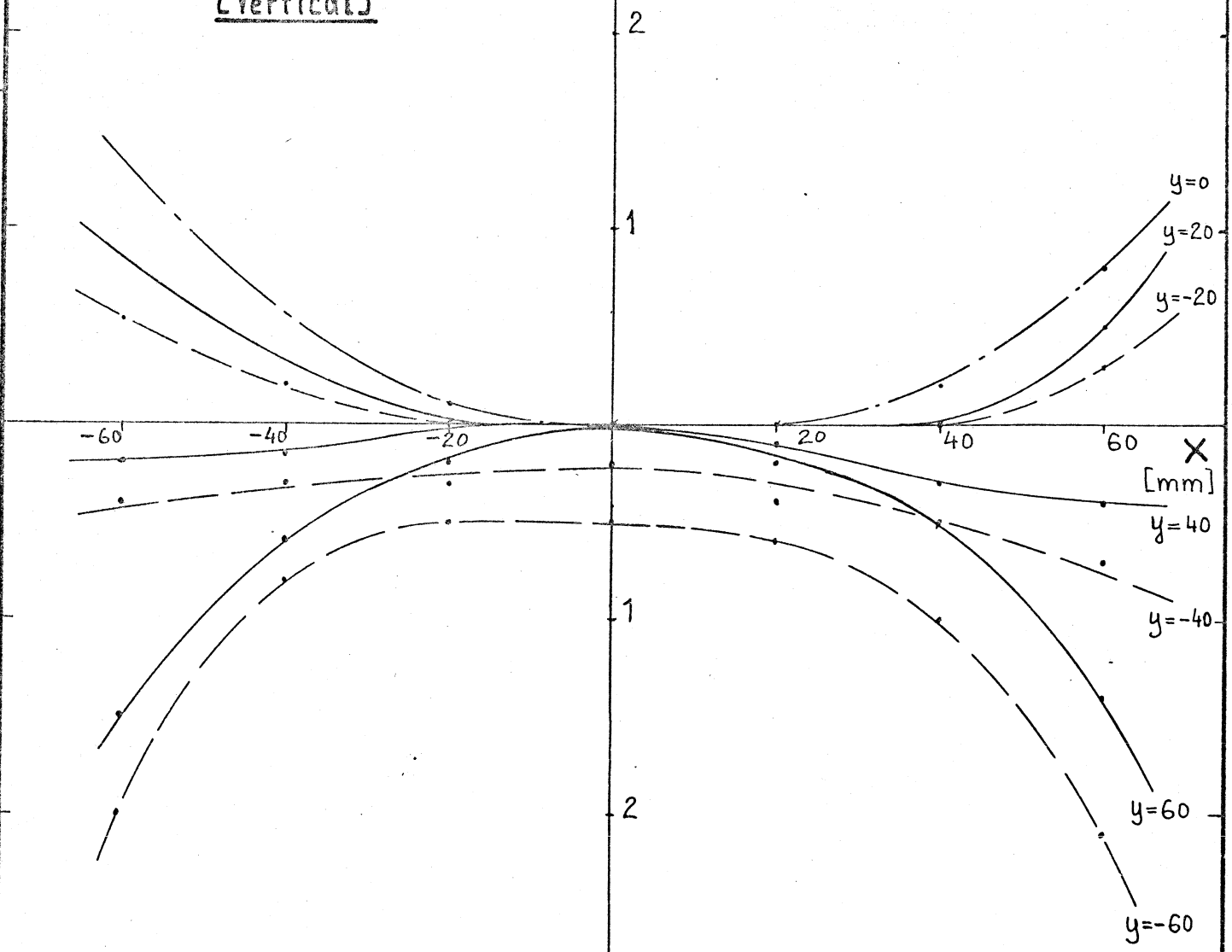
Type 4a,4b&7 (Vertical)

Remarques : Types 3,4a & 4b ont une culasse massive.
Type 4b : Bobines refroidies à l'eau

Type 3,4a&7	Type 4b
T - DH,V	T - DH,V
R = 3,2 Ω	R = 0,8 Ω
$B_{oH,V}$ = 0,022 T	$B_{oH,V}$ = 0,044 T
I = 5 A	I = 20 A
$\delta_{H,V}$ = 2 mrad à 0,8 GeV.	$\delta_{H,V}$ = 4 mrad à 0,8 GeV.
W = 340 kg & 95 kg	W = 95 kg
$\ell_{m.}$ = 0,365 m	$\ell_{m.}$ = 0,365 m
$\ell_{eq.}$ = 0,436 m	$\ell_{eq.}$ = 0,436 m

$$\varepsilon_{\%} = \frac{\int B_o ds - \int B ds}{\int B_o ds}$$

Fig.6 Horizontal (Vertical)



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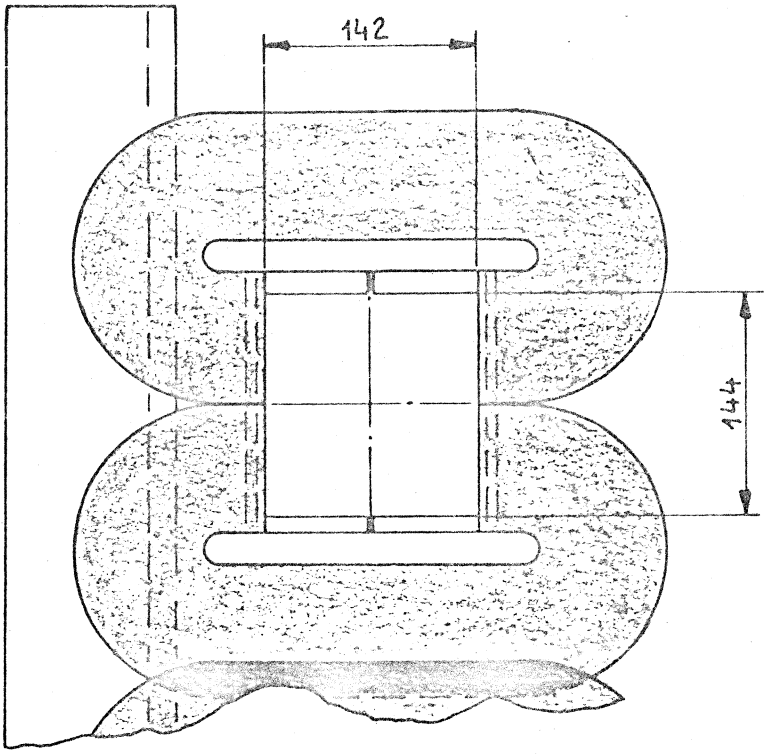
Mesures faites sur 1 dipôle

