

Geophysics

A EQUIPMENT

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The Ω mega resistivity meter was developed by ACF in collaboration with the association Aquifer. It meets most of requirements for electric geophysical exploration (DC), with a number of features that are useful in the conditions typical of humanitarian missions: ability to use different power sources (internal battery, external 12 V battery, 220 V generator set, batteries in series up to 400V), ability to recharge internal battery from external 12-V battery or a 220 V AC source. The purchase price of the ACF kit is about 4 500 €, including the complete resistivity meter, two 400-m spools (AB), two 200-m spools (MN), a compass, two 50-m tape measures, transparent log-log paper, and Caniard nomograms.

The compromise between weight, price and performance allows exploration to depths of 60 or 70 m in resistant areas (bedrock with weathering products and cover, for example), and down to 40 or 50 m in more conductive formations (clayey sedimentary formations, for example). When conditions need high power (very conductive environments, large depths), it is necessary to use equipment that is more powerful (800V, 400 W), and much more expensive.

1 Resistivity-measurement instructions

1) Choose MEASURE on the FUNCTION selector: the measurement devices light up.

2) Choose the power source with the POWER selector:

- internal battery
- 12 V external battery
- 230 V AC
- DC source: 400 V maximum.

3) Connect spools A-B and M-N:



4) Choose the injection voltage with the button VOLT AB:

- 25 V
- 50 V
- 100 V
- 200 V
- 400 V

5) Press MEASURE to inject the current. Wait for 3-4 seconds until the values indicated by the measurement devices stabilize, and lock the displayed values using the HOLD button.

Notes

- Values of I and V read on the measurement devices are never completely stable: after a few seconds of injection, values decrease together. The HOLD button freezes the measurements to facilitate simultaneous reading of the measured values.
- Start the injection below 25 V (selector VOLT AB). For maximum accuracy in measurements, increase the voltage when indicated values of V are lower than 10 mV.
- When the injection button (MEASURE) is released, a short beep can be heard. This means that everything is normal. If this beep occurs during injection, i.e. when the MEASURE button is pressed, this indicates:
 - the battery is flat and needs to be recharged;
 - or that the injection voltage is too high (power of the device is insufficient): take another measurement using a lower voltage, e.g. 200 V instead of 400 V.

2 Internal battery charging instructions

- 1) Set the FUNCTION button to INT. BATT. CHARGE.
- 2) Set the POWER button to the available power source:
 - MAIN 230V or
 - 12 V EXT.BAT.
- 3) Connect the chosen source to the case with clamps or power connectors: the green pilot lamp lights up. Then there are two possible charge programmes:
 - A. If you have less than 18 hours to recharge the internal battery: leave the case as it is after operations 1, 2, and 3 (do not press START). In this case, the battery is charged to 1/28 of its capacity per hour, that is to say, about 30% of its capacity in one night.
 - B. If you have 18 hours or more, press START. The green pilot lamp goes out, and the following cycle begins:
 - discharging the battery: the red pilot lamp lights up, and goes out when discharge is complete (depending on the remaining capacity of the battery, the duration of this discharge operation varies between several minutes and four hours);
 - recharge for 14 hours: as soon as the red pilot lamp goes out, the charging cycle begins. When charging is complete, the green pilot lamp lights up again. The battery is then completely charged.

Notes

- A charge-cycle B which has already started must never be interrupted before the green pilot lamp lights up again: as the cycle starts with a discharge, there is a risk of discharging the battery without having time to recharge it again.
- In the event of a power failure during the A or B charging process, the cycle restarts automatically at the point where it stopped, as long as no control buttons have been touched.
- In order to stop a cycle (if you have pressed START accidentally), set the FUNCTION button on OFF for one minute, and then restart charge A.
- If the battery has been completely discharged, the charge-cycle B cannot start at all (the green pilot lamp does not go out). It is then necessary to charge the battery for one hour on cycle A, and then to revert to cycle B while pressing START.

3 Technical characteristics

Internal battery

- Ni mH (metallic Nickel Hydroxide) 12 V and 7 Ah (i.e., 0.7 A for 10 hours, and up to a maximum of 30 A for short bursts).
- Number of possible measurements with the internal battery completely charged: from 150 to 1 000.

Converter (DC/AC)

- Power = 150 W.

