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Introduction:

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Technical Specification

3rd Generation Partnership Project; Technical Specification Group Core Network; Customised Applications for Mobile network Enhanced Logic; (CAMEL) Phase 4 - Stage 2 IM CN Interworking (Release 5)

The present document has been developed within the 3rd Generation Partnership Project (3GPP ™) and may be further elaborated for the purposes of 3GPP.

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Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The present document specifies the stage 2 description for the third phase (see 3GPP TS 22.078 [2]) of the Customized Applications for Mobile network Enhanced Logic (CAMEL) feature within the 3GPP system.

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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x the first digit:

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3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document specifies the stage 2 description for the Customized Applications for Mobile network Enhanced Logic (CAMEL) feature which provides the mechanisms to support services of for the IP Multimedia Core Network (IM CN) Subsystem.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TR 21.905: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Vocabulary for 3GPP Specifications".

[2] 3GPP TS 22.078: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Customised Applications for Mobile network Enhanced Logic (CAMEL);Service description, Stage 1".

[3] 3GPP TS 22.228: "3rd Generation Partnership Project; Technical Specification Group Systems Aspects; IP Multimedia (IM) Subsystem –Stage 1.

[4] 3GPP TS 23.228: "3rd Generation Partnership Project; Technical Specification Group Systems Aspects; IP Multimedia (IM) Subsystem –Stage 1.

[5] 3GPP TS 23.218: "3rd Generation Partnership Project; Technical Specification Group Core Networks; IP Multimedia (IM) Session Handling; IP Multimedia Call Model.

[6] 3GPP TS 24.228: "3rd Generation Partnership Project; Technical Specification Group Core Networks; Signalling flows for the IP multimedia call control based on SIP and SDP.

[7] 3GPP TS 29.002: "3rd Generation Partnership Project; Technical Specification Group Core Network; Mobile Application Part (MAP) specification".

[8] 3GPP TS 29.078: "3rd Generation Partnership Project; Technical Specification Group Core Network; Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 3 CAMEL Application Part (CAP) specification".

3 Definitions and abbreviations

3.1 Definitions

IP Multimedia Core Network Service Switching Function (imcnSSF): functional entity that interfaces the IM-SSF to the gsmSCF. The concept of the imcnSSF is derived from the IN SSF, but uses different triggering mechanisms because of the nature of the mobile network.

IP Multimedia SSF (IM-SSF)

3.2 Abbreviations

Abbreviations used in the present document are listed in 3GPP TR 21.905 [1].

For the purposes of the present document, the following abbreviations apply:

BCSM	Basic Call State Model
CAMEL	Customized Applications for Mobile network Enhanced Logic
CAP	CAMEL Application Part
CSCF	Call State Control Function
DP	Detection Point
EDP	Event Detection Point
FTN	Forwarded To Number
GPRS	General Packet Radio Service
gsmSCF	GSM Service Control Function
gsmSRF	GSM Specialised Resource Function
gsmSSF	GSM Service Switching Function
HPLMN	Home PLMN
HSS	Home Subscriber Server
IE	Information Element
IF	Information Flow
IP	Internet Protocol
ISC	IM-CN Service Control
I-CSCF	Interrogating CSCF
IM	IP Multimedia
IM-BCSM	IP Multimedia Basic Call State Model
IMCN	IP Multimedia Core Network
imcnSSF	IM CN Service Switching Function
IM-CSI	IP Multimedia CAMEL Subscription Information
IM-SSF	IP Multimedia Service Switching Function
IPLMN	Interrogating PLMN
MGCF	Media Gateway Control Function
MO	Mobile Originating
MT	Mobile Terminating
NNI	Network Node Interface
O-IM-BCSM	Originating IP Multimedia Basic Call State Model
O-IM-CSI	Originating IP Multimedia CAMEL Subscription Information
PIC	Point In Call
PLMN	Public Land Mobile Network
P-CSCF	Proxy CSCF
SIP	Session Initiation Protocol
S-CSCF	Serving CSCF
T-IM-BCSM	Terminating IP Multimedia Basic Call State Model
T-IM-CSI	Terminating IP Multimedia CAMEL Subscription Information
TDP	Trigger Detection Point
UNI	User Network Interface
VPLMN	Visited PLMN

4 <?>

4.1 Architecture

This subclause describes the functional architecture needed to support CAMEL interactions with the S-CSCF in the IP Multimedia Subsystem. The IM-SSF is a SIP Application Server that interfaces SIP to CAP. The generic SIP Application Server behaviour of the IM-SSF is specified in TS 23.218[5].

4.1.1 Functional Entities used for CAMEL at IP Multimedia Registration

Figure 4.1 shows the functional entities involved when an MS registers for IP Multimedia session requiring CAMEL support.

Subscriber data is transferred from the HSS to the CSCF during the SIP Registration. The subscriber data includes CAMEL related information.

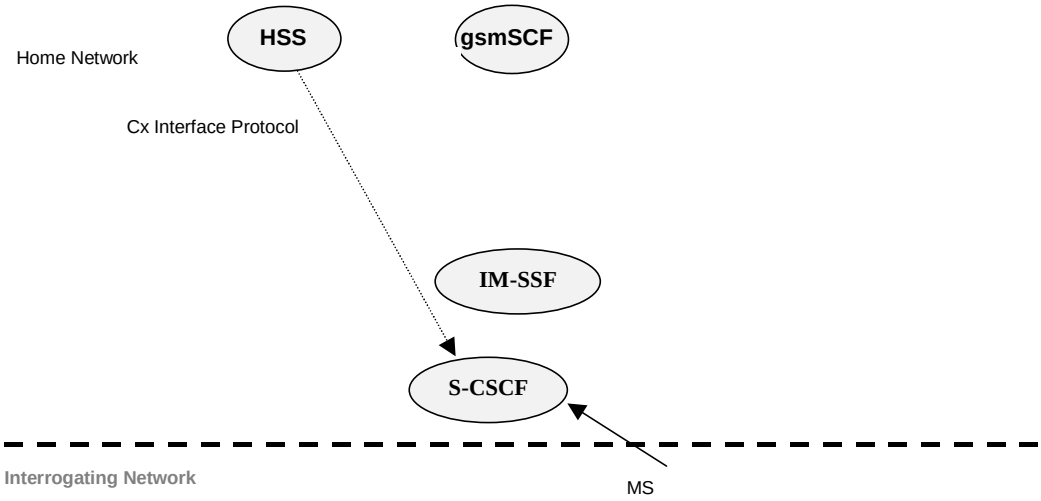


Figure 4.1: Functional architecture for support of CAMEL when mobile registers for IP Multimedia session

4.1.2 Functional Entities used for CAMEL for MO and MT IP Multimedia session

Figure 11.2 shows the functional entities involved in a Mobile Originated IP Multimedia session requiring CAMEL support.

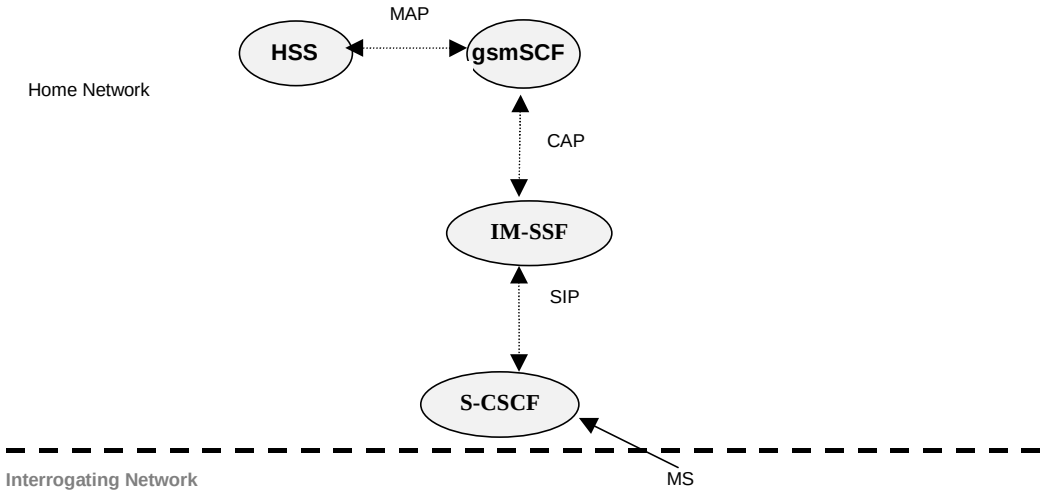


Figure 4.2: Functional architecture for support of CAMEL control of a MO IP Multimedia session

4.2 Interfaces defined for an IM-SSF based Application Server

4.2.1 CSCF – IM-SSF interface

This interface is the IP Multimedia Service Control interface (ISC). This interface shall be based on SIP as detailed in 3GPP TS 23.228 [4].

4.2.2 IM-SSF - gsmSCF interface

This interface is used by the gsmSCF to control an IP Multimedia session in a certain IM-SSF. Relationships between the IM-SSF and the gsmSCF on this interface are opened as a result of the IM-SSF sending a request for instructions to the gsmSCF. This interface shall be based on 3GPP TS 29.078[8].

4.2.3 HSS – CSCF interface

This interface is used to send CAMEL related subscriber data to a CSCF, e.g. IM-CSI.

4.3 Detection Points (DPs)

Certain basic call events may be visible to the GSM Service Control Function (gsmSCF). The DPs are the points in call at which these events are detected.

. Editor's Note: The DPs for Mobile Originated IP Multimedia session and Mobile Terminated IP Multimedia session will be described here

A DP can be armed in order to notify the gsmSCF that the DP was encountered, and potentially to allow the gsmSCF to influence subsequent handling of the call. If the DP is not armed, the processing entity continues the processing without gsmSCF involvement.

Three different types of DPs are identified:

- Trigger Detection Point - Request (TDP-R).

  This detection point is statically armed and initiates a CAMEL control relationship when encountered and there is no existing relationship due to the same CSI. Processing is suspended when the DP is encountered.

- Event Detection Point - Request (EDP-R).

  This detection point is dynamically armed within the context of a CAMEL control relationship. Processing is suspended when encountering the DP and the imcnSSF waits for instructions from the gsmSCF.

- Event Detection Point - Notification (EDP-N).

  This detection point is dynamically armed within the context of a CAMEL control relationship. Processing is not suspended when encountering the DP.

The DPs are characterized in the following clauses.

4.3.1 Arming/Disarming mechanism

A DP may be statically armed or dynamically armed.

The following arming rules apply:

- DPs for a mobile originating call handling is statically armed in the IM-SSF as a result of O-IM-CSI and D-IM-CSI data delivery from the HSS. Likewise, DPs for mobile terminating call handling is statically armed in the IM-SSF as a result of T-IM-CSI data delivery from the HSS. Static arming of DPs in the IM-SSF occurs during the UE's registration in the IMS CN. Basically, when the IM-SSF is notified of the UE's initial registration, the IM-SSF queries the HSS for the subscriber's CAMEL Subscription Information via the Si interface.

- A DP is dynamically armed by the gsmSCF within the context of a CAMEL control relationship (between the imcnSSF and the gsmSCF).

The following disarming rules apply:

- A statically armed DP is disarmed when the IP Multimedia CSI data is withdrawn in the HSS/HLR. Only TDP-Rs can be disarmed using this mechanism.

- If an armed EDP is met, then it is disarmed.

- If an EDP is met that causes the release of the related leg, then all EDPs related to that leg are disarmed.

- If a call session is released, then all EDPs related to that call session are disarmed.

- If an EDP is met, then other EDPS are disarmed, in accordance with the implicit disarming rule table specified in TS 23.078 (refer to the section for “Rules for Implicit Disarming of Event Detection Points’).

If an EDP is armed, it can be explicitly disarmed by the gsmSCF by means of the RequestReportBCSMEvent information flow.

4.3.2 Criteria

Criteria are the conditions that must be met in order for the imcnSSF to request instructions from the gsmSCF.

DP criteria are checked in the IM-SSF. Criteria for originating DPs (i.e. Collected_Info, Analysed_Information, and Route_Select_Failure TDPs) are checked in the IM-SSF associated with the originating UE’s S-CSCF. Criteria for terminating DPs (i.e. T_Busy and T_No_Answer) are checked in the IM-SSF associated with the terminating UE’s S-CSCF.

Based on the Initial Filter Criteria information, the S-CSCF forwards the SIP message to the IM-SSF. The DP encountered is identified based on the SIP message received from the S-CSCF. Refer to Table 4.3 and Table 4.4 for mapping of SIP messages to CAMEL IM-BCSM Detection Points.

4.3.2.1 Criteria at Collected_Info

The following criteria are applicable for DP Collected_Info:

- Destination number triggering criterion: The HLR may store a list of up to 10 destination numbers and/or up to 3 number lengths. There is no restriction on the nature of address. There is no restriction on the numbering plan indicator. This criterion may be defined to be either "enabling" or "inhibiting".

Triggering at DP Collected_Info shall be strictly based on the destination number received from the S-CSCF.

The destination number received from the S-CSCF shall not be modified before conditional triggering check takes place.

If the destination number triggering criterion is enabling, then the imcnSSF may establish a dialogue with the gsmSCF if:

- the destination number matches one of the destination number strings defined in the list; or

- the length of the destination number matches one of the destination number lengths defined in the list.

In this test the destination number matches one of the destination number strings in the list if:

- the nature of address of destination number is the same as the nature of address of the destination number string;

- the destination number is at least as long as the destination number string in the list; and

- all the digits in the destination number string in the list match the leading digits of the destination number.

If the destination number triggering criterion is inhibiting, then the imcnSSF may establish a dialogue with the gsmSCF if:

- the destination number does not match any of the destination number strings defined in the list; and

- the length of the destination number does not match any of the destination number lengths defined in the list.

In this test the destination number matches one of the destination number strings in the list if:

- the nature of address of destination number is the same as the nature of address of the destination number string;
- the destination number is at least as long as the destination number string in the list; and
- all the digits in the destination number string in the list match the leading digits of the destination number.

4.3.2.2 Criteria at DP Analysed Information

4.3.2.2.1 General

The following criteria are applicable for DP Analysed Information:

- Destination number triggering criterion: The HLR may store a list of up to 10 destination numbers. There is no restriction on the nature of address. There is no restriction on the numbering plan indicator.

For MO calls, triggering at DP Analysed Info shall be based on the destination number received in the Connect operation from the gsmSCF during a Mobile Originating CAMEL Service.

4.3.2.2.2 Number comparison

The following procedure shall be performed for the comparison of the destination number triggering criterion and the address information in the given order.

1. The numbering plan indicators of both numbers are ignored.
2. The type of number/nature of address indicators of both numbers are compared. If there is a match of the type of number indicator, then the check shall be performed by comparing the digits as defined in step 6. If there is no match of the type of number the comparison procedure shall continue as follows.
3. If there are other type of number/nature of address indicators present than "unknown", "national (significant) number" or "international number" then the destination number does not match the destination number triggering criterion. Otherwise the comparison procedure shall continue as follows.
4. If there is a number with type of number/nature of address "unknown" this number shall be translated based on the numbering plan of the serving entity in either of the following ways:

   - if the leading digits refer to an international prefix, those digits shall be removed and the type of number/nature of address shall be set to "international number".
   - if the leading digits refer to a national (trunk) prefix, those digits shall be removed and the type of number/nature of address shall be set to "national (significant) number".

   If the leading digits refer neither to an international prefix nor to a national (trunk) prefix, then the destination number does not match the destination number triggering criterion.

   If there is a match of the type of number/nature of address indicator after this number modification, then the check shall be performed by comparing the digits as defined in step 6, otherwise the comparison procedure shall continue as follows.

5. If there is a number with type of number/nature of address "national (significant) number" this number shall be translated based on the numbering plan of the serving entity to international format by adding the country code of the serving entity to the number string. After this modification both numbers shall be in international format and shall be checked by comparing the digits as defined in step 6.

6 If the number digits of the address information are compared with the number digits of the destination number triggering criterion, then there is a match if:

- the destination number is at least as long as the destination number string of the destination number triggering criterion; and

- all the digits in the destination number string of the destination number triggering criterion match the leading digits of the destination number.

The check described in this clause shall be repeated for every number contained in the destination number triggering criterion of the D-IM-CSI until a match is recognised and DP Analysed_Info is triggered, or until all the destination numbers have been checked without a match being recognised. In the latter case DP Analysed_Info is not triggered.

4.3.2.3 Criteria at DP Route_Select_Failure

The HLR may store a list of up to 5 cause values.

The following criteria are applicable for DP Route_Select_Failure:

- Release cause code.

The trigger criteria is met if the cause code received from the terminating party's network (could be a PSTN or an IMS network) is equal to at least one of the cause codes in the trigger criteria list.

(Editor's note: use of release cause code is FFS).

If a O-IM-BCSM was already invoked and there is a relationship with the gsmSCF at that moment, then no additional relationship shall be initiated.

4.3.2.4 Criteria at DP T_Busy and T_No_Answer

The HSS may store a list of up to 5 cause values.

The triggering is based on the release cause code received from terminating UE's P-CSCF.

The following criteria are applicable for DP T_Busy and T_No_Answer:

- Release cause code.

The trigger criteria are met if the cause code received from the terminating UE's P-CSCF is equal to at least one of the cause codes in the trigger criteria list. *(FFS)*

If trigger criteria are satisfied, then the corresponding Service Logic shall be invoked.

4.4 Description of CAMEL Subscriber Data

4.4.1 IP Multimedia CAMEL Subscription Information (IM-CSI)

This subclause defines the contents of the IP Multimedia CAMEL Subscription Information. IM-CSI data are provisioned in the HSS for subscribers having originating and/or terminating IP Multimedia CAMEL services. This information shall be sent by the HSS to the IM-SSF via the Si Interface.~~CSCF via the Cx Interface.~~ The IM-CSI data contains the O-IM-CSI, D-IM-CSI, and VT-IM-CSI.

4.4.1.1 Originating IP Multimedia CAMEL Subscription Information (O-IM-CSI)

4.4.1.1.1 gsmSCF Address

Address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing.

4.4.1.1.2 Service Key

The Service Key identifies to the gsmSCF the service logic that shall apply.

4.4.1.1.3 Default ~~IP Multimedia~~Call Handling

The Default ~~IP Multimedia~~Call Handling indicates whether the IP Multimedia session shall be released or continued as requested in case of error in the IM-SSF to gsmSCF dialogue.

4.4.1.1.4 TDP List

The TDP List indicates on which detection point triggering shall take place.

4.4.1.1.5 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked by the gsmSCF for the service.

4.4.1.1.6 CSI Status

The CSI state indicates whether the O-IM-CSI is active or not.

4.4.1.1.7 Notification Flag

The notification flag indicates whether changes of the O-IM-CSI shall trigger the Notification on Change of Subscriber Data.

4.4.1.1.8 DP Criteria

The DP criteria indicate whether the imcnSSF shall request the gsmSCF for instructions.

4.4.1.2 Dialled Services IP Multimedia CAMEL Subscription Information (D-IM-CSI)

4.4.1.2.1 gsmSCF Address

Address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing.

4.4.1.2.2 Service Key

The Service Key identifies to the gsmSCF the service logic that shall apply.

4.4.1.2.3 Default Call Handling

The Default Call Handling indicates whether the IP Multimedia session shall be released or continued as requested in case of error in the IM-SSF to gsmSCF dialogue.

4.4.1.2.4 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked by the gsmSCF for the service.

4.4.1.2.5 CSI Status

The CSI state indicates whether the D-IM-CSI is active or not.

4.4.1.2.6 Notification Flag

The notification flag indicates whether changes of the D-IM-CSI shall trigger the Notification on Change of Subscriber Data.

4.4.1.2.7 DP Criteria

The DP criteria indicate whether the imcnSSF shall request the gsmSCF for instructions.

4.4.1.3 Terminating IP Multimedia CAMEL Subscription Information (VT-IM-CSI)

4.4.1.3.1 gsmSCF Address

Address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing.

4.4.1.3.2 Service Key

The Service Key identifies to the gsmSCF the service logic that shall apply.

4.4.1.3.3 Default Call Handling

The Default Call Handling indicates whether the IP Multimedia session shall be released or continued as requested in case of error in the IM-SSF to gsmSCF dialogue.

4.4.1.3.4 TDP List

The TDP List indicates on which detection point triggering shall take place. The following trigger detection points are allowed: DP Terminating_Attempt_Authorised, DP T_Busy, and DP T_No_Answer.

4.4.1.3.5 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked by the gsmSCF for the service.

4.4.1.3.6 CSI Status

The CSI state indicates whether the VT-IM-CSI is active or not.

4.4.1.3.7 Notification Flag

The notification flag indicates whether changes of the VT-IM-CSI shall trigger the Notification on Change of Subscriber Data.

4.4.1.3.8 DP Criteria

The DP criteria indicate whether the imcnSSF shall request the gsmSCF for instructions.

4.4.1.4 Other CAMEL Data

4.4.1.4.1 gsmSCF address list for CSI

The gsmSCF address list for CSI indicates a list of gsmSCF addresses to which Notification on Change of Subscriber Data is to be sent. This list is common to all CSI.

4.5 Description of CAMEL State Models

Editor's Note: The text, diagrams and tables in section 4.5 are at an early stage of development. Further work is required to complete section 4.5.

In the IM Subsystem, calls are controlled by the Serving CSCF (S-CSCF) where a subscriber is registered. A state model describes the call control behaviour of an IM-SSF.

4.5.1 General Handling

The Basic Call State Model (BCSM) is used to describe the handling of originating and terminating calls. It identifies the points in a call where gsmSCF based service applications is permitted to interact with the call control capabilities of an IM-SSF. Figure 4.3 illustrates how transitions between states, Detection Points and Points In Call components are shown in the BCSM diagrams.

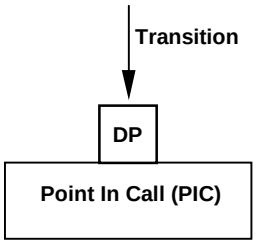
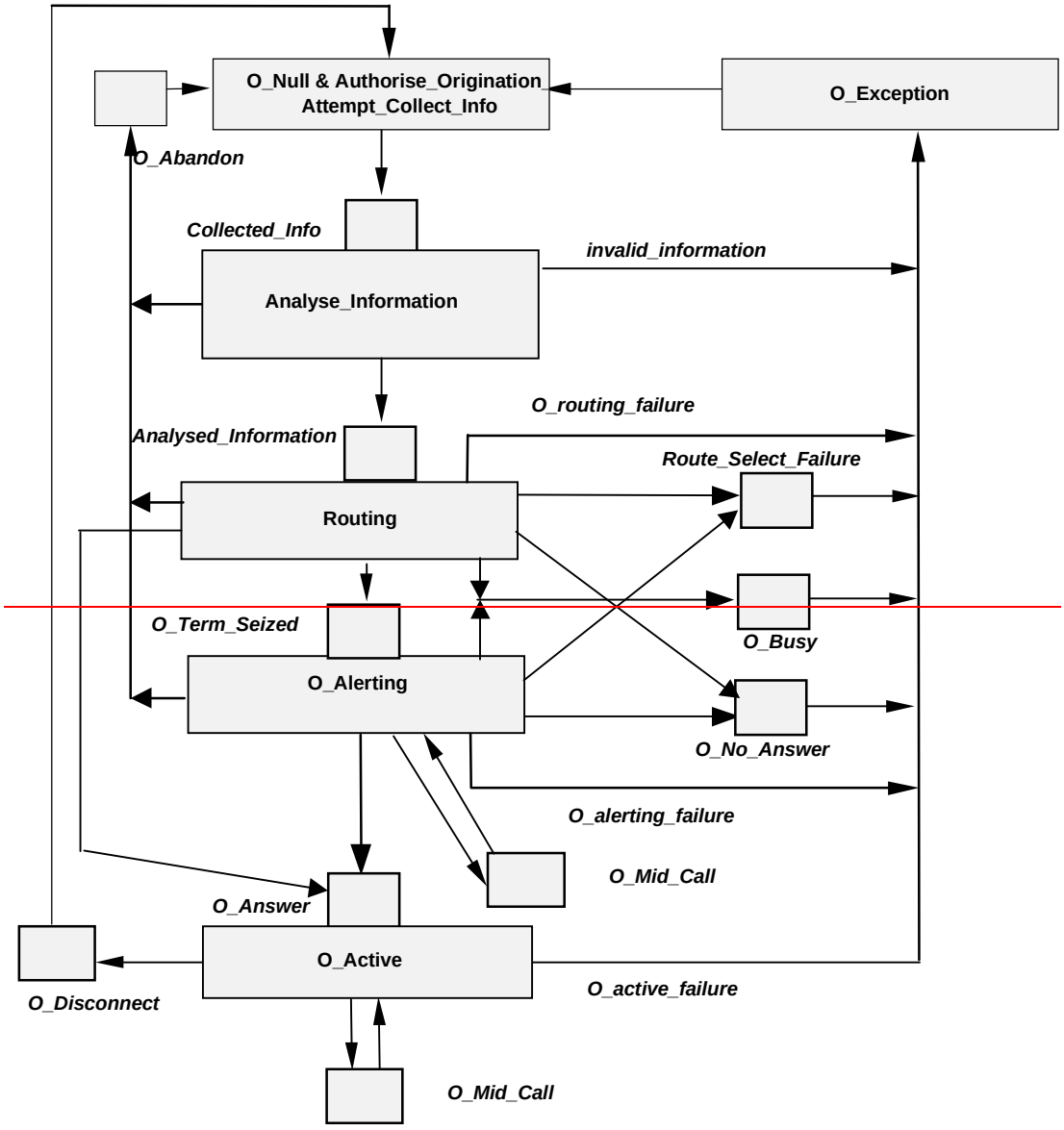


Figure 4.3: BCSM Components

4.5.2 Originating CAMEL Call State Model (O-IM-BCSM)

4.5.2.1 Description of the O-IM-BCSM

The O-IM-BCSM is used to model the behaviour of an IM-SSF for an originating call. When an armed DP is encountered, O-IM-BCSM processing is suspended at the DP and the IM-SSF indicates this to the gsmSCF if appropriate.


O_Null & Authorise_Origination
Attempt_Collect_Info
O_Exception
O_Abandon
Collected_Info
invalid_information
Analyse_Information
O_routing_failure
Analysed_Information
Route_Select_Failure
Routing
O_Busy
O_Term_Seized
O_Alerting
O_No_Answer
O_alerting_failure
O_Mid_Call
O_Answer
O_Active
O_Disconnect
O_active_failure
O_Mid_Call
Basic Call transition

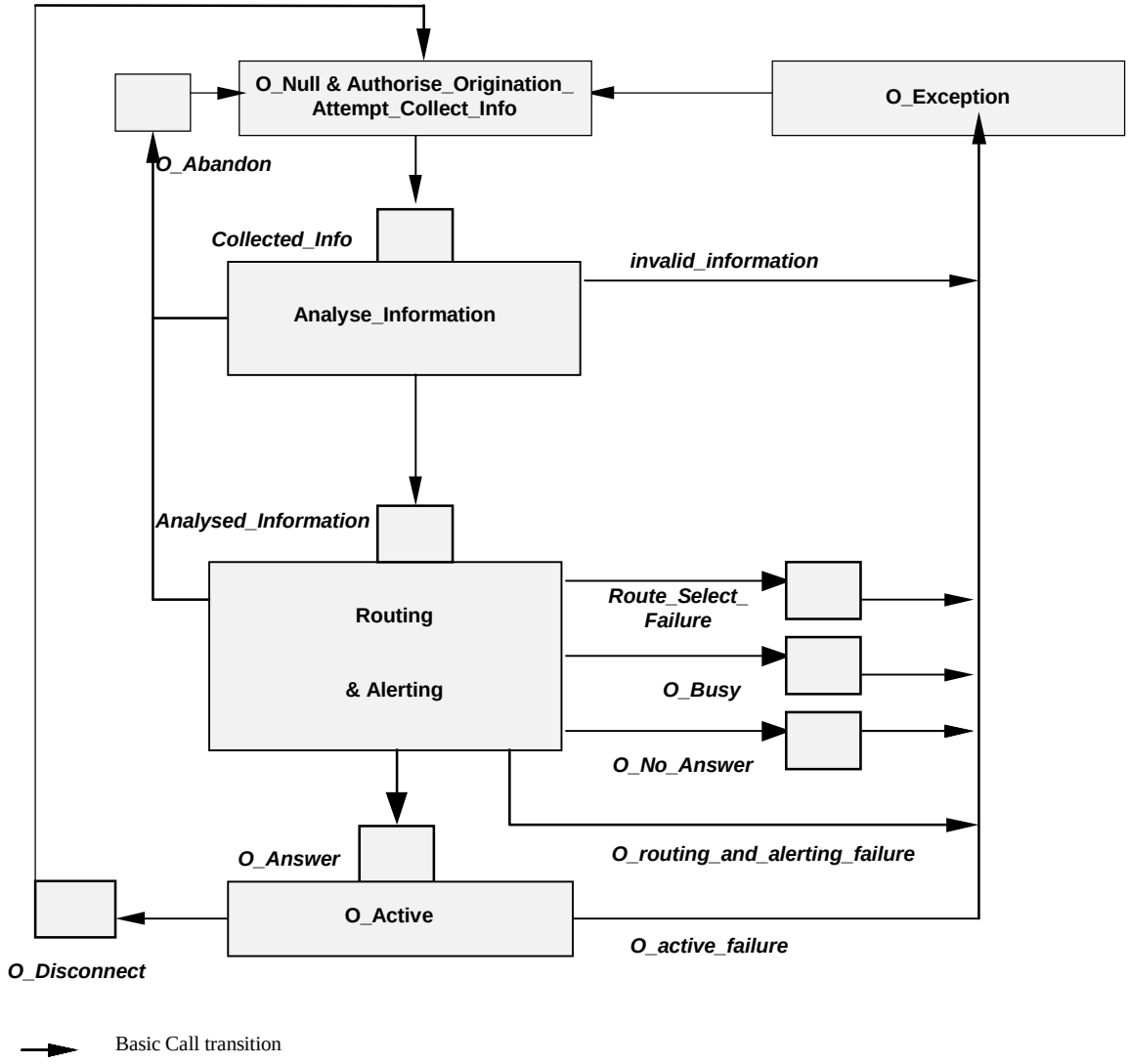


Figure 4.4: Originating CAMEL Basic Call State Model

The following table defines the DPs that apply to originating calls.

Table 4.1: Description of the O-IM-BCSM DPs in an IM-SSF

CAMEL Detection Point:	DP Type	Description:
DP Collected_Info	TDP-R	Indication that the O-IM-CSI is analysed or the gsmSCF has initiated a session attempt. In the later case the DP is neither triggered nor reported.
DP Analysed_Information	TDP-R	Availability of routeing address and nature of address.
DP Route_Select_Failure	TDP-R, EDP-N, EDP-R	Indication that the session establishment failed.
DP O_Busy	EDP-N, EDP-R	Indication that: - a busy indication is received from the terminating party, - a not reachable event is determined upon a SIP error response.
DP O_No_Answer	EDP-N, EDP-R	Indication that: - an application timer associated with the O_No_Answer DP expires, - a no answer event is determined upon SIP a error response
DP O_Answer	EDP-N, EDP-R	Indication that the session is accepted and answered by the terminating party.
DP O_Disconnect	EDP-N, EDP-R	A disconnect indication is received from the originating party or from the terminating party.
DP O_Abandon	EDP-N, EDP-R	Indication that a disconnect indication is received from the originating party during the session establishment procedure.

4.5.2.2 Description of Points In Call

This sub-clause describes the Points In Call for originating calls. The entry events, actions and exit events are described for each Point in Call.

Editor's Note: Further work is required to complete the sub-sections below.

4.5.2.2.1 4.5.2.2.1 O_Null & Authorise_Origination_Attempt_Collect_Info

Entry events:

- Disconnection and clearing of a previous call (DP O_Disconnect) or default handling of exceptions by IM-SSF completed.
- Abandon event is reported from Analyse_Information or Routing and Alerting PIC.
- Exception event is reported.

Actions:

- Interface is idled.
- Originating call: SIP INVITE request message containing the dialled number is received from MS.
- Information being analysed e.g., O-IM-CSI is analysed.

Exit events:

- Originating CSI is analysed.

- An exception condition is encountered. For this PIC, if the call encounters one of these exceptions during the PIC processing, the exception event is not visible because there is no corresponding DP. Example exception condition: Calling party abandons call.

4.5.2.2.2 4.5.2.2.2 Analyse_Information

Entry events:

- Originating CSI is analysed. (DP Collected Info).
- New routeing information is received when Busy event (DP O_Busy), Route Select Failure event (DP Route_Select_Failure), Not Reachable event (DP O_Busy) or No Answer event (DP O_No_Answer) is reported from Routing and Alerting PIC.
- New routeing information is received when Disconnect event is reported from O_Active PIC.

Actions:

- Compare the called party number with the dialled services information.

Exit events:

- Availability of routeing address and nature of address. (DP Analysed_Information).
- An exception condition is encountered (e.g. wrong number)- this leads to the O_Exception PIC.
- Calling party abandons the call- this leads to the O_Abandon DP.

4.5.2.2.3 4.5.2.2.3 Routing and Alerting

Entry events:

- Availability of routeing address and nature of address. (DP Analysed_Information).

Actions:

- Information is being analysed and/or translated according to dialling plan to determine routeing address.
- Routeing address being interpreted.
- Call is being processed by the terminating half BCSM. Continued processing of SIP call session setup (e.g., ringing) is taking place. Waiting for indication from terminating half BCSM that the call has been answered by terminating party.

Exit events:

- Indication from the terminating half BCSM that the call is accepted and answered by terminating party (DP O_Answer).
- An exception condition is encountered - this leads to the O_Exception PIC.
- Calling party abandons the call- this leads to the O_Abandon DP.
- A busy indication is received from the terminating party - this leads to the O_Busy DP.
- A not reachable indication is received from the terminating party - this leads to the O_Busy DP.
- Attempt to select the route for the call fails - this leads to the Route_Select_Failure DP.

If the no reply timer expires and DP O_No_Answer is armed - this leads to the O_No_Answer DP.

4.5.2.2.4 4.5.2.2.4 O_Active

Entry events:

- Indication from the terminating half BCSM that the call is accepted and answered by the terminating party (DP O_Answer).

Actions:

- SIP session established between originating party and terminating party. - Call release is awaited.

Exit events:

- A disconnection indication is received from the originating party, or received from the terminating party via the terminating half BCSM. (DP - O_Disconnect).

- An exception condition is encountered.

4.5.2.2.5 4.5.2.2.5 O_Exception

Entry events:

- An exception condition is encountered. In addition to specific examples listed above, exception events include any type of failure, which means that the normal exit events for a PIC can not be met.

Actions:

- Default handling of the exception condition is being provided. This includes general actions necessary to ensure that no resources remain inappropriately allocated such as:

  - If any relationship exists between the imcnSSF and the gsmSCF, the imcnSSF shall send an error information flow closing the relationships and indicating that any outstanding call handling instructions will not run to completion.

  - Resources made available for setting up the SIP call session are released.

Exit events:

- Default handling of the exception condition by IM-SSF completed.

4.5.3 Mapping of SIP Method/Response to O-IM-BCSM Detection Points

This sub-clause describes mapping of SIP methods and responses to CAMEL Detection Points.

Table 4.2: Mapping of SIP Method/Response to CAMEL O-IM-BCSM DPs

CAMEL O-IM-BCSM DP:	SIP Method/Response
DP Collected_Info	INVITE
DP Analysed_Information	N/A
DP Route_Select_Failure	404 Not Found 482 Loop Detected 483 Too Many Hops
DP O_Busy	486 Busy Here 600 Busy Everywhere
DP O_No_Answer	603 Decline 408 Request Timeout
DP O_Answer	200 OK
DP O_Disconnect	BYE
DP O_Abandon	CANCEL

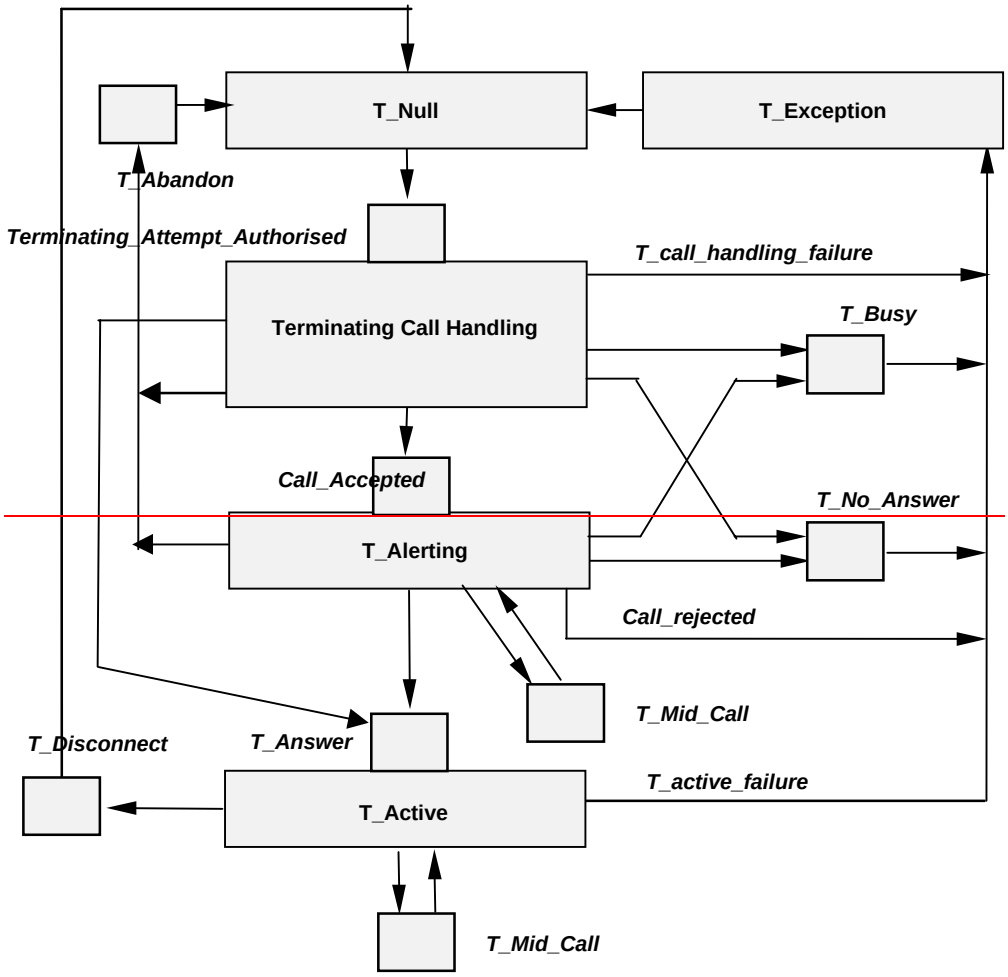
Editor's Note: The above mapping is incomplete. Further study is required to complete the table. Use of status code 603 Decline for DP O_No_Answer requires further study. Use of status codes 404, 482, 483 etc for DP Route_Select_Failure requires further study.

Editor's Note: The above mapping needs to consider all potential SIP responses mentioned in RFC 2543bis to determine which ones are appropriate. As indicated above, multiple responses may be mapped to the same DP.

4.5.4 Terminating CAMEL Call State Model (T-IM-BCSM)

4.5.4.1 Description of the T-IM-BCSM

The T-IM-BCSM is used to model the behaviour of an IM-SSF for a terminating call. When a DP is encountered, T-IM-BCSM processing is suspended at the DP and IM-SSF indicates this to the gsmSCF if appropriate.


