

APPENDIX H
TEST EQUIPMENT AND CIRCUITS FOR
SHOWERING ARC TEST
(see Clause 8.3.5.6)

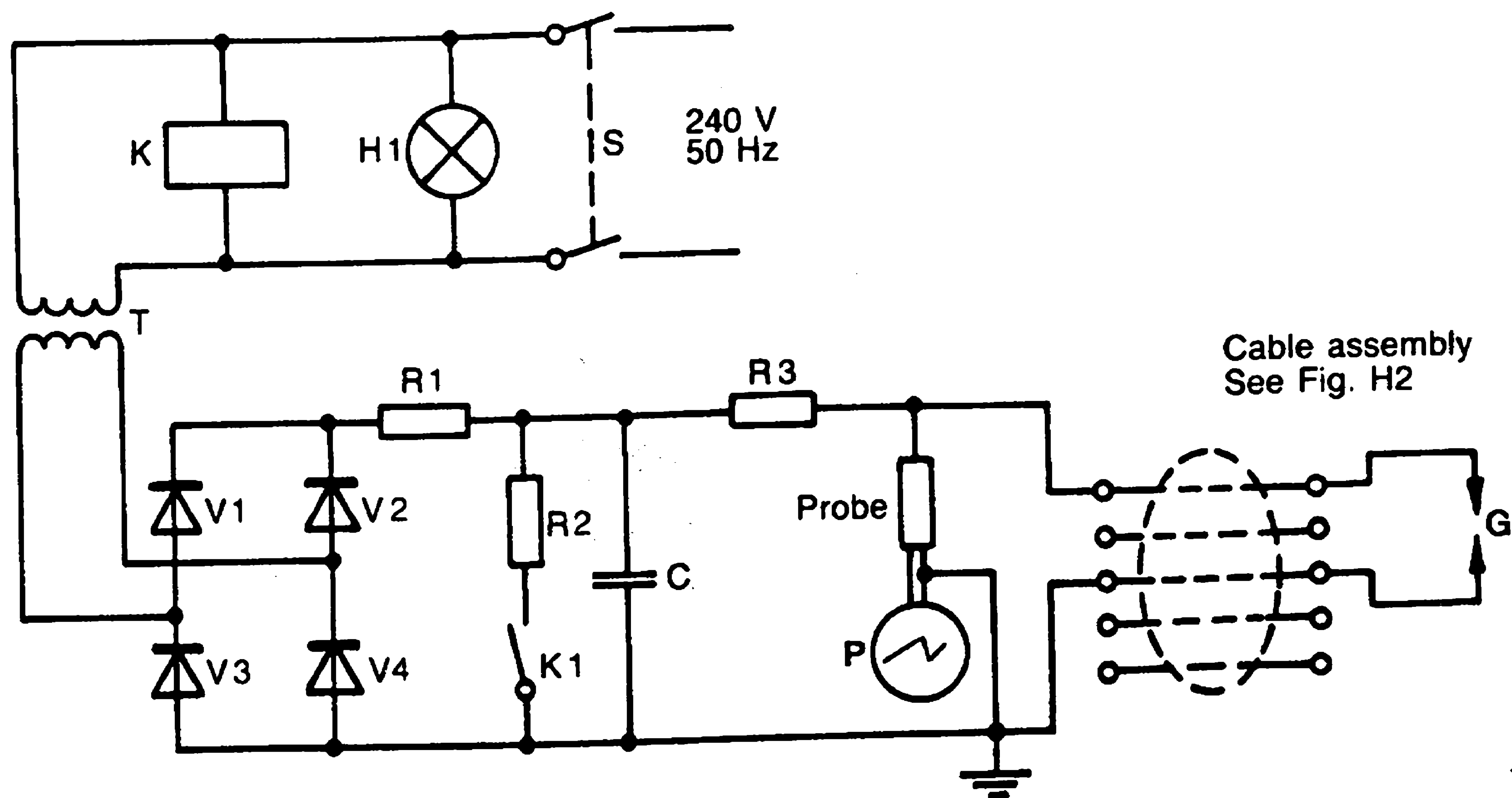
H1 TEST EQUIPMENT. An electrical noise generator shall be used as shown in Fig. H1. A coupling cable assembly used to couple the generated noise into the starter circuit under test is shown in Fig. H2 and the arrangement and connection of the wires within the cable is shown in Fig. H3. Alternative types of cables may be used which give an equivalent performance.