Transformer

- Power = 75 W (220V and 0.35 A, efficiency 90%).
- 25 V / 3 A.
- 50 V / 1.5 A.
- 100 V / 0.75 A.
- 200 V / 370 mA.
- 400 V / 185 mA.

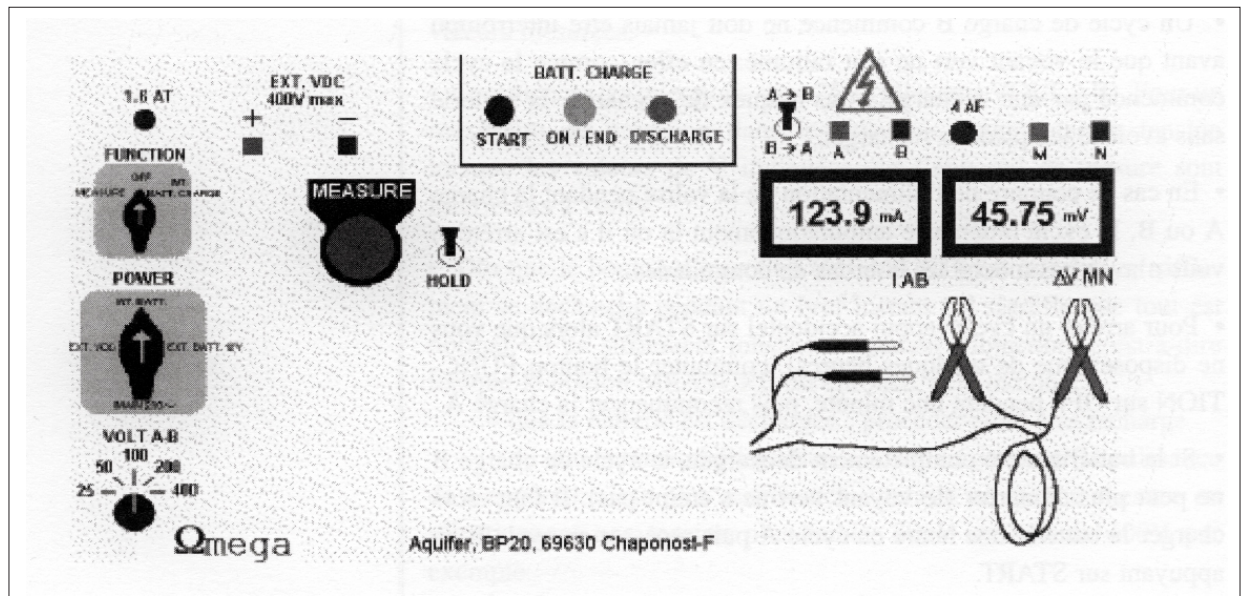
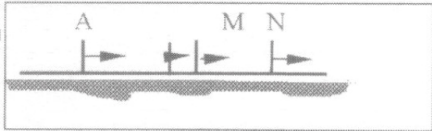


Figure 1: Front of the Ω mega resistivity meter.

B ELECTRICAL SUMMARY FILES

RESISTIVITY PROFILING FILE

Resistivity profiling Array: Schlumberger	Date: Reference :	Location : X: Y: Z:
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Resistivity $\rho_a = K \times \Delta V / I$
 $K = \pi \times (AM \times AN) / (MN)$
 AB = 200
 MN = 20
 K = 1555

Observation - Sketch

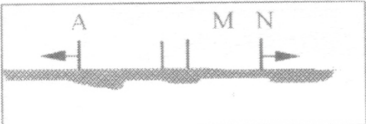
Profile n° : _____ **Direction of profile : N** _____

point	ΔV (mV)	I (mA)	ρ_a (ohm/m)
0			
10			
20			
30			
40			
50			
60			
70			
80			
90			
100			
110			
120			
130			
140			
150			
160			
170			
180			
190			
200			

point	ΔV (mV)	I (mA)	ρ_a (ohm/m)
210			
220			
230			
240			
250			
270			
280			
290			
300			
310			
320			
330			
340			
350			
360			
370			
380			
390			
400			
410			
420			

RESISTIVITY SOUNDING FILE

Resistivity sounding		Date:	Location :	
Array:	Schlumberger	Reference:	X:	Y: Z:

