Recommendation T/CS 49-09 (Cannes 1983, revised in Nice 1985)

SYSTEM L_1 MULTIFREQUENCY CODE SUPPLEMENTARY SERVICES

Recommendation proposed by Working Group T/WG 11 "Switching and Signalling" CS

Text of the Recommendation adopted by the "Telecommunications" Commission,

"The European Conference of Postal and Telecommunications Administrations,

considering

— that supplementary services[1]
Automatic number identification (ANI)
Completion of calls to busy subscriber (CCBS)
Call waiting
Call diversion
are commonly used in private automatic branch exchanges (PABXs),

— that SPC PABXs allow a flexible introduction of these supplementary services,

— that signalling system L_1 with multifrequency code interregister signalling is in use for the signalling over leased lines between PABXs,

— that in accordance with the principles of Multifrequency code interregister signalling outlined in Recommendations T/CS 49-07 [1] and T/CS 49-08 [2] sufficient codes are provided to support the signalling for supplementary services,

— that standardisation of the signalling for supplementary services between PABXs favours harmonisation of user control procedures, systems and equipment,

recommends

the procedures specified in this Recommendation when using the L_1 multifrequency code interregister signalling system to transmit supplementary service information."

[1] The study is going on and more supplementary services will be implemented.

1. GENERAL

1.1. Introduction to Supplementary Services

Supplementary services detailed within this Recommendation provide facilities in addition to fast call set-up to the user of a PABX. A supplementary service request may be made during call set-up, prior to conversation, or during conversation by means of a register recall procedure. Details of the request procedures are shown in Recommendations T/CS 49-07 [1] and T/CS 49-08 [2].

Request for a supplementary service is made by means of a two signal message.

There are three types of supplementary service requests:

a) Forward Service Request, indicated by a two signal message within Group IV during call set-up.
b) Service Request on Recall, indicated by a two signal message from Group IV following either a Forward or Backward register recall.
c) Backward Service Request, indicated by a two signal message within Group D during call set-up.

The signalling requirements for each service are detailed within the relevant service description (see Tables 1 and 2 T/CS 49-09).

The meanings of Group IV/D signals following the two signal supplementary service request will differ depending on the service concerned and are given in the relevant service description.

Some services require more signals than are available in Group IV/D, in which case additional groups are allocated within the service (e.g. Groups VI/F).

The signals allocated in Group VI/F, etc. are specific for the service concerned and may differ between services.

On completion of a supplementary service the signalling is normally returned to Group III/C of Recommendation T/CS 49-08 [2] where further supplementary services can be requested, or the call completed.

An exception to the above is the two signal message IV-12, IV-12, which causes immediate change-over to Group I and A signalling and does not enter into service specific signalling procedures. This message is used subsequent to 'Link Recall' to establish an enquiry call via the same private circuit as the original call.

Entry and exit points between the SDL, diagrams in a service and the SDL diagrams of Recommendation T/CS 49-08 [2] are shown by means of connectors, designated X, Y and Z, see Figures 5-8 (T/CS 49-09).

The signalling procedure for rejection of a Supplementary Service within the services is common. The procedures are shown in Figures 1-4 (T/CS 49-09) and are applicable at any point within the service.

1.2. Allocation of Two Signal Messages

The first signal of a two signal message indicates the category of the Supplementary Service as shown below.

Signals 1-9	Manufacturer Specific signalling procedures. Each manufacturer has a unique category number.
Signal 10	An escape to a second category digit.
Signals 11-14	Procedures specified by Administrations.
Signal 15	Procedures originated by CEPT.

Where a service, initially specified by individual Administrations, is subsequently adopted by CEPT the original two signal message (i.e. in the range 11-14) will be retained.

The allocations are listed within this Recommendation.

1st Group IV Signal	2nd Group IV Signal	Message	T/CS 49-09 Section
11	1	Request Call Back	3
»	2	Call Back Attempt	3
»	3	Diversion Bypass	
»	4	Free Notification Request	3
»	5	Request ANI	2
»	6		
»	7	Request Executive Intrusion	*
»	8	Call Waiting	4
»	9		
»	10		
»	11		
»	12	Operator Intrusion	
»	13		
»	14		
»	15		
12	1	Request Override	*
»	2	Operator Recall	*
»	3	Request Re-Ring	*
»	4	Request Camp-on	*
»	5	Free Notification	3
»	6	Request Called Party Identity	*
»	7	Cancel Call Back	3
»	8	Reverted Call Back Attempt	3
»	9	Diversion Activation on Ring Tone No Reply	*
»	11		
»	12	Revert to Selection Phase; Changeover to GPI/A	1
»	13		
»	14		
»	15		

* Reserved.

Table 1 (T/CS 49-09).
Two signal messages for forward supplementary service requests.

1st Group IV Signal	2nd Group IV Signal	Message	T/CS 49-09 Section
13	1		
»	2		
»	3		
»	4	ANI Request	2
»	5	Request Immediate Diversion (own PABX)	*
»	6		
»	7	Request Immediate Diversion (off PABX)	*
»	8	Request Diversion on RTNR	*
»	9		
»	10		
»	11		
»	12		
»	13		
»	14		
»	15		
14	1		
»	2		
»	3		
»	4		
»	5		
»	6		
»	7		
»	8		
»	9		
»	10		
»	11		
»	12		
»	13		
»	14		
»	15		

* Reserved.

Table 2 (T/CS 49-09).
Two signal messages for forward supplementary service requests.

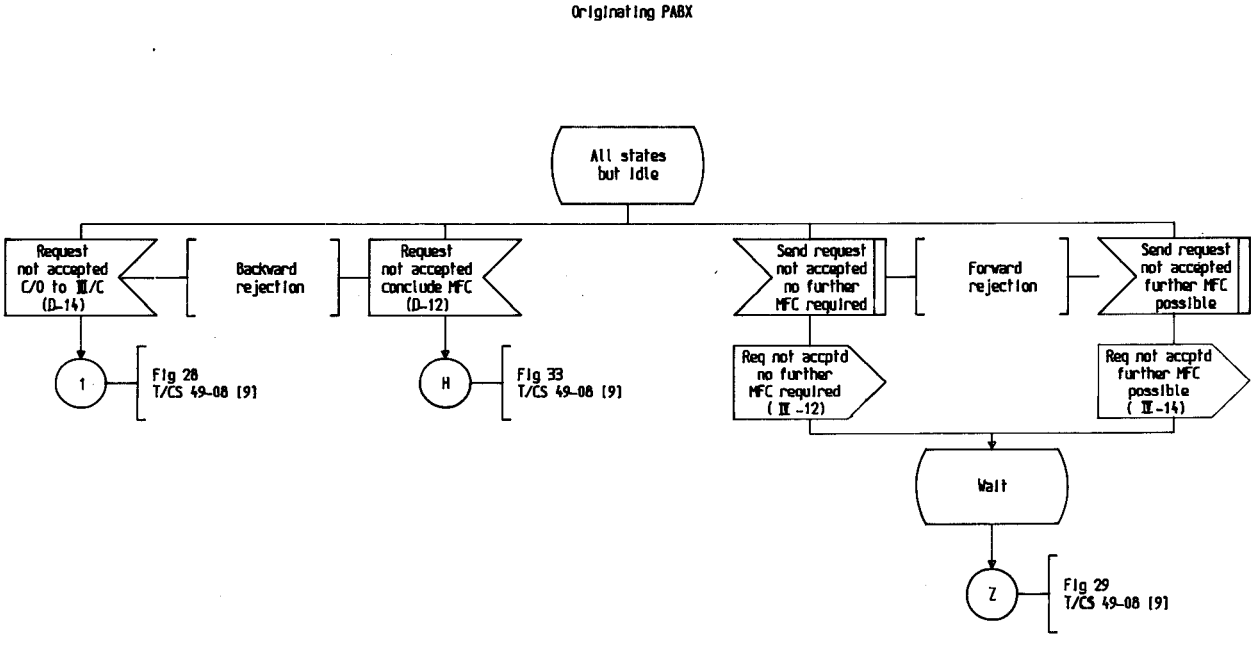

Figure 1 (T/CS 49-09). Rejection of service within service signalling (Groups IV/D).

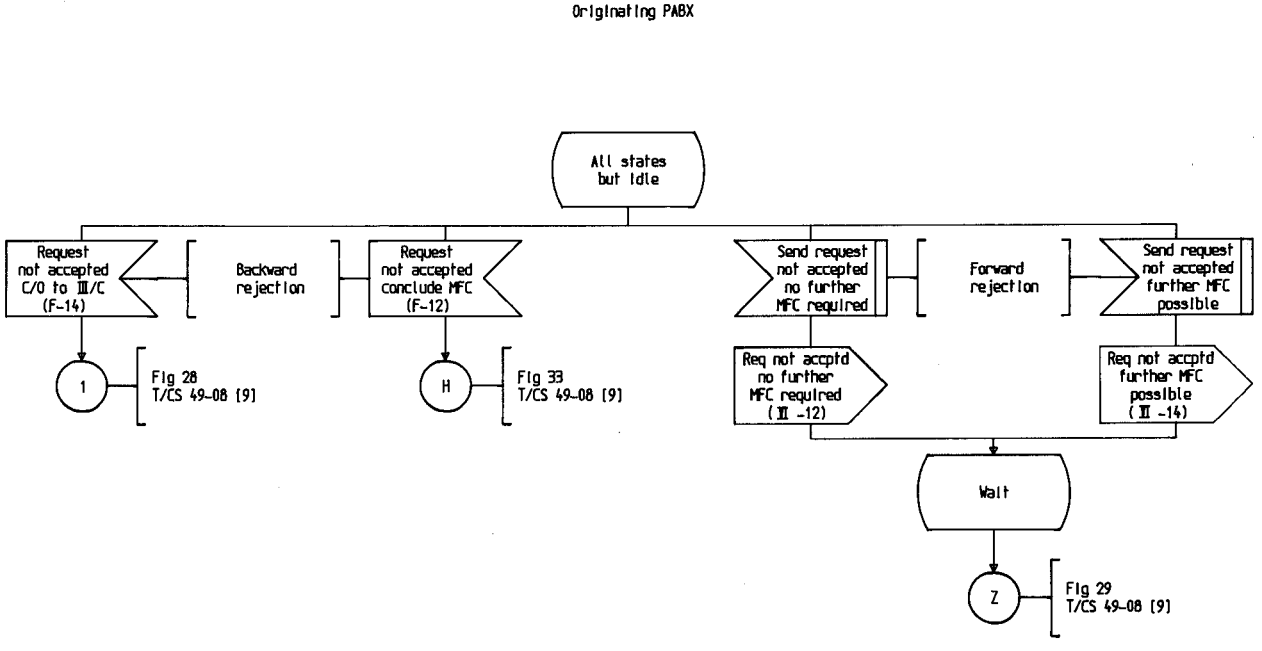

Figure 2 (T/CS 49-09). Rejection of service within service signalling (Groups VI/F).

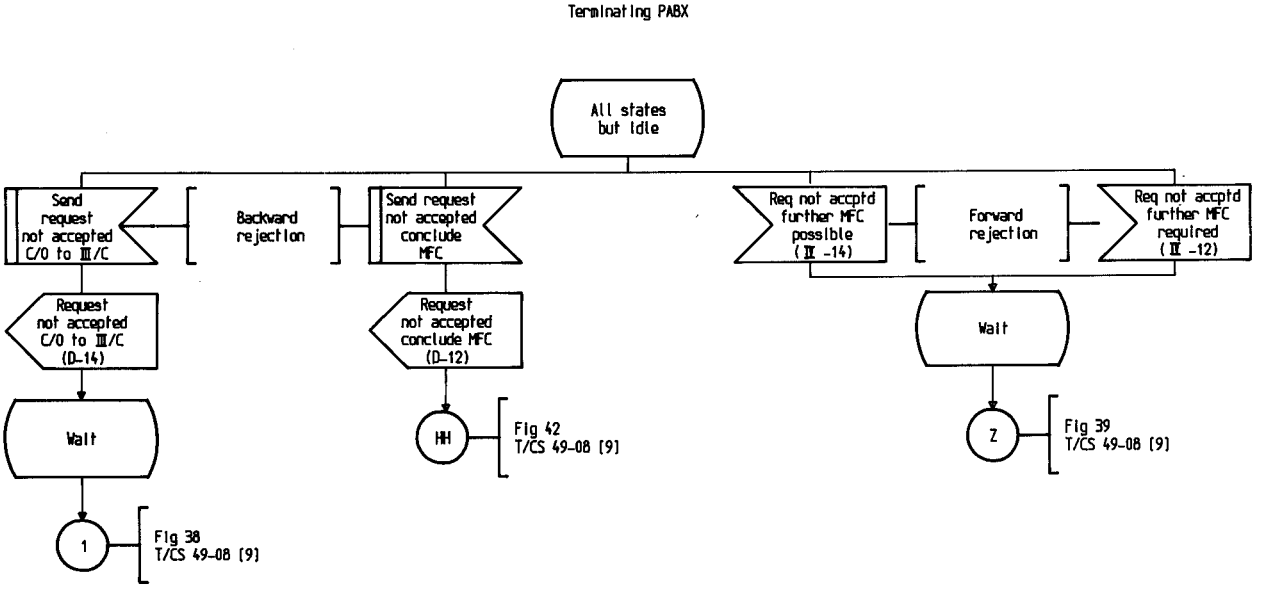

Figure 3 (T/CS 49-09). Rejection of service within service signalling (Groups IV/D).

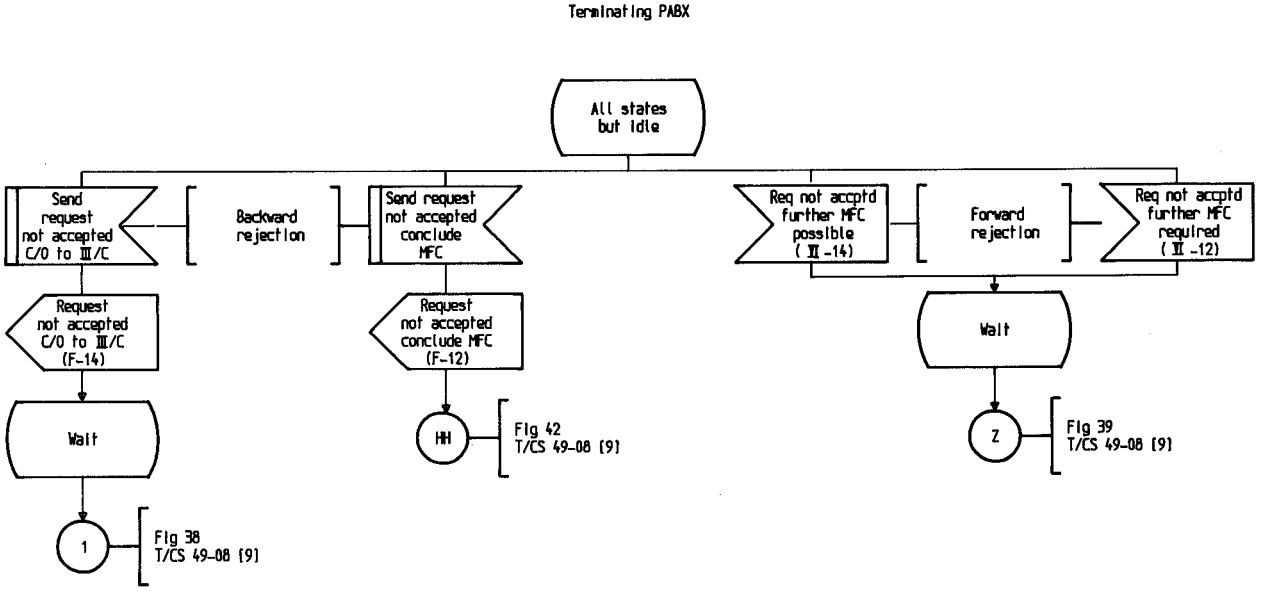

Figure 4 (T/CS 49-09). Rejection of service within service signalling (Groups VI/F).