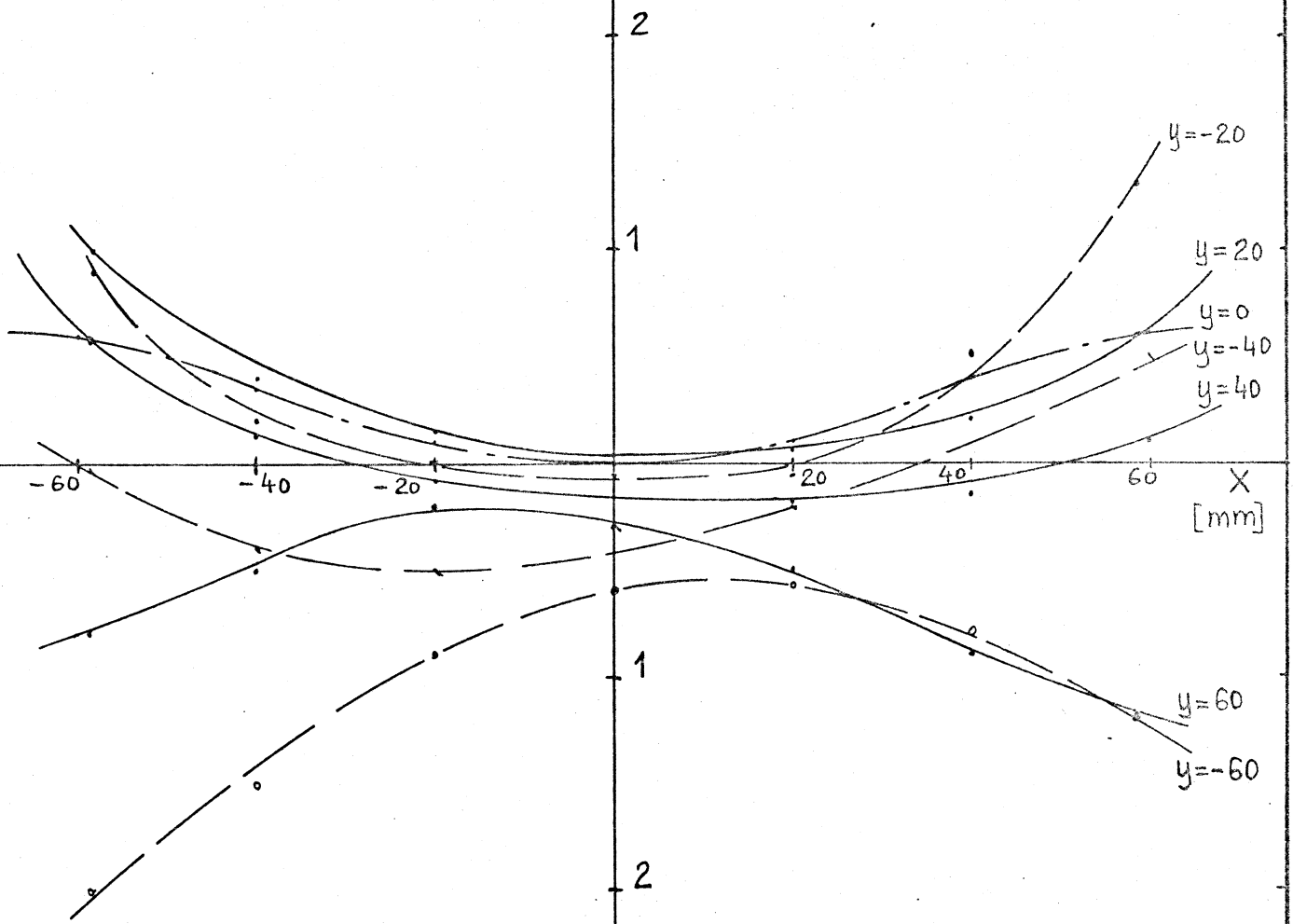


Type 5

R - EDH
R = 39 mΩ
L = 0,78 mH
B_o = 0,118 T
$\hat{I}$ = 525 A
δ = 13 mrad à 0,8 GeV.
W = 340 kg
ℓ_m = 0,409 m
ℓ_{eq} = 0,55 m

Fig.7

$$\varepsilon_{\%} = \frac{\int B_o\,ds - \int B\,ds}{\int B_o\,ds}$$



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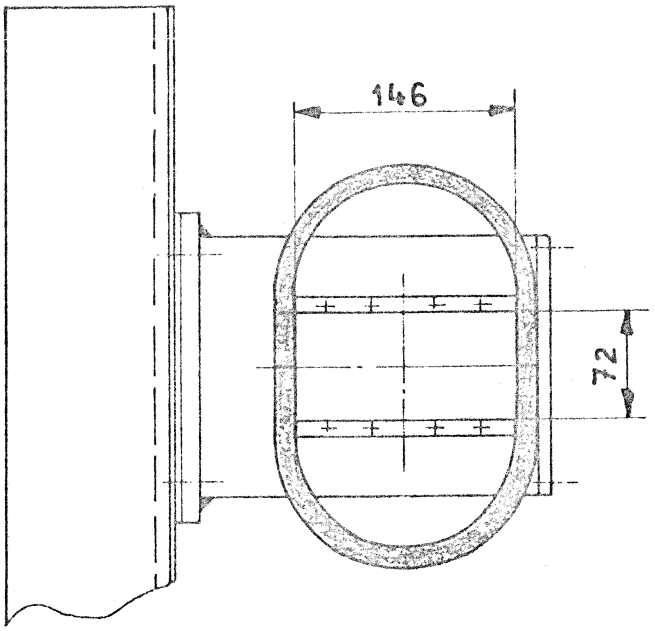
Mesures faites sur 1 dipôle