T_Null
T_Exception
T_Abandon
Terminating_Attempt_Authorised
T_call_handling_failure
Terminating Call Handling
T_Busy
Call_Accepted
T_No_Answer
T_Alerting
Call_rejected
T_Mid_Call
T_Disconnect
T_Answer
T_active_failure
T_Active
T_Mid_Call
Basic Call transition

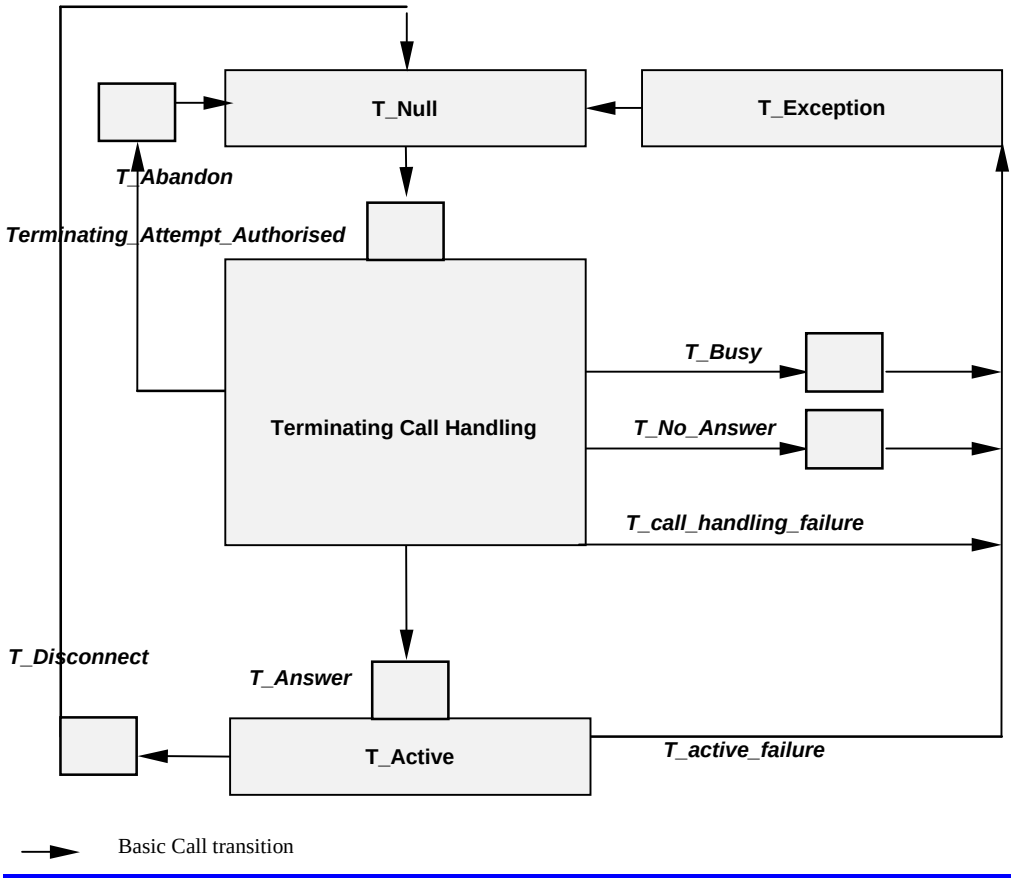


Figure 4.5: Terminating CAMEL Basic Call State Model

The following table defines the DPs that apply to terminating calls.

Table 4.3: Description of T-IM-BCSM DPs in the S-CSCF

CAMEL DP:	DP Type	Description:
DP Terminating_Attempt_ _Authorised	TDP-R	Indication that the T-IM-CSI is analysed.
DP T_Busy	TDP-R, EDP-N, EDP-R	Indication that: - a busy indication is received from the terminating party, - a not reachable event is determined upon a SIP error response.
DP T_No_Answer	TDP-R, EDP-N, EDP-R	Indication that an application timer associated with the T_No_Answer DP expires.
DP T_Answer	EDP-N, EDP-R	Session is accepted and answered by terminating party.
DP T_Disconnect	EDP-N, EDP-R	A disconnect indication is received from the terminating party or from the originating party.
DP T_Abandon	EDP-N, EDP-R	A disconnect indication is received from the originating party during the session establishment procedure.

~~Editor's Note: Further work is required to complete the DP Type and Description columns in the table above.~~

4.5.4.2 Description of Points In Call

This sub-clause describes the Points In Call for terminating calls. The entry events, actions and exit events are described for each Point in Call.

~~Editor's Note: Further work is required to complete the sub-sections below.~~

4.5.4.2.1 ~~4.5.4.2.1~~ T_Null

Entry events:

- Disconnection and clearing of a previous call (DP T_Disconnect) or default handling of exceptions by IM-SSF completed.
- Abandon event is reported from Terminating Call Handling PIC.
- Exception event is reported.

Actions:

- Interface is idled.
- SIP INVITE message for terminating call request is received, the appropriate information is analysed.
- T-IM-CSI is analysed.

Exit events:

- Terminating CSI is analysed.
- An exception condition is encountered. For this PIC, if the call encounters one of these exceptions during the PIC processing, the exception event is not visible because there is no corresponding DP.

  Example exception condition is:

- Calling party abandons call.

4.5.4.2.2 ~~4.5.4.2.2~~ Terminating Call Handling

Entry events:

- Terminating CSI (if available) is analysed. (DP Terminating_Attempt_Authorised).
- New routeing information is received when Busy event (DP T_Busy) or No Answer event (DP T_No_Answer) is reported from Terminating Call Handling PIC.
- New routeing information is received when Disconnect event is reported from T_Active PIC.
- New routeing information is received when the terminating party not reachable is reported from Terminating Call Handling PIC.

Actions:

- - Routeing address and call type being interpreted. The next route or terminating access is being selected.
- The terminating party is being alerted. Waiting for the call to be answered by terminating party.

Exit events:

- Call is accepted and answered by terminating party.
- An exception condition is encountered - this leads to the T_Exception PIC. Example exception conditions: the SIP call session request was not successful.
- Calling party abandons the call - this leads to the T_Abandon DP.
- A busy indication is received from the terminating party's P-CSCF - this leads to the T_Busy DP.

- Not reachable event detected from the terminating party's P-CSCF this leads to the T_Busy DP.

- If no reply timer expires and DP T_No_Answer is armed - this leads to the T_No_Answer DP.

4.5.4.2.3 4.5.4.2.3 T_Active

Entry events:

- Indication that the call is accepted and answered by the terminating party. (DP T_Answer).

Actions:

- SIP session established between originating party and terminating party.

- Call release is awaited.

Exit events:

- A disconnection indication is received from the terminating party, or received from the originating party via the originating half BCSM. (DP T_Disconnect).

- An exception condition is encountered. In addition to specific examples listed above, exception events include any type of failure that means that the normal exit events for a PIC can not be met.

4.5.4.2.4 4.5.4.2.4 T_Exception

Entry events:

- An exception condition is encountered. In addition to specific examples listed above, exception events include any type of failure, which means that the normal exit events for PIC cannot be met.

Actions:

- Default handling of the exception condition is being provided. This includes general actions necessary to ensure that no resources remain inappropriately allocated such as:

  - If any relationship exists between the imcnSSF and the gsmSCF, the imcnSSF shall send an error information flow closing the relationships and indicating that any outstanding call handling instructions will not run to completion.

  - . Resources made available for setting up the SIP call session are released.

Exit events:

- Default handling of the exception condition by IM-SSF completed.

4.5.5 Mapping of SIP Method/Response to T-IM-BCSM Detection Points

This sub-clause describes mapping of SIP methods and responses to CAMEL Detection Points.

Table 4.4: Mapping of SIP Method/Response to CAMEL T-IM-BCSM DPs

CAMEL T-IM-BCSM DP:	SIP Method/Response
DP Terminating_Attempt_ _Authorised	INVITE
DP T_Busy	486 Busy Here 600 Busy Everywhere
DP T_No_Answer	603 Decline 408 Request Timeout
DP T_Answer	200 OK
DP T_Disconnect	BYE
DP T_Abandon	CANCEL

Editor's Note: The above mapping is incomplete. Further study is required to complete the table. Use of status code 603 Decline for DP T_No_Answer requires further study.

Editor's Note: The above mapping needs to consider all potential SIP responses mentioned in RFC 2543bis to determine which ones are appropriate. As indicated above, multiple responses may be mapped to the same DP.

5 Procedures for IM-SSF Application Server

The SDLs in this specification illustrate how CAMEL modifies the normal multimedia call. They do not attempt to show all the details of multimedia handling in all the modes that support CAMEL.

The text in this clause is a supplement to the definition in the SDL diagrams; it does not duplicate the information in the SDL diagrams.

5.1 Overall SDL Architecture

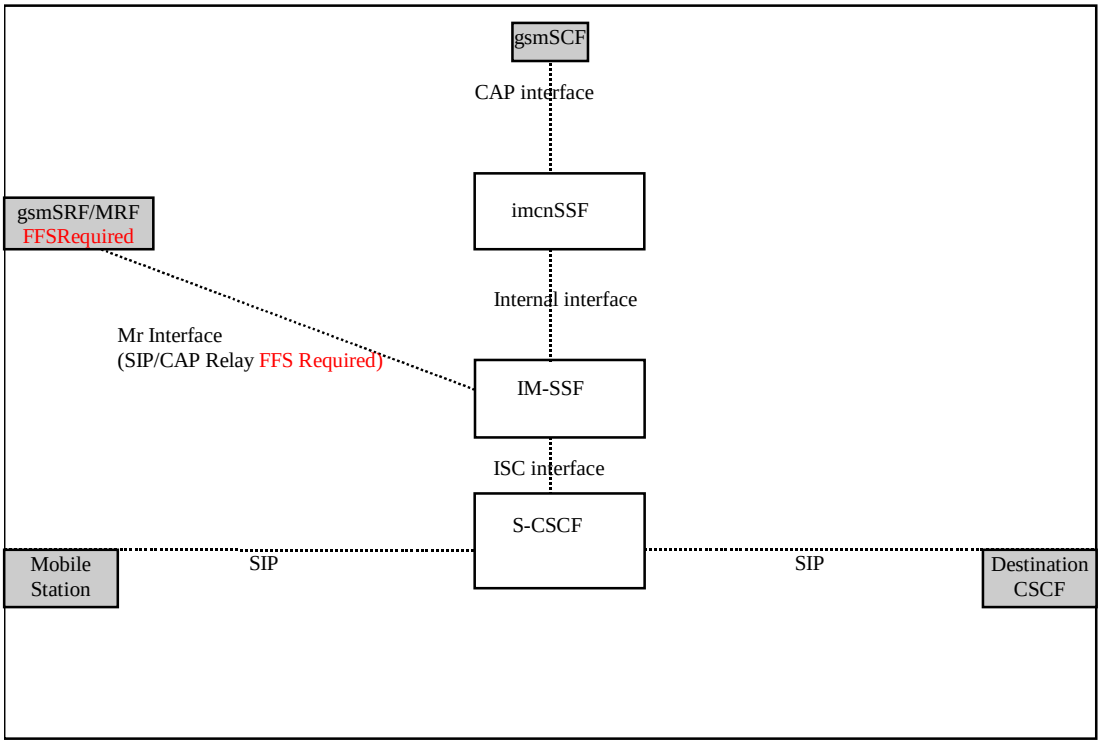


Figure 5.1: Outgoing Case (IM-SSF relay)

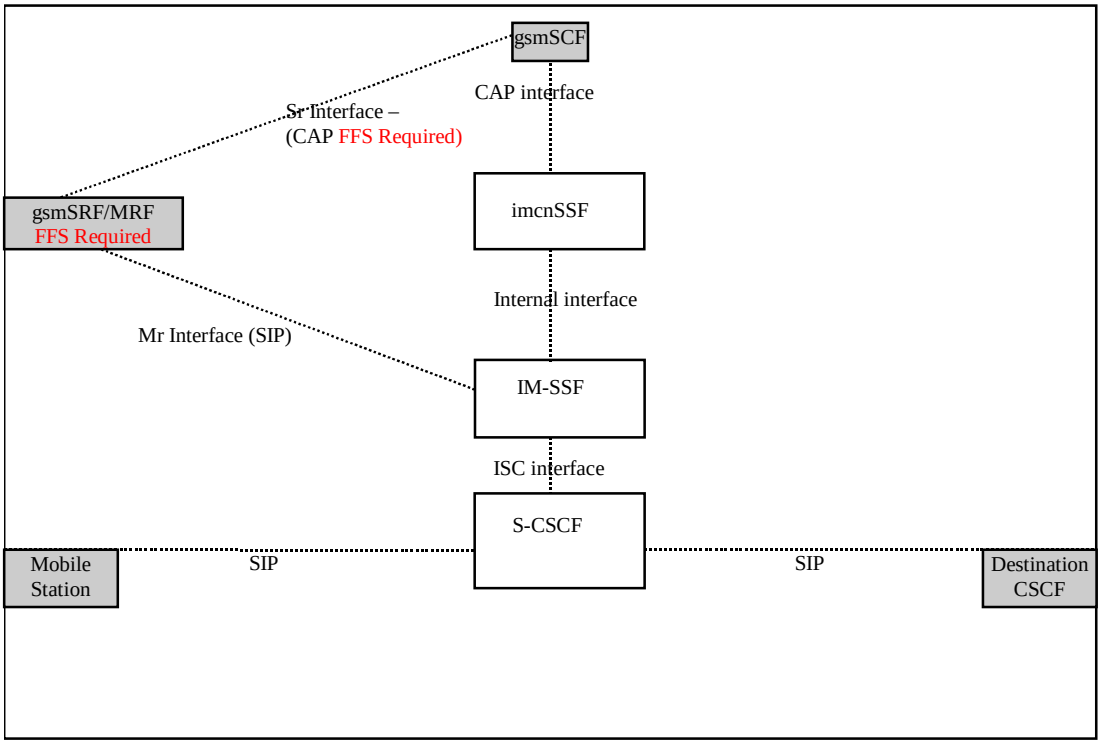


Figure 5.2: Outgoing Case (direct path gsmSCF to gsmSRF/MRCF)

5.1.1 Handling of Registration and Deregistration in the IM-SSF

The functional behaviour of the IM-SSF is specified in 3GPP TS 23.218 [**Error! Reference source not found.**]. The procedures specific to CAMEL are specified in this subclause:

- Procedure CAMEL_IMCN_Register;
- Procedure CAMEL_IMCN_DeRegister.

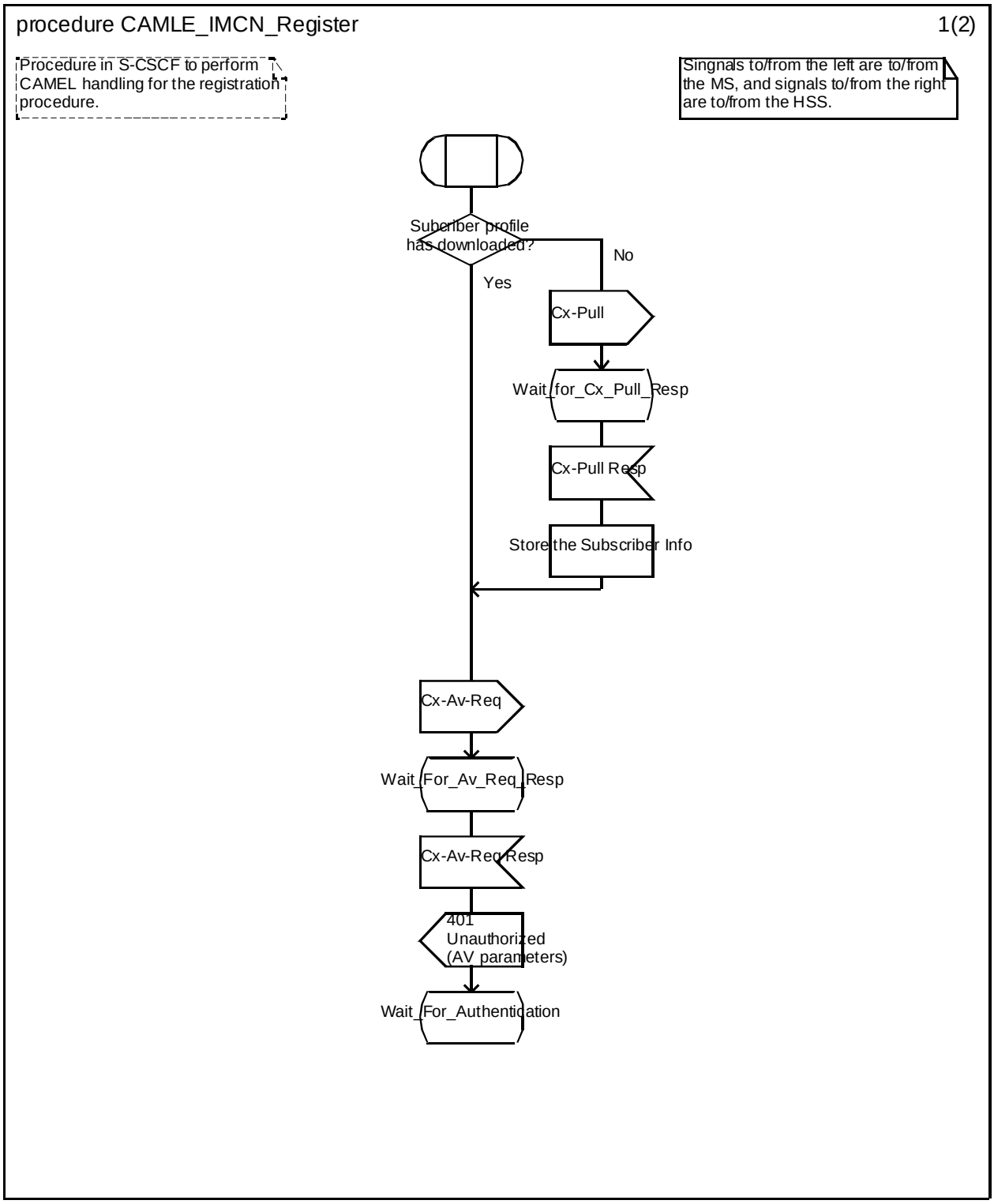

procedure CAMLE_IMCN_Register
1(2)
Procedure in S-CSCF to perform CAMEL handling for the registration procedure.
Singnals to/from the left are to/from the MS, and signals to/from the right are to/from the HSS.
Suberiber profile has downloaded?
No
Yes
Cx-Pull
Wait_for_Cx_Pull_Resp
Cx-Pull Resp
Store the Subscriber Info
Cx-Av-Req
Wait_For_Av_Req_Resp
Cx-Av-Req Resp
401 Unauthorized (AV parameters)
Wait_For_Authentication

Figure 5.3a

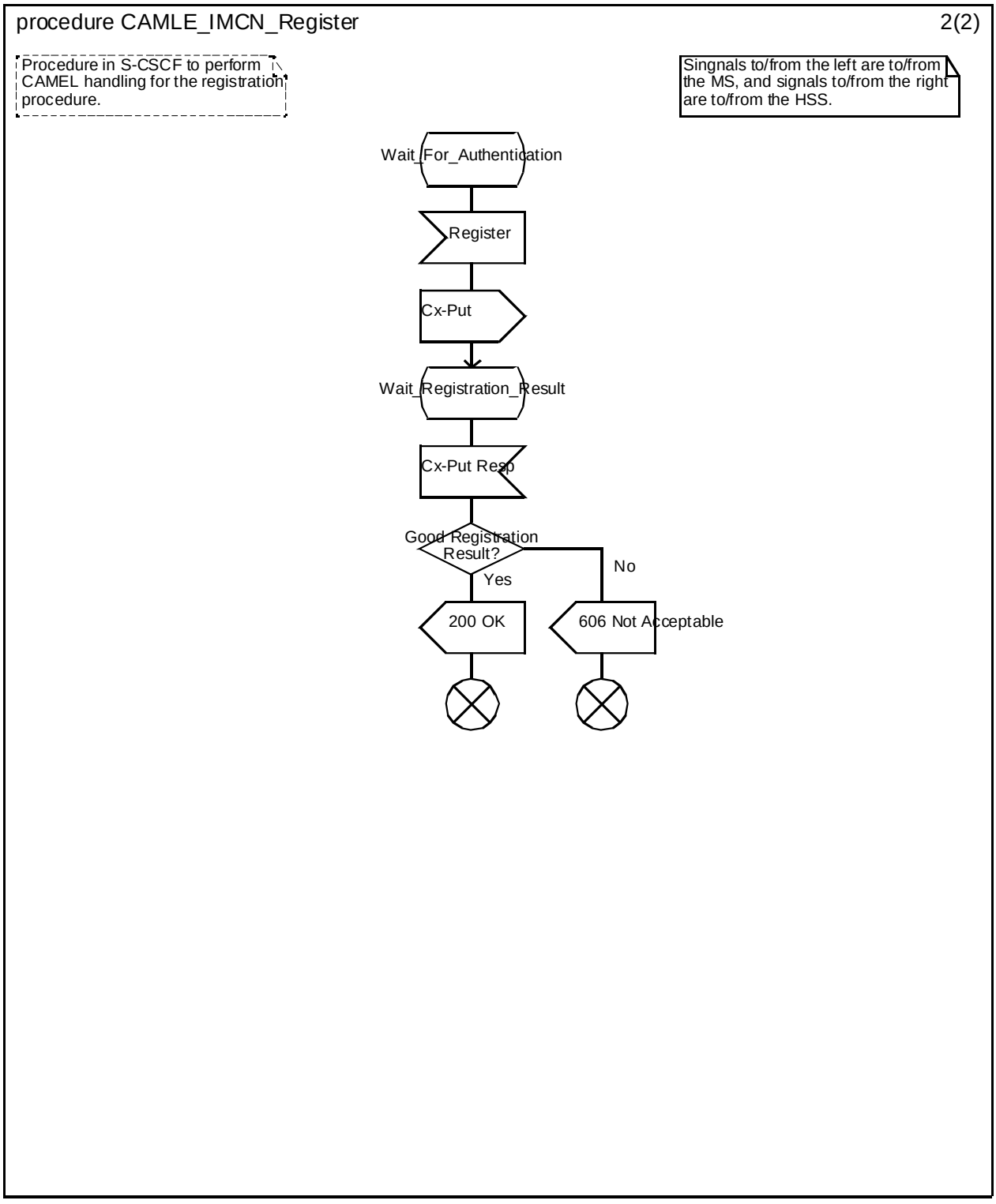

procedure CAMLE_IMCN_Register
2(2)
Procedure in S-CSCF to perform CAMEL handling for the registration procedure.
Singnals to/from the left are to/from the MS, and signals to/from the right are to/from the HSS.
Wait_For_Authentication
Register
Cx-Put
Wait_Registration_Result
Cx-Put Resp
Good Registration Result?
Yes
No
200 OK
606 Not Acceptable

Figure 5.18b

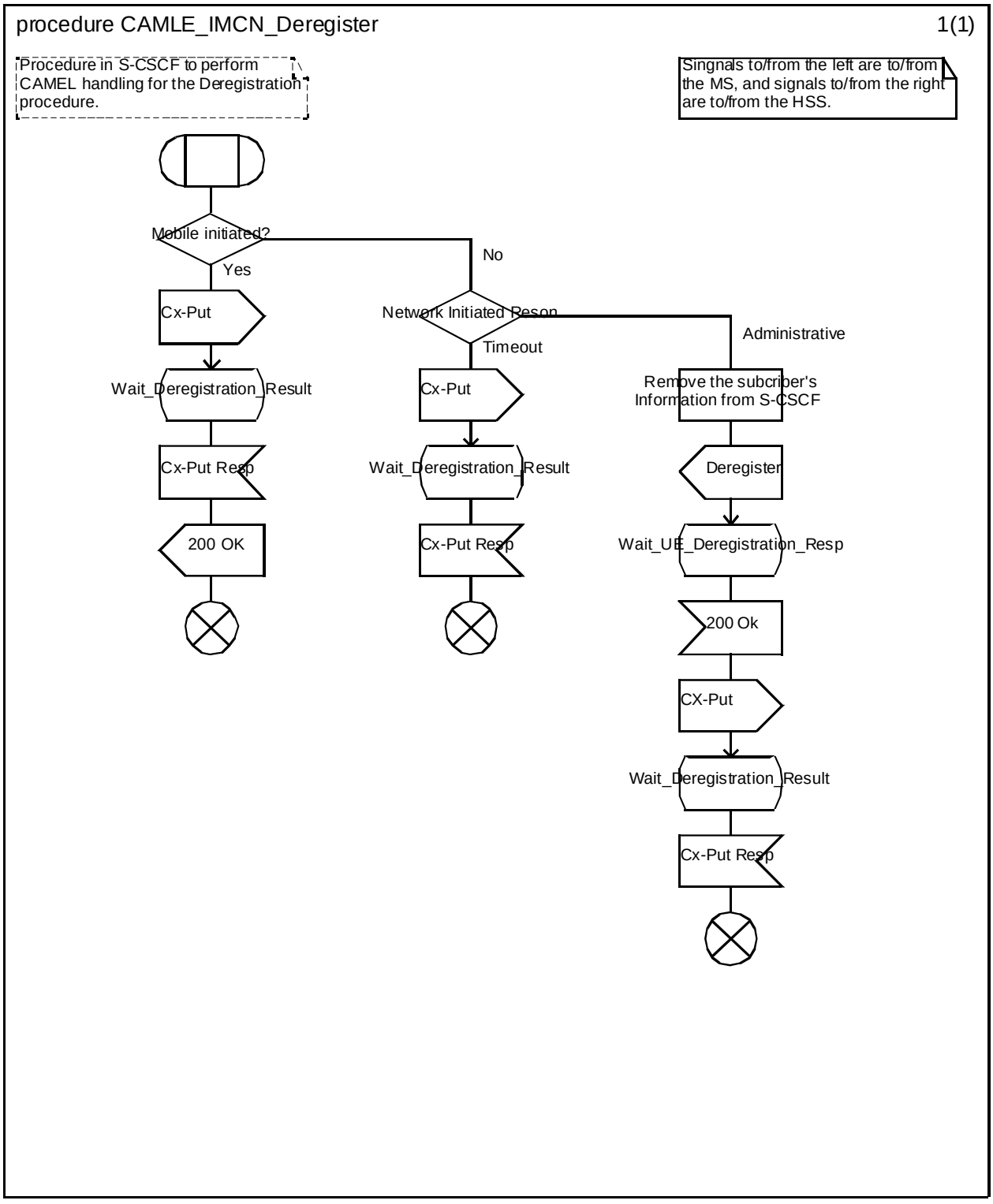


Figure 5.4a

5.1.2 Handling of Mobile Originated Calls in the IM-SSF

The functional behaviour of the IM-SSF is specified in 3GPP TS 23.218 [5]. The procedures specific to CAMEL are specified in this subclause:

- Procedure CAMEL_IMCN_MO_INVITE;

- Procedure CAMEL_IMCN_MO_BYE;
- Procedure CAMEL_IMCN_MO_CANCEL;
- Procedure CAMEL_IMCN_MO_Response_Code.

5.1.2.1 Actions of the IM-SSF on receipt of Int_Error

The IM-SSF checks the default Call Handling parameter in the relevant CSI.

If the default call handling is release, a BYE indication is sent to the MS. The IM-SSF then releases all resources and the invoked CAMEL procedure ends.

If the call handling is continue, the IM-SSF continues processing without CAMEL support.

5.1.2.2 Actions of the IM-SSF on receipt of Int_Continue

The IM-SSF continues processing without any modification of call parameters.

5.1.2.3 Actions of the IM-SSF on receipt of Int_Continue_With_Argument

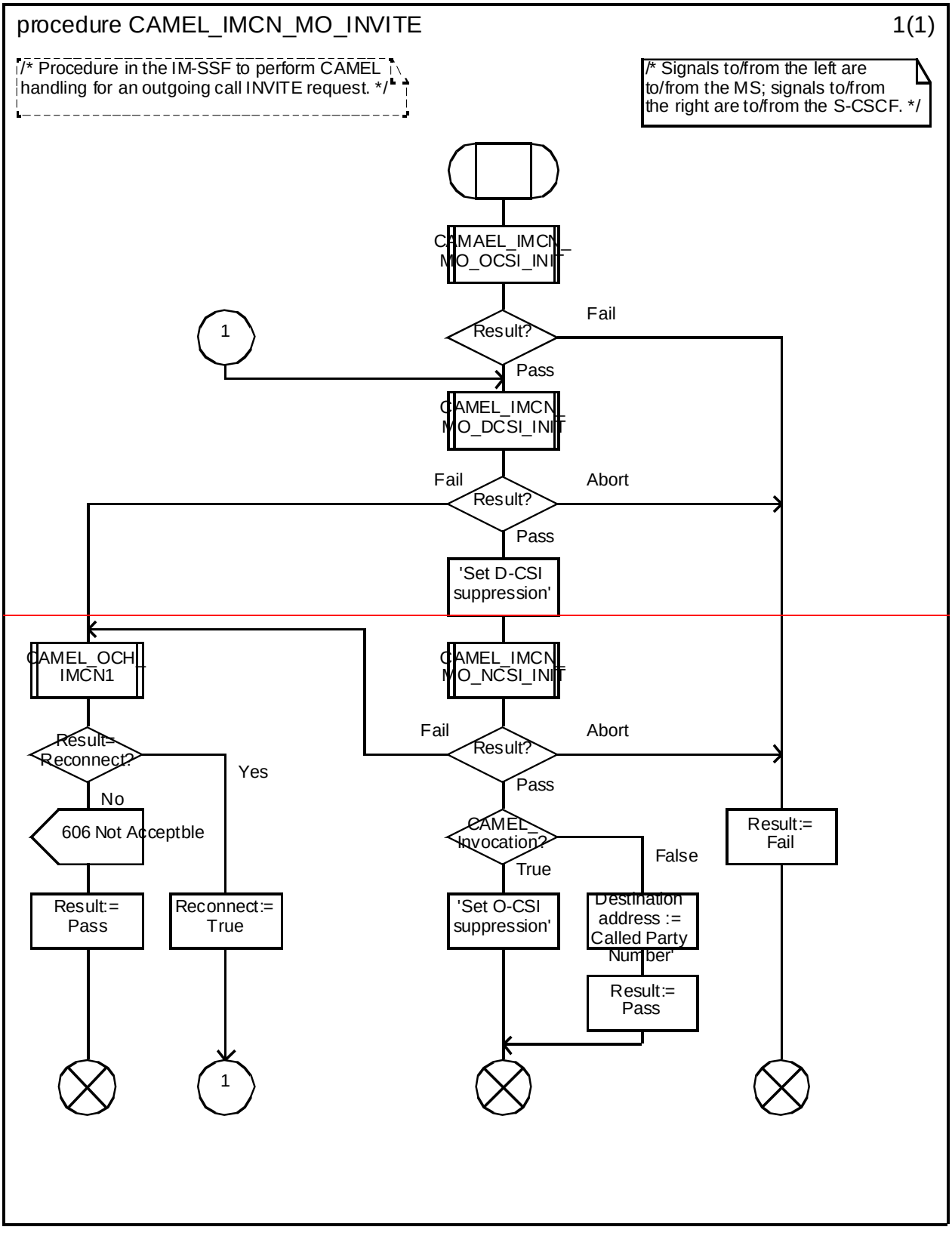
The IM-SSF continues processing with modified call parameters. The IM-SSF shall modify the call parameters by the information received in the Int_Continue_With_Argument message. Call parameters that are not included in the Int_Continue_With_Argument_Message are unchanged.

5.1.2.4 Actions of the IM-SSF on receipt of Int_Connect

The IM-SSF continues processing with modified call parameters. The IM-SSF shall transparently modify the call parameters with the received information. Call parameters which are not included in the Int_Connect message are unchanged.

5.1.2.5 Actions of the IM-SSF on receipt of Int_Release_Call

A BYE is sent to the MS, and a BYE is sent to the destination CSCF. The release cause received in the Int_Release_Call is used. The IM-SSF then releases all call resources and all CAMEL processing ends.


procedure CAMEL_IMCN_MO_INVITE
1(1)
/* Procedure in the IM-SSF to perform CAMEL handling for an outgoing call INVITE request. */
/* Signals to/from the left are to/from the MS; signals to/from the right are to/from the S-CSCF. */
CAMAEL_IMCN_MO_OCSI_INIT
Result?
Fail
Pass
1
CAMEL_IMCN_MO_DCSI_INIT
Fail
Result?
Abort
Pass
'Set D-CSI suppression'
CAMEL_OCH_IMCN1
CAMEL_IMCN_MO_NCSI_INIT
Result= Reconnect?
Yes
No
606 Not Acceptble
Fail
Result?
Abort
Pass
CAMEL_ Invocation?
False
True
Result:= Fail
Result:= Pass
Reconnect:= True
'Set O-CSI suppression'
Destination address := Called Party Number'
Result:= Pass
1

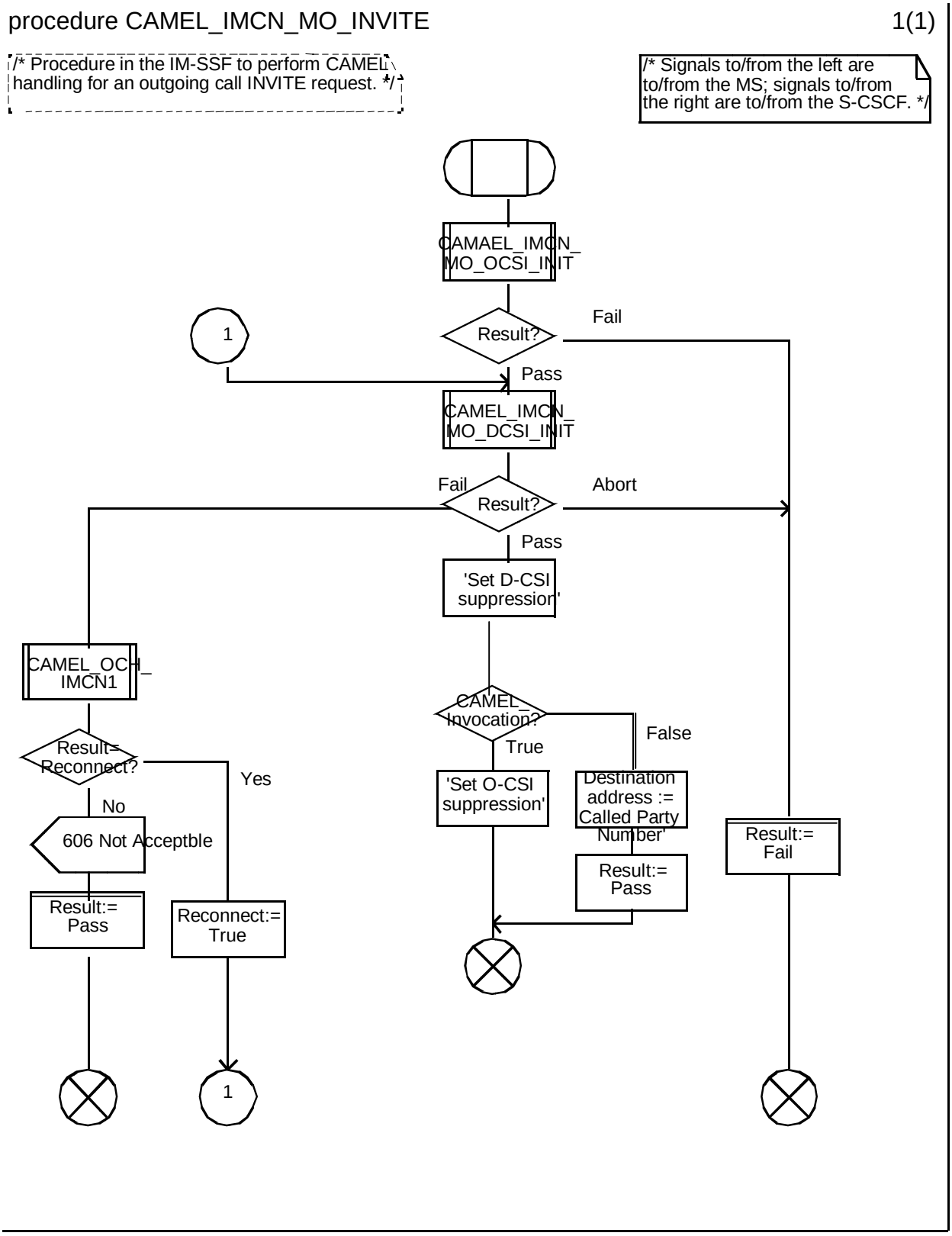


Figure 5.5a Procedure CAMEL_IMCN_MO_INVITE (sheet 1)

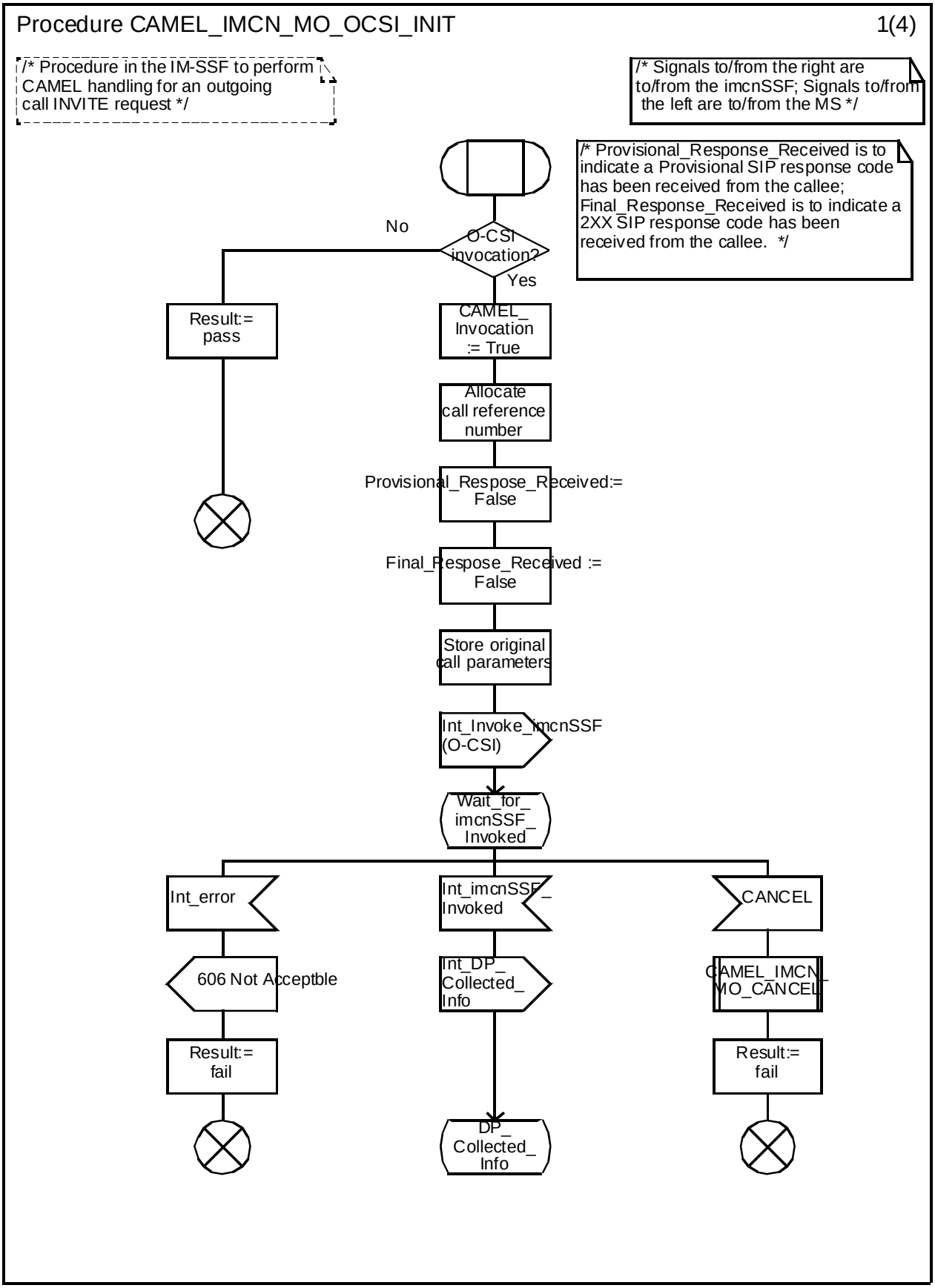

Procedure CAMEL_IMCN_MO_OCSI_INIT
1(4)
/* Procedure in the IM-SSF to perform CAMEL handling for an outgoing call INVITE request */
/* Signals to/from the right are to/from the imcnSSF; Signals to/from the left are to/from the MS */
/* Provisional_Response_Received is to indicate a Provisional SIP response code has been received from the callee; Final_Response_Received is to indicate a 2XX SIP response code has been received from the callee. */
No
O-CSI invocation?
Yes
Result:= pass
CAMEL_ Invocation := True
Allocate call reference number
Provisional_Respose_Received:= False
Final_Respose_Received := False
Store original call parameters
Int_Invoke_imcnSSF (O-CSI)
Wait_for_ imcnSSF_ Invoked
Int_error
Int_imcnSSF_ Invoked
CANCEL
606 Not Acceptble
Int_DP_ Collected_ Info
CAMEL_IMCN_ MO_CANCEL
Result:= fail
Result:= fail
DP_ Collected_ Info

