

POST OFFICE TELECOMMUNICATIONS HEADQUARTERS

SPECIFICATION OF REQUIREMENTS

FOR

SELF-CONTAINED STROWGER-PULSING KEYPHONESTELEPHONE NOS. 755, 756, 758, 766CONTENTS

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1. GENERAL

1.1 Specification D 1000 shall be taken as forming part of this specification.

1.2 Manufacturers wishing to submit designs of keyphone to this specification must follow the procedure laid down by the Post Office in Specification S 1440 Open Issue. This covers such matters as submission of prototypes, component standards etc.

1.3 The Post Office will evaluate prototypes submitted to this specification, paying particular attention to the features listed in Appendix 3. The features marked with a * in Appendix 3 would not normally be tested by the Post Office on production items although the Quality Assurance Division of the Post Office is entitled to assess production items to all Clauses of this specification, at their discretion.

1.4 This specification states the requirements for self-contained 10 pps batteryless keyphones to enable push-button signalling facilities to be offered to loop/disconnect exchange subscribers without the need for special equipment at the exchange.

2. FACILITIES

2.1 Telephone 766 based on Telephone 2/722 shall be capable of completely replacing Telephone 2/722 without change to cabling, strapping and any other connexion on all relevant plan arrangements.

2.2 Telephone 756 based on Telephone 746 shall be capable of completely replacing Telephone 746, without change to cabling, strapping and any other connexion on all relevant plan arrangements.

2.3 Telephone 758 based on Telephone 740 shall be capable of completely replacing Telephone 740, without change to cabling, strapping and any other connexion on all relevant plan arrangements.

2.4 Telephone 755 is a wall mounted (inverted) version of Telephone 756 and shall meet the requirements of paragraph 2.2 above.

3. DEFINITIONS

I 3.1 Push Button Unit. The Push Button Unit is defined to comprise the keypad which converts button depressions into electrical information, and the sender which accepts this information and sends loop disconnect pulses to line. The sender also includes the power extraction circuitry.

4. CONSTRUCTION

4.1 General

I 4.1.1 The telephones shall be assembled in accordance with the relevant SM specifications.

I 4.1.2 The telephones shall be constructed in such a manner that no part of the push-button unit, or connecting wires shall foul the bell gongs, Bell 59 or 79 armature, gravity switch or any other spring-set operating mechanism.

4.1.3 The sender and keypad shall be readily replacable without the need to use a soldering iron. The keypad and sender shall be combined in a single replacable unit. A common push-button unit shall be used for Telephones 756, 758 and 755.

4.2 Telephone.

I 4.2.1 With the exception of the push-button unit, the telephone shall comply with the specification for the corresponding dial telephone and shall be electrically interchangeable with the corresponding dial telephone as listed below. The internal wiring of the telephone shall comply with Figure 1. The 6 wires from the PBU shall be colour coded in accordance with Figure 1. They shall be terminated on the transmission board using Tags 201A terminated as shown in Drawing 13/SD77. (Key to the colour code - O-Orange, BK-Black, BN-Brown, P-Pink, B-Blue, W-White.)

TELEPHONE	CORRESPONDING DIAL TELEPHONE	
	TELEPHONE	SPECIFICATION
766	2/722	S 1008
756, 755	746	S 1009
758	740	S 1009

I 4.2.2 The PBU shall use an approved version of the standard 22 Terminal Telephone Unit board including SG1 (Drawing D 93883 for the 755, 756 and 758). The use of telephone terminals T1-T19 shall remain unchanged. Terminals T11-T14 shall remain spare.

4.2.3 The telephones shall be capable of accepting at least the following add-on parts (Diagrams N 848 and N 849 refer).

4.2.3.1 Telephone 766

- 1 Switch 13A-2
- 1 Switch 19A-1
- 1 Thermistor 1A-1

4.2.3.2 Telephone 756 and 755

- 1 Buzzer 32C-3
- 2 Switches 5A-4 (or equivalent) or Switches 23A-4
- 1 Switch 19D-1
- 1 Thermistor 1A-1
- 2 Parts 2/DST/836
- 1 Capacitor 7712-2 with Clip 90
- 1 Button DBU/362
- or 2 Buttons DBU/363
- Lamp Signalling Units 1 and 2

4.2.3.3 Telephone 758

- 1 Buzzer 32C-3
- 1-4 Switches 5A-4 in Positions ABC and D or Switches 23A-4
- 1 Switch 19D-1
- 1 Thermistor 1A-1
- 2 Parts 2/DST/836
- or 1 Strips Connexion 155A
- 1 Capacitor 7712-2 with Clip 90
- 1-4 Buttons DBU/372
- 2 Lamp Fittings 16A
- 1 Switch Composite D 93313
- Lamp Signalling Units 1 and 2

4.2.4 It shall be possible to fit and remove the push-button unit when all of the parts referred to in 4.2.3 are fitted.

I 4.2.5 The colours of separate mouldings of the telephone shall match each other, where appropriate, to the satisfaction of the Post Office Quality Assurance Division (PE/C3 (QA)).