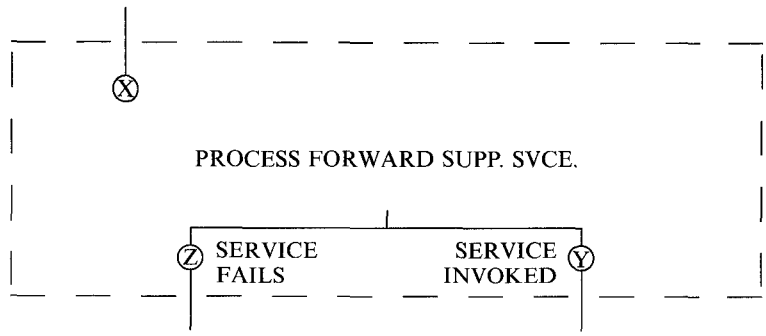

Figure 5 (T/CS 49-09). Extract from Figure 29 (T/CS 49-08) (Originating PABX supplementary service request procedure).

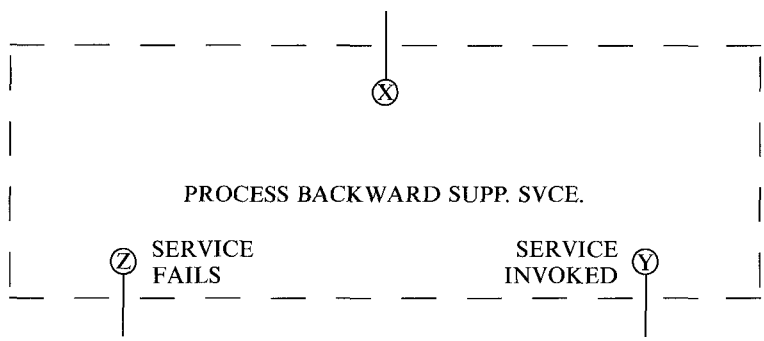

Figure 6 (T/CS 49-09). Extract from Figure 31 (T/CS 49-08) (Originating PABX supplementary service request procedure).

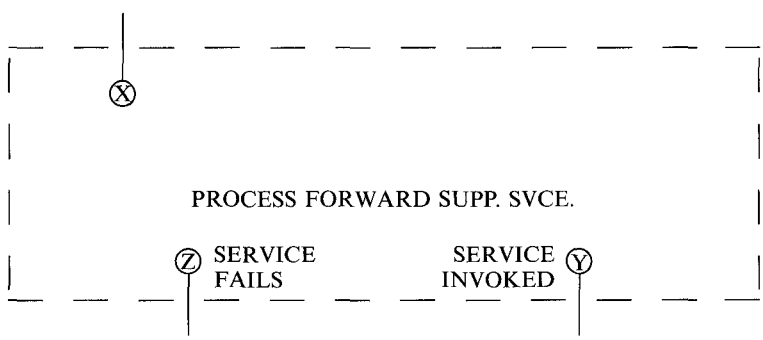

Figure 7 (T/CS 49-09). Extract from Figure 39 (T/CS 49-08) (Terminating PABX supplementary service request procedure).

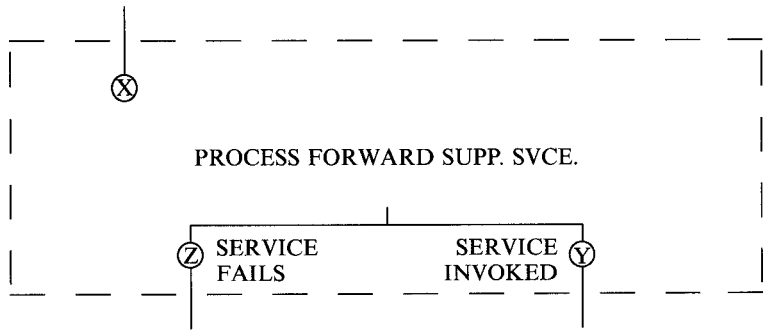

Figure 8 (T/CS 49-09). Extract from Figure 40 (T/CS 49-08)
(Terminating PABX supplementary service request procedure).

2. SUPPLEMENTARY SERVICE – AUTOMATIC NUMBER IDENTIFICATION

2.1. General

The ANI service enables a user to request the identity of either the called or calling party (whichever is relevant), and to send its own identity at the same time. The information received by each PABX must be sufficient to enable a return call to be made (i.e. the ANI digits must comprise of the directory numbers needed to make a call to the destination extension). ANI could be requested where the identity of a party changes (e.g. following Immediate Diversion – own PABX).

2.2. Outline of Control Procedures

The signalling procedures within this service are based on an interleaving method, whereby the receipt of an ANI digit signal in one direction implies the request to send the next ANI digit in the other direction.

The signal codes used to request the service are as follows:

Forward Request	IV-11/IV-5
After Recall	IV-11/IV-5
Backward Request	D-13/D-4

Following the two signal ANI request the responding PABX will send a Group IV signal (if the request was in the forward direction or following recall) or Group D signal (if the request was in the backward direction). This signal shall return the 1st ANI digit or indicate that there are no ANI digits to send, and changeover signalling to Groups VI/F. Signalling within Groups VI/F will continue until all address information has been sent.

Where number lengths differ the PABX with the smaller number will continue requesting ANI digits from the responding PABX, by sending 'End of Digits' signals, until it in turn receives an 'End of Digits' signal.

If a PABX cannot send ANI digits it shall respond to the receipt of an ANI digit signal by sending an 'End of Digits' signal, and when necessary continue to request further digits by sending the 'End of Digits' signals.

After the 'End of Digits' signal has been transmitted in both directions the signalling will revert back to Groups IV/D where completion of the service will be indicated. Subsequent to Group IV/D signalling, reversion back to Group III/C signalling will occur, where further supplementary services may be requested, or the call completed.

During signalling in Groups VI/F, any failure prior to completion of the service will cause a 'Changeover to Group III/C' signal to be sent. Further signalling will depend on whether the failure signal is concluding or enabling further signalling within MFC.

2.3. Allocation and Description of Signals

a) 1st ANI Digit/Send Next Signal/C/O to Groups VI/F (Code IV-10 and D1-10)

These signals have composite meanings and convey the following information:

- 1st Address digit of the calling/called party
- Request C/O to Group IV/F
- Send Next Signal

The 1st ANI Digit/Send Next Signal/C/O to Groups VI/F signal is allocated to MF Code IV1-10 after a Backward request, or D1-10 after a forward request.

b) ANI Digit/Send Next Digit (Code VI1-10 and F1-10)

This signal shall convey the address digits of the called/calling party identity (except the first digit of the responding PABX), and request the next signal from the other PABX.

The ANI Digit/Send Next Signal is allocated to MFC Code VI1-10 in the forward direction, and Code F1-10 in the backward direction.

c) No ANI Digits/Send Next Digit (Code IV-15 and D-15)

This signal shall only be used when the responding PABX, on receipt of a Request ANI signal message, is unable to return address digits. The No ANI Digits signal requests the next signal from the service originating PABX.

The No ANI Digits/Send Next Digit signal is allocated to MFC code IV-15 in the forward direction, and code D-15 in the backward direction.

d) End of Digits/Send Next Digit (Code VI-15 and F-15)

This signal shall be used to inform the responding PABX that all of the ANI digits have been conveyed to it. This signal shall also request the next signal from the responding PABX.

The 'End of Digits/Send Next Digit' signal is allocated to MFC Code VI-15 in the forward direction, and Code F-15 in the backward direction.

e) Changeover to Groups IV/D (Code VI-11 and F-11)

This signal shall be used when either:

1 The service has failed during Group VI/F signalling.

or 2 The service has been completed following and 'End of Digits' signal from both PABXs.

This signal allows re-entry to signalling procedures defined in Recommendation T/CS 49-08 [2] where acceptance or rejection signalling occurs.

The 'Changeover to Groups IV/D' signal is allocated to MFC Code VI-11 in the forward direction, and code F-11 in the backward direction.

GROUP D SIGNALS		
Frequency combination	Name of Signal	Remarks
1	ANI Digit 1/Send Next/C/O to Groups VI/F	
2	ANI Digit 2/Send Next/C/O to Groups VI/F	
3	ANI Digit 3/Send Next/C/O to Groups VI/F	
4	ANI Digit 4/Send Next/C/O to Groups VI/F	
5	ANI Digit 5/Send Next/C/O to Groups VI/F	
6	ANI Digit 6/Send Next/C/O to Groups VI/F	
7	ANI Digit 7/Send Next/C/O to Groups VI/F	
8	ANI Digit 8/Send Next/C/O to Groups VI/F	
9	ANI Digit 9/Send Next/C/O to Groups VI/F	
10	ANI Digit 10/Send Next/C/O to Groups VI/F	
11	OK – Conclude MFC	
12	Request Not Accepted – Conclude MFC	
13	OK – Changeover to Group III/C	
14	Request Not Accepted – C/O to Group III/C	
15	No ANI Digits/Send Next Digit/C/O to Groups VI/F	

Table 3 (T/CS 49-09). Following IV-11 + IV-5 Request ANI.

GROUP VI SIGNALS		
Frequency combination	Name of Signal	Remarks
1	ANI Digit 1/Send Next/C/O to Groups VI/F	
2	ANI Digit 2/Send Next/C/O to Groups VI/F	
3	ANI Digit 3/Send Next/C/O to Groups VI/F	
4	ANI Digit 4/Send Next/C/O to Groups VI/F	
5	ANI Digit 5/Send Next/C/O to Groups VI/F	
6	ANI Digit 6/Send Next/C/O to Groups VI/F	
7	ANI Digit 7/Send Next/C/O to Groups VI/F	
8	ANI Digit 8/Send Next/C/O to Groups VI/F	
9	ANI Digit 9/Send Next/C/O to Groups VI/F	
10	ANI Digit 10/Send Next/C/O to Groups VI/F	
11	C/O to Group IV/D	
12	Request Not Accepted – No further MFC required	
13		
14	Request Not Accepted – Further MFC possible	
15	No ANI Digits/Send Next Digit/C/O to Groups VI/F	

Table 4 (T/CS 49-09). Following IV-11 + IV-5 Request ANI + Group D Signal.

GROUP F SIGNALS		
Frequency combination	Name of Signal	Remarks
1	ANI Digit 1/Send Next Digit	
2	ANI Digit 2/Send Next Digit	
3	ANI Digit 3/Send Next Digit	
4	ANI Digit 4/Send Next Digit	
5	ANI Digit 5/Send Next Digit	
6	ANI Digit 6/Send Next Digit	
7	ANI Digit 7/Send Next Digit	
8	ANI Digit 8/Send Next Digit	
9	ANI Digit 9/Send Next Digit	
10	ANI Digit 10/Send Next Digit	
11		
12	Request Not Accepted – Conclude MFC	
13		
14	Request Not Accepted – C/O to Group III/C	
15	End of Digits/Send Next Digit	

Table 5 (T/CS 49-09). Following IV-11 + IV-5 Request ANI + Group D Signal.

GROUP IV SIGNALS		
Frequency combination	Name of Signal	Remarks
1	ANI Digit 1/Send Next Digit	
2	ANI Digit 2/Send Next Digit	
3	ANI Digit 3/Send Next Digit	
4	ANI Digit 4/Send Next Digit	
5	ANI Digit 5/Send Next Digit	
6	ANI Digit 6/Send Next Digit	
7	ANI Digit 7/Send Next Digit	
8	ANI Digit 8/Send Next Digit	
9	ANI Digit 9/Send Next Digit	
10	ANI Digit 10/Send Next Digit	
11		
12	Request Not Accepted – No further MFC required	
13		
14	Request Not Accepted – Further MFC possible	
15	No ANI Digits/Send Next Digit/C/O to Groups VI/F	

Table 6 (T/CS 49-09). Following D-13 + D-4 (Request ANI).

GROUP F SIGNALS		
Frequency combination	Name of Signal	Remarks
1	ANI Digit 1/Send Next Digit	
2	ANI Digit 2/Send Next Digit	
3	ANI Digit 3/Send Next Digit	
4	ANI Digit 4/Send Next Digit	
5	ANI Digit 5/Send Next Digit	
6	ANI Digit 6/Send Next Digit	
7	ANI Digit 7/Send Next Digit	
8	ANI Digit 8/Send Next Digit	
9	ANI Digit 9/Send Next Digit	
10	ANI Digit 10/Send Next Digit	
11	C/O to Group IV/D	
12	Request Not Accepted – Conclude MFC	
13		
14	Request Not Accepted – C/O to Groups III/C	
15	End of Digits/Send Next Digit	

Table 7 (T/CS 49-09). Following D-13 + D-4 Request ANI + Group IV Signal.

GROUP VI SIGNALS		
Frequency combination	Name of Signal	Remarks
1	ANI Digit 1/Send Next Digit	
2	ANI Digit 2/Send Next Digit	
3	ANI Digit 3/Send Next Digit	
4	ANI Digit 4/Send Next Digit	
5	ANI Digit 5/Send Next Digit	
6	ANI Digit 6/Send Next Digit	
7	ANI Digit 7/Send Next Digit	
8	ANI Digit 8/Send Next Digit	
9	ANI Digit 9/Send Next Digit	
10	ANI Digit 10/Send Next Digit	
11		
12	Request Not Accepted – No further MFC required	
13		
14	Request Not Accepted – Further MFC possible	
15	End of Digits/Send Next Digit	

Table 8 (T/CS 49-09). Following D-13 + D-4 Request ANI + Group IV Signal.

