POST OFFICE ENGINEERING DEPARTMENT

SPECIFICATION T 4203E

FOR

MACHINE PULSING AND RINGING NO.1

DIAGRAM AT 5445

DRAWING CD 1205

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1. GENERAL

The terms used in this specification are defined in either BSS 170 or BSS 171. The machine shall conform in all respects to the requirement of specification T 4190 current at the time the contract is placed.

The machine shall be of the dynamotor or rotary converter type having a two pole field energized either electrically, or by permanent magnet. It shall be suitable for operation from a 50 volt D.C. supply.

If it is of the rotary converter type, it shall incorporate a Transformer P.O. No. 283A to drawing CD 1135 specification D 1968 or approved equivalent. The inductance of the machine shall be such that when the secondary winding of the transformer is closed with a resistance of 1000 ohms, a 3 amp. fuse connected in the supply will not rupture when the machine is started in the "through" position.

The machine shall be of the open end plate type fitted with inspection covers of adequate size to permit bedding of the brushes, cleaning of the commutator and slip rings, and to facilitate the removal of brush deposit from the body of the machine.

A totally enclosed inductor type generator providing one output at 50 cycles/sec. two at 400 cycles/sec. and one at 400 cycles/sec. modulated 25 cycles/sec. shall be fitted. Permanent magnet excitation for this inductor generator shall be employed.

1. GENERAL (CONTD.)

A Mark No. will be allocated for each particular design of machine, all machines of the same Mark No. shall be identical as regards replaceable parts. Should a manufacturer desire to change the design in such a way that any of the replaceable parts are altered, or are no longer required details of the changes shall be forwarded to the Engineer-in-Chief (TPM1/3) before any contract is undertaken. If the changes are agreed, a new Mark No. will be allocated. The replacement parts which shall remain unchanged (unless authority is given) are as follows:-

Brushes, Brush Holders, Worm
Worm Wheel, Spur Wheels
Cam Shafts, Bearings.

2. CONNEXIONS

The connexions shall be in accordance with Diagram ATW 54450.

The external connexions shall be terminated on the springs of two multi-point P.O. pattern plugs No. 3201 to be fixed in position relative to the machine mountings as shown on Drawing CD 1205. Viewed from the rear, the Left Hand plug will be numbered 1-32 and the Right Hand plug 51-82.

The plugs shall be marked on the front of the machine in accordance with Drg. CD 1205.

All connections shall be made with "WIRE SWITCHBOARD 20 lbs" P.V.C. INSULATED to P.O. Specification No. CW 109 except connexions to alternator or rotary convertor and its associated transformer which shall be made with WIRE 23/.0076 INSULATED to D.E.F. 12 TYPE 2.

3. SPEED OF MACHINE

The speed at half load and at an input voltage of 49.5 volts shall be nominally 1500 R.P.M. when the machine is hot. It shall not rise to more than 1550 R.P.M. on no load at an input voltage of 52 volts when the machine is hot, nor fall below 1300 R.P.M. on full load at an input voltage of 47 volts when the machine is cold.

4. ELECTRICAL SILENCE OF MACHINE

The dynamotor or rotary convertor shall be so designed that when the motor is energized via one coil of a Coil Retardation No. 20A no appreciable noise shall be heard in the receiver when the listening test shown in Diagram AT 5119 is applied. The test shall be carried out with the dynamotor or rotary convertor on full load.

5. RINGING OUTPUT

When the input is 52 volts, the alternator or rotary convertor shall give an output of not more than 97.5 volts on no load, and when the input is 47 volts, the alternator or rotary convertor shall give an output of not less than 75 volts with a maximum load current of 67 mA into a resistive load.

Note. The output voltage of the rotary convertor shall be measured at the load side of the step-up transformer.

6. MOUNTING

Each machine shall be suitable for mounting in a vertical plane.

The relative positions of the fixing holes and plugs on each machine shall not depart from the dimensions given in Drawing CD 1205, and the overall dimensions shall not be exceeded.

7. OVERLOAD

The alternator or rotary convertor shall be capable of giving an overload current 50% in excess of the normal maximum load current of 67 m/A. Under these conditions, i.e. with an output current of 100 mA, an input voltage of 47.0V shall produce an output voltage not less than 70.0 volts.

8. INDUCTOR TONE GENERATOR

The generator shall comprise four or five separate inductor alternators of the multi-pole stator and unwound rotor type, totally enclosed in one housing, providing four separate tone outputs at the following frequencies.