4.3 Keypad

4.3.1 The escutcheon plate (except for Telephone 766) shall be to Drawing CD 2626 (Sheet 1). The protector shall be to Drawing 1/DPR/8. The case for Telephone 766 shall be to the approval of PD1.1.1.

4.3.2 The keypad shall meet Specification S 1204C. In particular, it shall have no separate common contacts.

4.4 Sender

4.4.1 The sender shall be connected into the telephone circuit as shown in Figure 1 in accordance with Paragraph 4.2.1.

4.4.2 The sender shall not require an add-on gravity switch.

5. PERFORMANCE

5.1 Conditions. The telephones shall be designed to operate satisfactorily in accordance with the performance requirements of this specification under the following conditions:

5.1.1 Over local lines having a loop resistance up to 1.25 kilohm and having insulation resistance of not less than 50 kilohms from each wire to earth and between wires, powered by PO standard transmission bridges (see Appendix 2) with exchange bus bar voltages in the range 45 V-55 V. (The resultant worst case loop current is 22 ma. This may be simulated under test conditions by using 6 km of 0.5 mm cu artificial cable - see Appendix 2 - and a battery voltage of less than 45 V, typically 38 V.)

5.1.2 The telephones shall operate over a temperature range of -10°C to 50°C.

5.1.3 With a break in line feed current during the inter-digital pause of up to 110 ms occurring after a period of 90 ms following the last make of the previous digit and before a period of 100 ms prior to the first break of the following digit.

5.2 General

5.2.1 The telephones shall be insensitive to line polarity and any change in polarity which may occur during the course of a call.

5.2.2 The introduction of the sender into the telephone circuit shall not worsen the transmission performance compared to a telephone 746. This requirement shall be met when either a carbon microphone or a non-carbon to Post Office Specification S 1377 Open Issue is used. At loop currents of less than 22 mA (such as when 'handing over' to another telephone in parallel), the sender shall not oscillate or cause other interference to the transmission circuit.

5.2.3 The telephone shall not be able to send more than 10 pulses to line in any one digit regardless of the number of push-buttons simultaneously operated.

5.2.4 The insulation resistance between points designated to be electrically isolated shall be not less than 5 megohms measured with 250 V d.c. applied for not less than 5 seconds.

5.2.5 Lightning Test. The complete telephone instrument shall withstand, without damage, the application of a pulse derived from a 4 micro-farad capacitor discharged into a series combination of 4 ohm and 40 ohm non-reactive resistors. The telephone, via the line cord, colours red and white, shall be connected directly across the 40 ohm resistor.

The test shall be conducted with the telephone in the on-hook condition and the capacitor charged to 4 kilo-volts.

I The test shall be repeated with telephone off-hook in the transmission mode powered by an inductive power source and the capacitor charged to 1 kilo-volt. The surge protection device (SG 1) used shall be connected to T8 and T19 and mounted on the Telephone Unit board.

I 5.2.6 Flashing of the gravity switch with on-hook periods of greater than 300 ms when in the 'pulsing' mode shall cause cancellation of any digits stored and shall not cause any misoperation of the sender.

I 5.2.7 Normal speech transmission conditions shall exist within 0.1s from the instant of application of power to the telephone circuit, regardless of the previous state of any contact and provided no button is depressed.

5.2.8 When the handset is on-hook the sender shall be inoperative.

5.2.9 When the handset is replaced, the sender shall cease pulsing to line.

5.2.10 Drop Test. To ensure that transmission will not be lost during the handling of the telephone, the instrument will be subjected to a drop test.

The PO drop tester consists basically of a horizontal platform falling between two vertical guides. The specimen is suspended below the platform which is raised to the required height above a hard wood block floor and released. The platform is prevented from striking the specimen by arrestor pistons.

The telephone will be dropped once in each mode through a vertical distance of 100 mm onto its base and onto each face (ie front rear and sides) with the base of the telephone in a vertical plane. The handset, terminal block and cords shall be placed in such a manner as not to impede the fall of the telephone.

The telephone will be connected to a test line (or equivalent circuit) and normal transmission conditions established. As a result of impact normal transmission shall not be disturbed for a period of more than 1 s.

I 5.2.11 Ringing Current. The telephone, with handset off-hook, shall be capable of withstanding without damage or physical impairment 10 cycles of ringing current. The test circuit of Appendix 2 Figure C1 shall be used.

5.3 The Sender

5.3.1 General

5.3.1.1 The sender shall accept electrical information from the keypad. Each digit shall be stored and transmitted as loop/disconnect pulses without the need for further action on the part of the user. The nominal speed, break/make ratio and interdigit pause shall be 10 pps. 2:1 and 850 msec respectively.

5.3.1.2 The sender shall be capable of receiving electrical information from the keypad and pulsing out stored digits simultaneously.

5.3.1.3 The sender shall be capable of handling an unlimited number of digits during any one call without misoperation. For design purposes it may be assumed that the digits occur in blocks of up to 21 followed by a return to 'transmission' mode before the next block commences.

5.3.1.4 The sender shall be capable of accepting electrical signals from the keypad at a rate of 10 digits/sec and shall operate correctly when any button is depressed for a period in excess of 30 ms (up to 40 ms for the first digit after the 'transmission' mode is acceptable).