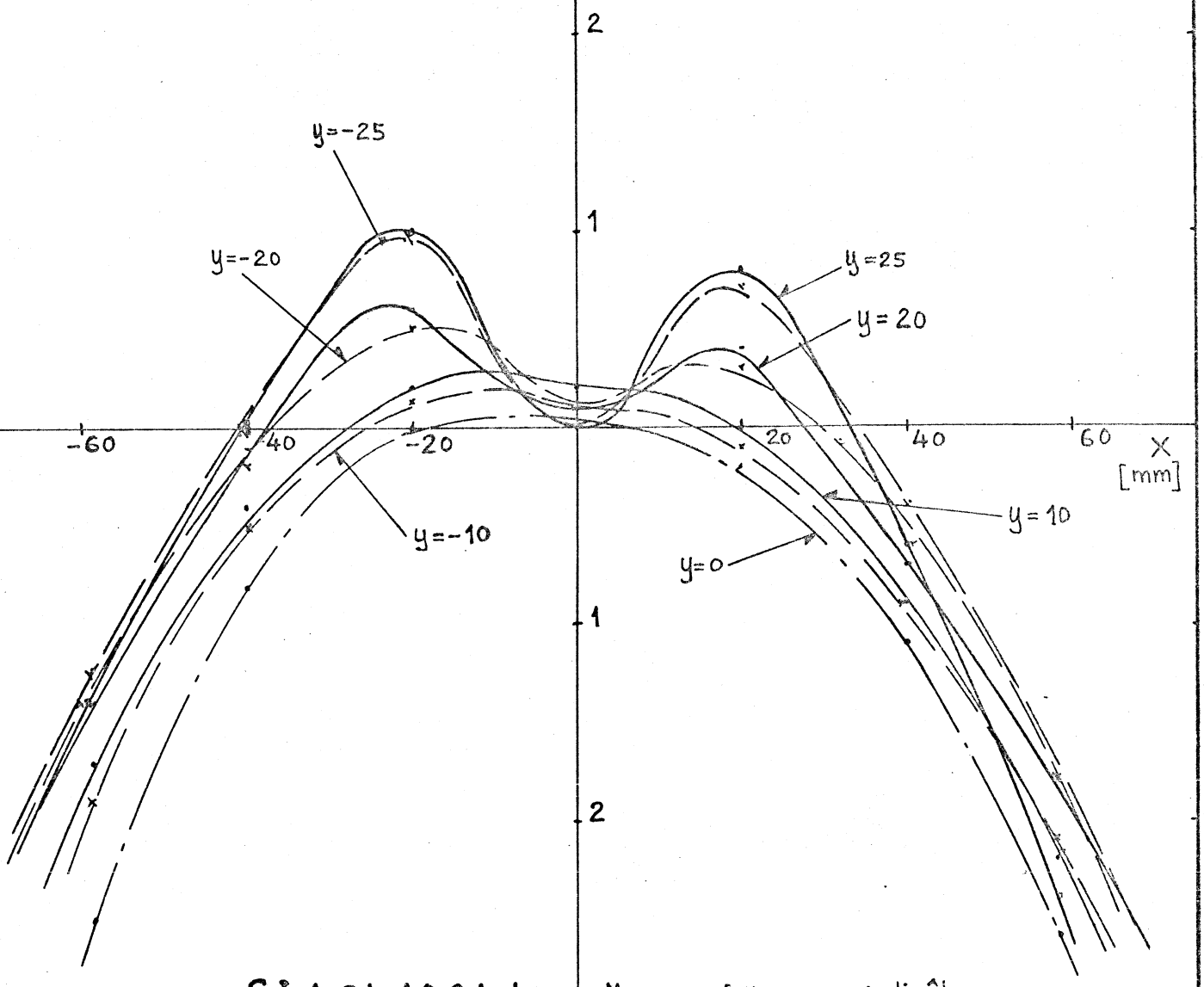


Type 6

R - EDH
R = 22 mΩ
L = 0,615 mH
B_o = 0,192 T
$\hat{I}$ = 460 A
δ_H = 15 mrad à 0.8 GeV
W = 370 kg
$\ell_{m.}$ = 0,39 m
$\ell_{eq.}$ = 0,38 m

Fig.8

$$\varepsilon_{\%} = \frac{\int B_o ds - \int B ds}{\int B_o ds}$$



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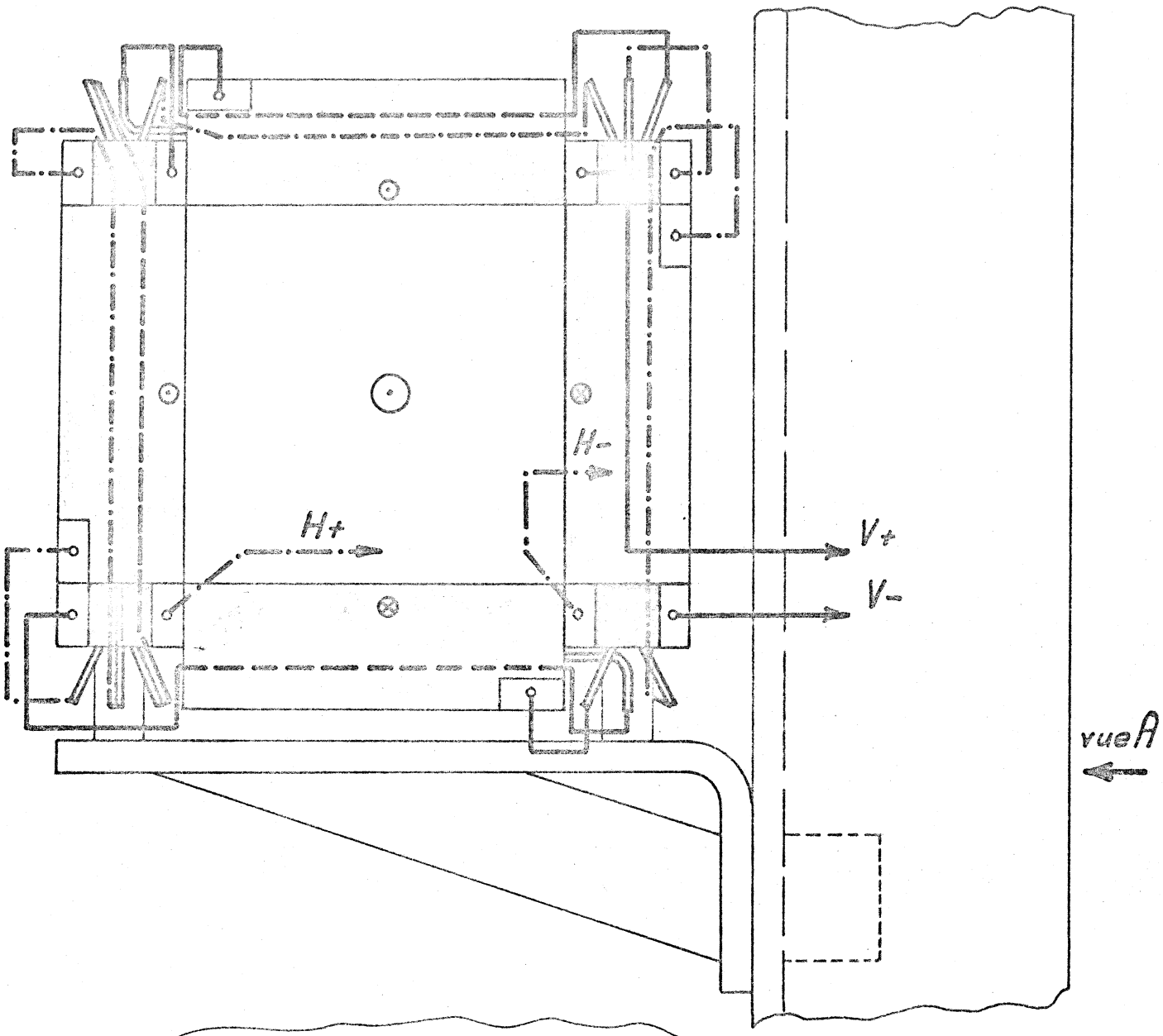
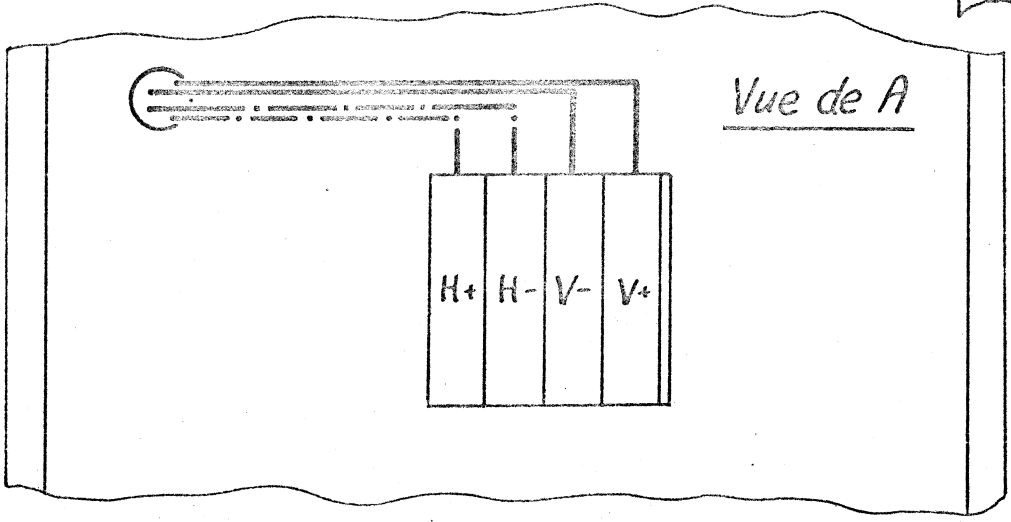
Mesures faites sur 1 dipôle

