



Table

A. Toll/Tandem PIDENTs . . . . . 2

1. GENERAL

INTRODUCTION

1.01 The toll/tandem software performs the actions needed to route toll calls and calls requiring a trunk-to-trunk connection through a No. 1/1A Electronic Switching System (ESS) office.

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

1.03 Part 6 of this section provides a defined list of the abbreviations and acronyms used in this section.

PURPOSE OF THE TOLL/TANDEM SOFTWARE

1.04 The toll/tandem software provides a centralized stored program control system (SPCS) which enables a No. 1/1A ESS office to process toll and tandem calls in addition to local calls. These calls require the establishment of a trunk-to-trunk connection. This section also provides information about software which interfaces the ESS to operator/switchboard positions on toll calls requiring operator assistance.

SCOPE OF SECTION

1.05 This section provides an introduction to the toll/tandem software operating in a No. 1/1A ESS office. This section is based on the generic programs through 1E7 (for No. 1 ESS) and 1AE7 (for No. 1A ESS).

PIDENTS DESCRIBED IN SECTION

1.06 Table A provides a list of the PIDENTs which are covered in this section.

2. FUNCTIONAL OVERVIEW

TANDEM CONNECTIONS PROGRAM

2.01 A tandem call is defined as an incoming call on an incoming trunk (ICT) which will not terminate at a line or tone circuit in the local ESS office, but will be routed over a nonoperator outgoing trunk (OGT).

2.02 There are four types of tandem calls:

- (1) Local tandem—trunk-to-trunk connection set up when an ESS office serves as a local tandem office.
- (2) Centrex tandem—connects a pair of centrex tie trunks.
- (3) Tandem connection which occurs because an incoming call is to a customer line which has temporary transfer active to a line outside the local office.
- (4) Connection resulting from an incoming direct inward dialing (DID) call to centrex customer premises equipment.

2.03 Routing of tandem calls is handled by PIDENT TAND. TAND provides supervision on the ICT while the called number is outpulsed on the OGT. It then establishes the talking path if outpulsing is successful. If outpulsing fails, it takes appropriate actions.

TABLE A

TOLL/TANDEM PIDENTS

PIDENT	TITLE	NO. 1 PR	NO. 1A PR
TAND	Tandem Connections Program	1A129	6A129
TOPR	Toll Operator Signaling Program	1A051	6A051
TSPS	Traffic Service Position System	1A150	6A150

**TOLL OPERATOR SIGNALING PROGRAM**

**2.04** The toll operator signaling program (TOPR) handles signals sent over intertoll trunks to and from switchboards. TOPR is entered from the scan point change director program when an operator trunk ferrod changes states. TOPR then determines which of the possible signals has been received and takes appropriate action for that signal. It also processes operator answer and disconnect.

**TRAFFIC SERVICE POSITION SYSTEM PROGRAM**

**2.05** The TSPS program processes all calls routed to a traffic service position (TSP) or Traffic Service Position System (TSPS). This includes any calls requiring operator intervention such as collect or person-to-person calls. It takes appropriate actions for on- or off-hook reports and also processes coin collect and return signals on coin calls.

**3. TANDEM CONNECTION (TAND) PROGRAM DESCRIPTION****GENERAL**

**3.01** The primary purpose of the tandem connections program is to establish a trunk-to-trunk connection. It is entered from the incoming call digit analysis program ICAL or ISXS. TAND provides supervision on the ICT while outpulsing the called number over an OGT. If outpulsing fails for any reason, TAND takes appropriate action as further described in the following paragraphs.

**3.02** When TAND is entered, it performs initialization to prepare to outpulse the called number. It then calls the outpulsing program. The outpulsing program idles the digit receiver which was used to receive the called number from the ICT. It searches for an OGT based on a route index (RTI). The RTI is passed to TAND, which in turn passes it to the outpulsing program. The outpulsing program then seizes an idle transmitter of the proper type for the OGT, if a transmitter is required.