5.3.1.5 After pulsing the last digit held in store, the sender shall remain capable of accepting digital signals for a period of 500 ms during conditions of breaks in line feed of up to 110 ms commencing between 90 ms and 350 ms after the last make.

5.3.1.6 The maximum allowable peak power level of any signal sent to line is shown in Appendix 2 Page 1.

5.3.1.7 The mask switches providing the dial off-normal functions shall operate between 300 ms and 900 ms prior to the first digit to be pulsed. They shall remain operated until after a period of not less than 28 ms, and not more than 920 ms has elapsed following the last break pulse of the last digit in the store has been sent.

5.3.1.8 The inter-digital pause, measured between the end of the last make pulse of one digit and the beginning of the first break pulse of the next digit shall be not less than 720 ms and not more than 920 ms.

5.3.1.9 The first break pulse of the first digit shall occur within 1 s of the first button depression.

5.3.2 Pulsing Performance. The object of this paragraph is to ensure that the pulsing performance of the sender in combination with its associated power extraction circuit will be no worse than that of a PO standard rotary dial when connected to any combination of the full range of local lines pulse detecting elements likely to be met in the public switched network. To achieve this the pulse distortion exhibited by the sender will be compared with that exhibited by 2 reference standard pulse sources.

5.3.2.1 Reference Standard Pulse Sources. The 2 reference standard pulse sources will consist of pulsing contacts in parallel with a spark quench circuit. The pulsing contacts will consist of non-reactive passive components of resistance not exceeding 50 ohms. The spark quench will consist of a 1.8 micro-farad capacitor in series with a 100 ohm resistor.

Reference Source 1 will be 10.2 pps speed and 63% break/make ratio.

Reference Source 2 will be 9.8 pps and 72%.

5.3.2.2 Pulse Detectors and Line Simulators. Some typical items of equipment which may be controlled directly from a customers station are listed in Appendix 2 Table 1. Also shown, where appropriate, are the codes of the particular pulse detecting relays together with the permissible adjustment and voltage variations from which adverse circuit conditions may be deduced.

The pulsing performance requirements of the sender must be met with each of the pulse detectors listed.

The pulsing performance tests will be made using the circuit in Appendix 2 Figure A2.1. The artificial cable will be used in kilometre lengths of 0 km, 3 km and 6 km, both with and without the 50 kilo-ohm shunt. Measurement should be made on the 9th or 10th pulse of a train of 10 pulses to avoid flux build-up in the detector adversely affecting the results. The battery voltage will be 45 V, 50 V and 55 V.

5.3.2.3 Speed and Ratio. The speed and ratio measured at the output of the telephone shall always be within the following limits:-

Speed:- 9.8 - 10.2 pps
Ratio:- 65.7 - 67.7%

5.3.2.4 Distortion. This test shall be performed by measuring the output break of the pulse detector when the telephone under test, then Reference Source 1 and then Reference Source 2 are connected in the test circuit. The duration of any contact bounce occurring at the output of the pulse detector shall be included in the period following the transition.

The output break duration resulting from the telephone under test shall lie between those resulting from Reference Source 1 and 2 for each of the detectors listed.

5.3.3 Interference Test. The purpose of this test is to ensure the sender has adequate immunity to noise coming down the line from the exchange.

The telephone under test is connected to the test circuit in Appendix 2, Figure A2.1. The pulse detector will be the Relay 19/5 and the artificial cable will be set to 0 km without the 50 k Ω shunt. A changeover relay contact will be wired in series with the telephone by connecting the common contact to the telephone and both NO and NC contacts together to the leg of the artificial cable. The relay will be chosen such that when operated, it breaks the loop for not more than 5 ms approximately (a small reed should be suitable). The relay coil will be driven with an appropriate regular signal so that the contact breaks the loop 20 times per second.

Under the above conditions and with the handset off-hook, the telephone shall pulse out correctly the 10 digits 1, 2, 3 0 keyed without pause.

6. POWER

6.1 The sender shall be operated by power extracted from the line.

6.2 When the Push Button Unit (PBU) (connected into the telephone circuit as shown in Figure 1) is in the "transmission" mode it shall not divert more than 0.5 mA of line current away from flowing between Terminals T10-T19B on any length of line.

6.3 When in the "transmission" mode, the voltage dropped by the PBU itself (ie the voltage across Terminals T8-T19A minus the voltage across Terminals T10-T19B) shall be not more than 2.5 V when measured with a loop current of 22 mA. (It should be a design aim to achieve the smallest possible voltage for this parameter.)

6.4 When the sender is in the "pulsing" mode and the pulsing element is in the "break" condition the sender shall not take more than 100 microamps from the line. This excludes the transient current exchanged with the spark quench circuit and tone ringer or bell.

6.5 No power shall be drawn from the line to supply the sender while the handset is on-hook.

6.6 The pulsing loop of the telephone shall consist of a combination of active and passive components which drop no more than 7 V across the telephone Terminals T8-T18 when measured with a loop current of 22 mA.

