# No. 23 AUTOMATIC CALL DISTRIBUTING (ACD) SYSTEM TRANSMISSION ENGINEERING CONSIDERATIONS

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## 1. GENERAL

**1.01** The transmission plan presented in this section is for the Operator Services Network associated with the No. 23 Automatic Call Distributing (ACD) system. The No. 23 ACD system will serve local and toll Directory Assistance (DA) and Intercept traffic with combined operator teams. The system uses a modified No. 23 Operating Room Desk (ORD) having up to 38 operator positions. Two additional No. 23 ORDs can be employed and all three can be interconnected by load-balance arrangements for efficient operation. The supporting service transmission network provides access to class 5 and toll offices for this traffic. In some cases the access is via No. 23 or No. 1 Trunk Concentrators (TCs). The plan also includes arrangements to permit charging for directory assistance.

**1.02** When this section is reissued, the reason for reissue will be given in this paragraph.

**1.03** The No. 23 ORD has been used for many years for local or metropolitan ACD service without a formal transmission plan. It is assumed that the present usage of the No. 23 ORD is limited to metropolitan areas because of the incapability of the 181B telephone circuit to supply proper transmit and receive levels or to control operator sidetones, talker echo, or high level disturbance as well as other deficiencies. The plan presented in this section requires the new operators telephone

circuit, 4251A Network, which corrects these deficiencies and provides for standard transmission performance. It is intended to be used for all newly planned No. 23 ACD systems, for both metropolitan and extended areas. It may also be used to update installed systems where transmission improvements are desired.

**1.04** The plan includes the recommended trunking arrangements and trunk transmission requirements on loss, through balance, terminal balance, and office wiring restrictions. Also, application information, equipment modifications, and additions necessary to meet the transmission objectives are discussed.

## 2. SYSTEM DESCRIPTION

**2.01** The basic No. 23 ACD system uses a modified No. 23 ORD having up to 38 operator positions and one or two Service Assistance (SA) positions. The ORD consists of frame-mounted switching equipment and co-located operators positions (desks) and service assistance positions. The switching equipment distributes traffic from a maximum of 140 incoming trunks in order of the approximate order of arrival.

**2.02** The No. 23 ORD has provisions for traffic load balancing and for light-load transfer or night closing under supervisor key control. The load balancing permits automatic transfer of calls from a No. 23 ORD, whose team of operators is busy, to another local or remote ACD. The light load or night closing provision will automatically route all calls to a local or remote ACD.

**2.03** The No. 23 ACD provides operator assistance for the following classes of connections.

(a) Local directory assistance from class 5 offices—The network between local offices and the call distributor may include one stage of trunk concentration.

(b) Intra-NPA (metropolitan) directory assistance—Calls enter the ACD system from a direct or sector tandem office or a toll office and should not be concentrated.

(c) Toll directory assistance—Calls enter the ACD system from a class 3 or higher toll office. No trunk concentration should be used.

(d) Intercept service for calls which cannot be completed because of number change, discontinued service, etc, at the terminating class 5 office—Trunks between the class 5 office and the ACD may include one stage of concentration.

**2.04** The associated service network is shown in Fig. 1 and 2 in simplified form. The figures indicate the various trunking arrangements for DA charging or noncharging service and for intercept service. Either the No. 1 or No. 23 TCs can be employed, although the 4-wire No. 1 TC is the preferred choice for new installations.

**2.05** Two supervisory (SA) consoles can be provided to receive calls transferred from the operators for various reasons and because the operator cannot complete calls. The SA cannot be bridged onto the operator-customer connection, but instead the operator transfers a call directly to the SA through the switch. The SA console can be arranged to complete a call to a local office or a toll office if required. However, an acceptable end-to-end transmission performance cannot be guaranteed.

## 3. TRANSMISSION PERFORMANCE OBJECTIVES

### A. General

**3.01** The No. 23 ACD system is designed to meet the same transmission objectives for the Bell System unified number services.

### B. Loss-Noise Grade of Service

**3.02** Loss-Noise grade of service (L-N/GOS) presented to customers on toll calls is also the objective for customer-operator connections.

**3.03** The L-N/GOS should not be significantly worse on local DA, intra-NPA DA, and local intercept calls than that provided to DDD customers on short (100 airline miles or less) toll calls.

**3.04** The L-N/GOS should not be significantly worse on toll DA calls than that provided to DDD customers on a toll call having the same length of regular message network facilities as used between the originating class 5 office and the office providing access to the No. 23 ACD. Toll intercept will be somewhat poorer because in addition to the DDD connections, the calls are routed through the service network.

