MULTIFREQUENCY CURRENT SUPPLY FOR AC KEYSETS AND MULTIFREQUENCY PULSING SENDERS EQUIPMENT DESIGN REQUIREMENTS COMMON SYSTEMS

1. GENERAL

Scope

1.01 This specification, together with the supplementary information listed herein, covers the equipment design requirements for the framework, equipment, and circuits for multifrequency current supply (MFCS) equipment for ac pulsing.

1.02 This specification is reissued to reflect the loading on the current supply based on lower distributing levels. The method for calculating loading is also simplified in this issue by providing for a method of estimating loading by use of a loading factor which is tabulated for different types of circuits. Distribution resistor lists are corrected and amended on this issue.

1.03 The equipment covered in this specification, arranged for 6-wire distribution, supersedes the equipment per J68608, arranged for 24-wire distribution. J98608 has been rated A&M Only.

Capacity

1.04 In engineering an MF current supply frame, the loading of the different circuits supplied by it must be considered. The effective load that a circuit presents to the supply depends on the level of tone used, the number and duration of uses per call of the most heavily loaded tone, and the expected activity of the circuit during the busy hour. Testing circuits are not included since busy hour testing is presumed minimal.

1.05 The total load on a supply is limited to that which causes a 0.5 db drop in the output voltage of an oscillator. Table A is a listing of types of circuits and the level which must be supplied to them. The level and the manner of distribution establishes the maximum number of simultaneous uses of any of these circuits to remain within the permitted loading. Based on a probability of 0.001 of exceeding the 0.5 db drop in oscillator voltage in the busy hour, the allowable average number of simultaneous uses of a particular oscillator pair (Q) is given in this table which is utilized in establishing the percent loading of the different circuits.

TABLE A

ALLOWABLE AVERAGE SIMULTANEOUS USES FOR FULL LOADING OF MF CURRENT SUPPLY

MF LEVEL dbm/FREQ	OPTION SD-9539-01	TYPE OF CIRCUIT	MAXIMUM SIMULTANEOUS USES	AVERAGE SIMULTANEOUS USES (Q)
−3	R option	Service Observing	15.4	6.0
−6	R option	Recording-Completing and Toll Switching Trunks (MD)	10.0	2.9
−6	K option	Recording-Completing and Other Inband Control Circuits and Toll Switching Trunks (STD); Local SXS Senders; ANI Outpulsers; No. 1 Crossbar Senders; Panel Senders; Class 5 or Local Tandem No. 5 Crossbar Senders; DSA Switchboards 3C and 3CL; and 13D, 14, and 15C and 15D Switchboards; TSPS No. 1 Outpulsers	20.1	9.0

TABLE A (Cont)

MF LEVEL dbm/FREQ	OPTION SD-9539-01	TYPE OF CIRCUIT	MAXIMUM SIMULTANEOUS USES	AVERAGE SIMULTANEOUS USES (Q)
−8	J option	No. 4 Crossbar Senders and Toll Switchboard No. 5	18.4	7.9
−8	M option	Toll Switchboards No. 1, 3, 3C and 3CL; and combined Toll and DSA Switchboards No. 1, 3, 3C and 3CL; CAMA Positions; 100A TSP Control Pulsing Circuits; Crossbar Tandem, and SXS CAMA Senders; CAMA in Register; Combined Class 5 and Class 4 or Greater No. 5 Crossbar Senders (2W or 4W)	25.6	12.7

1.06 The general equation for developing the percentage of loading of a type of circuit is given below:

$$P = \frac{NA}{Q} \times \frac{(KP)(Tkp)(Fkp) + (D)(Td)(Fd) + (C)(Tc)(Fc)}{3600} \times 100$$

In this equation:

P — is the percent loading of a type of circuit based on a 0.001 probability of overload in the busy hour.

N — is the number of circuits of a particular type connected to the supply.

A — is traffic expressed as the number of call attempts by the particular circuit type in the busy hour.

Q — is the allowable average simultaneous uses of a particular oscillator pair for a type of circuit during the busy hour based on a 0.001 probability of overload.

KP, D, C — are the number of keypulse, digits and control pulses per call, respectively.

Tkp, Td, Tc — are the duration of each type of pulse in seconds for keypulse, digits, or control pulses, respectively.

Fkp, Fd, Fc — are the probabilities that the oscillator frequency (F) will be utilized in either a keypulse, digit pulse, or control pulse. (See 1.07.)

3600 — the number of seconds in an hour.

100 — the multiplier to express P in percent.

1.07 Because of the complexity of the general fomula, two methods of calculating the loading are given. Both methods are derived from the general formula for the most used frequency which is normally 1100 Hz which has a Fkp of 1.0 and an Fd of 0.4. 1500 Hz is used in calculating CAMA and TSP positions. The first method is an approximation utilizing a system wide derived activity of calls per busy hour (A), and digits per call (D) for each type of circuit. The second method provides the known factors of each type of circuit consolidated into a concise factor, but leaves the activity (A) and digits per call (D) to be filled in according to the type of traffic being handled.

1.08 Table B gives the loading factors to be used in approximating the loading of any circuit on the carrier supply. To use the table, establish the number (N) of circuits of a type on the supply and multiply by the loading factor for that type of circuit. Do this for each type of circuit connected

to the supply and add all of the results together. The loading factors in this table are based on the reduced tones shown in Table A. If the tone reduction option is not in the supply these factors must be increased by multiplying by the factor Q/6 where Q is taken from Table A for the particular type circuit.

$$P_{Total} = (N \times \text{loading factor})_{\text{circuit type A}} + (N \times \text{loading factor})_{\text{circuit type B}} + \ldots + (N \times \text{loading factor})_{\text{circuit type ( )}}$$

If the total (P_{Total}) is less than 90, the supply is not fully loaded and no further calculation is necessary. If the total is between 90 and 110, a more precise calculation utilizing the formula in Table C is indicated. If the total is more than 110 it is quite likely that the supply is overloaded.