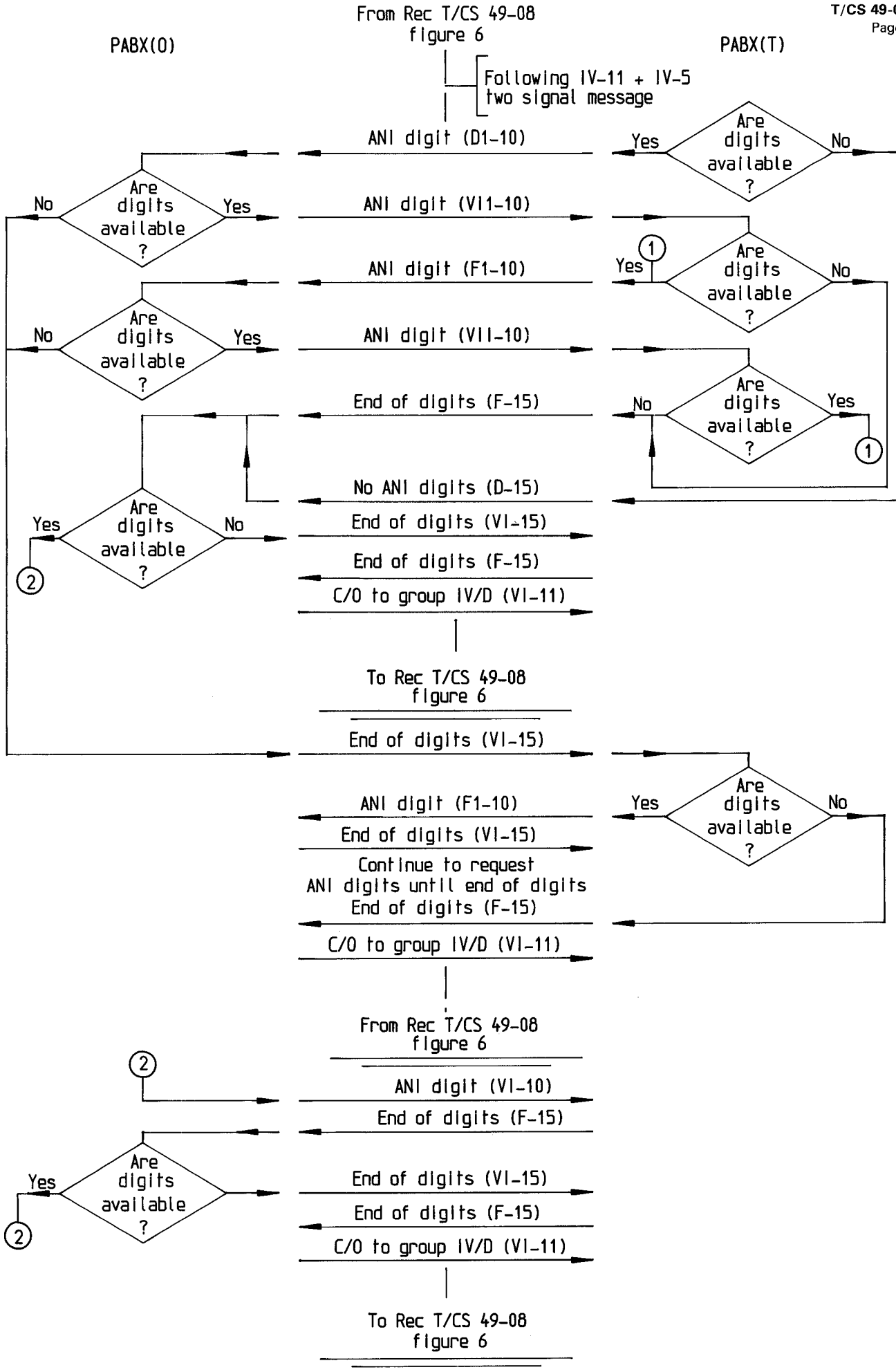

Figure 9 (T/CS 49-09). ANI supplementary service.

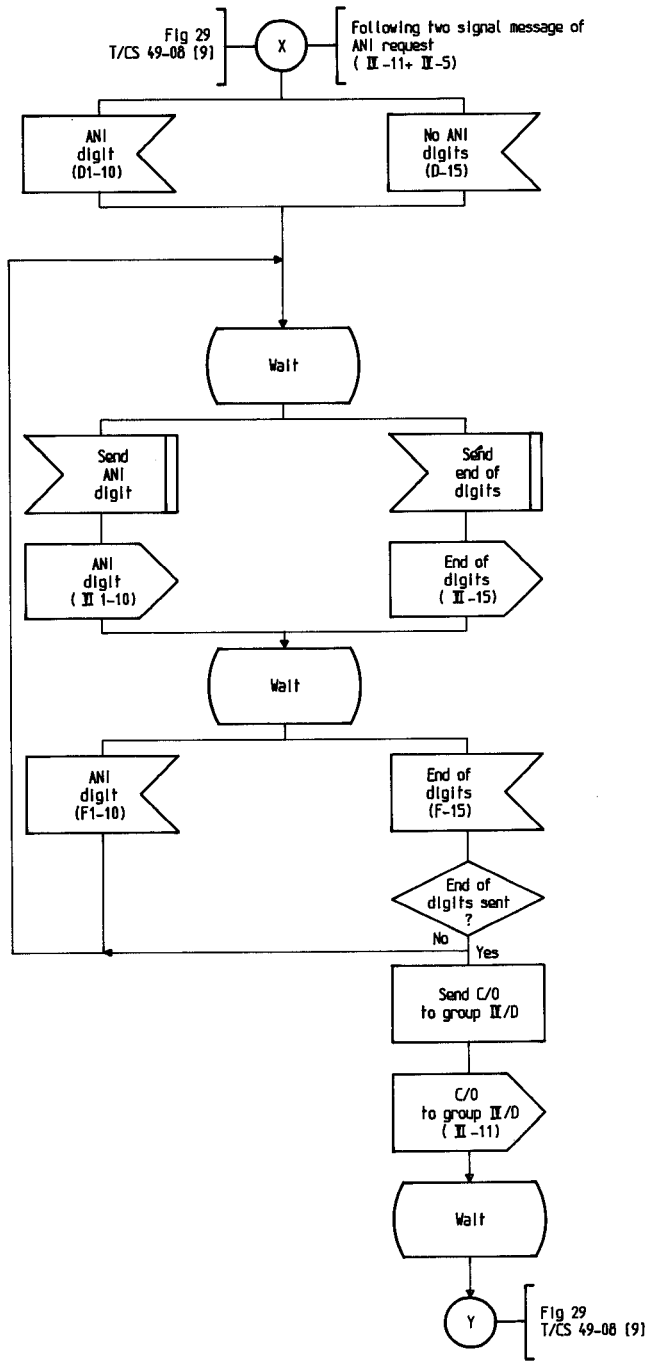

Figure 10 (T/CS 49-09). ANI supplementary service (originating PABX).
Forward direction during call set up or after register recall.

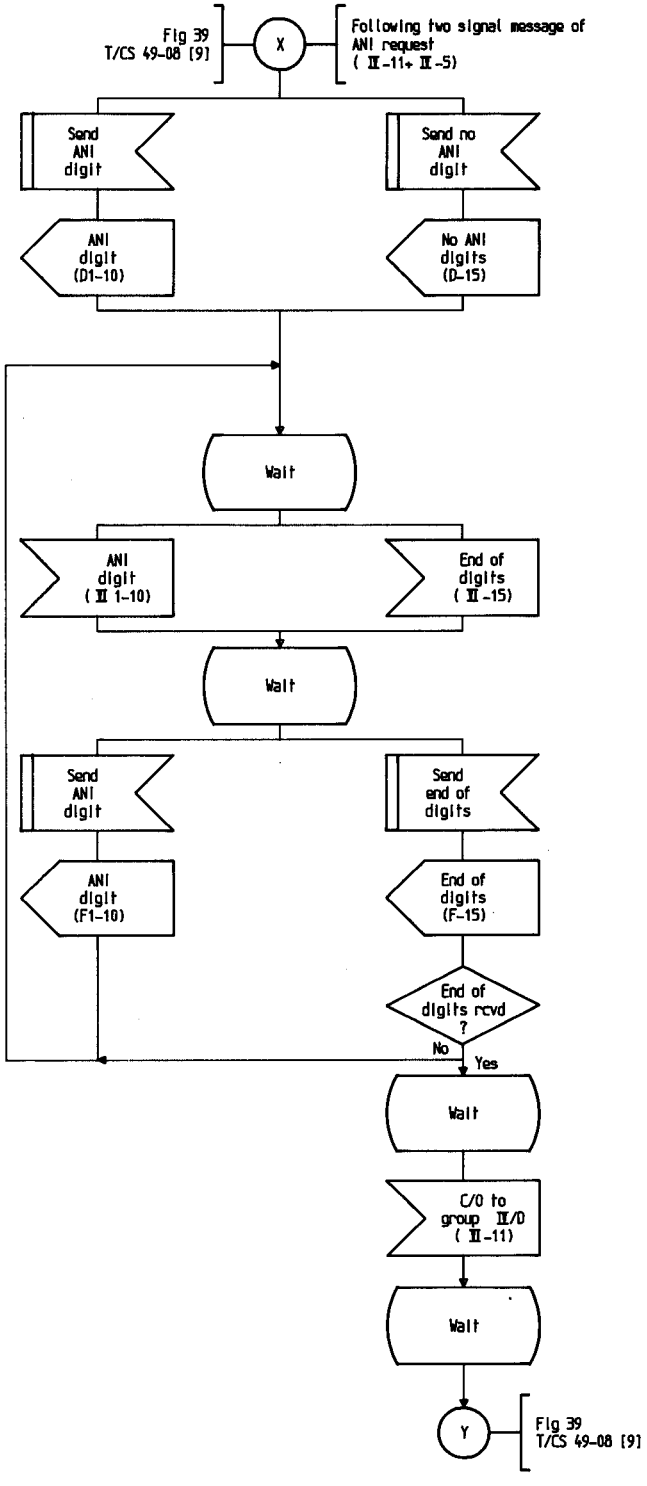

Figure 11 (T/CS 49-09). ANI supplementary service (terminating PABX).
Forward direction during call set up or after register recall.

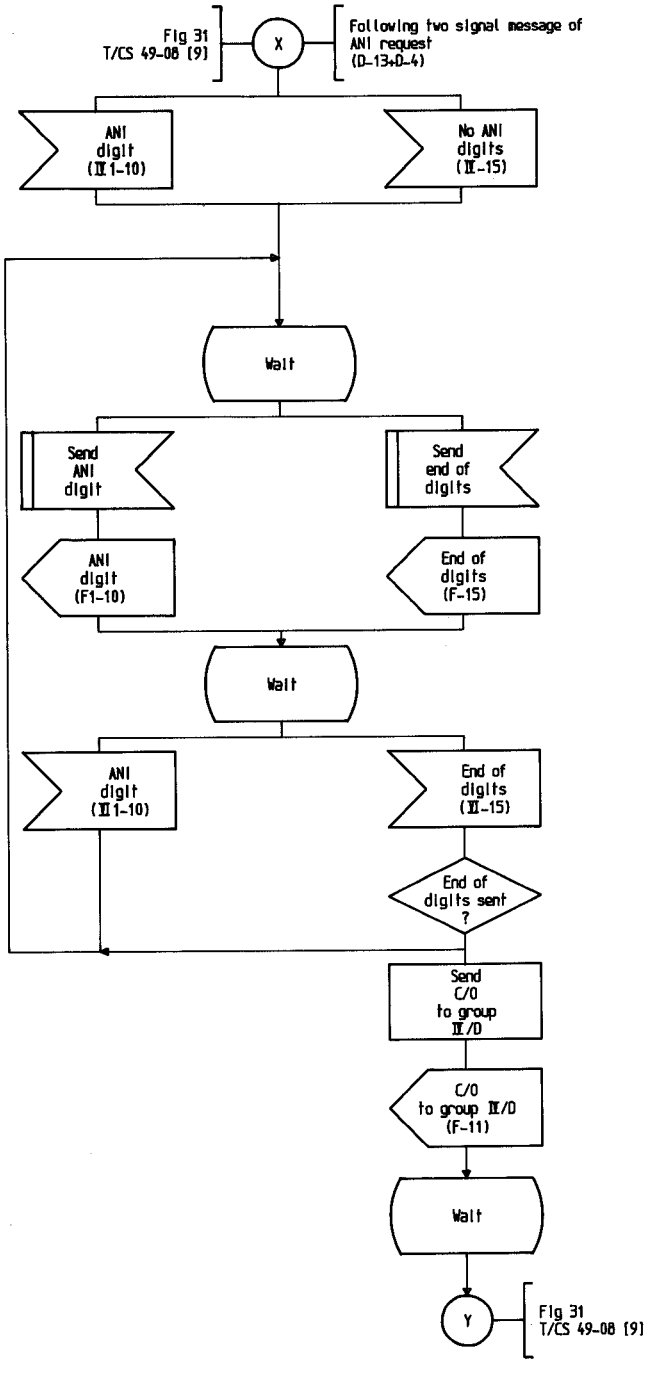

Figure 12 (T/CS 49-09). ANI supplementary service (terminating PABX).
Backward direction during call set up.

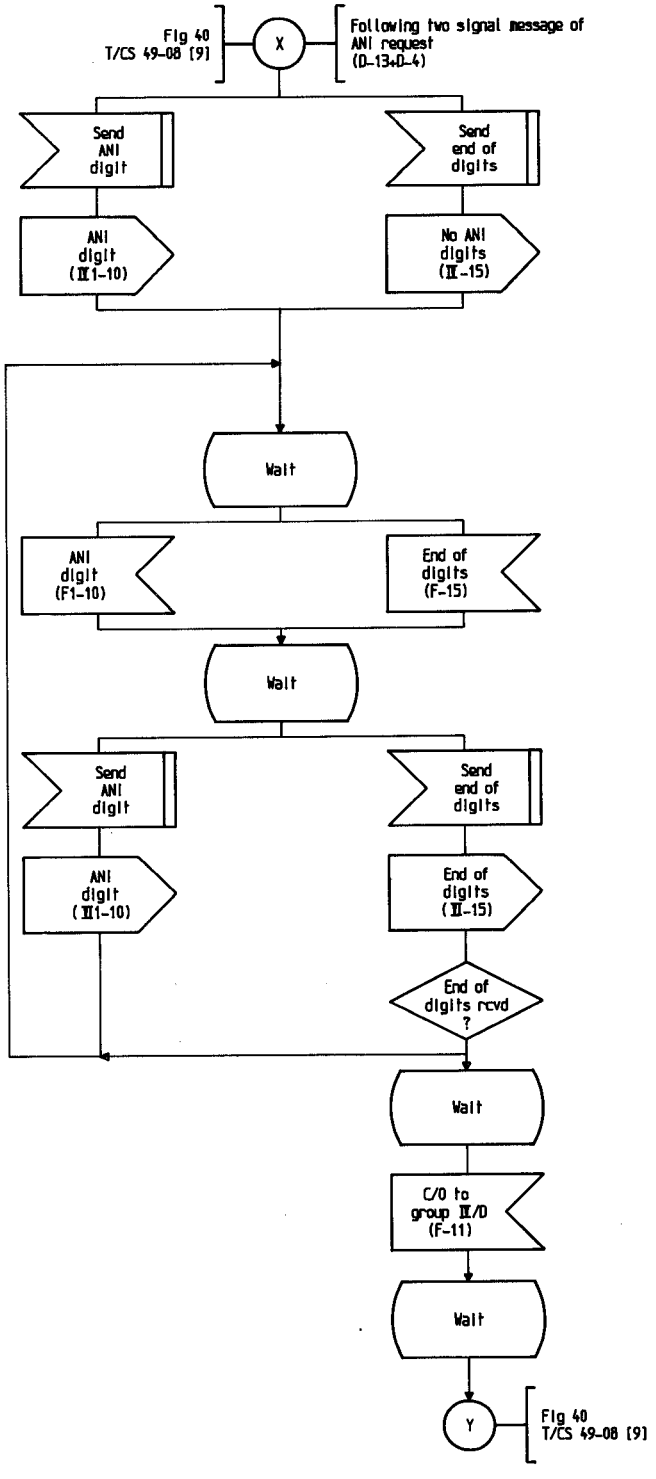

Figure 13 (T/CS 49-09). ANI supplementary service (originating PABX).
Backward direction during call set up.

