Recommendation T/CS 49-08 (Vienna 1982)

SYSTEM L1 MULTIFREQUENCY CODE CALL CONTROL SIGNALLING PROCEDURES

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 Recommendation T/CS 49-07 [1] provides for multifrequency code (MFC) signalling functions between private automatic branch exchanges (PABXs), which are suitable for the fast set-up of calls and the provision of supplementary services,

— that supplementary services already available to extension users within a single PABX need to be extended to extension users on others PABXs within a private network,

recommends

to the members, that the signalling procedures specified below are used when MFC interregister signalling is applied between private branch exchanges in different countries."

1. GENERAL

1.1. Outline

1.1.1. On international inter-PABX lines, System L1 MFC interregister signalling, as specified in Recommendation T/CS 49-07 [1], is used in conjunction with L1 line signalling, as specified in Recommendation T/CS 49-01 [2].

1.1.2. System L1 MFC provides, in principle, the inter-PABX signalling capability to enable a wide range from set-up of simple calls to a variety of supplementary services to be made available to extension users and operators.

1.1.3. The range of supplementary services provided by a PABX is optional, and depends upon customer requirements and PABX capability. In any given private network, PABXs of differing capability will be encountered, and the procedures specified for System L1 MFC in this Recommendation take this into account. During the initial set-up of the call, an interchange of terminal status information takes place between originating and terminating PABXs. This enables certain subsequent supplementary service demands, from either the interconnected terminals or a third party, to be processed locally without recourse to inter-PABX signalling.

1.1.4. Where a supplementary service demand requires inter-PABX signalling, the request is handled by the responding PABX on an accept or reject basis, depending upon the availability of the service at that PABX.

1.1.5. PABXs that do not provide any supplementary services, but require System L1 MFC signalling capability for fast call set-up and private network compatibility reasons, can utilise a subset of System L1 MFC signalling procedures referred to as *basic*. The *basic* subset provides, as a minimum, the necessary repertoire of signals to establish an extension-to-extension call, with an optional procedure to provide locally applied supervisory tones and limited class-of-service information.

1.2. Signals

1.2.1. *Interregister signals*

The System L1 MFC interregister signals, as well as the 2280 Hz signal for the initiation of the MFC signalling, are specified in Recommendation T/CS 49-07 [1]. This includes their allocation to the multifrequency codes and the abbreviations used.

1.2.2. *Line signals*

Table 1 (T/CS 49-08) shows the System L1 line signals which are used in conjunction with System L1 MFC interregister signalling. The meanings of these signals comply with Recommendation T/CS 41-01 [3]. The requirements for the transmission of these signals are given in Recommendation T/CS 49-01 [2].

Seizing
Answer
Clear-forward
Clear-back
Cleared
Forward-service-request-recall
Forward-link-recall
Backward-service-request-recall
Backward-link-recall

Table 1 (T/CS 49-08). Line signals used for System L1 MFC.

2. SIGNALLING PROCEDURES

2.1. General

This section gives the signalling procedures in three parts:

— outline of call control procedures;

— description of the signalling procedures for selection, subset compatibility check and dialogue phases;
Note: This part requires further study. See contribution T/CS (82) 109 [4].

— signal flows in arrow chart form and SDL sequence charts according to CCITT Recommendation Z.101 [5], Z.102 [6] and Z.104 [7].
Note: The SDL diagrams are included in this Recommendation to assist in the understanding of the technical text, and must only be used in association with the text.

2.2. Outline of call control procedures

2.2.1. Establishment of a call by means of System L1 MFC can be considered in three main phases: the selection phase, the subset compatibility check phase, and the dialogue phase.

2.2.2. The selection phase, which includes access to an *enhanced routing subset*[1], is standard in all System L1 MFC applications. It enables establishment of an ordinary call.

2.2.3. The dialogue phase is carried out by one of the following signalling procedures subsets:
— *Basic:* provides a minimum interworking capability to enable simple call set-up;
— *Enhanced:* provides capability for call set-up plus access to supplementary service procedures;
— *Manufacturer:* subsets enabling specific manufacturer's procedures to be used (see Paragraph 2.5.3.).
Where part of a multi-link call is routed via a non-MFC private circuit, no dialogue phase will take place.

2.2.4. The particular subset used will depend upon the capabilities of the interconnected PABXs, and is determined by the subset compatibility check, which is carried out after the selection phase and before possibly entering the dialogue phase.

2.2.5. When the dialogue phase has been entered, both PABXs exchange information regarding the originating and destination parties in either *basic* or *enhanced* working.

2.2.6. The signalling procedures structure in Figure 1 (T/CS 49-08) shows the relationship between the subsets.

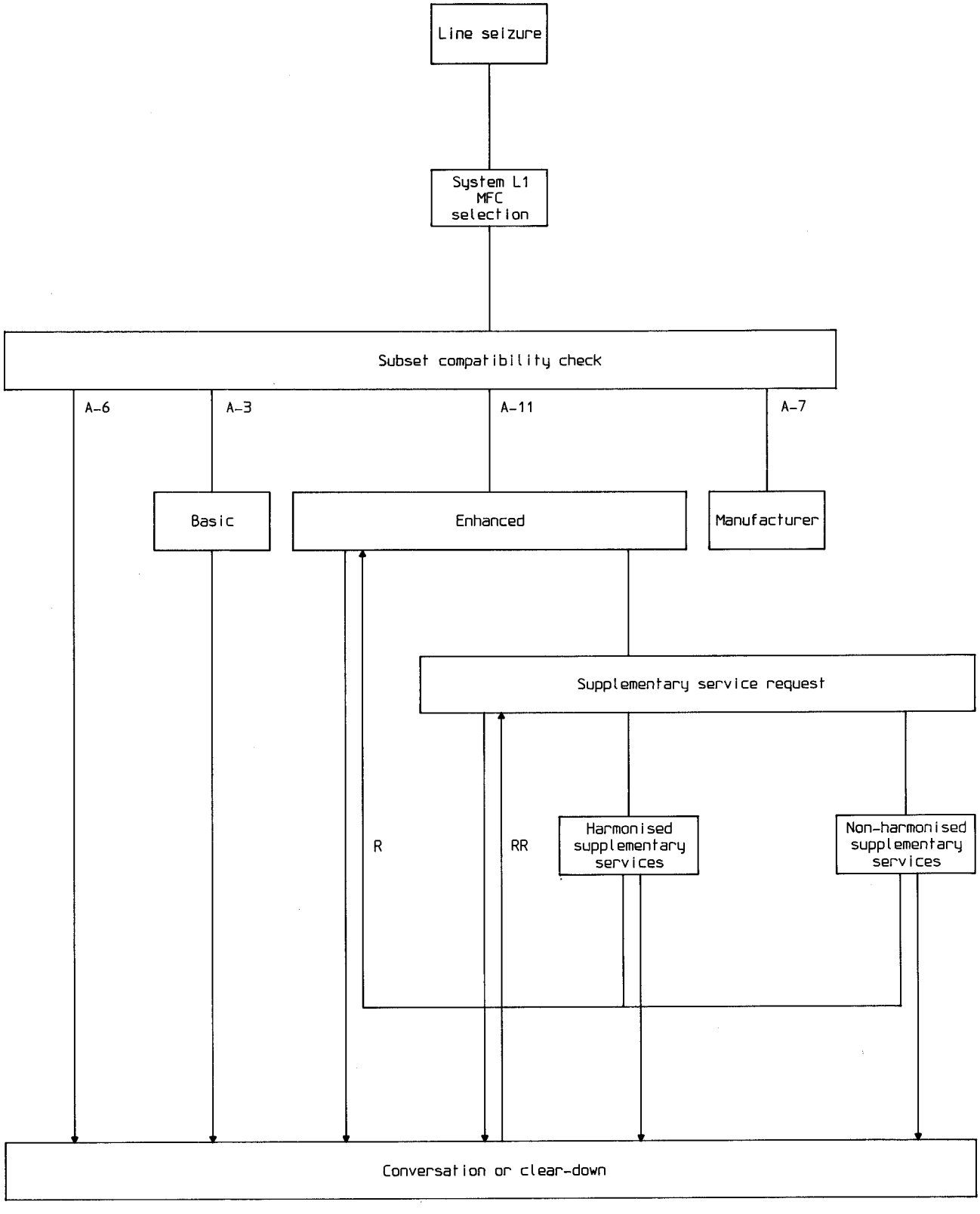
2.2.7. In *basic* working, the dialogue phase interchange is limited to one signal in each direction.

2.2.8. In *enhanced* working, the interchange involves at least two signals in each direction and, if a supplementary service is involved, may extend to many more, except for states such as parked where only one signal interchange need take place.

2.2.9. The signal exchange for a supplementary service is a function of the service concerned. The procedures based on supplementary services harmonised by CEPT are specified in Annexes to this Recommendation. Procedures required for other categories of supplementary services, e.g. defined for national use or marketed by PABX providers, are not covered in this Recommendation. However, provisions are made in System L1 MFC to gain access to such procedures (see Paragraph 2.5.2.3.).

2.2.10. In *basic* working, the service-request-recall and link-recall signals are not used.

[1] Under study.



Legend: R = revert.
RR = register-recall.
A = group A backward signal.

Figure 1 (T/CS 49-08). System L1 signalling procedures structure.

2.2.11. PABXs with transit functions must be capable of repeating a service-request-recall signal to the next link. If a transit switch is not capable of using a link-recall signal, it will take no action on its recognition.

2.3. Signalling procedures for the selection phase

The selection phase covers all signalling necessary to establish a connection between the originating and destination PABXs, including the forwarding of the required extension number to the destination PABX.

The selection phase is entered, following the application of the seizing signal by the originating PABX. On recognition of the seizing signal, the responding PABX prepares to receive MFC signals and applies the proceed-to-send signal.

As a multi-link call is progressively set-up across a network (see Recommendation T/CS 49-07 [1]), each transit switch applies a seizing signal to the subsequent link, and each responding PABX applies the proceed-to-send signal.

To facilitate network management, backward MFC signals are used during the selection phase to

i) request address signals (routing digits and extension number) one after the other from the originating PABX, as required by the transit switch or terminating PABX; when all address digits have been sent, the originating PABX responds if it receives a further send-next-digit signal by sending the no-further-digit signal (I-15);
ii) inform the originating PABX of the progress of the call, e.g. how many transit switches have been encountered;
iii) inform the originating PABX of alternative routing that has occurred at a transit switch;
iv) inform the originating PABX that access to the public switched telephone network (PSTN) is about to occur;
v) request entry into the optional enhanced routing subset[1)] in order to influence the routing of the call, e.g. special quality circuits for data.

Figure 2 (T/CS 49-08) shows the selection phase in arrow chart form.

Figure 3 (T/CS 49-08) shows the entry into the enhanced routing subset in arrow chart form.

2.4. Signalling procedures for subset compatibility check

On completion of selection, it is necessary for the originating and destination PABXs to determine whether MFC signalling is going to continue, and if so, which procedure subset is to be used for the remainder of the call handling.

If no further MFC signalling is possible (e.g. a non-MFC route or a PSTN has been encountered by a transit switch), an address-complete, no-MFC, set-up-speech-path signal will be sent (A-6).

Where further MFC signalling is possible, the subset compatibility check is initiated by the destination PABX, which applies one of the following signals (see Figure 1 (T/CS 49-08)):

i) Address-complete, *enhanced*, change-over-to-reception-of-group-B signals (A-11);
ii) Address-complete, request-subset-identity (A-7);
iii) Address-complete, *basic*, change-over-to-reception-of-group-B signals (A-3).

The originating PABX responds by either:

(a) implicitly accepting the proposed subset (*enhanced* or *basic*) by sending forward information as shown in Section 2.5.;
or
(b) implicitly agreeing to attempt entry into a *manufacturer* subset by sending forward its subset identity digit(s) for subset compatibility checking (the range required and the allocation of subset identity digits is under study);
or
(c) rejecting the proposed subset by sending either the *enhanced*-request-not-accepted or the *manufacturer*-request-not-accepted signal.

The originating PABX cannot reject a request to enter *basic*.

On receipt of either a request-not-accepted signal or an incompatible *manufacturer* subset identity, the destination PABX will offer another subset. This interaction will continue until a common subset is found (usually *enhanced* or *basic*). Figure 4 (T/CS 49-08) shows the subset compatibility check in arrow chart form.

2.5. Signalling procedures for the dialogue phase

On completion of the subset compatibility check, both PABXs enter one of the following procedures subsets.

[1)]Under study.

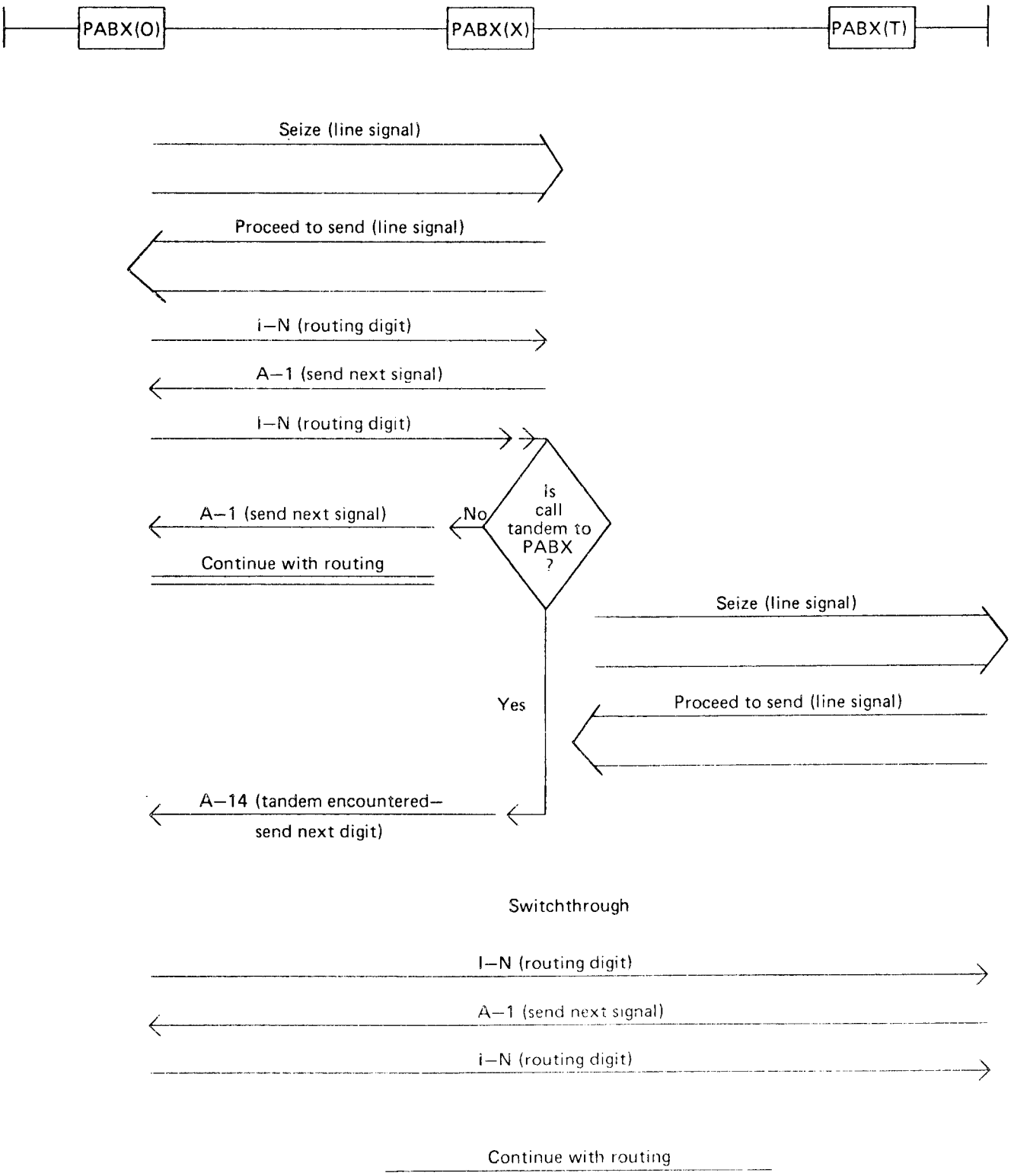


Figure 2 (T/CS 49-08). Routing via a transit PABX.

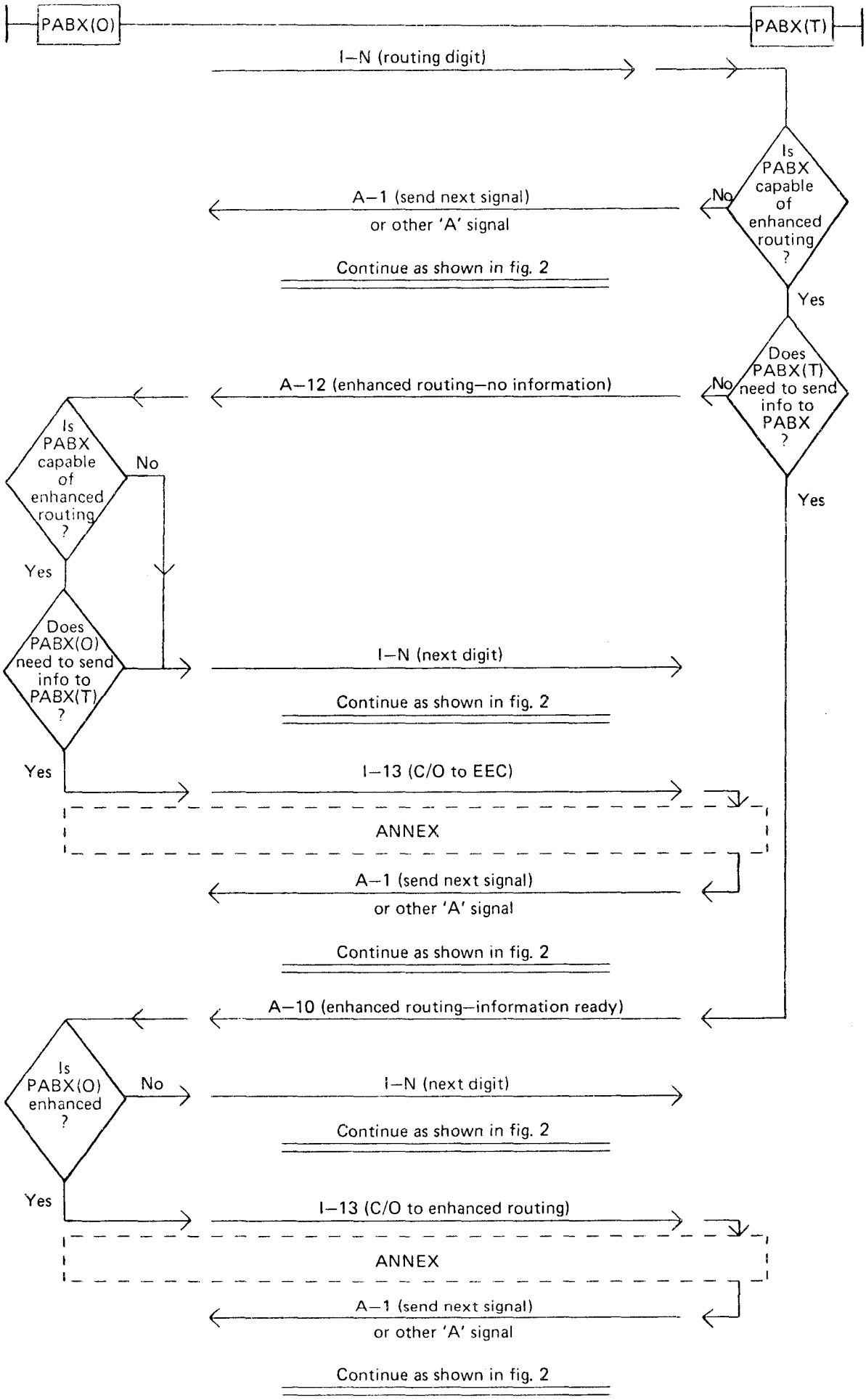


Figure 3 (T/CS 49-08). Enhanced routing procedure.