The direct output of the noise generator is monitored by oscilloscope P through the probe (voltage divider) as shown in Fig. H1. A typical display of the oscilloscope is shown in Fig. H4.

NOTE: The details of the coupling cable assembly in Figs H2 and H3 are as shown in IEC 158-2.

H2 CALIBRATION OF TEST EQUIPMENT. In order to have a reproducible test, it is necessary to calibrate the output of the coupling cable assembly. This is done by selecting the proper pairs of wires to be used as the input and output of the cable assembly. This should be accomplished as follows:

- (a) Connect the test circuit to the terminals as shown in Fig. H5. Adjust the noise generator by means of the spark gap G to produce 1000-volt transients similar to the display shown in Fig. H4. After setting the noise generator, make an oscilloscope measurement of the output of the cable assembly as shown in Figs H5 and H6. This provides a measure of the peak current and the maximum slope of the current in the leading and trailing edges of the first current pulse of the oscillation caused by each showering arc transient.
- (b) If the measurements are not within the tolerances shown in Fig. H6, select another adjacent wire pair, e.g. instead of wires 2-2A and 4-4A try 7-7A and 8-8A. If no such combination will produce the desired result, it is recommended that another pair of wires be used for the input instead of wires 1-1A and 3-3A and the above test procedure be repeated, with wires adjacent to these wires being used for the output.
- (c) Having established the pairs of wires which give an output within the calibration shown in Fig. H6, the test apparatus is ready for use in the test specified in Clause 8.3.5.6.