**3.03** The outpulsing program will attempt to outpulse the called number and will return to TAND with either a success report or a report of why outpulsing failed. Outpulsing may fail for one of the following reasons:

(a) Transmitter preemption

(b) Abandon during outpulsing

(c) Non-POB failure

(d) Busy or blocked condition

(e) Hardware failure

The actions taken by TAND for these cases are described in the following paragraphs. A functional flowchart of TAND is shown in Fig. 1.

**OUTPULSING REPORTS****A. Transmitter Preemption**

**3.04** If a transmitter does not receive a start-pulsing signal within approximately 4 seconds, it may be preempted as further explained in paragraph 3.07 below and in Reference (b) in Part 7. If this occurs, TAND idles the network path in memory and restores the OGT and transmitter to idle lists. If the ICT is still off-hook, overflow tone is returned. If the ICT has abandoned, abandon procedures are taken.

**B. Abandon During Outpulsing**

**3.05** If an abandon (on-hook condition) is detected on the ICT while the outpulsing program has control of the call, the call must be taken down. The ICT and OGT are restored to the idle state, the path is idled, and all registers associated with the call are released.

**C. Non-POB Failure**

**3.06** If a trouble condition exists in the interoffice signaling equipment at either the local office or the distant office, a non-POB failure report is returned to TAND. When this occurs, TAND idles all memory associated with the outgoing portion of the call and will optionally try to outpulse over a different OGT if the ICT is still off-hook.

**D. Busy or Blocked**

**3.07** If the network is blocked (no network path available) the ICT is connected to overflow tone. If a busy condition exists because there is no idle transmitter available, an attempt is made to preempt a transmitter from another call. Preemption is done by the outpulsing control program. This program hunts for an outpulsing