TABLE B

LOADING FACTORS FOR MF CURRENT SUPPLY

CIRCUIT TYPE	ACTIVITY CALLS PER BUSY HOUR (A)	DIGITS PER CALL (D)	MAXIMUM NUMBER OF CIRCUITS	APPROXIMATE LOADING FACTOR
TSP Position Circuit Remote with CAMA	69	7	1700	0.059
TSP Position Circuit Remote, no CAMA	33	7	3550	0.028
TSP Position Circuit Local, DCKP CAMA or no CAMA	12	7	9800	0.010
TSP Position Circuit Local, MFKP CAMA	48	7	2440	0.041
TSP Control Pulsing Circuit	380	7	460	0.218
CAMA Positions	500	7	235	0.425
Toll Switchboard No. 5	100	9	625	0.160
Toll Switchboard or Combined Toll and DSA SWBDS No. 1, 3, 3C and 3CL*	100	7	1180	0.085
DSA Switchboards 1, 3, 3C, 3CL, 13D, 14, 15C, and 15D	100	7	840	0.119
ANI Outpulser	1150	7	78	1.280
Panel and No. 1 Crossbar Auxiliary Sender	400	9	205	0.487
No. 1 Crossbar Subscriber Sender (MF)	160	7	605	0.165
Local SXS Senders	250	5	425	0.235
Combined Class 5 and Class 4 or higher ranking No. 5 Crossbar Senders (2W or 4W)	680	5	250	0.400
Class 5 and Local Tandem No. 5 Crossbar Senders	680	5	175	0.571
SXS CAMA Senders	400	7	350	0.286

* If Telco specifies −6 dbm/frequency, tone level for combined toll and DSA SWBDS (distribution resistor option K) loading factor 0.119 should be used.

TABLE B (Cont)

CIRCUIT TYPE	ACTIVITY CALLS PER BUSY HOUR (A)	DIGITS PER CALL (D)	MAXIMUM NUMBER OF CIRCUITS	APPROXIMATE LOADING FACTOR
Crossbar Tandem Senders	380	7	370	0.270
No. 4 Crossbar Incoming Senders	310	9	235	0.425
CAMA Incoming Register	110	9	1090	0.092
Service Observing Converter Circuits	10	5	13300	0.008
Recording-Completing Trunks, 1F-2F (MD)	12		695	0.145
Recording-Completing Trunks, 2F, (STD) and Other Inband Control Circuits	12		2780	0.036
TSPS No. 1 Outpulser	850	9	97	1.03

1.09 The second, or more precise method which allows the loading to be determined by the type of traffic, consists of a formula for each type of circuit in which known quantities have been inserted but activity (A) and digits per call (D) have been left to be filled in. Table C gives the formulas. These formulas are calculated for the distribution based on the tone reduction option reflected by the levels shown in Table A. If the tone reduction option is not provided, each formula should be corrected by the factor Q/6 where Q is taken from Table A for the particular type of circuit involved. The output of each formula (P) is added to all other loads (P) to give a resultant total percentage of full rated load (Pt). A result of 100 means that the system is fully loaded.

TABLE C

PERCENTAGE OF FULL RATED LOAD

(For Expected Most Used Frequency)

	CIRCUIT TYPE	PERCENTAGE OF FULL LOAD FORMULA
(1)	Traffic Service Position — Position Circuit — CAMA Position Keyset Td = 0.1 C = 1 Q = 12.7 Fd = 0.4 Tc = 0.1	$P = \frac{NA}{10{,}000}(2.2+0.9D)$
(2) (2a)	Switchboard Position Keysets — Toll Switchboard No. 5 KP = 1 Td = 0.1 Q = 7.9 Tkp = 0.1 Fd = 0.4	$P = \frac{NA}{10{,}000}(3.5+1.4D)$
(2b)	Toll Switchboards or Combined Toll and DSA SWBDS* No. 1, 3, 3C, and 3CL Position Keysets KP = 1 Td = 0.1 Q = 12.7 Tkp = 0.1 Fd = 0.4	$P = \frac{NA}{10{,}000}(2.2+0.9D)$
(2c)	DSA Switchboards No. 3C and 3CL; 13D, 14 and 15C and 15D Position Keysets KP = 1 Td = 0.1 Q = 9.0 Tkp = 0.1 Fd = 0.4	$P = \frac{NA}{10{,}000}(3.1+1.2D)$
(3)	Traffic Service Position Control Pulsing Circuit Td = 0.07 C = 1 Q = 12.7 Fd = 0.4 Td = 0.07	$P = \frac{NA}{10{,}000}(0.6D+1.5)$

* Use 2C if Telco specifies −6 dbm/frequency (distribution resistor option K) for combined toll and DSA switchboards.