Figure 5.6a

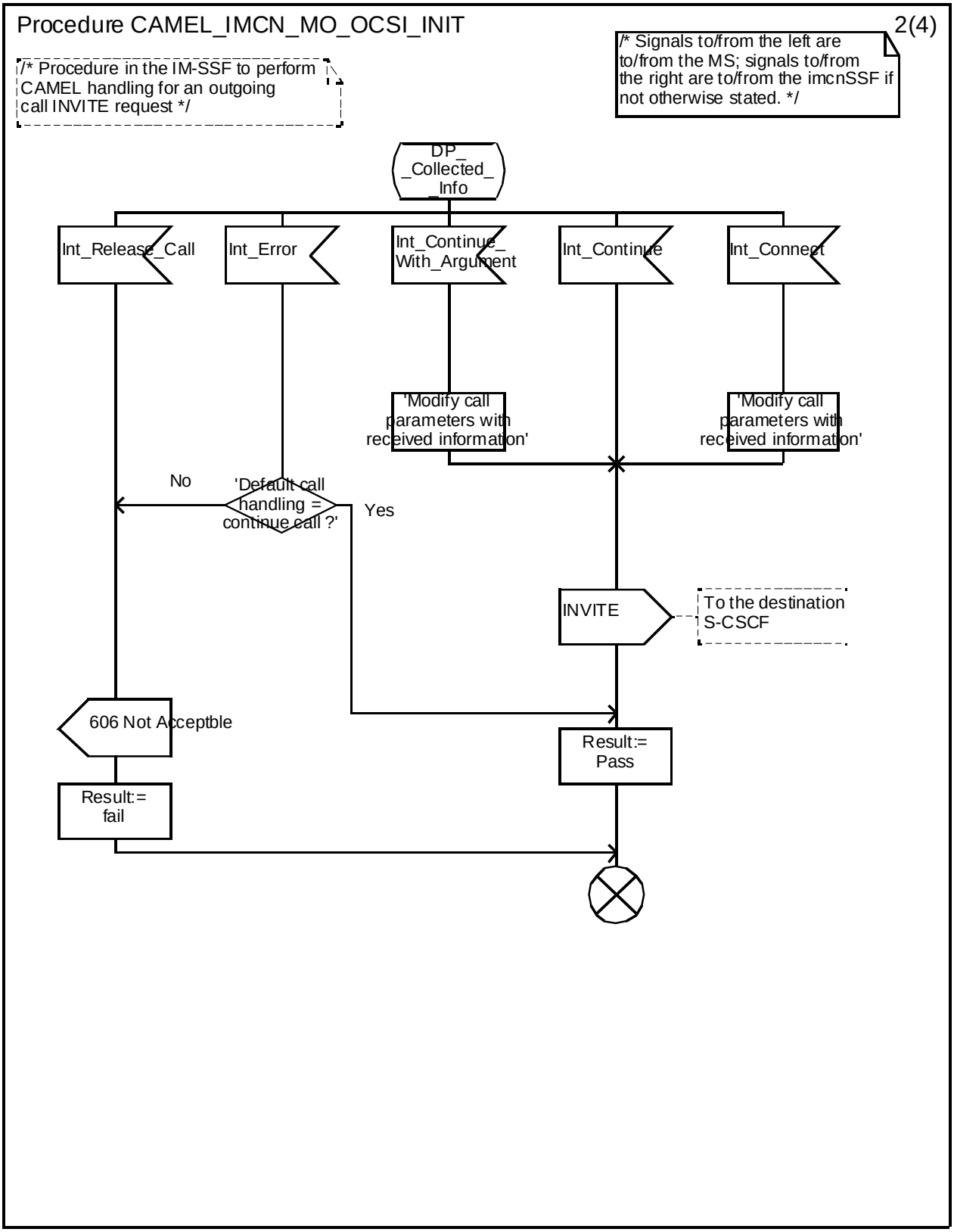

Procedure CAMEL_IMCN_MO_OCSI_INIT
2(4)
/* Procedure in the IM-SSF to perform CAMEL handling for an outgoing call INVITE request */
/* Signals to/from the left are to/from the MS; signals to/from the right are to/from the imcnSSF if not otherwise stated. */
DP_ _Collected_ _Info
Int_Release_Call
Int_Error
Int_Continue_ With_Argument
Int_Continue
Int_Connect
'Modify call parameters with received information'
'Modify call parameters with received information'
No
'Default call handling = continue call ?'
Yes
INVITE
To the destination S-CSCF
606 Not Acceptble
Result:= Pass
Result:= fail

Figure 5.6b

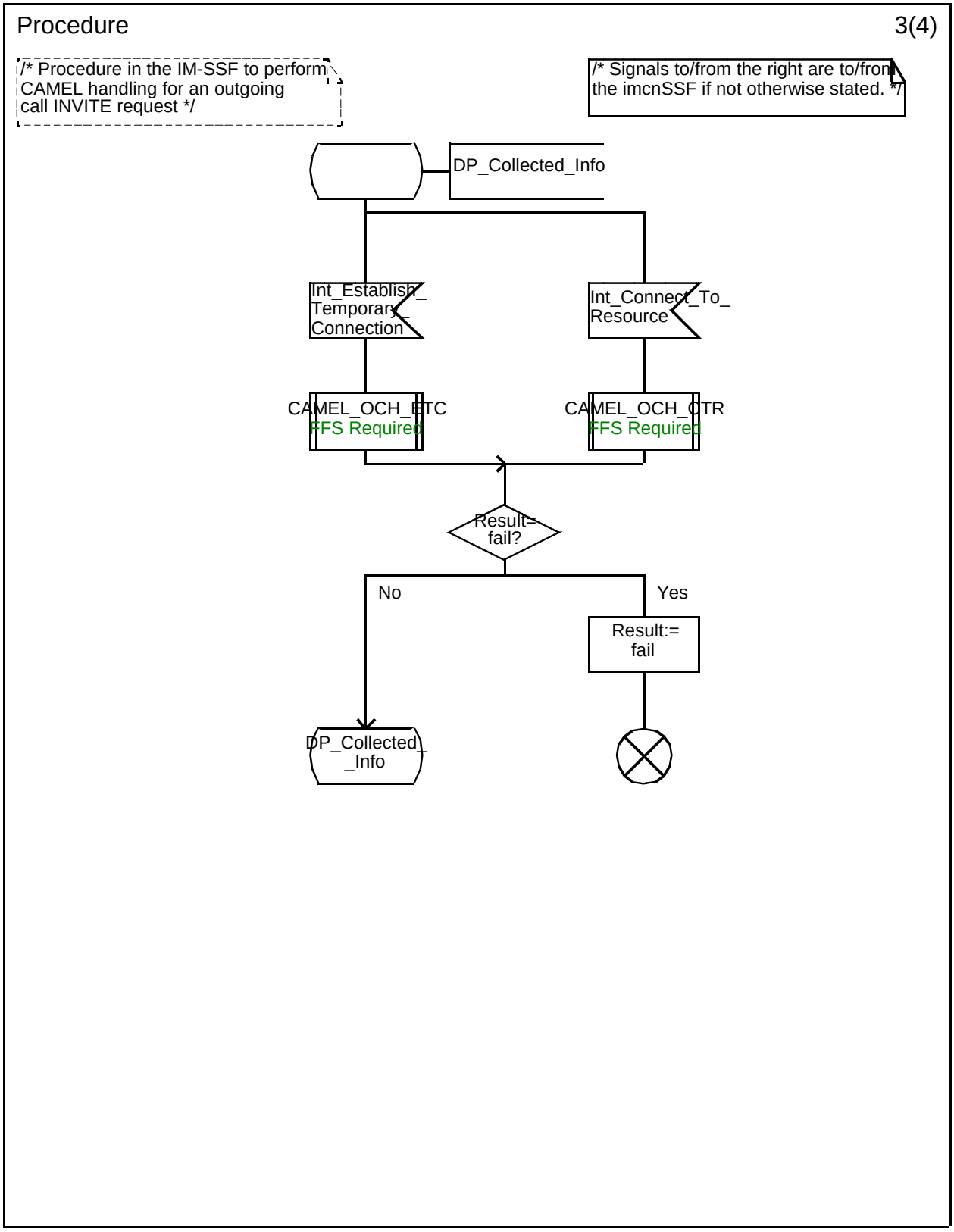

Procedure
3(4)
/* Procedure in the IM-SSF to perform CAMEL handling for an outgoing call INVITE request */
/* Signals to/from the right are to/from the imcnSSF if not otherwise stated. */
DP_Collected_Info
Int_Establish_Temporary_Connection
Int_Connect_To_Resource
CAMEL_OCH_ETC
FFS Required
CAMEL_OCH_CTR
FFS Required
Result= fail?
No
Yes
Result:= fail
DP_Collected_Info

Figure 5.6c

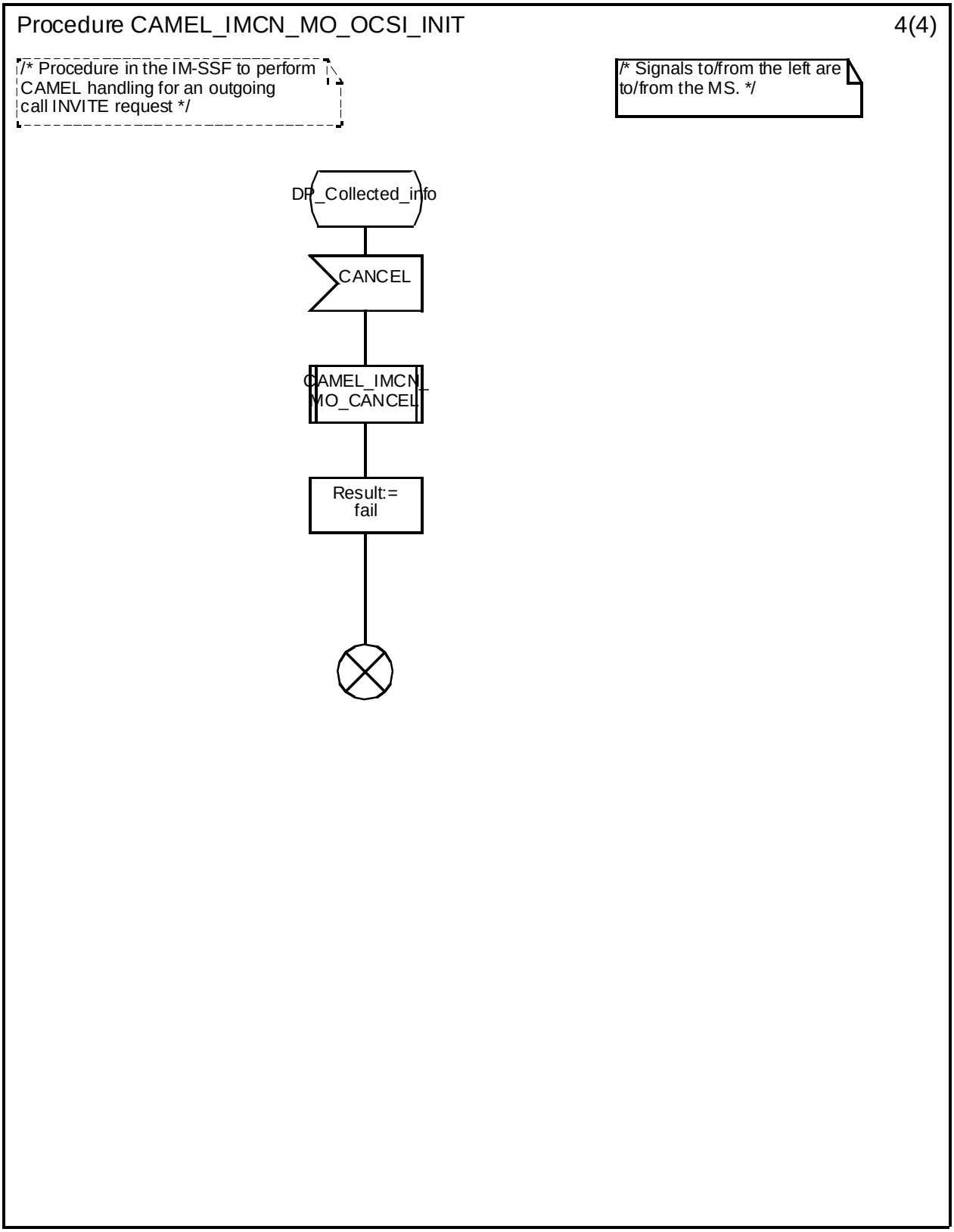

Procedure CAMEL_IMCN_MO_OCSI_INIT
4(4)
/* Procedure in the IM-SSF to perform CAMEL handling for an outgoing call INVITE request */
/* Signals to/from the left are to/from the MS. */
DP_Collected_info
CANCEL
CAMEL_IMCN_MO_CANCEL
Result:= fail

Figure 5.6d:

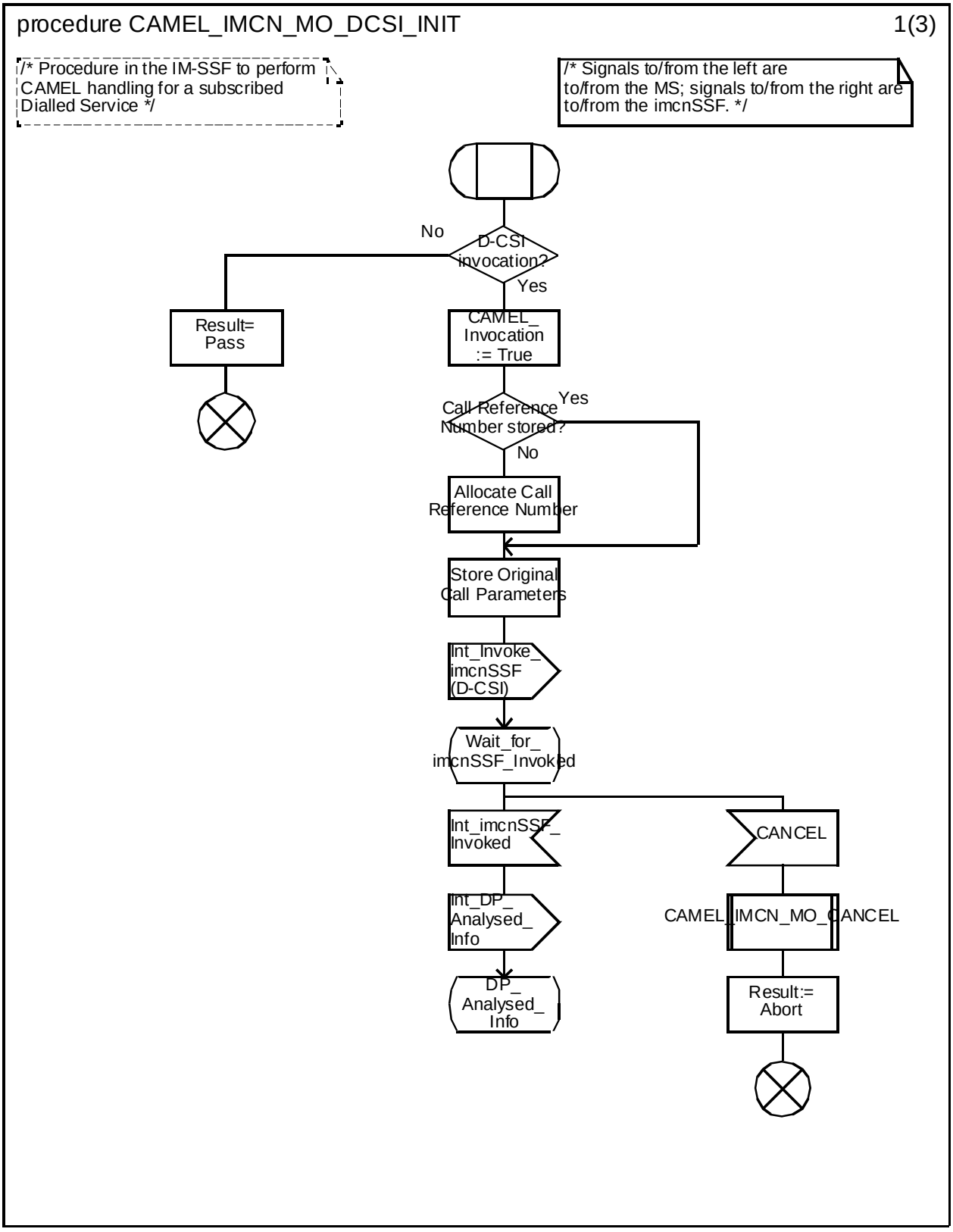

procedure CAMEL_IMCN_MO_DCSI_INIT
1(3)
/* Procedure in the IM-SSF to perform CAMEL handling for a subscribed Dialled Service */
/* Signals to/from the left are to/from the MS; signals to/from the right are to/from the imcnSSF. */
No
D-CSI invocation?
Yes
Result= Pass
CAMEL_ Invocation := True
Call Reference Number stored?
Yes
No
Allocate Call Reference Number
Store Original Call Parameters
Int_Invoke_ imcnSSF (D-CSI)
Wait_for_ imcnSSF_Invoked
Int_imcnSSF_ Invoked
CANCEL
Int_DP_ Analysed_ Info
CAMEL_IMCN_MO_CANCEL
DP_ Analysed_ Info
Result:= Abort

Figure 5.7a

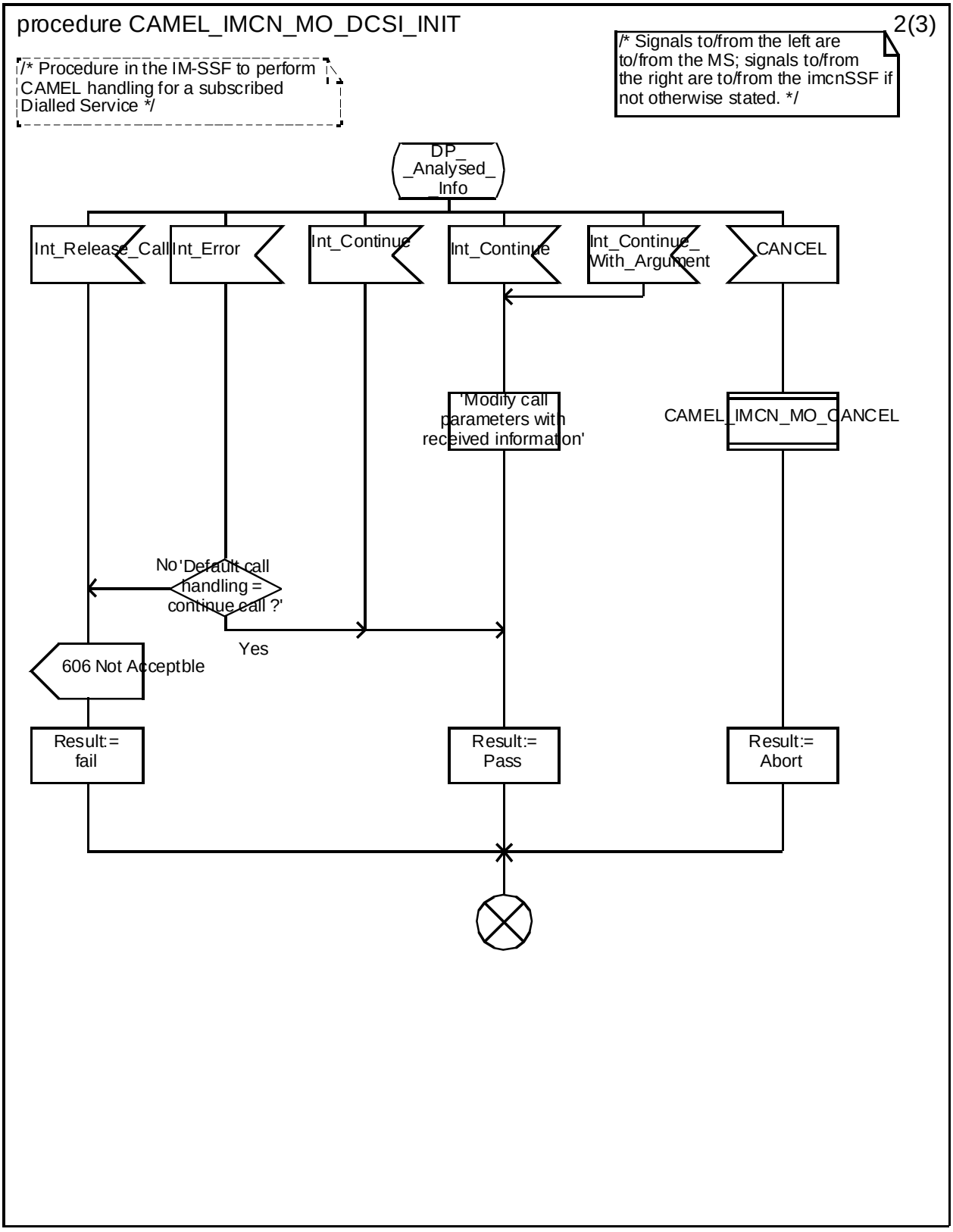

procedure CAMEL_IMCN_MO_DCSI_INIT
2(3)
/* Procedure in the IM-SSF to perform CAMEL handling for a subscribed Dialled Service */
/* Signals to/from the left are to/from the MS; signals to/from the right are to/from the imcnSSF if not otherwise stated. */
DP_ _Analysed_ Info
Int_Release_Call
Int_Error
Int_Continue
Int_Continue
Int_Continue_ With_Argument
CANCEL
'Modify call parameters with received information'
CAMEL_IMCN_MO_CANCEL
No
'Default call handling = continue call ?'
Yes
606 Not Acceptble
Result:= fail
Result:= Pass
Result:= Abort

Figure 5.7b:

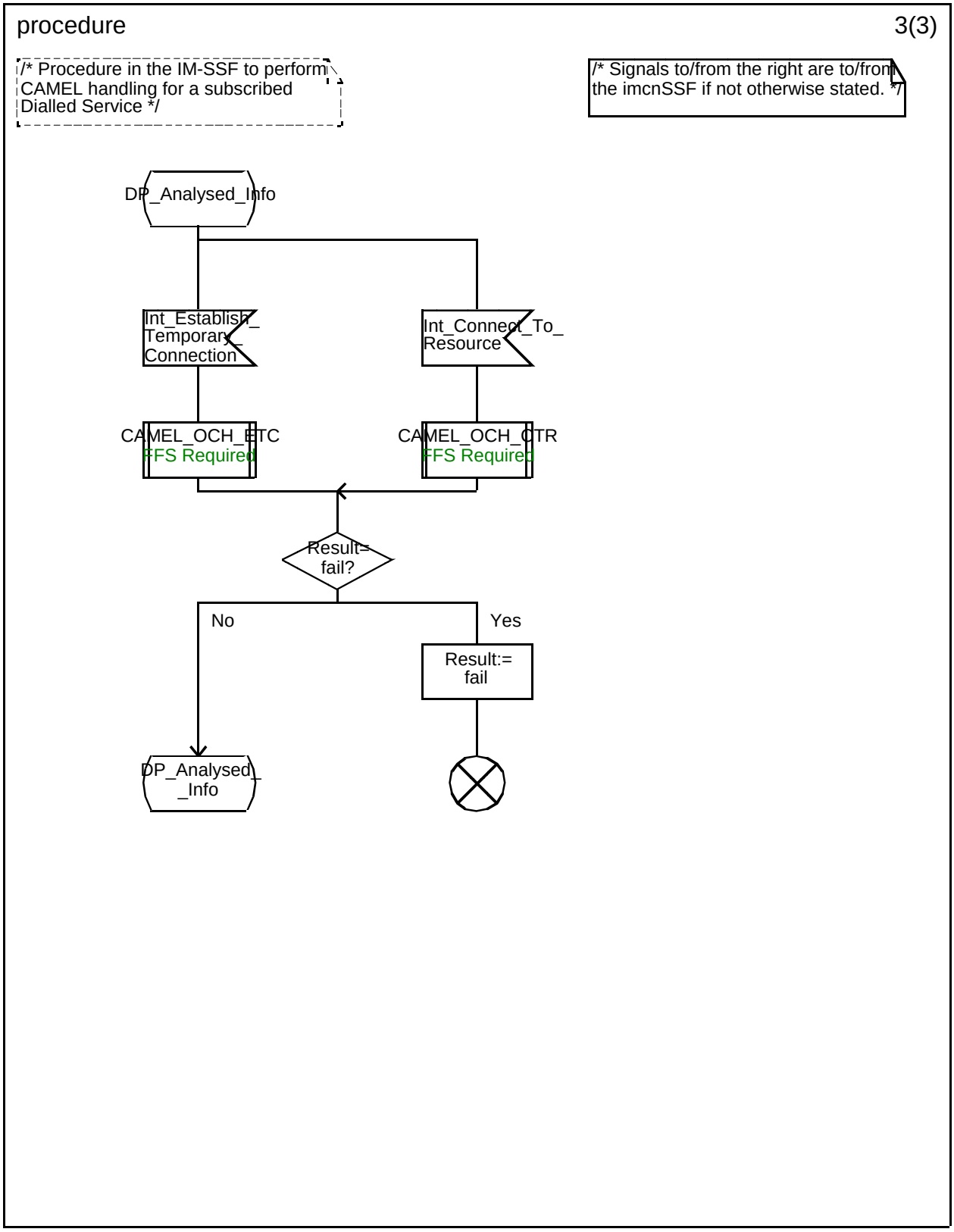
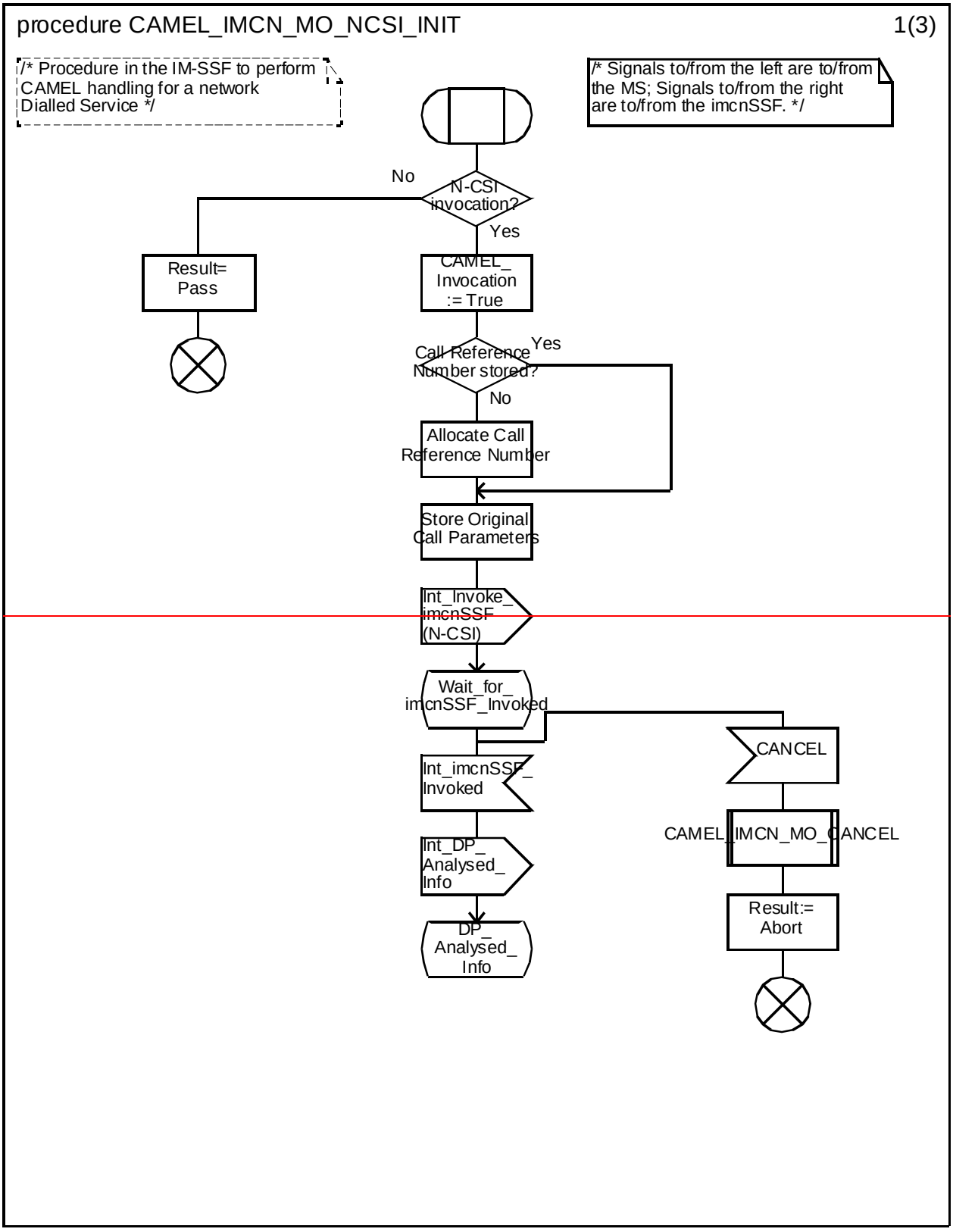

procedure
3(3)
/* Procedure in the IM-SSF to perform CAMEL handling for a subscribed Dialled Service */
/* Signals to/from the right are to/from the imcnSSF if not otherwise stated. */
DP_Analysed_Info
Int_Establish_Temporary_Connection
Int_Connect_To_Resource
CAMEL_OCH_ETC
FFS Required
CAMEL_OCH_CTR
FFS Required
Result= fail?
No
Yes
Result:= fail
DP_Analysed_Info

Figure 5.7c


procedure CAMEL_IMCN_MO_NCSI_INIT
1(3)
/* Procedure in the IM-SSF to perform CAMEL handling for a network Dialled Service */
/* Signals to/from the left are to/from the MS; Signals to/from the right are to/from the imcnSSF. */
No
N-CSI invocation?
Yes
Result= Pass
CAMEL_ Invocation := True
Call Reference Number stored?
Yes
No
Allocate Call Reference Number
Store Original Call Parameters
Int_Invoke_ imcnSSF (N-CSI)
Wait_for_ imcnSSF_Invoked
Int_imcnSSF_ Invoked
Int_DP_ Analysed_ Info
DP_ Analysed_ Info
CANCEL
CAMEL_IMCN_MO_CANCEL
Result:= Abort

~~Figure 5.8a:~~

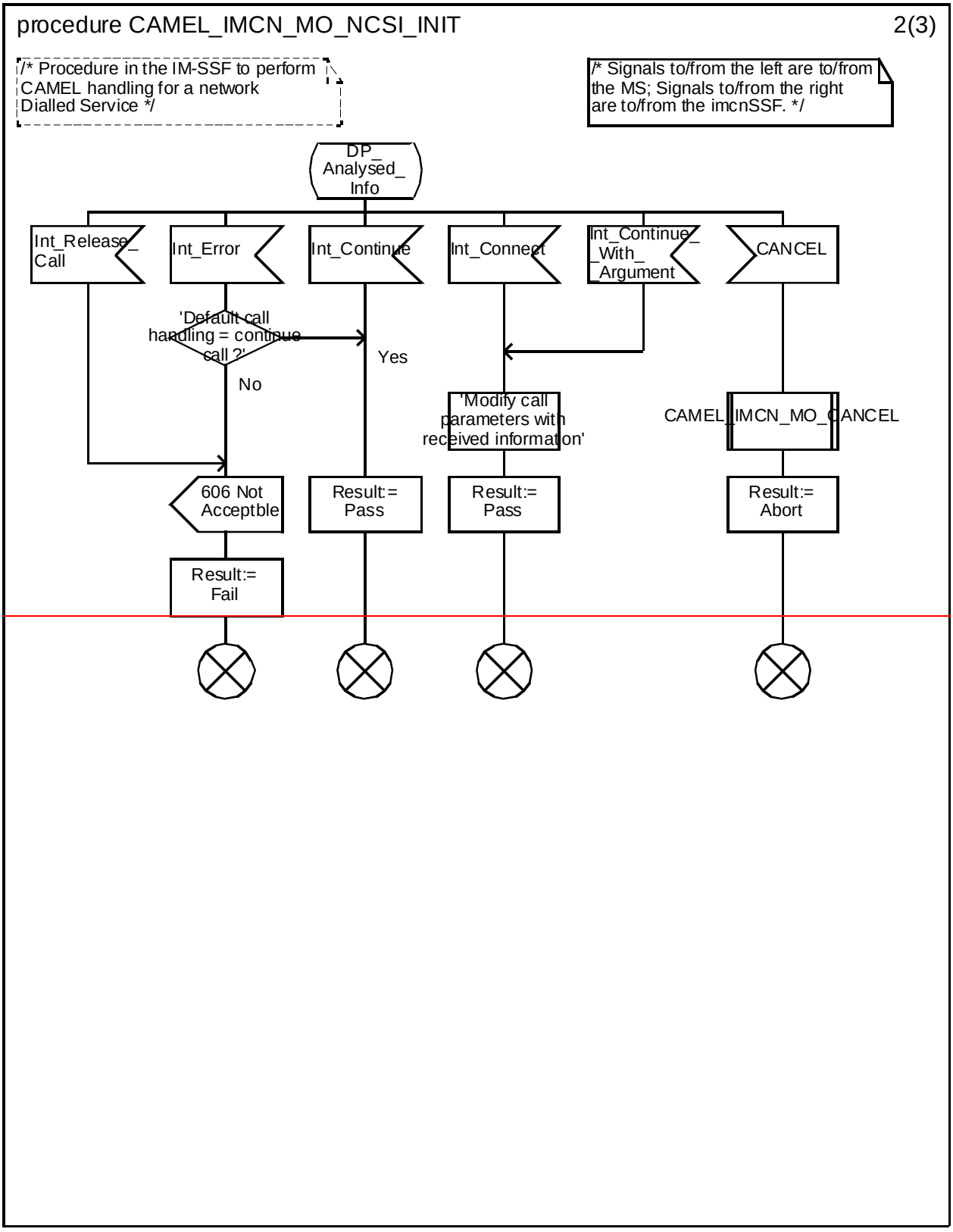

procedure CAMEL_IMCN_MO_NCSI_INIT
2(3)
/* Procedure in the IM-SSF to perform CAMEL handling for a network Dialled Service */
/* Signals to/from the left are to/from the MS; Signals to/from the right are to/from the imcnSSF. */
DP_ Analysed_ Info
Int_Release_ Call
Int_Error
Int_Continue
Int_Connect
Int_Continue_ _With_ _Argument
CANCEL
'Default call handling = continue call ?'
Yes
No
'Modify call parameters with received information'
CAMEL_IMCN_MO_CANCEL
606 Not Acceptble
Result:= Pass
Result:= Pass
Result:= Abort
Result:= Fail

Figure 5.8b

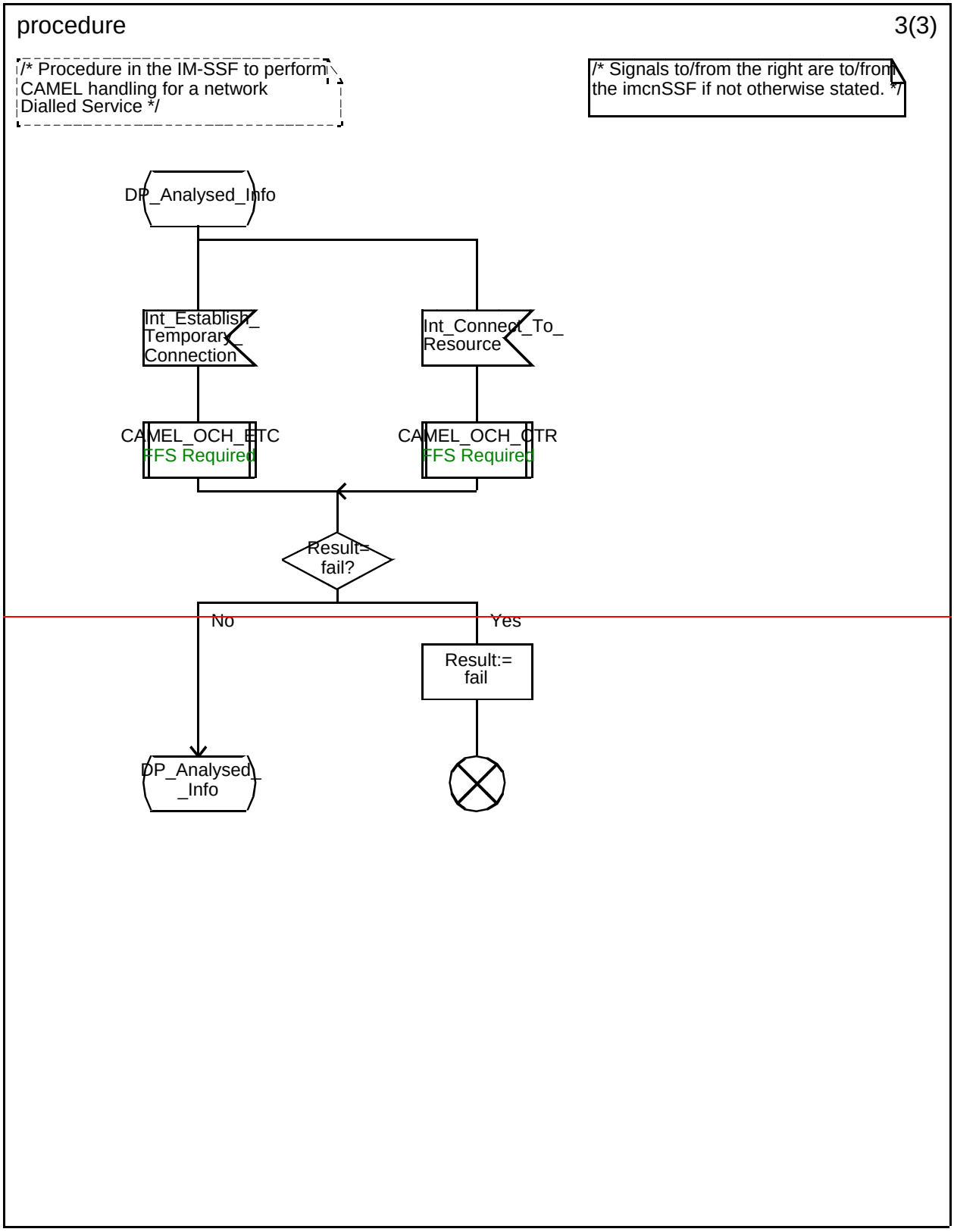

procedure
3(3)
/* Procedure in the IM-SSF to perform CAMEL handling for a network Dialled Service */
/* Signals to/from the right are to/from the imcnSSF if not otherwise stated. */
DP_Analysed_Info
Int_Establish_Temporary_Connection
Int_Connect_To_Resource
CAMEL_OCH_ETC
FFS Required
CAMEL_OCH_CTR
FFS Required
Result= fail?
No
Yes
Result:= fail
DP_Analysed_Info

Figure 5.8c:

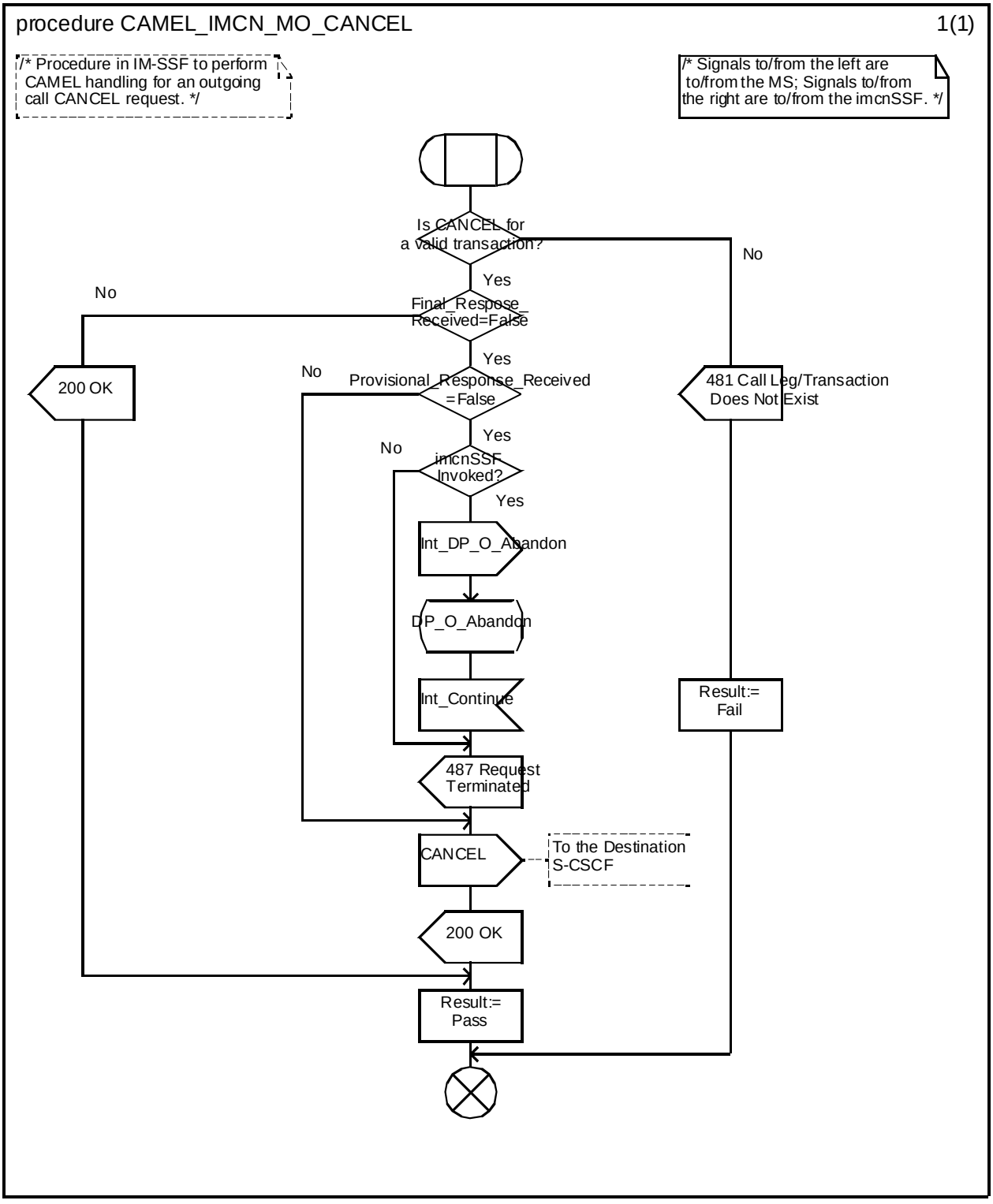

procedure CAMEL_IMCN_MO_CANCEL
1(1)
/* Procedure in IM-SSF to perform CAMEL handling for an outgoing call CANCEL request. */
/* Signals to/from the left are to/from the MS; Signals to/from the right are to/from the imcnSSF. */
Is CANCEL for a valid transaction?
No
Yes
No
Final_Response_ Received=False
Yes
200 OK
No
Provisional_Response_Received =False
481 Call Leg/Transaction Does Not Exist
Yes
No
imcnSSF Invoked?
Yes
Int_DP_O_Abandon
DP_O_Abandon
Int_Continue
Result:= Fail
487 Request Terminated
CANCEL
To the Destination S-CSCF
200 OK
Result:= Pass