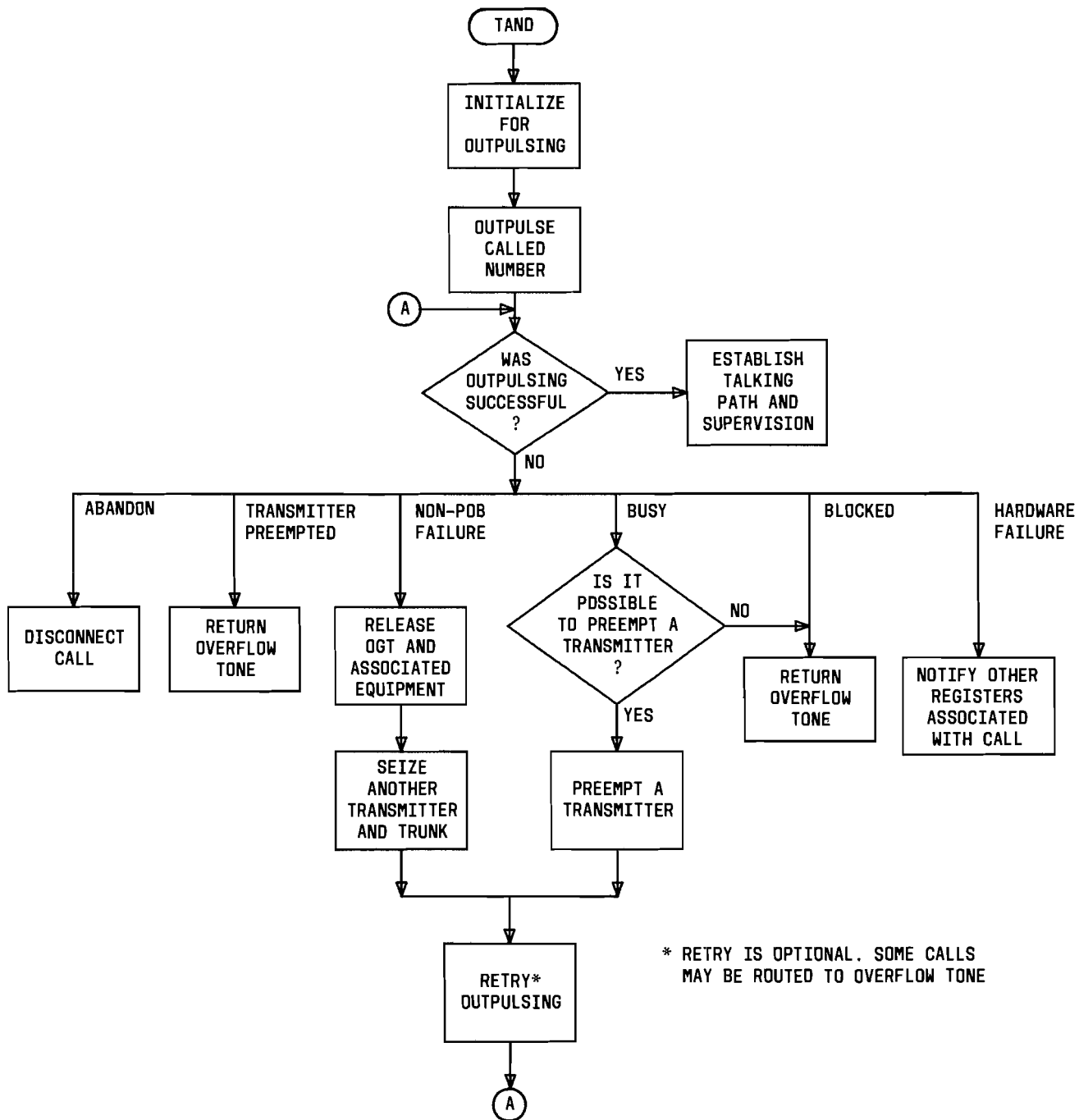


Fig. 1—Tandem Connections Program—Functional Flowchart

control register which has been in the start pulsing signal detection state for more than 4 seconds. If such a register is found, the transmitter associated with the register is made idle and the path to it is abandoned. Programs handling the call which had control of the transmitter are notified that

the transmitter has been preempted. The previously busy call can then use the newly idled transmitter. If a transmitter can be preempted, outputting is attempted using that transmitter. Otherwise the ICT is connected to overflow. If no OGT is available, the call is connected to overflow.

### E. Hardware Failure

**3.08** If hardware troubles occur when the outpulsing program attempts to connect a transmitter to the OGT, the report is passed on to all registers linked to the incoming call register and the call is torn down. TAND then returns to the main program.

### F. Successful Outpulsing

**3.09** If outpulsing is successful, TAND establishes a talking path between the ICT and the OGT. The transmitter is restored to the idle list and a peripheral order buffer (POB) is loaded with orders to set up the talking path which was reserved when the outpulsing connection was established. The POB is then loaded with orders to put the trunks in the proper states for talking. If these POB orders are successful, answer supervision is established on the OGT and disconnect supervision is established on the ICT. Supervision reports are processed by the call processing programs such as the disconnect programs and dialing connections programs. See Reference (a) in Part 7 for further information on these programs.

### SPECIAL TRUNKS

**3.10** Digital carrier trunks (DCTs) or trunks with common channel interoffice signaling (CCIS) must be handled somewhat differently than other trunks by TAND since they do not use digit transmitters and receivers. When a CCIS trunk is used, the called number is sent over a data link. When a DCT with digital carrier address signaling is used, the called number is sent (on an OGT) or received (on an ICT) by a peripheral unit controller (PUC) rather than by a transmitter or receiver.

## 4. TOLL OPERATOR SIGNALING (TOPR) PROGRAM DESCRIPTION

### GENERAL

**4.01** The toll operator signaling program TOPR handles operator signals to and from switchboards. These signals are sent over intertoll trunks and include:

- Ringback
- Ring forward

- TSPS double ring forward
- Alerting wink

TOPR also handles answer and disconnect on calls routed over intertoll trunks.

**4.02** TOPR is called by the scan point change director program (CHGD) whenever it detects a change in state in a trunk ferrod. TOPR then determines what kind of signal is represented by the change in state and calls other routines to take the appropriate action for that signal. The operation of TOPR is described in the following paragraphs. Figure 2 provides a functional flowchart of TOPR.