TABLE C (Cont)

CIRCUIT TYPE	PERCENTAGE OF FULL LOAD FORMULA
(4) Senders and Registers — (4a) No. 1 Crossbar, Panel, Local SXS, and Class 5 or Local Tandem No. 5 Crossbar KP = 1 Td = 0.07 Q = 9.0 Tkp = 0.13 Fd = 0.4	$P = \frac{NA}{10,000} (4+0.9D)$
(4b) Crossbar Tandem, SXS CAMA Sender, CAMA Incoming Register, and Combined Class 5 and Class 4 or higher ranking No. 5 Crossbar Sender (2W or 4W) KP = 1 Td = 0.07 Q = 12.7 Tkp = 0.13 Fd = 0.4	$P = \frac{NA}{10,000} (2.9+0.6D)$
(4c) No. 4 Crossbar Kp = 1.0 Td = 0.07 Q = 7.9 Tkp = 0.13 Fd = 0.4	$P = \frac{NA}{10,000} (4.6+1.0D)$
(5) Service Observing, DP to MF Converters KP = 1 Td = 0.07 Q = 6 Tkp = 0.08 Fd = 0.4	$P = \frac{NA}{10,000} (3.7+1.9D)$
(6) ANI Outpulsers KP = 1 Td = 0.07 C = 1.0 Q = 9 Tkp = 0.130 Fd = 0.4 Tc = 0.07 Fc = 0.4	$P = \frac{NA}{10,000} (5+0.9D)$
(7) Recording-Completing and Toll Switching Trunks (7a) 1F — 2F (MD) C = 1.25 Q = 2.9 Tc = 1.33 Fc = 0.67	$P = \frac{NA}{10,000} (121)$
(7b) 2F (STD) and Other Inband Control C = 1.25 Q = 9.0 Tc = 1.33 Fc = 0.67	$P = \frac{NA}{10,000} (40)$
(8) TSPS No. 1 Outpulser KP = 1.0 Td = 0.07 Q = 9 Tkp = 0.13 Fd = 0.4	$P = \frac{NA}{10,000} (4+0.9D)$

1.10 In some instances, the distribution cable from the MF current supply can affect the loading characteristics. This will not normally occur until the cumulative total of cable pairs per oscillator reach a length of 20,000 feet. When this total is reached or exceeded measurements outlined in section 18 of CD-95391-01 should be made and J98609E, L2 should be supplied if corrective action is required.

Description

1.11 Multifrequency pulsing is a form of ac signaling over telephone trunks for the transfer of information required to select switch paths in local, toll, and tandem dial telephone systems. It is used as an alternative to dialing at switchboard positions because it is more rapid, permits signaling over any talking circuit regardless of range, and involves less operator effort. There is also a wide use of multifrequency pulsing from senders in dial offices to local, toll, and tandem crossbar offices. In this case, the multifrequency pulses are sent out by a sender instead of by an operator keyset.

1.12 The multifrequency current supply frame consists of a standard 11-foot 6-inch relay rack bay for 1-3/4 by 23-inch mounting plates

on which are assembled two oscillator units, each providing six frequencies, a transfer and alarm unit, distributing jacks, test trunk jacks, and miscellaneous equipment, as required, covered by the numbered lists of J98609E. The arrangement of the equipment on a supply bay, furnishing signal current to senders and/or positions, is shown in Fig. 1. The unfilled space above the equipment would be used for distributing resistance panels as required.

Oscillator Group Equipment

1.13 Each oscillator group unit, J98609A, consists of six bridge-type electron tube oscillators stabilized within ±1 percent for frequency, and within ±1 db for output voltage within load, battery, and temperature limits. These oscillators are designated 0, 1, 2, 4, 7, and 10 for frequencies of 700, 900, 1100, 1300, 1500, and 1700 cycles, respectively. Two frequencies are transmitted for each digit or signal. The sum of the designations of the two oscillators used for sending digits 1 to 9 will be the digit; for example, output from oscillators 0 and 1 sends digit 1, from 2 and 4 sends digit 6, etc. The digit 0 is the exception since it is sent from 4 and 7. Signal KP (setup) is sent from 2 and 10 and ST (end of keying) from 7 and 10.

1.14 Two oscillator group units are provided for each MF supply equipment when used for MF keypulsing from switchboards, testboards, for MF pulsing from senders, dial to MF converters, CAMA positions, toll switching trunk coin circuits, recording-completing trunk circuits, and 2-way trunk circuits. These oscillator groups are operated continuously, and except in the case of No. 4-type toll switching systems, each normally shares one half of the office load. However, an oscillator group is capable of carrying the whole office load if failure occurs in either group. In No. 4-type toll switching systems and other systems where a minimum of two MF supply equipments are always required, each supplies one half of the office load for senders and operator position.

Note: The test equipment load, pulse converter, toll switching or recording-completing, or 2-way trunks, etc, need not be distributed over more than one supply frame.

Transfer and Alarm Unit

1.15 In case of complete or partial failure of one of the oscillator group units, the transfer and alarm unit automatically switches the associated load over to the other oscillator group unit of the MF supply and an alarm is sounded. This transfer and alarm unit also incorporates other alarms and testing features as described more fully in subsequent paragraphs.

Distribution — General

1.16 In furnishing the signaling supply to trunk circuits which use only three frequencies, a set of three resistors, one per frequency, is provided for each trunk served. Each set of three resistors that are served from the oscillators are horizontally multipled to another set of three resistors which will supply another trunk circuit. These resistors are mounted with terminal punchings on a 1-3/4 by 23-inch panel per J98609F. The panel is equipped with 48 resistors grouped to supply 16 trunk circuits. This panel shall be mounted below the blank distributing panel at the top of an MF current supply primary or supplementary bay and additional panels mounted directly below. When a J98609F distributing resistor panel is mounted in a primary bay, the oscillator supply leads are cabled from the distributing jacks through the blank distributing panel to the distributing resistor panel. When the J98609F distributing resistor panel is located in a supplementary bay, and there are no J98609F panels in the primary bay, the oscillator supply leads are cabled to the distributing jacks furnished in the primary bay. If the primary bay is equipped with J98609F distributing panels, then the oscillator supply leads for the supplementary bay may be connected through the blank distributing panel associated with the J98609F distributing resistor panel furnished in the primary bay.