3. SUPPLEMENTARY SERVICE – COMPLETION OF CALLS TO BUSY SUBSCRIBERS (CCBS)

3.1. General

The CCBS service is used to enable an extension user who, on meeting a busy extension, wishes that extension to call back when free, or the unattended extension to call back when next used.

A caller encountering an engaged extension may request a Call Back or Free Notification by dialling a specific code within a short period of receiving engaged tone.

Confirmation or rejection of the Call Back Request shall be indicated to the calling party.

Following receipt of the Call Back Request, when the called party becomes free or automatic call back attempt is made. If the requesting party has subsequently become busy, control of the service may be transferred to the requesting PABX (this is called Revert).

The CCBS Service may be cancelled either by the requesting extension, or automatically after a specific number of call back attempts have been made. The Call Back Service may only be provided in Networks where there is a common linked numbering scheme.

3.2. Outline of Control Procedures

As there are a number of separate services within the CBS family, the control procedure for each service is dealt with individually.

The signal codes used to request the service are as follows:

a) Request Call Back	IV-11 + IV-1
b) Call Back Attempt	IV-11 + IV-2
c) Request Call Back Reversion	(Associated with IV-11 + IV-2)
d) Reverted Call Back Attempt	IV-12 + IV-8
e) Request Free Notification	IV-11 + IV-4
f) Free Notification	IV-12 + IV-5
g) Cancel Call Back	IV-12 + IV-7

a) *Request Call Back*

At the end of normal call set-up the MFC registers release leaving the caller listening to busy tone. On receipt of a Call Back request from the extension user the outgoing PABX applies a Register Recall followed by the two signal message IV-11 + IV-1.

Following the Request Call Back two signal message (IV-11 + IV-4), the responding PABX will request the address digits of the calling line by returning the Send Next Digit signal. The originating PABX will send the address digits in response to the Send Next signal until all digits have been sent, at which time it will send the End of Digits signal. Signalling will then re-enter procedures as defined in Recommendation T/CS 49-08 [2] where acceptance or rejection of the service will occur.

The originating extension user will receive an indication that the service has been accepted or rejected, and then replace their handset.

b) *Call Back Attempt*

When the Call Back Attempt is made the initial call set up is carried out as if a normal call is being made, except that the Group II Signal signifying the Class of Service is a "Network signal". If the extension to which the call back is being made is free it is guarded against further incoming calls, and the signalling procedure continues in accordance with T/CS 49-08 until the Call Back attempt two signal message (IV-11 + IV-2) is sent.

Following this two signal message, the first signal from the responding PABX will request the address digits of the calling party by returning the Send Next Digit Signal. The originating PABX will send the address digits in response to the Send Next Digit signal until all digits have been sent, at which time it will send to End of Digits signal.

Signalling reverts to the procedures defined in Recommendation T/CS 49-08 [2] where indication of acceptance or rejection of the service will occur. On acceptance of the service the extension which requested Call Back is rung, and upon answer a line signal 'Requesting party answer' (single tone on pulse) is transmitted to the calling back PABX. The calling back extension is then rung and ring tone is applied to the requesting extension. The call is now processed in the normal way.

c) *Request Call Back Reversion*

If the extension to which a Call Back attempt has been made is busy, the calling PABX may wish to transfer control to the PABX which originally requested the Call Back Service by simply continuing with the Call Back attempt as detailed in paragraph 3.2.b. The called PABX, having received the Network class of service followed by the two signal message IV-11 + IV-2 earlier in the call, will interpret the service as Request Call Back Reversion.

d) *Reverted Call Back Attempt*

When Call Back has been returned to the PABX which originally requested the service (i.e. Reversion) the requesting extension is monitored and when free a Reverted Call Back Attempt is made.

The originating PABX sets up a call using the signalling procedures defined in T/CS 49-08 [2], except that the Group II Class of Service signal Network is sent. If the extension to which the Call Back is being made is free it is guarded against any further incoming calls, and the signalling procedure continues in accordance with Recommendation T/CS 49-08 [2] until the two signal message for the Reverted Call Back attempt, with the exception that the extension which requested the Call Back Service shall be rung first, as shown in the Arrow Chart (Figure 13 (T/CS 49-09)).

c) *Request Free Notification*

As an alternative to the Call Back request a user may request Notification of the called party becoming free.

Following the Request Free Notification two signal message (IV-11 + IV-4) signalling for the service is the same as that for Request Call Back.

f) *Free Notification*

When the Free Notification indication is made the initial call set up is normal except that the Group II signal 'Network' is sent. Following the two signal message (IV-2 + IV-5) signalling for the service is the same as that for Call Back attempt but signalling concludes when address information is completed.

Following the Free Notification, the PABX receiving the indication may either inform the service requesting party that the called party has become free, enabling the user to make a new call, or automatically set up a call in the same manner as a Reverted Call Back attempt.

g) *Cancel Call Back*

When Cancel Call Back is indicated the initial call set up is normal except that the Group II signal 'Network' is sent. Following the two signal message (IV-12 + IV-7) the signalling is the same as that for Request Call Back. Signalling reverts to procedures defined in Recommendation T/CS 49-08 [2] where acceptance or rejection of the service occurs. On acceptance of the cancellation, records of the service shall be cancelled. However, if the service is rejected the originating PABX memorises the call back cancellation and a subsequent Call Back attempt shall be rejected.

The Free Notification Service is cancelled at the requesting PABX only, so that receipt of the Free Notification indication removes the records of the service.

3.3. Allocation and Description of Signals

Because of the nature of the call back service it is necessary to describe signals applicable to each service individually.

Request Call Back

a) Digits 1-0 (Code IV 1-0)
These signals shall be used to convey the address digits of the extension requesting call back.
The 'Digit' signals are allocated to MFC Codes IV 1-10.

b) End of Digits (Code IV-15)
This signal shall be used to inform the responding PABX that all address digits of the extension requesting Call Back have been sent, and that no further supplementary service signalling within the service is required.
The 'End of Digits' signal is allocated to MFC Code IV-15.

c) Send Next Digit (Code D-15)
This signal shall be used to request the next address digit of the extension requesting Call Back.
The 'Send Next Digit' signal is allocated to MFC Code D-15.

Call Back Attempt

a) Digits 1-0 (Code IV 1-10)
As for (a) in 'Request Call Back'

b) Send Next Digit (Code D-15)
As for (c) in 'Request Call Back'

c) End of Digits (Code IV-15)
This signal shall be used to inform the responding PABX that
— all Address digits of the calling party have been sent and providing the service is available,
— signalling within the service is complete.
The End of Digits signal is allocated to MFC Code IV-15.

d) *Request Call Back Reversion*
Signals for this service are as for the Call Back Attempt.

e) *Reverted Call Back Attempt*
Signals for this service are as for the Call Back Attempt.

f) *Request Free Notification*
Signals for this service are as for the Request Call Back.

g) *Free Notification*
Signals for this service are as for Call Back Attempt.

h) *Cancel Call Back*
Signals for this service are as for Request Call Back.

GROUP IV SIGNALS		
Frequency combination	Name of Signal	Remarks
1	Digit 1	
2	Digit 2	
3	Digit 3	
4	Digit 4	
5	Digit 5	
6	Digit 6	
7	Digit 7	
8	Digit 8	
9	Digit 9	
10	Digit 10	
11		
12	Request Not Accepted – No further MFC required	
13		
14	Request Not Accepted – Further MFC possible	
15	End of Digits	

Table 9 (T/CS 49-09).
Following IV-11 + IV-1 (Request Call Back)
IV-11 + IV-4 (Request Free Notification)
IV-11 + IV-7 (Cancel Call Back)

GROUP D SIGNALS		
Frequency combination	Name of signal	Remarks
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11	OK – Conclude MFC	
12	Request Not Accepted – Conclude MFC	
13	OK – Changeover to Group III/C	
14	Request Not Accepted – C/O to Groups III/C	
15	Send Next Digit	

Table 10 (T/CS 49-09).
Following IV-11 + IV-1 (Request Call Back)
IV-11 + IV-4 (Request Free Notification)
IV-12 + IV-7 (Cancel Call Back)

GROUP D SIGNALS		
Frequency combination	Name of signal	Remarks
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11	OK – Conclude MFC	
12	Request Not Accepted – Conclude MFC	
13	OK – Changeover to Group III/C	
14	Request Not Accepted – C/O to Groups III/C	/
15	Send Next Digit	

Table 11 (T/CS 49-09).

Following IV-11 + IV-2 (Call Back Attempt or Request Call Back Reversion)
IV-12 + IV-8 (Reverted Call Back Attempt)
IV-12 + IV-5 (Free Notification)

GROUP IV SIGNALS		
Frequency combination		Remarks
1	Digit 1	
2	Digit 2	
3	Digit 3	
4	Digit 4	
5	Digit 5	
6	Digit 6	
7	Digit 7	
8	Digit 8	
9	Digit 9	
10	Digit 0	
11		
12	Request Not Accepted – No further MFC required	
13		
14	Request Not Accepted – Further MFC possible	
15	End of Digits	

Table 12 (T/CS 49-09).

Following IV-11 + IV-2 (Call Back Attempt or Request Call Back Reversion)
IV-12 + IV-8 (Reverted Call Back Attempt)
IV-12 + IV-5 (Free Notification)

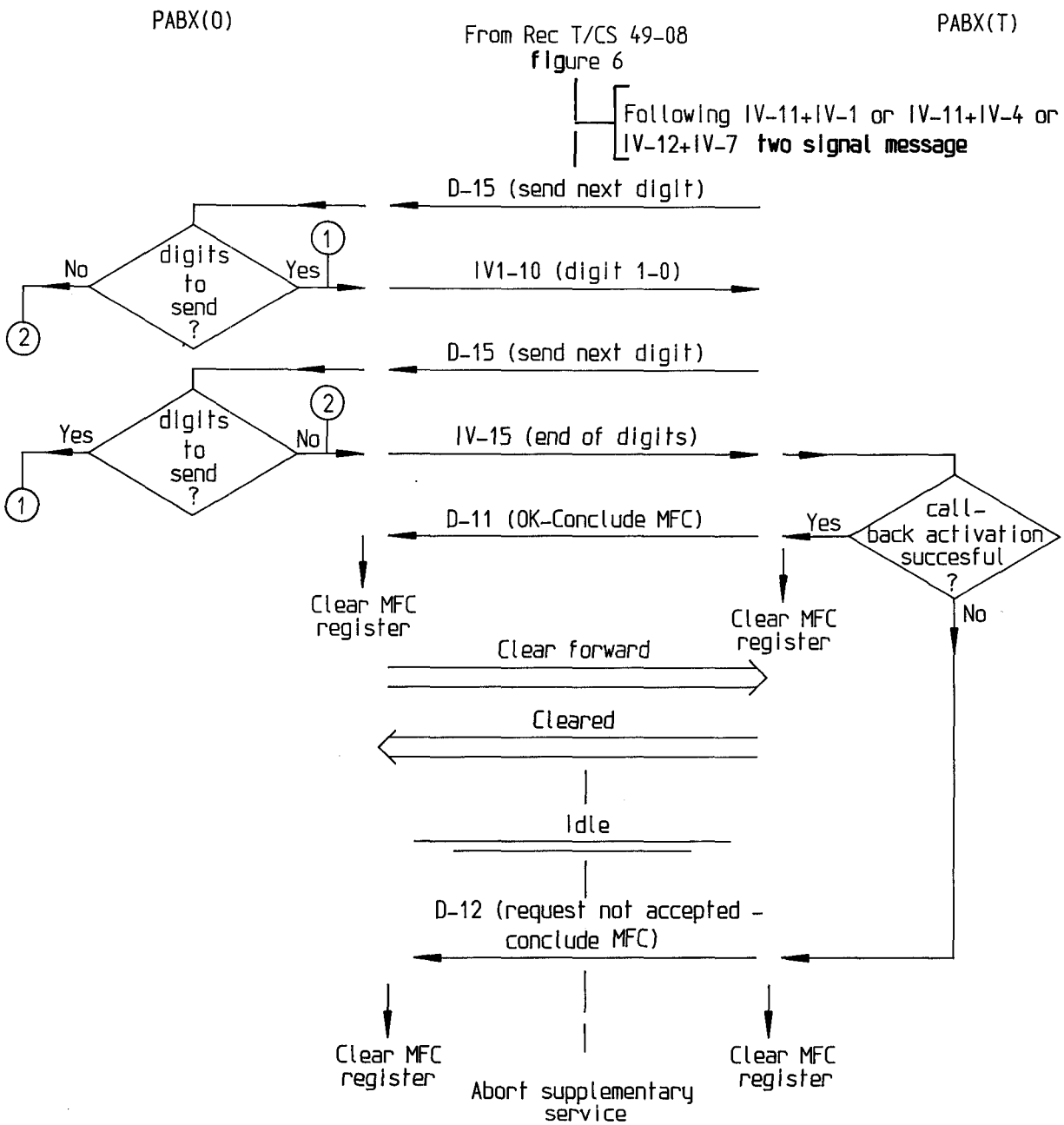

Figure 14 (T/CS 49-09).
Request call back.
Request Free Notification.
Cancel Call Back.