Figure 5.9

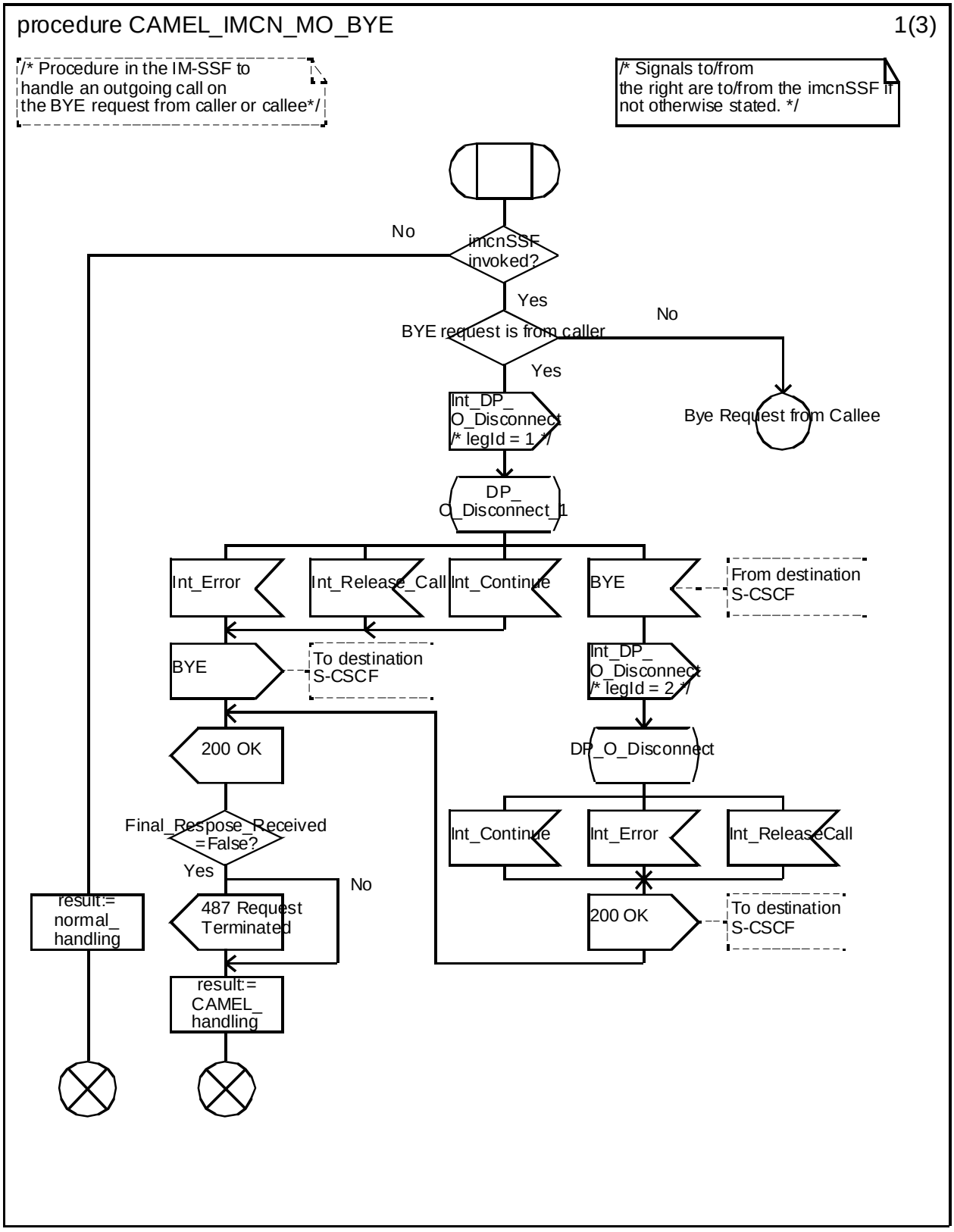

procedure CAMEL_IMCN_MO_BYE
1(3)
/* Procedure in the IM-SSF to handle an outgoing call on the BYE request from caller or callee*/
/* Signals to/from the right are to/from the imcnSSF if not otherwise stated. */
No
imcnSSF invoked?
Yes
BYE request is from caller
No
Yes
Int_DP_ O_Disconnect /* legId = 1 */
Bye Request from Callee
DP_ O_Disconnect_1
Int_Error
Int_Release_Call
Int_Continue
BYE
From destination S-CSCF
BYE
To destination S-CSCF
Int_DP_ O_Disconnect /* legId = 2 */
200 OK
DP_O_Disconnect
Final_Respose_Received =False?
Int_Continue
Int_Error
Int_ReleaseCall
Yes
No
result:= normal_ handling
487 Request Terminated
200 OK
To destination S-CSCF
result:= CAMEL_ handling

Figure 5.10a

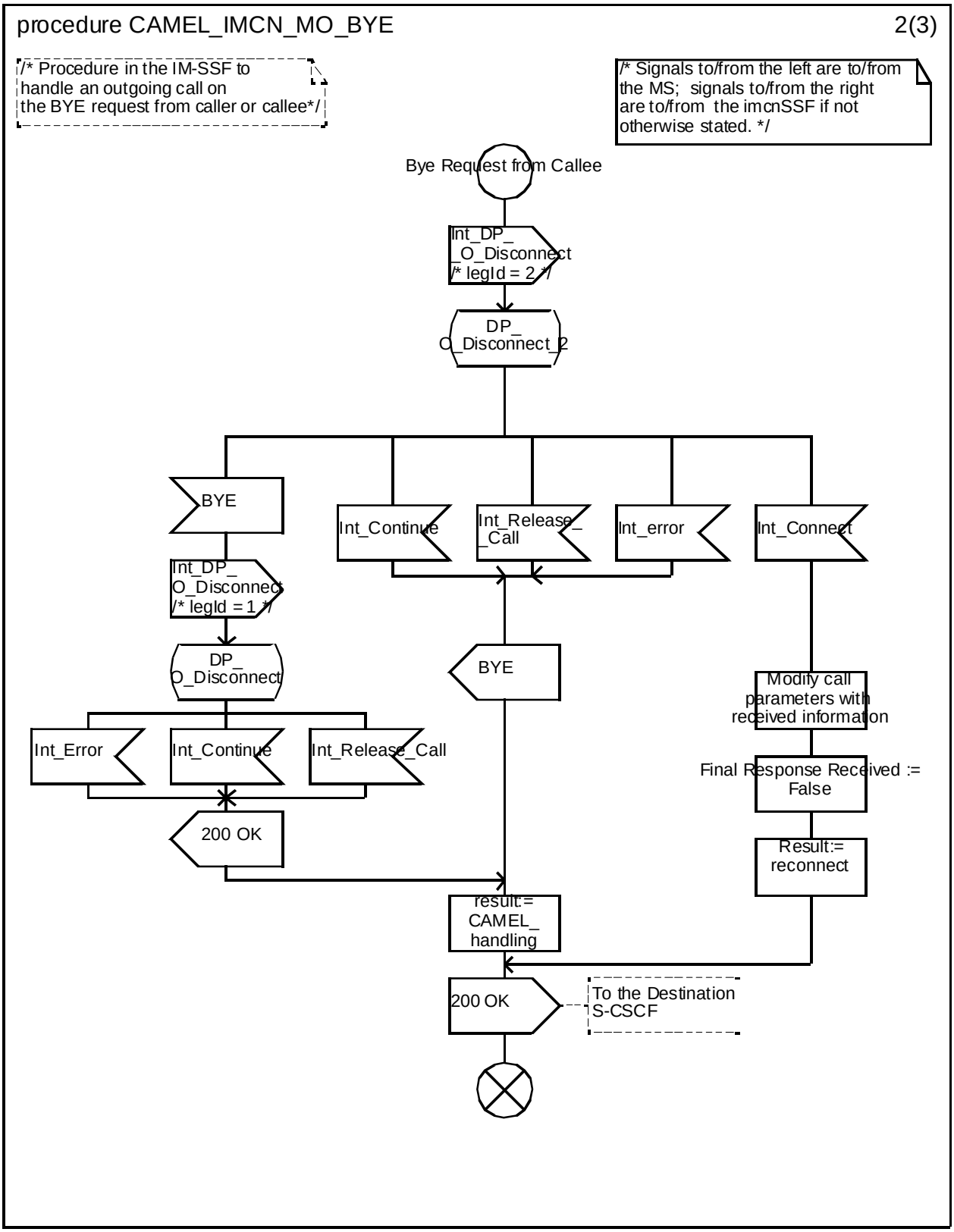

procedure CAMEL_IMCN_MO_BYE
2(3)
/* Procedure in the IM-SSF to handle an outgoing call on the BYE request from caller or callee*/
/* Signals to/from the left are to/from the MS; signals to/from the right are to/from the imcnSSF if not otherwise stated. */
Bye Request from Callee
Int_DP_ _O_Disconnect /* legId = 2 */
DP_ O_Disconnect_2
BYE
Int_Continue
Int_Release_ _Call
Int_error
Int_Connect
Int_DP_ O_Disconnect /* legId = 1 */
DP_ O_Disconnect
BYE
Modify call parameters with received information
Int_Error
Int_Continue
Int_Release_Call
Final Response Received := False
200 OK
Result:= reconnect
result:= CAMEL_ handling
200 OK
To the Destination S-CSCF

Figure 5.10b

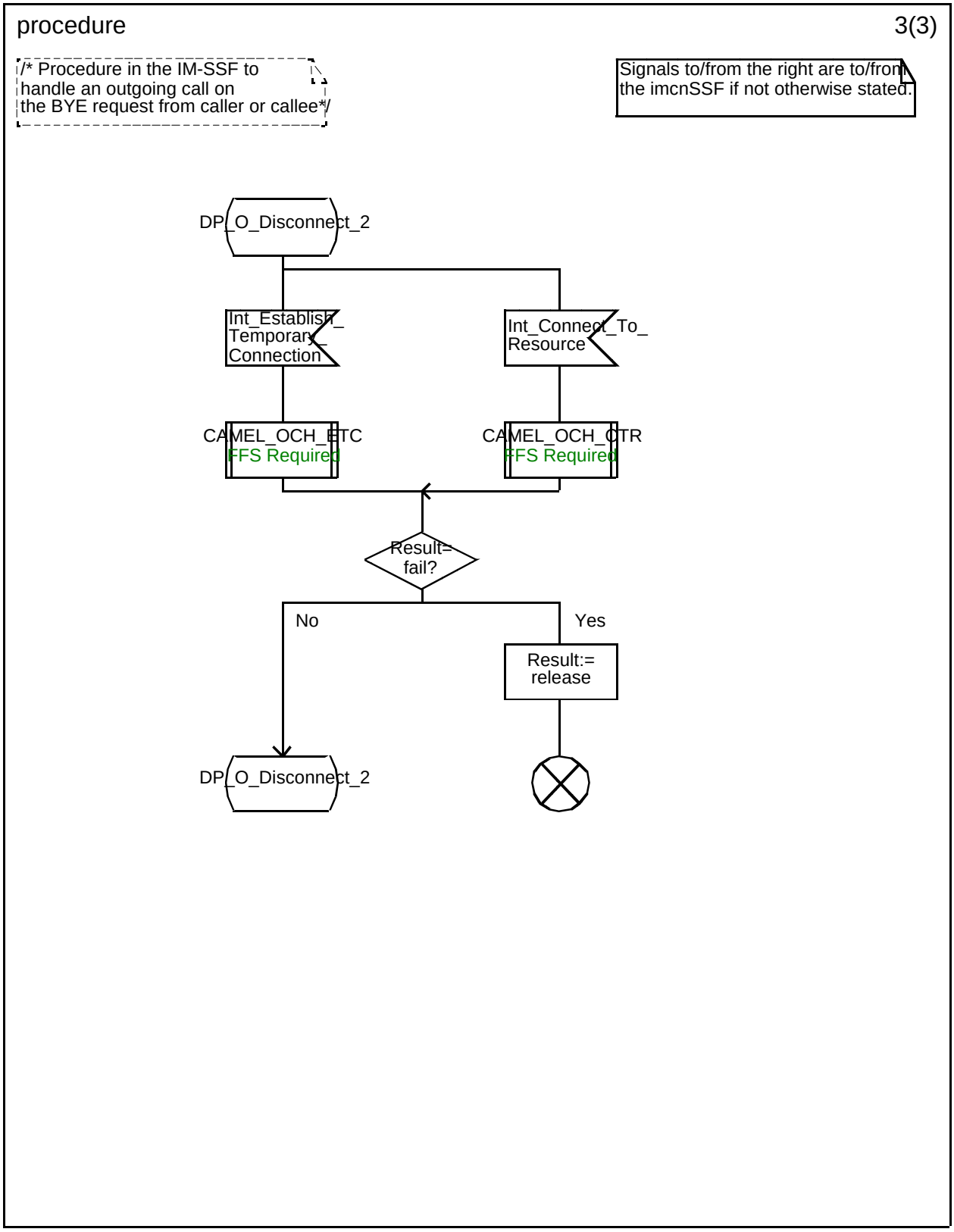

procedure
3(3)
/* Procedure in the IM-SSF to handle an outgoing call on the BYE request from caller or callee*/
Signals to/from the right are to/from the imcnSSF if not otherwise stated.
DP_O_Disconnect_2
Int_Establish_Temporary_Connection
Int_Connect_To_Resource
CAMEL_OCH_ETC
FFS Required
CAMEL_OCH_CTR
FFS Required
Result= fail?
No
Yes
Result:= release
DP_O_Disconnect_2

Figure 5.10c

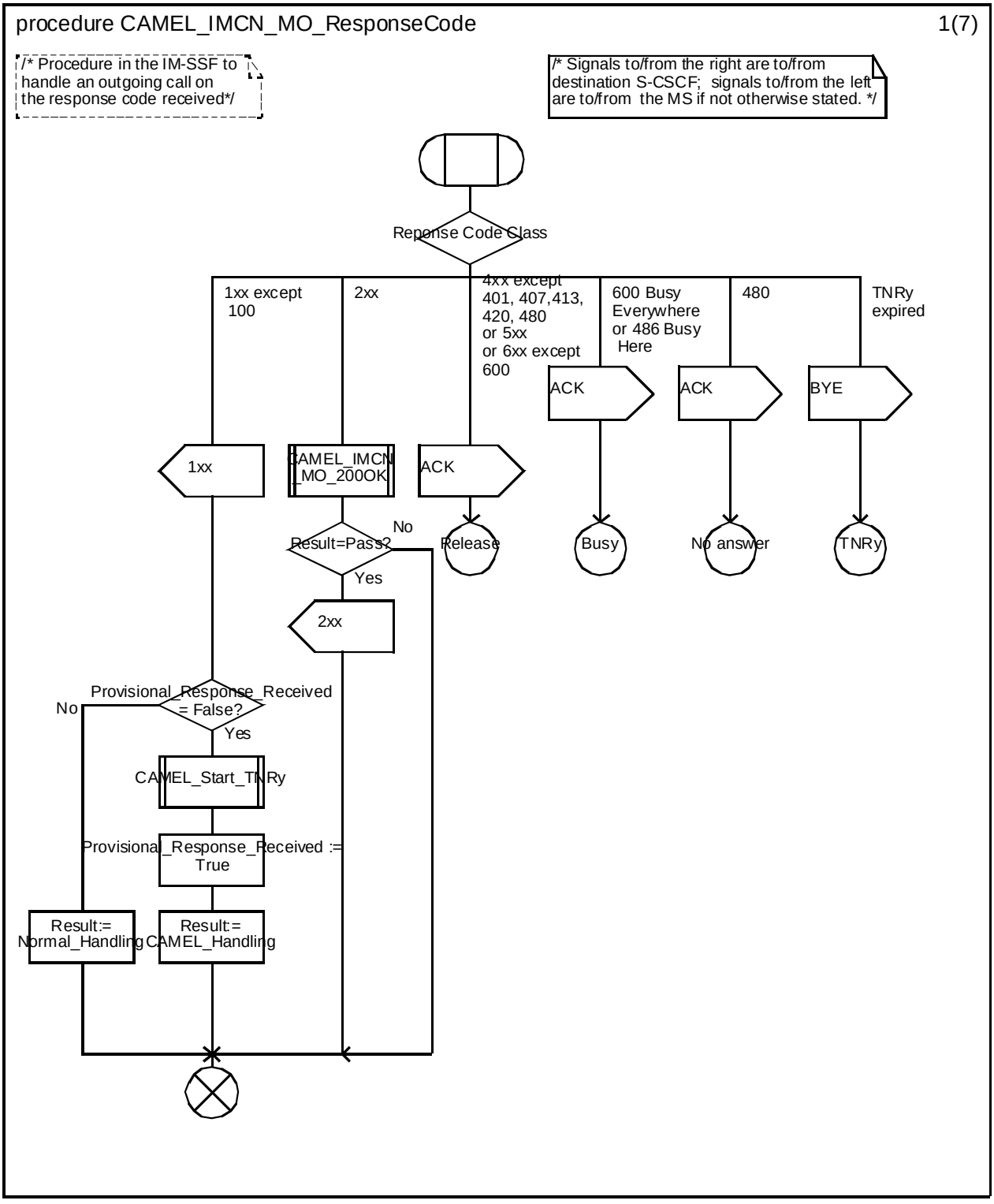

procedure CAMEL_IMCN_MO_ResponseCode
1(7)
/* Procedure in the IM-SSF to handle an outgoing call on the response code received*/
/* Signals to/from the right are to/from destination S-CSCF; signals to/from the left are to/from the MS if not otherwise stated. */
Reponse Code Class
1xx except 100
2xx
4xx except 401, 407,413, 420, 480 or 5xx or 6xx except 600
600 Busy Everywhere or 486 Busy Here
480
TNRy expired
ACK
ACK
BYE
1xx
CAMEL_IMCN_MO_200OK
ACK
No
Result=Pass?
Yes
Release
Busy
No answer
TNRy
2xx
Provisional_Response_Received = False?
No
Yes
CAMEL_Start_TNRy
Provisional_Response_Received := True
Result:= Normal_Handling
Result:= CAMEL_Handling

Figure 5.11a

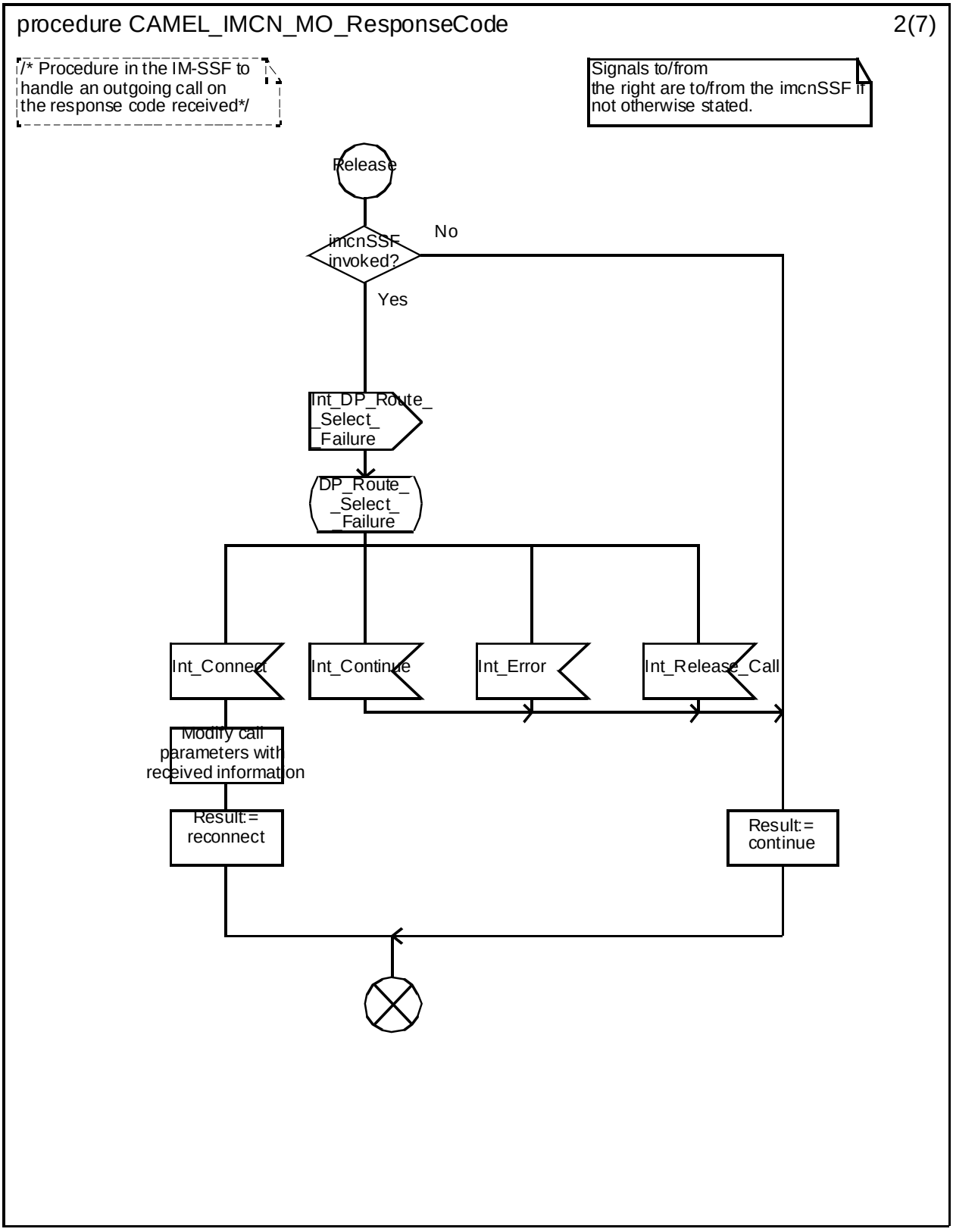

procedure CAMEL_IMCN_MO_ResponseCode
2(7)
/* Procedure in the IM-SSF to handle an outgoing call on the response code received*/
Signals to/from the right are to/from the imcnSSF if not otherwise stated.
Release
imcnSSF invoked?
No
Yes
Int_DP_Route_Select_Failure
DP_Route_Select_Failure
Int_Connect
Int_Continue
Int_Error
Int_Release_Call
Modify call parameters with received information
Result:= reconnect
Result:= continue

Figure 5.11b

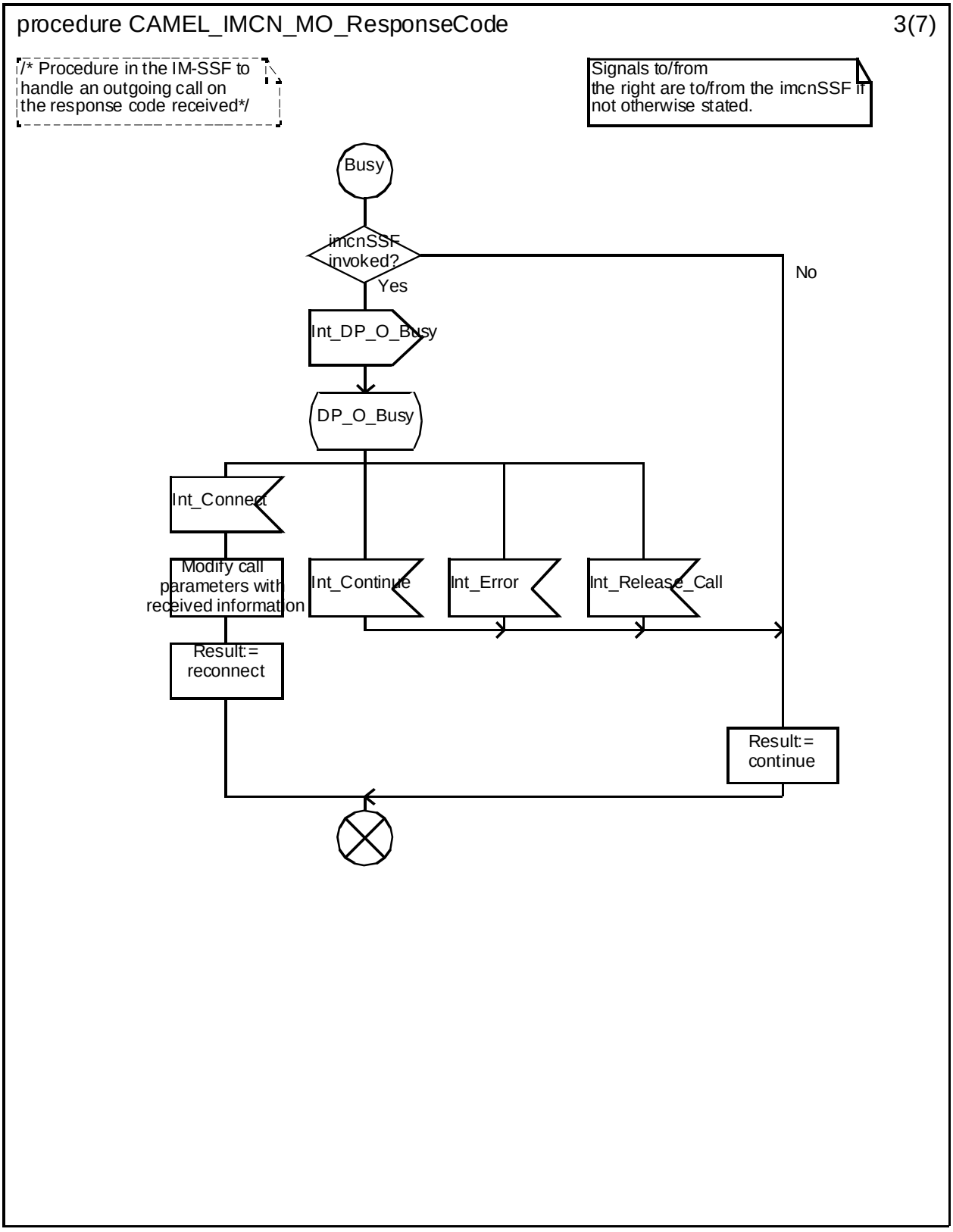

procedure CAMEL_IMCN_MO_ResponseCode
3(7)
/* Procedure in the IM-SSF to handle an outgoing call on the response code received*/
Signals to/from the right are to/from the imcnSSF if not otherwise stated.
Busy
imcnSSF invoked?
No
Yes
Int_DP_O_Busy
DP_O_Busy
Int_Connect
Modify call parameters with received information
Int_Continue
Int_Error
Int_Release_Call
Result:= reconnect
Result:= continue

Figure 5.11c

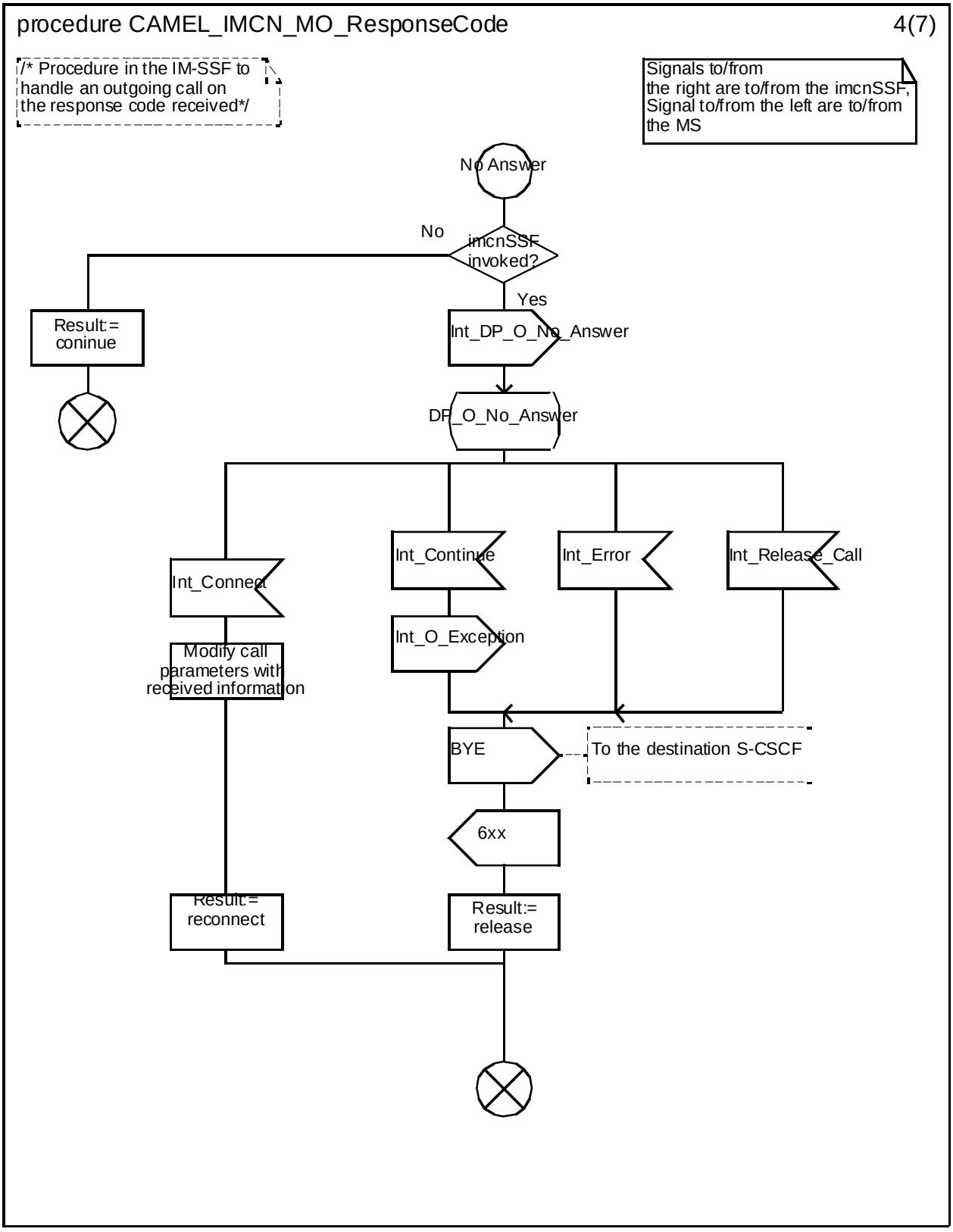

procedure CAMEL_IMCN_MO_ResponseCode
4(7)
/* Procedure in the IM-SSF to handle an outgoing call on the response code received*/
Signals to/from the right are to/from the imcnSSF, Signal to/from the left are to/from the MS
No Answer
No
imcnSSF invoked?
Yes
Result:= coninue
Int_DP_O_No_Answer
DP_O_No_Answer
Int_Connect
Int_Continue
Int_Error
Int_Release_Call
Int_O_Exception
Modify call parameters with received information
BYE
To the destination S-CSCF
6xx
Result:= reconnect
Result:= release

Figure 5.11d

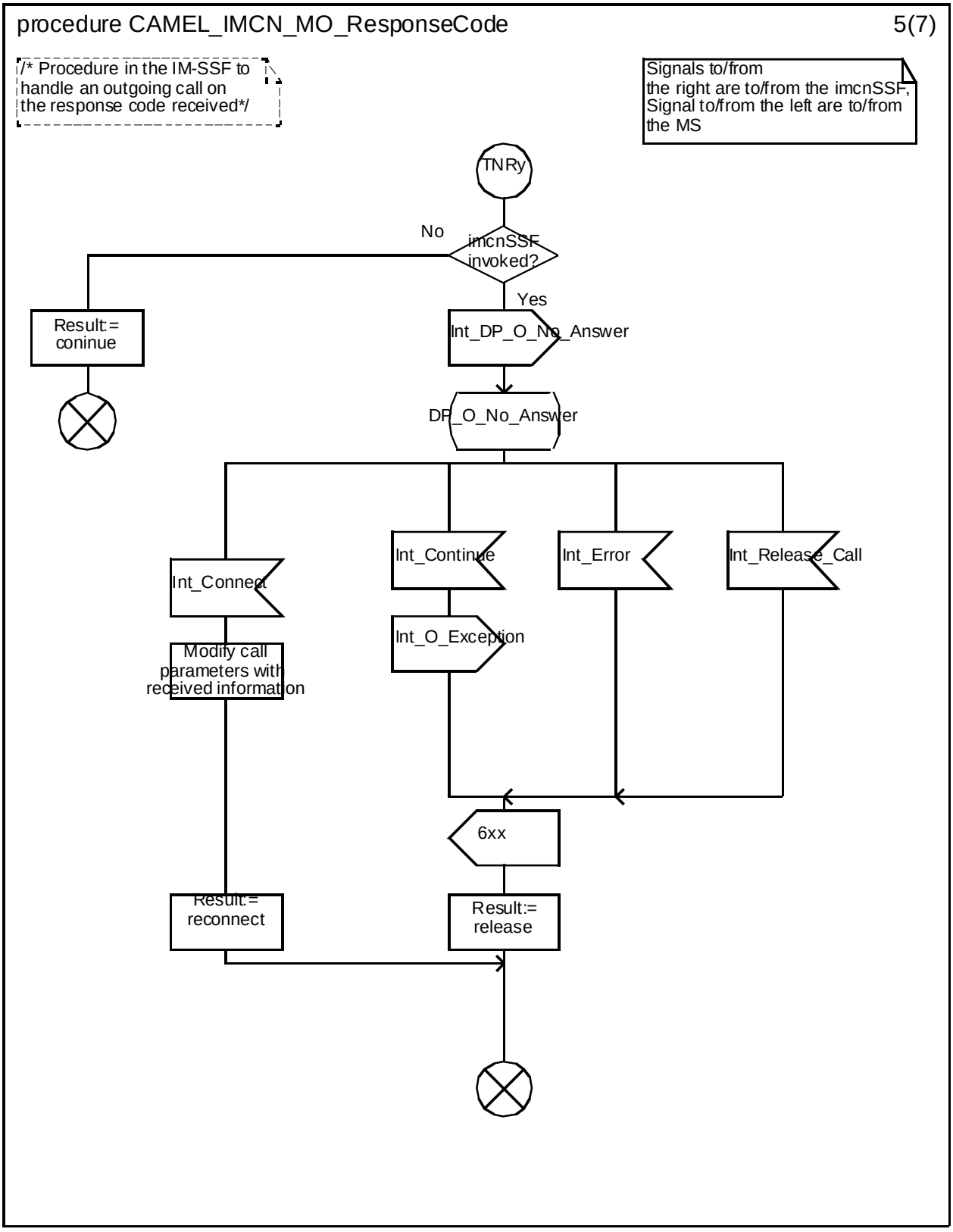

procedure CAMEL_IMCN_MO_ResponseCode
5(7)
/* Procedure in the IM-SSF to handle an outgoing call on the response code received*/
Signals to/from the right are to/from the imcnSSF, Signal to/from the left are to/from the MS
TNRy
No
imcnSSF invoked?
Yes
Result:= coninue
Int_DP_O_No_Answer
DP_O_No_Answer
Int_Connect
Int_Continue
Int_Error
Int_Release_Call
Int_O_Exception
Modify call parameters with received information
6xx
Result:= reconnect
Result:= release

Figure 5.11e

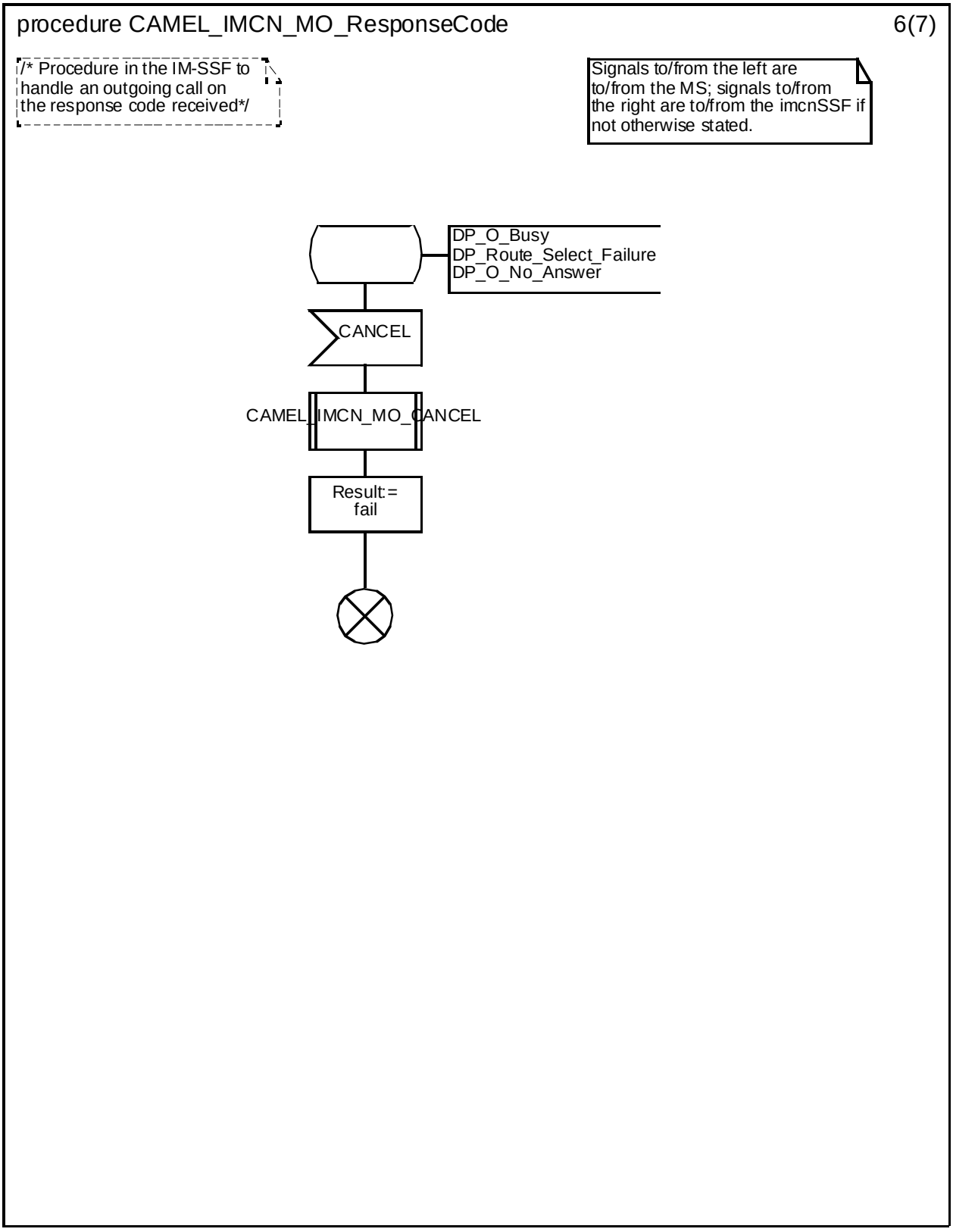

procedure CAMEL_IMCN_MO_ResponseCode
6(7)
/* Procedure in the IM-SSF to handle an outgoing call on the response code received*/
Signals to/from the left are to/from the MS; signals to/from the right are to/from the imcnSSF if not otherwise stated.
DP_O_Busy
DP_Route_Select_Failure
DP_O_No_Answer
CANCEL
CAMEL_IMCN_MO_CANCEL
Result:= fail