1.17 Wiring to the distributing resistors is carried through distributing jacks whch provide not only testing facilities, but, principally, emergency patching facilities. The latter facilities would be of value in case of severe damage to the apparatus of wiring of the transfer and alarm unit, in which case it would be possible to patch directly from output jacks on the oscillator group unit to the distributing jacks located below the distributing resistors and to cut loose any distributing leads from the transfer and alarm unit.

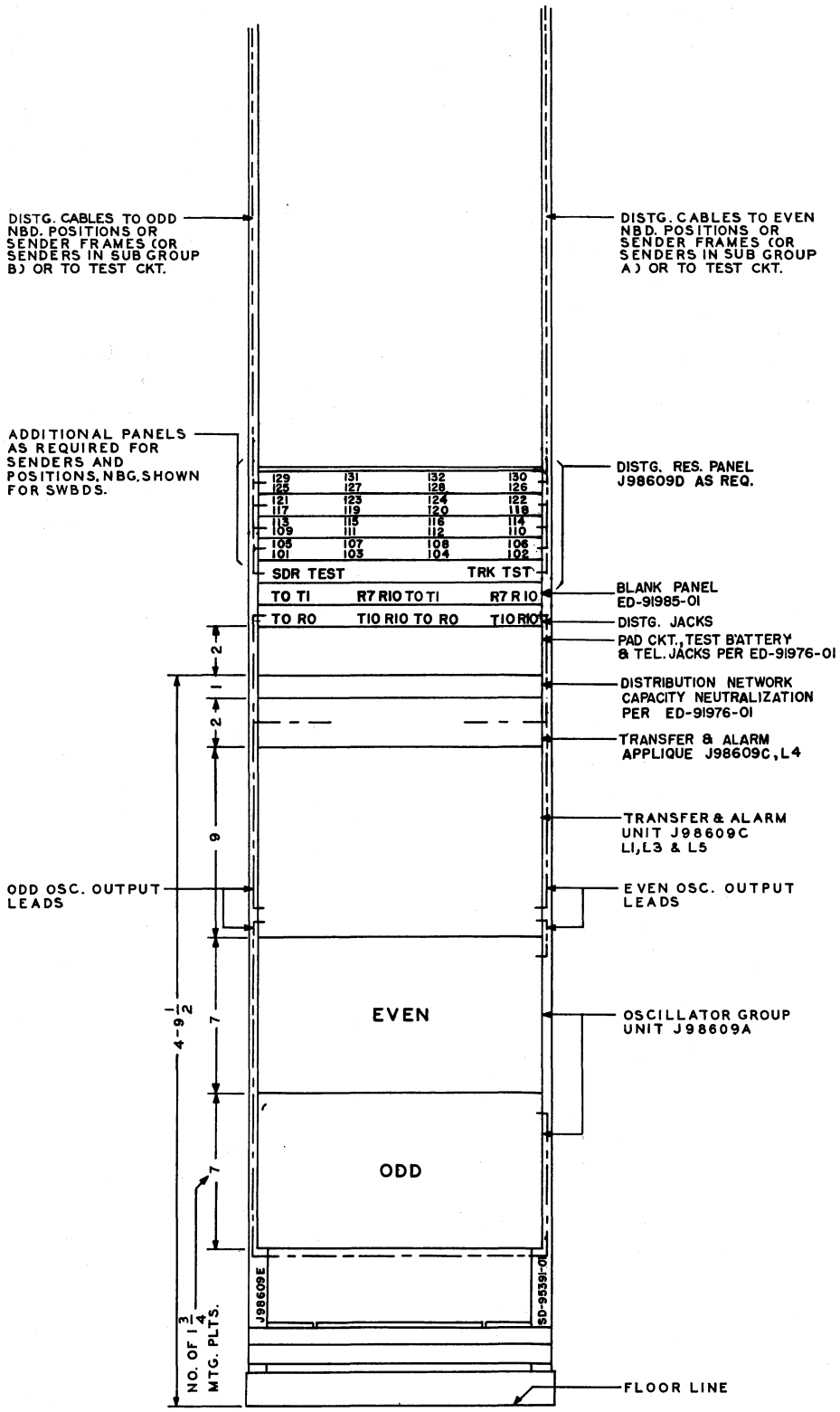

Fig. 1 – Typical Bay Layout — Signal and Test Supply

1.18 The arrangement of the resistors on the distributing resistor panels is such that a pair of resistors are connected to a common terminal on the front of the panel permitting 12 odd and 12 even oscillator group multiple leads to run vertically from panel to panel. The other ends of the resistors are connected to individual terminals on the rear of the panel for leads to the positions and senders.

1.19 The method of cabling and distribution to positions, senders, and test circuits is covered in figures on SD-95391-01. Cables from odd positions and sender frames (or senders in subgroup B in No. 5 crossbar office) are run down the right side of the frame facing the rear, and cables from even positions and sender frames (or senders in subgroup A in No. 5 crossbar office) are run down the left side. The distributing resistor panels, distributing jacks, and transfer and alarm units are laid out correspondingly.

Facilities for Test Current or Pulse Converter Supply

1.20 A supply bay furnishing signal current to senders and/or positions may also be used for furnishing signal current to test equipment or pulse converters. The distributing resistors for test equipment are located in the first panel directly above the distributing jacks and below the other distributing resistor panels as shown in Fig. 1.

1.21 Where the MFCS is required for testing and/or pulse converter purposes only, one oscillator is used which is mounted together with test jack equipment, distributing resistors, and control relays as shown on the bay equipment drawings. No transfer and alarm equipment is required. In this case, the oscillator unit is equipped with a battery control key for turning the heaters on or off, but is not equipped with plate alarm relays. The location of this oscillator is not critical, but it is desirable that it be located not more than 5 feet from the floor to permit ready operation of the ON key.