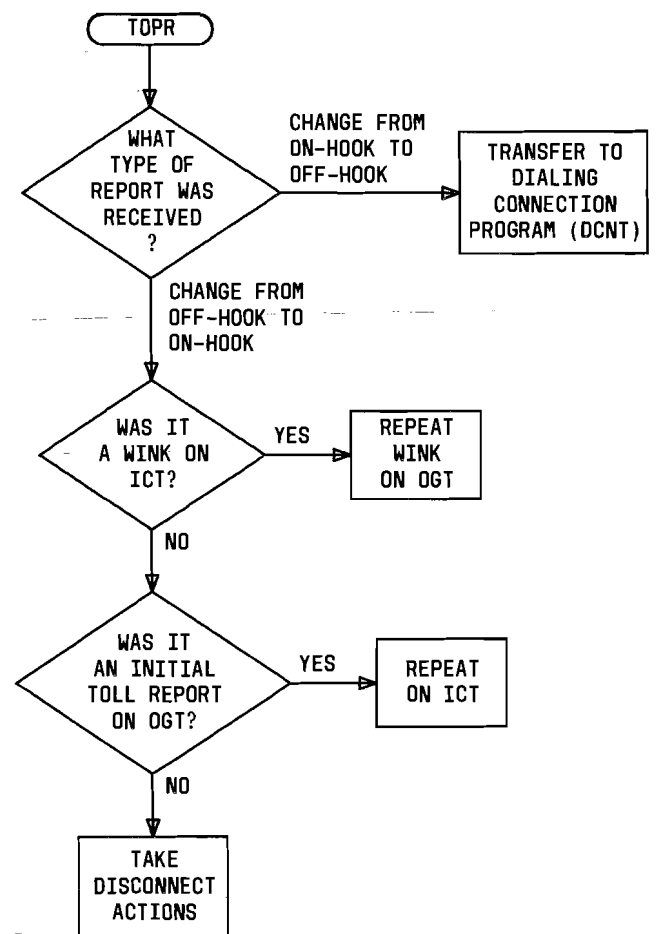


Fig. 2—Toll Operator Signaling Program—Functional Flowchart

**OFF-HOOK REPORTS**

**4.03** When an ICT changes from on-hook to off-hook, TOPR interprets this as a seizure and calls the dialing connections program (DCNT) to connect a digit receiver.

**4.04** When a trunk side ferrod of an OGT changes from on-hook to off-hook, this indicates answer or end of ringback. In either case, TOPR transfers to DCNT to take appropriate action.

**ON-HOOK REPORTS**

**4.05** If an ICT is reported to be on-hook, there are several possible reasons. It may indicate disconnect, in which case the disconnect program DISC is called to release all equipment and registers currently associated with the call. Supervision is then restored on the ICT to detect new seizures. The on-hook report may also indicate either ring forward or double ring forward. If it is ring forward, the on-hook condition will last for approximately 100 milliseconds. For double ring forward there are two on-hook winks of 100 milliseconds each, separated by 275 milliseconds. TOPR determines which type of signal was received and transfers to the peripheral order buffer execution program to repeat the signal on the OGT.

**4.06** If an OGT is reported to be on-hook, it may indicate disconnect, in which case the call is then taken down by DISC. It may also indicate an initial toll report. In this case an on-hook is passed on to the ICT.

**5. TRAFFIC SERVICE POSITION SYSTEM (TSPS) PROGRAM DESCRIPTION****GENERAL**

**5.01** The traffic service position system program (TSPS) processes signals for all calls which are routed to a traffic service position (TSP) or traffic service position system (TSPS). It analyzes on- and off-hook reports received on OGTs to the TSP or TSPS. These trunks may be expanded inband signaling (EIS) trunks or ordinary inband signaling trunks. These trunks are scanned at a fast (50 millisecond) rate. Examples of calls which are routed to a TSP or TSPS are:

- Person-to-person

- Collect
- Credit card
- Charge to third telephone
- Time and charge requests
- Coin calls requiring operator handling

In the following paragraphs the notation "TSP/S" will be used to indicate that an item applies to either a TSP or TSPS.

**5.02** TSPS has two main entry points from the scan point change director program (CHGD). TSPNDN is entered when a change in state from off-hook to on-hook is recognized on a trunk using ordinary inband signaling. TSPEIS is entered when an off-hook to on-hook change in state is recognized on an EIS trunk.