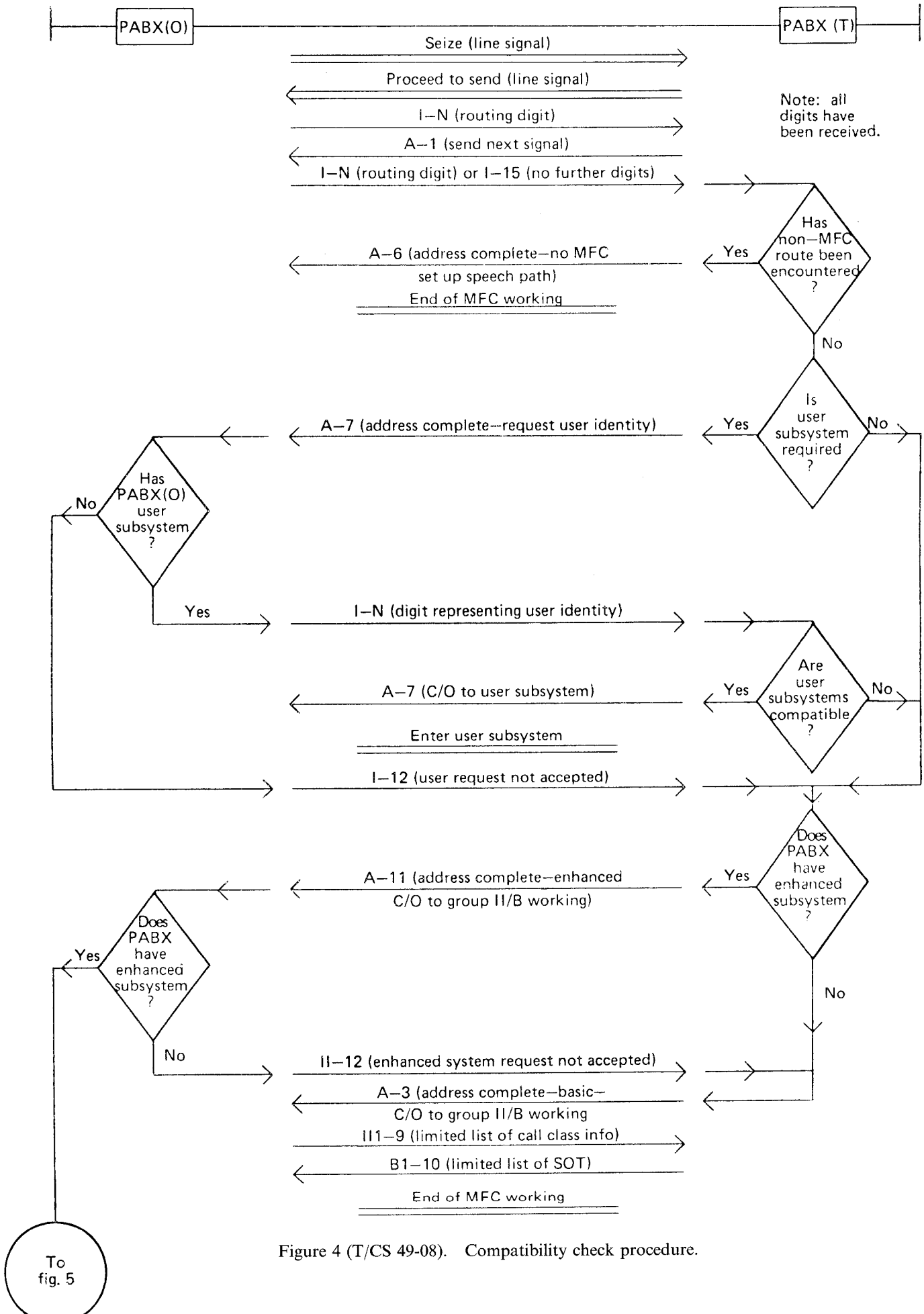


Figure 4 (T/CS 49-08). Compatibility check procedure.

2.5.1. *Basic subset*

The *basic* subset provides a single signal interchange in which one of the following pieces of information can be sent.

Forward information:

Call originates from

— an ordinary extension;
— a restricted signalling capability private circuit;
— maintenance equipment;
— the public switched telephone network (PSTN);
— an operator position;
— data transmission equipment;
— an operator assisting an ordinary extension;
— an operator assisting a PSTN caller;
— an operator assisting a restricted signalling capability private circuit.

Backward information:

The destination is

— in a parked state;
— barred PSTN calls;
— busy with intrudable status;
— temporarily out-of-service, unallocated number;
— free with intrudable status;
— barred to incoming calls;
— busy with non-intrudable status.

In addition there are signals to indicate:

— destination PABX congestion;
— destination PABX call failure.

The exchange of additional information using *basic* is shown as the last two signals in Figure 4 (T/CS 49-08).

2.5.2. *Enhanced subset*

2.5.2.1. Exchange of calling and called party information

In *enhanced* working, the exchange of calling and called party information is by means of two signal interchanges. The first signal interchange (groups II and B) conveys the following pieces of information, in addition to the items listed in Paragraph 2.5.1.

Forward direction:

Call originates from

— the network;
— an ordinary extension holding a PSTN call;
— an executive extension;
— the ISDN.

Backward direction:

The destination is

— an operator position;
— busy with partially-intrudable status;
— free with partially-intrudable status;
— in a state with no applicable state of destination.

The second signal interchange (groups III and C) enables further qualifying information to be exchanged, such as whether the call has been diverted; whether or not it may be partially intruded upon; whether the called party is barred access to the PSTN; and whether further MFC signalling is required by either PABX, e.g. supplementary service control information, or calling line identity.

The exchange of additional information using *enhanced* is shown in Figure 5 (T/CS 49-08) in arrow chart form.

2.5.2.2. Simple call

Following the exchange of additional information, and assuming that no supplementary services are required, the MFC registers release and leave the connection under the control of line signals.

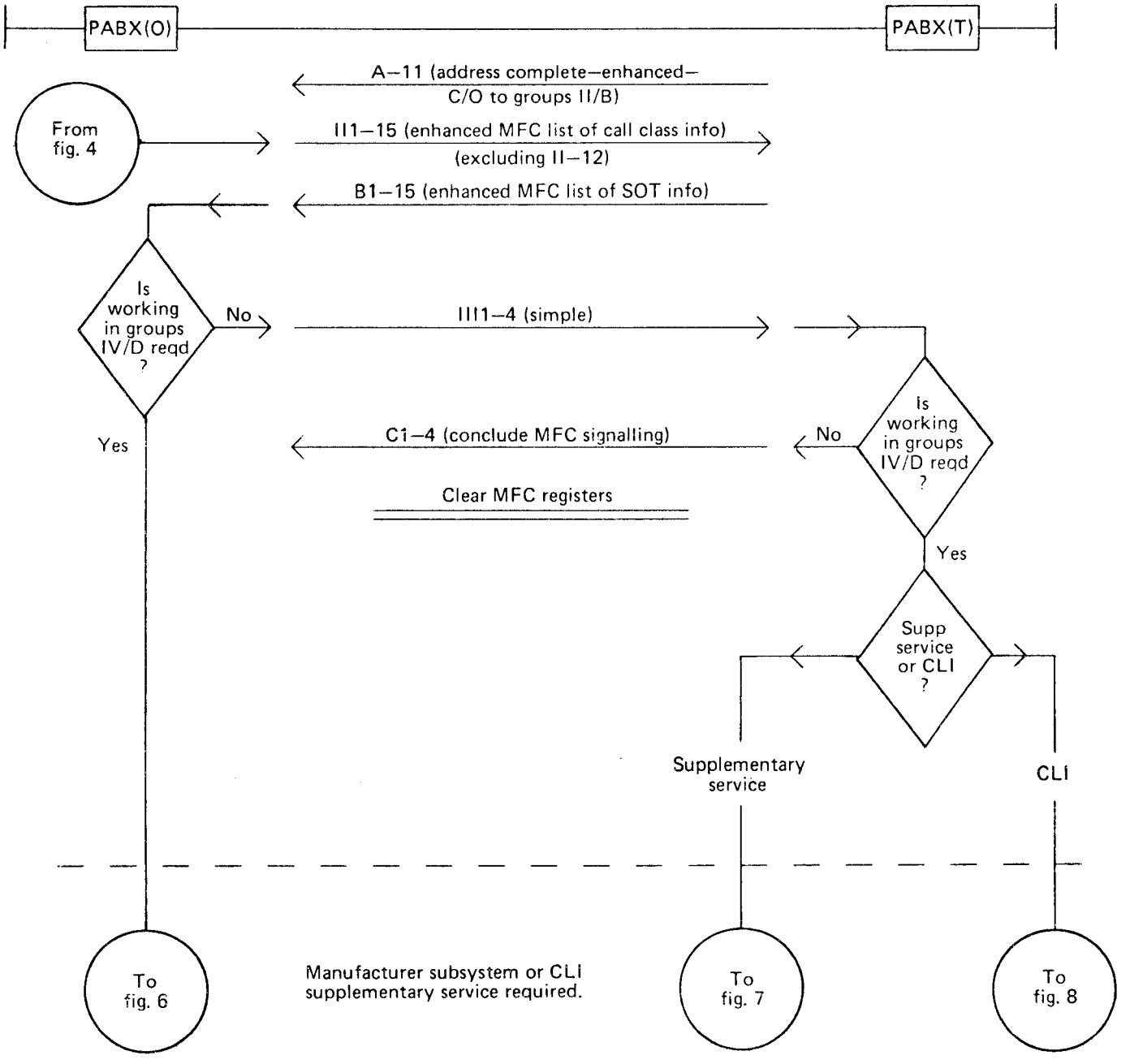


Figure 5 (T/CS 49-08). Exchange of SOT/COS information (enhanced MFC subsystem).

2.5.2.3. Supplementary services

In addition to establishing a call, System L1 MFC *enhanced* signalling procedures are specified to provide access to supplementary services during the exchange of additional information before the MFC registers release. The supplementary service category concerned will be determined by a *supplementary service request procedure.*

Forward supplementary service request

When the originating PABX requires a supplementary service, it indicates this with a group III signal (III-5 to III-12). Upon recognition of this signal, the destination PABX responds with the request-forward-supplementary-service-category signal (C-15). This provokes change-over-to-group-IV-and-D signals, which are used for two compelled MFC cycles dedicated to the category and supplementary service identification.

Backward supplementary services request

The destination PABX changes-over to group IV and D signals by transmission of one of the signals C-7 to C-14. The response on C-7, C-8, C-10 and C-13 shall be the signal IV-15, requesting the backward supplementary service category and identity. As in forward supplementary service request, two cycles are used. The signals C-9, C-11, C-12 and C-14 initiate the sending of the calling-line-identity, see Paragraph 2.5.2.4.

The above arrangements allow transmission of at least 15×15 codes in both directions. By using code 10 as an escape, extension is possible. Further study is required on the allocation of the codes to identify category groups and specific supplementary services.

Forward supplementary service requests are given priority over backward requests and, depending upon the capability of the PABXs concerned, any number of requests can be processed sequentially until neither PABX has an outstanding requirement for further MFC signalling (see *revert* on Figure 1 (T/CS 49-08) and Paragraph 2.5.2.8.).

Signal flows for forward and backward supplementary service requests are shown in Figure 6 (T/CS 49-08) and 7 (T/CS 49-08) respectively.

Supplementary service requests can also occur after the release of MFC registers, either before or after answer (see Paragraph 2.5.2.5.).

Signalling procedures specifications for non-harmonised supplementary services in national use or defined by a manufacturer, are not shown in this Recommendation. The relevant documentation should be provided by the Administration or manufacturer concerned.

2.5.2.4. Calling-line-identity

Calling-line-identity (CLI) requests occur normally as a part of the call establishment procedure by means of one of the following backward signals:
Send-CLI (Signal C-9);
Send-CLI, PSTN-barred (Signal C-11);
Send-CLI, non-intrusion-request-rejected (Signal C-12);
Send-CLI, PSTN-barred, non-intrusion-request-rejected (Signal C-14).

Since the calling-line-identity request is liable to occur on a large number of calls, the necessary signals are included in the main MFC signalling procedures, and are not included in an Annex like other supplementary services. This reduces the number of signals required and, consequently, shortens the post-dialling delay.

On completion of the calling-line-identity request, the responding PABX, dependent upon its capability, either concludes MFC signalling, or retains its MFC registers to offer a subsequent supplementary service (see Paragraph 2.5.2.9.). Signal flows for calling-line-identity request are shown in Figure 8 (T/CS 49-08).

2.5.2.5. Supplementary services after register release

Where a supplementary service is required after the MFC registers have released, a register-recall signal will be used. Following a register-recall signal, both PABXs will automatically commence signalling in groups IV and D. The PABX that sends the register-recall signal will be considered the initiating PABX in terms of MFC, and will commence the signalling procedure by sending a group IV signal.

2.5.2.6. Signalling within supplementary services

The subsequent signalling flows within a supplementary service depend upon which supplementary service is requested. Details will be given in the relevant Annex to this specification as they are agreed upon.

2.5.2.7. Rejection of supplementary service requests

Where a PABX cannot provide the service that has been requested, it shall return a request-no-accepted signal and, depending upon its capability, either concludes MFC signalling, or retains the MFC register to give an opportunity for an alternative service to be requested (see Paragraph 2.5.2.9.).

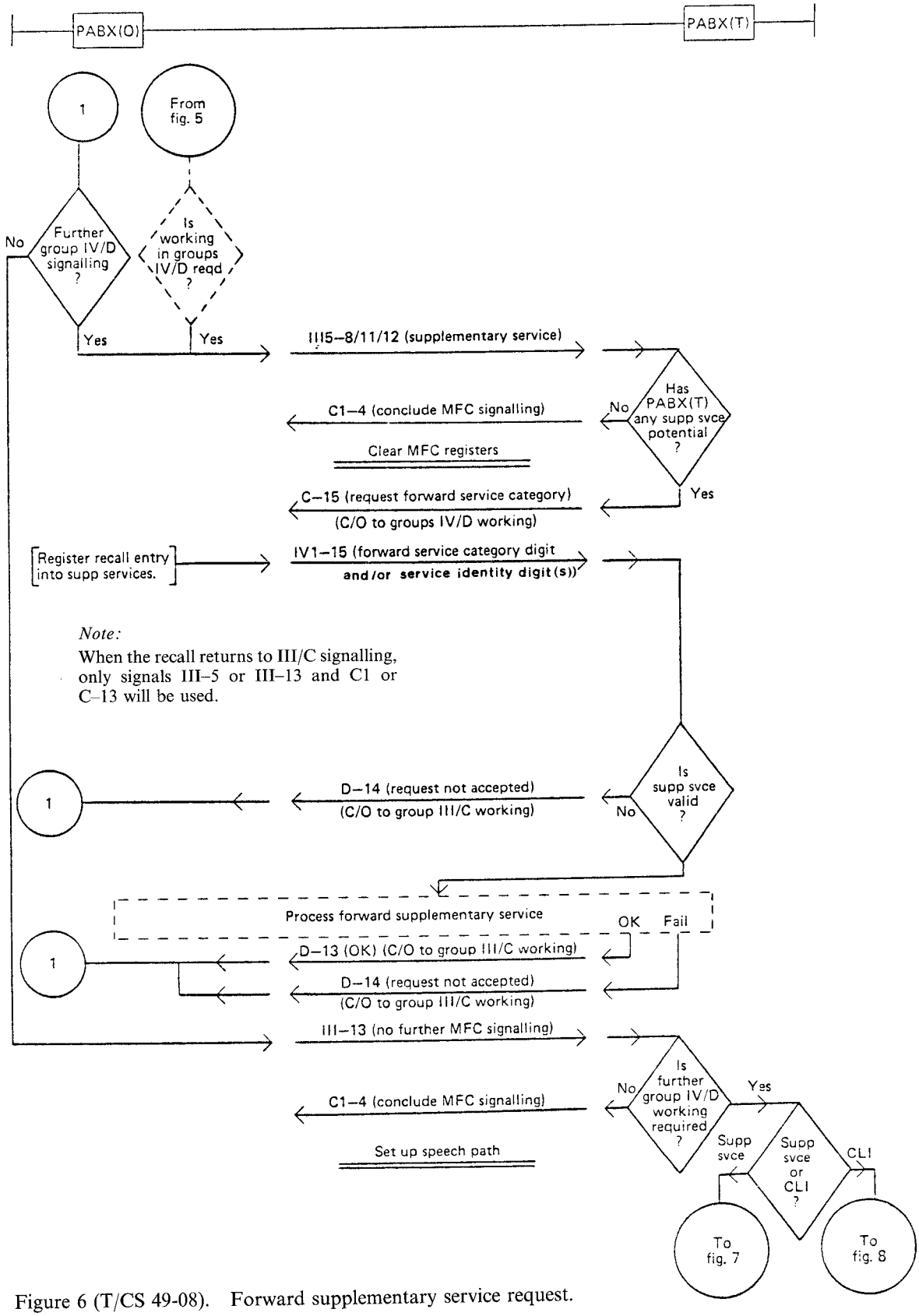


Figure 6 (T/CS 49-08). Forward supplementary service request.

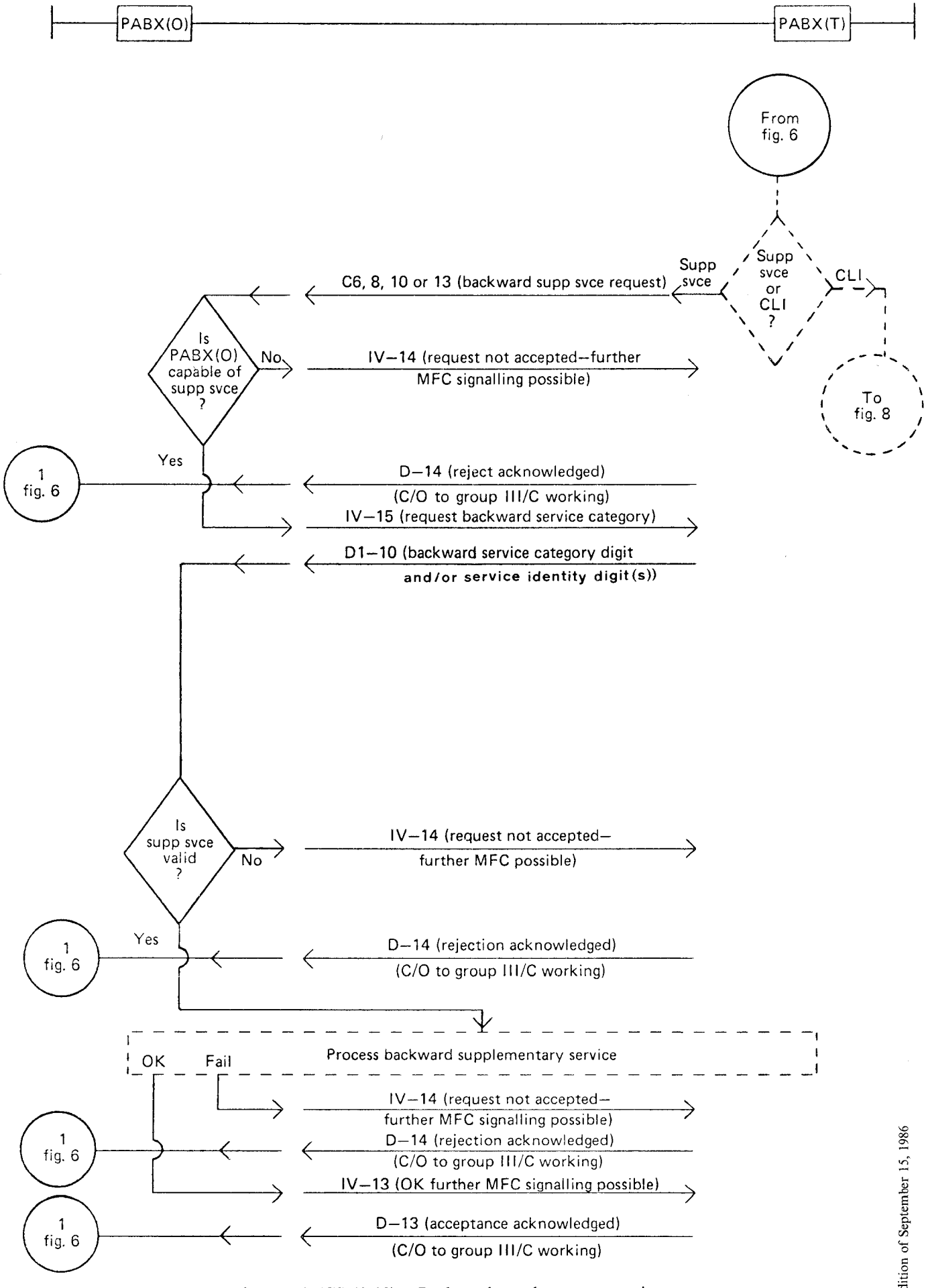


Figure 7 (T/CS 49-08). Backward supplementary service request.