 Resistivity $\rho_a = K \times \Delta V / I$ $K = \pi \times (AM \times AN) / (MN)$ AB max = MN overlaps =	Observation - Sketch
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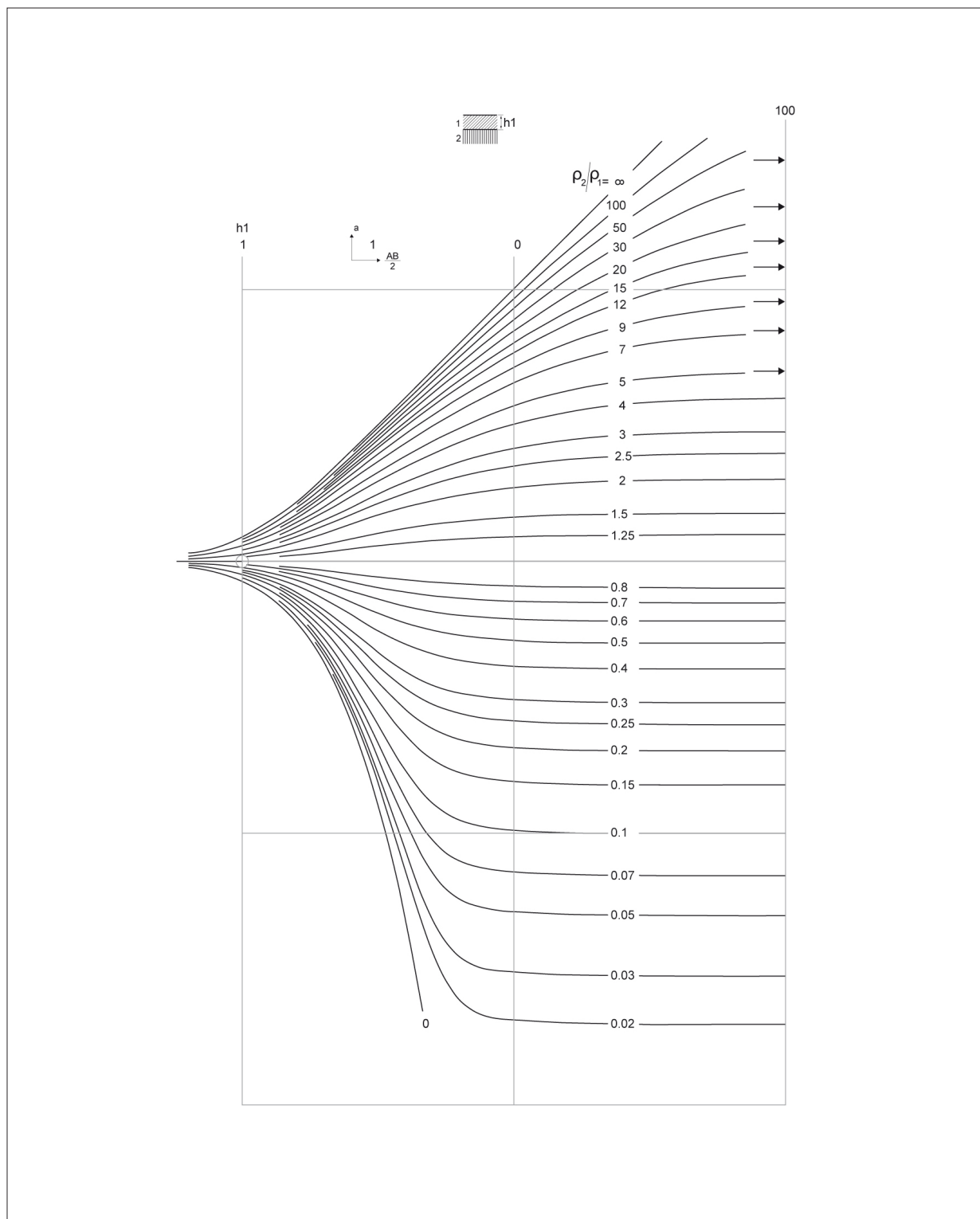
Sounding n° : _____ **Profile point:** _____ **Direction of sounding : N** _____