Busy Tone	400 c.p.s.	
N.U. Tone	400 c.p.s.	
Dial Tone	50 c.p.s.	
Ringing Tone	400 c.p.s.	mixed with 450 c.p.s. which is obtained by series connecting a 400 c.p.s. and a 450 c.p.s. winding,
	or 400 c.p.s.	modulated by 25 c.p.s. The depth of modulation or mixing must be greater than 90%.

9. PROTECTION

The machine shall be protected by means of a built-in manually reset thermal trip device of such characteristics that the machine will not be damaged under locked rotor conditions.

The device shall be of a pattern approved by the Engineering Department.

A switch, snap type to Drawing CD 824 shall be mounted on the baseplate connected in the battery supply to the machine.

10. TONE GENERATOR

The rotor shall consist of four or five sets of discs built up of stampings of soft iron or other suitable magnetic material having the appropriate number of slots and mounted on a drum keyed to the alternator shaft. The spacing of the discs shall be sufficient to preclude magnetic interference between any of the generated tones. The rotor may if required contain the energising magnet.

11. TONE GENERATOR STATOR

The stator shall consist of the permanent magnet system (if not contained in the rotor) and sets of stampings of soft iron or other magnetic material suitably spaced to match the rotor and carrying the output windings only. The stampings and permanent magnet system if fitted in the stator shall be rigidly clamped to the stator casing and the latter shall be bolted to the ringing machine framework. Each set of stampings shall be provided with the number of poles appropriate for the generation of the relative tone output.

12. TONE GENERATOR WINDINGS AND TERMINATIONS

The output windings shall be rigidly attached to the stator poles. They shall be tapped at 25%, 50% and 75% of their full capacity. In the case of Ringing Tone sufficient tappings shall be provided to ensure that the conditions of Clause 8 can be met for 25%, 50% and 75% output conditions.

The windings shall be terminated on a terminal block in accordance with Drg. 70287. The terminal block shall be mounted on the outside of the tone generator. The terminal block shall be protected from accidental damage or contact by a suitable cover. If adjustable mechanical flux shunts are provided in the magnetic circuit, the coils will not require to be tapped.

12. TONE GENERATOR WINDINGS AND TERMINATIONS (CONTD.)

If resistors are used to give a fine adjustment of output in the case of tapped coils, the resistors must be mounted on a separate terminal block from that given in Drg. 70287, and the block should be signwritten with their resistance values.

13. TONE GENERATOR OUTPUTS

The tests shall be made with a rotor speed of not less than 1450 r.p.m. or more than 1500 r.p.m.

The tone outputs to be in accordance with the following schedule. The test should be carried out on the full output winding. The output voltages shall be calculated from the readings obtained on a calibrated variable non-inductive resistance unit connected in series with a milli ampere-meter of the thermocouple type of known resistance. The tests shall be made when the machine temperature has been constant for at least one hour. The resistance shall be adjusted for each reading to bring the pointer of the instrument to the same convenient selected value so that instrument errors shall be effectively eliminated. The full scale deflection of the instrument shall not exceed 10 m.a. With the conditions shown in column (2) of the following table, the output voltages obtained with the instrument circuit only connected shall not exceed the values shown in column (3), and the output voltages obtained when a resistance of the value shown in column (4) is applied as a load in parallel with the instrument circuit shall be not less than the values given in column (5).

Inductor Output (1)	Coil Tapping Permanent Magnet Fields or Flux Shunt not fully closed (2)	Max. Output voltage with instrument circuit only connected (3)	Load Resistance ohms (4)	Min. Output Voltage with instrument cct. shunted by load resistance (5)
Busy & N.U. Tones 400 cycles/sec	Full Coil	4.5 volts	100	3 volts
Dial Tone 50 pulses/sec	Full Coil	4.5 volts	50	3 volts
Ringing Tone 400 cycles/sec mixed with 450 cycles/ sec or 400 cycles/ sec modulated by 25 cycles/sec.	Full Coil	4.5 volts	100	3 volts

14. QUALITY OF TONES

The quality of the tones shall be equal to those heard when listening to the tone outputs of a machine approved by the Department as a reference standard by means of the circuit shown in Diagram AT 5118.

15. FIELD MAGNETS

Where Permanent magnet fields are provided, the magnetic circuit shall be so arranged that no de-magnetization occurs when the armature and tone generator rotor unit are removed from the stator.

16. INTERRUPTERS

The machine shall be fitted with two low speed interrupter systems consisting of P.O. 600 relay springsets operating on cams. The springsets shall be in accordance with Drawings No. SSP 771 and SSP 780. Cam followers shall be in

16. INTERRUPTERS (CONTD.)

accordance with Drawing No. DSP 1148 Buffer blocks shall be in accordance with Drawing No. SBL 20 Buffer Block Washers shall be in accordance with Drawing Drawing No. DPL 536.