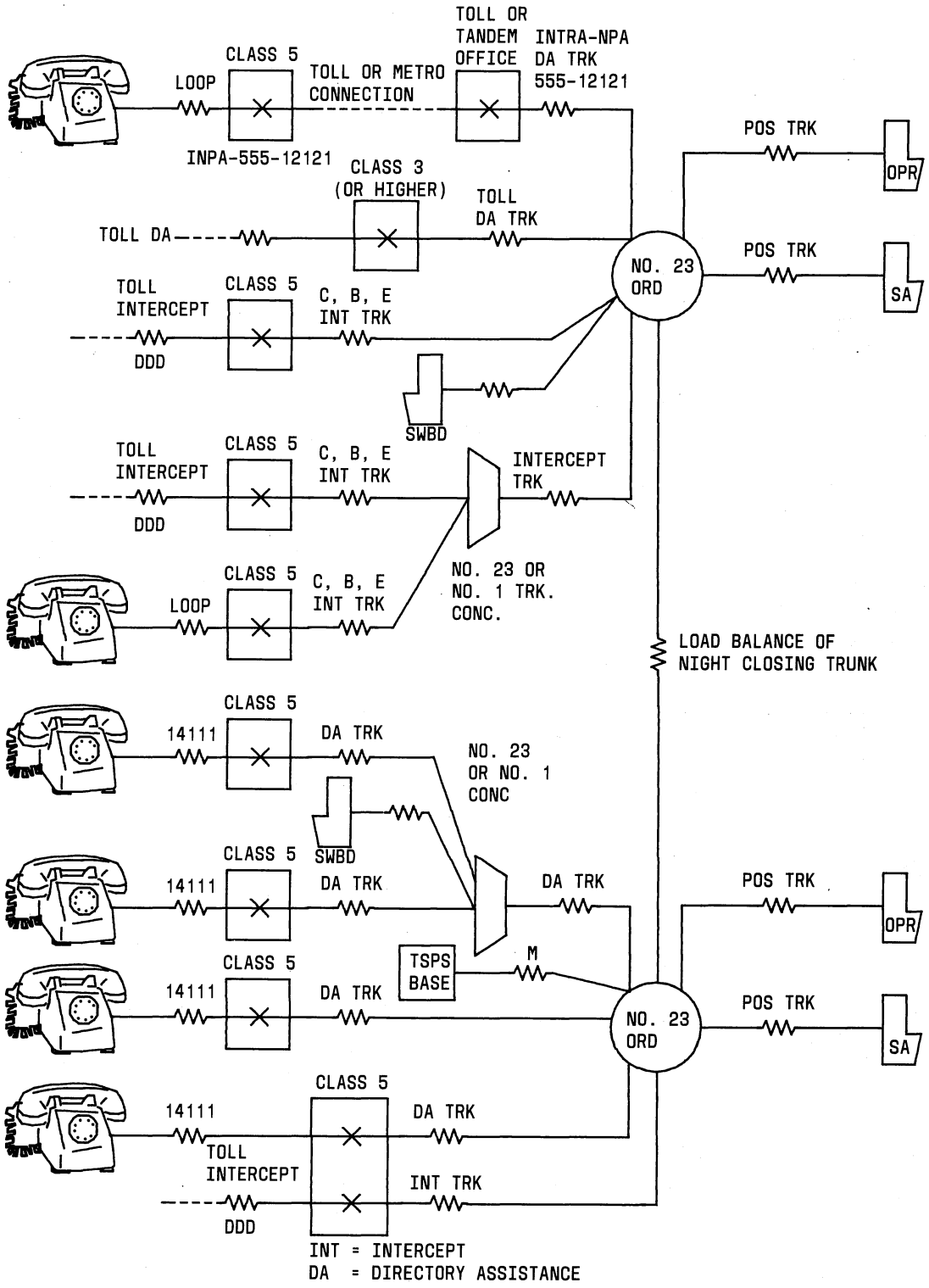


**Fig. 1—No. 23 ACD Trunking Plan**

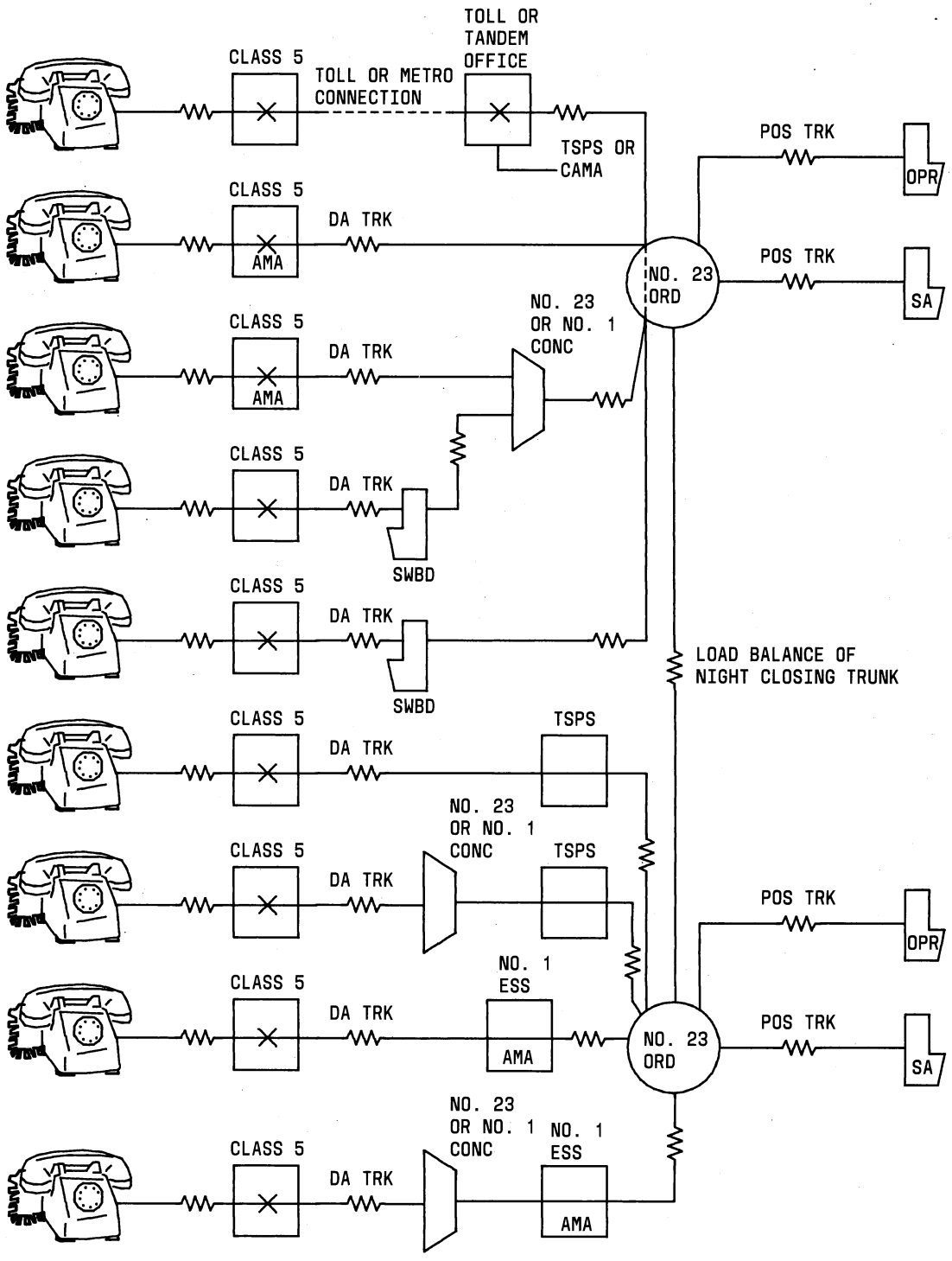


**Fig. 2—No. 23 ACD Trunking Plan for Directory Assistance Charging**

### C. Echo Grade of Service

**3.05** The average echo grade of service (E/GOS) for the customer is about the same as for the reference DDD connection. The E/GOS for the operator, however, has been allowed to be about 10 to 15 percent poorer for the extended service network. This is considered permissible because the operator will be handling a mix of local and toll calls, all of short duration.

### D. Operator Sidetone

**3.06** The mean operator acoustic sidetone path loss should be 12 dB. Sidetone losses in the range of 8 to 16 dB are acceptable.

## 4. TRANSMISSION PLAN AND REQUIREMENTS

### A. General

**4.01** The basic trunking arrangements and trunk losses are similar to those for the extended Phase II No. 5 ACD and for the extended Automatic Intercept System (AIS). There are no trunks from the switch location to the operators location for the No. 23 ORD because operator positions are co-located with the switching network and are interconnected by office wiring. The plan provides for light-load transfer to another similar No. 23 ACD or to a Phase II No. 5 ACD.

**4.02** To meet transmission requirements, the No. 23 ORD needs the modifications described in Part 5. Depending upon the area served, some trunks may become extended over long distances which increase the noise. This adversely affects the grade of service. To decrease the effective noise from analog trunks in such service, either the new J99338E Compandor Applique for L-multiplex (LMX) facilities or the Type B N3-L function should be used.

**4.03** When a particular trunk combination will handle more than one type of traffic, the trunk transmission requirements for the most stringent type traffic must be used. For example, a trunk group expected to handle both DA and intercept should meet the intercept requirements. It is important that the grade of service of which the customers are accustomed to in these types of calls be maintained in a centralized call distributing system.

**4.04** Balancing requirements play a vital part of overall transmission performance as toll DA and intercept traffic are extensions of the intertoll network. Balancing requirements and procedures are not covered in this section but are covered in Sections 660-462-301 and 660-462-502.

**4.05** The No. 23 ORD is assigned a transmission level of -2 dB TLP which requires TP2 testing. The modified ORD is arranged for TP2 testing.

**4.06** With these modifications and additions the transmission plan allows the overall length of the No. 23 ACD system to be increased to a maximum of 1000 route miles from the access office to the operator positions while providing about the same satisfactory grade-of-service performance as Phase II No. 5 ACD and AIS systems.