1.22 When a portable incoming trunk test set is furnished in No. 1 crossbar and tandem offices, the supply for the trunk test set is passed through a set of control relays which open the supply when not required in order to avoid exposing the supply leads throughout the line-ups of trunk frames. Operating leads for the control relays are multipled through Jones sockets mounted on every third incoming or tandem trunk frame, to which connection is made by the portable trunk test set, as required.

Voltage Alarm and Load Transfer Equipment

1.23 The office signaling load is so proportioned that each group of oscillators carries approximately an equal portion of the load. If the output voltage of any oscillator in either of the two groups varies beyond established limits, the load of that group of oscillators is automatically shifted to the other oscillator group. The output of the oscillators is sufficiently stable to insure that trouble conditions occurring beyond the protective resistors, mentioned in previous paragraphs, will not cause the transfer to function. The voltage alarm and transfer is accomplished by comparing the voltage output of two oscillators in a group (for example, 1100 and 1300 cycles) by means of a high-low voltage relay connected through a rectifier arrangement. Any difference in the voltage of these two oscillators beyond limits causes the operation of the relay, which in turn operates a group of transfer relays to transfer the load to the other group of oscillators and to bring in an alarm. Each group of six oscillators requires three of these voltage relays. When supplying a group of senders, provision is made for furnishing ground to the senders during the short transfer interval to avoid pulsing during that time. In all senders, except those in No. 5 crossbar and step-by-step offices, pulsing is resumed when ground is removed. In No. 5 crossbar and step-by-step offices, a reorder signal is sent to the originating operator when ground is received.

Ground Alarm

1.24 Provision is made to detect a ground in the distribution system by applying a dc voltage to the supply leads through a relay which operates to bring in an alarm in the event of flow of dc to any ground point.

Testing and Maintenance of Supply

1.25 Jacks are provided on each oscillator group unit which gives access to each individual oscillator output for voltage or frequency tests. Arrangements are provided for

making frequency comparisons, either with an external variable frequency or between two single oscillators of the same frequency of the odd and even oscillator group units through a head receiver. Keys in the transfer and alarm unit are provided for manually operating the transfer arrangement for maintenance purposes. Provision is made also for a trunk to a multifrequency bay in the same or distant building for use in making frequency comparison tests.

2. SUPPLEMENTARY INFORMATION

800-600-000 — List of General Equipment Requirement Sections
801-000-000 — Equipment Design and General Equipment Requirements and Engineering Information — Common Systems
801-620-170 — Multifrequency Pulsing System — Common Systems
J25150 — 819-055-150 — Multifrequency Pulsing Equipment — No. 5 Crossbar
J64072 — 804-911-154 — 72A Frequency Meter
J97025 — 801-006-155 — Relay Rack — Angle-type Framework
X-67191 — Testing Requirements
Floor Plan Data — Section 92, Sheet 15 — No. 1 Crossbar
Section 10.2, Sheet 16 — No. 4 Type Toll Switching Systems

3. DRAWINGS

WECo J drawings should be ordered by referring to the prefix and base number and requesting the current dash (—) number.

Circuits

SD-25440-01 — No. 1 or Tandem Office Miscellaneous Circuit
SD-25784-01 — Testing Current Supply Control Circuit for Incoming of Tandem Trunk Test Set
SD-68090-01 — No. 4 Type Toll Switching Systems
SD-90122-01 — Test Terminal Circuit for Battery and Ground
SD-95391-01 — Multifrequency Current Supply Circuit
SD-95664-01 — Pad Circuit

Framework

ED-90782-01, G2 — Applique Unit Framework
ED-91183-01, G1 — Framework Guardrail
ED-91205-01 — Cable Brackets
ED-91210-01 — Grounding, Connecting Blocks, and Miscellaneous Mounting Details
ED-91639-01 — Mounting Details
ED-91837-01, G1 — Framework Guardrail
ED-91985-01 — Blank Distribution Panel

Equipment

ED-26606-01 — Bay Equipment — Signaling and Test Current Supply — No. 5 Crossbar
ED-26607-01 — Bay Equipment — Testing Current Supply Only — No. 5 Crossbar
ED-91977-01 — Oscillator Group Equipment — Signaling and Testing Current Supply
ED-91979-01 — Transfer and Alarm Equipment
ED-91988-01 — Bay Equipment — Testing or Pulse Converter Current Supply Only — Except No. 5 Crossbar
ED-92076-01 — Transfer and Alarm Applique Equipment
J98609D-( ) — Distributing Resistor Panel Equipment
J98609E-( ) — Bay Equipment — Signaling and Testing Current Supply — Except No. 5 Crossbar
J98609F-( ) — Distributing Resistor Panel — Three Frequencies Only

Wiring and Cabling

ED-91510-01 — Typical Switchboard Cabling Angle-type Relay Rack

4. EQUIPMENT

Framework

ED-91183-01 — 10-inch Guardrail

ED-91837-01 — 12-inch Guardrail

Group 1 — Framework of an adjacent bay in which overflow resistance panels may be located.

ED-91985-01 — Blank Distribution Panel

Group 1 — Blank distribution panel used below distributing resistor panels J98609D.

Relay Rack Units

J98609A (AT&TCo Std) -- Oscillator Group Unit

Equipment — ED-91977-01

List 1 — Framework, assembly, wiring, and equipment for one unit of six oscillators.