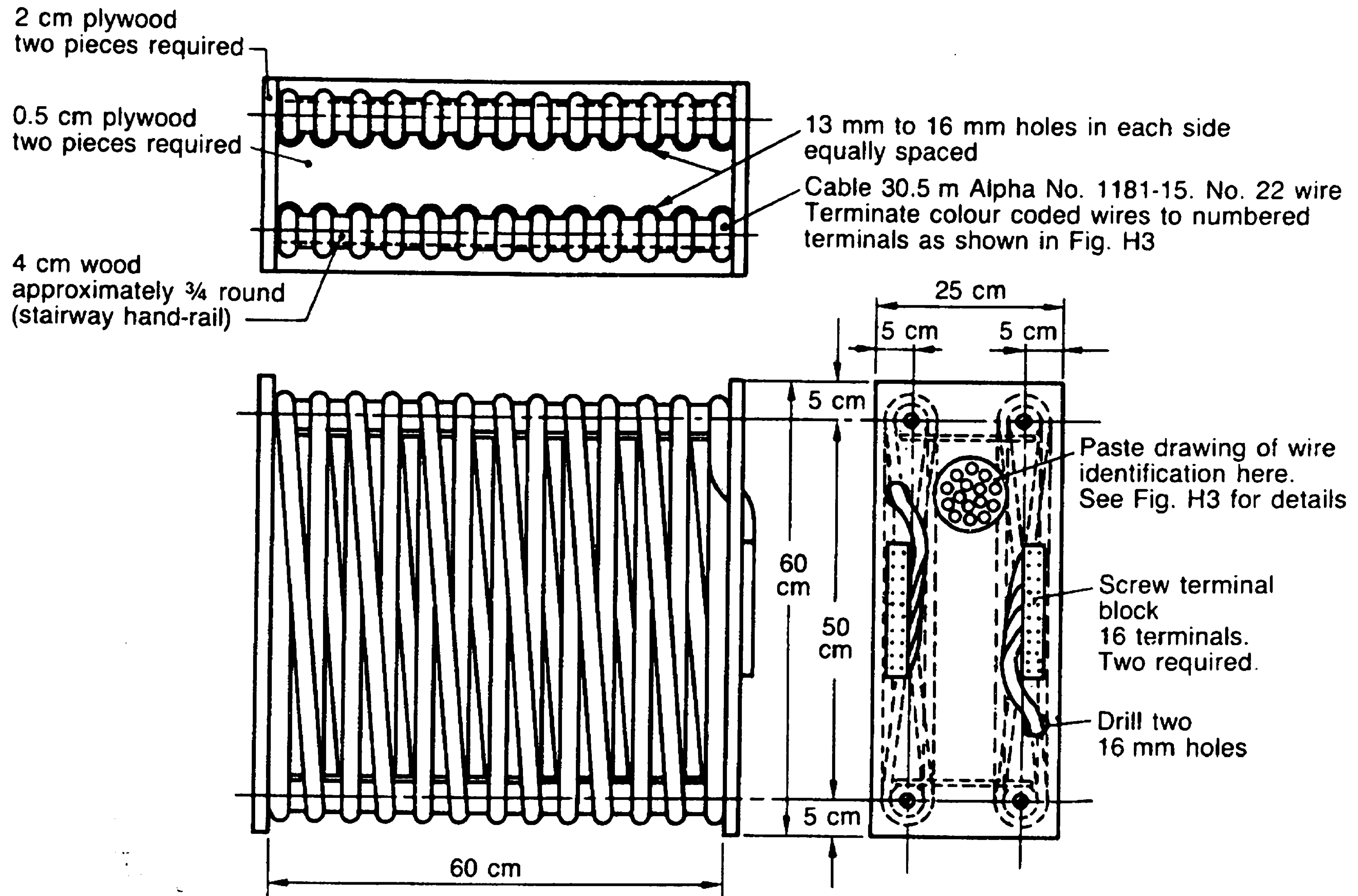


K	= 240 V, 50 Hz relay with normally closed contacts (K1)
T	= transformer approximately 100 VA, 240 V primary, 3000 V secondary
R1, R2	= 50 k Ω 20 W wirewound resistor
R3	= 300 k Ω , 30 W resistor
S	= ON-OFF switch
H1	= red warning lamp
V1, V2, V3, V4	= 10 kV, 25 mA silicon diodes
C	= 1.0 μ F, 5 kV capacitor
P	= oscilloscope (100 kHz or greater upper bandwidth limit)
Probe	= oscilloscope probe
G	= stationary tungsten contacts (automobile ignition breaker point set with insulated lever attached. Lever provides 2:1 motion reduction so that 2.5 mm motion provided by micrometer screw results in gap adjustment from 0 to 1.25 mm)

NOTE: Contacts should be clean (degreased) to prevent glow discharge.

CAUTION: The voltages and power available may be dangerous to human life. The equipment must be handled with care. The red pilot light warns of the danger. The relay contacts provide a rapid discharge path for capacitor C when S is opened.

Fig. H1. ELECTRICAL NOISE GENERATOR SCHEMATIC DIAGRAM AND PARTS LIST



NOTE: Assemble frame with wood screws and glue. Finish with two coats of shellac and then mount cable.