### B. ACD Trunk Network

**4.07** ***Local DA Trunking:*** A subscriber placing a local DA call connects through the class 5 office to an ACD incoming trunk. The call is switched through the ORD to an operator's position circuit. The incoming trunks may be concentrated with the trunks between the concentrator and ORD being required on 4-wire facilities.

**4.08** ***Intra-NPA DA Trunking:*** A subscriber placing an intra-NPA DA call may be routed via a direct or sector tandem in a metropolitan network. Also, the call may route via a combined local-toll arrangement. The incoming trunks to the ACD should not be concentrated. A call entering the ACD from a switchboard may be concentrated if the switchboard and concentrator are co-located and considered as a common switching location.

**4.09** ***Toll DA Trunking:*** A subscriber placing a toll DA call connects from a class 3 or higher office. Toll DA trunking does not allow for trunk concentration, and a system being engineered should not consider ACD incoming trunk concentration. The incoming trunk between the toll office and the ACD is considered to be an intertoll trunk and requires use of 4-wire facilities.

**4.10** ***Intercept Trunking:*** Intercept calls may originate from a local subscriber, from the intra-NPA network, or from the intertoll network. The intercept transmission requirements are the

most stringent because intercept service is an extension and termination of the toll network. The intercept incoming trunks may have one stage of concentration. The incoming trunk between the concentrator and the ACD will require a 4-wire facility.

**4.11** ***Combined DA and Intercept Trunking:*** The circuits of the No. 23 ORD can be arranged so that the various services are connected to operators in a predetermined order. This traffic may be handled at any or all positions, certain positions, all services at still other positions, or an overlapping of services as desired.

**4.12** ***Directory Assistance Charging (DAC):*** DAC trunking arrangements are shown in Fig. 2. If the class 5 office is not equipped with local automatic message accounting (LAMA), charging can be accomplished at a toll office with connections to a centralized automatic message accounting (CAMA) system. Traffic Service Position Systems (TSPSs) equipped with Generic Program No. 5 or higher or No. 1 Electronic Switching System (ESS) office using Generic 8 or higher and having a data connection to the automatic message accounting (AMA) system can be arranged to record DAC calls. As usual, if the originating class 5 offices do not have automatic calling number identification (ANI) equipment, the customer must be connected to operator number identification (ONI) operators who obtain the calling number for the AMA system.