	WIRE	EQUIP	SEE NOTES
Panel, Assoc Det, and Misc App per ED-91977-01, Fig. 1		1	
MF Current Supply Ckt, SD-95391-01:			
Osc Grp Ckt, Fig. 1, C or F, Less P Res Lp	1	1	B,C 4.01
Fil Bat. Sup. Ckt, Fig. 6	3	0	A
Plate Alm Rel Ckt, Fig. 16	1	0	
Fil ON Key Ckt, Fig. 17	1	0	

List 2 — Plate alarm equipment per SD-95391-01, Fig. 16 required in addition to list 1 to equip an oscillator group unit for signaling only, or for signaling and testing purposes.

List 3 — Filament key equipment per SD-95391-01, Fig. 17 required in addition to list 1 to equip an oscillator group unit for testing purposes only.

List 4 — Filament battery equipment consisting of three Fig. 6 per SD-95391-01 required in addition to list 1 to equip an oscillator group unit for signaling or testing purposes when 24-volt regulated filament battery supply is furnished.

List 6 — Filament battery equipment consisting of one Fig. 30 per SD-95391-01 required in addition to list 1 to equip an oscillator group unit for signaling or testing purposes when 48-volt regulated filament battery supply is furnished.

Notes

A. This unit may also be used in offices having nonregulated battery. In that case, (a) the resistances per SD-95391-01, Fig. 6 shall not be furnished, (b) the B1, B2, and B3 ballast lamps per Fig. 5 shall be furnished by the telephone company, arranged and designated as shown on ED-91976-01, Fig. H, and located at the top of the relay rack bay as shown on typical bay layout.

B. The six No. 328A electron tubes required are not furnished with this unit and shall be ordered separately.

C. Furnish Fig. C for 24-volt operation and Fig. F for 48-volt operation.

J98709C (AT&TCo Std) — Transfer and Alarm Unit

Equipment — ED-91979-01, ED-92076-01

List 1 — Framework, assembly, wiring, and equipment for one transfer and alarm unit.

	WIRE	EQUIP	SEE NOTES
Panel, Assoc Det, and Misc App per ED-91979-01		1	
MF Current Supply Ckt, SD-95391-01:			
Trans and Alm Ckt, Fig. 2, Less V App	1	1	
Voltage Alm Ckt, Fig. 3	2	2	
Hld Grd Ckt, Fig. 19, Rel A1, A2, C1, C2, D1, and D2 Only	1	0	B
Grd Alm Ckt, Fig. 8 & A, Less B Res Lp	1	1	4.01
Tst Ckt, Fig. 9 & 10	1	1	

List 3 — Equipment per SD-95391-01, Fig. 19, relays A1, A2, C1, C2, D1, and D2 only, required in addition to list 1 for sender holding ground.

List 4 — Framework, assembly, wiring, and equipment required in addition to list 3 for one transfer and alarm unit applique. (See note A.)

	WIRE	EQUIP
Unit Framework, ED-90782-01, G2		1
Hld Grd Ckt, SD-95391-01, Fig. 19, Keys, Lp, and Rel B1, B2, E1, E2, F1, F2, and AL Only	1	1

List 5 — Equipment per SD-95391-01, Fig. 2, V apparatus only, required in addition to list 1 for connection to No. 5 crossbar office alarm circuit.

Notes

A. This equipment is normally located on the frame above the transfer and alarm unit as

shown on typical bay layouts. All switchboard wiring including battery and ground leads to applique unit shall be run from terminal strips on transfer and alarm unit following cross connection SD-95391-01, Fig. 53. If the maximum number of senders per G lead has been filled as described in Note 106 on SD-95391-01, an additional holding ground applique unit may be mounted miscellaneously and multipled at the alarm and transfer unit per SD-95391-01, Fig. 64.

B. Sender holding ground circuit SD-95391-01, Fig. 7, is rated Mfr Disc. and is replaced by Fig. 19. To modify an existing installation from Fig. 7 to Fig. 19, the B1 and B2 relays shall be removed from the transfer and alarm unit, and an applique unit per list 4 shall be provided and located per note A, space permitting. Otherwise, it shall be located where space is available on same or adjacent bay.

J98609D (AT&TCo Std) — Distributing Resistance Panel

Equipment — J98609D-( )

List 2 — Framework, assembly, wiring, and equipment for one distributing resistor panel serving eight positions, eight senders, or four test circuits.

	WIRE	EQUIP	SEE NOTES
Distr Res Ckt, SD-95391-01, Fig. 11, 20, 26, or 28	4	4	A,B

Notes

A. Shop wiring of the distributing resistor panel involves only the connection and soldering of the resistances.

B. Distributing resistor option for tone level for a particular circuit type must be specified according to Table 1 on this specification and/or Note 1 on SD-95391-01.

J98609E (AT&TCo Std) — Multifrequency Current Supply Bay Common Equipment (Except No. 5 Crossbar)

Equipment — J98609E-( )
Cabling — ED-91510-01, Fig. 1

List 1 — Assembly, frame wiring, and common equipment for multifrequency current supply (less distributing resistor panels). (See note E.)

	WIRE	EQUIP	SEE NOTES
Grd Bar, ED-91210-01, Item 13		1	
Osc Grp Unit, J98609A, L1 & L2		2	A, 4.01
Trans and Alm Unit, J98609C, L1		1	B
Blk Panel and Cover, ED-91985-01, G1		1	
Set of Intrabay Cables		1	C
MF Current Supply Ckt, SD-95391-01:			
Distr Jk Ckt, Fig. 4	1	1	4.05
Tst Trk Jk Ckt, Fig. 13		1	
Cable Brackets, ED-91205-01:			
G3		10	
G4		4	
G7		3	
Mtg Det, ED-91639-01, G1		2	

List 2 — Wiring and equipment consisting of two Fig. 24 per SD-95391-01, required in addition to list 1 to provide distribution network capacity neutralization. (See note D.)