7. MARKING

The telephone shall be marked with the PO stock list number, approved code letters identifying the manufacturer, the year of manufacture, and the mark number in accordance with the relevant SM specification.

eg 756 FHB 99/1

The letters FHB are typical and shall be substituted by the approved letters allocated to the manufacturer.

8. REFERENCES

<u>SPECIFICATIONS</u>	<u>DIAGRAMS</u>	<u>DRAWINGS</u>
D 1000V S 1008B	N 822	CD 2625
S 1009A	N 840	CD 2626
S 1204B	N 846	DPR/8
S 1377	N 848	SD 77
S 1440	N 849	

9. HISTORY

Date	Issue	Details
July 1973	Open	
June 1975	A	
January 1977	B	'Break in line feed' requirements included.
August 1979	C	22 Terminal Telephone Unit specified.
May 1980	D	Performance requirements brought into line with S 1341. Component Standards requirement altered. Appendix 3 added.

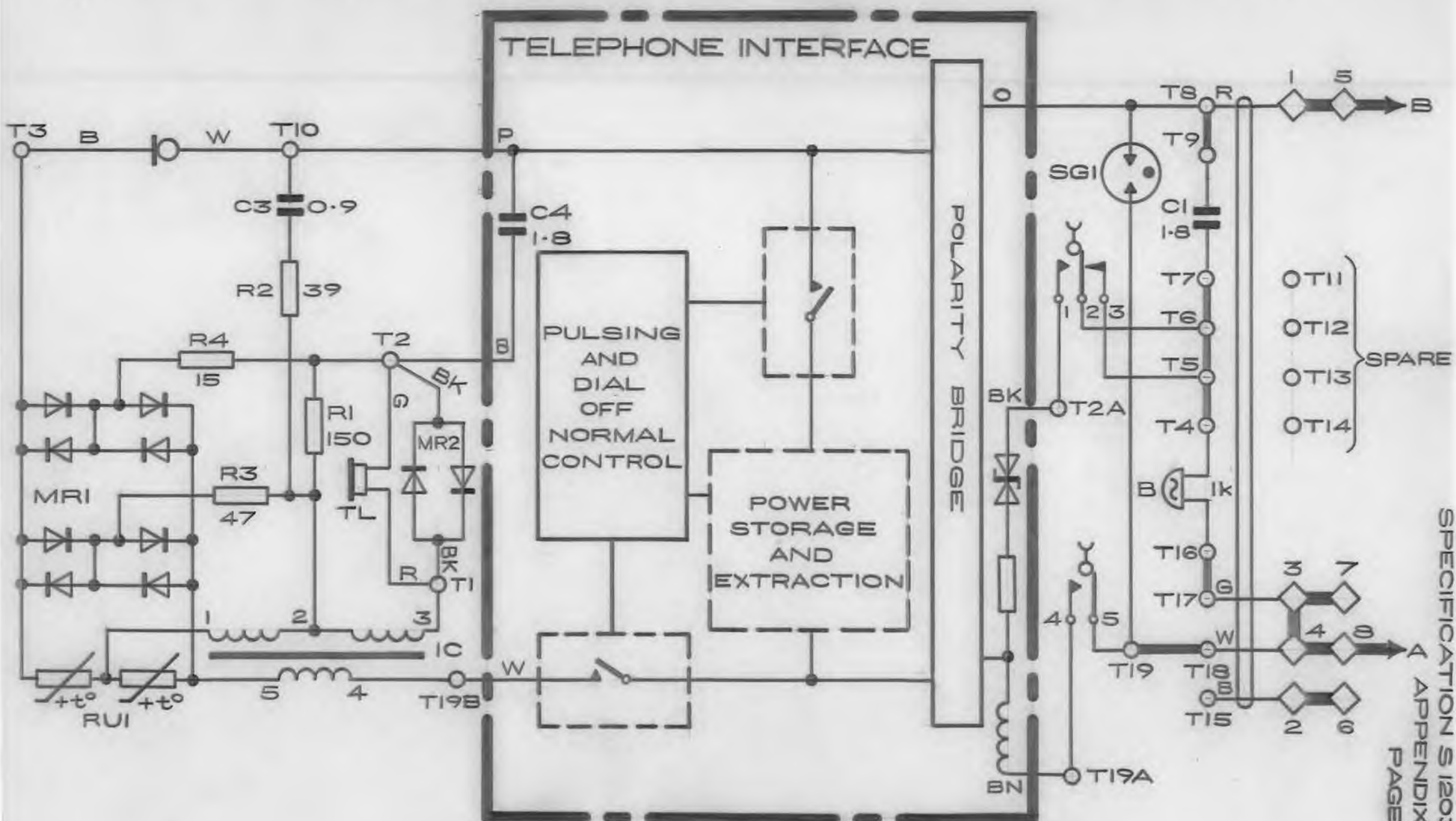
END OF SPECIFICATION

June 1980
PD 1.1.1/ANC

Post Office Telecommunications Headquarters
Marketing Executive
Product Development Division (PD1.1)
Procter House
100/110 High Holborn
LONDON
WC1V 6LD