Fig.9 Câblage dipôle type 1





Vue de A

Dipôle Horizontal

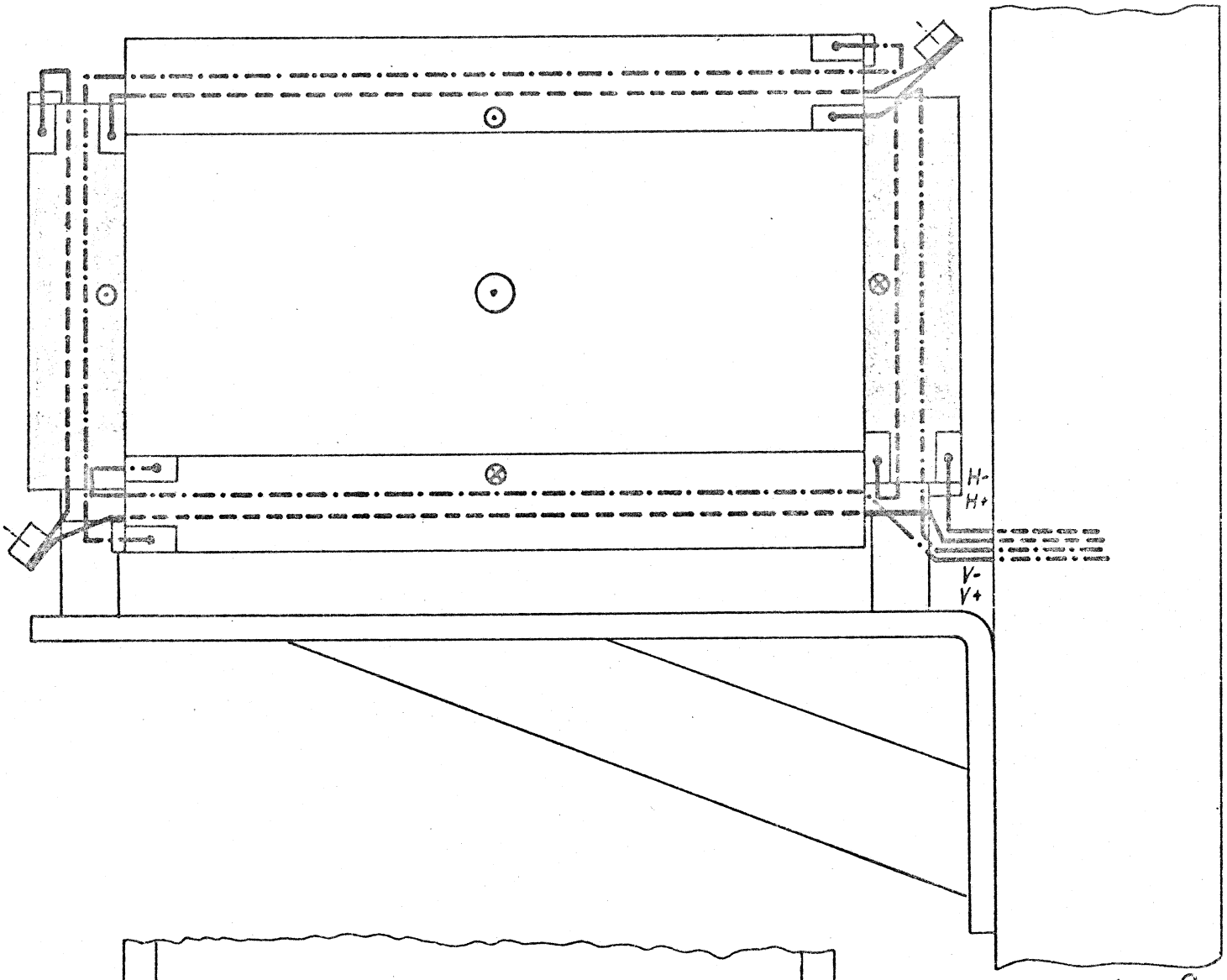
6 bobines séries.