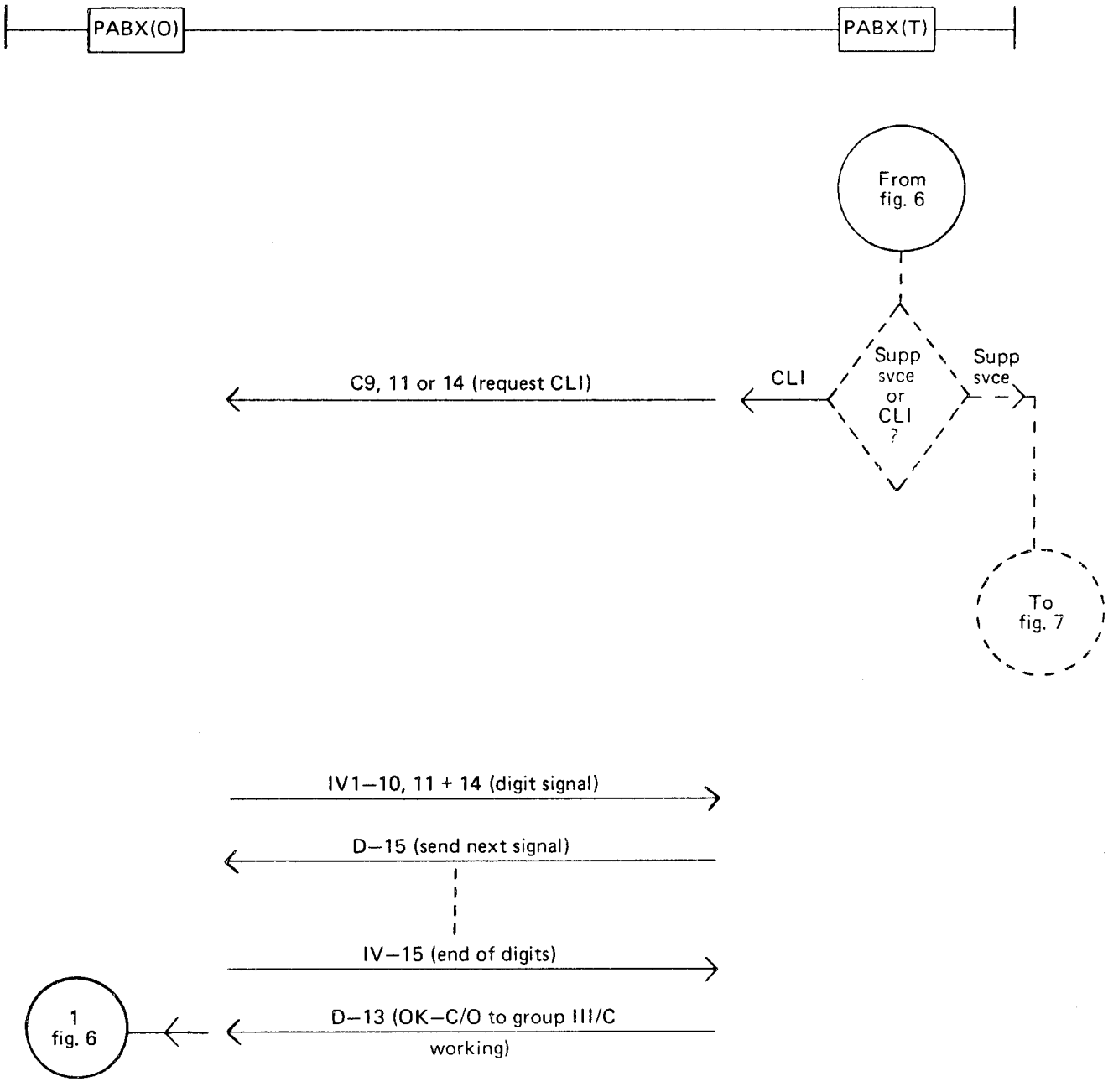


Figure 8 (T/CS 49-08). Calling line identity request (CLI).

2.5.2.8. Sequential processing of supplementary service requests

During a call it is possible, although improbable, that more than one service demand will need to be processed at a given time. Examples of this are listed below.

i) Clash of supplementary services: an incoming call has diversion-override capability and the called party has diversion activated.

ii) Second attempt: a supplementary service or calling line identification is required, following an unsuccessful attempt to change-over to *manufacturer*.

iii) Enhancement of a supplementary service: following a supplementary service request, the PABX wants to change-over to *manufacturer* for a specific enhancement.

To enable a number of supplementary service requests to be processed sequentially, the following signals are included in groups IV and D:

OK/acceptance-acknowledged, change-over-to-groups-III-and-C	D-13
Request-not-accepted/rejection-acknowledged, change-over-to-groups-III-and-C	D-14
OK, further-MFC-signalling-possible	IV-13
Request-not-accepted, further-MFC-signalling-possible	IV-14

These signals, which may be used either on completion of a supplementary service or on rejection of a service request, return the signalling to groups III and C allocations, thus enabling the PABXs to either request a further service or conclude MFC signalling. On each return to groups III and C signalling, the originating PABX has priority. When the originating PABX has no further requests to make, it sends a no-further-supplementary-service-request signal (III-15). The responding PABX, on receipt of this signal, either sends a supplementary service request or concludes MFC signalling by sending a conclude-MFC-signalling signal C-1.

2.5.3. *Manufacturer subset*

When the subset compatibility check has identified a common *manufacturer* subset, call handling continues in accordance with the appropriate specifications. However, once *manufacturer* subset procedures have been entered, it is still possible to revert back to standard System L1 MFC working.

The signalling procedures within *manufacturer* subsets are not given in this Recommendation, and the relevant documentation should be provided by the manufacturer concerned.

REFERENCES

[1] Recommendation T/CS 49-07. *System L1 multifrequency code interregister signalling.*

[2] Recommendation T/CS 49-01. *System L1 line signalling over international inter private automatic branch exchange lines.*

[3] Recommendation T/CS 41-01. *Signal and signalling message names and meanings.*

[4] Sub-Working Group CS-LEA. *System L1 MFC signal descriptions and functions (under study).*

[5] Recommendation Z.101. *General explanation of the specification and description language (SDL).*

[6] Recommendation Z.102. *Symbols and rules.*

[7] Recommendation Z.104. *Semantics.*

SDL-DIAGRAMS

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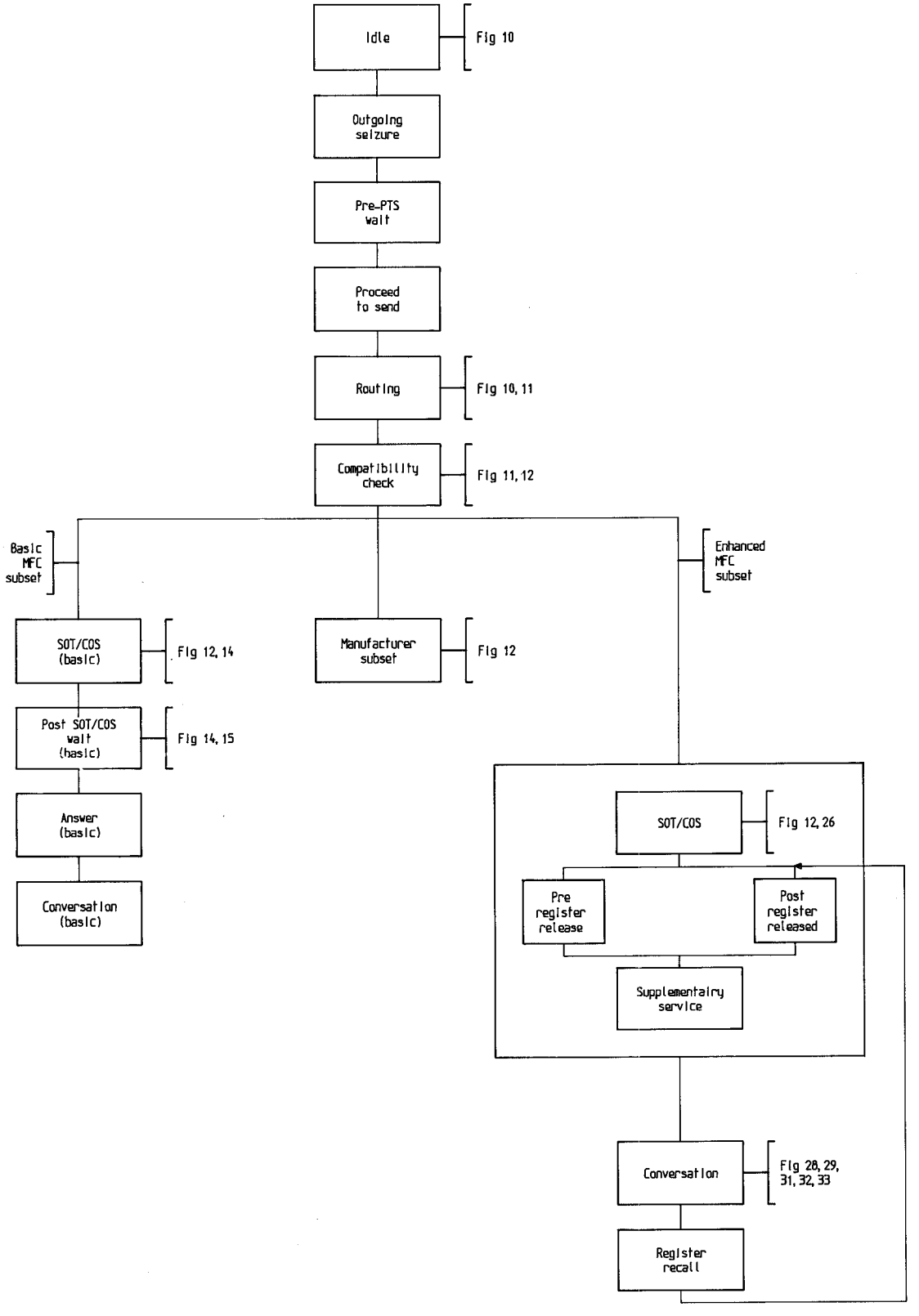


Figure 9 (T/CS 49-08). Functional block description of originating PABX.

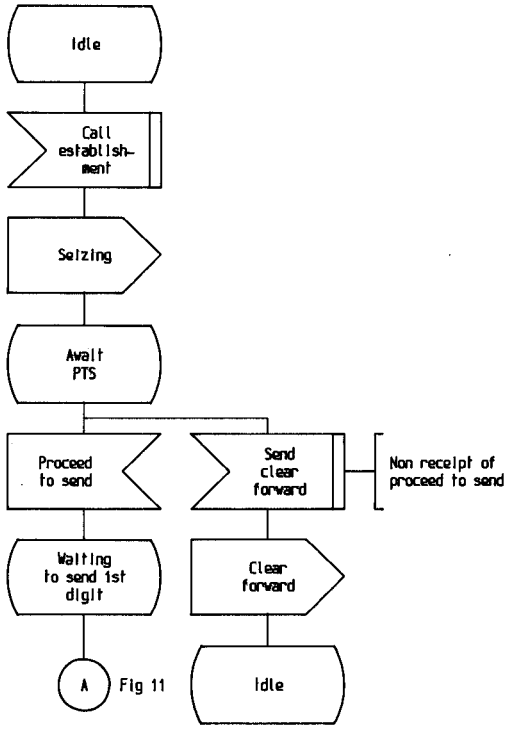


Figure 10 (T/CS 49-08). Originating PABX circuit seizure.

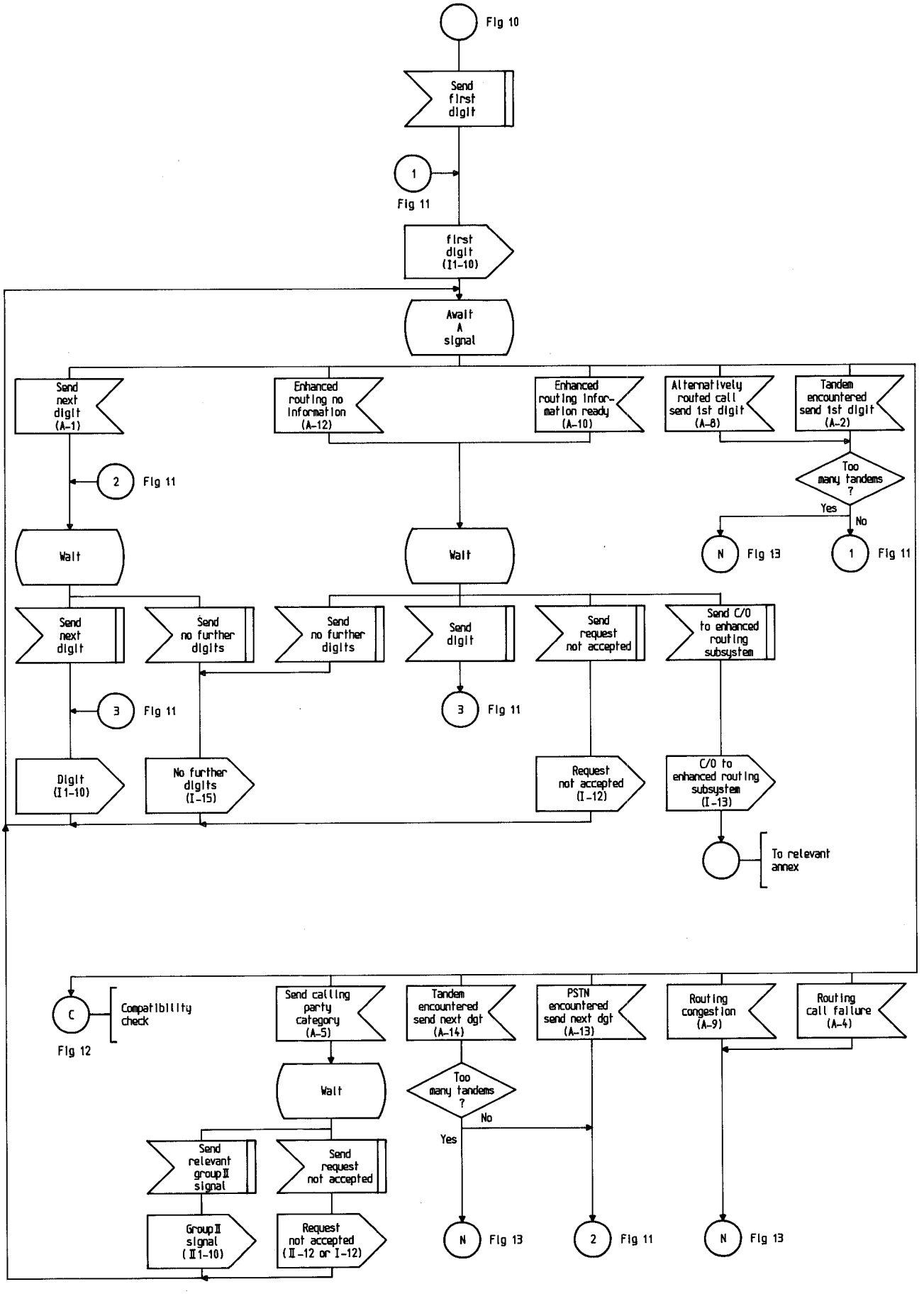


Figure 11 (T/CS 49-08). Originating PABX routing.

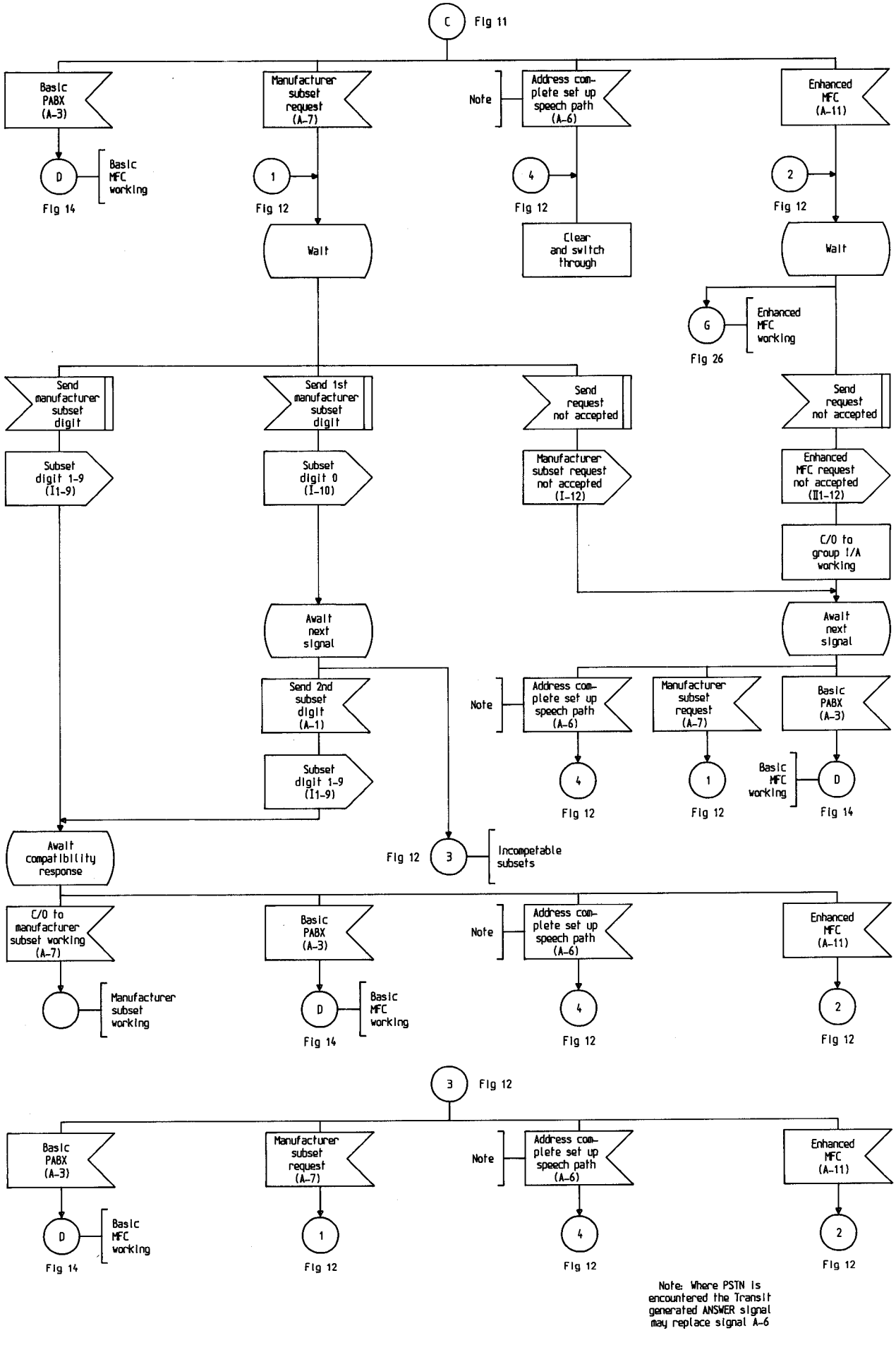


Figure 12 (T/CS 49-08). Originating PABX compatibility procedure.