### C. Transmission Requirements

**4.13** ***Trunk Loss:*** The trunk loss requirements for 2-wire and 4-wire trunks are shown in Table A for inserted connection loss (ICL) and expected measured loss (EML). The ICLs and EMLs for the trunks are defined from switch to switch as shown generally by Fig. 3. The No. 23 ORD is assigned a transmission of -2 dB TLP which requires TP2 testing. The testing arrangement provided with the No. 23 ORD has a 2-dB test pad.

**4.14** ***Balance Requirements:*** The echo return loss (ERL) and singing return loss (SRL) requirements are given in Table B. The balance testing procedures for the No. 23 ACD and No. 23 TC are given in Section 660-462-502. Refer to other appropriate sections for balance testing of the other offices in the No. 23 ACD network.

**4.15** ***Noise Requirements:*** Noise requirements are the same as indicated in Section 660-403-500. When the Type B N3-L junction is used to obtain compandored LMX trunks on a group basis, refer to Section 362-900-506 (for N3 length of 0 to 50 miles) for noise requirements. When the Compandor Applique per J99338E is used on a channel basis, the requirements are given in Table B.

### D. System Length

**4.16** The permissible overall system length of the operator service network from the originating office to the operators position is determined by echo (delay) and noise. Operator talker echo control is provided by the voice switched amplifier (VSA) of the new operators telephone circuit (4251A Network). This will control operator talker echo for up to 1000 route miles. The VSA feature as well as the automatic gain control (AGA) is always enabled without dependence upon distance.

**4.17** Customer echo is controlled by the insertion losses of the circuits and the specified return losses at points of reflections.

**4.18** Noise, the other major length-dependent transmission impairment of long analog trunks, can be effectively reduced by using compandored facilities in both directions of transmission. There is no system length limit with the use of digital facilities.

**4.19** The maximum recommended system length is shown in Table C. Without compandors, the system length is loss-noise limited. With compandors on the long-haul analog trunks, the system length can be extended up to 1000 route miles. Beyond this length, both echo and noise grades of service deteriorate.

**4.20** There is an existing option on the No. 23 ORD for night closing to No. 3CL cordboards. This option is not permitted on extended No. 23 ACD systems.

## 5. ENGINEERING CONSIDERATIONS

### A. General

**5.01** When a transmission plan is engineered for a No. 23 ACD system, several modification and additions must be applied. Modifications for

TABLE A
NO. 23 ACD SYSTEM LOSS AND BALANCE REQUIREMENTS

| TRUNK TYPE | | SVC | FAC | ICL dB | RLMS LOC. | TERM LOC. | BALANCE REQUIREMENTS ERL, dB MED | ERL, dB MIN | ERL, dB TURN DOWN | SRL, dB MED | SRL, dB MIN | SRL, dB TURN DOWN | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CL 5 | TO NO. 23 ACD WITHOUT NIGHT CLOSING | DA | 2- & 4-WIRE | 3.0 | ACD | CL 5 | 13 | 10 | 10 | 10 | 6 | 6 | 1 |
| | | | 4-WIRE | | ACD | | - | 14 | - | - | 6 | - | |
| | | | 2-WIRE | | ACD | CL 5 | 18 | 13 | 10 | 10 | 6 | 4 | 2 |
| | | | 4-WIRE | | | | 22 | 16 | 10 | 15 | 11 | 4 | |
| TSPS BASE | | OS | 2-WIRE | 2.0 | | TSPS BASE | 18 | 13 | 10 | 10 | 6 | 4 | 2,3 |
| TC SWBD ACD | | DA | 4-WIRE | 0.8 | ACD | | 22 | 16 | 10 | 15 | 11 | 4 | 2 |
| CL 5 | TO NO. 23 ACD WITH NIGHT CLOSING | DA | 2-WIRE | 3.0 | ACD | CL 5 | 18 | 13 | 10 | 10 | 6 | 4 | 1 |
| | | | 2-WIRE | | | | 22 | 18 | 10 | 14 | 10 | 4 | 1,3 |
| | | | 4-WIRE | | | | - | 14 | - | - | 6 | - | 1 |
| | | | 2- & 4-WIRE | | | | 22 | 16 | 10 | 15 | 11 | 4 | |
| TC SWBD | | DA & IR | 4-WIRE | 0.8 | ACD | | 27 | 21 | 18 | 20 | 14 | 11 | 2 |
| CL 5 | TO NO. 23 ACD WITH OR WITHOUT NIGHT CLOSING | IR | 2- & 4-WIRE | 3.0 | ACD | CL 5 | 22 | 16 | 10 | 15 | 11 | 4 | |
| SWBD | | DA & IR | 2-WIRE | 0.8 | | SWBD | 22 | 18 | 10 | 14 | 10 | 4 | 2,3 |
| TDM | | DA | 2- & 4-WIRE | 2.0 | | TDM | 22 | 16 | 10 | 15 | 11 | 4 | |
| TOLL | | | | | | | | | | | | | |
| TSPS BASE | | OS | 4-WIRE | VNL | ACD | | 27 | 18 | 10 | 20 | 14 | 11 | |
| NO. 23 ACD TO | POS | DA & IR | | 4.0 | | | 22 | 16 | 10 | 15 | 11 | 4 | 2 |
| | | | | | | | 20 | 17 | - | 12 | 9 | - | |
| | ACD OR AIS | | | 0.0 | | | 27 | 18 | 10 | 20 | 14 | 11 | |
| CL 5 | TO NO. 23 TC | DA | 2- & 4-WIRE | 3.0 | TC | CL 5 | 13 | 10 | 10 | 10 | 6 | 6 | 1 |
| | | | 4-WIRE | | TC | | - | 14 | - | - | 6 | - | |
| | | | 2-WIRE | | TC | CL 5 | 22 | 18 | 10 | 14 | 10 | 4 | |
| | | | 2-WIRE | | | | 18 | 13 | 10 | 10 | 6 | 4 | 2 |
| | | | 4-WIRE | | | | 22 | 16 | 10 | 15 | 11 | 4 | |
| | | IR | 2- & 4-WIRE | | | | | | | | | | |
| SWBD | | DA & IR | 2-WIRE | 0.8 | | SWBD | 22 | 18 | 10 | 14 | 10 | 4 | 2,3 |
| NO. 23 TC TO | ACD OR AIS | IR | 4-WIRE | | TC | | 27 | 18 | 10 | 20 | 14 | 11 | |
| | TSPS NO.1 ESS | DAC | 4-WIRE | 0.8 | | | | | | | | | |