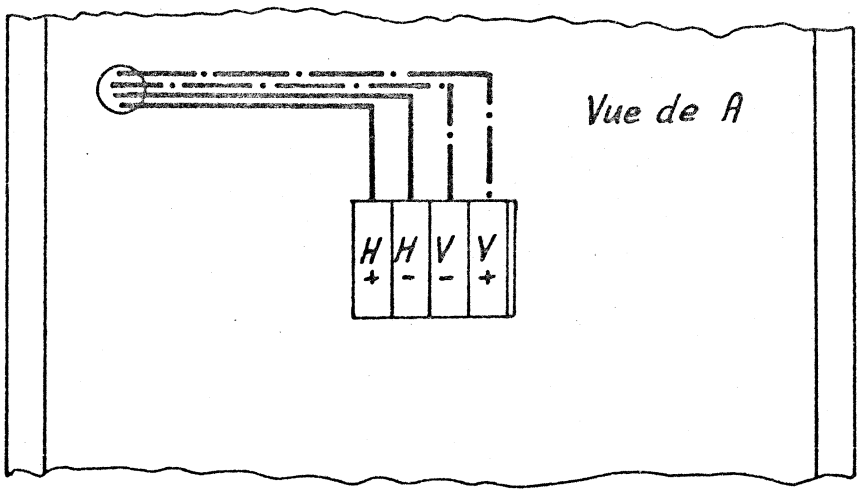
Dipôle Vertical.

6 bobines séries

SI.1.04_1008.4a MB

Fig.10 Câblage dipôles type 2





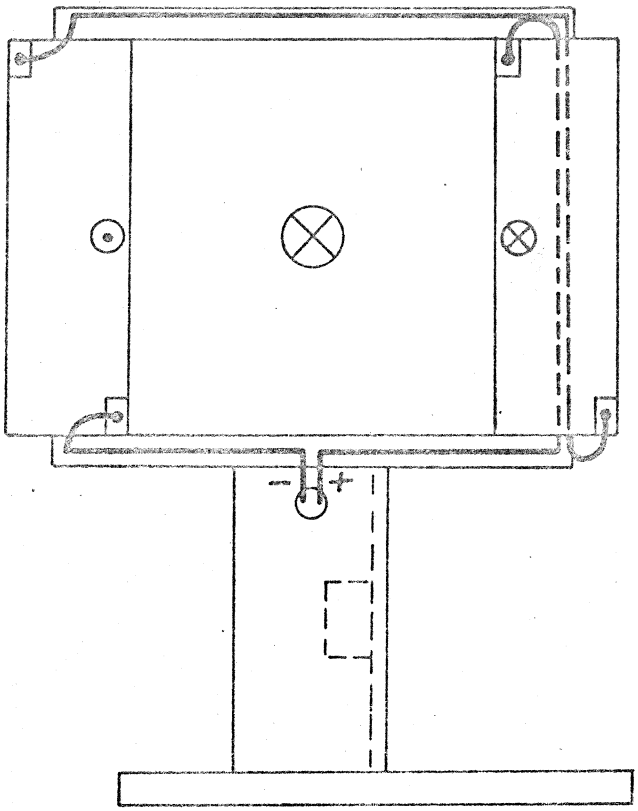
Dipôle Horizontal

2 bobines séries.

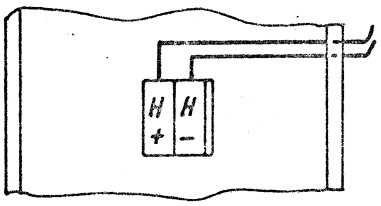
Dipôle Vertical.

2 bobines séries.