List 3 — Equipment per SD-95664-01, Fig. 1 required in addition to list 1 for pad circuit to deliver adjusting tone to J95102B MF pulsing receivers (one per office except in No. 4-type toll switching systems, a list 3 may be specified in the second J98609E MFCS frame when the number of aisles in which J95102B MF pulsing receivers appear is in excess of nine). (See note E2 and 4.08.)

List 4 — Equipment per SD-95664-01, Fig. 3 required in addition to list 3 for pad jacks (one per aisle with J95102B MF pulsing receiver appearance).

List 5 — Equipment per SD-25440-01, Fig. 1, 2, and 5 required in addition to list 1 in No. 1 crossbar and crossbar tandem offices. This list provides one test battery and test battery jack and one set of talking telephone jacks.

List 6 — Equipment per SD-68090-01, Fig. 1 and 3 required in addition to list 1 for No. 4-type toll switching systems. This list provides one test battery, one test battery jack, and one set of frame line telephone jacks.

List 7 — Equipment per SD-90122-01, Fig. 8 required in addition to list 1 for all offices except No. 1 crossbar, crossbar tandem, and No. 4-type toll switching systems.

List 8 — Framework per ED-91183-01, Group 1 required in addition to list 1 when 10-inch guardrails are required.

List 9 — Framework per ED-91837-01, Group 1 required in addition to list 1 when 12-inch guardrails are required.

List 10 — Equipment per SD-25784-01, Fig. 1 required in addition to list 5 when a portable incoming trunk test set is used to test incoming MF trunks.

Notes

A. Use of this frame with regulated or nonregulated battery is as follows.

1. When this frame is used in offices using 24-volt regulated filament or signal battery, provide two J98609A, List 4.
2. When this frame is used in offices using 48-volt regulated signal battery, provide two J98609A, List 5.
3. When this frame is used in offices using nonregulated battery, provide six SD-95391-01, Fig. 5 arranged as shown on ED-91976-01, Fig. H. The ballast lamps shall be furnished by the telephone company.

B. When this frame serves senders, provide one J98609C, Lists 3 and 4, and one set of intrabay cables made up from switchboard cable formed into paths shown on ED-91976-01, Fig. 2 to interconnect as follows.

Two — No. 1451CL Cables — Between transfer and alarm units and the transfer and alarm applique equipment (one even cable and one odd cable)

C. One set of intrabay cables, made up from switchboard cable, formed into the paths shown on ED-91976-01, Fig. 2, shall be provided to interconnect as follows.

Two — No. 1452CL Cables — Between transfer and alarm units and the distributing jack panels (one even cable and one odd cable)

Two — No. 1452CL Cables — Between transfer and alarm units and oscillator group units (one even cable and one odd cable)

D. List 2 should not be specified initially. When installation measurements indicate the requirement, the installer or telephone company shall request list 2. In such cases, the installer shall provide a local cable for tip and ring lead connection.

E. Shop wiring, job basis wiring, and storage requirements for this frame are as follows.

1. Shop wiring of this frame, in addition to the wired component units, shall include only the connection of the intrabay cables as provided in list 1, Note B, and the oscillator group multiple strap wiring as shown on ED-91976-01, Fig. G.
2. Storage for patch cords required with this frame shall be provided by the telephone company.
3. Distributing resistance panels, as required, should be provided on a job basis in accordance with lists in J98609D or J98609F.

J98609F (AT&TCo Std) — Distributing Resistance Panel (Three Frequencies Only)

Equipment — J98609F-( )

List 1 — Equipment, assembly, and wiring required for one distributing resistance panel serving a maximum of 16 trunk circuits using three frequencies only. (T0-R0, T2-R2, and T10-R10.)

	WIRE	EQUIP	SEE NOTES
Distr Res Ckt, SD-95391-01, Fig. 31	4	4	A,B

Notes

A. Shop wiring of the distributing resistor panel consists of connecting and soldering of the resistors and horizontal multiple strapping.

B. When the J98609F distributing resistor panel is mounted in an MF current supply primary or supplementary bay, it is necessary to furnish one blank distributing panel and cover, and two brackets similar to list 11 of J98609E.

Miscellaneous Equipment

4.01 ***SD-95391-01, Fig. 1 and 8 — Resistor Lamps:*** The P and B 13C resistor lamps are mounted separately from the oscillator group and transfer and alarm units. These lamps are mounted on a resistor lamp panel either near the fuseboard or on the power ringing and tone distributing frame (No. 5 crossbar).

4.02 ***SD-95391-01, Fig. 4 — Distributing Jacks (for No. 5 Crossbar):*** One set of these jacks shall be furnished per multifrequency current signaling supply frame, as shown on ED-26606-01, Fig. 1 and B.

4.03 ***SD-95391-01, Fig. 5 — Ballast Lamps:*** Three ballast lamps per oscillator group unit are required for offices with nonregulated battery supply and shall be furnished as covered in J98609A, Note A.

4.04 ***SD-95391-01, Fig. 13 — Test Trunk Jacks:*** One set of these jacks shall be furnished per multifrequency current supply frame. When required with a signaling supply, the arrangement is shown on ED-91976-01, Fig. C and ED-26606-01, Fig. B (No. 5 crossbar). When required with a multifrequency current supply for testing only and/or for pulse converting only, the arrangement is shown on ED-91988-01, Fig. B and ED-26607-01 (No. 5 crossbar).