| TRUNK TYPE | | SVC | FAC | ICL dB | RLMS LOC. | TERM LOC. | BALANCE REQUIREMENTS ERL, dB MED | ERL, dB MIN | ERL, dB TURN DOWN | SRL, dB MED | SRL, dB MIN | SRL, dB TURN DOWN | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CL 5 | TO NO.1 TC | DA & IR | 2-WIRE | 10.0 | TC | CL 5 | 18 | 13 | 10 | 10 | 6 | 4 | 2 |
| | | | 4-WIRE | | | | 22 | 16 | 10 | 15 | 11 | 4 | |
| CL 5 SWBD | | | 2-WIRE | 7.0 | | CL 5 SWBD | 22 | 18 | 10 | 14 | 10 | 4 | |
| CL 5 | TO SWBD | DA & IR | 2- & 4-WIRE | 3.0 | SWBD | CL 5 | 13 | 10 | 10 | 10 | 6 | 6 | 1 |
| | | | 2-WIRE | | | | 18 | 13 | 10 | 10 | 6 | 6 | 2 |
| | | | 4-WIRE | | | | 22 | 16 | 10 | 15 | 11 | 4 | |
| | | | 2-WIRE | | | | 22 | 18 | 10 | 14 | 10 | 4 | 2,3 |
| CL 5 | TO TOLL | DAC | 2-WIRE | 3.0 | TOLL | CL 5 | 18 | 13 | 10 | 10 | 6 | 6 | 2 |
| | | | 4-WIRE | | | | 22 | 16 | 10 | 15 | 11 | 4 | |
| | | | 2-WIRE | | | | 22 | 18 | 10 | 14 | 10 | 4 | 2,3 |
| | TO TSPS | | 2- & 4-WIRE | | TSPS | CL 5 | - | 18 | - | - | - | - | 2 |
| | | | | | | OGT 4WTS | - | 18 | - | - | - | - | |
| | | OS | | | | TSPS | - | 26 | 18 | - | 19 | 11 | |
| TC | | DAC | 4-WIRE | 0.0 | | | 22 | 16 | 10 | 15 | 11 | 4 | |
| CL 5 | TO NO.1 ESS | | 2- & 4-WIRE | 3.0 | ESS | CL 5 | 13 | 10 | 10 | 10 | 6 | 6 | 1 |
| | | | 2-WIRE | | | | 18 | 13 | 10 | 10 | 6 | 6 | 2 |
| | | | 4-WIRE | | | | | | | | | | |
| TC | | | 4-WIRE | 0.0 | | TC | 22 | 16 | 10 | 15 | 11 | 4 | |

NOTES:
1. ACD SYSTEM LENGTH LIMITED TO 450 MILES.
2. ACD SYSTEM LENGTH LIMITED TO 600 MILES USING NON-COMPANDORED FACILITIES OR 1000 MILES USING COMPANDORED OR T-CARRIER FACILITIES.
3. INTRA-BUILDING TRUNKS.