X 21775/TD

FIG. 1
FUNCTIONAL SCHEMATIC AND INTERCONNECTION DIAGRAM

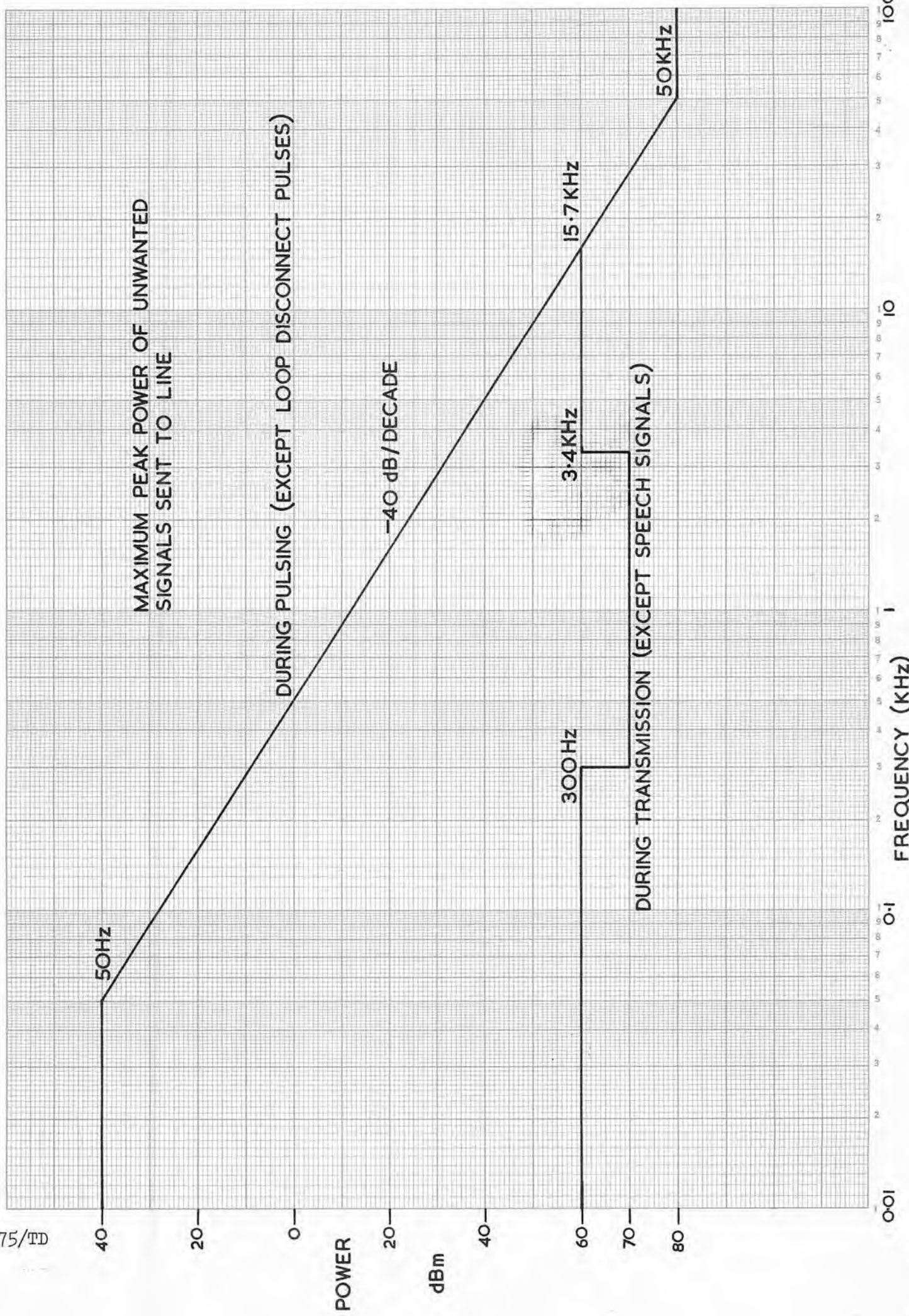


Log 4 Cycles x mm, 1/2 and 1 cm

Graph Data Ref. 5541



X 21775/TD



PULSE SOURCE SIMULATED LINE