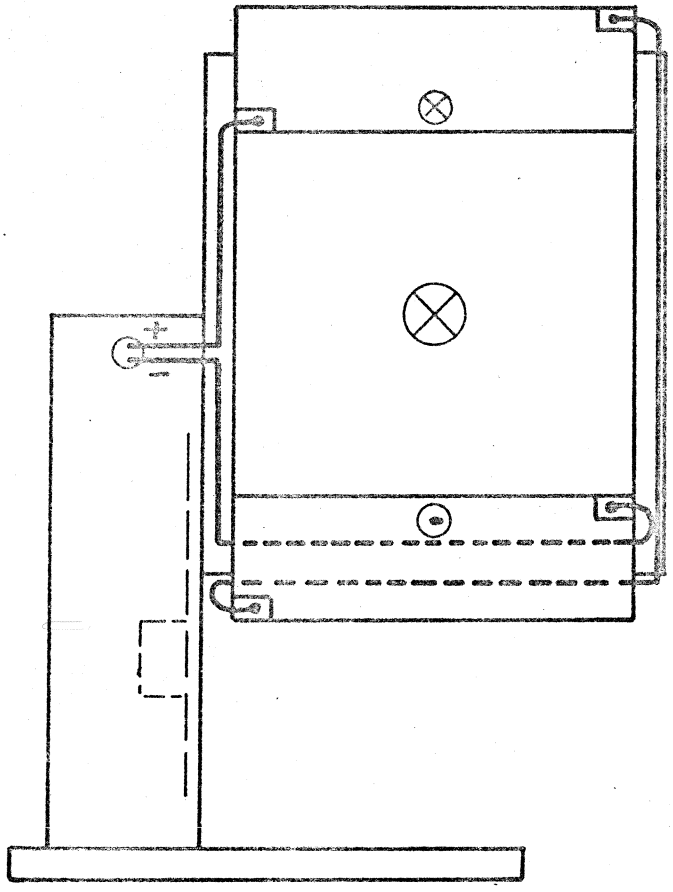
Fig. 11 Câblage dipôles type 3_4a_7



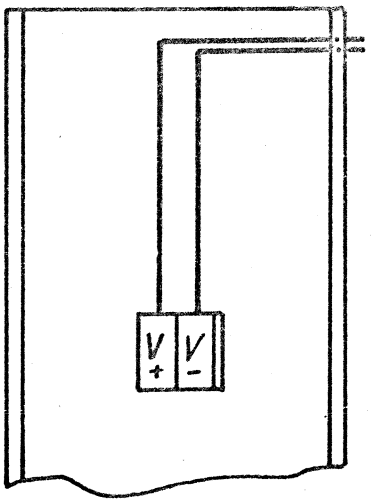
Horizontal



Dipôle vertical et horizontal
2 bobines séries

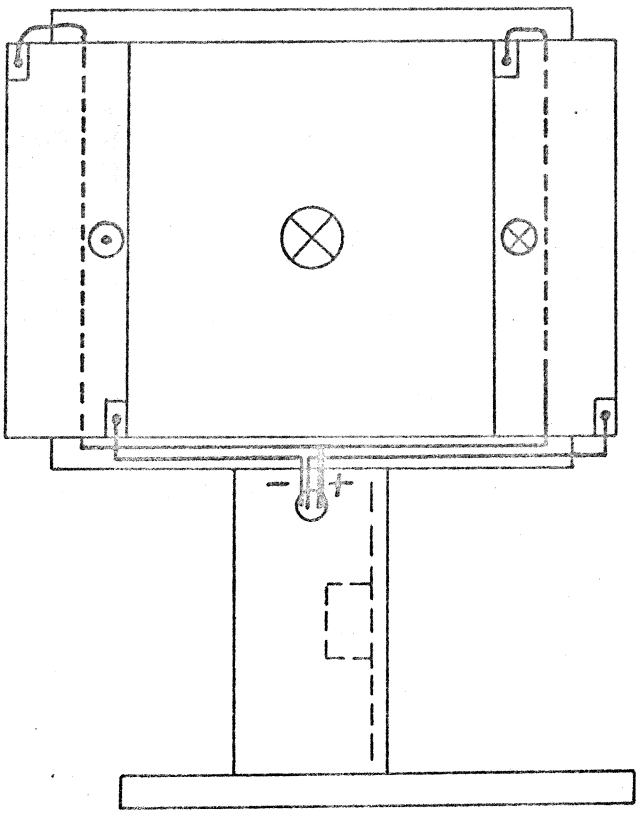


Vertical

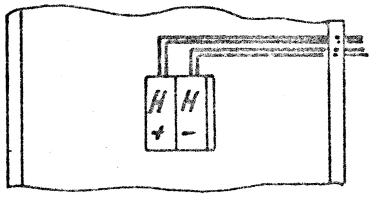


SI.1.04_1010_4a MB

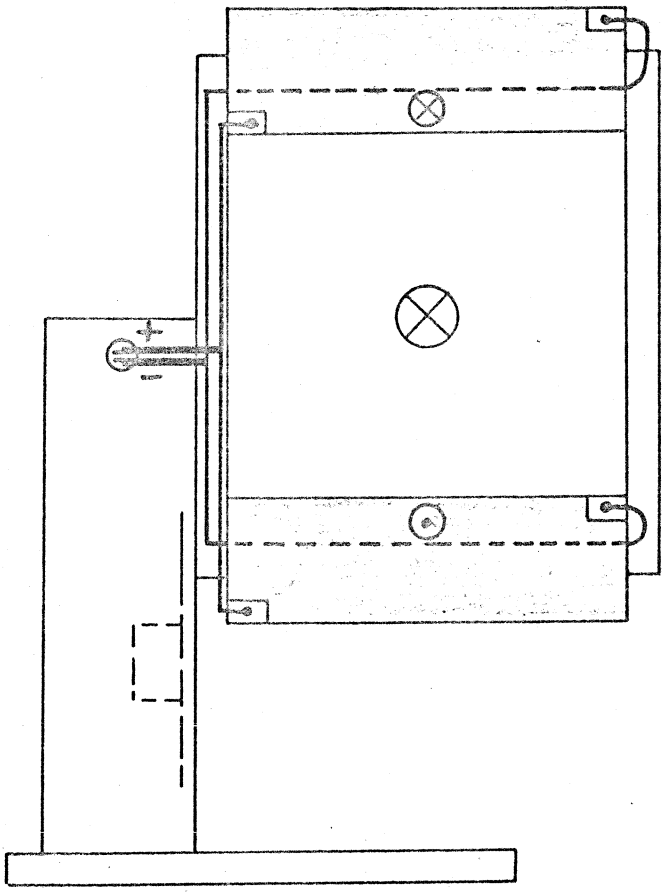
Fig.12 Câblage dipôles type 4b (avec refroidissement)