Figure 5.11f

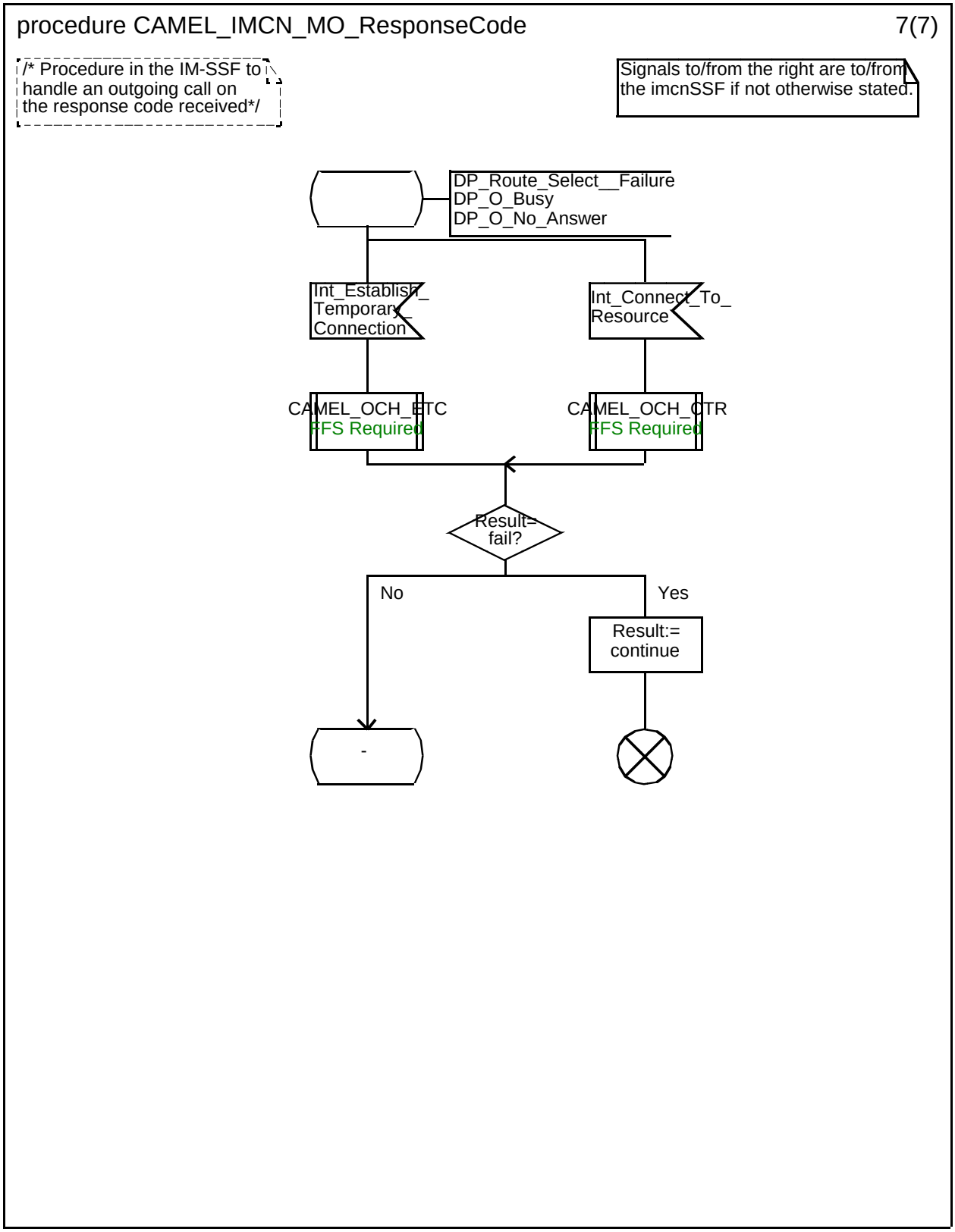

procedure CAMEL_IMCN_MO_ResponseCode
7(7)
/* Procedure in the IM-SSF to handle an outgoing call on the response code received*/
Signals to/from the right are to/from the imcnSSF if not otherwise stated.
DP_Route_Select__Failure
DP_O_Busy
DP_O_No_Answer
Int_Establish_ Temporary_ Connection
Int_Connect_To_ Resource
CAMEL_OCH_ETC
FFS Required
CAMEL_OCH_CTR
FFS Required
Result= fail?
No
Yes
Result:= continue
-

Figure 5.11g

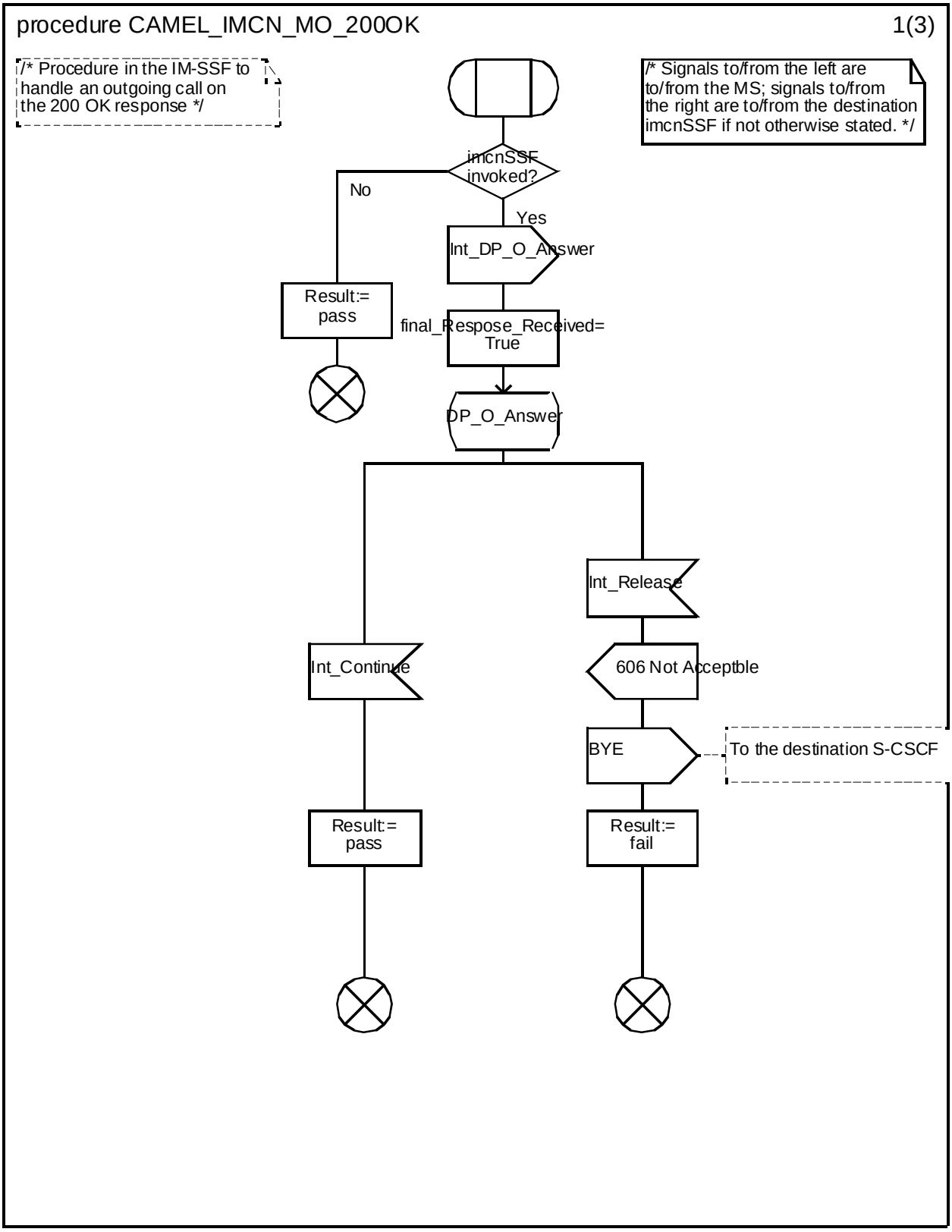

procedure CAMEL_IMCN_MO_200OK
1(3)
/* Procedure in the IM-SSF to handle an outgoing call on the 200 OK response */
/* Signals to/from the left are to/from the MS; signals to/from the right are to/from the destination imcnSSF if not otherwise stated. */
imcnSSF invoked?
No
Yes
Int_DP_O_Answer
Result:= pass
final_Respose_Received= True
DP_O_Answer
Int_Release
Int_Continue
606 Not Acceptble
BYE
To the destination S-CSCF
Result:= pass
Result:= fail

Figure 5.12a

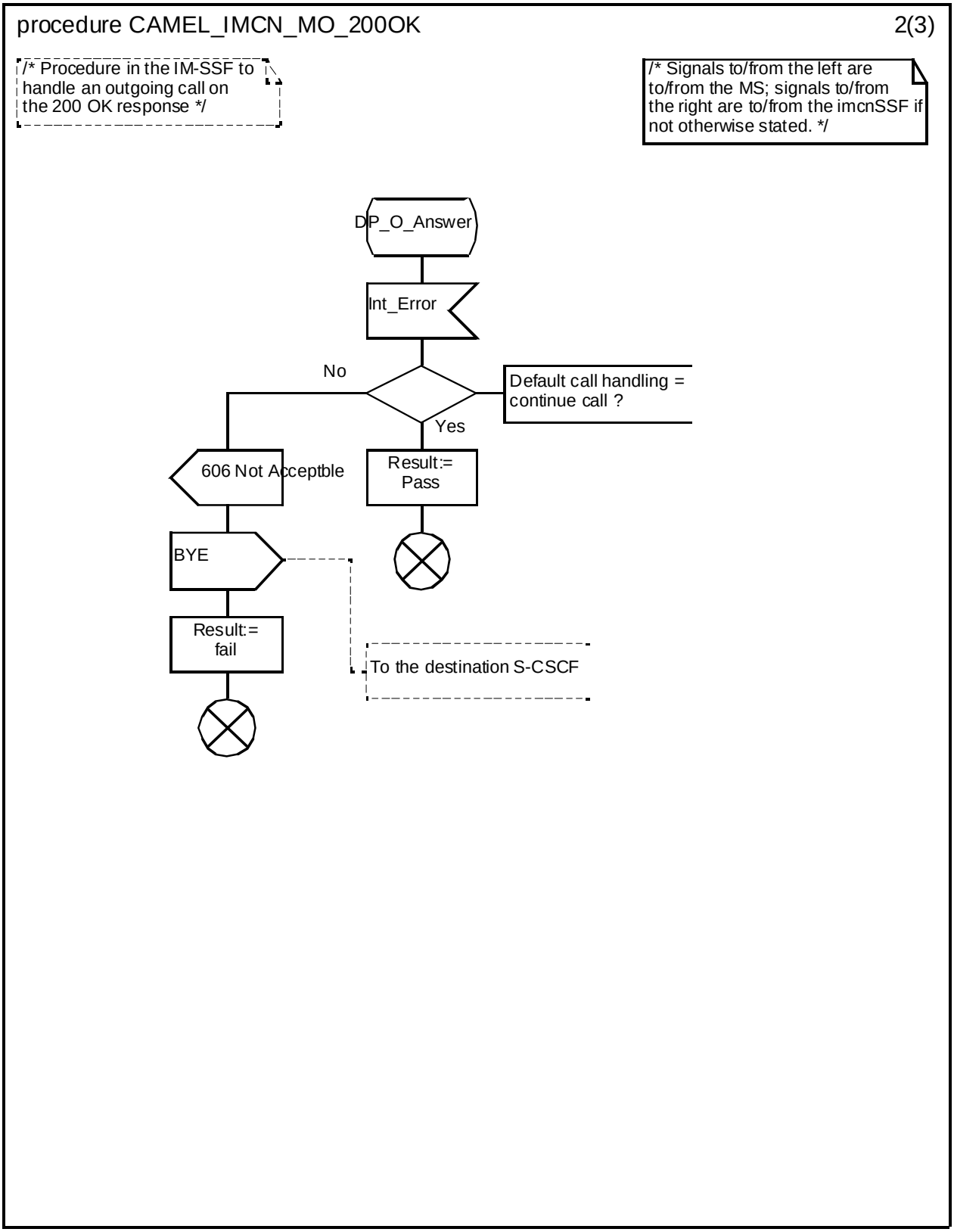

procedure CAMEL_IMCN_MO_200OK
2(3)
/* Procedure in the IM-SSF to handle an outgoing call on the 200 OK response */
/* Signals to/from the left are to/from the MS; signals to/from the right are to/from the imcnSSF if not otherwise stated. */
DP_O_Answer
Int_Error
No
Default call handling = continue call ?
Yes
606 Not Acceptble
Result:= Pass
BYE
Result:= fail
To the destination S-CSCF

Figure 5.12b

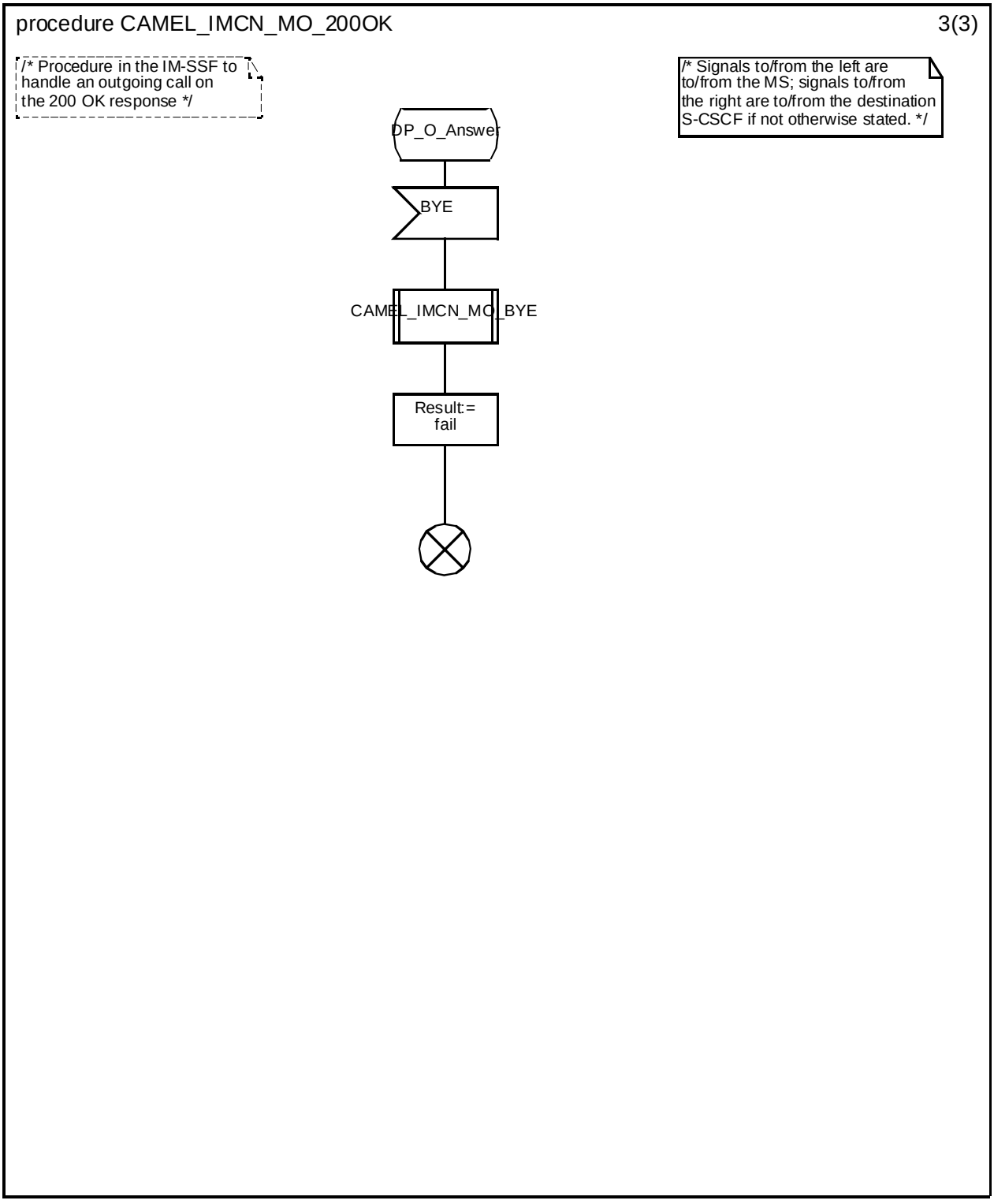

procedure CAMEL_IMCN_MO_200OK
3(3)
/* Procedure in the IM-SSF to handle an outgoing call on the 200 OK response */
/* Signals to/from the left are to/from the MS; signals to/from the right are to/from the destination S-CSCF if not otherwise stated. */
DP_O_Answer
BYE
CAMEL_IMCN_MO_BYE
Result:= fail

Figure 5.12c

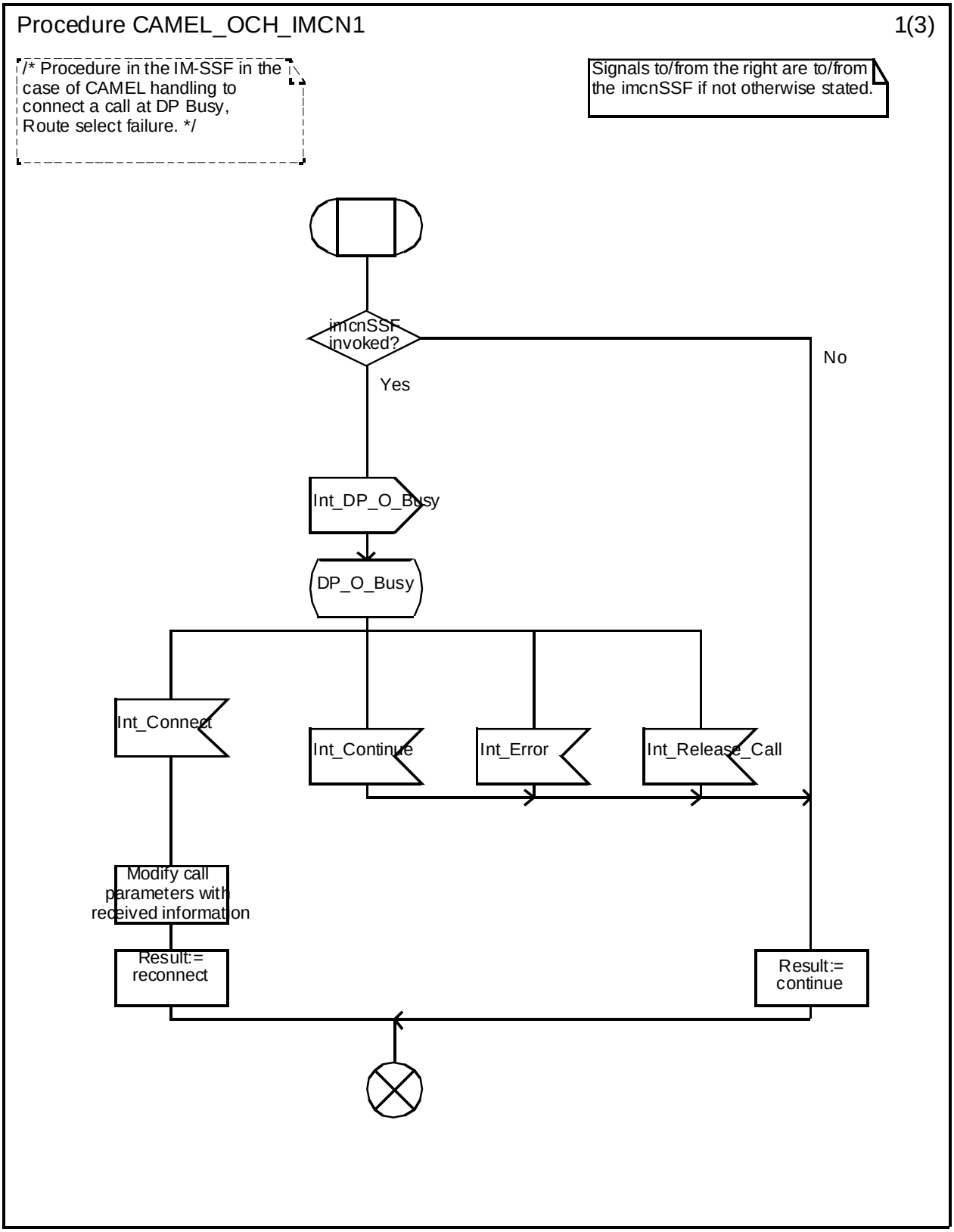

Procedure CAMEL_OCH_IMCN1
1(3)
/* Procedure in the IM-SSF in the case of CAMEL handling to connect a call at DP Busy, Route select failure. */
Signals to/from the right are to/from the imcnSSF if not otherwise stated.
imcnSSF invoked?
No
Yes
Int_DP_O_Busy
DP_O_Busy
Int_Connect
Int_Continue
Int_Error
Int_Release_Call
Modify call parameters with received information
Result:= reconnect
Result:= continue

Figure 5.13a

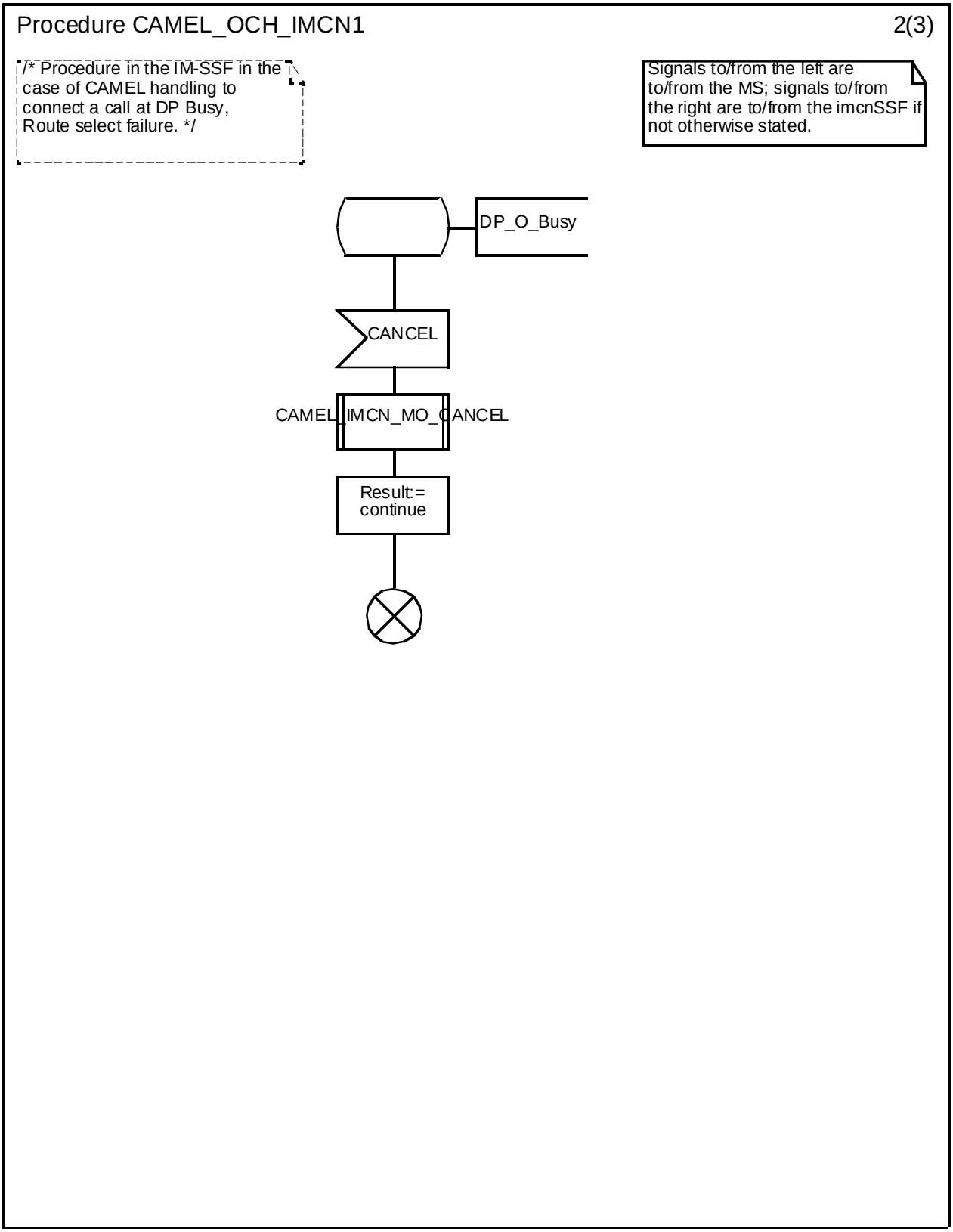

Procedure CAMEL_OCH_IMCN1
2(3)
/* Procedure in the IM-SSF in the case of CAMEL handling to connect a call at DP Busy, Route select failure. */
Signals to/from the left are to/from the MS; signals to/from the right are to/from the imcnSSF if not otherwise stated.
DP_O_Busy
CANCEL
CAMEL_IMCN_MO_CANCEL
Result:= continue

Figure 5.13b

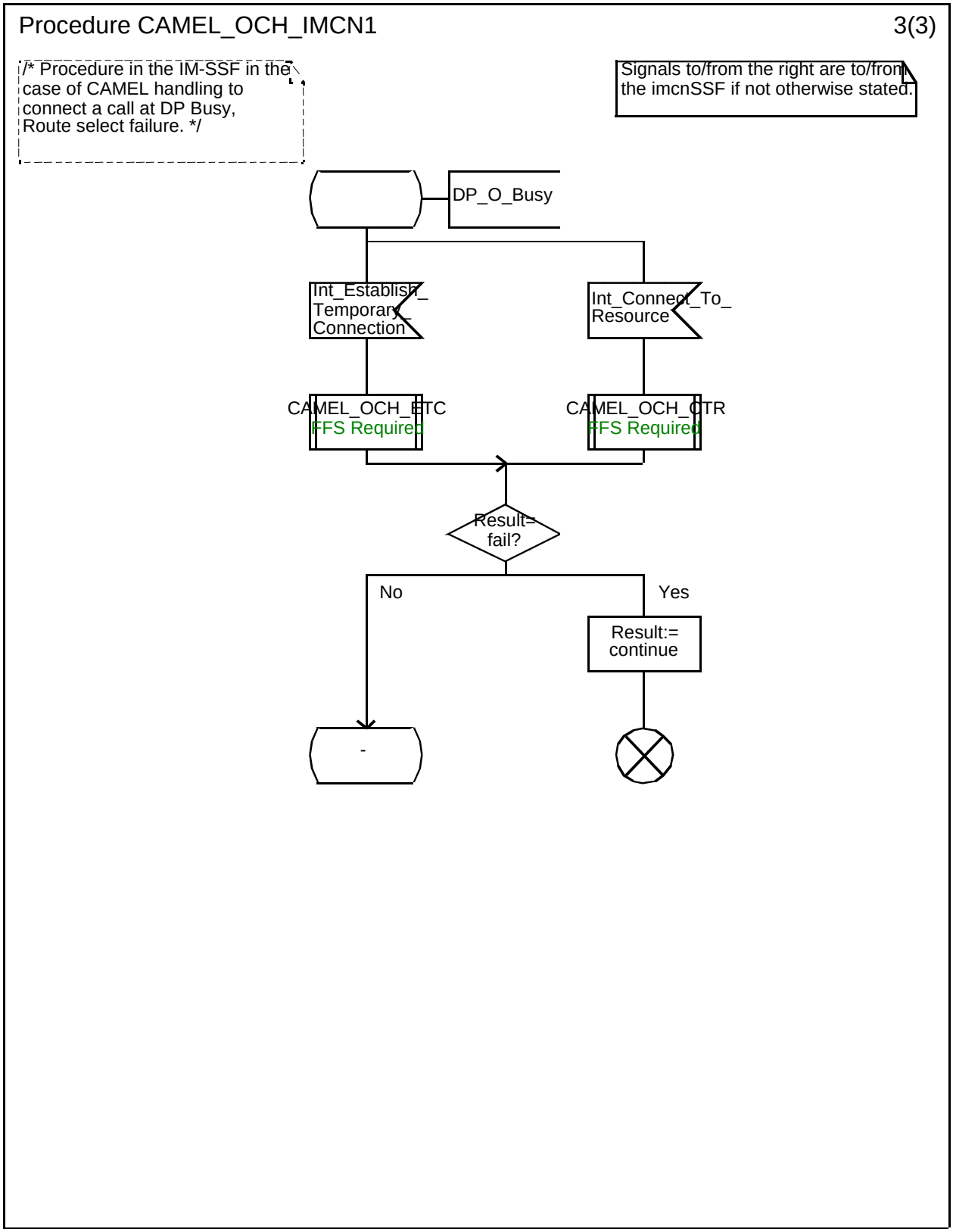

Procedure CAMEL_OCH_IMCN1
3(3)
/* Procedure in the IM-SSF in the case of CAMEL handling to connect a call at DP Busy, Route select failure. */
Signals to/from the right are to/from the imcnSSF if not otherwise stated.
DP_O_Busy
Int_Establish_ Temporary_ Connection
Int_Connect_To_ Resource
CAMEL_OCH_ETC FFS Required
CAMEL_OCH_CTR FFS Required
Result= fail?
No
Yes
Result:= continue
-

Figure 5.13c

5.1.3 Handling of Mobile Terminated Calls in the IM-SSF

The functional behaviour of the S-CSCF for handling terminating calls is specified in 3GPP TS 23.218 [5]. The procedures specific to CAMEL are specified in this subclause:

- Procedure CAMEL_IMCN_MT_INVITE;
- Procedure CAMEL_IMCN_MT_BYE;
- Procedure CAMEL_IMCN_MT_CANCEL
- Procedure CAMEL_IMCN_MT_Response_Code.

5.1.3.1 Actions of the IM-SSF on receipt of Int_Error

The IM-SSF checks the default Call Handling parameter in the relevant CSI.

If the default call handling is release, a BYE indication is sent to the originating CSCF. The IM-SSF then releases all resources and the invoked CAMEL procedure ends.

If the call handling is continue, the IM-SSF continues processing without CAMEL support.

5.1.3.2 Actions of the IM-SSF on receipt of Int_Release_Call

The IM-SSF BYE message is sent to the originating CSCF and resources are released.

5.1.3.3 Actions of the IM-SSF on receipt of Int_Continue_With_Argument

The IM-SSF shall replace the call parameters by the information received in the Int_Continue_With_Argument message. Call parameters that are not included in the Int_Continue_With_Argument_Message are unchanged.

5.1.3.4 Actions of the IM-SSF on the receipt of Int_Connect

Editor's note : Text to be provided in future

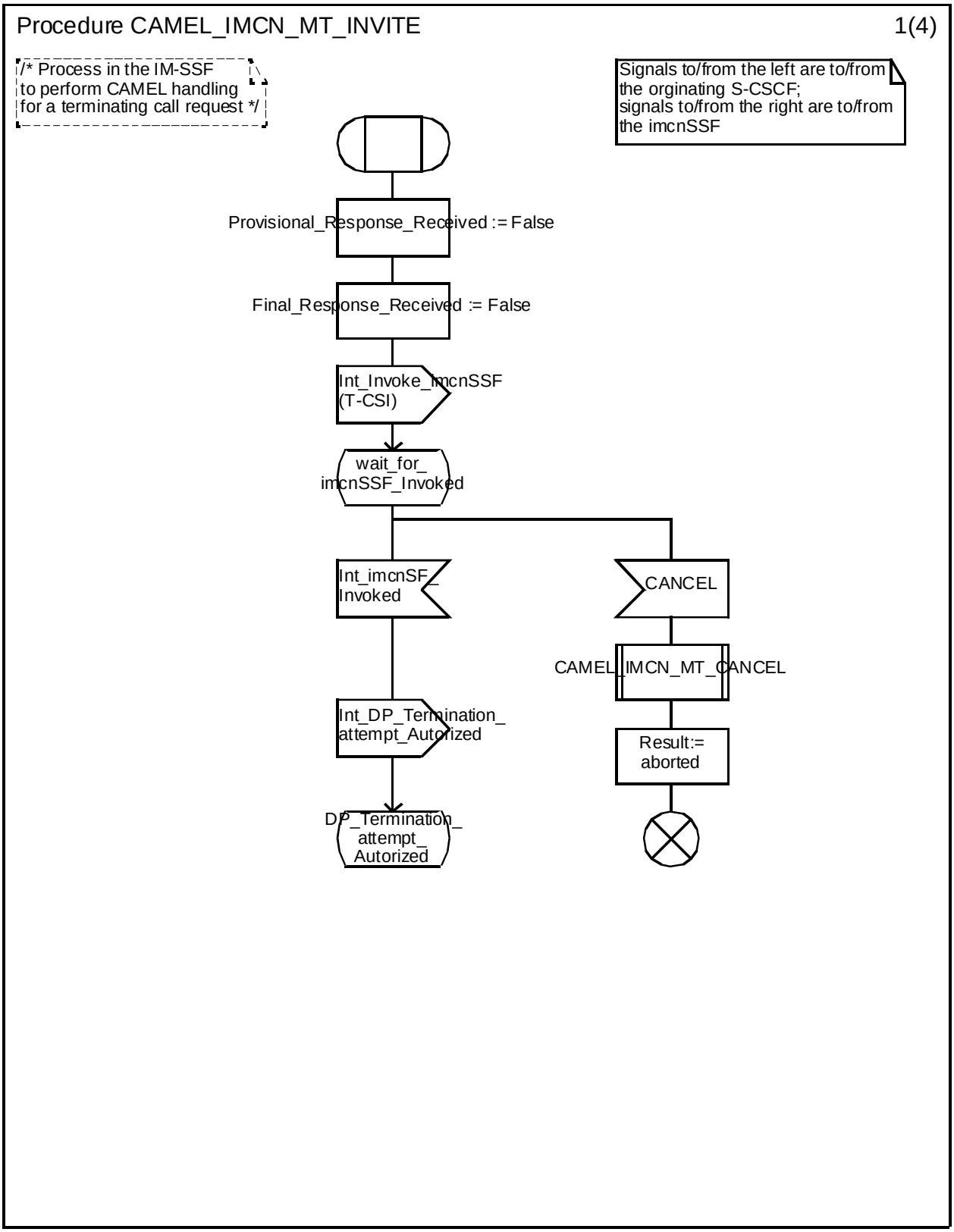

Procedure CAMEL_IMCN_MT_INVITE
1(4)
/* Process in the IM-SSF to perform CAMEL handling for a terminating call request */
Signals to/from the left are to/from the orginating S-CSCF; signals to/from the right are to/from the imcnSSF
Provisional_Response_Received := False
Final_Response_Received := False
Int_Invoke_ImcnSSF (T-CSI)
wait_for_ imcnSSF_Invoked
Int_imcnSF_ Invoked
CANCEL
CAMEL_IMCN_MT_CANCEL
Int_DP_Termination_ attempt_Autorized
Result:= aborted
DP_Termination_ attempt_ Autorized

Figure 5.14a

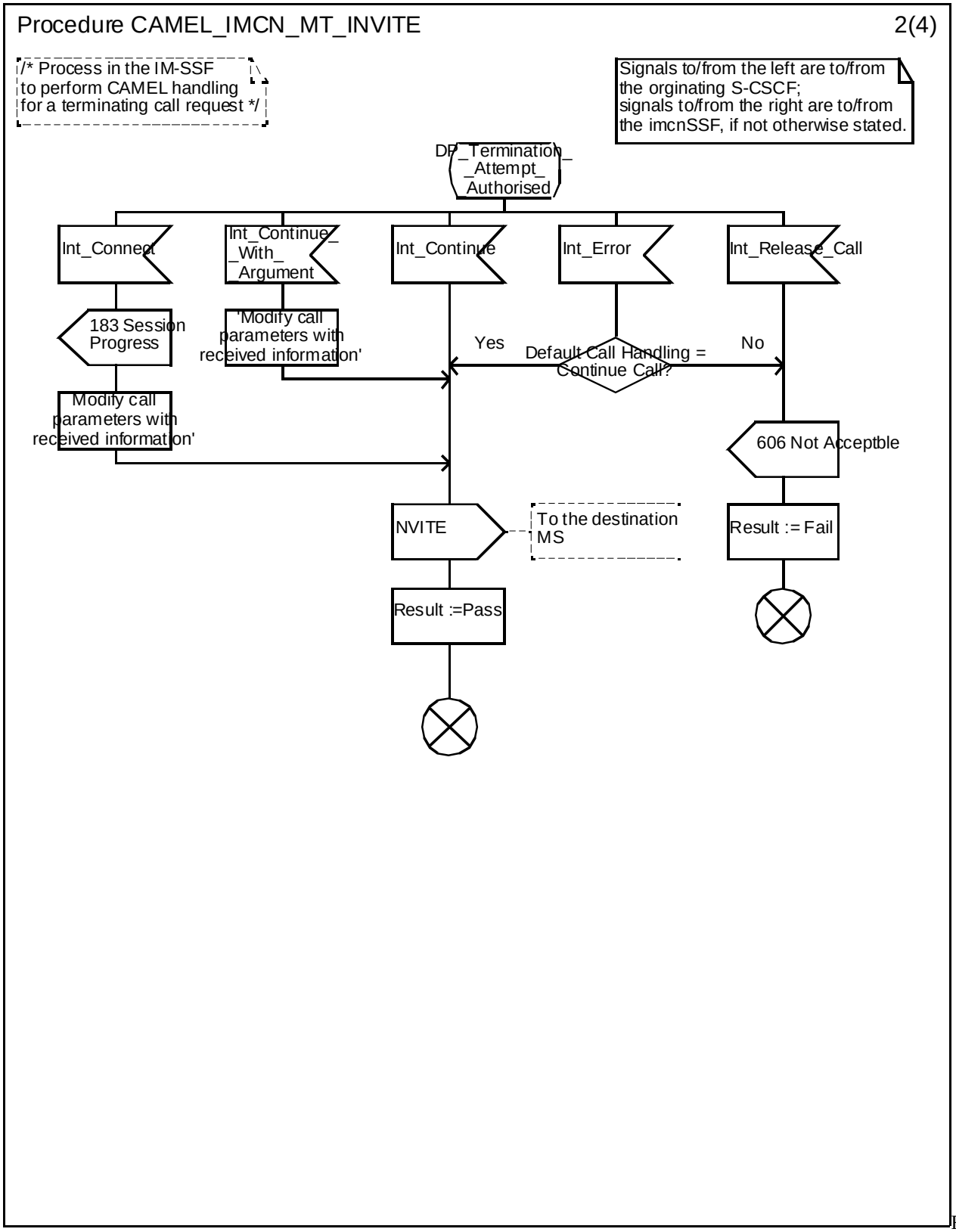

Procedure CAMEL_IMCN_MT_INVITE
2(4)
/* Process in the IM-SSF to perform CAMEL handling for a terminating call request */
Signals to/from the left are to/from the orginating S-CSCF; signals to/from the right are to/from the imcnSSF, if not otherwise stated.
DP_Termination_ _Attempt_ Authorised
Int_Connect
Int_Continue_ _With_ _Argument
Int_Continue
Int_Error
Int_Release_Call
183 Session Progress
'Modify call parameters with received information'
Yes
Default Call Handling = Continue Call?
No
Modify call parameters with received information'
606 Not Acceptble
NVITE
To the destination MS
Result := Fail
Result :=Pass

Figure 5.14b

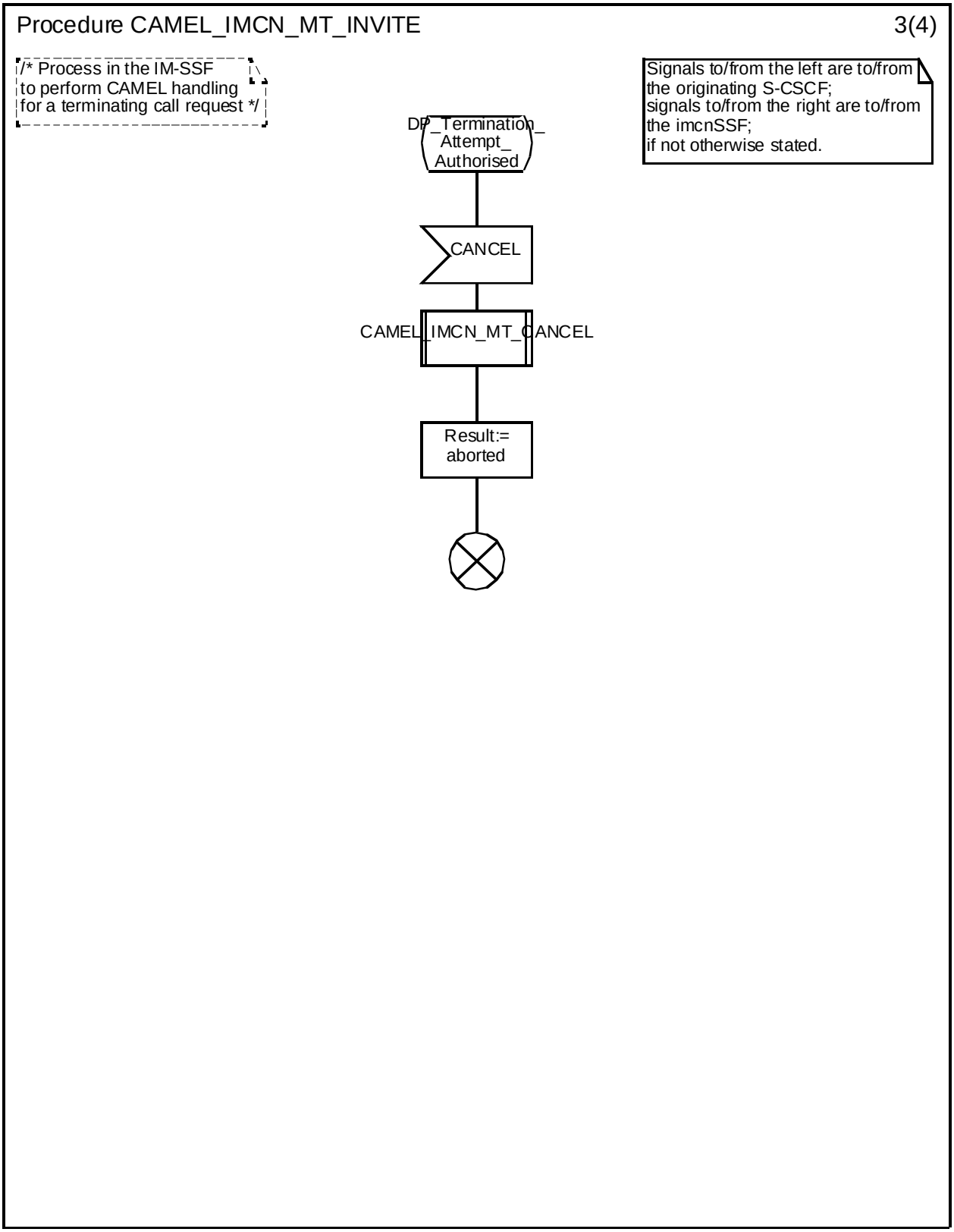

Procedure CAMEL_IMCN_MT_INVITE
3(4)
/* Process in the IM-SSF
to perform CAMEL handling
for a terminating call request */
Signals to/from the left are to/from
the originating S-CSCF;
signals to/from the right are to/from
the imcnSSF;
if not otherwise stated.
DP_Termination_
Attempt_
Authorised
CANCEL
CAMEL_IMCN_MT_CANCEL
Result:=
aborted