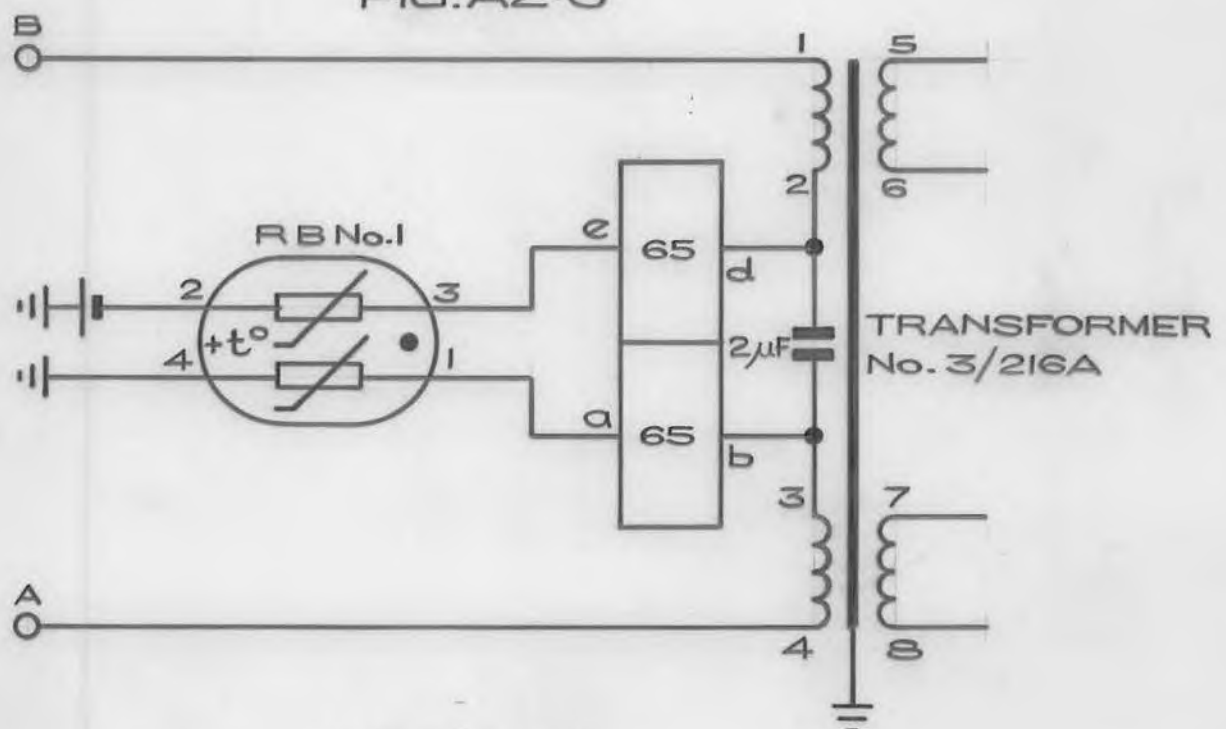
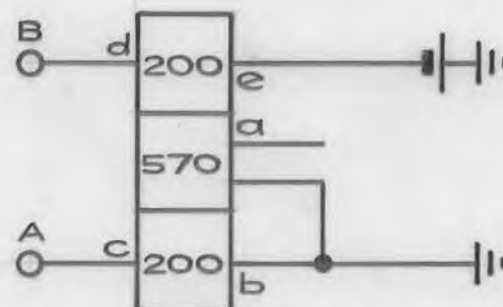
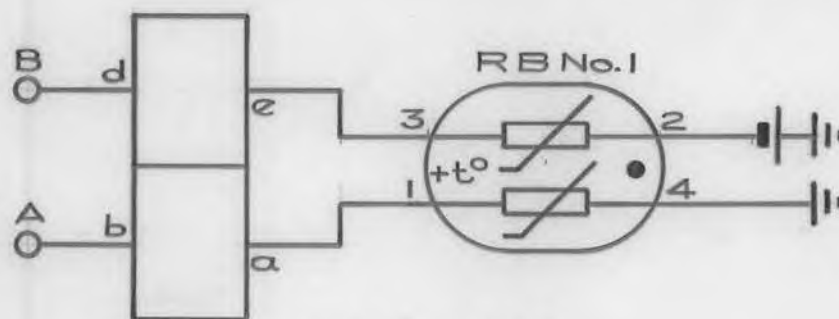
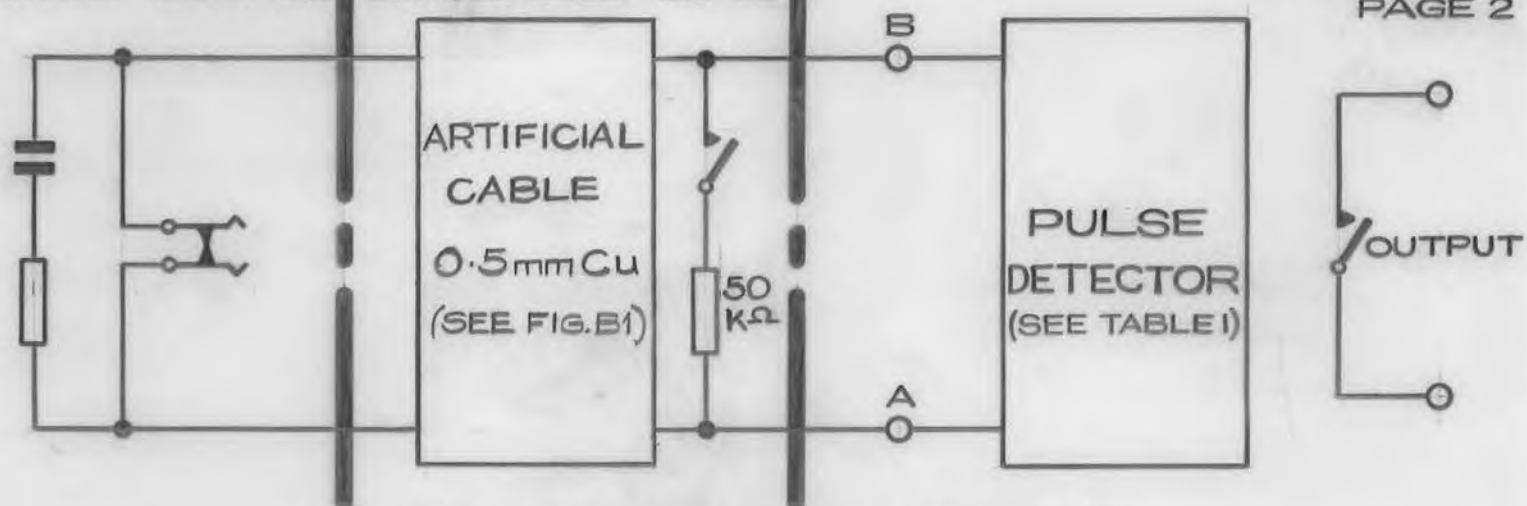
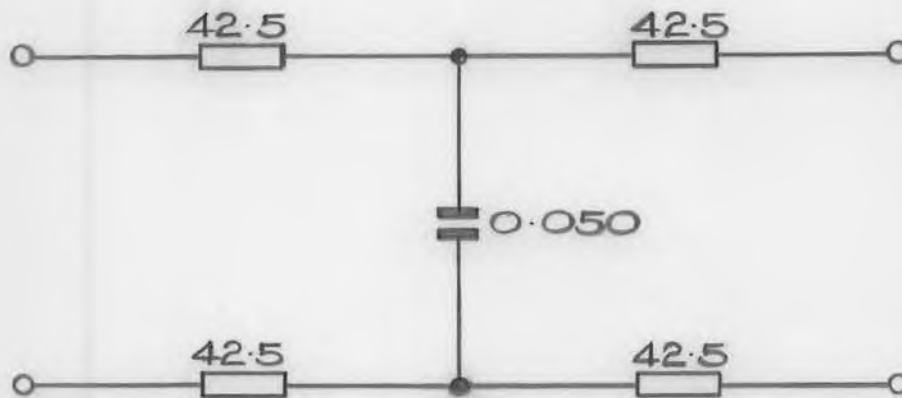