One camshaft shall rotate at a speed of 20 R.P.M., and the other at a speed of 1 R.P.M. when the speed of the mainshaft is 1500 R.P.M.

The two camshafts shall be axial or parallel in alignment to facilitate a uniform springset layout. A cover shall be provided to enclose the springsets and cams.

17. CAM ASSEMBLIES

The interrupters shall be arranged to give the timing and facilities shown on Diagram AT 5445, when the machine is running at 1500 R.P.M. The cams shall be in accordance with Drawings No. DCA 151 DCA 152 DCA 153 and DCA 155.

18. ADJUSTMENT OF SPRINGSETS

All springs should be straight and adjusted in accordance with the following table.

Spring	Tension Grammes	
	Min.	Max.
'Make' spring against block step	15	21
'Break' " " " "	15	21
Lever " " Break spring	4	9
Cam follower on lowest point of cam	5	10

The minimum clearance between lever spring and 'Make' spring with the cam follower at the lowest point, and between the lever spring and the 'break' spring with the cam follower at the highest point shall be 10 mils.

Twin contacts shall make or break simultaneously as far as can be judged by eye. All 'break' contacts units to break before 'make' contact units make.

Pairs of contacts which make contact with each other shall not be out of alignment by more than one third of the diameter of the contact as far as can be judged by eye.

19. GEARBOX

The gearbox containing the driving gear for the camshafts shall be fitted with a drain plug in the bottom and a filler plug in the top. An oil throwing cone shall be provided to give adequate lubrication to all moving parts within the gearbox unless the gears do not require lubrication. It shall be so designed that no oil leak through the main shaft bearing occurs when the machine is in service.

No shaft shall project through the bottom of the gearbox.

Where nylon gears are used, the gearbox shall be suitably marked to indicate that no lubrication is required.

20. INFORMATION TO BE SUPPLIED WITH TENDER

The following information shall be supplied with the tender:-

(a) The power consumption of the machine at no load, and full load when the machine is driving the interrupters, with the inductor tone generator fully loaded.

20. INFORMATION TO BE SUPPLIED WITH TENDER (CONTD.)

(b) The ringing alternator voltage at full load, half load and no load. The ringing current output and voltage shall be measured at the terminals of the ringing alternator.

(c) Insulating materials used:-

(1) For armature conductors

(2) For armature slots

(3) Between Commutator and shaft

(4) Between Commutator segments

(5) For Inductor Output Coils

(6) Inductor Output Coil Formers.

(d) The percentage modulation of Ringing Tone at 25%, 50%, 75% and full output. The percentage modulation shall be measured between plug point 65 (continuous ringing tone output) and earth on the machine.

21. TESTING

Each machine shall be tested in accordance with the requirements of the Specification. The tests shall be carried out in the following order.

1. Commencing with the machine at room temperature, the initial requirements of Clauses 3 and 5 shall be tested.

2. The machine shall be run for five hours, and during this run the tone generators shall be tested in accordance with Clauses 13 and 14, and the test specified in Clause 4 shall also be applied.

3. The power consumption shall be measured as specificd in Clause 20(a).

4. Immediately after the 5 hour run, the remaining requirements of Clauses 3 and 5 shall be tested, and a further run made to enable the test outlined in Clause 7 to be applied.

5. The requirements of Clauses 2, 3 and 16 of Specification T 4190 shall then be tested.

22. DRAWINGS, DIAGRAMS AND SPECIFICATIONS

The drawings, diagrams and specifications referred to in this specification are shown below.

Drawings	Diagrams	Specifications
CD 1205	ATW 54450	T 4190
CD 824	AT 5118	CW 109
CD 1135	AT 5119	BSS 170
SSP/771	AT 5445	BSS 171
SSP/780		D 1000
SBL/20		D 1968
DCA/151		DEF 12
DCA/152		
DCA/153		
DSP/1148		
DPL/536		
DCA/155		
70287		

23. HISTORY

Date	Issue	Details
October 1956	A	Clauses 1, 4, 6 & 20 amended.
May 1957	B	Clauses 1 and 3 amended Clauses 4 and 21 added Remainder of Clauses Renumbered.
November 1957	C	Clauses 1, 8, 10, 13, 19, amended.
December 1962	D	Clauses 2, 5, 6, 7, 12 and 22 amended.
August 1965	E	Clauses 1, 8, 9, 12, 13 and 20 amended.

END OF SPECIFICATION

TPM1/3/DRHL
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Telephone Exchange Standards & Maintenance Branch,
Engineering Department,
2-12 Gresham Street,
LONDON, E.C.2.