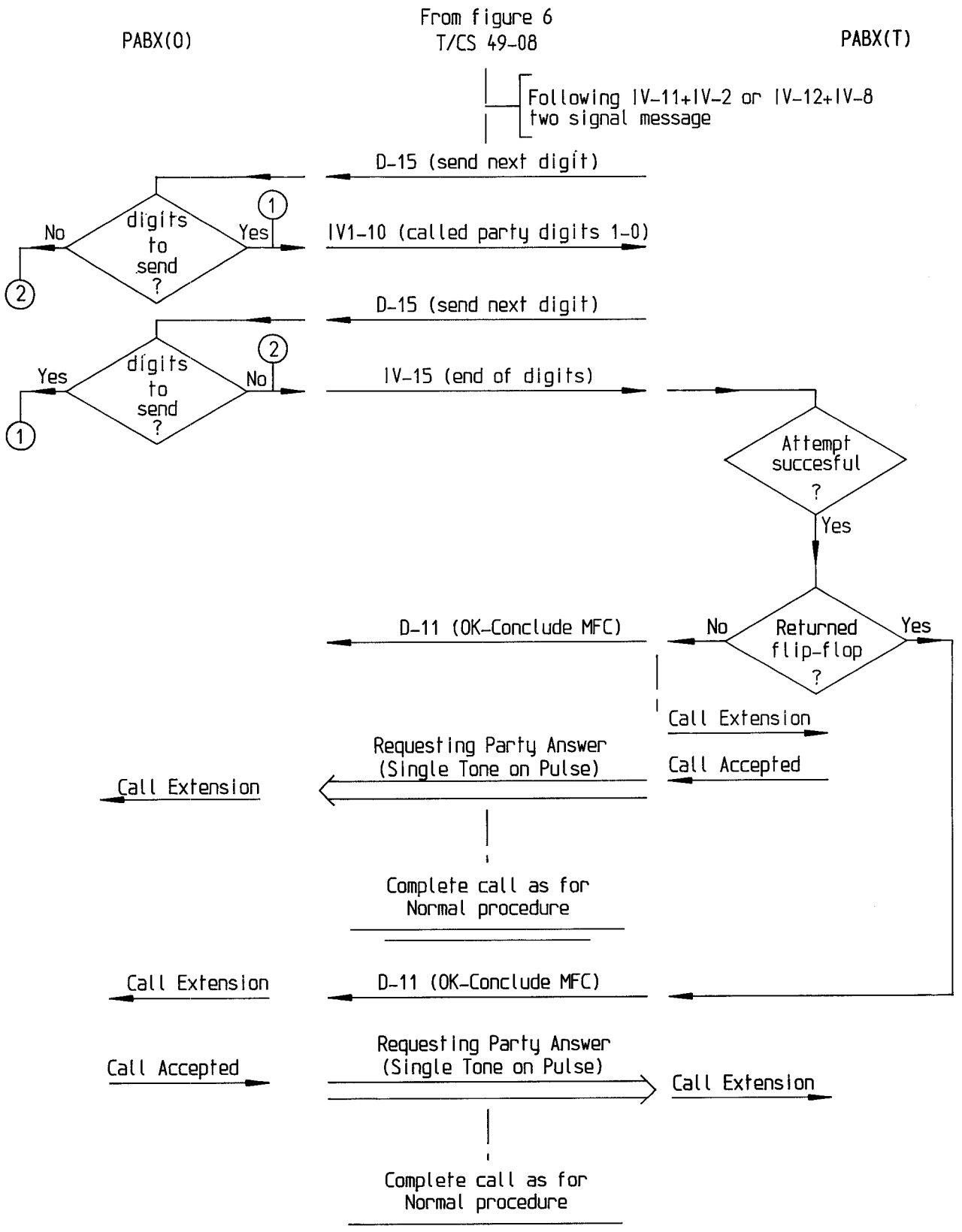

Figure 15 (T/CS 49-09). Call Back/Reverted Call Back Attempt.

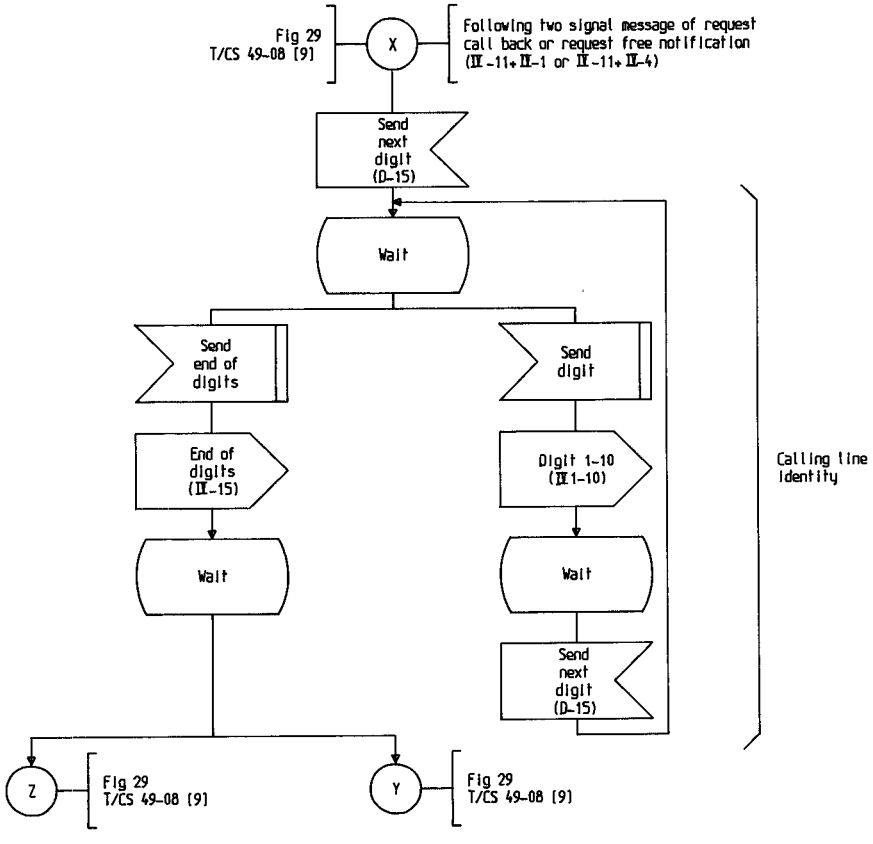

Figure 16 (T/CS 49-09). Request call back (originating PABX).

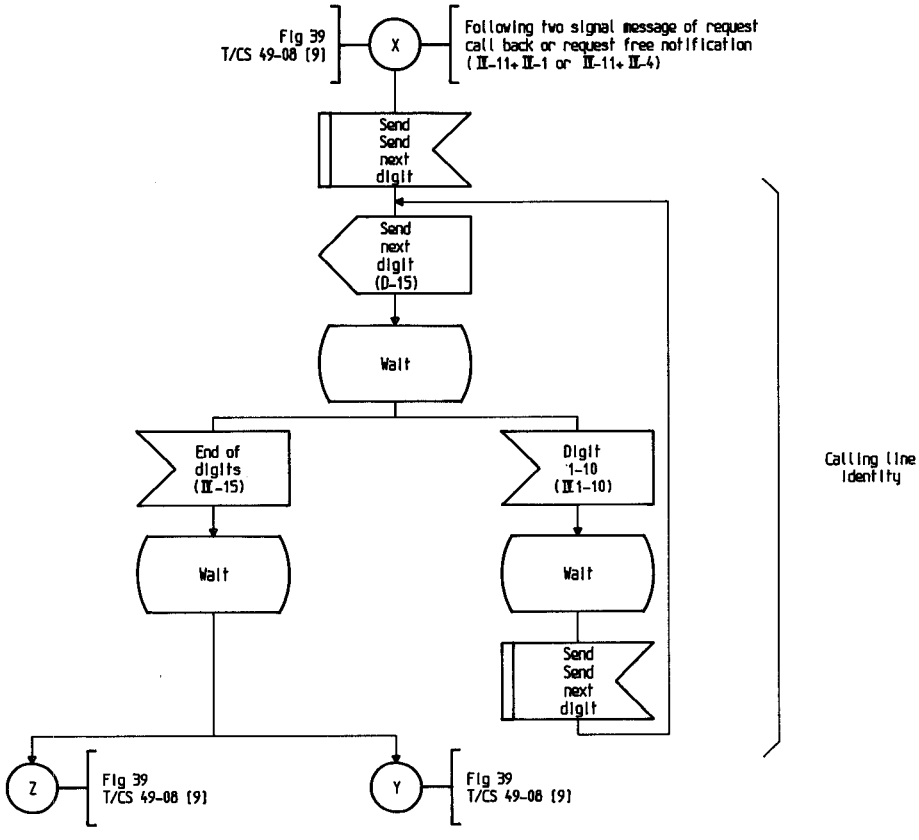

Figure 17 (T/CS 49-09). Request call back (terminating PABX).

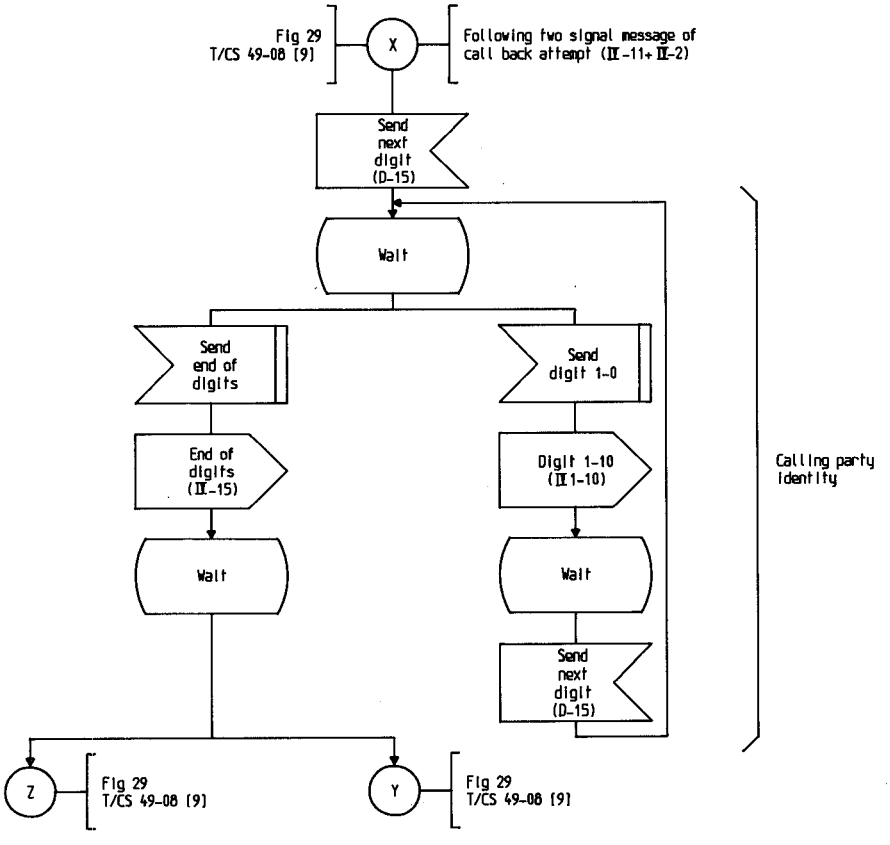

Figure 18 (T/CS 49-09). Call back attempt (originating PABX).

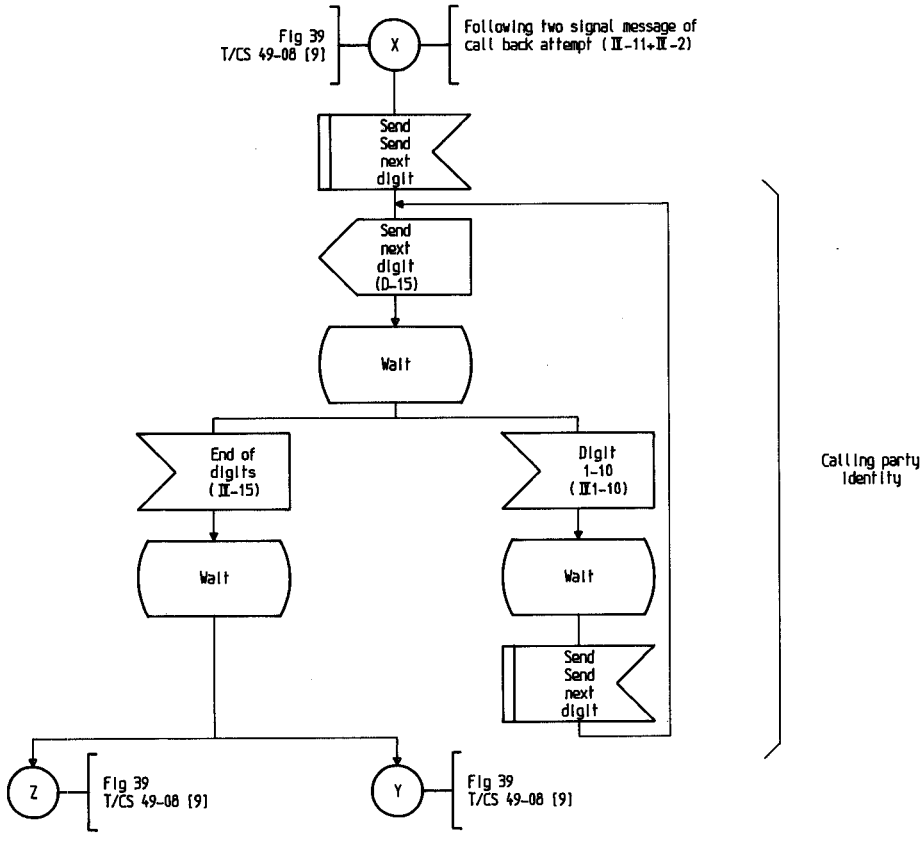

Figure 19 (T/CS 49-09). Call back attempt (terminating PABX).

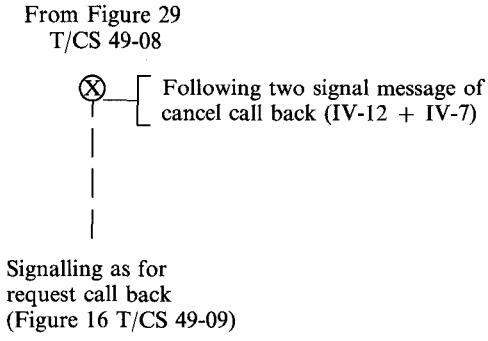

Figure 20 (T/CS 49-09). Cancel call back from originating extension (originating PABX).

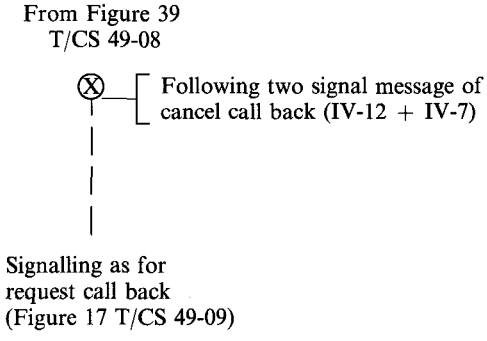

Figure 21 (T/CS 49-09). Cancel call back from originating extension (terminating PABX).