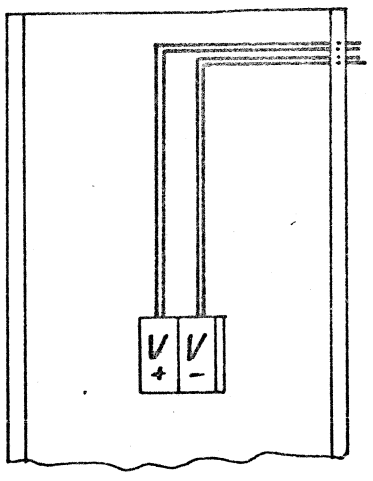
Horizontal



Dipôle vertical et horizontal
2 bobines parallèles

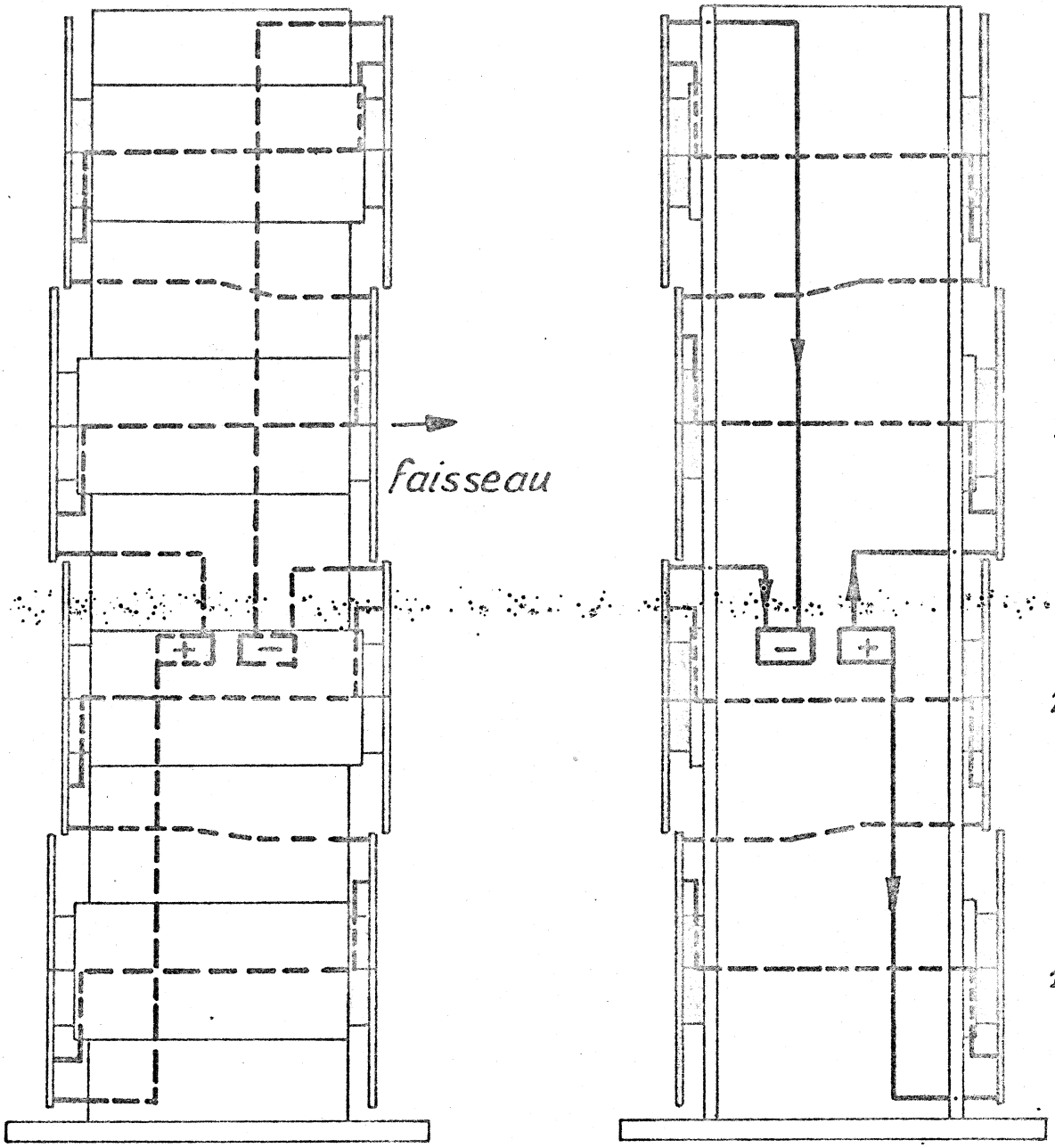


Vertical



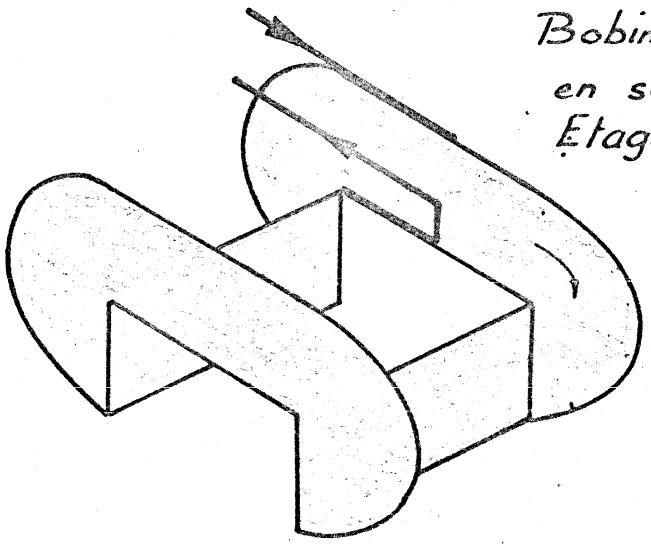
SI_1.04_1011_4a MB

Fig.13 Câblage dipôle type 5



vue de face

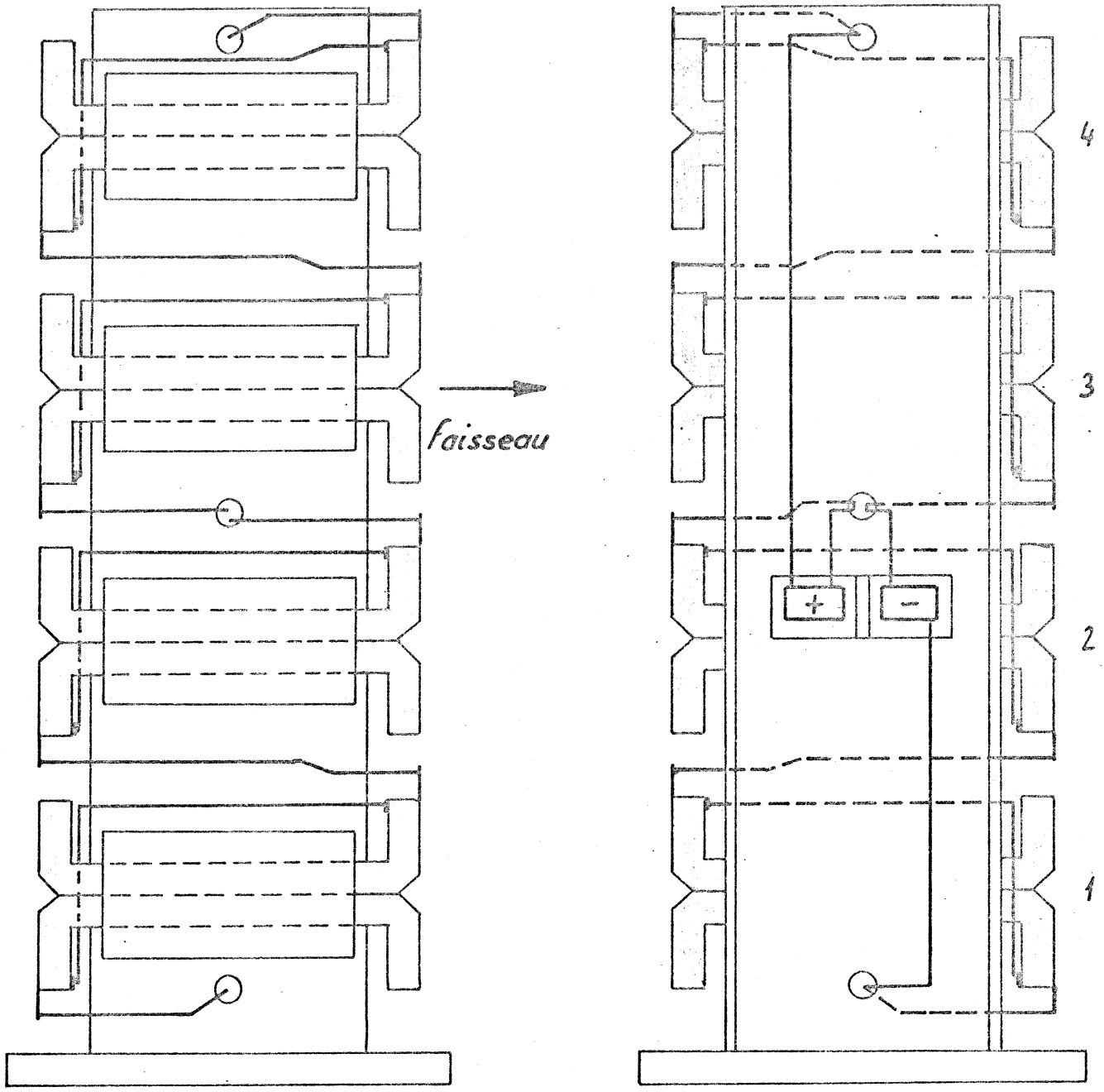
vue arrière



Bobines étages 1_2 étages 3_4
en série
Etages 1_2 ; 3_4 en parallèle

SI.1.04.1012.4a MB

Fig.14 Câblage dipôle type 6



Vue de face

Vue arrière

Bobines étages: 1_2 ; 3_4 en série

étages: 1_2 ; 3_4 en parallèle

SI.1.04.1013.4a MB

4. LIST OF CONSTRUCTION DRAWINGS

LIST OF SPARE UNITS AND PARTS

CASTING FORMS

LIST OF DRAWINGS FOR THE DIPOLES

TYPE 1 :