AB/2	MN=2	MN=10	MN=40	ΔV (mV)	I (mA)	ρ_a	hm - m
2	4,71						
3	12,5						
4	23,5						
5	37,7						
6	55						
8	99						
10	155						
15	352	62,8					
20	627	118					
25	980	188					
30	1412	275					
35	1922	377					
40	2511	495					
50	3925	780					
60	5653	1120					
70		1530					
80		2000	471				
100		3130	754				
120		4900	1100				
150		7050	1736				
175			2374				
200			3110				

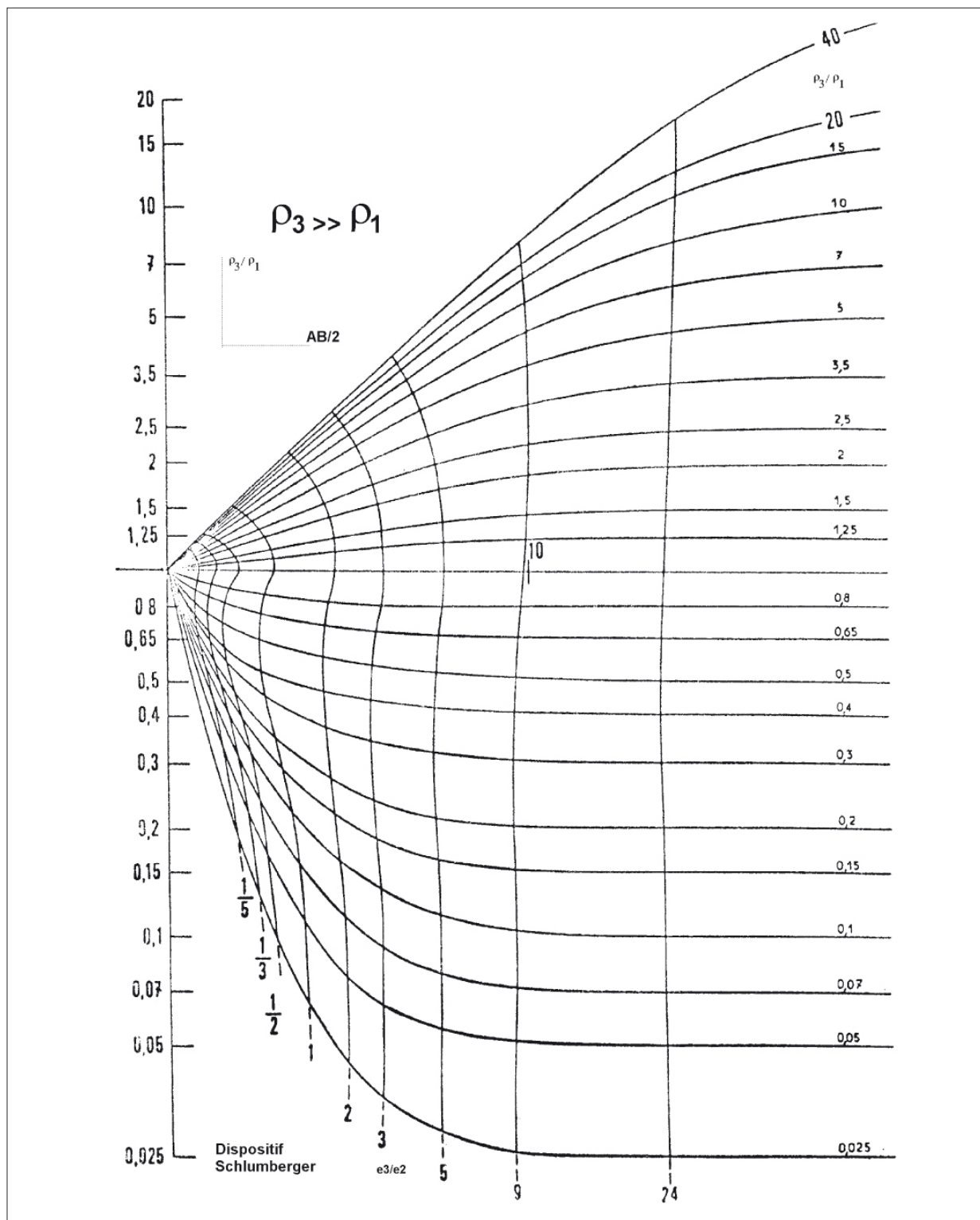
C NOMOGRAMS

NOMOGRAMS FOR INTERPRETATION OF SCHLUMBERGER ELECTRICAL SOUNDING

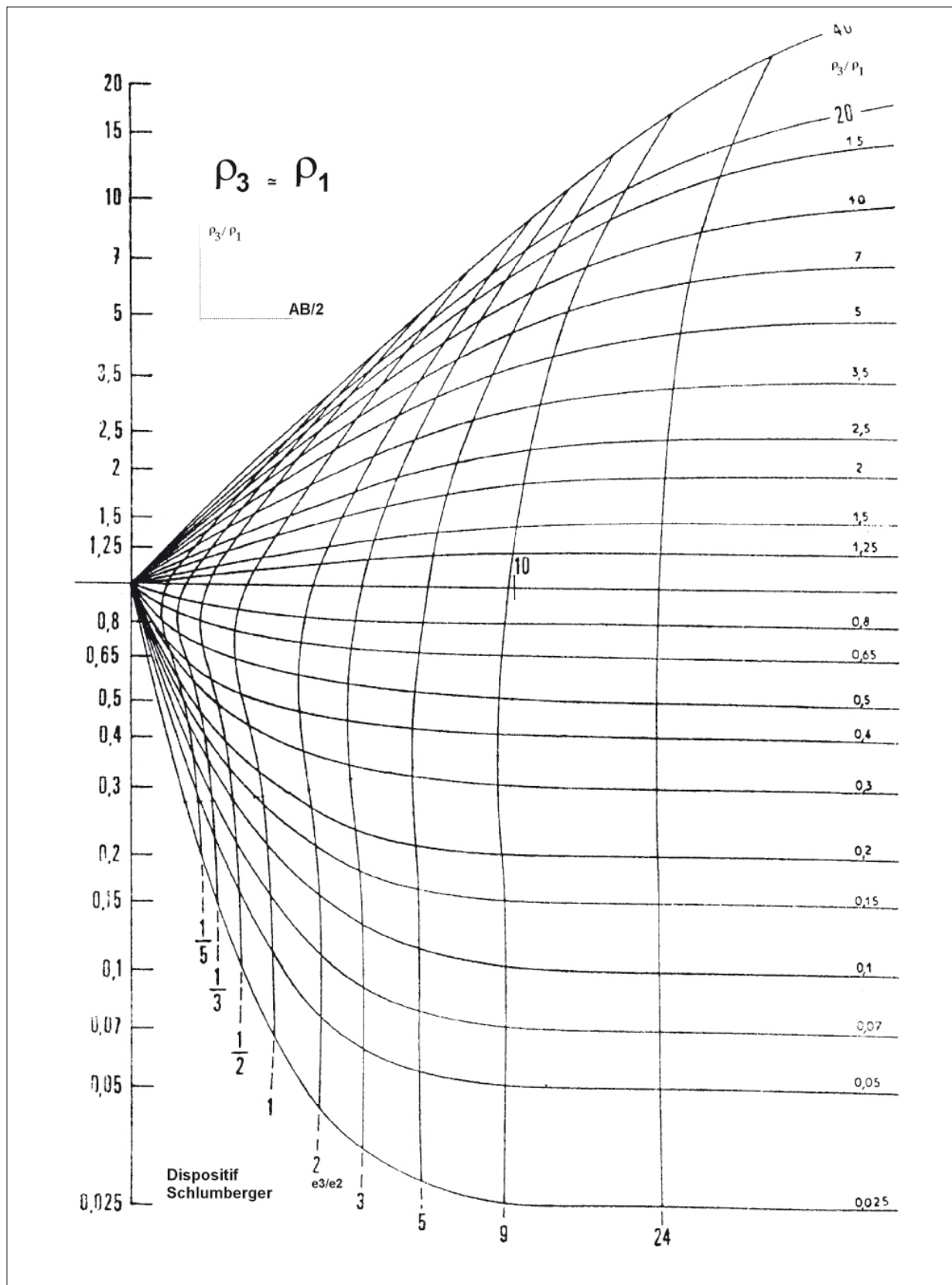
TWO-FORMATION NOMOGRAM



AUXILIARY NOMOGRAM ($\rho_3 \gg \rho_1$)



AUXILIARY NOMOGRAM ($\rho_3 = \rho_1$)



AUXILIARY NOMOGRAM ($\rho_3 \ll \rho_1$)