**5.03** With EIS, the TSPS program must perform timing to distinguish a TSP/S wink from a TSP/S disconnect, then take appropriate action. With ordinary inband signaling, the timing is not performed because signals from the TSP/S are already identified as either a wink or disconnect when the TSPS program is entered.

**PROCESSING OF ON-HOOK REPORTS**

**5.04** If a line side on-hook longer than a hit is reported to TSPS, the on-hook is repeated to the TSP/S unless the customer has add-on service. If the customer has add-on service and the on-hook condition lasts for less than 1400 milliseconds, it is recognized as a flash and a transfer is made to the add-on program. If a customer with add-on service wants to flash to recall the operator, they may dial a "110" code after they get the add-on service dial tone to try to recall the operator. If the customer with add-on goes on-hook for longer than a flash, the on-hook is passed on to the TSP/S. If the customer does not have add-on service and the on-hook is only a momentary flash, then the off-hook following the on-hook is also repeated to the TSP/S. However, if the on-hook persists for longer than about 1.5 seconds, a subsequent off-hook will not be repeated until a wink signal has been received from the TSP/S.

**5.05** Disconnect is under control of the TSP/S. If the TSP/S goes on-hook for longer than a wink (approximately 100 milliseconds), a transfer is made to the disconnect program (DISC) to idle the path in memory and release the registers associated with the call.

**5.06** Figure 3 provides a functional flowchart of the processing done by TSPS when it receives an on-hook report.

**SIGNALING**

**5.07** On a non-coin call using regular signaling, ringback is recognized as a wink from the TSP/S regardless of whether or not an MF signal follows. With EIS the wink must be followed by the proper MF signal. A valid ringback signal will not be recognized until the MF signal is received. Thus EIS eliminates the possibility of false detection of ringback.

**5.08** Ringback is the only valid inband signal from the TSP/S on a non-coin call. For coin calls,

coin collect and coin return signals are also possible. EIS trunks provide additional signals. These additional signals include operator attached, operator released, and combined coin collect and operator released. All of these inband signals are sent as a wink which is normally followed by an MF tone.

**5.09** When a TSP/S wink is reported to the TSPS program, an operator register is seized and loaded with path information. Control is then passed to the operator functions program (OFTR) to process coin collect, coin return, or ringback, or the additional EIS signals.

**5.10** A traffic count is pegged each time an operator wink is detected to indicate that an operator function was requested.

**SIMULTANEOUS REPORTS**

**5.11** Occasionally TSPS may receive reports on both the line side and trunk side almost simultaneously. When this occurs, the trunk side