Fig. 1	SI.1.43.1000.0	Ensemble
" 2	SI.1.43.1001.2	Support vertical
" 3	SI.1.43.1002.2	Plaque de base
" 4	SI.1.43.1063.3	Equerre de support
" 5	SI.1.43.1004.1	Iron core (sous-ensemble)
" 6	SI.1.43.1005.2	End plate
" 6a	SI.1.43.1058.3	Lamination
" 7	SI.1.43.1059.3	Foot for iron core
" 9	SI.1.43.1008.2	Plaque de base en 14L1
" 10	SI.1.43.1009.3	Schematic of coil
" 10a	SI.1.43.1057.3	Schematic of coil
" 11	SI.1.43.1006.2	Plaque d'alignement
" 12	SI.1.43.1003.2	Barre de levage

TYPE 2 :

Fig.13	SI.1.43.1012.0	Ensemble
" 14	SI.1.43.1013.2	Support vertical
" 15	SI.1.43.1014.2	Plaque de base
" 16	SI.1.43.1066.3	Equerre de support
" 16a	SI.1.43.1067.3	Plaque
" 17	SI.1.43.1016.1	Iron core (ensemble)
" 18	SI.1.43.1017.2	End plates
" 18a	SI.1.43.1060.3	Lamination
" 19	SI.1.43.1061.3	Foot for iron core
" 22	SI.1.43.1021.3	Schematic of coil

OTHER DRAWINGS ALSO VALID FOR TYPE 2 :

Fig.2	SI.1.43.1001.2, Pos. 2	Suppo t de niveau
" 11	SI.1.43.1006.2	Plaque d'alignement
" 12	SI.1.43.1003.2	Barre de levage

TYPE 3 :

Fig. 56	SI.1.74.1012.1	Ensemble
" 57	SI.1.74.1013.2	Support vertical
" 58	SI.1.74.1014.2	Plaque de base

OTHER DRAWINGS ALSO VALID FOR TYPE 3 :

Fig. 2	SI.1.43.1001.2, Pos. 2	Support de niveau
" 12	SI.1.43.1003.2	Barre de levage
" 50	SI.1.74.1006.3	Schematic of coil
" 54	SI.1.74.1010.3	Iron core (ensemble)
" 55	SI.1.74.1011.2	Iron core (details)

TYPES 4a, 4b, 7 AND 8 :

Fig. 44	SI.1.74.1000.1	Ensemble 4a, 4b, 7 et 8
" 45	SI.1.74.1001.1	Plaque de base DV 4a et 4b
" 46	SI.1.74.1002.2	Plaque de base 7
" 47	SI.1.74.1003.3	Iron core (ensemble) 4 b
" 47a	SI.1.74.1020.3	Pipe clamp 4b and 7
" 48	SI.1.74.1004.2	Iron core (details) 4b
" 49	SI.1.74.1021.3	Support vertical DV 4a, 4b et 7
" 50	SI.1.74.1006.3	Schematic of coil 4a, 4b and 8
" 51	SI.1.74.1022.2	Plaque de base 4a, 4b et 8
" 52	SI.1.74.1023.3	Support vertical DH 4a, 4b et 8
" 53	SI.1.74.1024.3	Plaque DH 4a, 4b et 8
" 54	SI.1.74.1010.3	Iron core (ensemble) 4a et 8
" 55	SI.1.74.1011.2	Iron details 4a and 8
" 62	SI.1.74.1018.3	Iron core (ensemble) 7
" 63	SI.1.74.1019.2	Iron core (details) 7

OTHER DRAWING ALSO VALID FOR TYPES 4a, 4b, 7 AND 8 :

Fig. 22	SI.1.43.1021.3, Pos. 1	Coil for 7

TYPE 5 :

Fig. 34	SI.1.43.1033.0	Ensemble
" 35	SI.1.43.1064.3	Equerre de support
" 35a	SI.1.43.1065.3	Equerre de support
" 36	SI.1.43.1035.2	Plaque de base
" 37	SI.1.43.1036.1	Iron core (ensemble)
" 38	SI.1.43.1062.3	Foot for iron core
" 38a	SI.1.43.1037.3	Barres
" 41	SI.1.43.1040.3	Schematic of coil

OTHER DRAWINGS ALSO VALID FOR TYPE 5 :

Fig. 2	SI.1.43.1001.2	Support vertical
" 6	SI.1.43.1005.2	End plates
" 6a	SI.1.43.1058.3	Lamination
" 11	SI.1.43.1006.2	Plaque d'alignement
" 12	SI.1.43.1003.2	Barre de levage

TYPE 6 :

Fig. 24	SI.1.43.1023.0	Ensemble
" 25	SI.1.43.1024.2	Support vertical
" 27	SI.1.43.1026.2	Iron core (ensemble)
" 28	SI.1.43.1027.3	Lamination and end plate
" 29	SI.1.43.1028.3	Back plate
" 30	SI.1.43.1029.3	Gap closing plate
" 31	SI.1.43.1032.4	Barre
" 33	SI.1.43.1031.3	Schematic of coil

OTHER DRAWINGS ALSO VALID FOR TYPE 6 :

Fig. 3	SI.1.43.1002.2	Plaque de base
" 11	SI.1.43.1006.2	Plaque d'alignement
" 12	SI.1.43.1003.2	Barre de levage

SPARE UNITS AND PARTS

Type 1 : 1 complete unit
15 coils 1/1
13 coils 1/3 left hand
12 coils 1/3 right hand

(1 dipole consists of 4 x 1/1 and 2 x 1/3 left and 2 x 1/3 right)

Remark : The dipole in 13L4 is powered by a special power supply (modified KEPCO). A spare supply for horizontal and a spare supply for vertical deflection are in stock.

Type 2 : 2 coils 2/1
1 coil 2/2

Types 3, 4a, 7 : 1 unit for horizontal deflection

Type 4b : 1 unit for vertical deflection

(By turning the dipole by 90 ^{o} and using the corresponding support, each of the 2 types can be made horizontal or vertical deflecting).

Type 5 : 4 coils

Type 6 : 5 coils

CASTING FORMS

One casting form for all types of coils is in stock. In addition, a winding core for every coil is available.

Distribution (open) :

A. Arn
A. Ašner
M. Battiaz
P. Bossard
M. Derosiaux
R. Gailloud
L. Guerrero
F.H. James
M. Métais
K.H. Reich
G. Suberlucq
J. Vlogaert
F. Völker