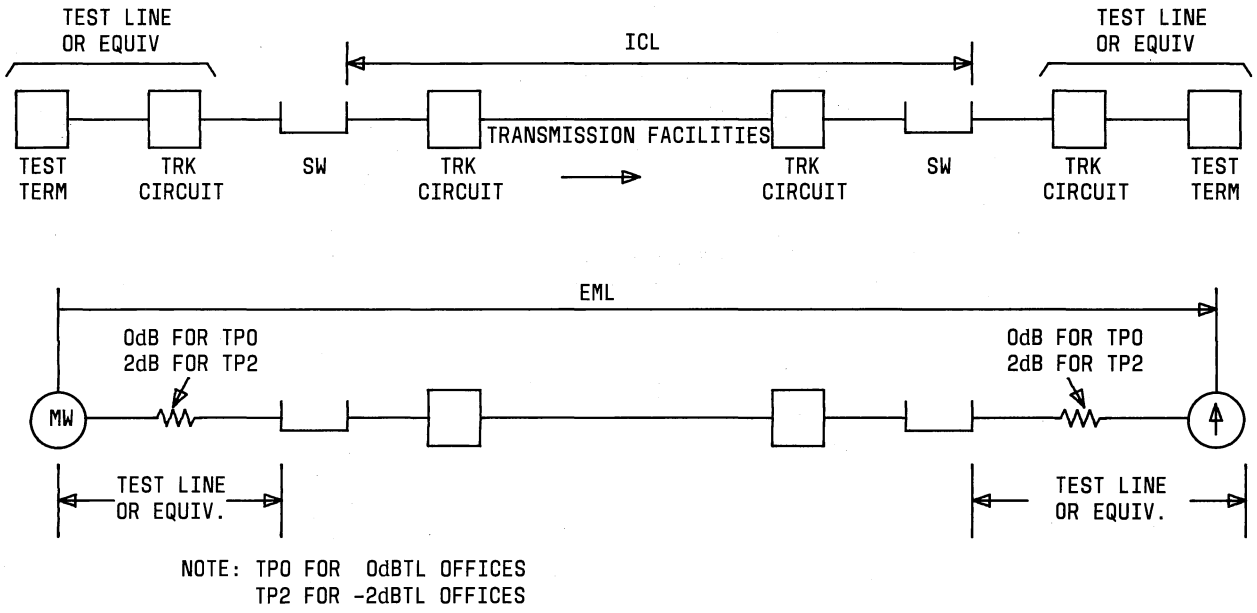


**Fig. 3—Trunk Loss Measurement—Inserted Connection Loss and Expected Measured Loss**

**TABLE B**

**NOISE LIMITS FOR MESSAGE TRUNKS USING N3 COMPANDOR APPLIQUE WITH L-MULTIPLEX TRANSMISSION FACILITIES**

| *NOISE LIMITS | ROUTE MILES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0 to 50 | 51 to 100 | 101 to 200 | 201 to 400 | 401 to 1000 | 1001 to 1500 | 1501 to 2500 | 2501 to 4000 |
| Immediate Action: | 24 | 25 | 25 | 26 | 27 | 28 | 30 | 31 |
| Circuit Order: | 19 | 20 | 20 | 21 | 22 | 23 | 25 | 26 |

* To be used instead of Table B of Section 660-403-500 where noise is measured without the 2-dB test pad. Subtract 2 dB where the test pad is used.

the No. 23 ORD for use as a 23 ACD fall into two categories: transmission and maintenance.

### B. Transmission Modifications

#### Position Circuits

**5.01** The position circuit is required to have the 4251A Network unified telephone circuit (UTC) added to provide the new telephone circuit as standard. This will be required instead of the 181B repeat coil telephone circuit presently used. The UTC includes a number of transmission improvements including features that make it possible to extend the length of the ACD to cover larger areas. A 1A 4-wire terminating set (4WTS) is added to interface the 2-wire position circuit to the UTC. A new option to provide drop build-out capacitors (DBOCs) is required to improve terminal and through balance.

**TABLE C**

**SYSTEM LENGTH GUIDELINE FOR NO. 23 ACD ACCESS OFFICE TO OPERATOR POSITIONS**

| TRUNK TYPE ARRANGEMENT WITH OR WITHOUT TRUNK TYPE G | ACD MAXIMUM LENGTH (ROUTE MILES) | |
|---|---|---|
| | NONCOMPANDORED | COMPANDORED |
| A | 450 | 1000 |
| B | 450 | 450 |
| E | 600 | 1000 |
| B+A (DAC) | 600 | 1000 |
| C+D | 600 | 1000 |
| B+F | 450 | 450 |
| E+F | 600 | 1000 |
| E+I+J | 600 | 1000 |
| B+K+F | 450 | 450 |
| H | 200 | 1000 |
| C+D+F (DAC) | 600 | 1000 |
| E+G+F (DAC) | 600 | 1000 |
| G | (see Note) | |

***Note:*** Cable, digital, N3 or L-carrier facilities can be used for Trunk Type G. The L facility should be compandored if longer than about 50 miles and other trunks are compandored.

**Trunk Circuits**

**5.02** The incoming trunk circuit is required to have a 120C repeat coil with both midpoint capacitors of 2.0 $\mu$F. The available DBOC for balance and the available idle termination options are required.

**5.03** The position transfer or concentrator junctor circuit (outgoing trunk) is required also to have a 120C repeat coil with both midpoint capacitors of 1.0 $\mu$F. The required DBOC will be provided by a new option. The available option for idle termination is required.

**Precision Balance Network**

**5.04** The usual compromise network in the 4WTS cannot be used because the incoming and outgoing trunk circuits contain repeat coils with midpoint capacitors. A new precision balance network, coded 4066L, was developed to meet through-balance requirements of the cross-office path between the incoming and outgoing 4WTS. The 4066L Network provides ERL values greater than 30 dB and SRL values greater than 25 dB in each direction of transmission for cross-office paths within a 65-ohm wiring restriction. See Fig. 4 for a circuit diagram of the 4066L Network.

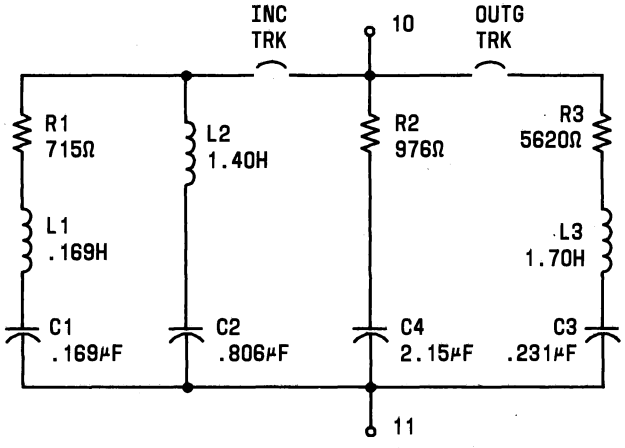


**Fig. 4—Circuit Schematic of 4066L Network**

### C. Maintenance Modifications

#### Access Jack Circuit (SD-1B147-01)

**5.05** Figure 5 shows new jacks that are required for the No. 23 ORD. These jacks are to be centrally located in a maintenance part of a frame. Access to portable test equipment will be provided at this point.

#### Path Selection Circuit (SD-1B148-01)

**5.06** A path selection feature is provided to permit establishing connections from any given incoming trunk to any given outgoing trunk or operator position. This feature is to be used for switch testing and alignment of the transmission facilities. Balance testing procedures require the Path Selection Circuit to set up testing connections. Two indicators are provided for seizing and holding. TP2 testing and a milliwatt supply are provided on the same test panel.

### D. Operator Headset

**5.07** At present, within the Bell System, there are several varieties of operator headsets being used. These headsets have varying electroacoustic efficiencies and impedances. An ACD operator may handle several different types of traffic especially when on a night closing team. Care must be exercised in equipping the operators with approved headsets.