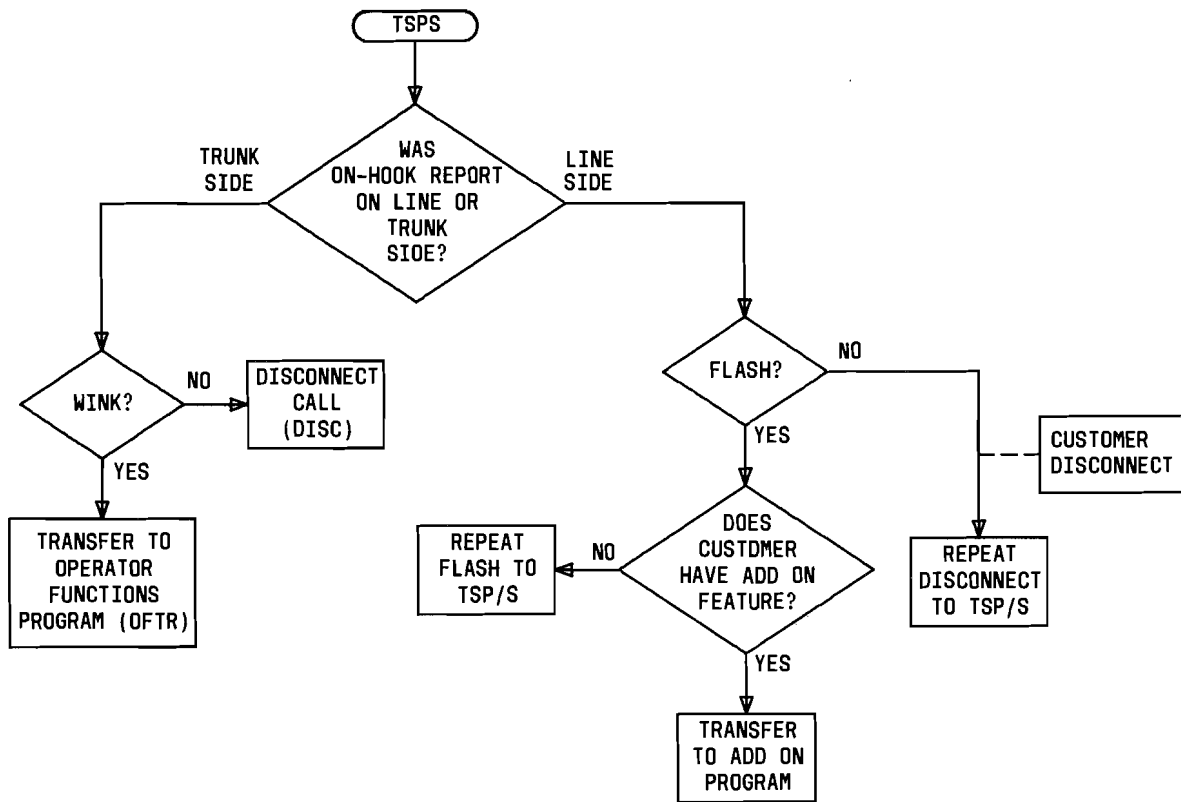


Fig. 3—TSPS On-Hook Processing—Functional Flowchart

report will be processed first. This gives the operator control over the call.

**PUT TRUNKS HIGH AND WET**

5.12 TSPS also contains routines which process maintenance make busy signals on TSP/S trunks. If the maintenance ferrod on one of these trunks is found to be off-hook, the trunk is removed from the idle list and placed on the high and wet list until the make busy signal is removed. When a scan of the maintenance ferrod indicates that the make busy signal is no longer present, the trunk is removed from the high and wet list and restored to the idle list.

5.13 For further software description of TSPS and related operator functions programs such as OFTR, see Reference (c) in Part 7.

**6. ABBREVIATIONS AND ACRONYMS**

CCIS	Common Channel Interoffice Signaling
CHGD	Scan Point Change Director Program
DCNT	Dialing Connection Program
DCT	Digital Carrier Trunk
DID	Direct Inward Dialing
DISC	Disconnect Program
EIS	Expanded Inband Signaling
ESS	Electronic Switching System
ICAL	Digital Analysis for Trunks Program
ICT	Incoming Trunk
ISXS	Step by Step Incoming Call Program
MF	Multifrequency
OFTR	Operator functions program—Toll Switch and Recording Completing

OGT	Outgoing Trunk
POB	Peripheral Order Buffer
PUC	Peripheral Unit Controller
RTI	Route Index
SPCS	Stored Program Control System
TAND	Tandem Connections Program
TOPR	Toll Operator Signaling Program
TSP	Traffic Service Position
TSPS	Traffic Service Position System
TSP/S	Applicable to either TSP or TSPS

**7. REFERENCES**

- (a) Section 231-045-105—Call Processing—POTS Software Subsystem Description
- (b) Section 231-045-115—Outpulsing Software Subsystem Description
- (c) Section 231-045-125—Operator Functions Software Subsystem Description
- (d) Section 231-090-095—Coin Features
- (e) Section 231-090-112—Feature Document Interface with Switchboards Feature
- (f) Section 231-090-114—Feature Document Interface with TSP and TSP 1A
- (g) Section 231-090-159—International Direct Distance Dialing Feature
- (h) Section 231-090-196—Operator Tandem Feature
- (i) Section 231-090-234—Operator signaling to and from the Toll Network
- (j) Section 231-090-372—Feature Document 2-Wire Toll/Tandem Operation Feature
- (k) Toll/Tandem PIDENTs—TAND, TOPR, TSPS