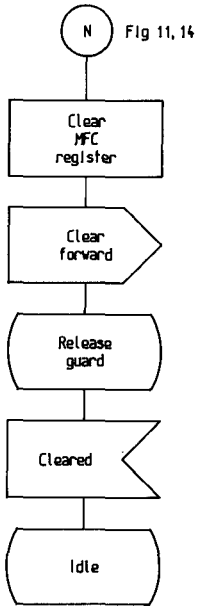


Figure 13 (T/CS 49-08). Originating PABX cleardown sequence (basic subsystem).

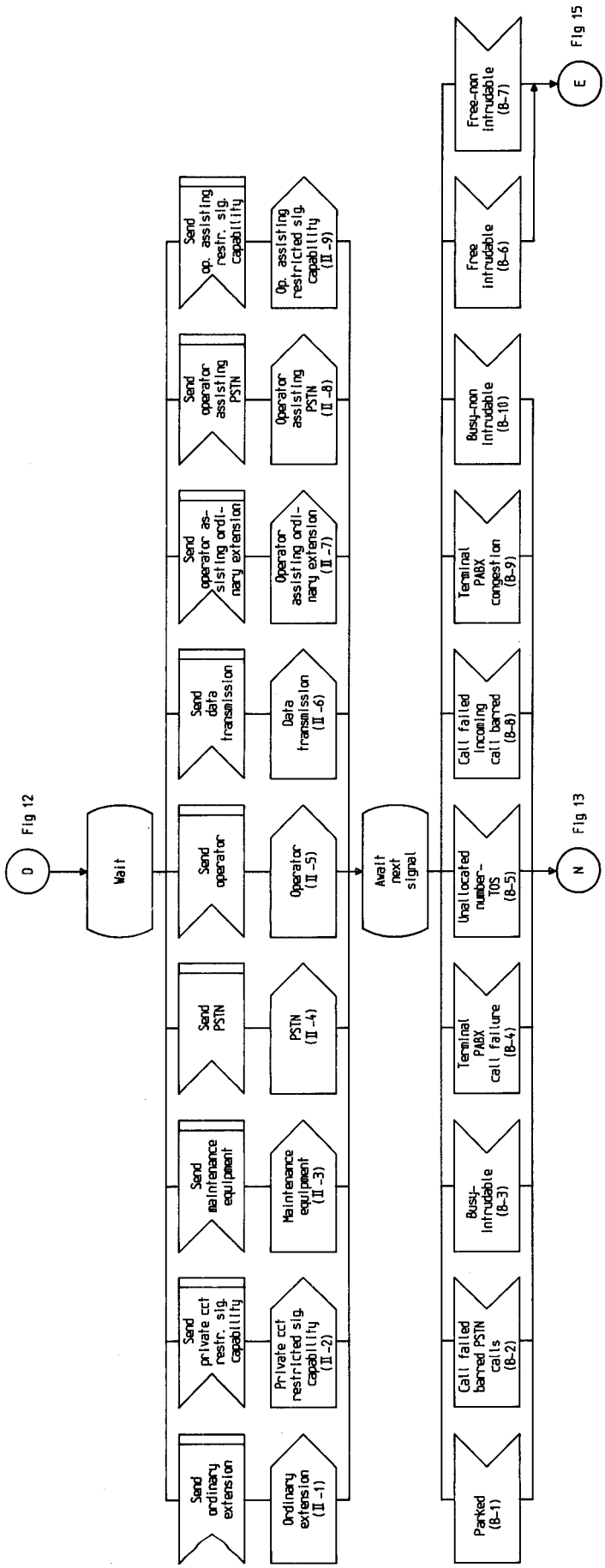


Figure 14 (T/CS 49-08). Originating PABX SOT/COS procedure (basic subsystem).

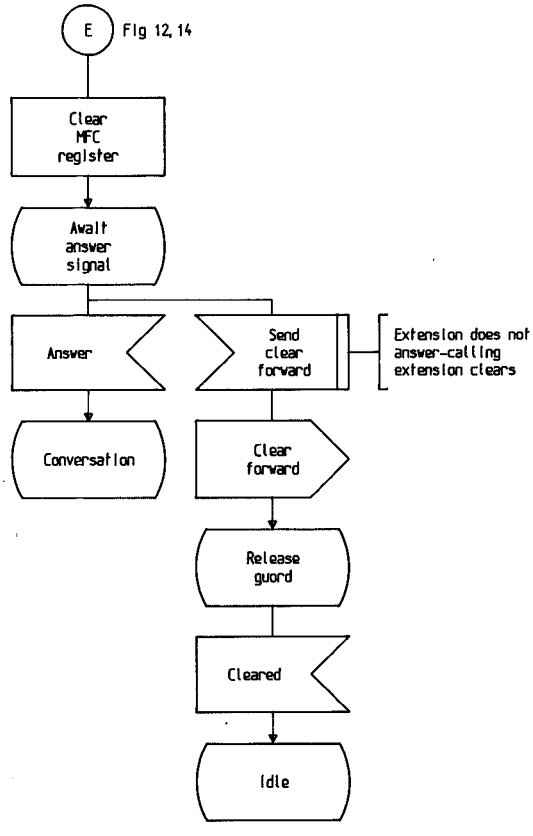


Figure 15 (T/CS 49-08). Originating PABX answer and conversation (basic subsystem).

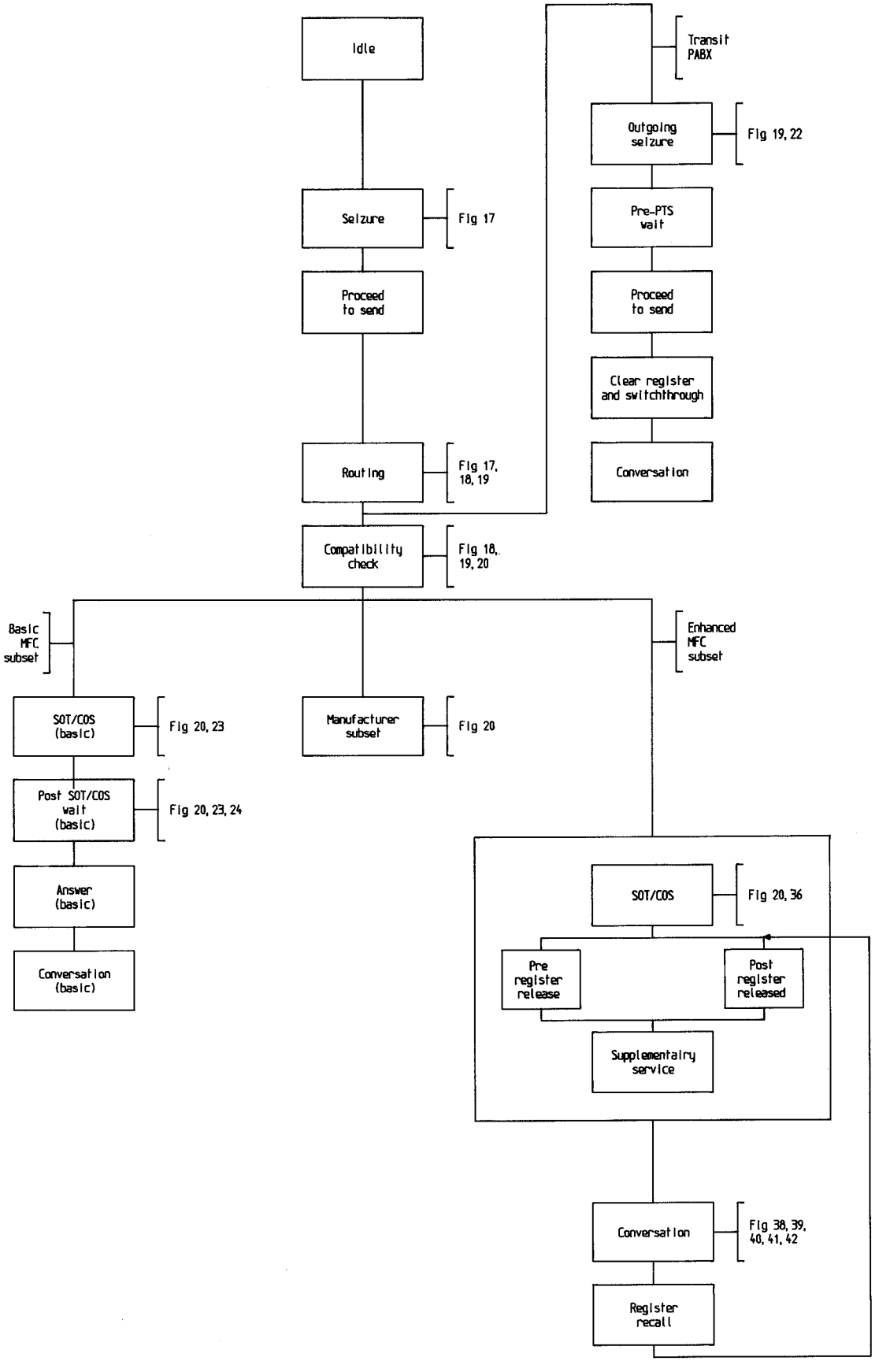


Figure 16 (T/CS 49-08). Functional block description of terminating and transit PABX.

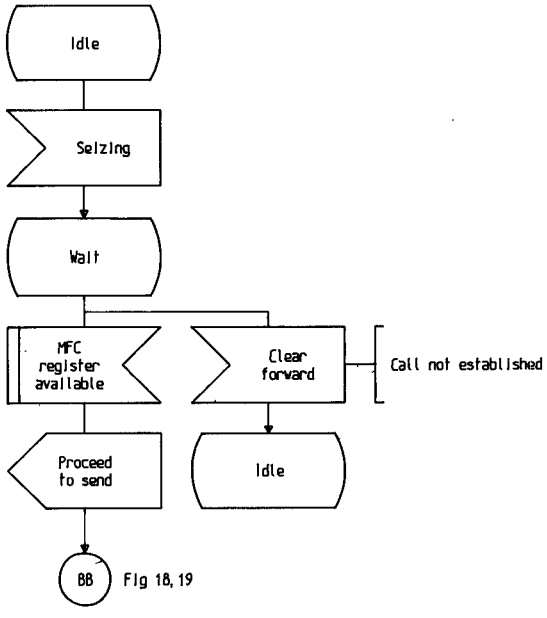


Figure 17 (T/CS 49-08). Terminating PABX circuit seizure.

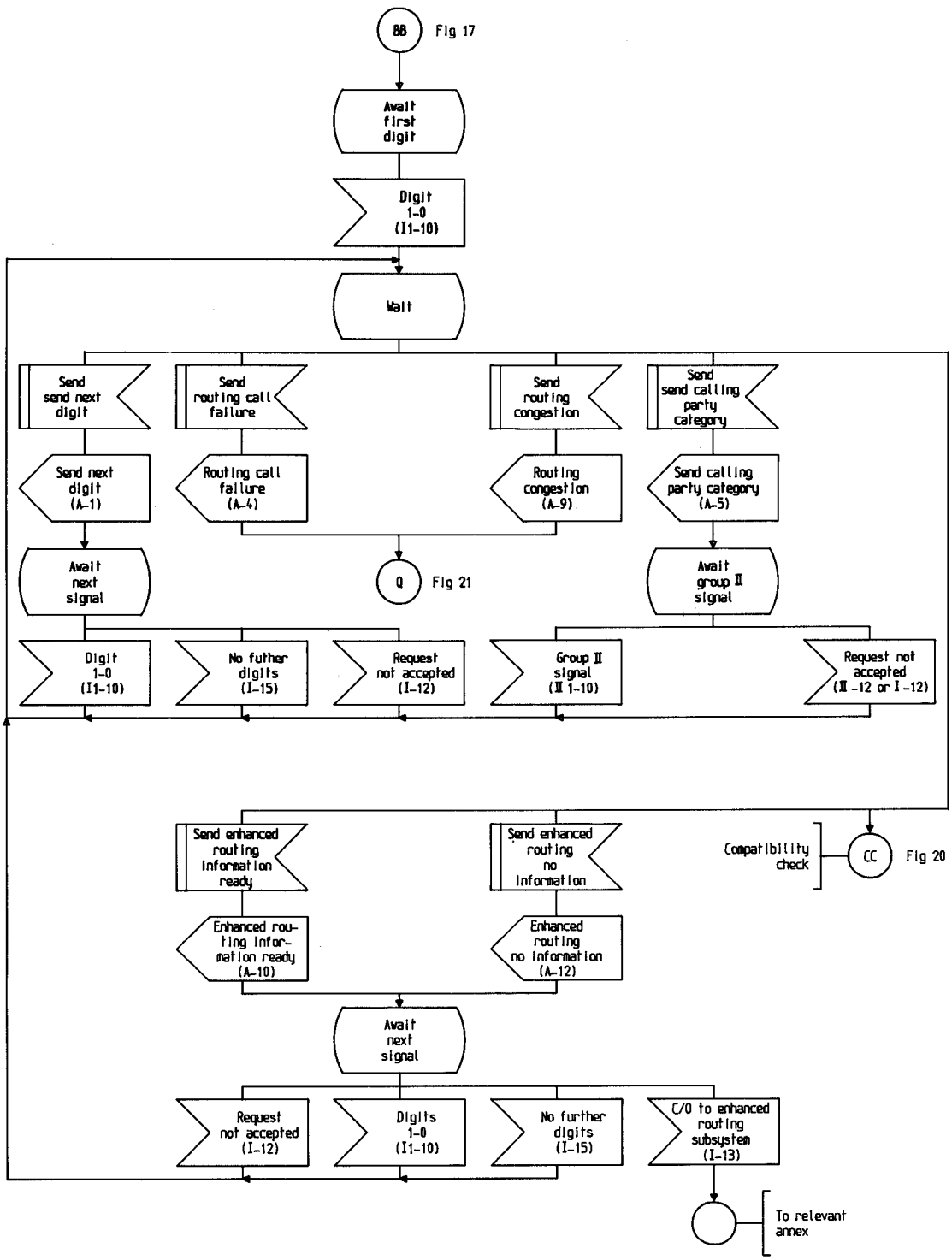


Figure 18 (T/CS 49-08). Terminating PABX routing including enhanced routing.

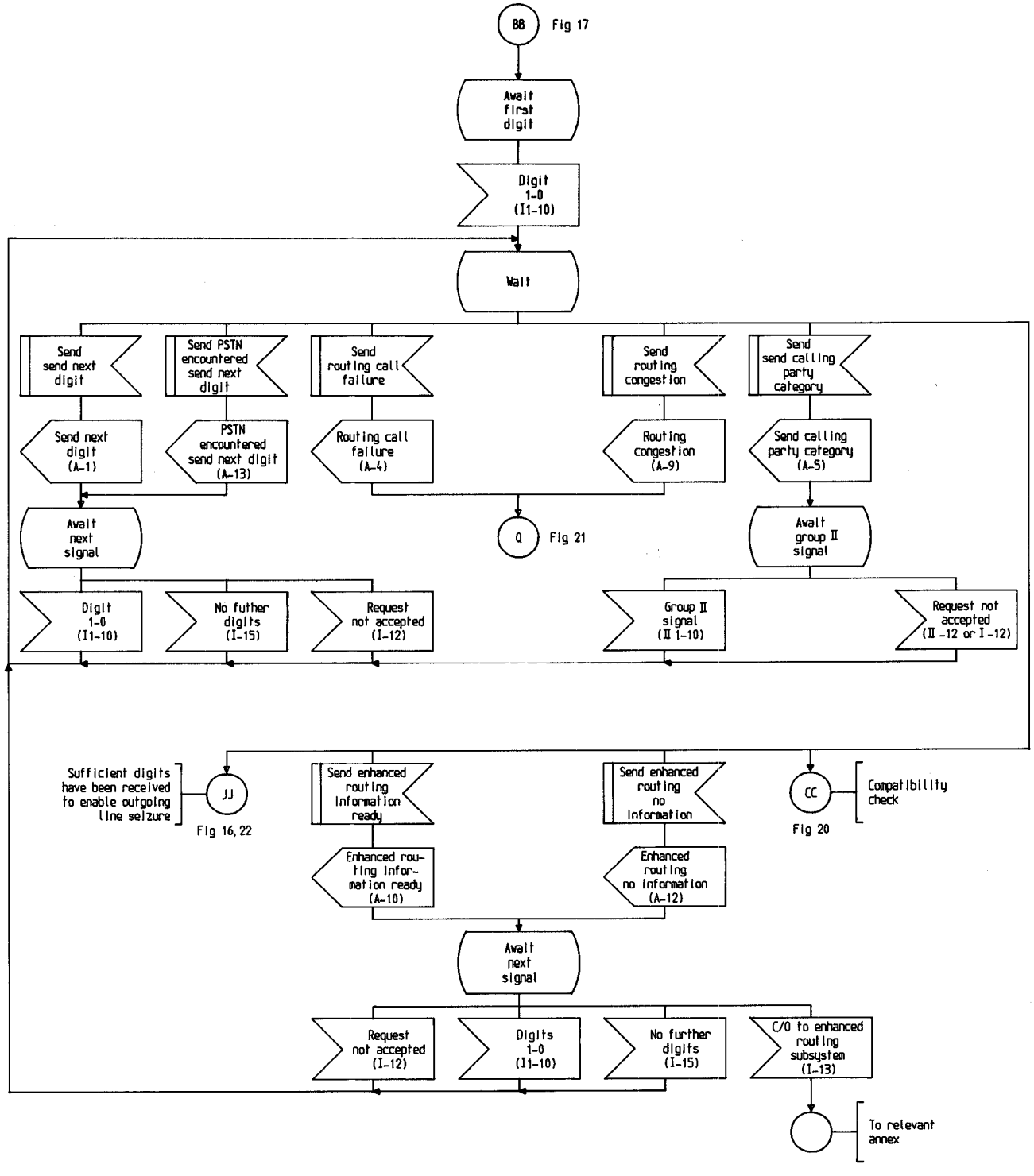


Figure 19 (T/CS 49-08). Transit PABX routing including enhanced routing.