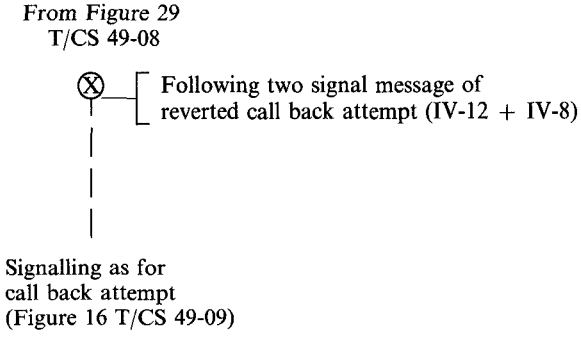

Figure 22 (T/CS 49-09). Reverted call back attempt (originating PABX).

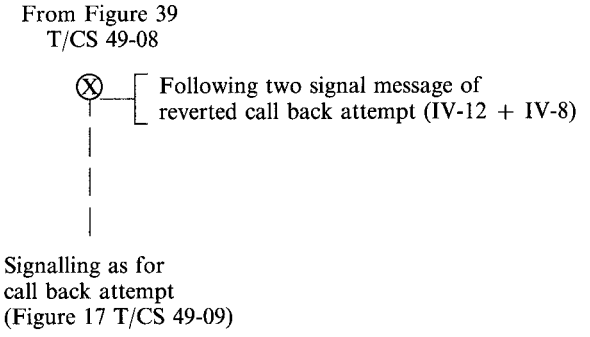

Figure 23 (T/CS 49-09). Reverted call back attempt (terminating PABX).

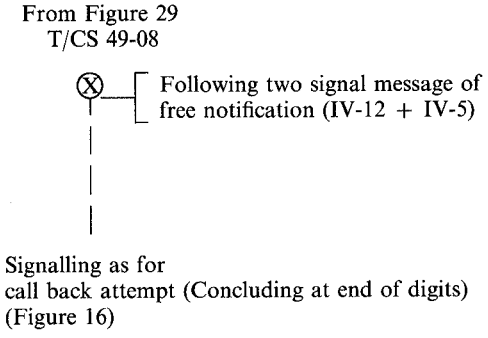

Figure 24 (T/CS 49-09). Free notification (originating PABX).

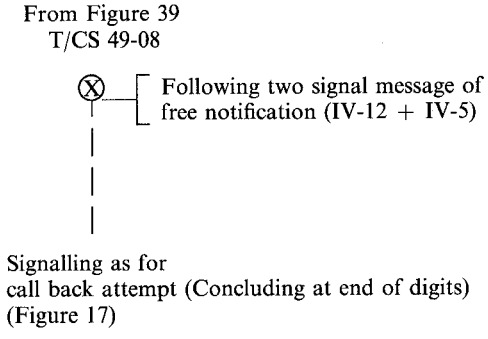

Figure 25 (T/CS 49-09). Free notification (terminating PABX).

4. SUPPLEMENTARY SERVICE – CALL WAITING

4.1. General

When a calling party meets an extension that is busy, it may be possible for that caller to offer the call to the busy extension. The busy extension may then either ignore the new call, go on-hook and be automatically re-rung, or answer the new call by parking the previous connection. Call Waiting is indicated to the engaged extension by means of call waiting tone.

The calling extension invokes the call waiting request, subsequent to receiving the busy signal, by dialling the relevant code, thus initiating a register recall procedure.

The calling line identity may be sent to the called PABX, if it is requested.

4.2. Outline of Control Procedures

Following the two signal message offering the call to the busy extension (IV-11 and IV-8) the responding PABX may either request the identity of the calling extension, or offer the call to the extension required immediately. If the calling extension identity is required, the responding PABX will return the Send Next Digit signal, and address information will be forwarded as for the Request Call Back Service (T/CS 49-09, Section 3.). Once the End of Digits signal has been sent, no further supplementary service signalling is required within the service, and acceptance or rejection of the service occurs within the signalling defined in T/CS 49-08 [2].

If the calling extension identity is not required, then acceptance or rejection of the service occurs within the signalling defined in T/CS 49-08 [2].

The called extension will have a call waiting tone applied to it, and any subsequent action will depend on whether or not the called extension accepts the call.

If the called party accepts the offered call, the responding PABX returns an Answer Signal to the original PABX, and a speech path is established between both parties.

The signal code used to request the service is:
Call Waiting IV-11 + IV-8.

4.3. Allocation and Description of Signals

a) Digits 1-0 (Codes IV1-10)
These signals shall be used to convey the address of the calling extension to the extension to which the call is being offered, where required.

The 'Digit' signals are allocated to MFC Codes IV1-10.

b) End of Digits (Code IV-15)

This signal shall be used to inform the responding PABX that all address digits of the calling extension have been sent and that no further supplementary service signalling within the service is required.

The 'End of Digits' signal is allocated to MFC Code IV-15.

c) Send Next Digit (Code D-15)

This signal shall be used to request the address digits of the calling extension, when the called PABX requires the calling line identity.

The 'Send Next Digit' signal is allocated to MFC Code D-15.

GROUP IV SIGNALS		
Frequency combination	Name of signal	Remarks
1	Digit 1	
2	Digit 2	
3	Digit 3	
4	Digit 4	
5	Digit 5	
6	Digit 6	
7	Digit 7	
8	Digit 8	
9	Digit 9	
10	Digit 10	
11		
12	Request Not Accepted – No further MFC required	
13		
14	Request Not Accepted – Further MFC possible	
15	End of Digit	

Table 13 (T/CS 49-09). Following IV-11 + IV-8 (Call Waiting).

GROUP D SIGNALS		
Frequency combination	Name of signal	Remarks
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11	OK – Conclude MFC	
12	Request Not Accepted – Conclude MFC	
13	OK – Changeover to Group III/C	
14	Request Not Accepted – C/O to Groups III/C	
15	Send Next Digit	

Table 14 (T/CS 49-09). Following IV-11 + IV-8 (Call Waiting).

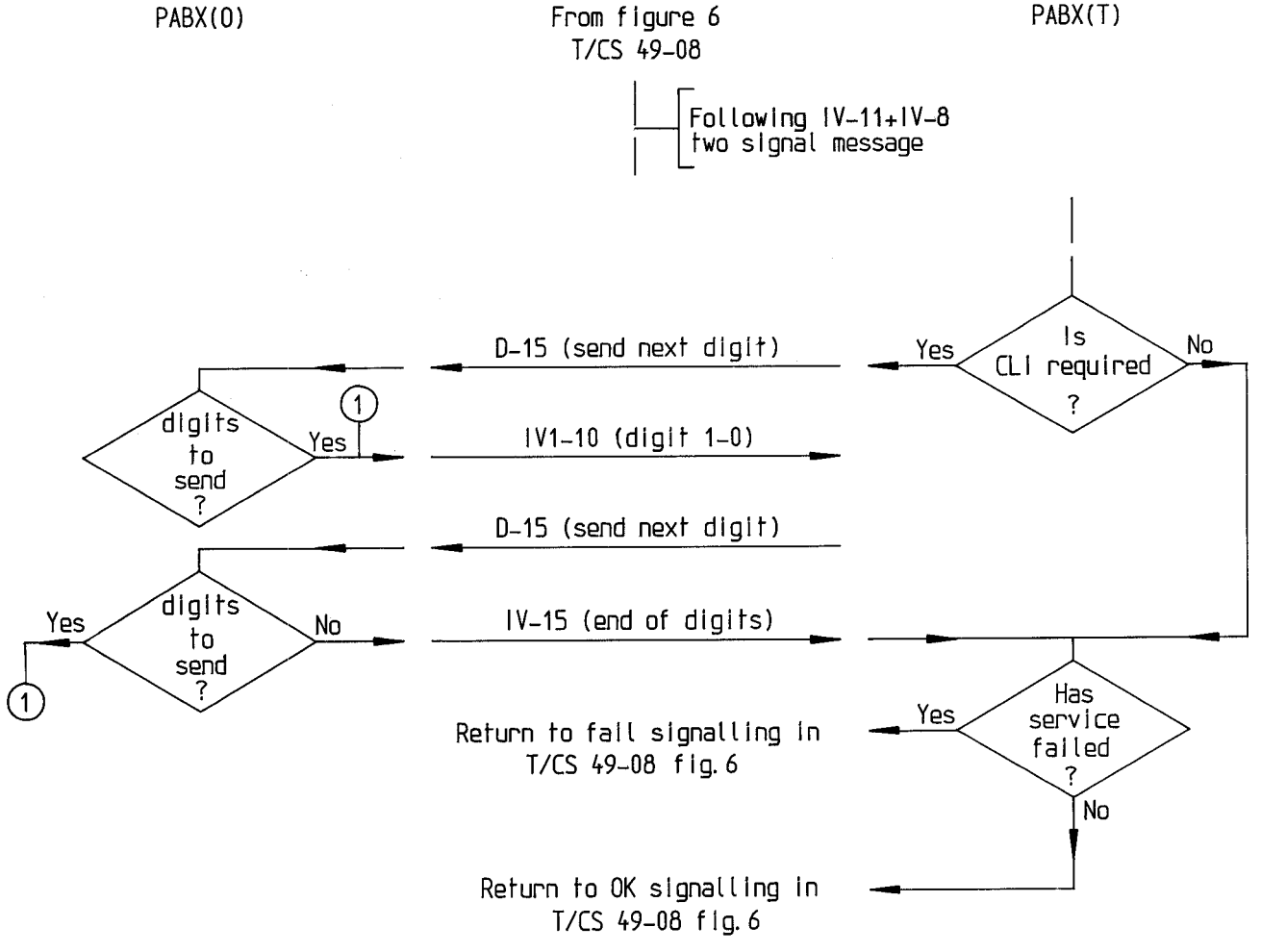

Figure 26 (T/CS 49-09). Call waiting.

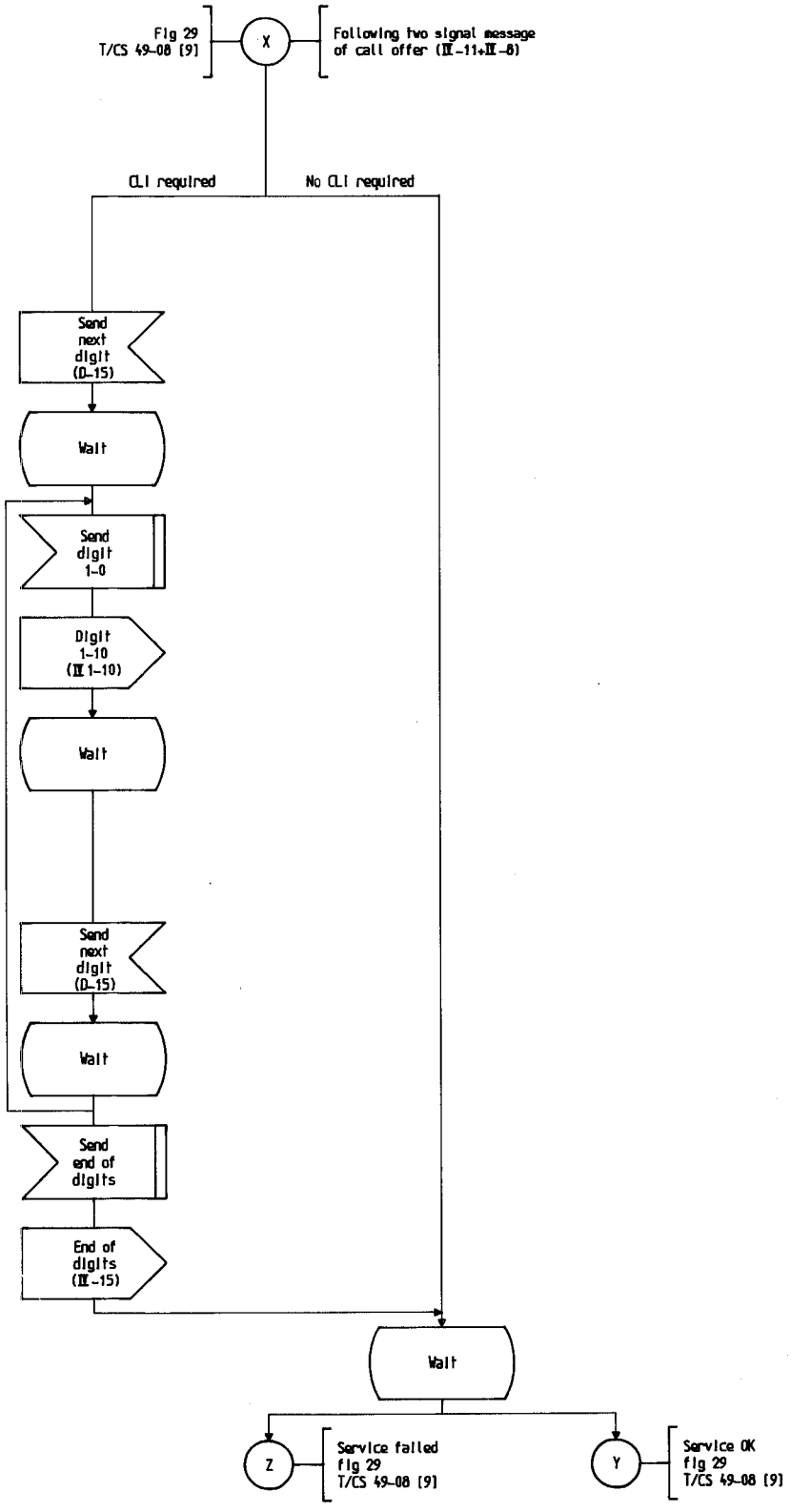

Figure 27 (T/CS 49-09). Call waiting (originating PABX).