TABLE 1 PULSE DETECTORS

EQUIPMENT	DIAGRAM NUMBER	PULSE DETECTING CIRCUIT	PULSE DETECTING RELAY DETAILS			
			PO CODE NUMBER	COIL RESISTANCE (ohms)	TEST OPERATE CURRENT (mA)	TEST RELEASE CURRENT (mA)
1st CODE SELR	AT 5472	FIG A2.2	11751	$63 + 63, \pm 10\%$	21	5.5
FINAL SELR	AT 5216	FIG A2.3	19/5	$200 + 200, + 15\%, -5\%$	14	4.5
A/A RELAY SET	AT 5616	FIG A2.2	19/2	$75 + 75, \pm 10\%$	14	10
" " "	AT 4019	FIG A2.2	5513	$50 + 50, \pm 10\%$	24	10
" " "	AT 60581	FIG A2.4	3/412 K	$65 + 65, \pm 10\%$	14.5	7.5



1KM OF 2 WIRE 0.50mm ($6\frac{1}{2}$ lb/MILE) CU CABLE

NOTE :- LENGTHS IN EXCESS OF 1 Km ARE ACHIEVED BY LINKING AN APPROPRIATE NUMBER OF SECTIONS IN TANDEM.

FIG.B1 ARTIFICIAL CABLE SIMULATION

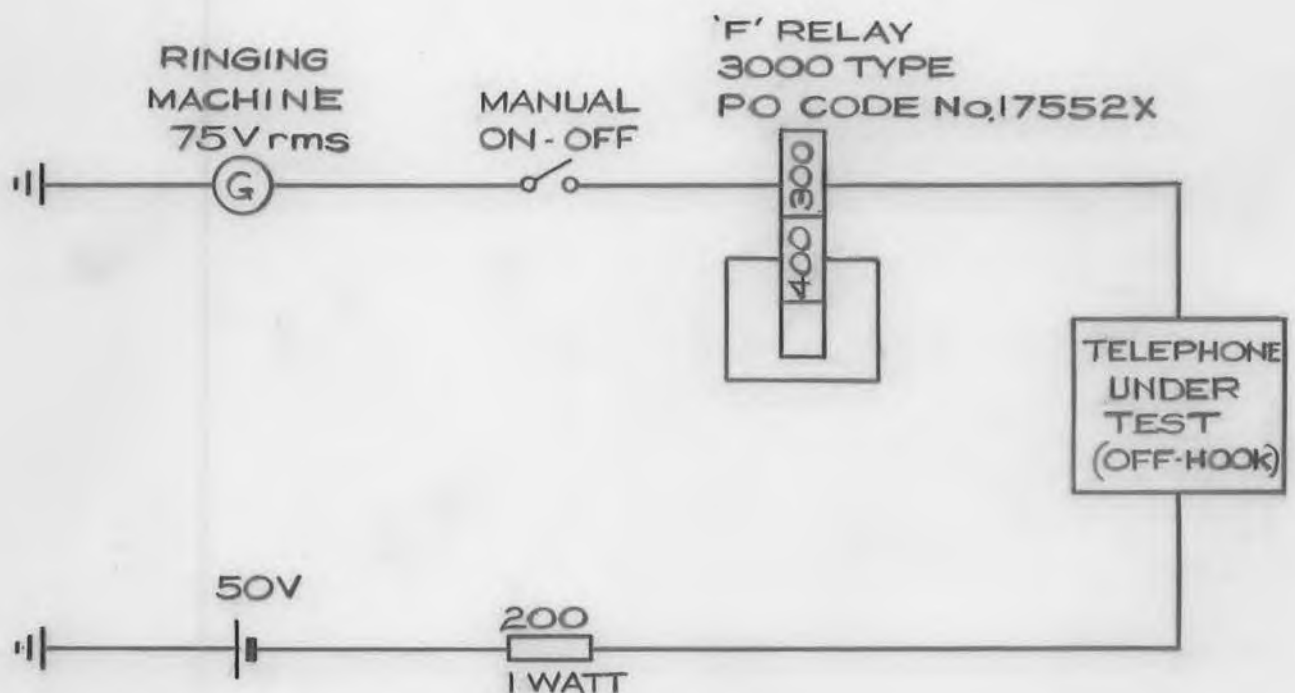


FIG C1 RINGING CURRENT TEST CIRCUIT

APPENDIX 3

FEATURE	CLAUSE	TEST CIRCUIT	TEST CONDITION	COMMENTS
*Microphone Sensitivity	5.2.2	Figure A2.1 and Relay 19/5	Full Range I	Battery voltage should also be reduced in stages to verify requirement below 22 mA.
Insulation Resistance	5.2.4	-	-	Use suitable insulation tester.
*Lightning Test	5.2.5	-	-	
Hookswitch Reset	5.2.6	Figure A2.1 and Relay 19/5	Full Range I	To be measured during both pulsing and IDP periods. Reset time must lie in the range 110-300 ms to meet Clause 5.1.3.
Power Up Time	5.2.7	Figure A2.1 and Relay 19/5	Short Range	
*Drop Test	5.2.10	-	-	
*Ringing Current	5.2.11	Figure C1	Figure C1	10 full cycles of interrupted ringing must be applied.
Digit Capacity	5.3.1.3	Figure A2.1 and Relay 19/5	Short Range	Key in blocks of 30 digits. Verify that at least 1st 21 pulsed correctly. Repeat for further 30 digits without reset of hookswitch.
*Keypad Rate	5.3.1.4	Figure A2.1 and Relay 19/5	Short Range	