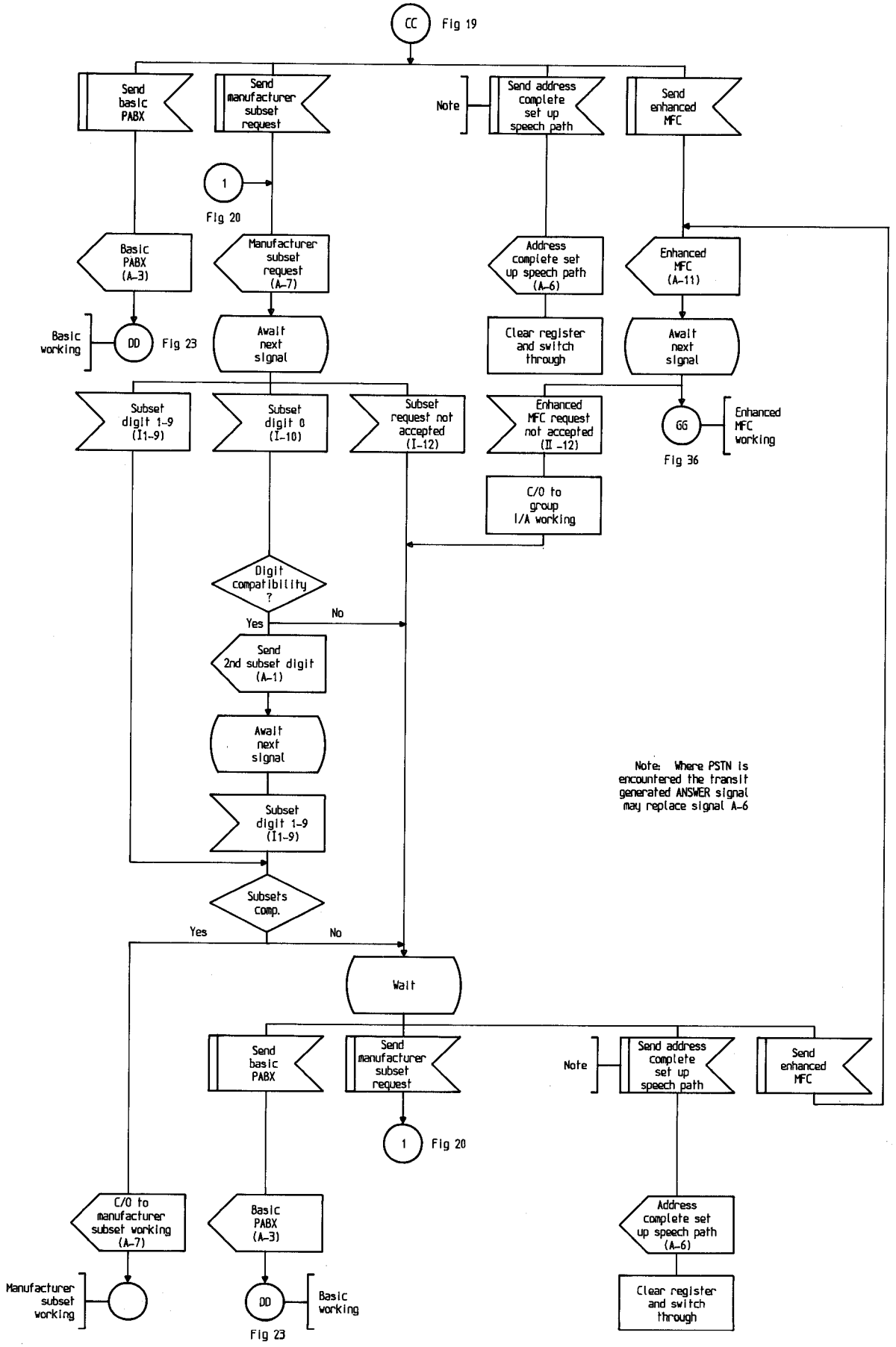


Figure 20 (T/CS 49-08). Terminating PABX compatibility procedure.

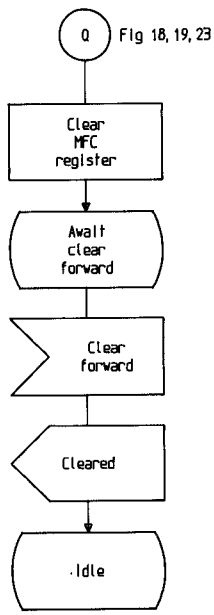


Figure 21 (T/CS 49-08). Terminating PABX cleardown sequence (basic subsystem).

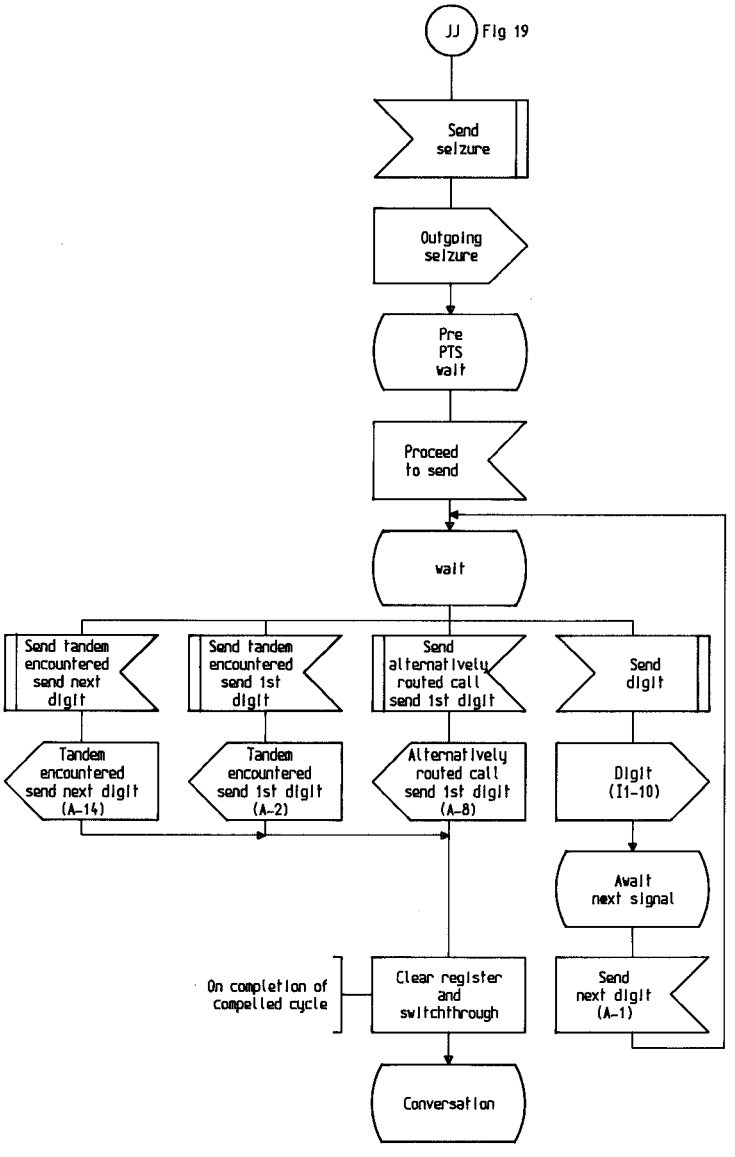


Figure 22 (T/CS 49-08). Transit PABX circuit seizure (O/G).

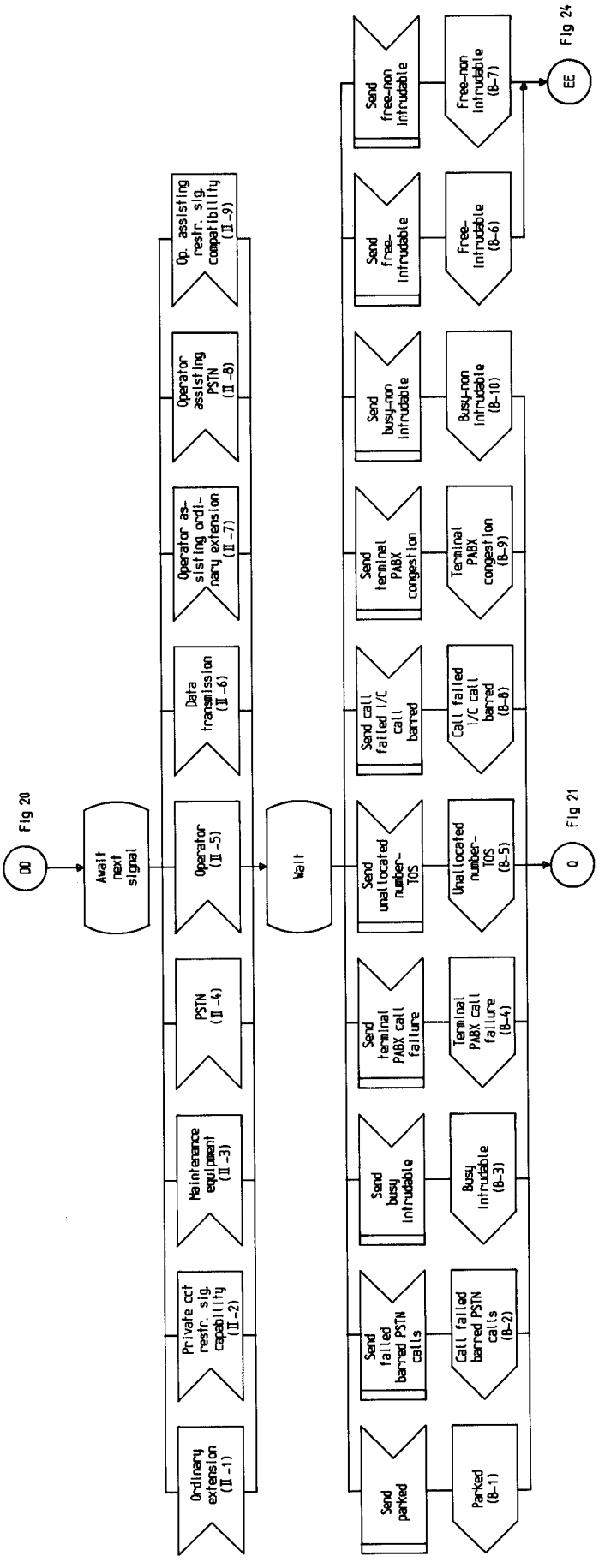


Figure 23 (T/CS 49-08). Terminating PABX SOT/COS procedure (basic MFC subsystem).

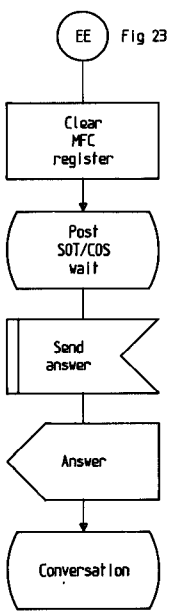


Figure 24 (T/CS 49-08). Terminating PABX answer and conversation (basic MFC subsystem).

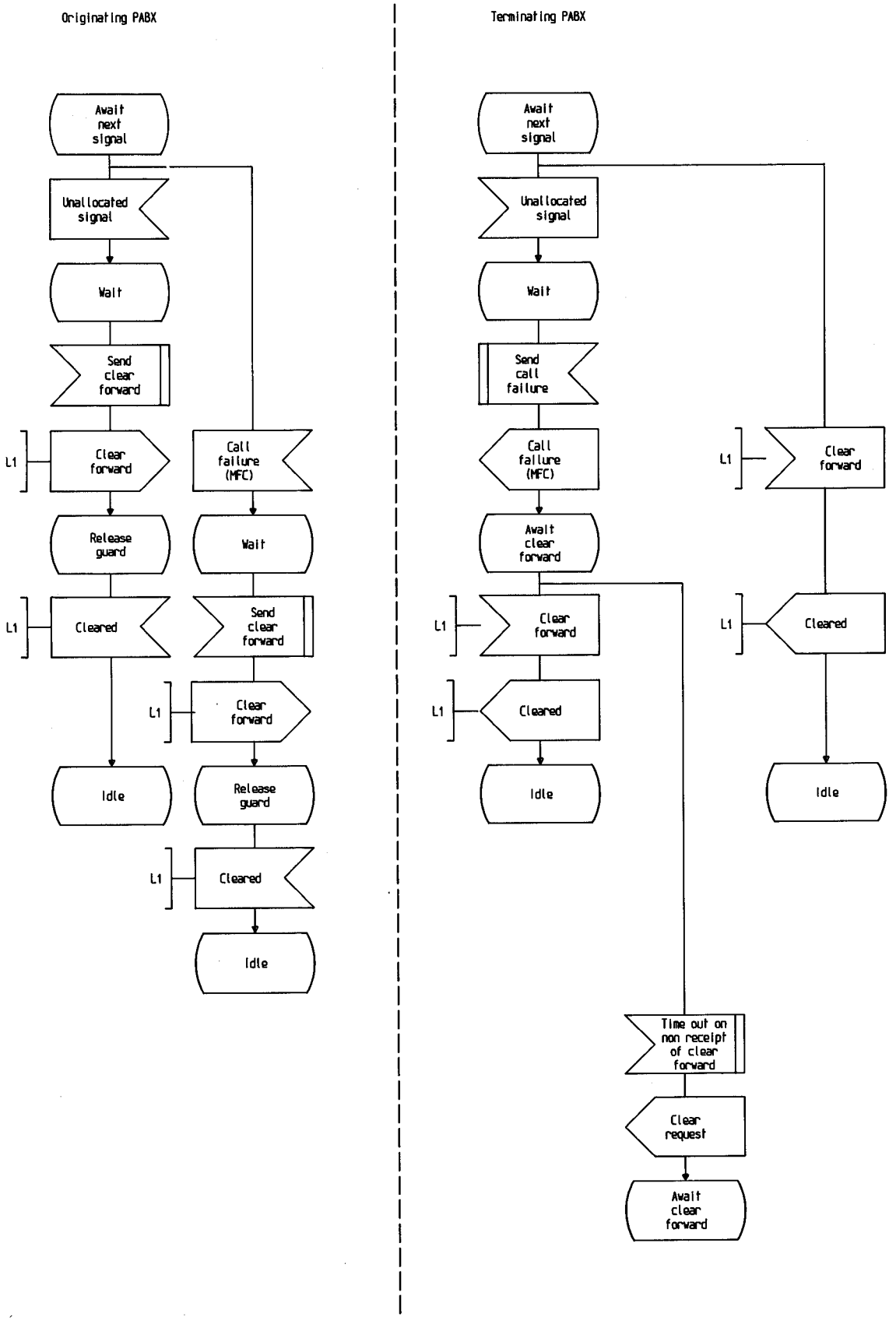


Figure 25 (T/CS 49-08). Action on receipt of unallocated signal.

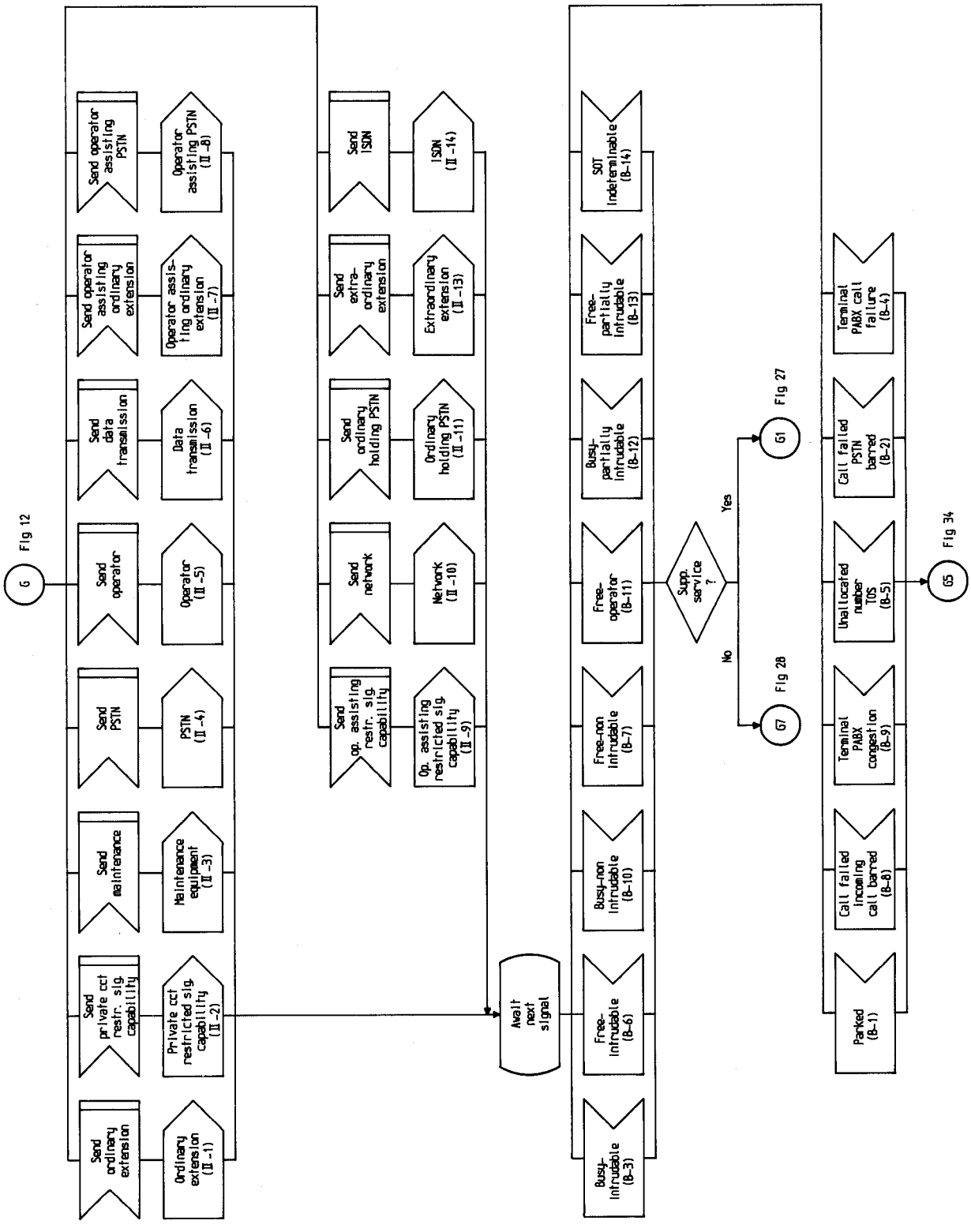


Figure 26 (T/CS 49-08). Originating PABX SOT/COS procedure (part 1) (enhanced MFC subsystem).

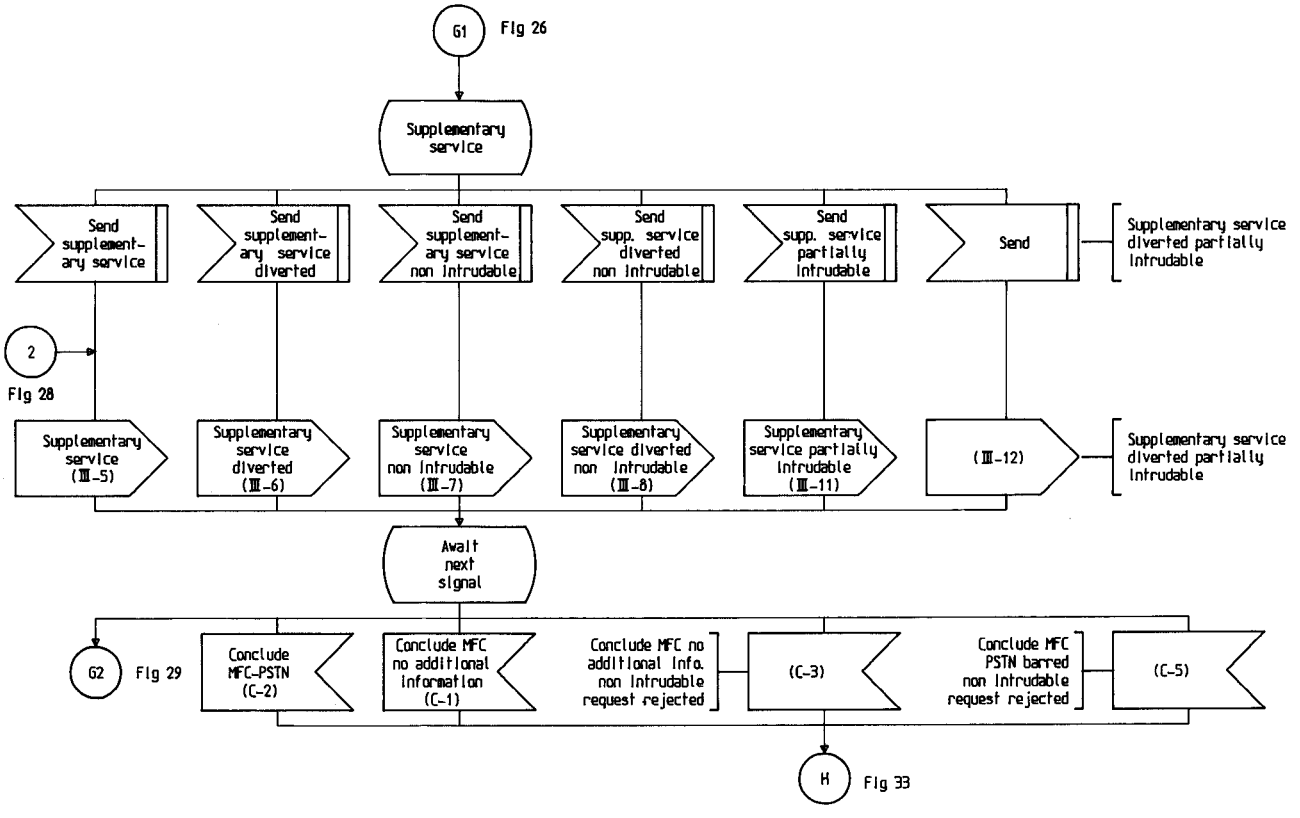


Figure 27 (T/CS 49-08). Originating PABX SOT/COS procedure (part 2) (enhanced MFC subsystem).