**5.08** Because of the expected high usage of the light-weight headsets, the lineup guidelines for No. 23 ACD operator circuits are based on the use of the 60A and 61A headsets. The 60A, 61A, KS-20778 List 16A, or KS-21118 should be used by No. 23 ACD operator teams.

### E. Operator Sidetone and Room Noise

**5.09** The UTC incorporates a separate amplifier to provide local operator sidetone. This amplifier can be adjusted to provide the objective 12 dB of acoustic sidetone path loss.

**5.10** The UTC circuit levels have been set on the assumption that the operating room noise is comparable to typical subscriber locations. Excessively high room noise may cause nonoperation of the VSA in the UTC. Customer and operator transmission complaints can be caused by high room noise. To avoid these problems, it is recommended that operating room noise be controlled by soundproofing and proper setting of positions. The recommended room noise should be held to the following levels during busy hour conditions:

***Room Noise Objectives at Positions***

55 dB (A) average
62 dB (A) maximum

***Note:*** Refer dB re 0.00002 $N/M_2$ with A-weighting American National Standard Institute S1.4 issued 1971.

### F. Circuit Round-Trip Delay

**5.11** The VSA is a part of the UTC. It is always used with the No. 23 ACD; therefore, no round-trip delay requirement is specified.

### G. System Balancing

**5.12** The No. 23 ACD terminates and switches traffic from the intertoll network or the local message network. The class of office in the ACD varies with the type of traffic it is handling. It may be a tandem or a class 4 or class 3 toll office. The ACD should meet balance requirements for the highest class connection of which it may be a part.

**5.13** The maximum length of the ACD system is dependent on meeting balance requirements. A trunk from the local office to the ACD meeting the 13-dB ERL objective has a 450-route mile maximum length, while the same trunk meeting terminal balance requirement can be extended to a maximum of 600 route miles.

**5.14** In cases where an incoming trunk from other than a local office switches to a load balancing or light-load tandem circuit, the connection should meet through-balance requirements. Balance requirements and test procedures for the No. 23 ACD system are covered in Sections 660-462-301 and 660-462-502.

### H. System Wiring Restrictions

**5.15** The wiring restrictions for the No. 23 ACD is shown in Fig. 6A and B. Fig. 6A is for the No. 23 ORD serving operator or SA positions. Fig. 6B is for the No. 23 ORD having light-load

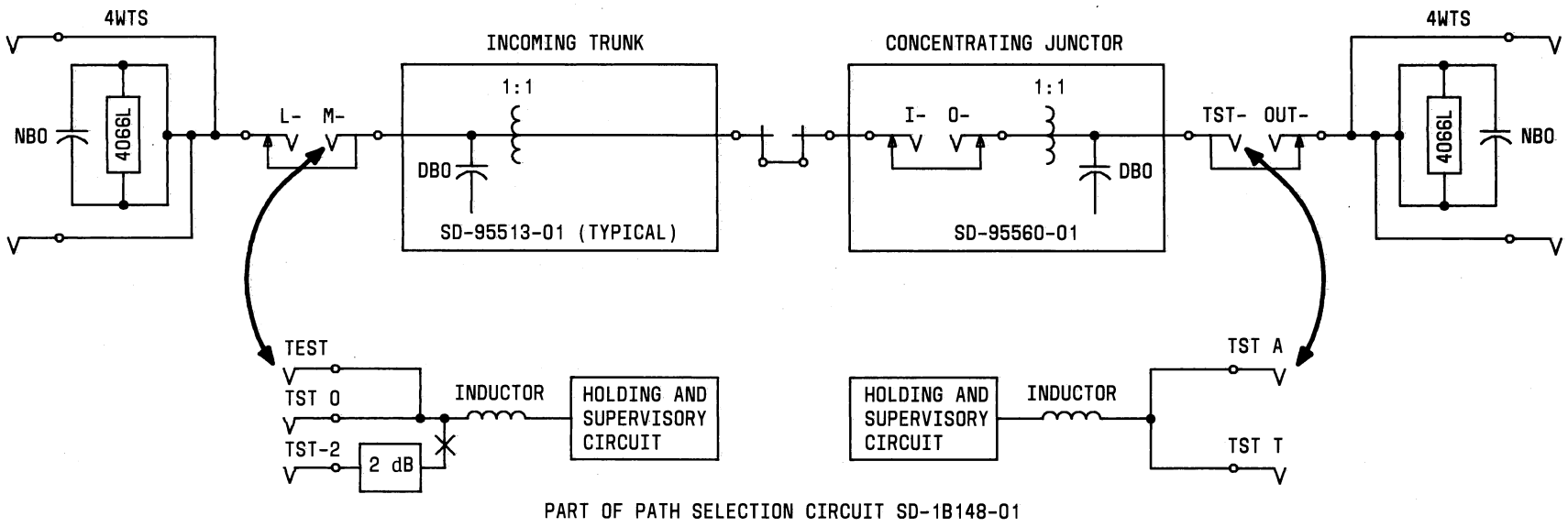


**Fig. 5—Modification of No. 23 ORD to Provide Transmission Jacks**

transfer or load balance features to a remote ACD. Office wiring restrictions for transmission reasons are based on current DDD practices and the use of 24-gauge switchboard cable. Wiring restrictions are primarily necessary in order that terminal or through-balance return-loss requirements can be met. Also, wiring restrictions are required to avoid excessive insertion loss or loss slope (loss at 1 kHz relative to 400 Hz or 2800 Hz) or exposure to 60 Hz ac or to noise for connection through the office. As usual, the transmission wiring should be separated from wiring used for control, signaling, and ac power to reduce chances of noise from these sources. This requirement also applies to cabling connecting transmission circuits to the positions or consoles.