Line Break Test	5.3.1.5 and 5.1.3	Figure A2.1 and Relay 19/5	Full Range I	Test during both the Inter Digit Pause and the Post Digit Pause.
*Unwanted Signals	5.3.1.6	Figure A2.1 and Relay 19/5	Short Range	Use spectrum analyser.
Off Normal Timing	5.3.1.7	Figure A2.1 and Relay 19/5	Full Range I	Use storage oscilloscope.

TABLE (Contd)

FEATURE	CLAUSE	TEST CIRCUIT	TEST CONDITIONS	COMMENTS
IDP Timing	5.3.1.8	Figure A2.1 and Relay 19/5	Full Range I	Use storage oscilloscope.
First Break Test	5.3.1.9	Figure A2.1 and Relay 19/5	Full Range I	Use storage oscilloscope.
Speed and Ratio	5.3.2.3	Figure A2.1 and 5 Pulse Detectors	Full Range II	Use all 5 relays listed in Appendix 2.
*Distortion	5.3.2.4	Figure A2.1 and 5 Pulse Detectors	Full Range II	Use all 5 relays listed in Appendix 2.
*Interference Test	5.3.3	Figure A2.1 and Relay 19/5	Short Range	6 km measurement not mandatory.
*Transmission Current	6.2	Figure A2.1 and Relay 19/5	Full Range I	
*Transmission Voltage	6.3	Figure A2.1 and Relay 19/5	Full Range I	Measure at 22 mA only.
*Pulsing Current	6.4	Figure A2.1 and Relay 19/5	Full Range I	
Pulsing Voltage	6.5	Figure A2.1 and Relay 19/5	Full Range I	Measure at 22 mA only.

TEST CONDITION DEFINITIONS

Short Range - Battery Voltage 50 V, Temperature Ambient, Line length 0 km and 6 km, 50 k ohm shunt out. Features tested using only the short range may also be measured using the Full Range I at the discretion of the Post Office.

Full Range I - Battery Voltage - 38 V*, 50 V, 55 V
 Temperature - -10°C, Ambient, +50°C
 Line Length - 0 km, 3 km, 6 km
 50 k ohm shunt - In, Out

Therefore, a total of 54 measurements are required.

*The battery voltage of 38 V should be fine adjusted to give a loop current of 22 mA.

Full Range II - As Full Range I substituting 45 V for the 38 V battery voltage. A total of 54 measurements are required.