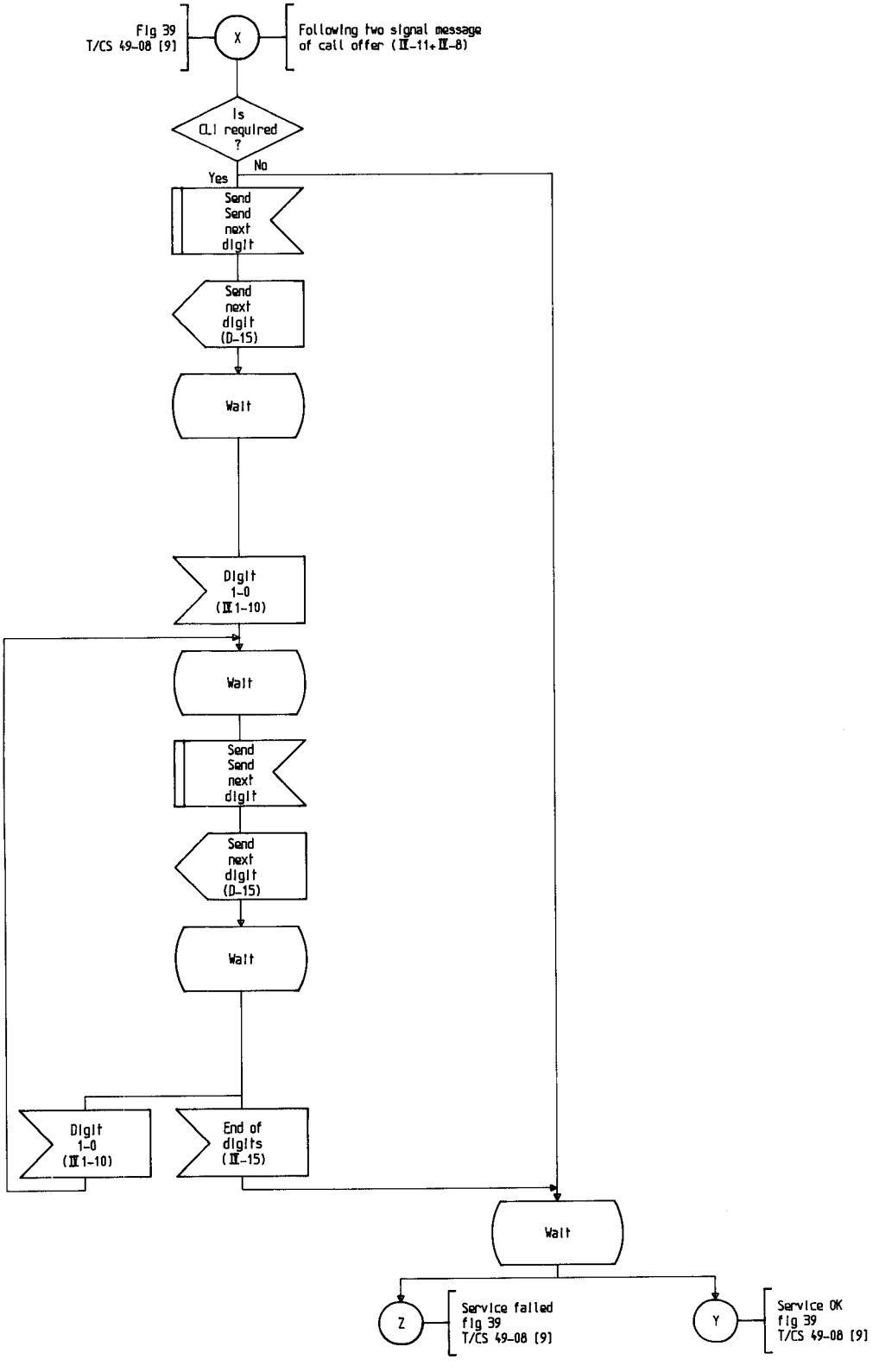

Figure 28 (T/CS 49-09). Call waiting (terminating PABX).

5. SUPPLEMENTARY SERVICE – DIVERSION ON BUSY/IMMEDIATE DIVERSION

5.1. General

The Diversion on Busy/Immediate Diversion service enables users, who know they may be absent and unable to answer their extension, or may not receive calls because their extension is busy, to divert a caller to another extension or a recorded announcement. When an Incoming Call encounters an extension which has the Diversion service active upon it, the call is diverted to the nominated extension which may be either on the same or another PBX.

5.2. Outline of Control Procedures

As the Diversion may be either ON or OFF PBX, the control procedure for each is dealt with separately. The Signal Codes used to request the service are as follows:

Request ON PBX D-13/D-5

Request OFF PBX D-13/D-7

5.2.1. *ON PBX Diversion*

Following the backward two signal message indicating "ON PBX" diversion (Signal Codes D-13 and D-5), the calling PBX will request the diverting PBX to send either the Group B state of Destination signal of the extension to which call is being diverted, or the address followed by the State of Destination (SOD) of the "diverted to" extension. The responding PBX will return the "diverted to" extension address if requested, and the relevant SOD of that extension. Subsequent to Group IV/D signalling, reversion back to Group III/C signalling will occur.

5.2.2. *OFF PBX Diversion*

Following the backward two signal message indicating "OFF PBX" diversion (Signal Codes D-13 and D-7), the calling PBX will request the "diverted to" extension address from the diverting PBX, digit by digit. The diverting PBX will return the address of the "diverted to" extension in response to the "Send Next" signal until all digits have been sent. At this point the End of digits signal will be returned, informing the calling PBX that the full address has been sent. Providing no subsequent forward supplementary service is requested which may prevent diversion from occurring (e.g. Diversion Bypass) then the signalling will be concluded, the MFC Registers released, and the circuit cleared. A new call will be made from the calling PBX to the "diverted to" extension, which shall include the information that the call has been diverted.

5.3. Allocation and Description of Signals

a) Change-over to Group B (Code IV-1)

This signal is used following an ON PBX Diversion signal (D-2). On receipt of this signal the responding PBX will send one Group B signal conveying the state of Destination of the "diverted to" extension and revert to Group IV/D signalling. The PBX sending this signal will change-over to receiving Group B signals for one signal only and then revert to Group IV/D signalling.

The "Changeover to Group B" signal is allocated to MFC Code IV-1.

b) Send Next Signal (Code IV-15)

This signal shall be used to request the next signal following either the End of Digits signal (D-15) or SOD information.

The "Send Next Signal" signal is allocated to MFC Code IV-15.

c) End of Digits (Code D-15)

This signal is used to inform the responding PBX that all address digits of the "diverted to" extension have been sent.

The "End of Digits" signal is allocated to MFC Code D-15.

GROUP IV SIGNALS		
Frequency combination	Name of Signal	Remarks
1	Changeover to Group B	
2		
3		
4		
5		
6		
7		
8		
9		
10		
11	OK – No Further MFC Required	
12	Request Not Accepted – No Further MFC Required	
13	OK – No Further MFC Possible	
14	Request Not Accepted – Further MFC Possible	
15	Send Next Digit	

Table 15 (T/CS 49-09).
Following D-13 + D-5 (Request Diversion ON PABX)
or D-13 + D-7 (Request Diversion OFF PABX)

GROUP D SIGNALS		
Frequency combination	Name of Signal	Remarks
1	Digit 1	
2	Digit 2	
3	Digit 3	
4	Digit 4	
5	Digit 5	
6	Digit 6	
7	Digit 7	
8	Digit 8	
9	Digit 9	
10	Digit 0	
11	OK – Conclude MFC	
12	Request Not Accepted – Conclude MFC	
13	OK – c/o to Group III/C	
14	Request Not Accepted – c/o to Group III/C	
15	End of Digits	

Table 16 (T/CS 49-09).
Following D-13 + D-5 (Request Diversion ON PABX)
or D-13 + D-7 (Request Diversion OFF PABX)

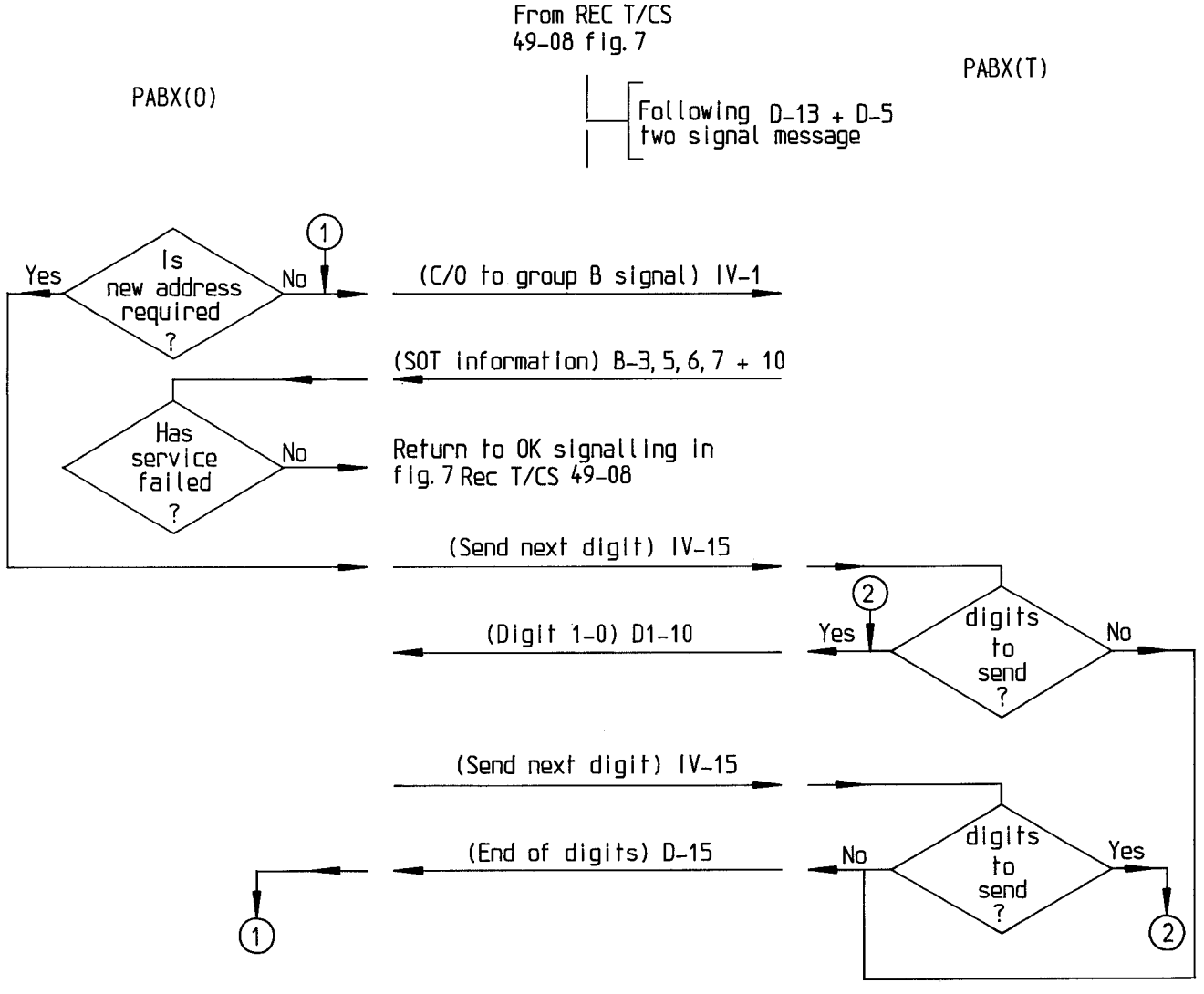

Figure 29 (T/CS 49-09). Immediate/busy diversion (own PABX).

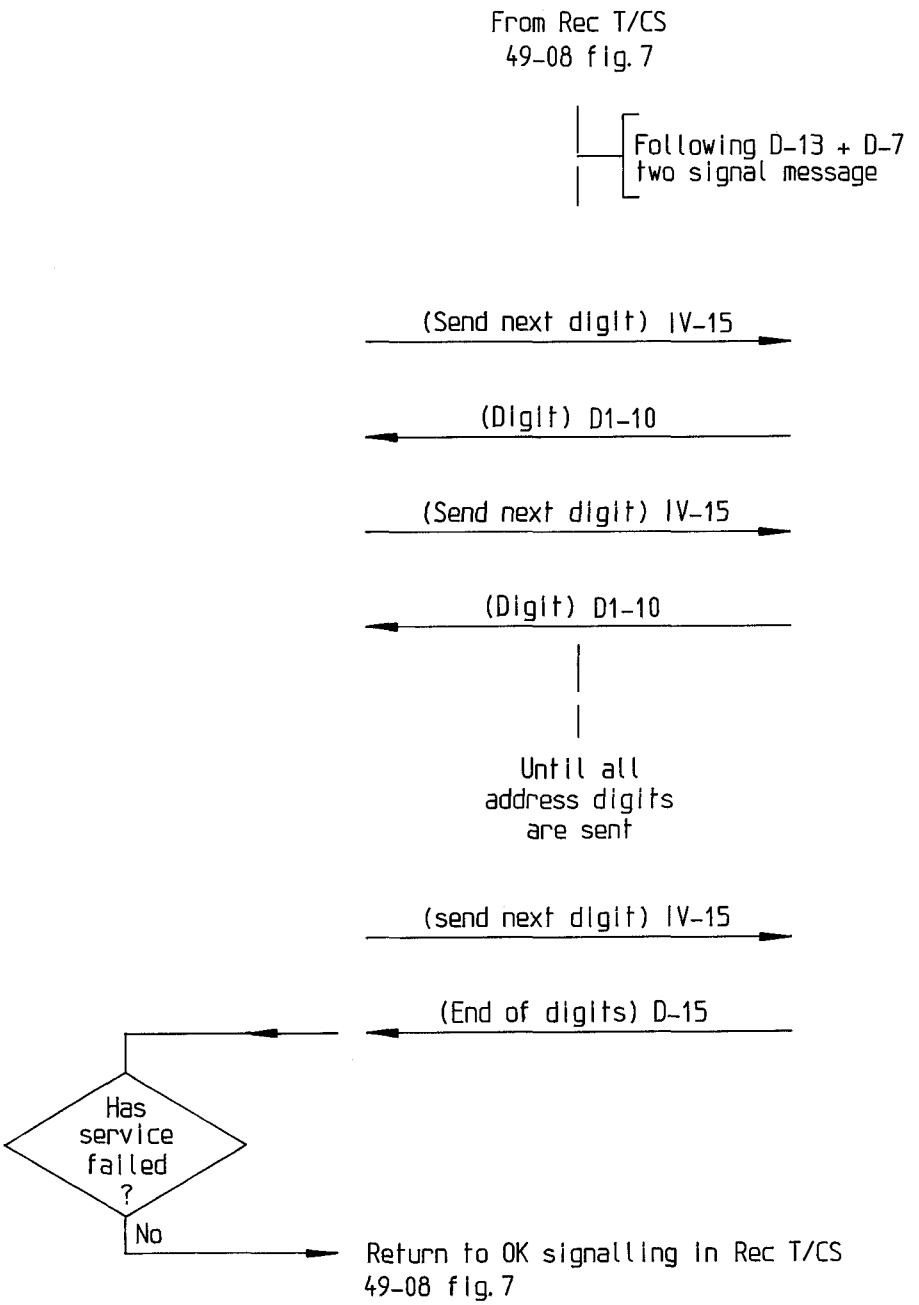

Figure 30 (T/CS 49-09). Immediate/busy diversion (off PABX).