Figure 5.14c

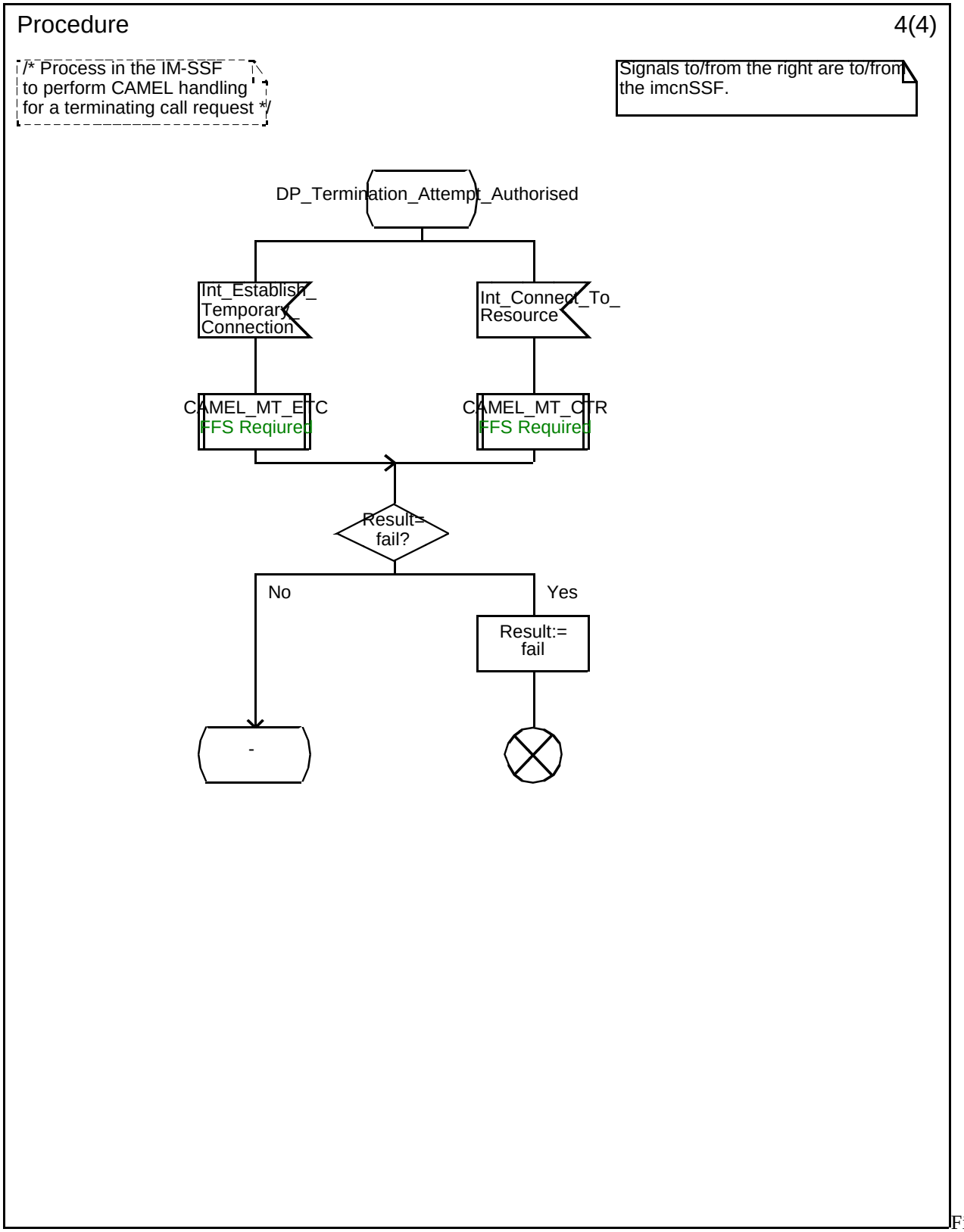

Procedure
4(4)
/* Process in the IM-SSF to perform CAMEL handling for a terminating call request */
Signals to/from the right are to/from the imcnSSF.
DP_Termination_Attempt_Authorised
Int_Establish_ Temporary_ Connection
Int_Connect_To_ Resource
CAMEL_MT_ETC FFS Reqiured
CAMEL_MT_CTR FFS Required
Result= fail?
No
Yes
Result:= fail
-

Figure 5.14d:

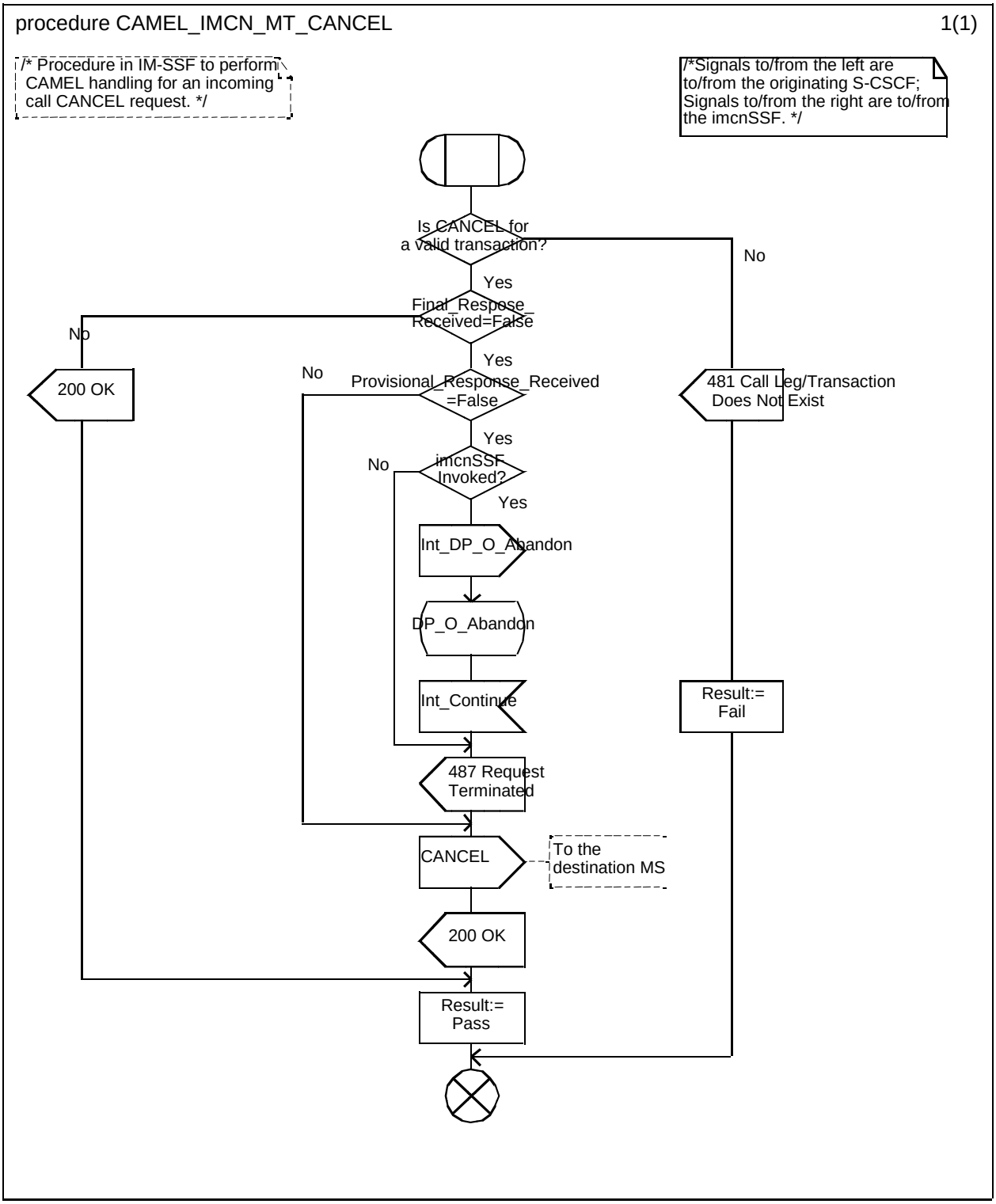

procedure CAMEL_IMCN_MT_CANCEL
1(1)
/* Procedure in IM-SSF to perform CAMEL handling for an incoming call CANCEL request. */
/*Signals to/from the left are to/from the originating S-CSCF; Signals to/from the right are to/from the imcnSSF. */
Is CANCEL for a valid transaction?
No
Yes
Final_Respose_ Received=False
No
Yes
200 OK
No
Provisional_Response_Received =False
481 Call Leg/Transaction Does Not Exist
Yes
No
imcnSSF Invoked?
Yes
Int_DP_O_Abandon
DP_O_Abandon
Int_Continue
Result:= Fail
487 Request Terminated
CANCEL
To the destination MS
200 OK
Result:= Pass

Figure 5.15

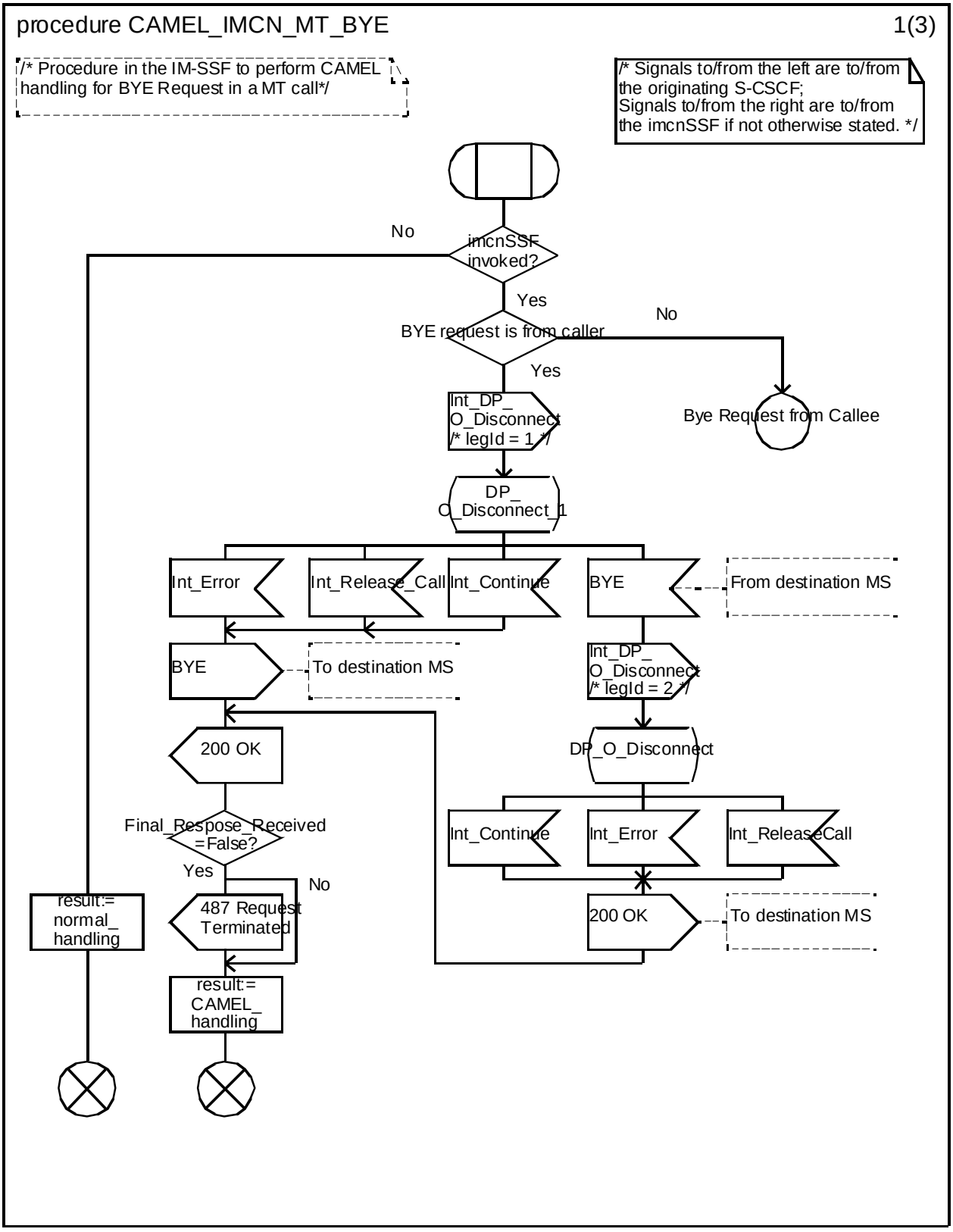

procedure CAMEL_IMCN_MT_BYE
1(3)
/* Procedure in the IM-SSF to perform CAMEL handling for BYE Request in a MT call*/
/* Signals to/from the left are to/from the originating S-CSCF;
Signals to/from the right are to/from the imcnSSF if not otherwise stated. */
No
imcnSSF invoked?
Yes
BYE request is from caller
No
Yes
Int_DP_ O_Disconnect /* legId = 1 */
Bye Request from Callee
DP_ O_Disconnect_1
Int_Error
Int_Release_Call
Int_Continue
BYE
From destination MS
BYE
To destination MS
Int_DP_ O_Disconnect /* legId = 2 */
200 OK
DP_O_Disconnect
Final_Respose_Received =False?
Int_Continue
Int_Error
Int_ReleaseCall
Yes
No
result:= normal_ handling
487 Request Terminated
200 OK
To destination MS
result:= CAMEL_ handling

Figure 5.16a

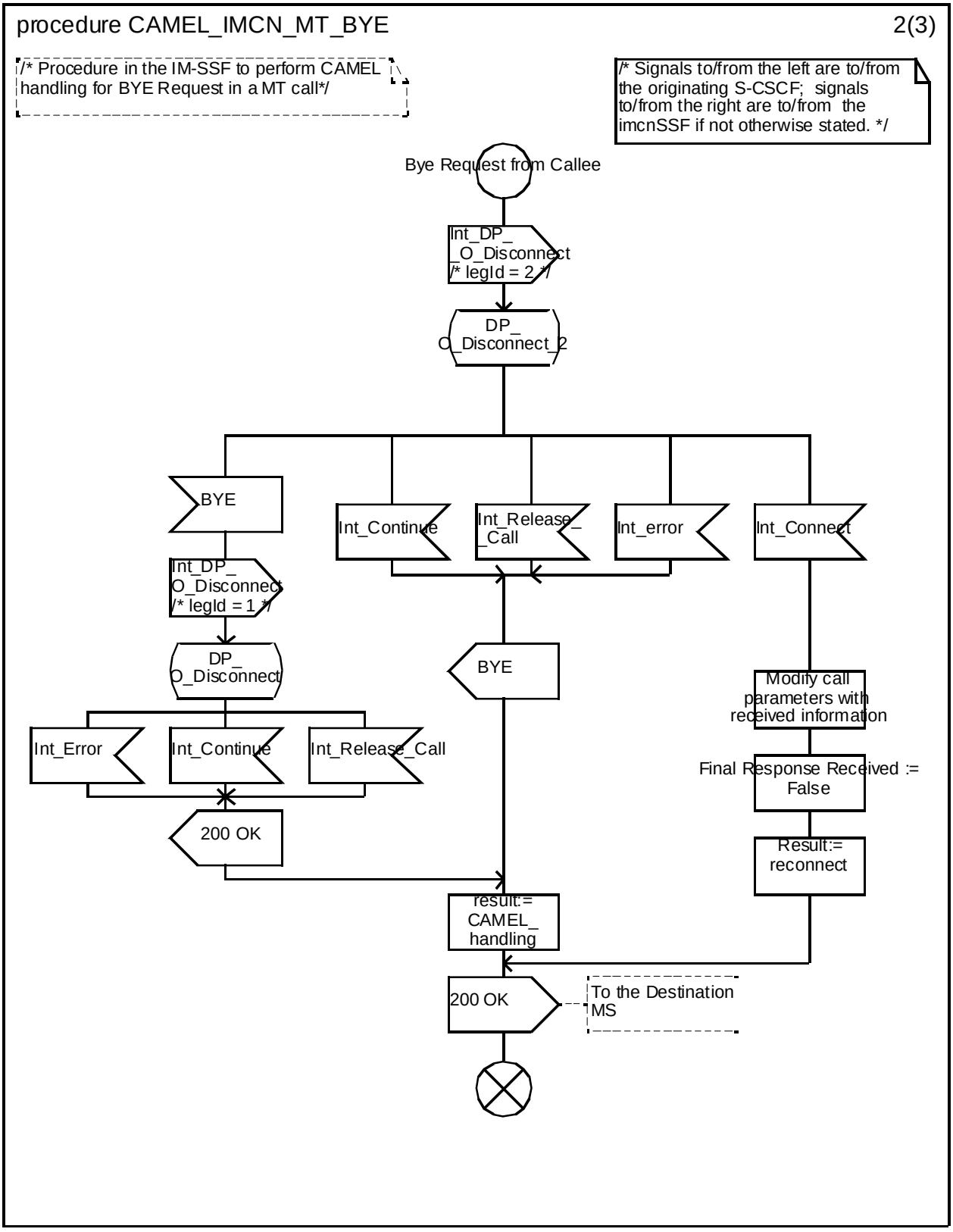

procedure CAMEL_IMCN_MT_BYE
2(3)
/* Procedure in the IM-SSF to perform CAMEL handling for BYE Request in a MT call*/
/* Signals to/from the left are to/from the originating S-CSCF; signals to/from the right are to/from the imcnSSF if not otherwise stated. */
Bye Request from Callee
Int_DP_ _O_Disconnect /* legId = 2 */
DP_ O_Disconnect_2
BYE
Int_Continue
Int_Release_ _Call
Int_error
Int_Connect
Int_DP_ O_Disconnect /* legId = 1 */
DP_ O_Disconnect
BYE
Modify call parameters with received information
Int_Error
Int_Continue
Int_Release_Call
Final Response Received := False
200 OK
Result:= reconnect
result:= CAMEL_ handling
200 OK
To the Destination MS

Figure 5.16b

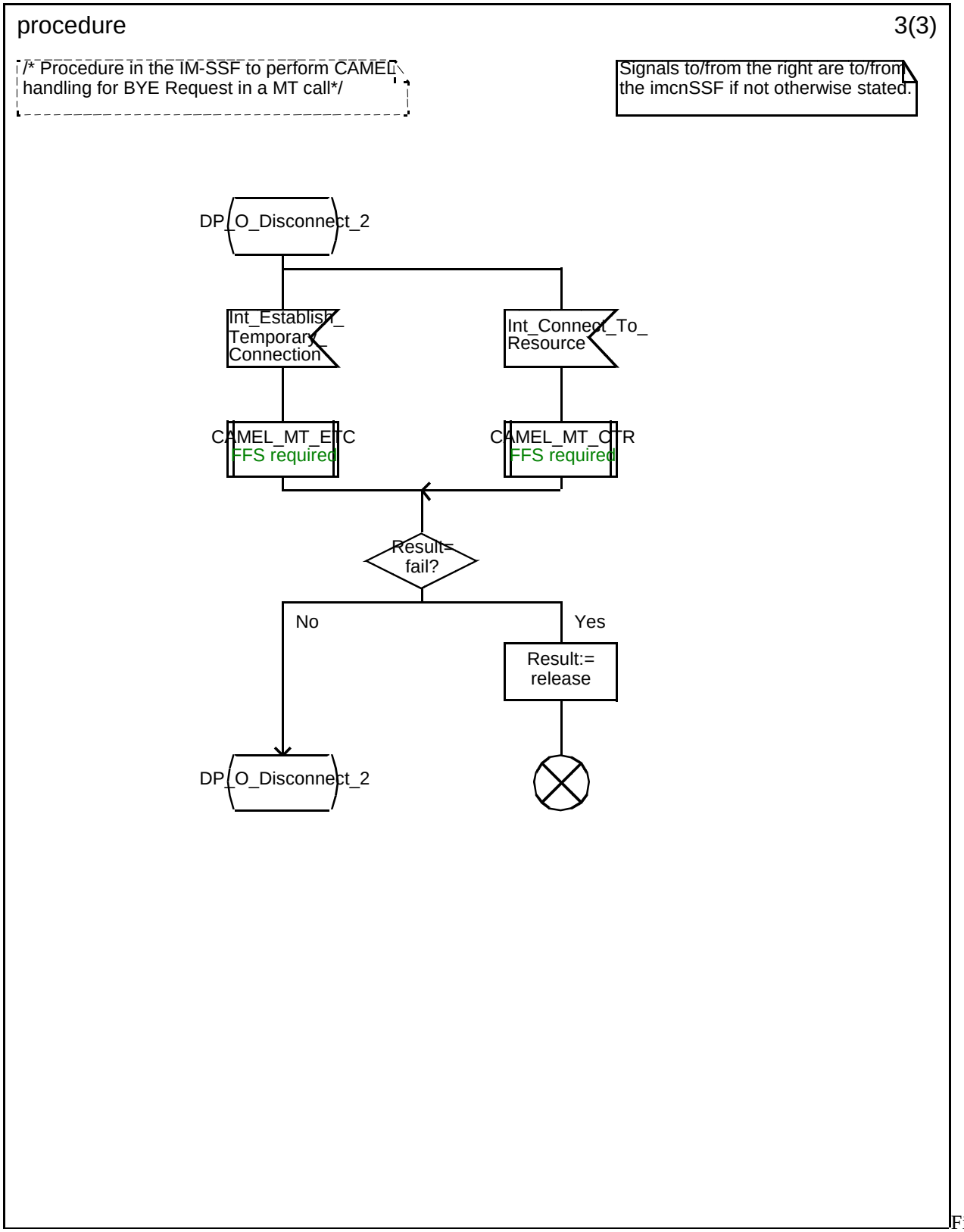

procedure
3(3)
/* Procedure in the IM-SSF to perform CAMEL handling for BYE Request in a MT call*/
Signals to/from the right are to/from the imcnSSF if not otherwise stated.
DP_O_Disconnect_2
Int_Establish_ Temporary_ Connection
Int_Connect_To_ Resource
CAMEL_MT_ETC FFS required
CAMEL_MT_CTR FFS required
Result= fail?
No
Yes
Result:= release
DP_O_Disconnect_2

Figure 5.16c

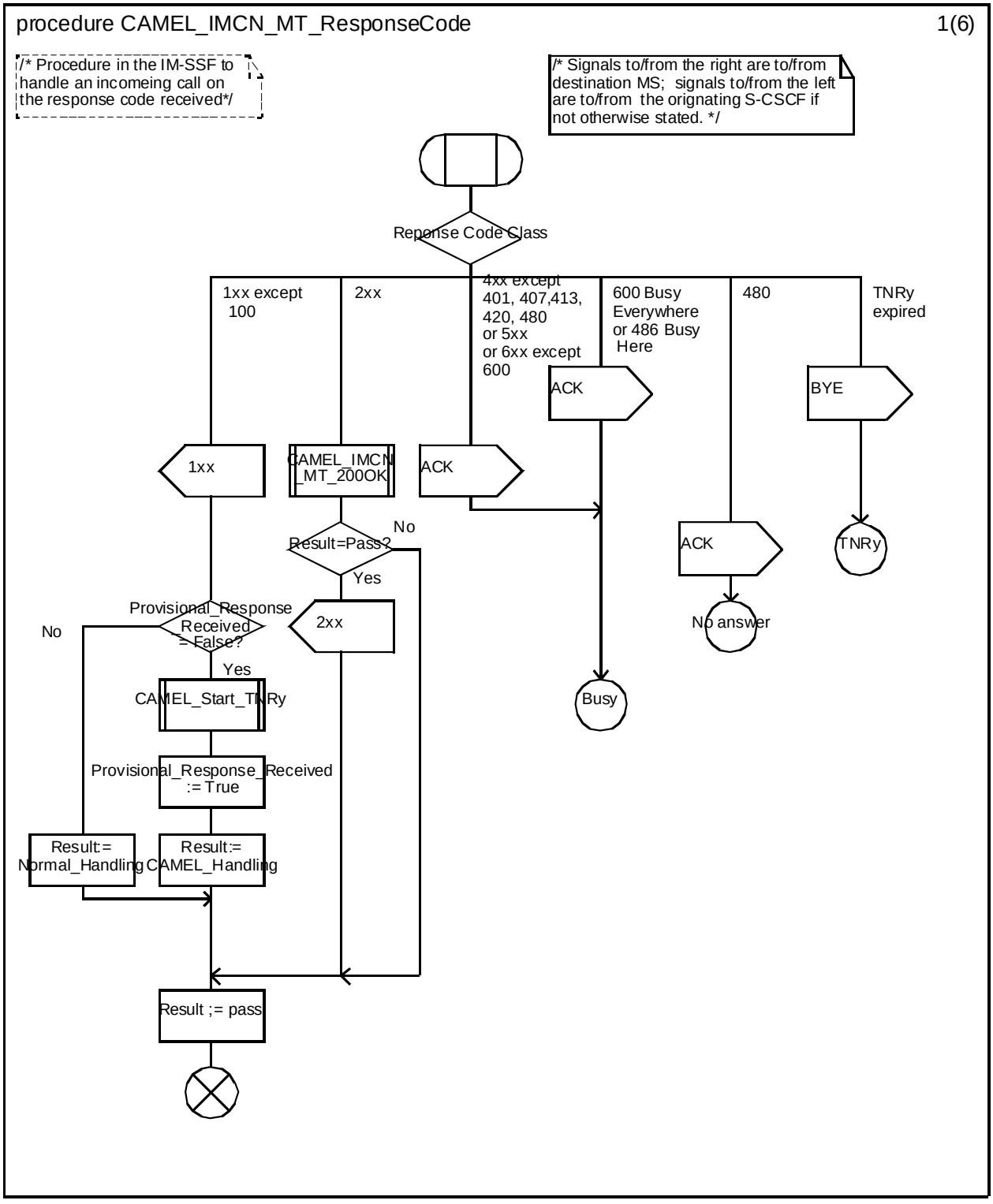

procedure CAMEL_IMCN_MT_ResponseCode
1(6)
/* Procedure in the IM-SSF to handle an incomeing call on the response code received*/
/* Signals to/from the right are to/from destination MS; signals to/from the left are to/from the orignating S-CSCF if not otherwise stated. */
Reponse Code Class
1xx except 100
2xx
4xx except 401, 407,413, 420, 480 or 5xx or 6xx except 600
600 Busy Everywhere or 486 Busy Here
480
TNRy expired
ACK
BYE
1xx
CAMEL_IMCN_MT_200OK
ACK
No
Result=Pass?
Yes
ACK
TNRy
Provisional_Response_Received = False?
2xx
No
No answer
Yes
CAMEL_Start_TNRy
Busy
Provisional_Response_Received := True
Result:= Normal_Handling
Result:= CAMEL_Handling
Result ;= pass

Figure 5.17a

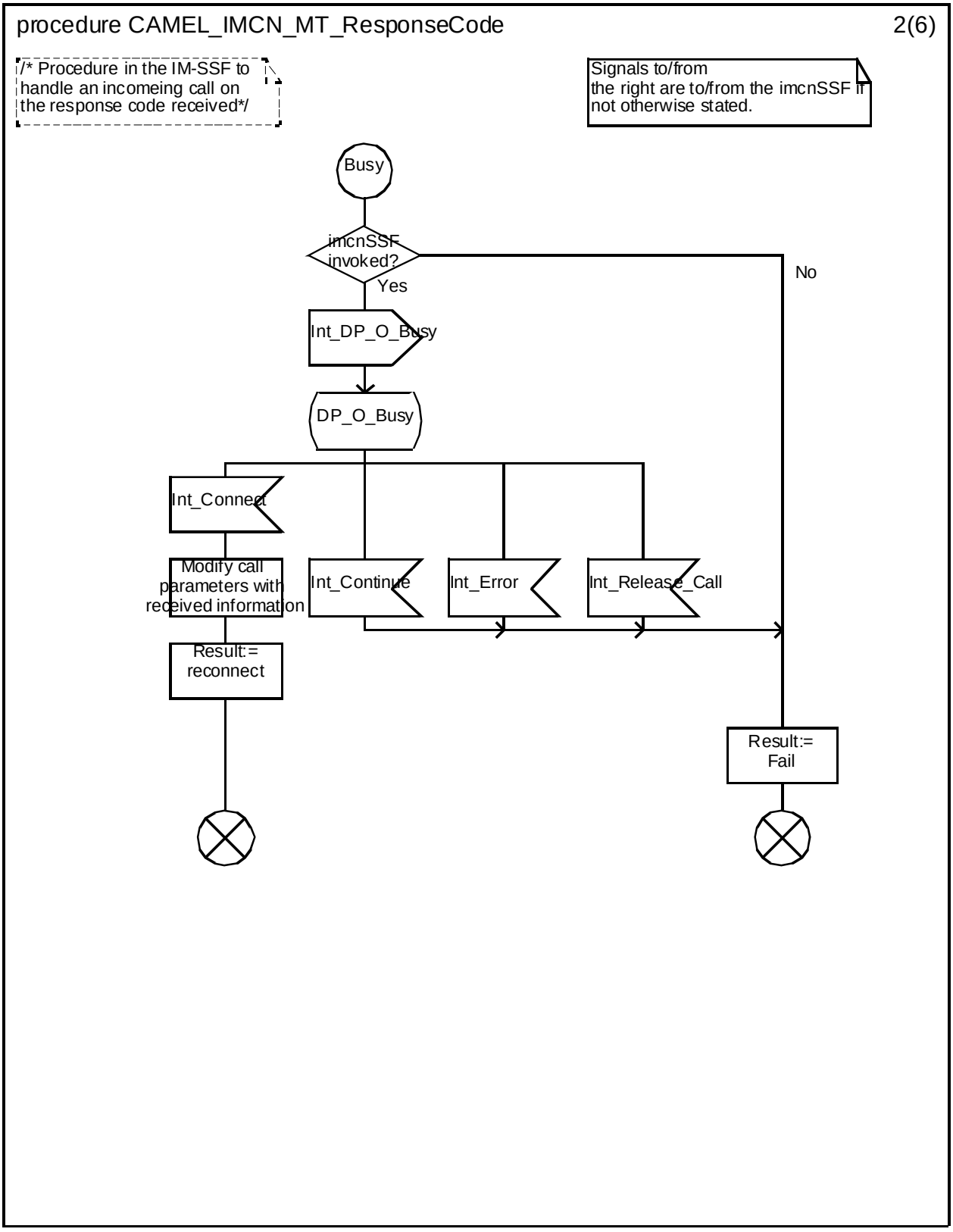

procedure CAMEL_IMCN_MT_ResponseCode
2(6)
/* Procedure in the IM-SSF to handle an incomeing call on the response code received*/
Signals to/from the right are to/from the imcnSSF if not otherwise stated.
Busy
imcnSSF invoked?
Yes
No
Int_DP_O_Busy
DP_O_Busy
Int_Connect
Modify call parameters with received information
Int_Continue
Int_Error
Int_Release_Call
Result:= reconnect
Result:= Fail

Figure 5.17b

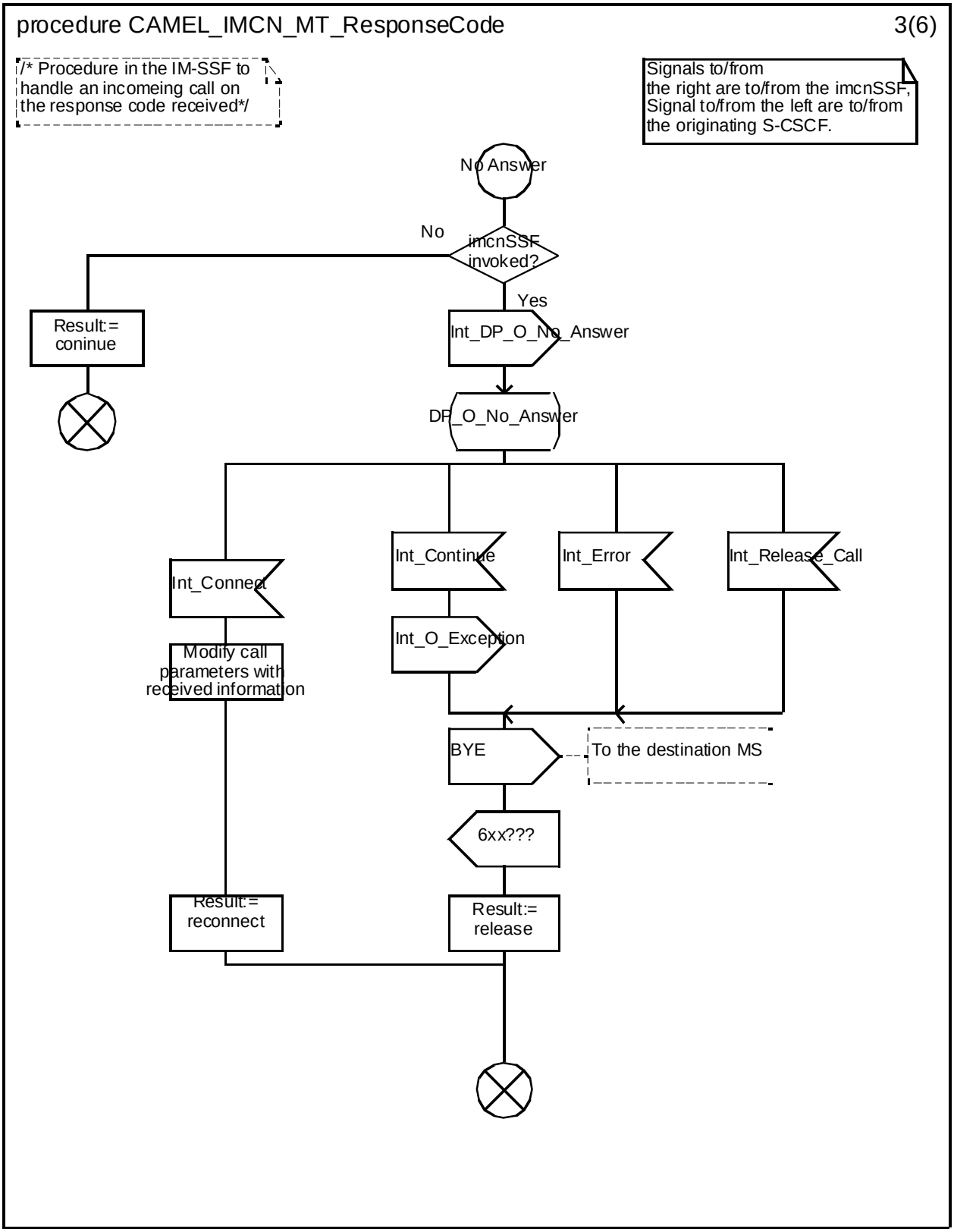

procedure CAMEL_IMCN_MT_ResponseCode
3(6)
/* Procedure in the IM-SSF to handle an incomeing call on the response code received*/
Signals to/from the right are to/from the imcnSSF; Signal to/from the left are to/from the originating S-CSCF.
No Answer
No
imcnSSF invoked?
Yes
Result:= coninue
Int_DP_O_No_Answer
DP_O_No_Answer
Int_Connect
Int_Continue
Int_Error
Int_Release_Call
Int_O_Exception
Modify call parameters with received information
BYE
To the destination MS
6xx???
Result:= reconnect
Result:= release

Figure 5.17c

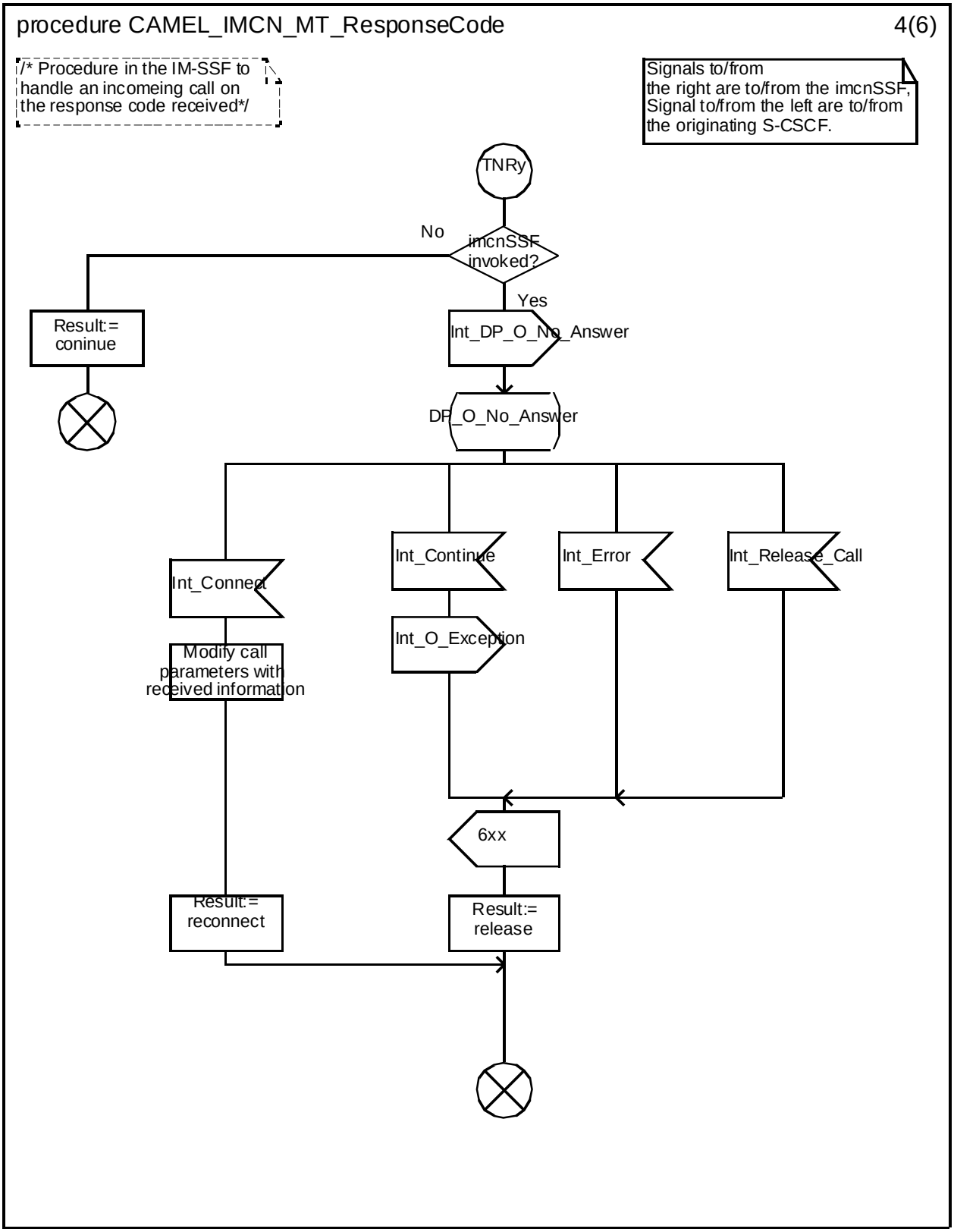

procedure CAMEL_IMCN_MT_ResponseCode
4(6)
/* Procedure in the IM-SSF to handle an incomeing call on the response code received*/
Signals to/from the right are to/from the imcnSSF; Signal to/from the left are to/from the originating S-CSCF.
TNRy
No
imcnSSF invoked?
Yes
Result:= coninue
Int_DP_O_No_Answer
DP_O_No_Answer
Int_Connect
Int_Continue
Int_Error
Int_Release_Call
Int_O_Exception
Modify call parameters with received information
6xx
Result:= reconnect
Result:= release