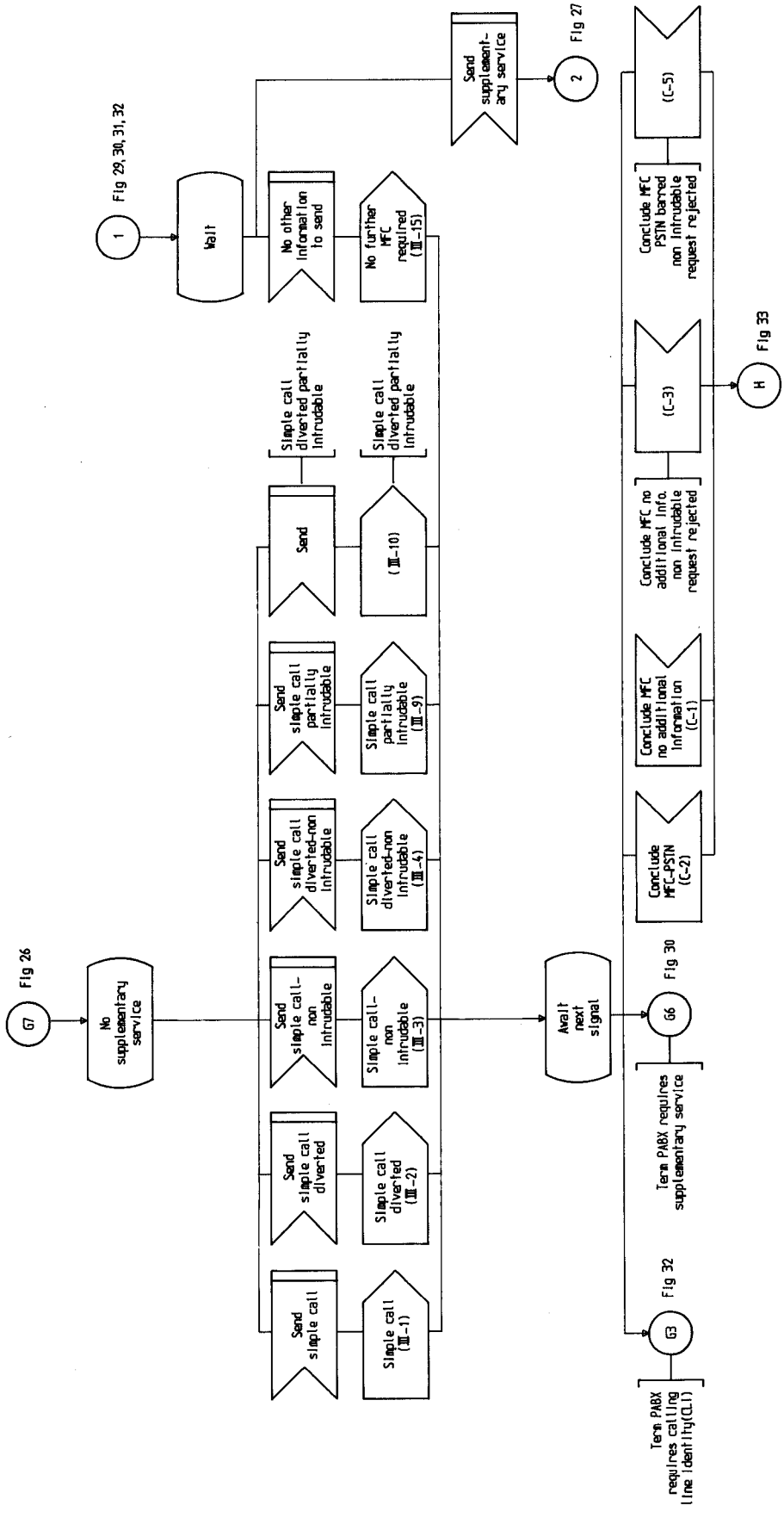


Figure 28 (T/CS 49-08). Originating PABX SOT/COS procedure (part 2) (enhanced MFC subsystem).

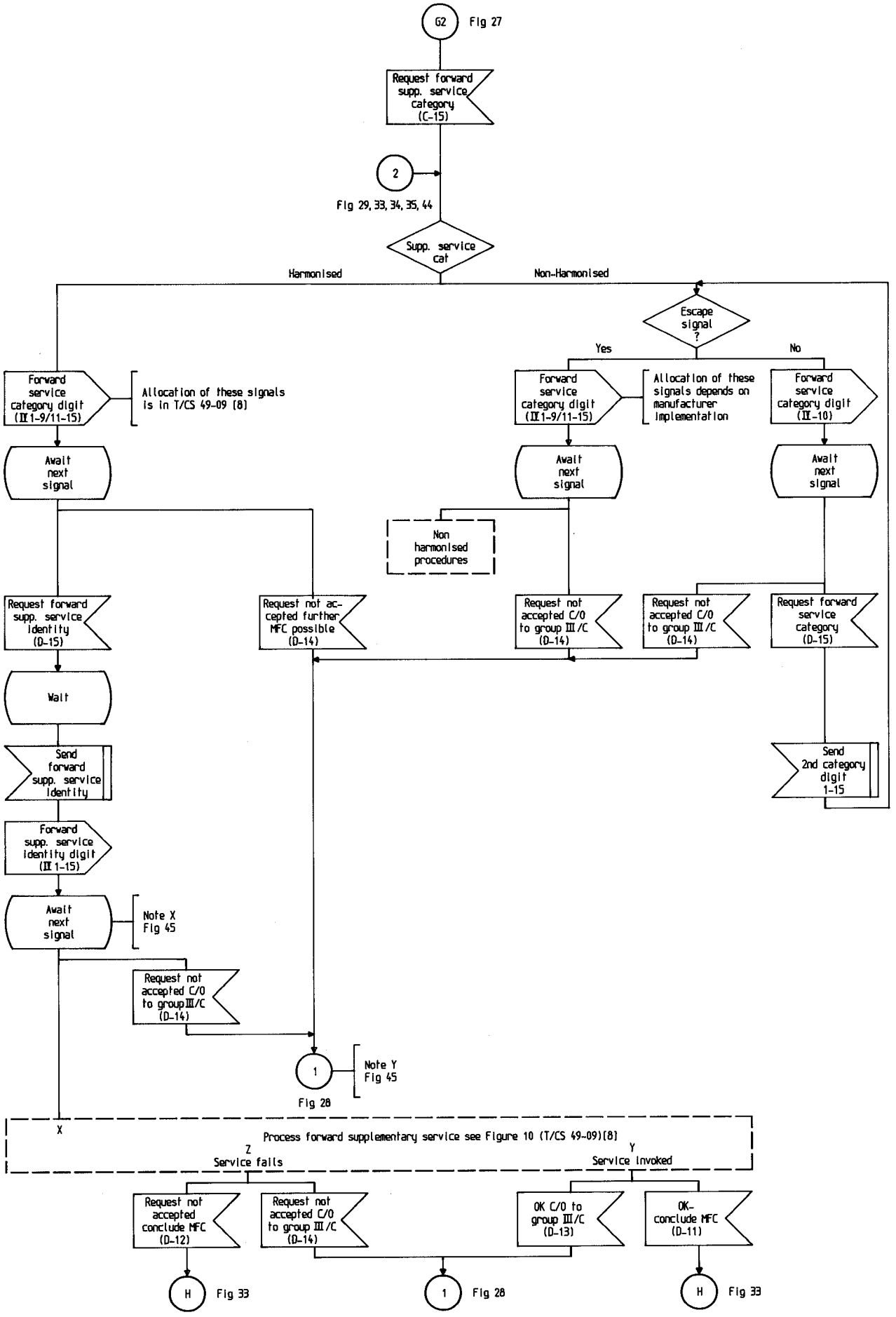


Figure 29 (T/CS 49-08). Originating PABX supplementary service request procedure (enhanced MFC subsystem).

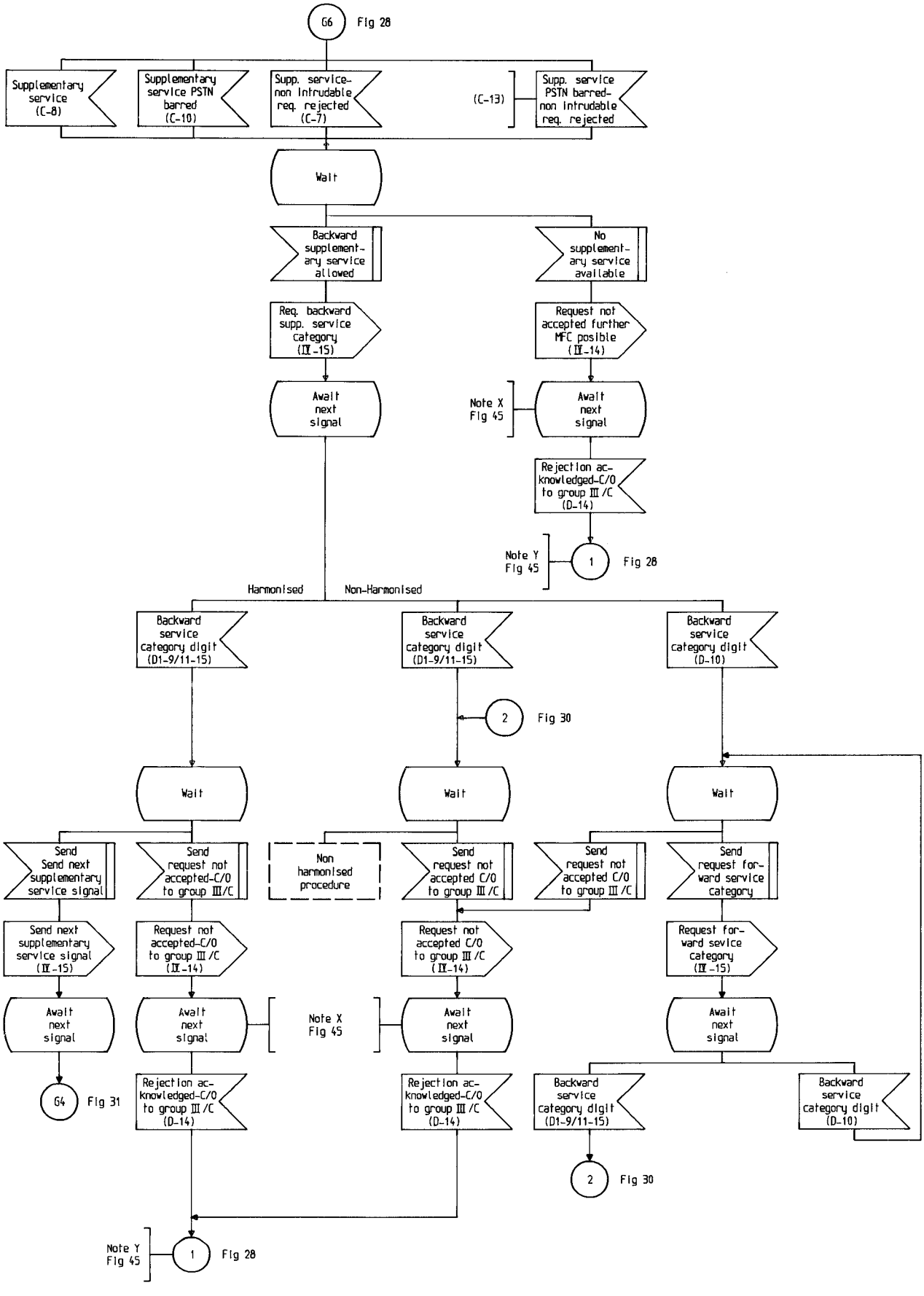


Figure 30 (T/CS 49-08). Originating PABX supplementary service request procedure (enhanced MFC subsystem).

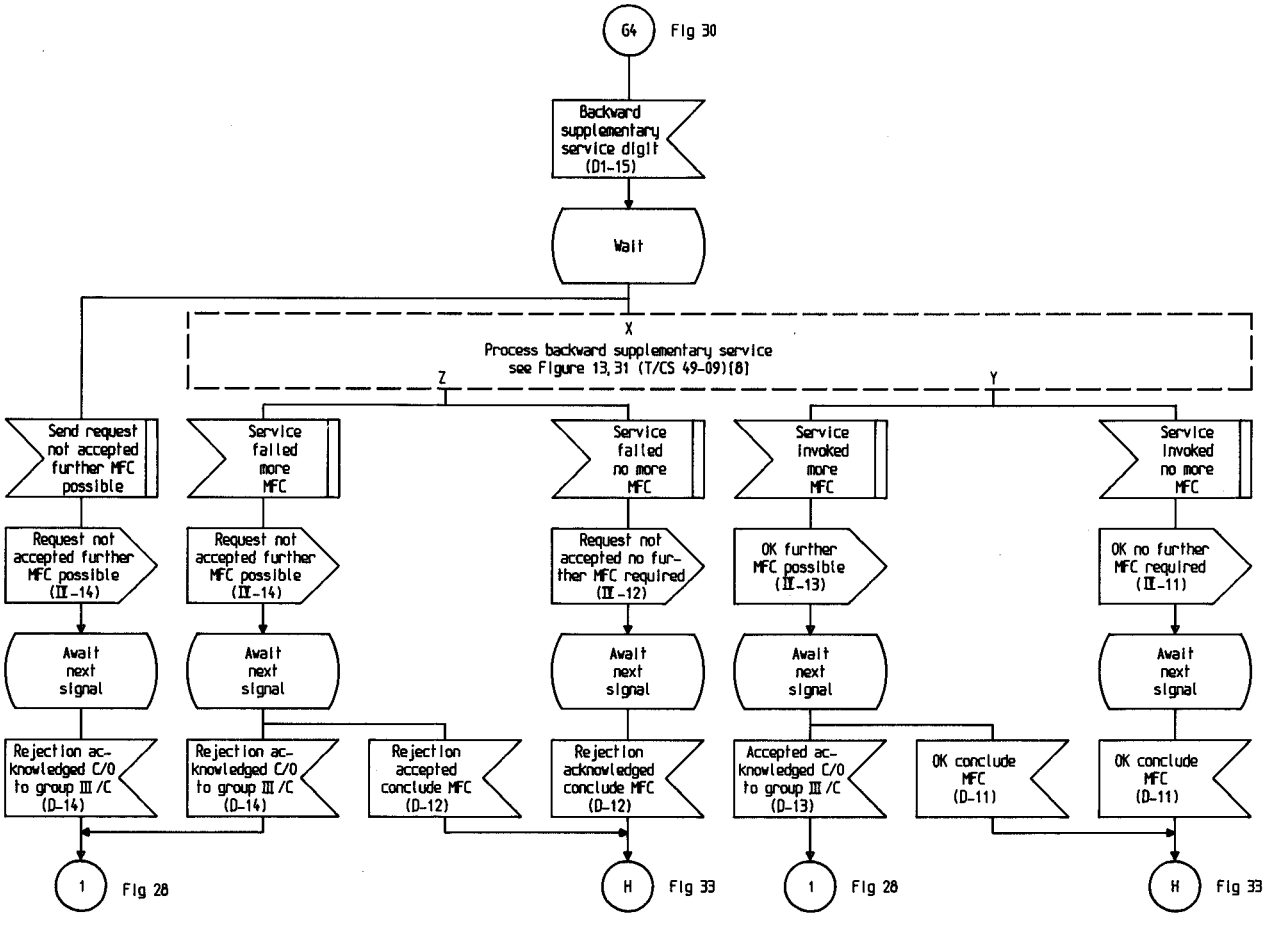


Figure 31 (T/CS 49-08). Originating PABX supplementary service request procedure (enhanced MFC subsystem).

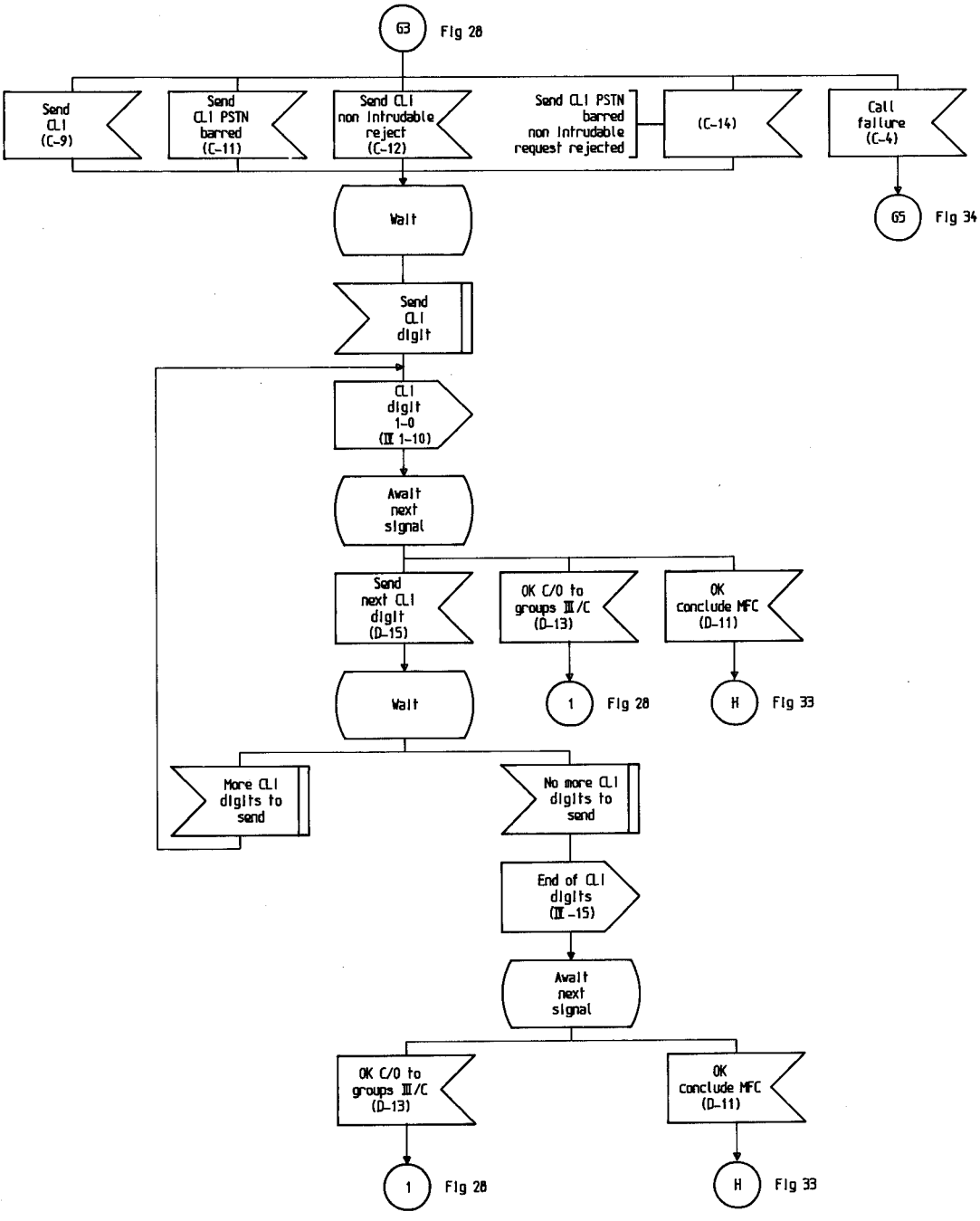


Figure 32 (T/CS 49-08). Originating PABX SOT/COS procedure (part 2) + calling line identity (CLI) (enhanced MFC subsystem).