Fig. H2. CABLE ASSEMBLY FOR COUPLING NOISE INTO SIGNAL AND POWER CIRCUITS

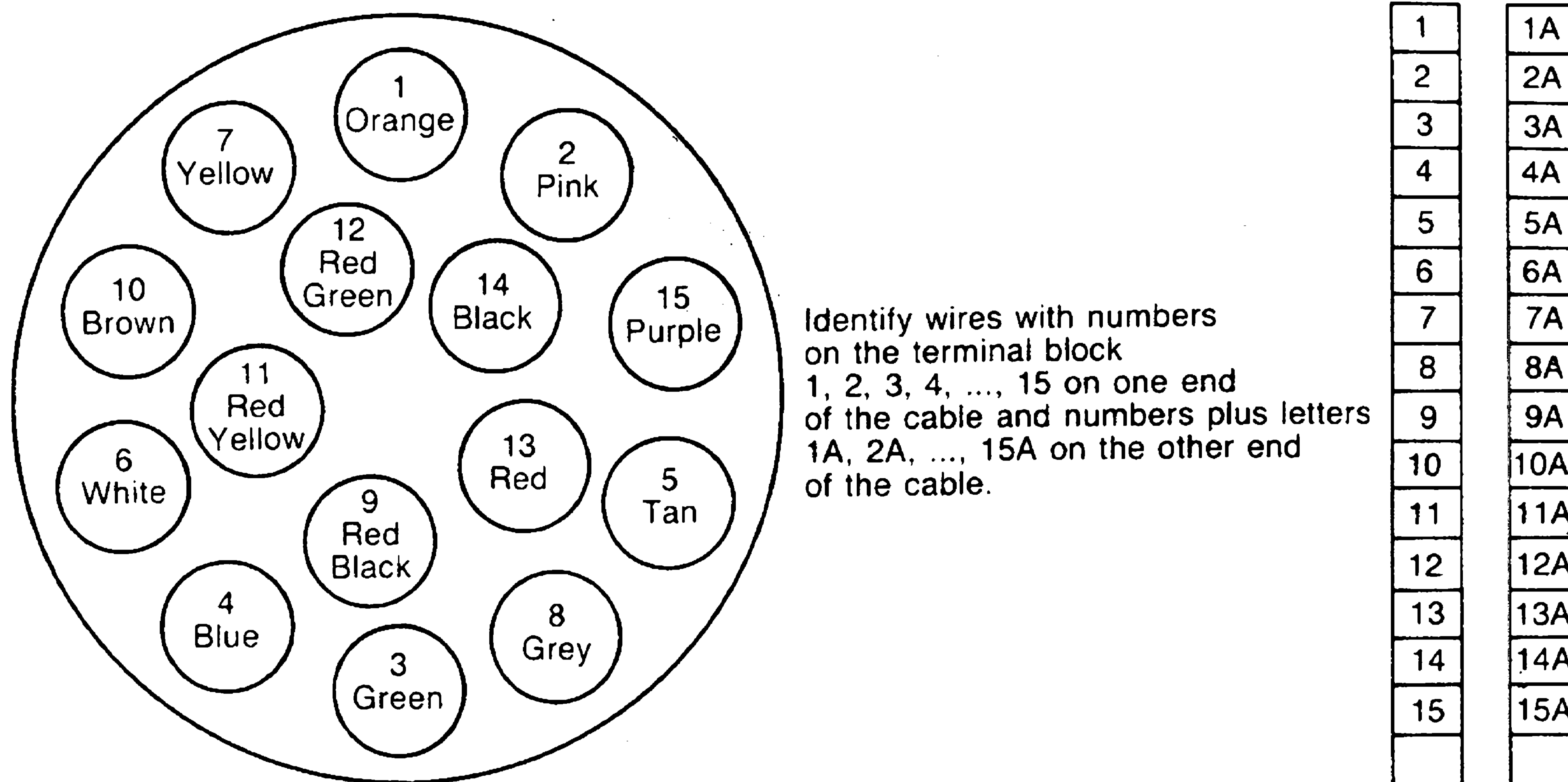


Fig. H3. CONDUCTOR ARRANGEMENT—ALPHA No 1181-15
CABLE (No 22 WIRE)