Figure 5.17d

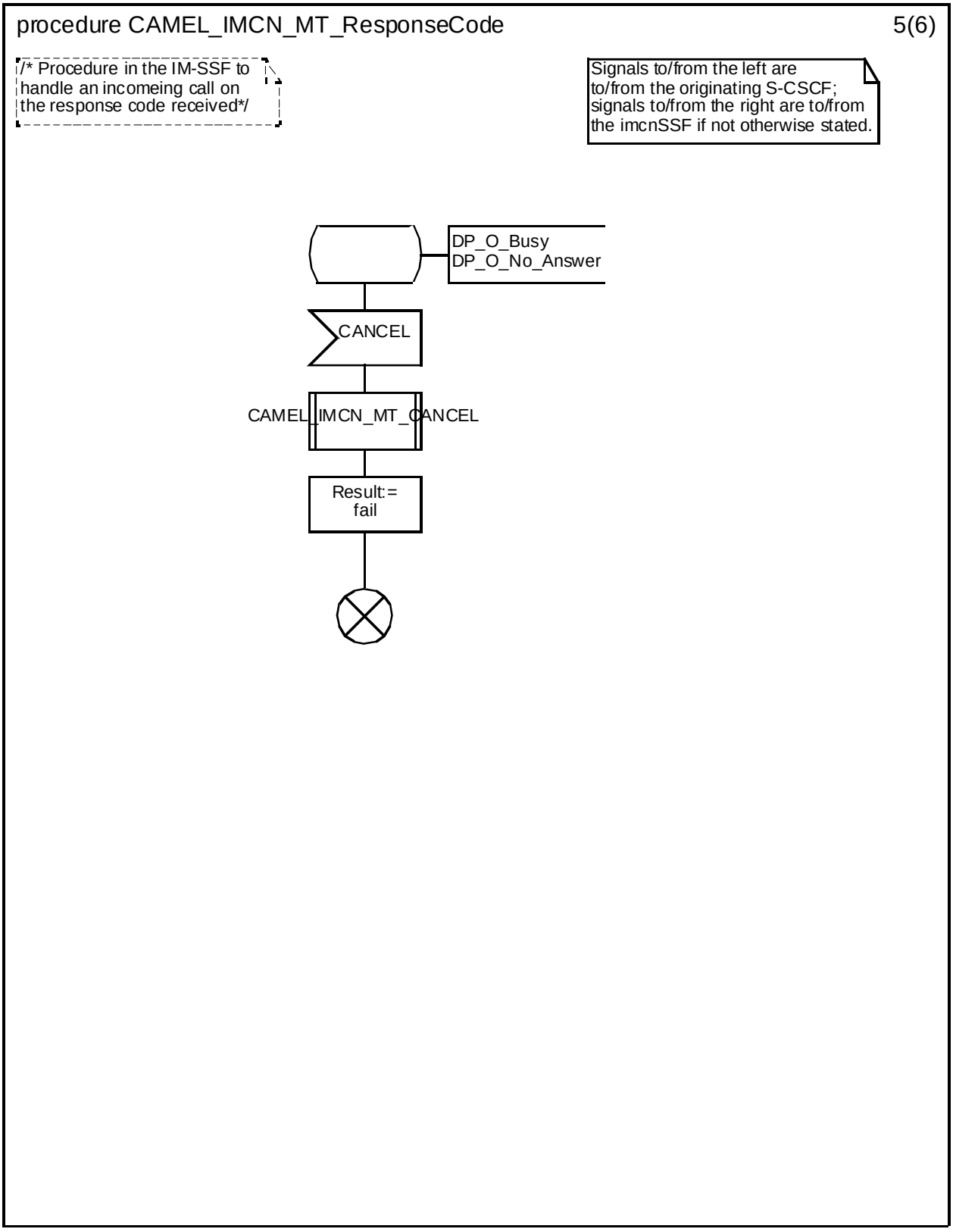

procedure CAMEL_IMCN_MT_ResponseCode
5(6)
/* Procedure in the IM-SSF to handle an incomeing call on the response code received*/
Signals to/from the left are to/from the originating S-CSCF; signals to/from the right are to/from the imcnSSF if not otherwise stated.
DP_O_Busy
DP_O_No_Answer
CANCEL
CAMEL_IMCN_MT_CANCEL
Result:= fail

Figure 5.17e

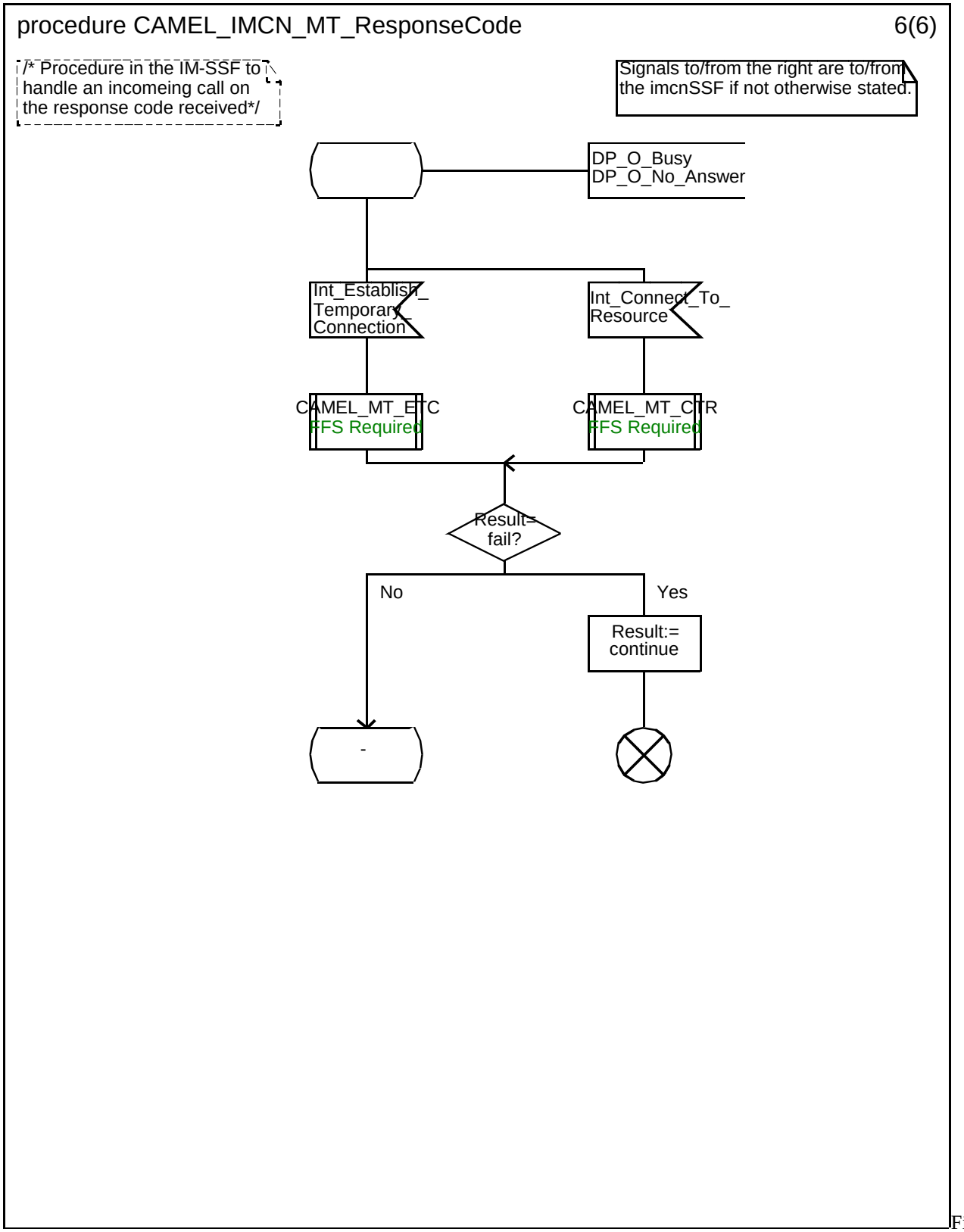

procedure CAMEL_IMCN_MT_ResponseCode
6(6)
/* Procedure in the IM-SSF to handle an incomeing call on the response code received*/
Signals to/from the right are to/from the imcnSSF if not otherwise stated.
DP_O_Busy
DP_O_No_Answer
Int_Establish_ Temporary_ Connection
Int_Connect_To_ Resource
CAMEL_MT_ETC
FFS Required
CAMEL_MT_CTR
FFS Required
Result= fail?
No
Yes
Result:= continue
-

Figure 5.18f

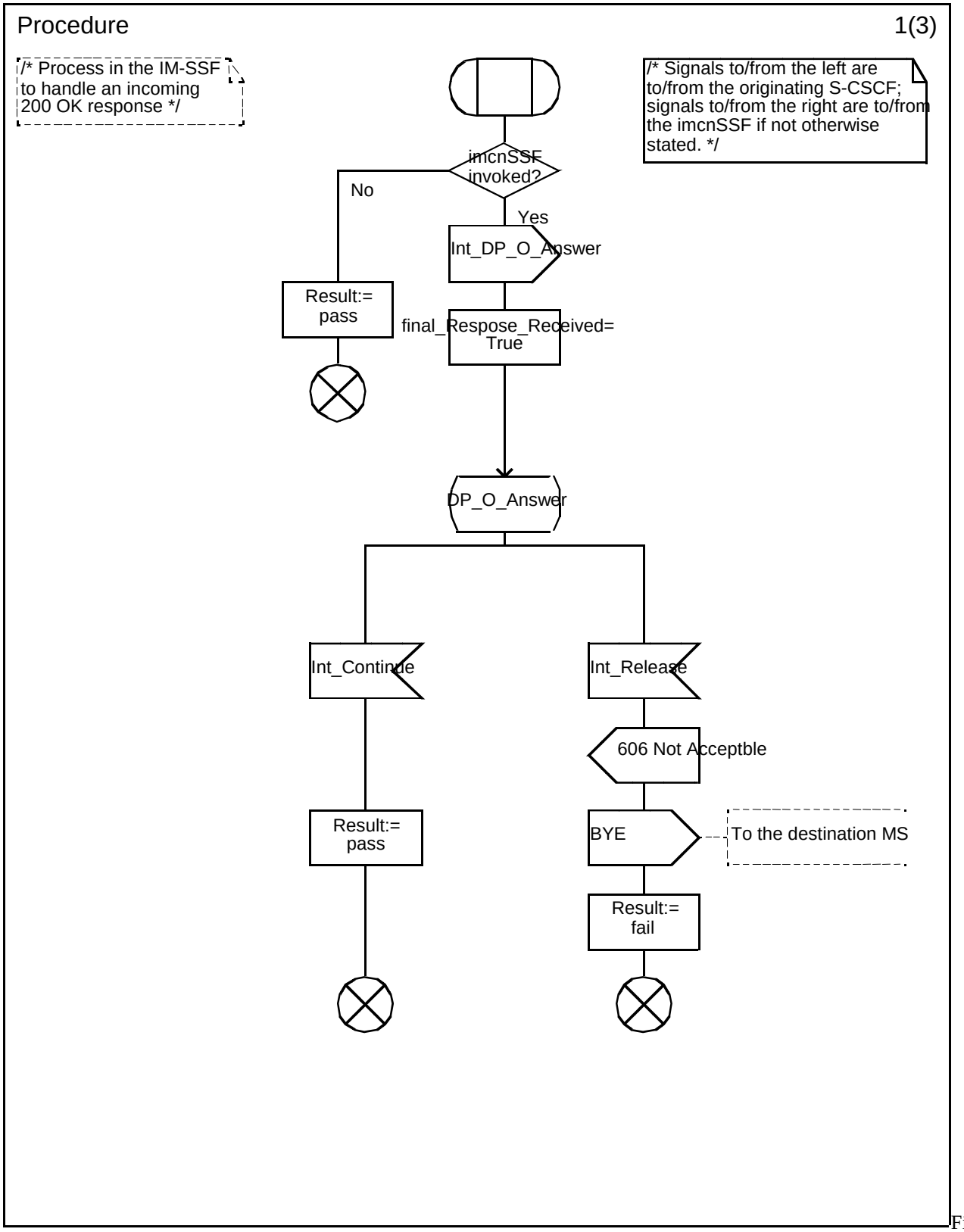

Procedure
1(3)
/* Process in the IM-SSF to handle an incoming 200 OK response */
/* Signals to/from the left are to/from the originating S-CSCF; signals to/from the right are to/from the imcnSSF if not otherwise stated. */
imcnSSF invoked?
No
Yes
Int_DP_O_Answer
Result:= pass
final_Respose_Received= True
DP_O_Answer
Int_Continue
Int_Release
606 Not Acceptble
Result:= pass
BYE
To the destination MS
Result:= fail

Figure 5.19a

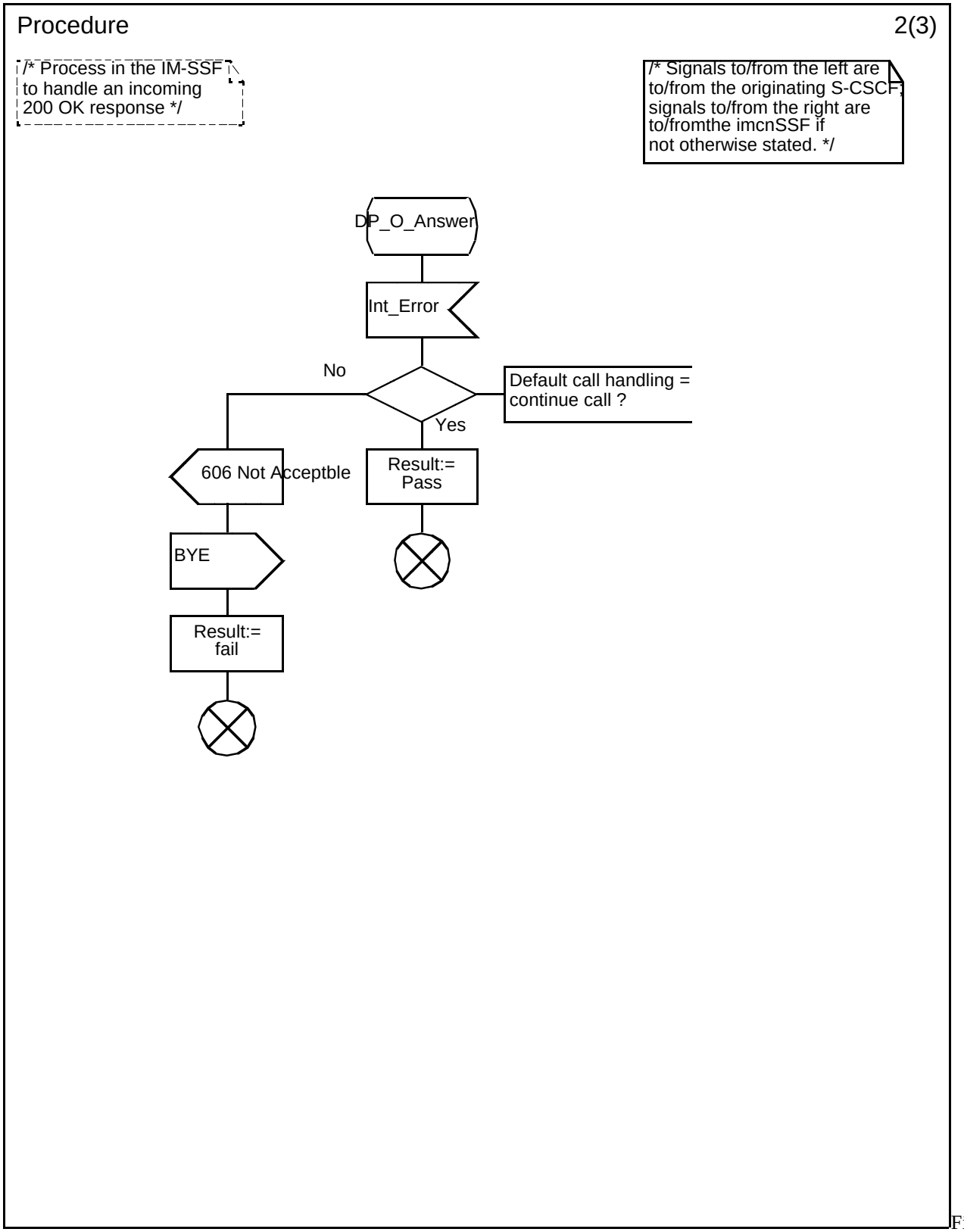

Procedure
2(3)
/* Process in the IM-SSF to handle an incoming 200 OK response */
/* Signals to/from the left are to/from the originating S-CSCF; signals to/from the right are to/fromthe imcnSSF if not otherwise stated. */
DP_O_Answer
Int_Error
No
Default call handling = continue call ?
Yes
606 Not Acceptble
Result:= Pass
BYE
Result:= fail

Figure 5.19b

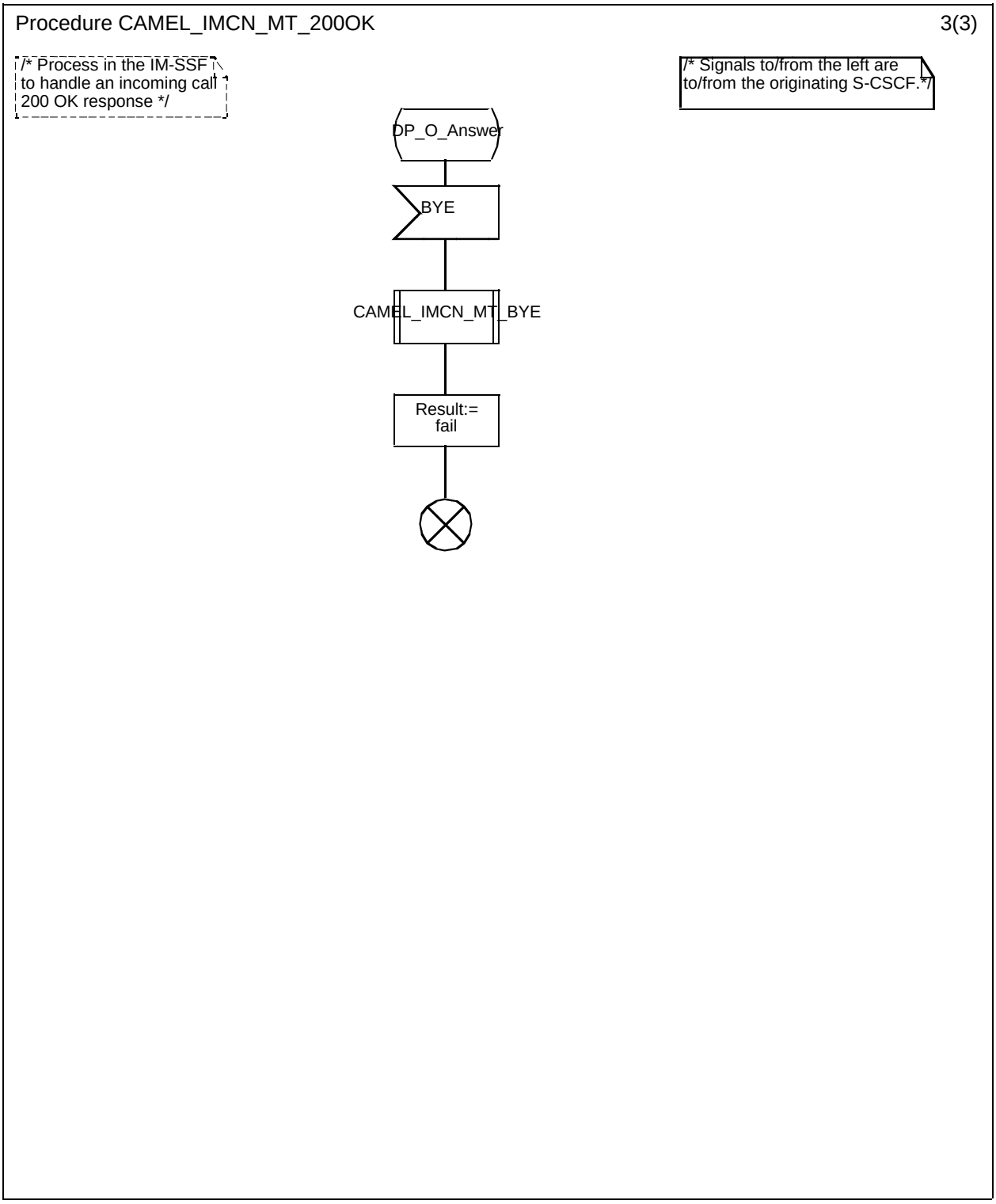

Procedure CAMEL_IMCN_MT_200OK
3(3)
/* Process in the IM-SSF to handle an incoming call 200 OK response */
/* Signals to/from the left are to/from the originating S-CSCF.*/
DP_O_Answer
BYE
CAMEL_IMCN_MT_BYE
Result:= fail

Figure 5.19c

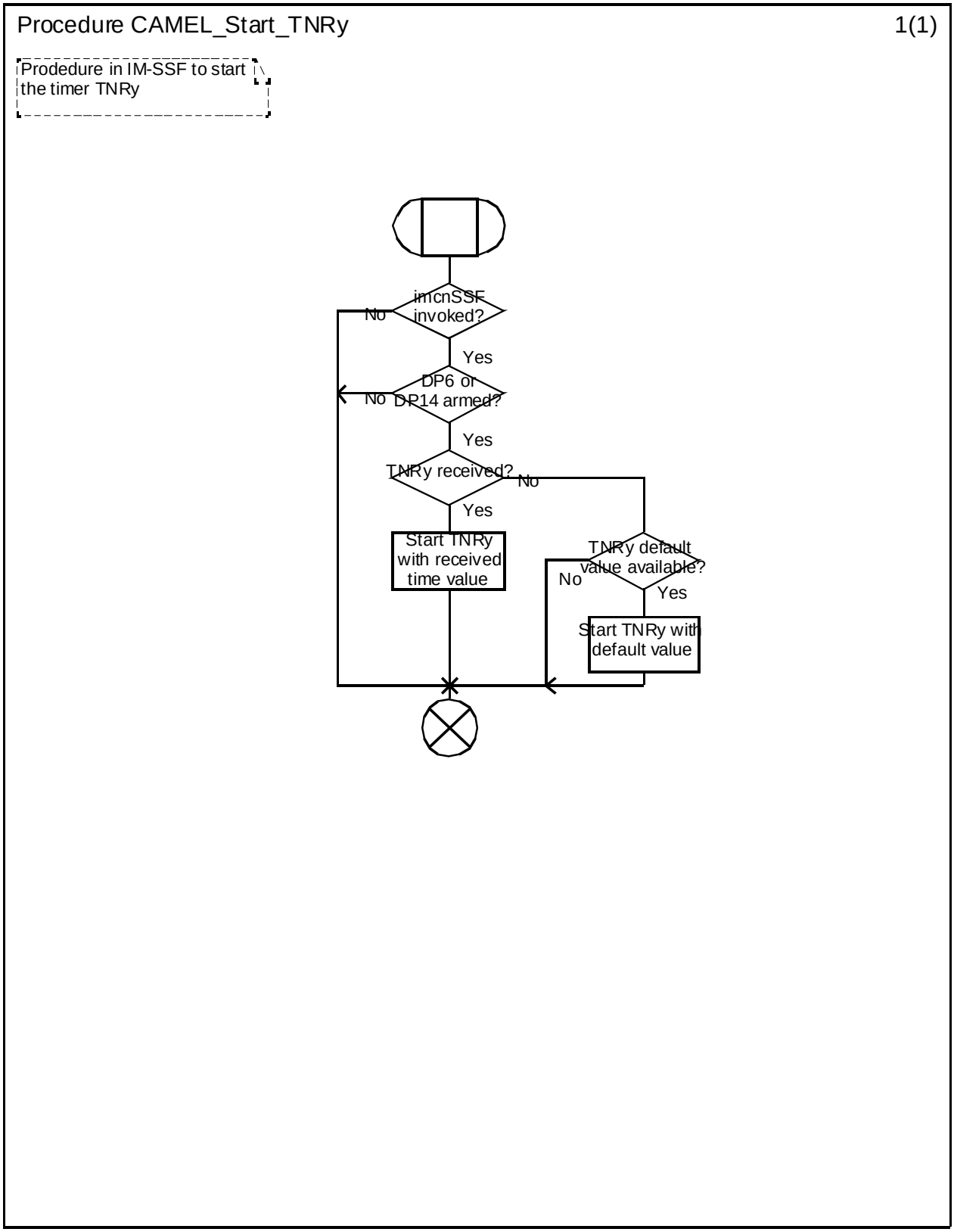

Procedure CAMEL_Start_TNRy
1(1)
Prodedure in IM-SSF to start the timer TNRy
imcnSSF invoked?
No
Yes
DP6 or DP14 armed?
No
Yes
TNRy received?
No
Yes
Start TNRy with received time value
TNRy default value available?
No
Yes
Start TNRy with default value

Figure 5.20a

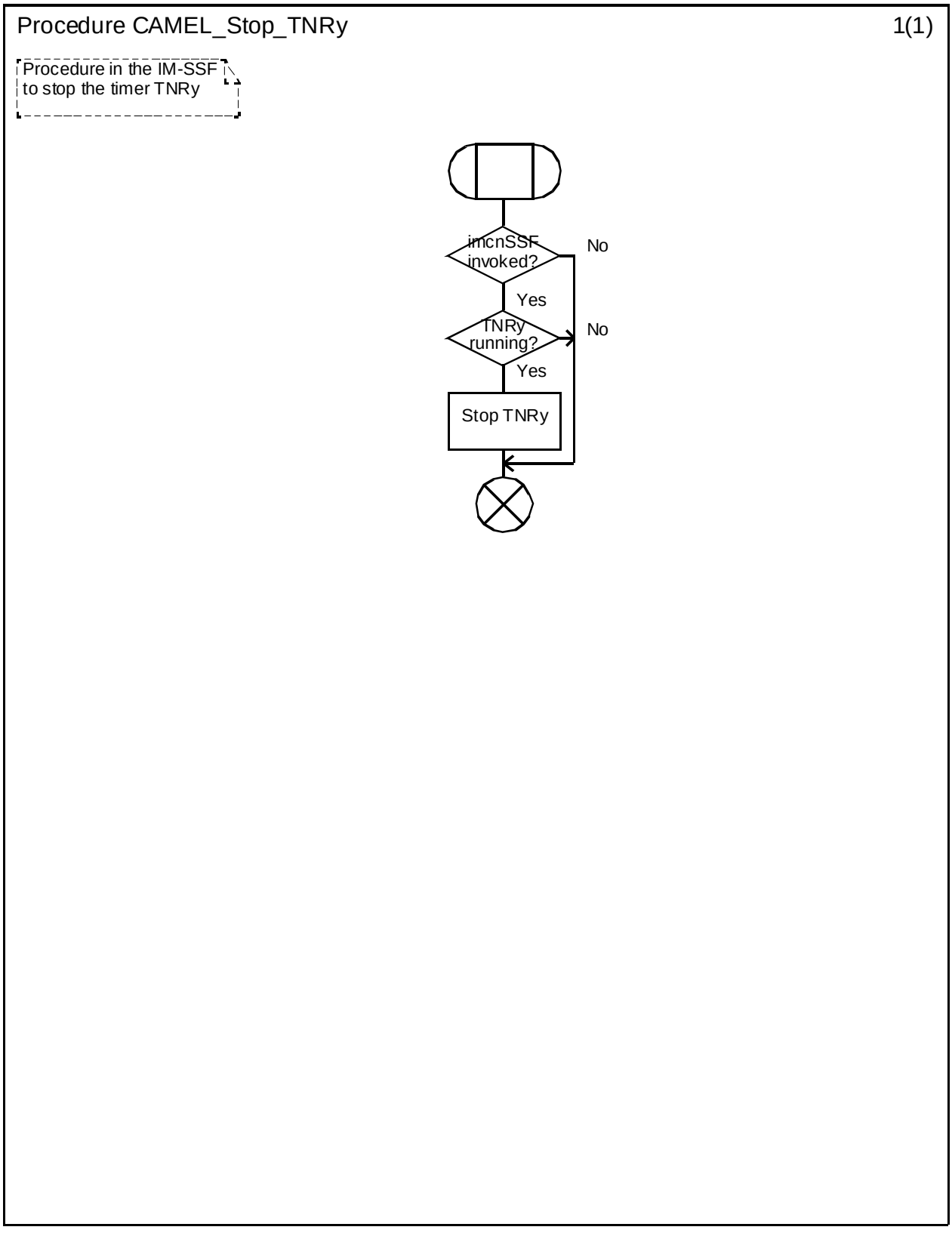

Procedure CAMEL_Stop_TNRy
1(1)
Procedure in the IM-SSF to stop the timer TNRy
imcnSSF invoked?
No
Yes
TNRy running?
No
Yes
Stop TNRy

Figure 5.21a

5.1.4 Handling of call in the imcnSSF

Handling of mobile calls in the imcnSSF may involve the following process and procedures:

- imcnSSF;
- imcnCheck_Criteria;
- imcnConnect_To_Resource;
- imcnHandle_AC;
- imcnHandle_ACR;
- imcnHandle_CIR;
- imcnHandle_CIR_leg;
- imcnComplete_FCI_record;
- imcnComplete_all_FCI_records;
- imcnHandle_O_AcceptCall;
- imcnHandle_T_AcceptCall.

The detailed error handling for the process gsmSSF and the associated procedures is specified in 3GPP TS 29.078 ([8]).

5.1.4.1 Behaviour of the imcnSSF in the process imcnSSF

5.1.4.2 Process imcnSSF and procedures

Process imcnSSF 1(33)

/* Invocation of imcnSSF in MO, MT call case. */

/* Timers used in the imcnSSF process:

Tssf: Application timer in the ssf.
Tcp: Timer for call period.
This timer measures the duration of a call period.
Tsw: Timer for tariff switch.
At the expiration of this timer, a new tariff switch shall be started.
Tw: Warning timer.
At the expiration of this timer, a warning tone shall be played to the calling party.
DELTA: time, measured in the imcnSSF, elapsed between the time an ApplyChargingReport operation is send to the imcnSCF and an ApplyCharging operation is received from the imcnSCF.
Tccd: Control of call duration timer.
This timer supervises if after sending of ACR a new AC is received.
Tccd has a value range of 1 to 20 seconds.

Ranges for the default values for Tssf.
- non user interaction Tssf timer value: 1 second to 20 seconds
- user interaction Tssf timer value: 1 minute to 30 minutes
*/

/* TASK definition:
The sending of an Application_Begin signal opens a new relationship to the imcnSCF.
The sending of an Application_End or Abort signal terminates the relationship to the imcnSCF.
*/

/* Decision box definitions (1)

'armed TDPs for this CSI?'
It is questioned whether or not the ongoing call can encounter further TDPs which are indicated in the current CSI.

'Call to be released?'
It is questioned whether or not the ongoing call will be released imediately after imcnSSF has responded; that is the ongoing call will not send any signals furtheron to the imcnSSF.
NOTE: In this case the imcnSSF shall also go to idle.

*/

/* Decision box definitions (2)
Thefollowing decisions are used by procedures in CCF.

'imcnSSF invoked?'
Is the imcnSSF process in any state other than Idle?

*/

Figure 5.22 a

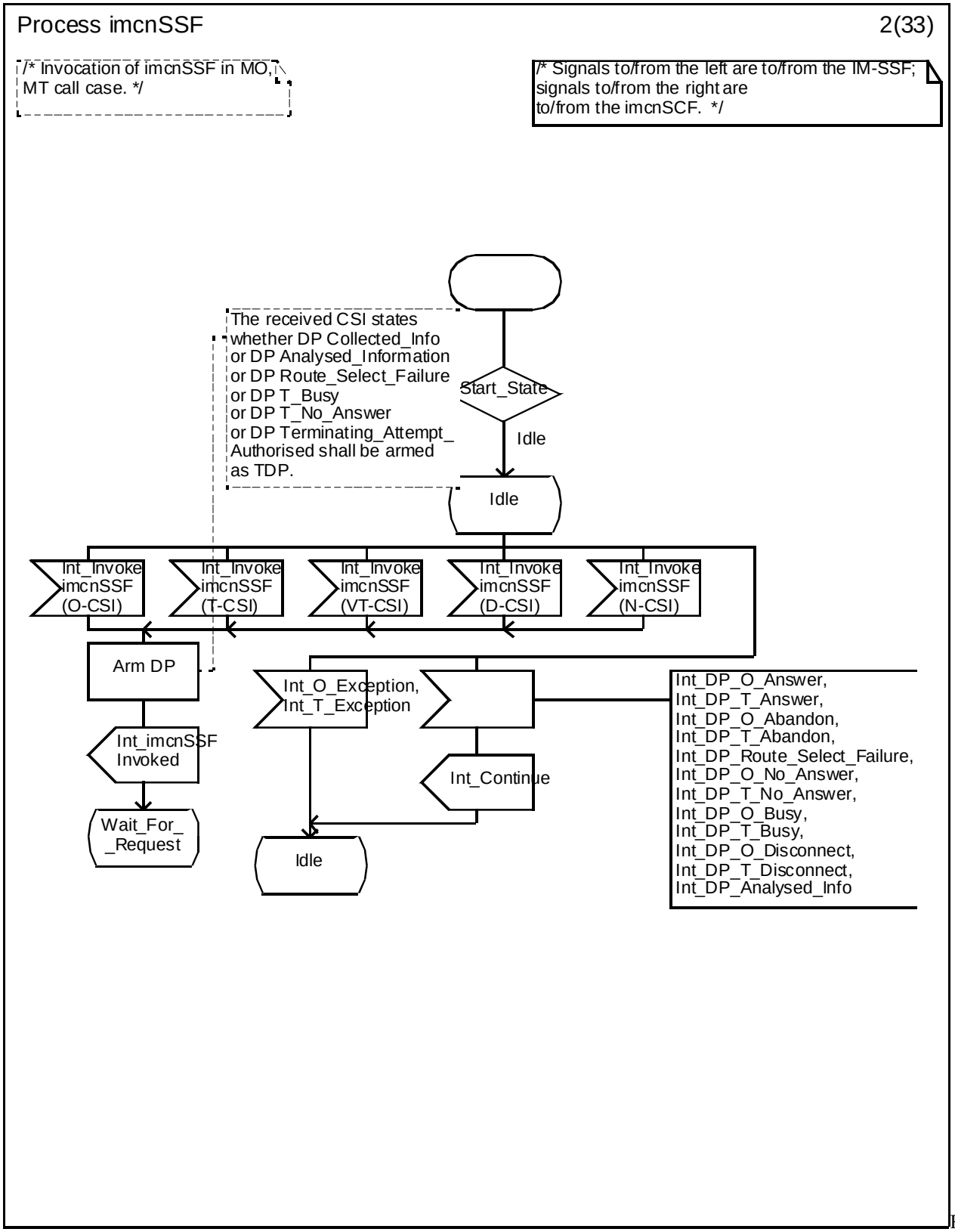

Process imcnSSF
2(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
The received CSI states whether DP Collected_Info or DP Analysed_Information or DP Route_Select_Failure or DP T_Busy or DP T_No_Answer or DP Terminating_Attempt_ Authorised shall be armed as TDP.
Start_State
Idle
Idle
Int_Invoke imcnSSF (O-CSI)
Int_Invoke imcnSSF (T-CSI)
Int_Invoke imcnSSF (VT-CSI)
Int_Invoke imcnSSF (D-CSI)
Int_Invoke imcnSSF (N-CSI)
Arm DP
Int_imcnSSF Invoked
Wait_For_ _Request
Int_O_Exception, Int_T_Exception
Int_Continue
Idle
Int_DP_O_Answer,
Int_DP_T_Answer,
Int_DP_O_Abandon,
Int_DP_T_Abandon,
Int_DP_Route_Select_Failure,
Int_DP_O_No_Answer,
Int_DP_T_No_Answer,
Int_DP_O_Busy,
Int_DP_T_Busy,
Int_DP_O_Disconnect,
Int_DP_T_Disconnect,
Int_DP_Analysed_Info

Figure 5.22b

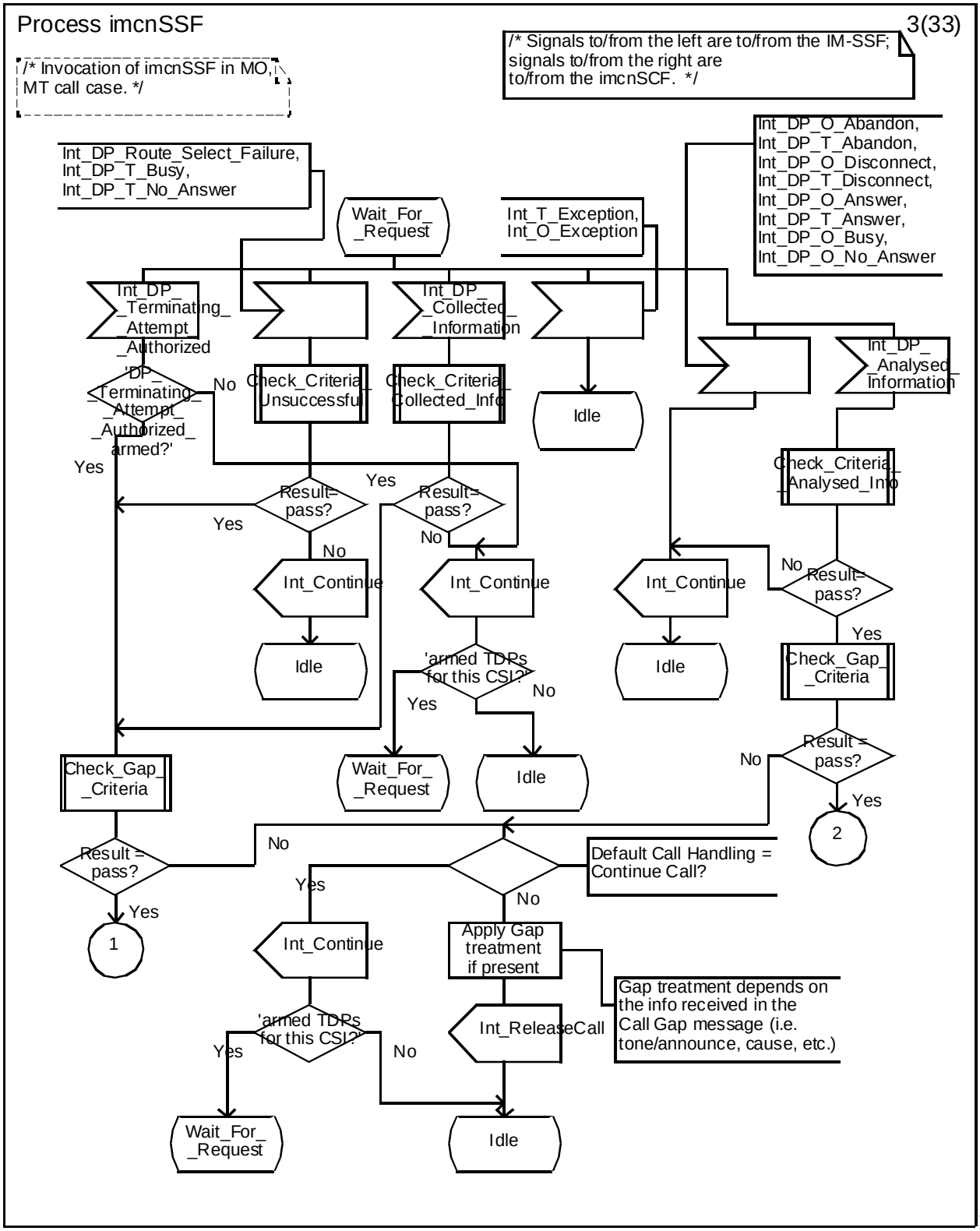

Process imcnSSF
3(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
Int_DP_Route_Select_Failure, Int_DP_T_Busy, Int_DP_T_No_Answer
Wait_For_ _Request
Int_T_Exception, Int_O_Exception
Int_DP_O_Abandon, Int_DP_T_Abandon, Int_DP_O_Disconnect, Int_DP_T_Disconnect, Int_DP_O_Answer, Int_DP_T_Answer, Int_DP_O_Busy, Int_DP_O_No_Answer
Int_DP_ _Terminating_ _Attempt_ _Authorized
Int_DP_ _Collected_ _Information
Int_DP_ _Analysed_ _Information
'DP_ Terminating_ _Attempt_ _Authorized_ armed?'
No
Yes
Check_Criteria_ Unsuccessful
Check_Criteria_ Collected_Info
Idle
Check_Criteria_ _Analysed_Info
Result= pass?
Yes
No
Int_Continue
Idle
'armed TDPs for this CSI?'
Check_Gap_ _Criteria
Result = pass?
Wait_For_ _Request
Default Call Handling = Continue Call?
1
2
Apply Gap treatment if present
Int_ReleaseCall
Gap treatment depends on the info received in the Call Gap message (i.e. tone/announce, cause, etc.)