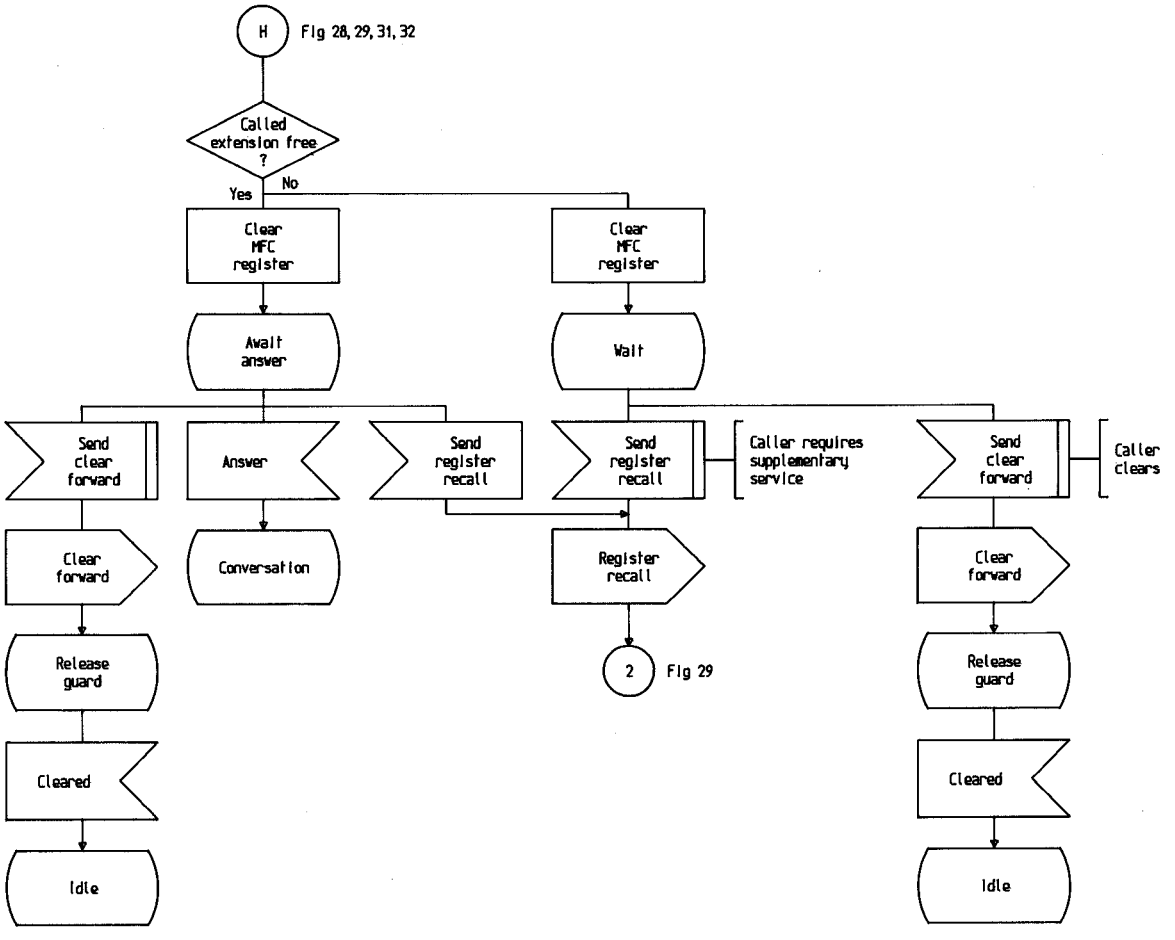


Figure 33 (T/CS 49-08). Originating PABX answer and conversation (enhanced MFC subsystem).

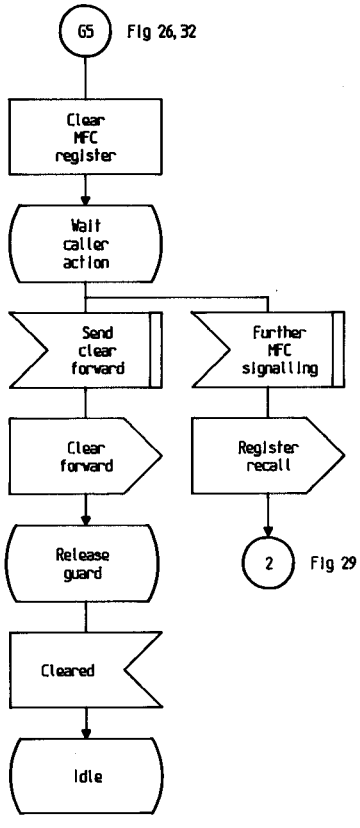


Figure 34 (T/CS 49-08). Originating PABX cleardown sequence (enhanced MFC subsystem).

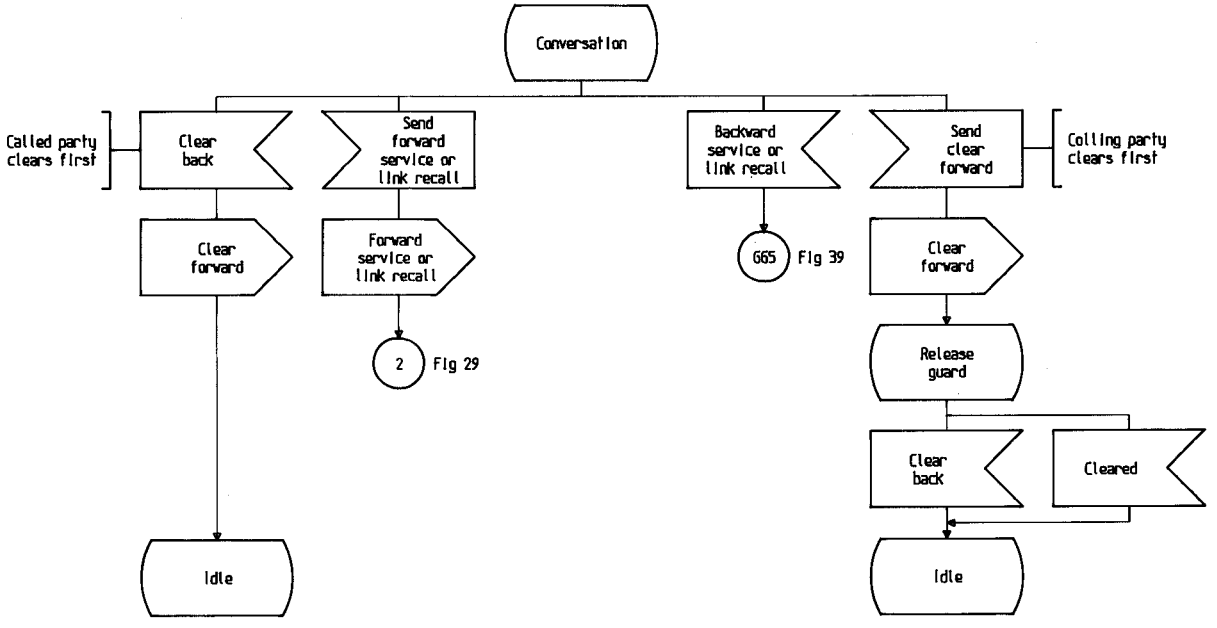


Figure 35 (T/CS 49-08). Cleardown or register recall during conversation (originating PABX enhanced MFC subsystem).

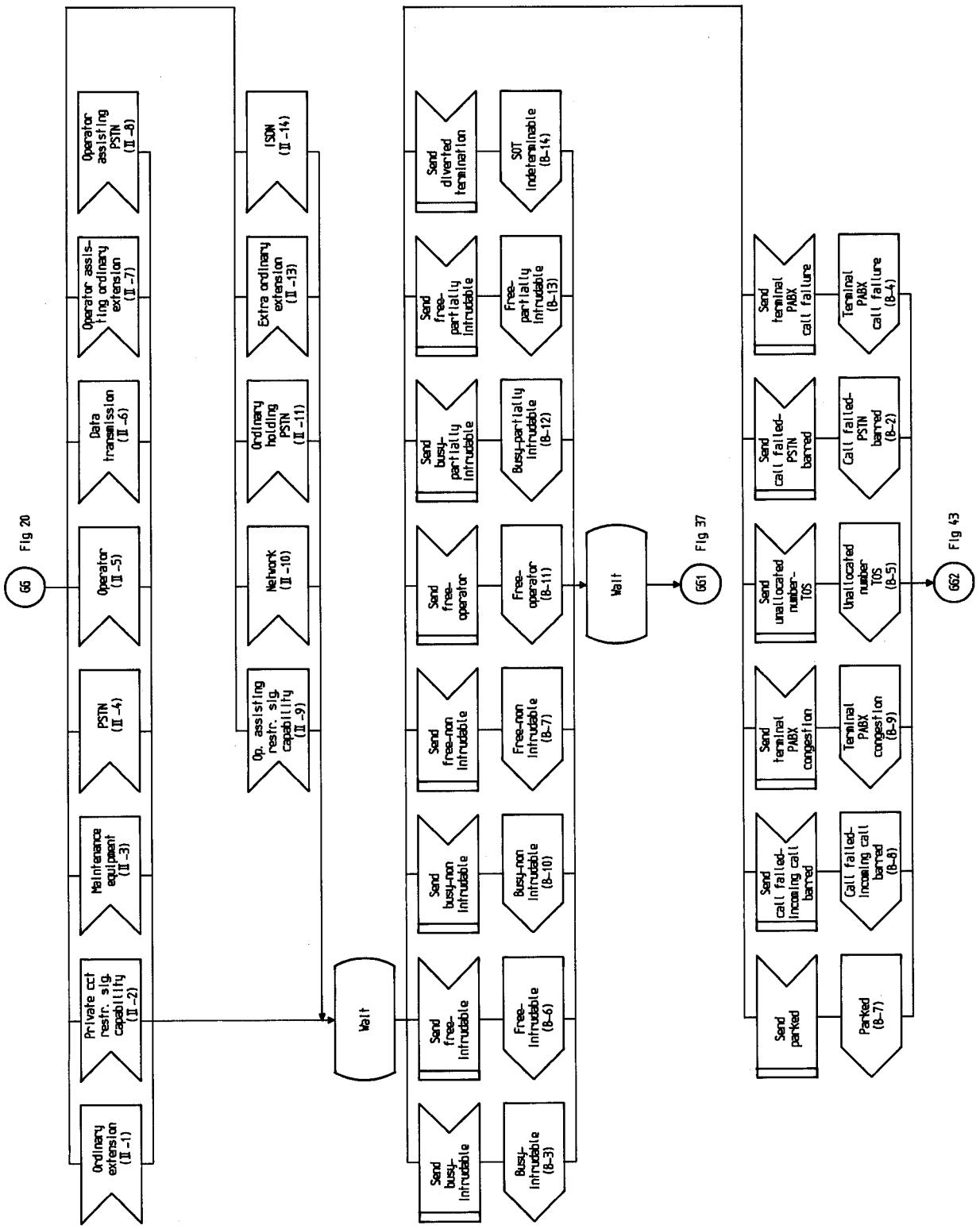


Figure 36 (T/CS 49-08). Terminating PABX SOT/COS procedure (part 1) (enhanced MFC subsystem).

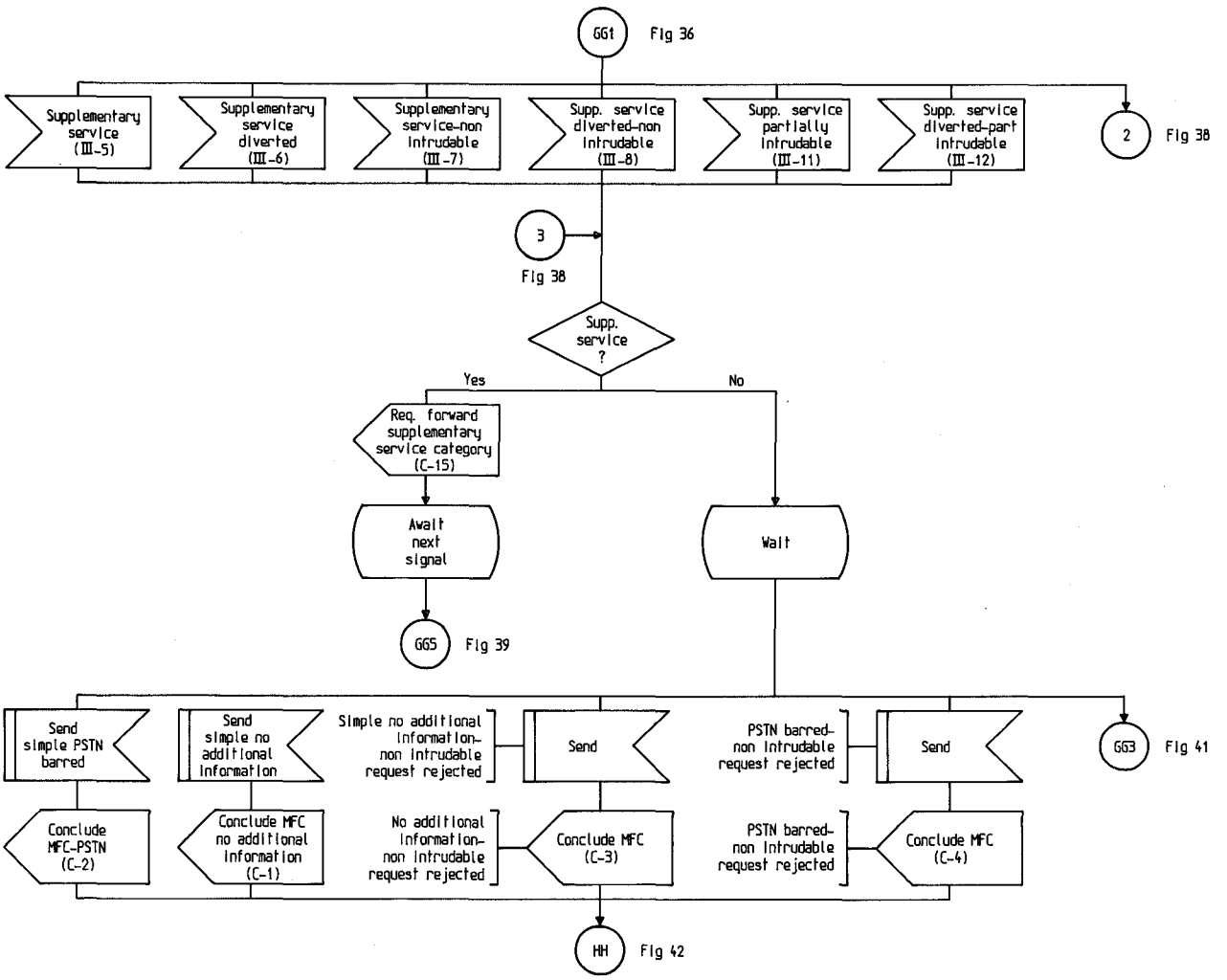


Figure 37 (T/CS 49-08). Terminating PABX SOT/COS procedure (part 2) (enhanced MFC subsystem).

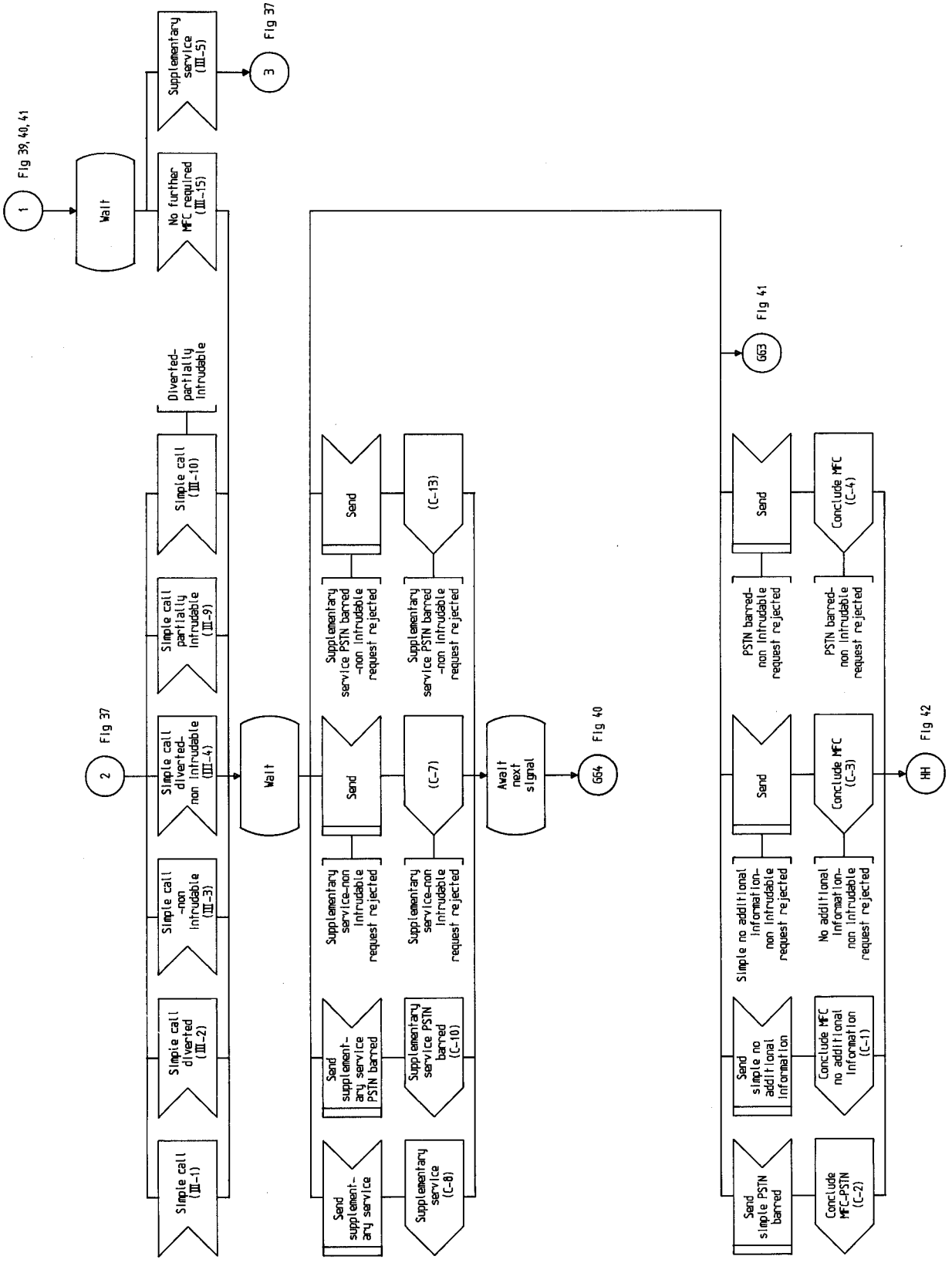


Figure 38 (T/CS 49-08). Terminating PABX SOT/COS procedure (part 2) (enhanced MFC subsystem).