### I. No. 23 Trunk Concentrator

**5.16** When the transmission plan for a No. 23 ACD system proposes using a No. 23 TC, several modifications must be made to improve the performance of intercept and local DA connections. The modifications are the same as for the No. 23 ORD and are discussed in paragraphs 5.02 through 5.06 of this section.

**5.17** The ICL of a properly modified No. 23 TC is 0.6 dB at 1 kHz between 900-ohm terminations. See Section 852-408-100 for engineering considerations of the No. 23 TC.

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J. No. 1 Trunk Concentrator

**5.18** The No. 1 TC is a new 4-wire crossbar switch with improved transmission and maintenance features. Shown in a typical local DA arrangement, the No. 1 TC can concentrate 2-wire and 4-wire incoming trunks to an ACD. The trunks between the No. 1 TC to the ACD should be engineered as 4-wire.

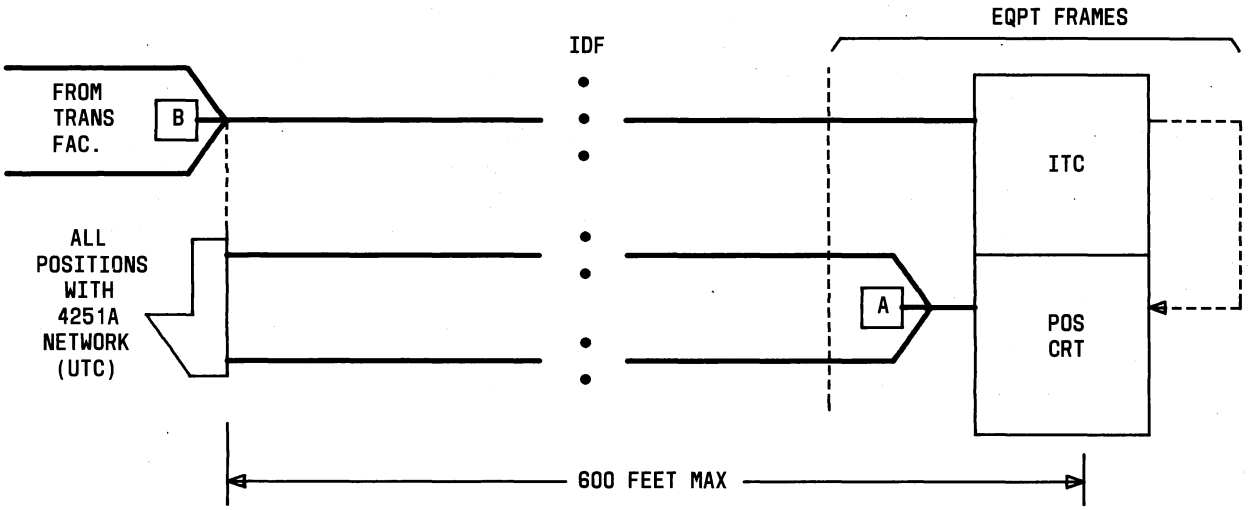
**5.19** In order to match the carrier levels in the carrier facilities, pad loss is necessary in the transmit and receive pairs.

## 6. REFERENCES

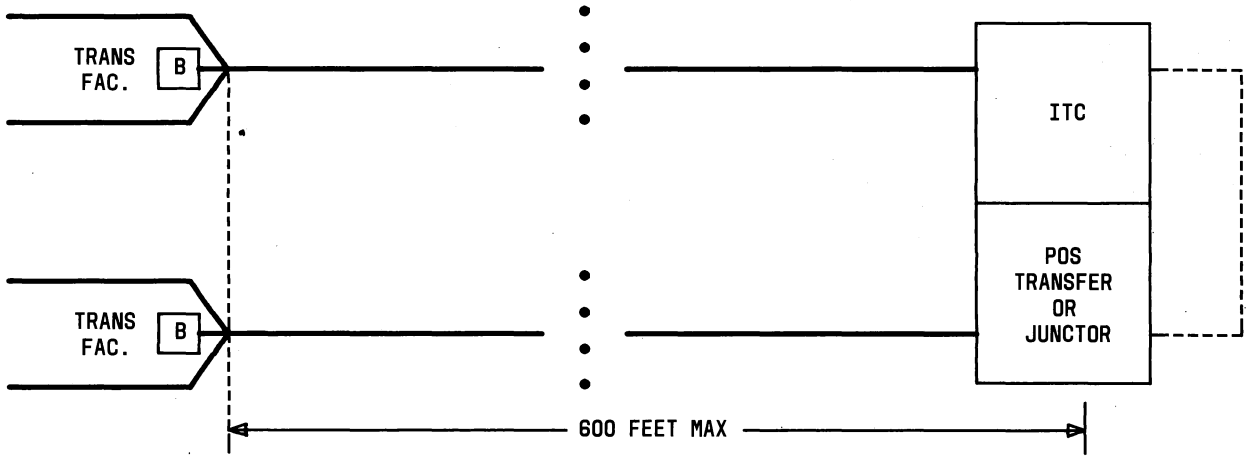
**6.01** The following list of references are given to assist the transmission engineer in the No. 23 ACD design.

| SECTION | TITLE |
|---|---|
| 660-462-XXX | No. 23 ACD and No. 23 TC Balance Practices |
| 852-408-100 | No. 23 TC Transmission Engineering Considerations |
| 852-408-101 | No. 1 TC Transmission Engineering Considerations |

A. NO. 23 ORD SERVING POSITIONS




B. NO. 23 ORD SERVING AS A CONCENTRATOR OR FOR LIGHT LOAD TRANSFER OR LOAD BALANCE




A = COMP NET OF HYBRID

B = 4066L NETWORK

**Fig. 6—No. 23 ORD Office Wiring Restrictions (24-Gauge Cable)**