4.05 ***SD-95391-01, Fig. 14 and 15 — Patching Cords:*** Except in No. 5 crossbar offices, these cords shall be furnished as specified by the telephone company. In No. 5 crossbar offices, a set of six each is furnished with the supply frame.

4.06 ***SD-95391-01, Fig. 18 — Voltage Test Jacks:*** One set of these jacks and associated resistances shall be furnished as part of a multifrequency test current supply. The arrangement is shown on ED-91988-01, Fig. B and ED-26607-01 (No. 5 crossbar).

4.07 ***SD-95664-01, Fig. 2 — Patching Cords:*** Two sets of cords per Fig. 2 shall be furnished for each office.

4.08 ***SD-95664-01, Fig. 1 and 3, and SD-25440-01, Fig. 1, 2, and 5; or SD-68090-01, Fig. 1 and 3; or SD-90122-01, Fig. 8 — Pad Circuit, Test Battery, and Telephone Jacks:*** When required, except in No. 5 crossbar, this equipment may be mounted on an A&M Only basis in the space reserved for testing equipment on ED-91976-01, Fig. 1.

5. GENERAL NOTES

5.01 When an MFCS is required for testing only and/or pulse converting only in all offices except No. 5 crossbar, the equipment shall be arranged on a relay rack frame as shown on ED-91988-01.

5.02 When an MFCS is required in a No. 5 crossbar office, the equipment and frame shall be ordered per J25150.

5.03 When it is necessary to locate overflow distributing resistors in a second bay, a second set of jacks is not required and the multiple connection to these resistors shall be made by means of cable from the first panel or resistors just above the blank panel in the MFCS frame directly to the corresponding bottom panel of resistors in the second bay.

5.04 The MFCS leads for switchboards are run by two 12-pair No. 276CL cables to the midpoint of a group of eight consecutively numbered positions. Each cable is then distributed to the four odd or even positions, the loose leads being run in the cable rings or cable well terminal strips. In manual switchboards and toll testboards where no rings or cable well terminal strips are furnished, cables having braid and enamel-insulated conductors are used. Since a 12-pair cable is not obtainable with these conductors, a 6-pair No. 1451CL cable is used and distributed to two odd or even positions. See Fig. 101 and Table A of SD-95391-01, and Fig 2.

5.05 When relays on keyset units associated with switchboards or toll testboard positions are located on relay rack frames, an additional 12-pair No. 276CL cable consisting of 2, 7, and 10 supply leads shall be run from the same distributing resistance panel as provided

for the wiring to the associated switchboard or toll testboard positions. In this case, the 10 supply leads are not required in the cable to the positions. See Fig. 106 and Table A of SD-95391-01.

5.06 In all offices except No. 5 crossbar, the MFCS leads for senders are run by a 12-pair No. 276CL cable to an odd or even sender frame. This cable provides for distribution to four senders. In case of only three senders per frame, cabling is installed for pairing reasons and the unused leads are terminated at the frame or left dead and insulated at the position of the sender. See Fig. 102 and 107 and Table A of SD-95391-01, and Fig. 3.

5.07 In No. 5 crossbar office, the MFCS leads for senders are run by a 6-pair No. 252CL cable to a sender frame in A or B subgroup. This cable provides for distribution to two senders per frame. When only one sender on a frame is to be served, the unused leads shall be left dead and insulated at the position of the sender. See Fig. 105, Table A, and Note 213 of SD-95391-01, and Fig. 4.

5.08 For a 15D switchboard having combined MF and DC keypulsing, the MFCS leads are run by a 12-pair No. 276CL cable directly to a group of four odd or even keyset relay units located on a relay rack frame. In order to maintain the pairing to the switchboard, another 12-pair cable, No. 276CL, is run from each unit to a switchboard position. One conductor of each pair is unused and shall be left dead and insulated at the position. See Fig. 104 and Table A of SD-95391-01, and Fig. 5.

5.09 The MFCS leads for relay rack mounted pulse converter units are run in six shielded pairs of type P wire to the converter unit terminal strips. One conductor of each pair is unused and shall be left dead and insulated at the unit. Every six pairs shall serve one pulse converter with strapped leads being provided at the unit terminal strips for a second pulse converter. If the length of the strapped leads exceeds 20 feet, they shall be paired and left dead-ended at the punchings on the terminal strips. See Fig. 108 and Table A of SD-95391-01, and Fig. 7.

5.10 The MFCS leads for switchboards employing trough-type cable distribution (for example, CAMA switchboards) are run by two 12-pair No. 276CL cable to a first (even) and second (odd) position of a group of eight consecutively numbered switchboard positions. Each cable is then distributed to the four odd or even positions; the loose leads remaining in the trough to the cutout provided for entrance to the positions being served. See Fig. 109 and Table A of SD-95391-01, and Fig. 2.

5.11 The MFCS leads for the incoming trunks to CAMA switchboard positions are run by an additional 12-pair No. 276CL cable, consisting of the 0, 1, and 10 supply leads, from the same distributing resistor panels as the associated CAMA positions directly to eight odd or even trunk relay rack units. In this case, the 10 supply leads are not required in the cable to the positions. See Fig. 109 and Table A of SD-95391-01.

List of A&M Only and Mfr Disc. Equipment

The following equipment has been replaced as indicated. Where A&M Only items appear, the issue numbers shown are those of the issue in which the rating was first applied.

EQUIPMENT	RATING	DETAILS LAST SHOWN IN ISSUE	REPLACING EQUIPMENT
J98609A,L5	Mfr Disc.	5	J98609A,L6
J98609B	Mfr Disc.	1	J98609A
J98609C,L2	Mfr Disc.	2	J98609C,L3 & L4
J98609D,L1	Mfr Disc.	3	J98609D,L2

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