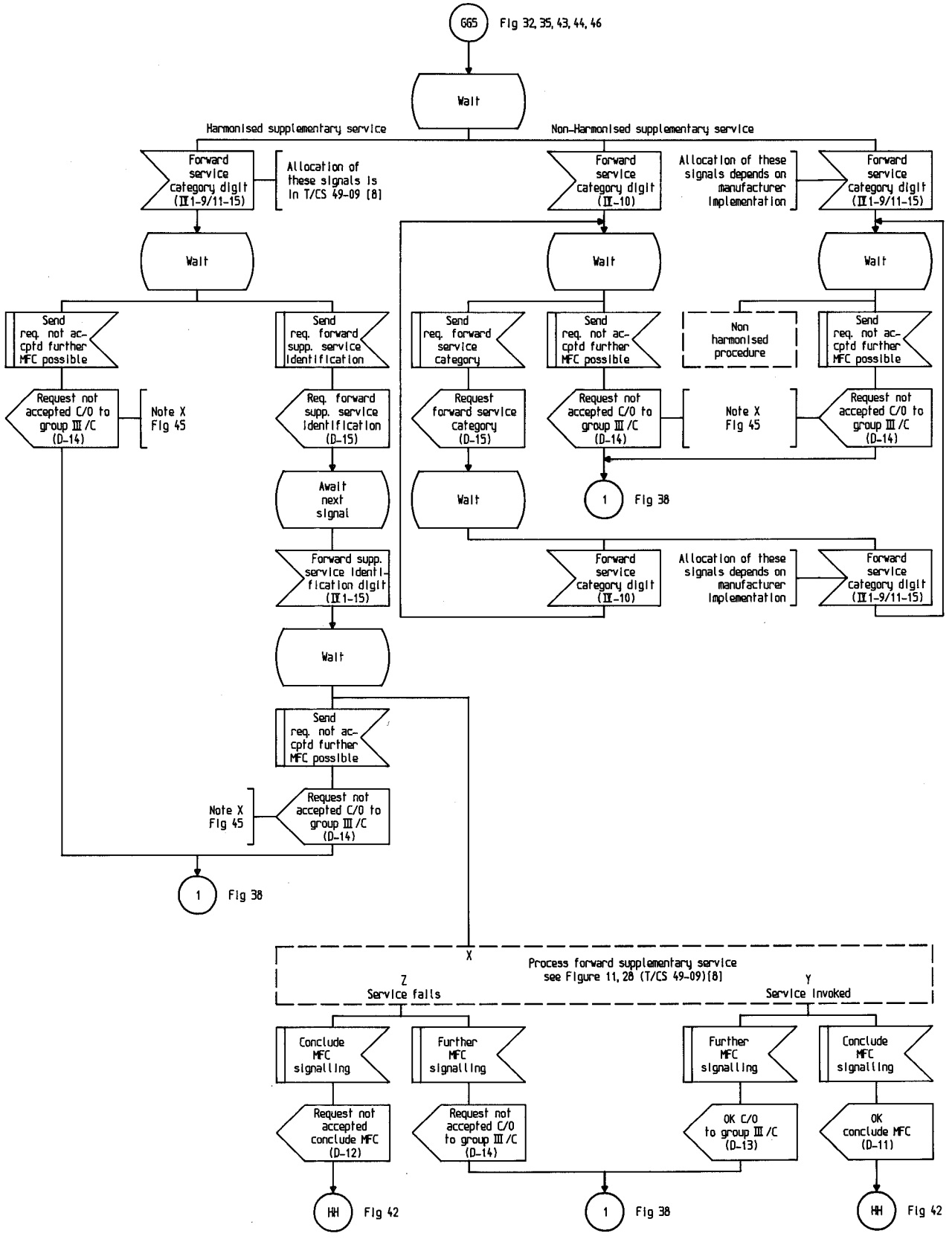


Figure 39 (T/CS 49-08). Terminating PABX supplementary service request procedure (enhanced MFC subsystem).

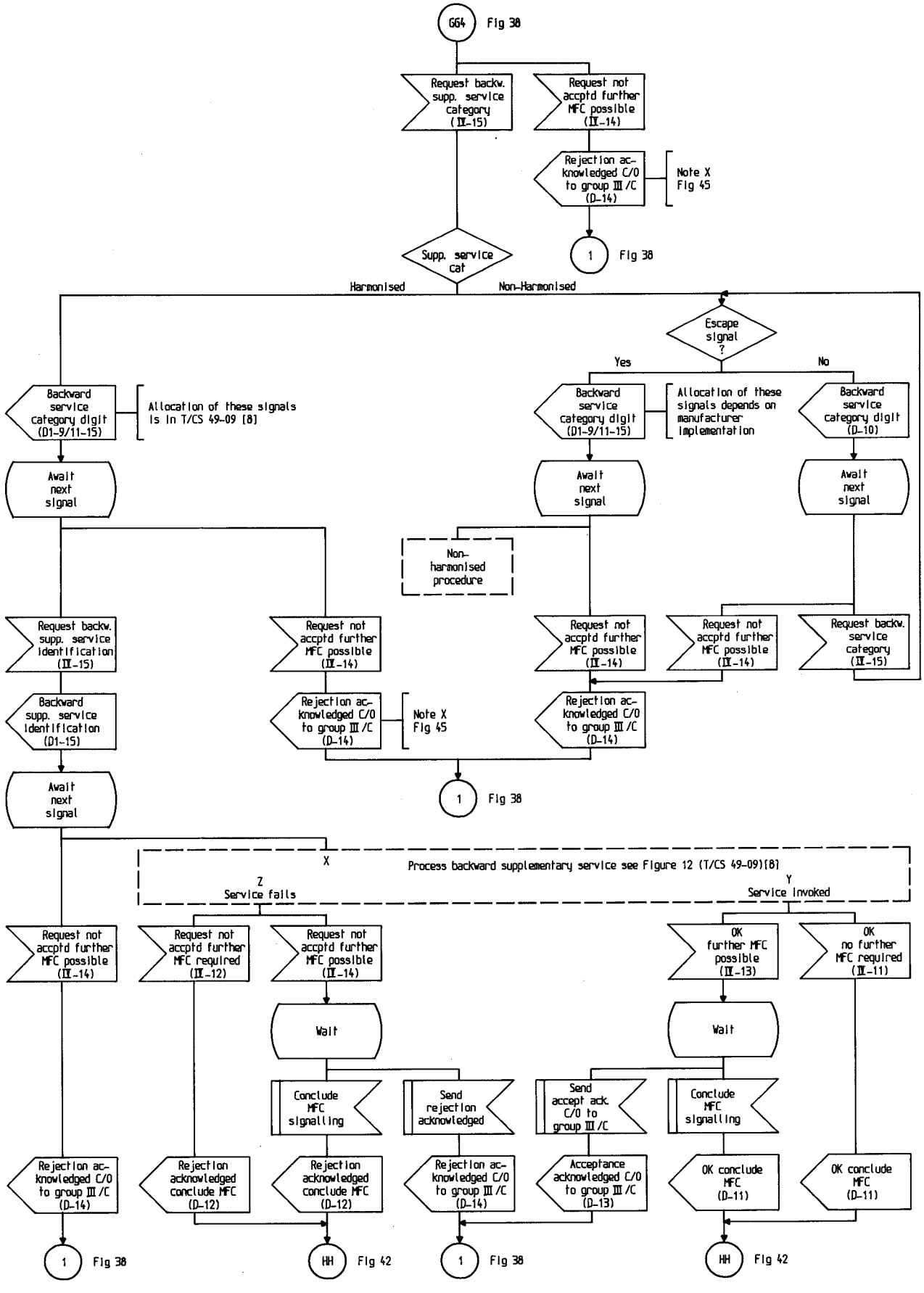


Figure 40 (T/CS 49-08). Terminating PABX supplementary service request procedure (enhanced MFC subsystem).

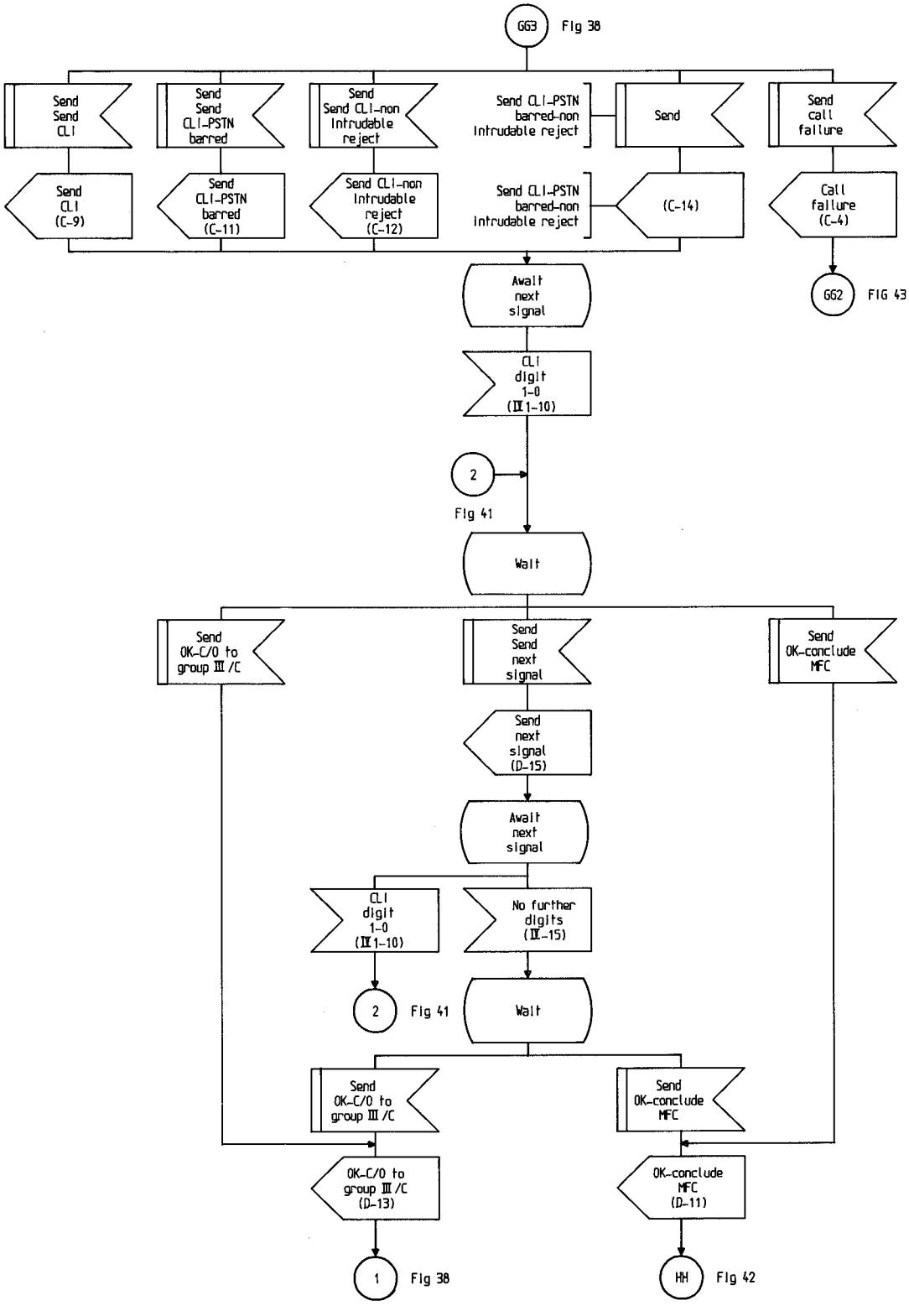


Figure 41 (T/CS 49-08). Terminating PABX SOT/COS procedure (part 2) + calling line identity (CLI) (enhanced MFC subsystem).

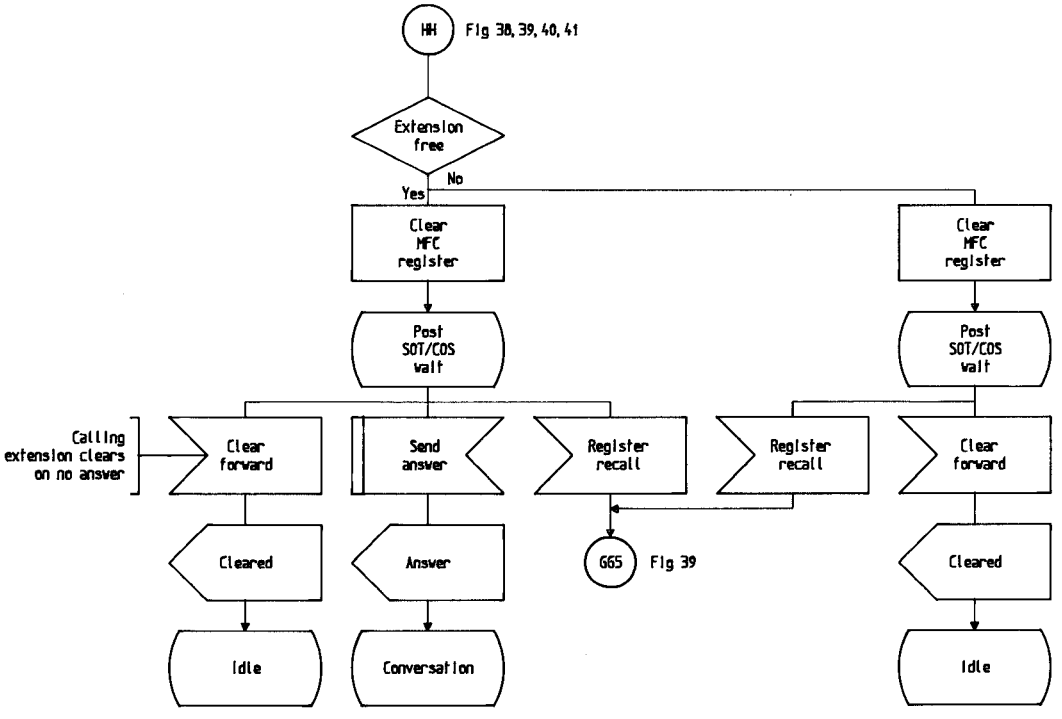


Figure 42 (T/CS 49-08). Terminating PABX answer and conversation (enhanced MFC subsystem).

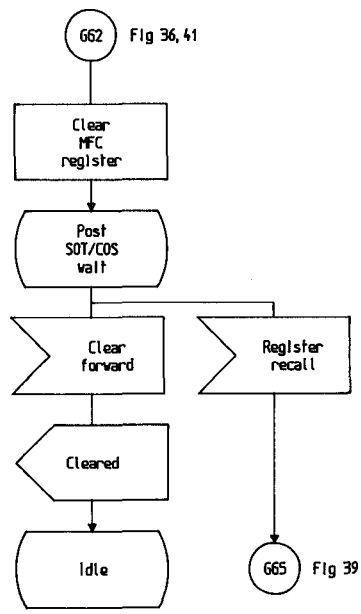


Figure 43 (T/CS 49-08). Terminating PABX cleardown sequence (enhanced MFC subsystem).

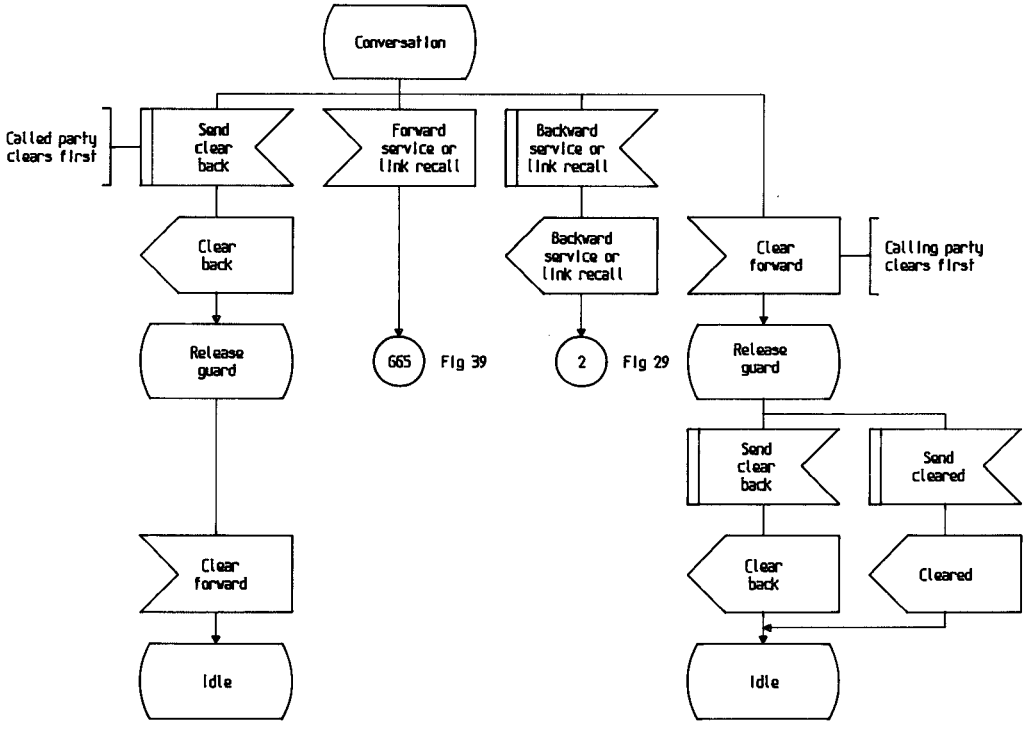
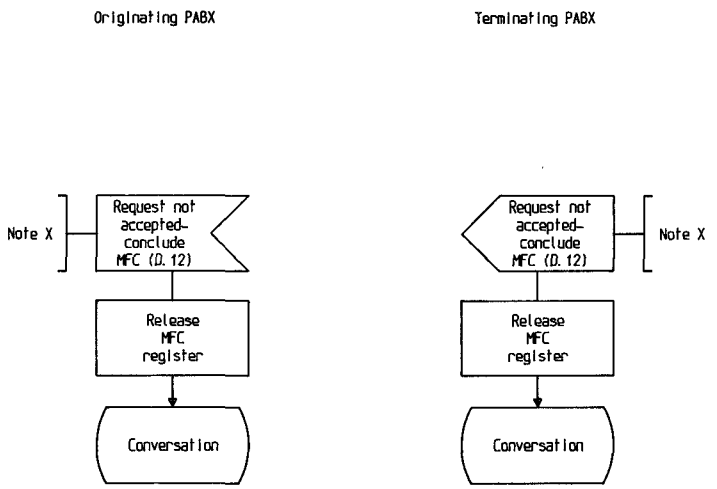


Figure 44 (T/CS 49-08). Cleardown or register recall during conversation (terminating PABX enhanced MFC subsystem).

Notes:

x: Where the capability of the responding PABX is limited to the extent that further MFC signalling would not be meaningful, it is permissible to forgo C/O to Groups III/C and send a D–12 signal, instead of the D–14 signals. Under these circumstances the signalling procedures shown below shall apply.



y: Where the capability of an originating PABX is so limited that further MFC signalling would not be meaningful, the receipt of signal D–14 may be taken as terminating and the register may be released. The terminating PABX must therefore be capable of timing out on non-receipt of a Group III signal following application of D–14.

Figure 45 (T/CS 49-08).

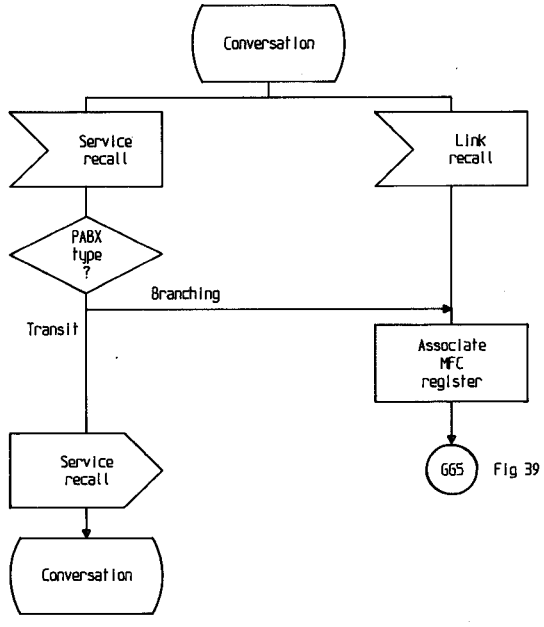


Figure 46 (T/CS 49-08). Action of a transit PABX on receipt of a recall signal during conversation.

Recommandation T/CS 49-08 (adoptée en 1982)

Information de la suite donnée

a = La Recommandation est appliquée.
b = L'application de la Recommandation est prévue.
c = L'application de la Recommandation n'est pas prévue.

N°	Pays	Information	Remarques
1	2	3	4
1	*Allemagne (Rép. féd. d')*	c	
2	*Autriche*	c	
3	*Belgique*		
4	*Chypre*		
5	*Danemark*	c	
6	*Espagne*		
7	*Finlande*	c	
8	*France*	c	
9	*Grèce*		
10	*Irlande*		
11	*Islande*		
12	*Italie*		
13	*Liechtenstein*		
14	*Luxembourg*		
15	*Malte*		
16	*Monaco*		
17	*Norvège*		
18	*Pays-Bas*		
19	*Portugal*		
20	*Royaume-Uni*		
21	*Saint-Marin*		
22	*Suède*	c	
23	*Suisse*	b	
24	*Turquie*		
25	*Vatican (Cité)*		
26	*Yougoslavie*	c	Pas pour le moment.