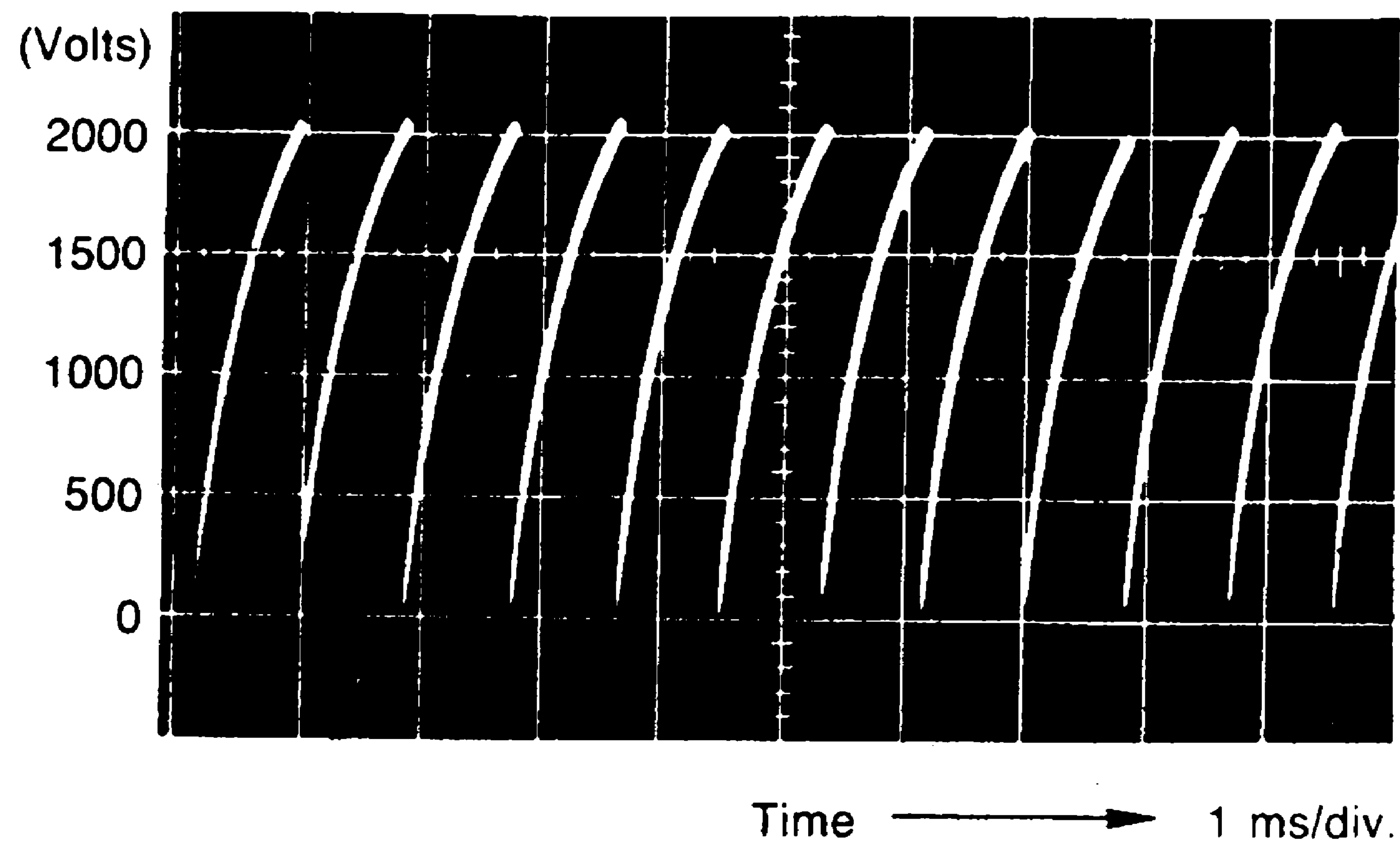
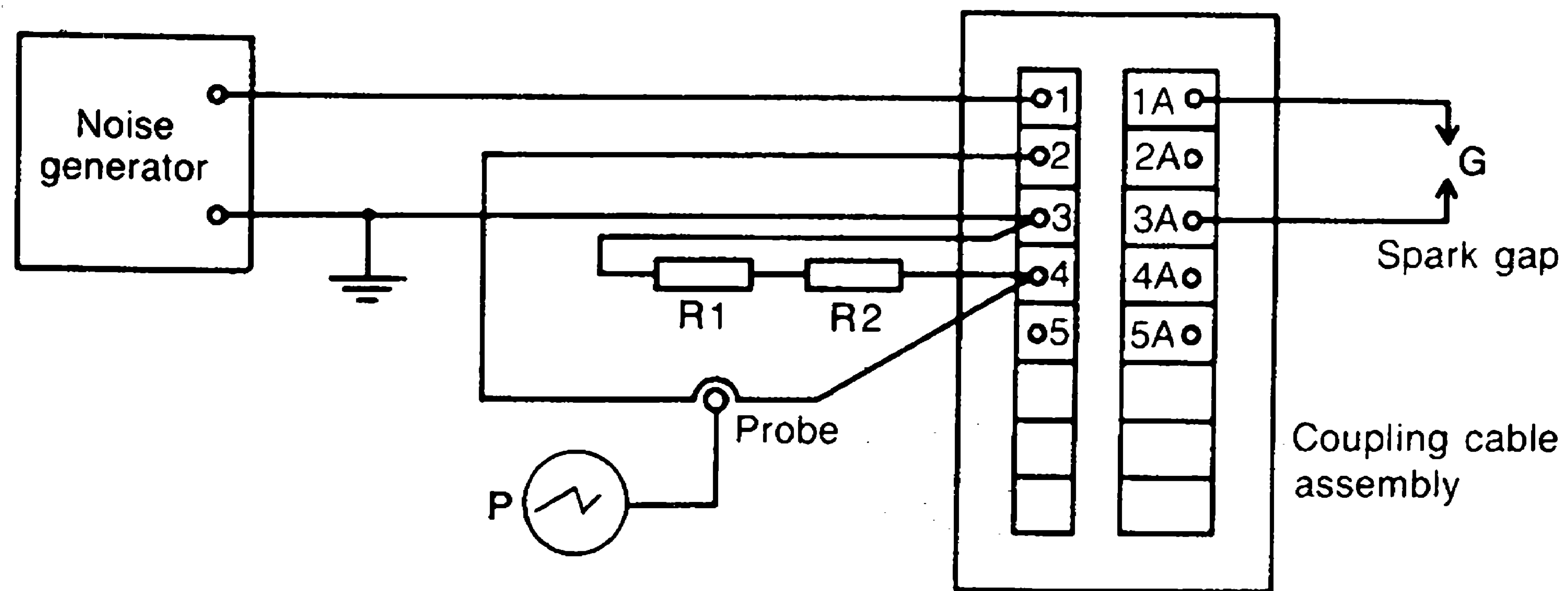
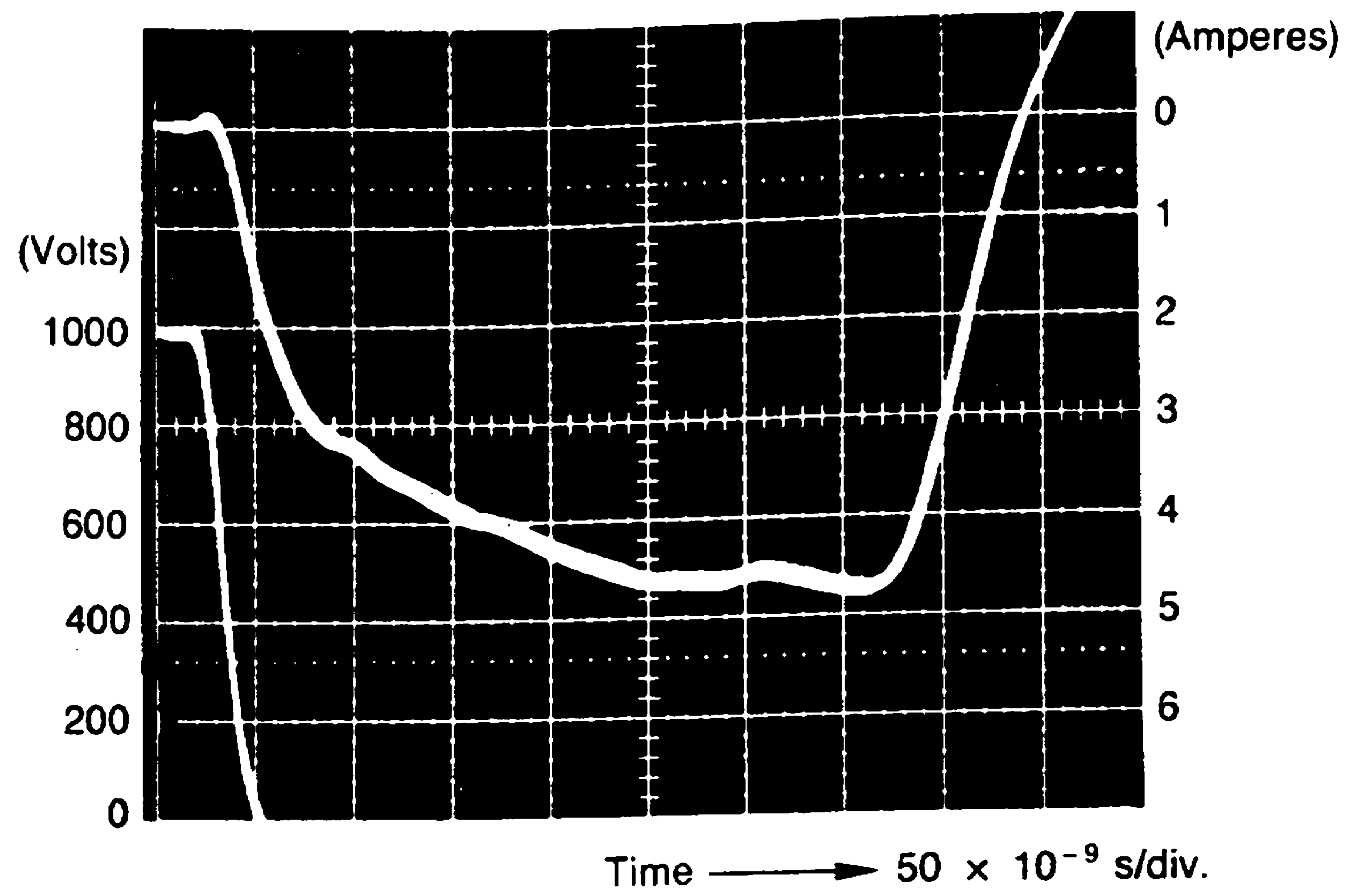


Fig. H4. TYPICAL OSCILLOGRAM OF VOLTAGE WAVE FORM PRODUCED BY SHOWERING ARC ELECTRIC NOISE GENERATOR



R1, R2 = $270 \pm 10\%$ k Ω carbon resistor
 Probe = current probe for oscilloscope, 50 MHz or greater upper bandwidth limit
 P = oscilloscope, 50 MHz or greater upper bandwidth limit.

Fig. H5. CONNECTION DIAGRAM AND PARTS LIST FOR COUPLING CABLE ASSEMBLY STANDARDIZATION



Peak current = $4.80 \pm 10\%$ A
Leading edge maximum slope = $95.0 \times 10^6 \pm 20\%$ A/s
Trailing edge maximum slope = $80.0 \times 10^6 \pm 20\%$ A/s

Fig. H6. CURRENT PULSE OSCILLOGRAM FOR STANDARDIZING
COUPLING CABLE ASSEMBLY