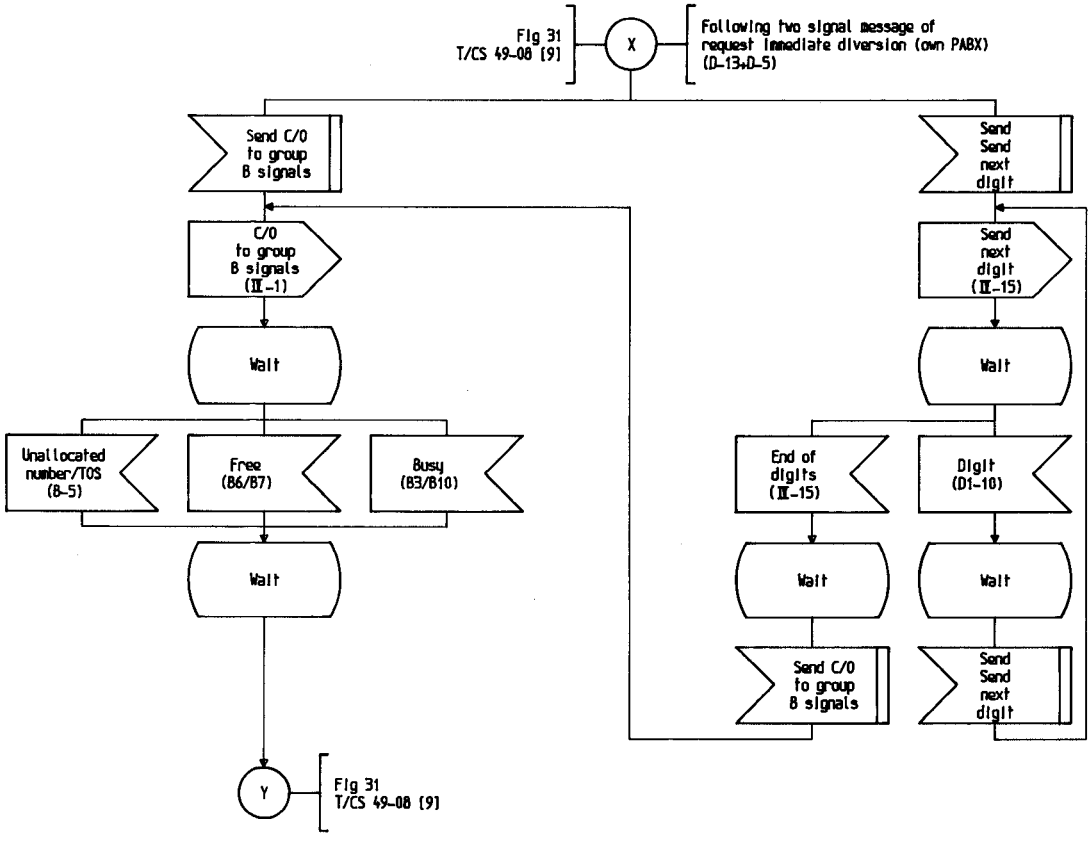

Figure 31 (T/CS 49-09). Immediate/busy diversion (own PABX) (originating PABX).

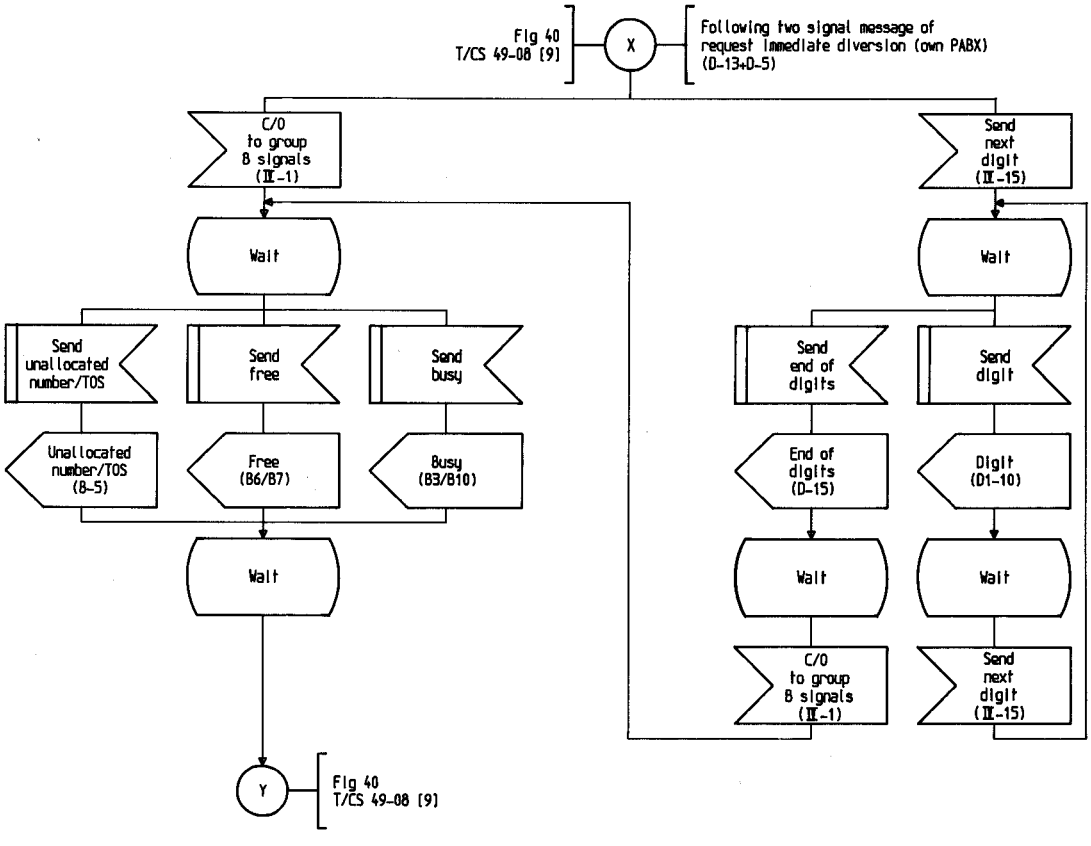

Figure 32 (T/CS 49-09). Immediate/busy diversion (own PABX) (terminating PABX).

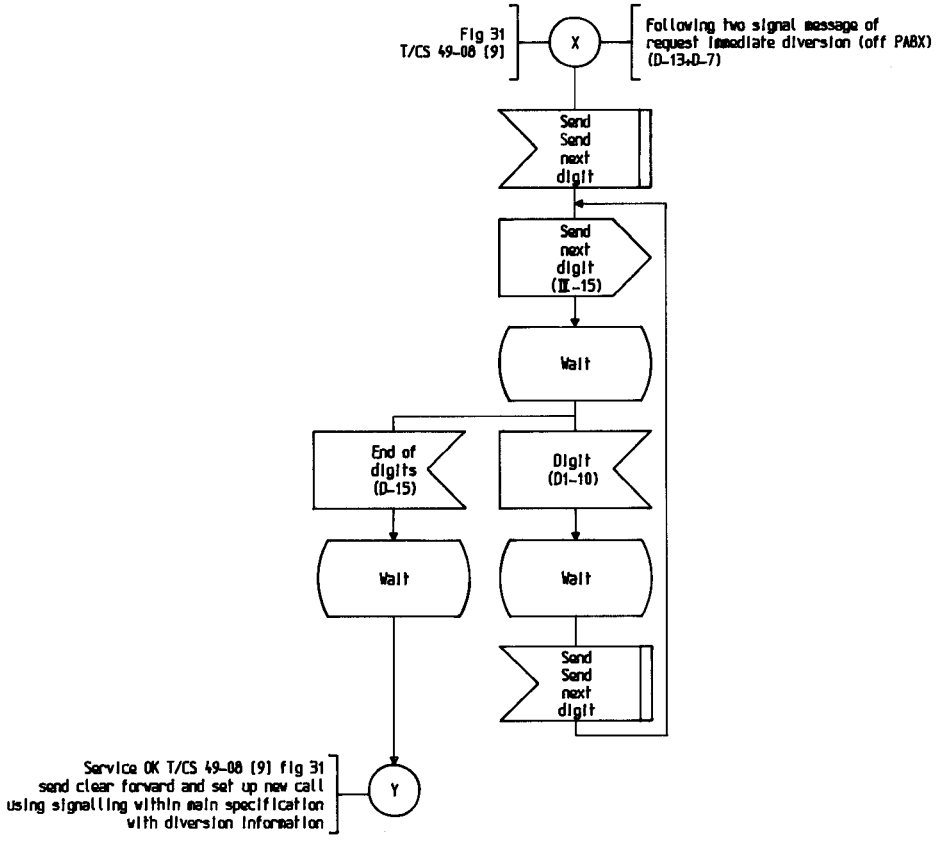

Figure 33 (T/CS 49-09). Immediate/busy diversion (off PABX) (originating PABX).

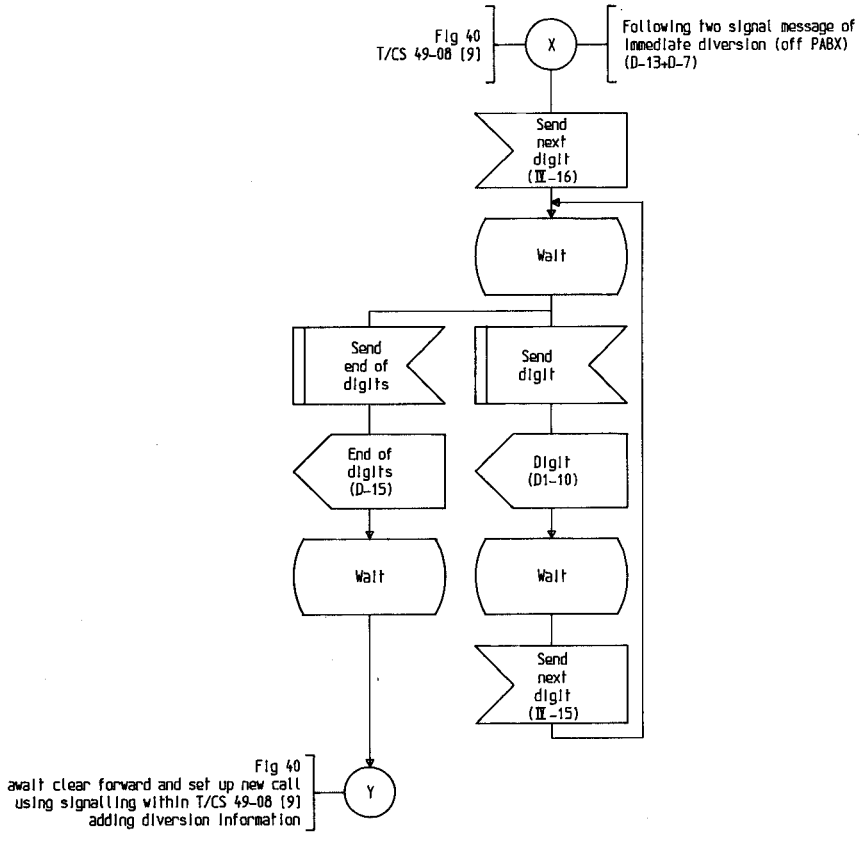

Figure 34 (T/CS 49-09). Immediate/busy diversion (off PABX) (terminating PABX).

6. SUPPLEMENTARY SERVICE – DIVERSION BYPASS

6.1. General

Whenever a call is made to an extension where diversion has been registered, the State of Destination signal in Group B is B-14.

If the calling party has the Diversion Bypass facility, the calling PBX will request a forward supplementary service following receipt of signal B-14. As all forward supplementary services take precedence over backward supplementary services, the Diversion Bypass request will be made immediately.

6.2. Outline of Control Procedures

The signal codes used for the Diversion Bypass service are:
Request Diversion Bypass IV-11/IV-3.

Following the Request Diversion Bypass two signal message, the called PBX will return the State of Destination of the originally called extension. Providing Bypass is acceptable subsequent to Group IV/D signalling, the reversion back to Group III/C signalling will occur.

GROUP IV SIGNALS		
Frequency combination	Name of signal	Remarks
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12	Request Not Accepted – No Further MFC required	
13		
14	Request Not Accepted – Further MFC Possible	
15	Send Next Signal	

Table 17 (T/CS 49-09).
Following IV-11 + IV-3 (Diversion Bypass c/o to Group B).

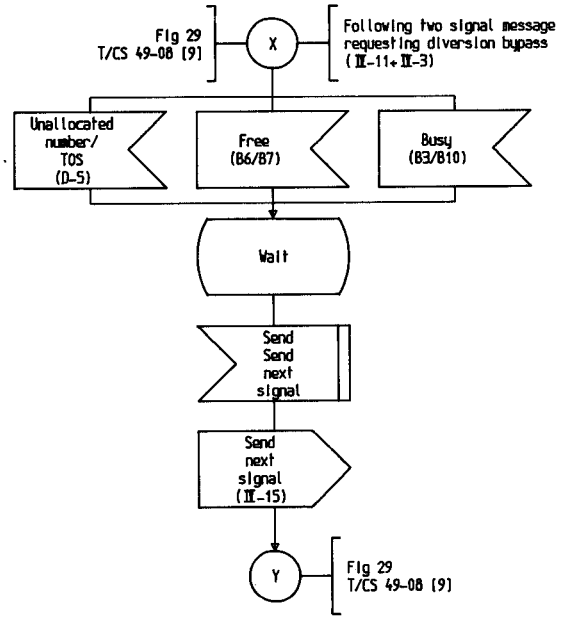

Figure 35 (T/CS 49-09). Diversion bypass (originating PABX).

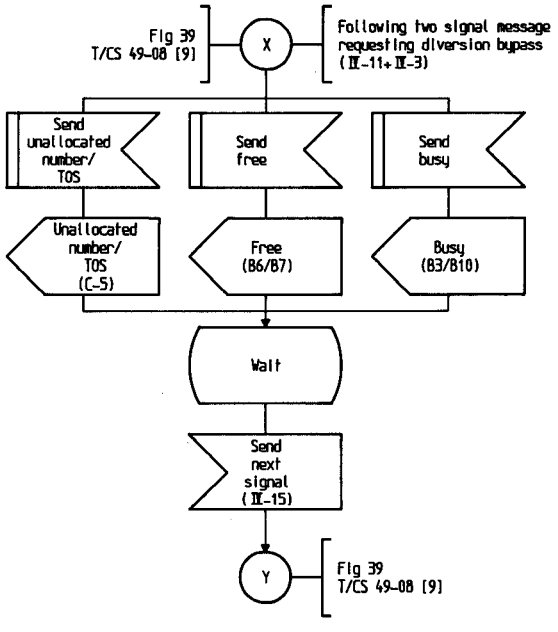

Figure 36 (T/CS 49-09). Diversion bypass (terminating PABX).

REFERENCES

[1] Recommendation T/CS 49-07. *System L_1 MFC interregister signalling.*

[2] Recommendation T/CS 49-08. *System L_1 MFC call control signalling procedures.*