Figure 5.22c

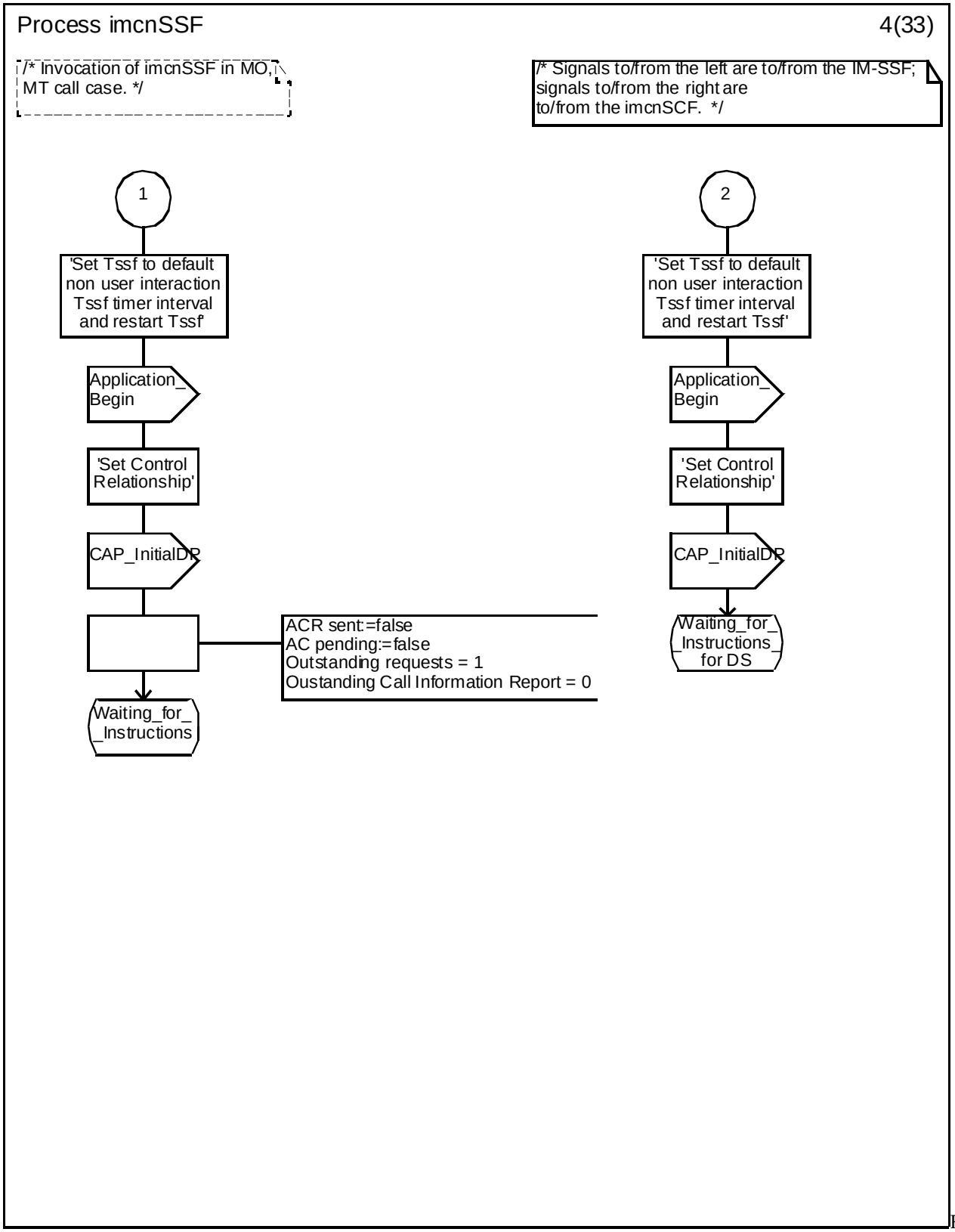

Process imcnSSF
4(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
1
'Set Tssf to default non user interaction Tssf timer interval and restart Tssf'
Application_ Begin
'Set Control Relationship'
CAP_InitialDP
Waiting_for_ _Instructions
ACR sent:=false
AC pending:=false
Outstanding requests = 1
Oustanding Call Information Report = 0
2
'Set Tssf to default non user interaction Tssf timer interval and restart Tssf'
Application_ Begin
'Set Control Relationship'
CAP_InitialDP
Waiting_for_ _Instructions_ for DS

Figure 5.22d

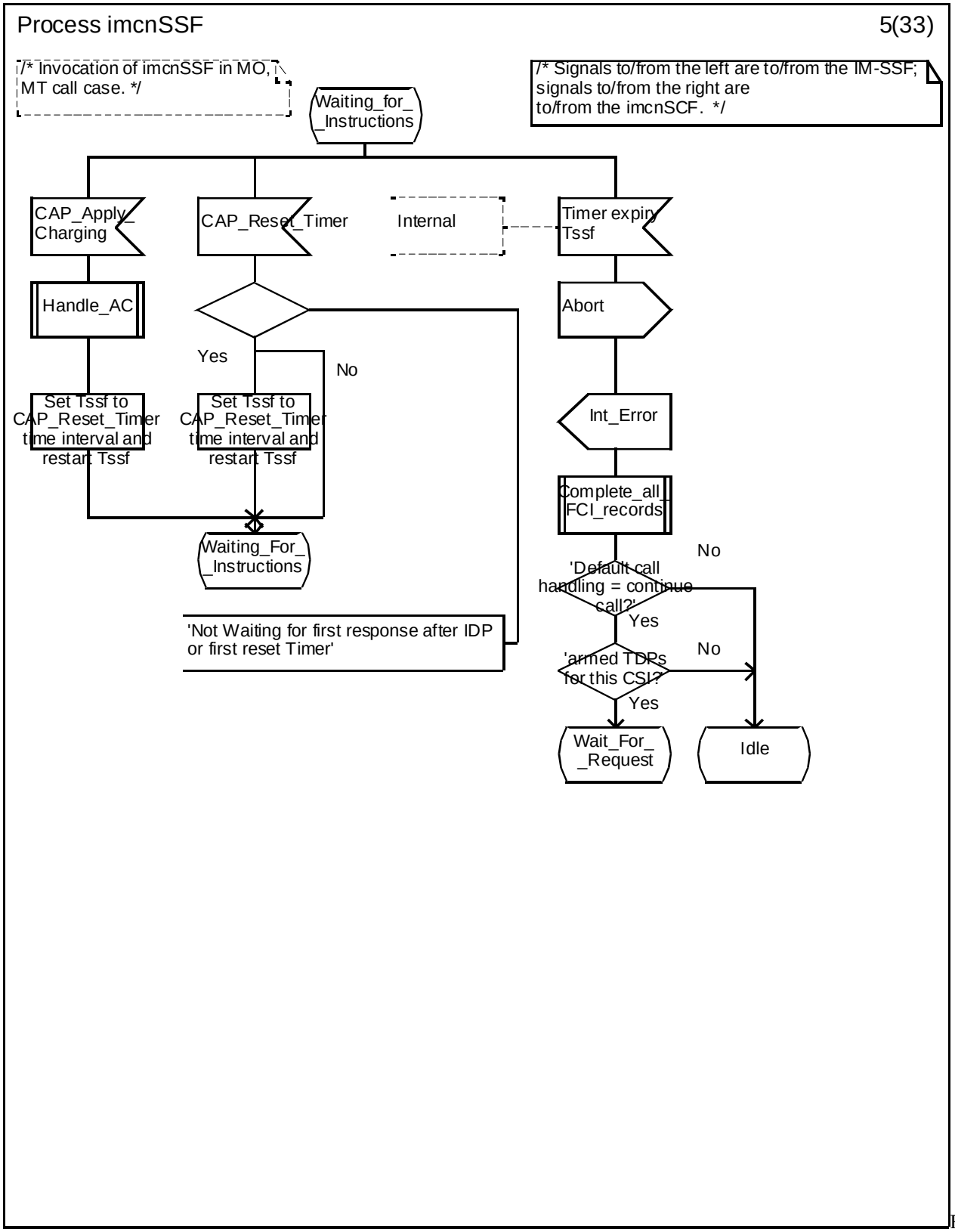

Process imcnSSF
5(33)
/* Invocation of imcnSSF in MO, MT call case. */
Waiting_for_ _Instructions
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
CAP_Apply_ Charging
CAP_Reset_Timer
Internal
Timer expiry Tssf
Handle_AC
Abort
Yes
No
Set Tssf to CAP_Reset_Timer time interval and restart Tssf
Set Tssf to CAP_Reset_Timer time interval and restart Tssf
Int_Error
Complete_all_ FCI_records
Waiting_For_ _Instructions
'Default call handling = continue call?'
No
Yes
'Not Waiting for first response after IDP or first reset Timer'
'armed TDPs for this CSI?'
No
Yes
Wait_For_ _Request
Idle

Figure 5.22e

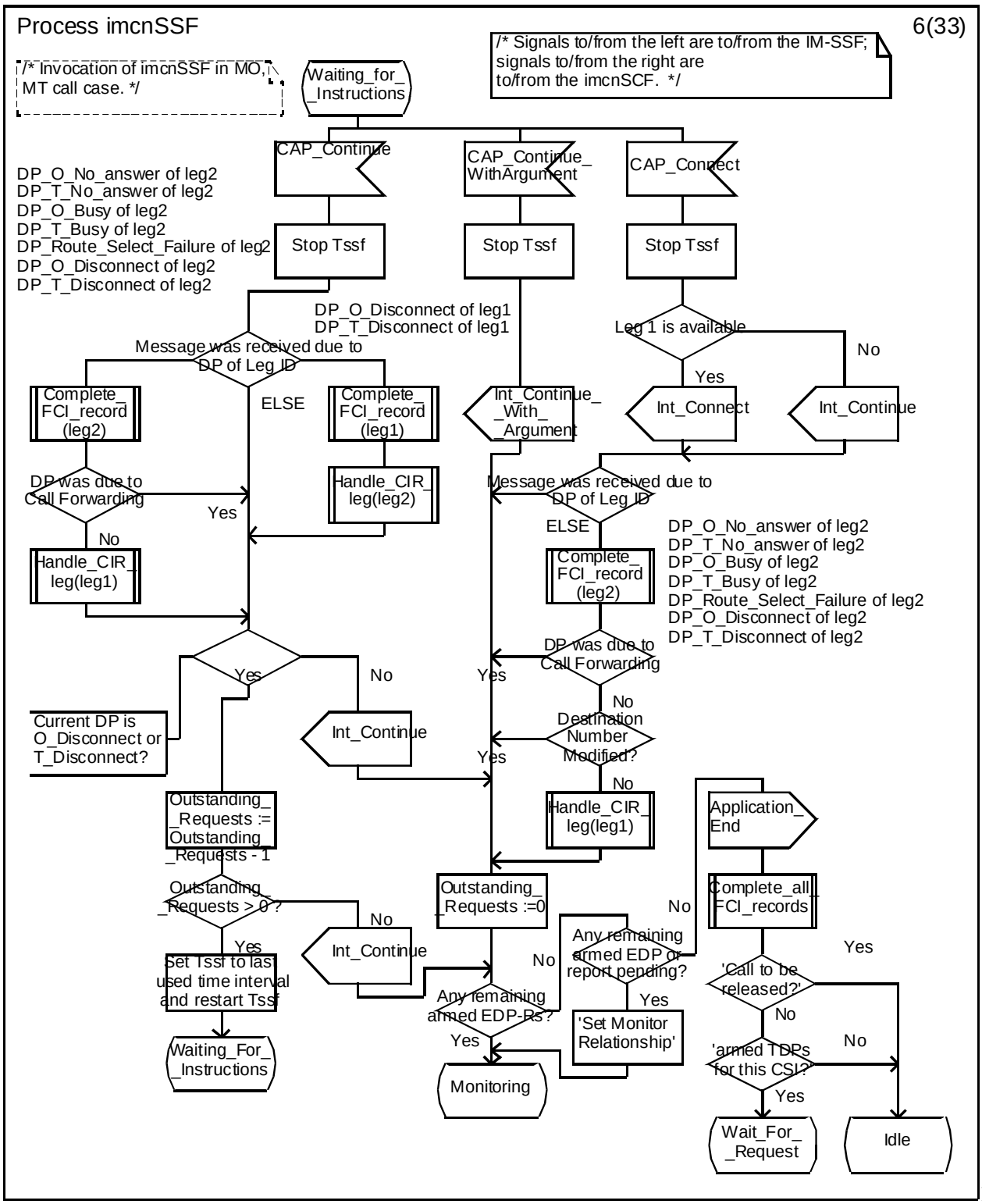

Process imcnSSF
6(33)
/* Invocation of imcnSSF in MO, MT call case. */
Waiting_for_Instructions
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
CAP_Continue
CAP_Continue_WithArgument
CAP_Connect
DP_O_No_answer of leg2
DP_T_No_answer of leg2
DP_O_Busy of leg2
DP_T_Busy of leg2
DP_Route_Select_Failure of leg2
DP_O_Disconnect of leg2
DP_T_Disconnect of leg2
Stop Tssf
Stop Tssf
Stop Tssf
DP_O_Disconnect of leg1
DP_T_Disconnect of leg1
Leg 1 is available
No
Yes
Message was received due to DP of Leg ID
ELSE
Complete_FCI_record (leg2)
Complete_FCI_record (leg1)
Int_Continue_With_Argument
Int_Connect
Int_Continue
DP was due to Call Forwarding
Yes
No
Handle_CIR_leg(leg2)
Handle_CIR_leg(leg1)
Message was received due to DP of Leg ID
ELSE
DP_O_No_answer of leg2
DP_T_No_answer of leg2
DP_O_Busy of leg2
DP_T_Busy of leg2
DP_Route_Select_Failure of leg2
DP_O_Disconnect of leg2
DP_T_Disconnect of leg2
Complete_FCI_record (leg2)
DP was due to Call Forwarding
Yes
No
Yes
No
Current DP is O_Disconnect or T_Disconnect?
Int_Continue
Destination Number Modified?
Yes
No
Handle_CIR_leg(leg1)
Application_End
Outstanding_Requests := Outstanding_Requests - 1
Outstanding_Requests := 0
Complete_all_FCI_records
Outstanding_Requests > 0 ?
No
Yes
Int_Continue
Any remaining armed EDP or report pending?
No
Yes
'Call to be released?'
Yes
No
Set Tssf to last used time interval and restart Tssf
Any remaining armed EDP-Rs?
'Set Monitor Relationship'
'armed TDPs for this CSI?'
No
Yes
Waiting_For_Instructions
Monitoring
Wait_For_Request
Idle

Figure 5.22f

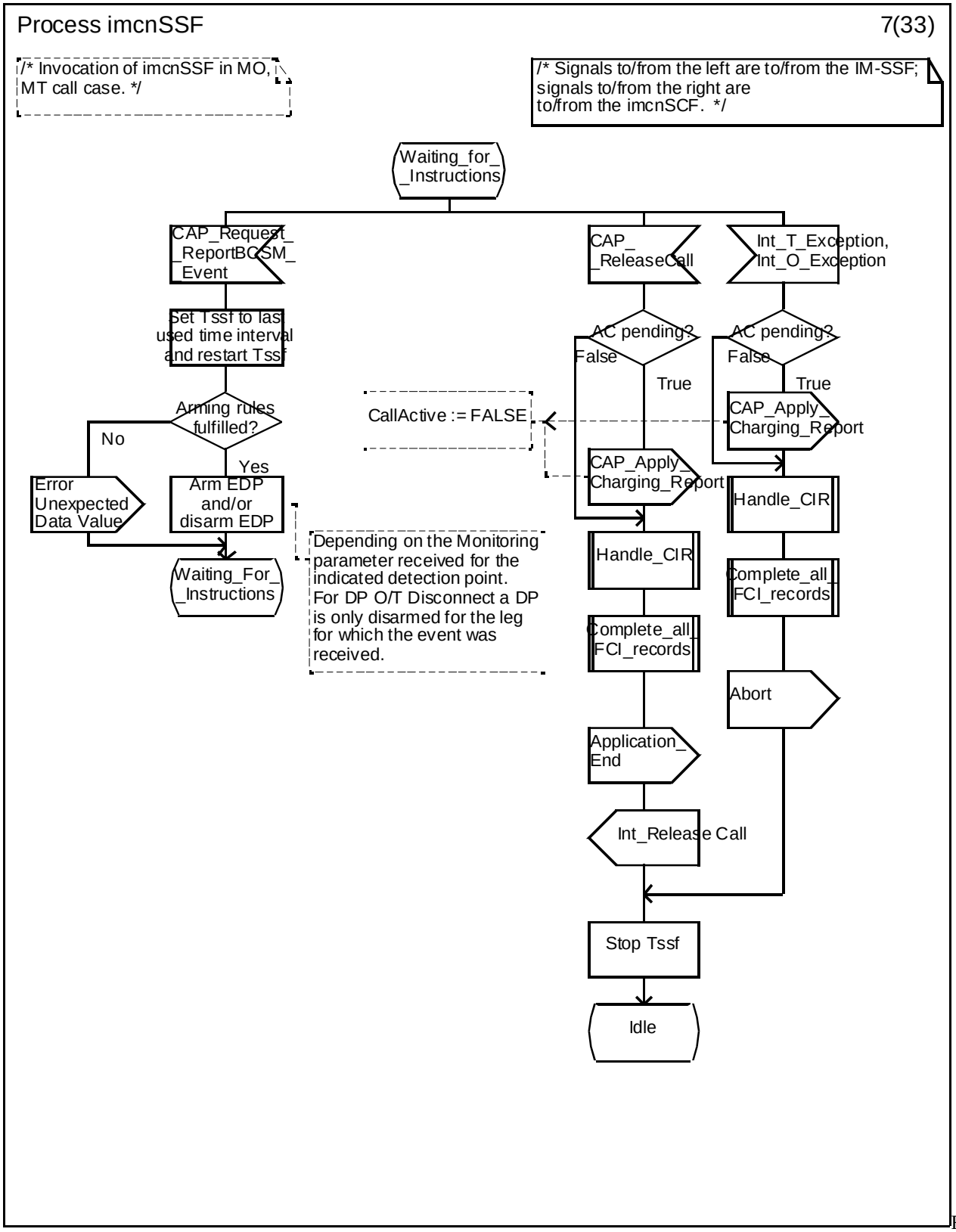

Process imcnSSF
7(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
Waiting_for_Instructions
CAP_Request_ReportBCSM_Event
CAP_ReleaseCall
Int_T_Exception, Int_O_Exception
Set Tssf to last used time interval and restart Tssf
AC pending?
False
True
AC pending?
False
True
Arming rules fulfilled?
No
Yes
CallActive := FALSE
CAP_Apply_Charging_Report
CAP_Apply_Charging_Report
Handle_CIR
Error Unexpected Data Value
Arm EDP and/or disarm EDP
Handle_CIR
Complete_all_FCI_records
Waiting_For_Instructions
Depending on the Monitoring parameter received for the indicated detection point. For DP O/T Disconnect a DP is only disarmed for the leg for which the event was received.
Complete_all_FCI_records
Abort
Application_End
Int_Release Call
Stop Tssf
Idle

Figure 5.22g

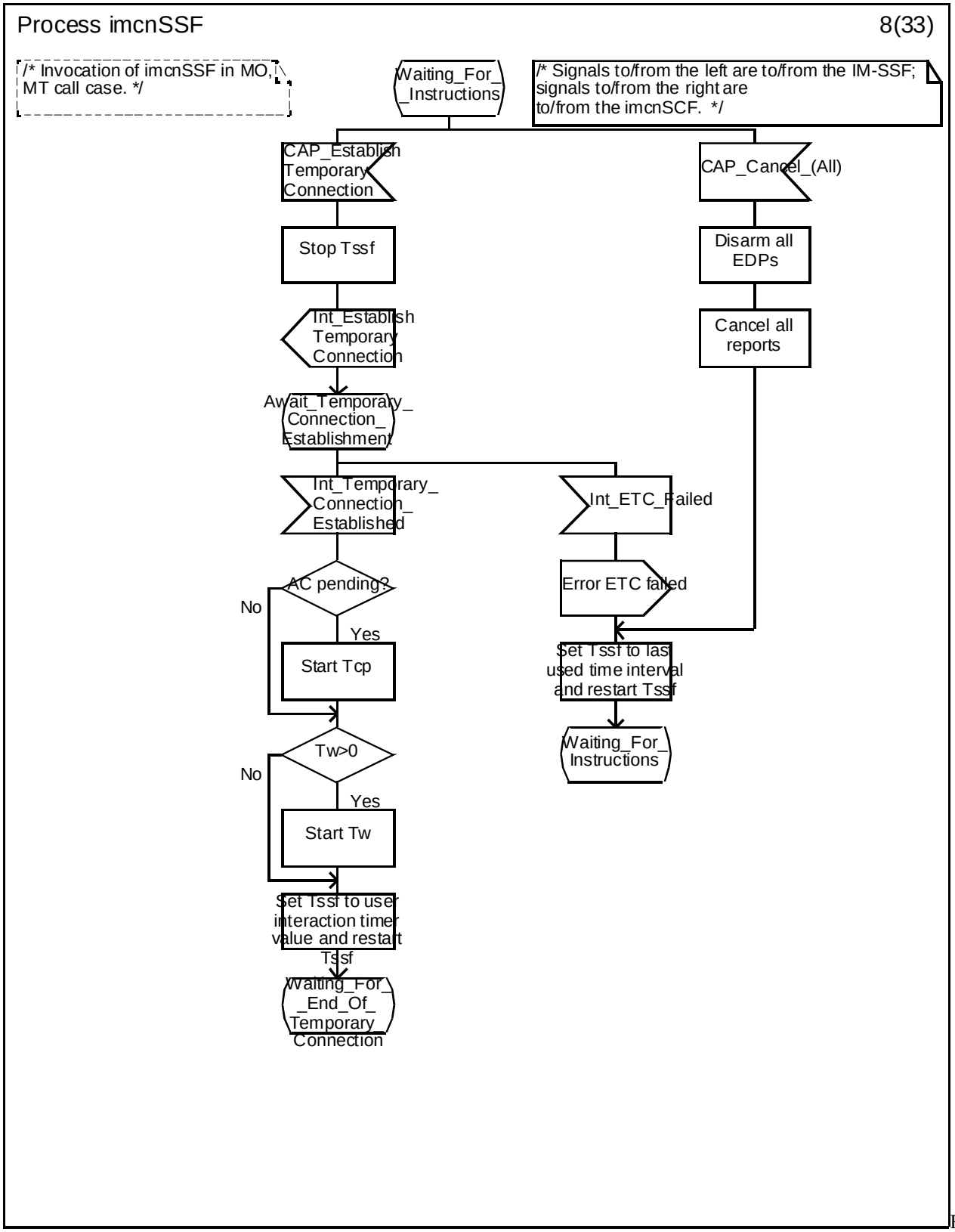

Process imcnSSF
8(33)
/* Invocation of imcnSSF in MO, MT call case. */
Waiting_For_Instructions
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
CAP_Establish Temporary Connection
CAP_Cancel_(All)
Stop Tssf
Disarm all EDPs
Int_Establish Temporary Connection
Cancel all reports
Await_Temporary_Connection_Establishment
Int_Temporary_Connection_Established
Int_ETC_Failed
AC pending?
No
Yes
Error ETC failed
Start Tcp
Set Tssf to last used time interval and restart Tssf
Tw>0
Waiting_For_Instructions
No
Yes
Start Tw
Set Tssf to user interaction timer value and restart Tssf
Waiting_For_End_Of_Temporary_Connection

Figure 5.22h

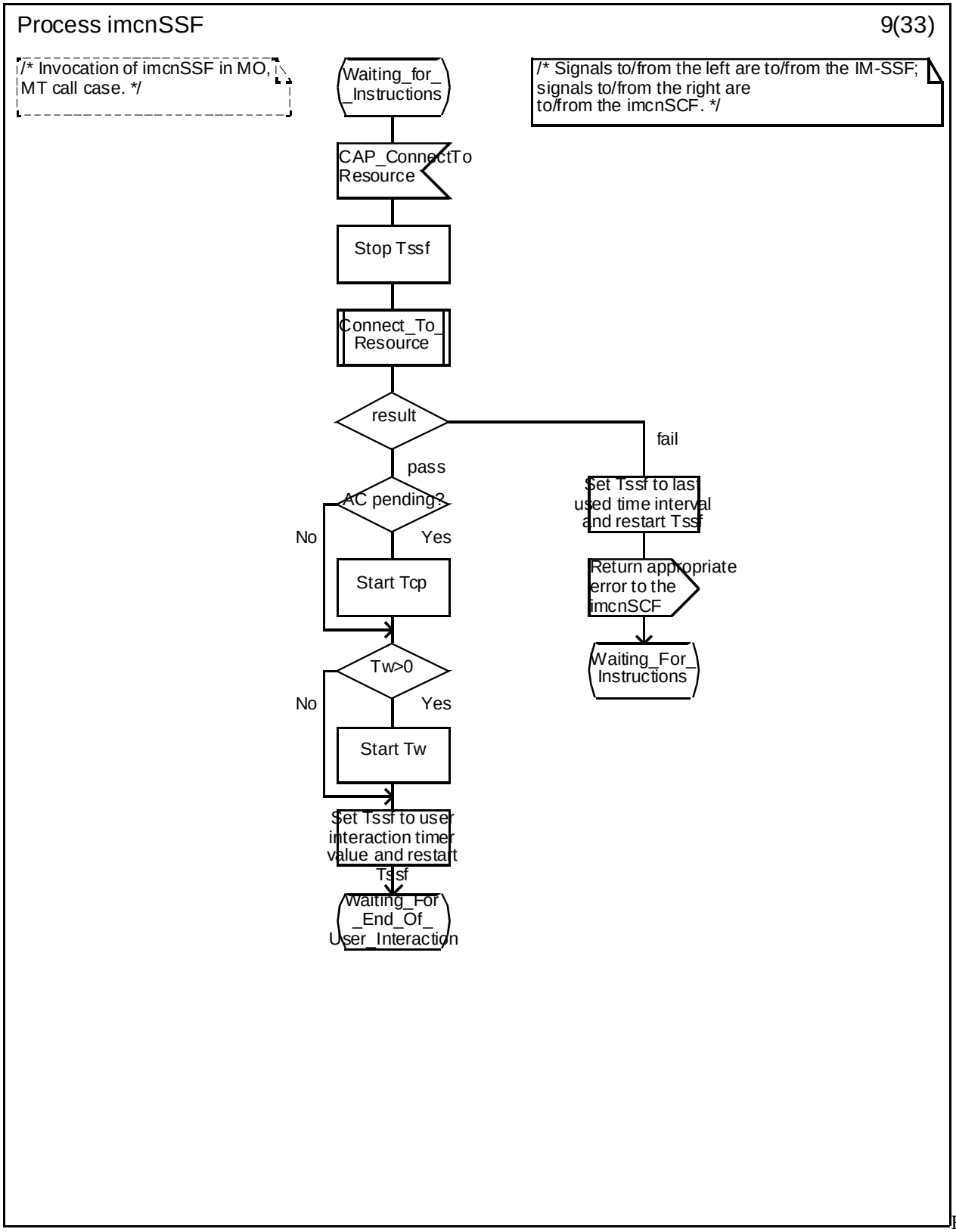

Process imcnSSF
9(33)
/* Invocation of imcnSSF in MO, MT call case. */
Waiting_for_Instructions
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
CAP_ConnectToResource
Stop Tssf
Connect_To_Resource
result
fail
pass
AC pending?
No
Yes
Set Tssf to last used time interval and restart Tssf
Start Tcp
Return appropriate error to the imcnSCF
Tw>0
Waiting_For_Instructions
No
Yes
Start Tw
Set Tssf to user interaction timer value and restart Tssf
Waiting_For_End_Of_User_Interaction

Figure 5.22i

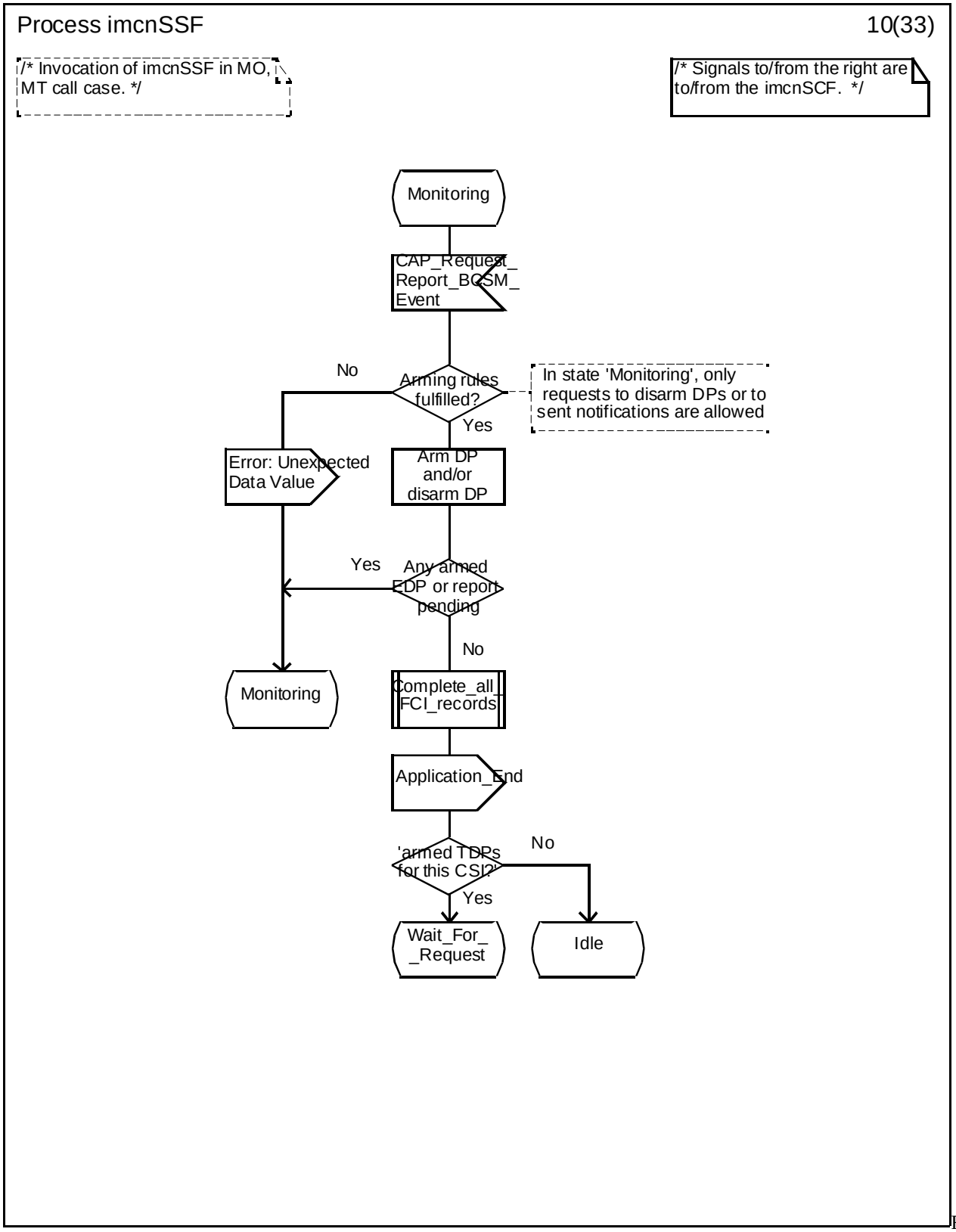

Process imcnSSF
10(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the right are to/from the imcnSCF. */
Monitoring
CAP_Request_Report_BCSM_Event
No
Arming rules fulfilled?
In state 'Monitoring', only requests to disarm DPs or to sent notifications are allowed
Yes
Error: Unexpected Data Value
Arm DP and/or disarm DP
Yes
Any armed EDP or report pending
No
Monitoring
Complete_all_FCI_records
Application_End
'armed TDPs for this CSI?'
No
Yes
Wait_For_Request
Idle

Figure 5.22j

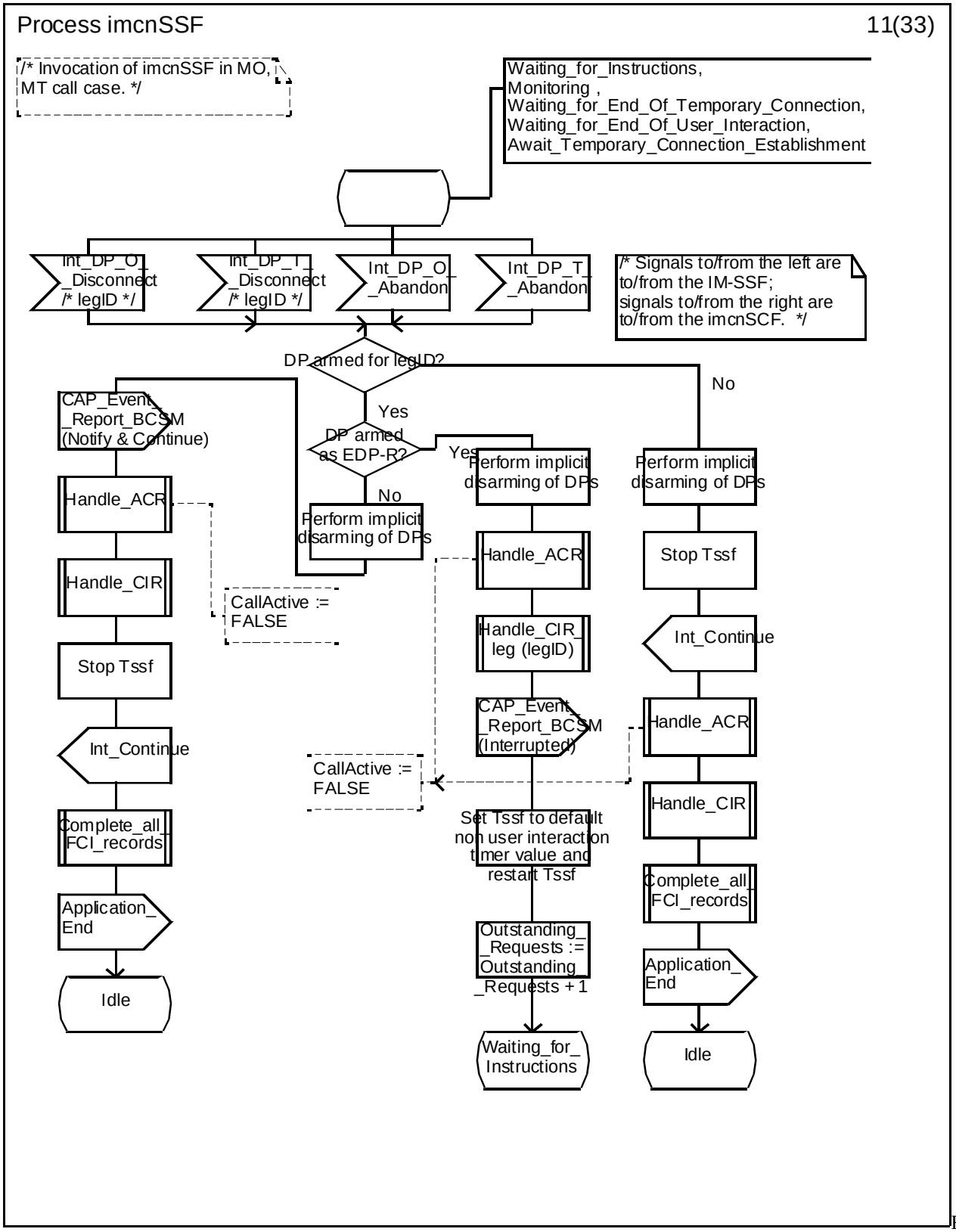

Process imcnSSF
11(33)
/* Invocation of imcnSSF in MO, MT call case. */
Waiting_for_Instructions, Monitoring , Waiting_for_End_Of_Temporary_Connection, Waiting_for_End_Of_User_Interaction, Await_Temporary_Connection_Establishment
Int_DP_O_ _Disconnect /* legID */
Int_DP_T_ _Disconnect /* legID */
Int_DP_O_ _Abandon
Int_DP_T_ _Abandon
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
DP armed for legID?
Yes
No
DP armed as EDP-R?
Yes
No
CAP_Event_ _Report_BCSM (Notify & Continue)
Handle_ACR
Handle_CIR
Stop Tssf
Int_Continue
Complete_all_ FCI_records
Application_ End
Idle
CallActive := FALSE
Perform implicit disarming of DPs
Perform implicit disarming of DPs
Handle_ACR
Handle_CIR_ leg (legID)
CAP_Event_ _Report_BCSM (Interrupted)
CallActive := FALSE
Set Tssf to default non user interaction timer value and restart Tssf
Outstanding_ _Requests := Outstanding_ _Requests + 1
Waiting_for_ Instructions
Perform implicit disarming of DPs
Stop Tssf
Int_Continue
Handle_ACR
Handle_CIR
Complete_all_ FCI_records
Application_ End
Idle

Figure 5.22k

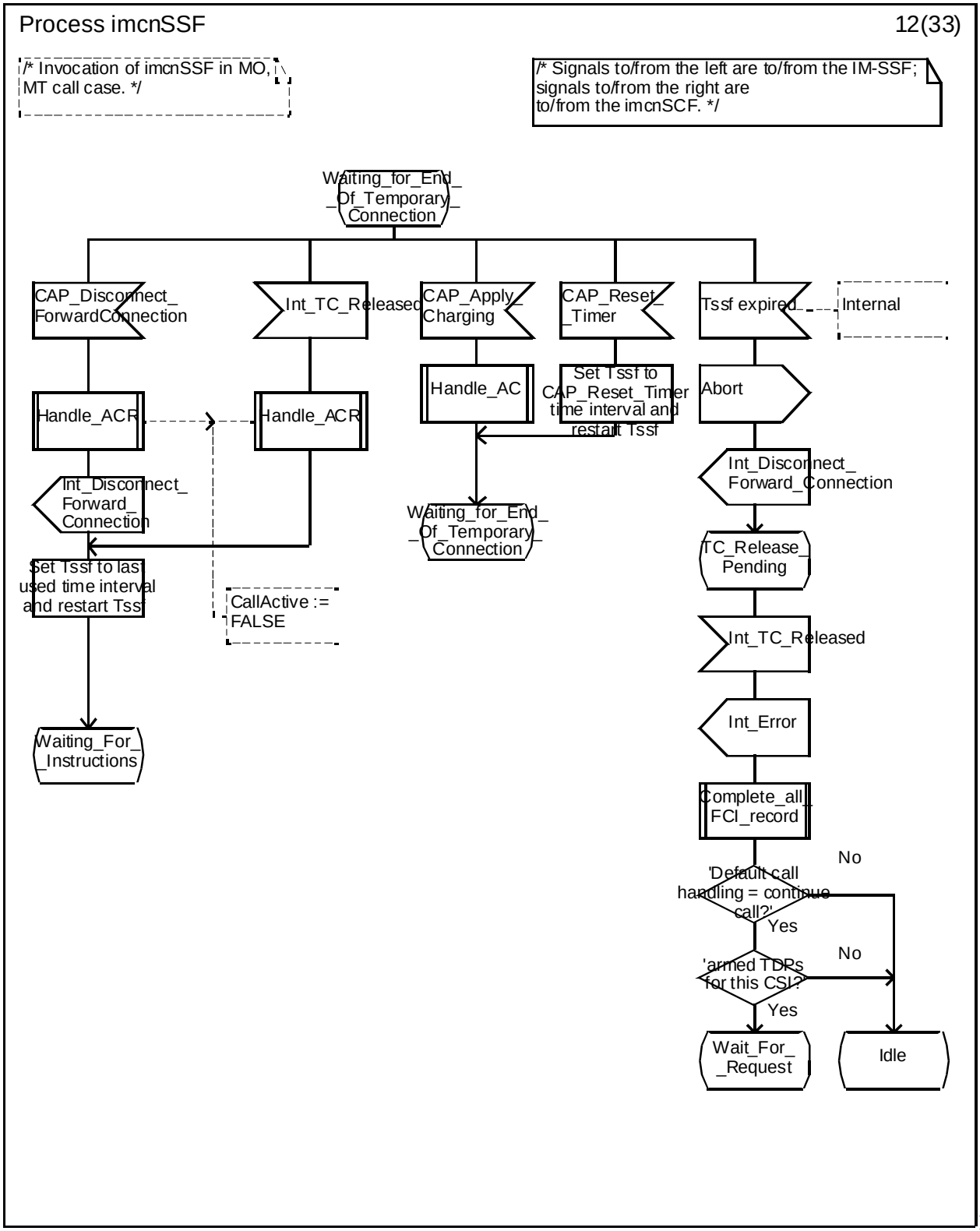

Process imcnSSF
12(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
Waiting_for_End_Of_Temporary_Connection
CAP_Disconnect_ForwardConnection
Int_TC_Released
CAP_Apply_Charging
CAP_Reset_Timer
Tssf expired
Internal
Handle_ACR
Handle_ACR
Handle_AC
Set Tssf to CAP_Reset_Timer time interval and restart Tssf
Abort
Int_Disconnect_Forward_Connection
Int_Disconnect_Forward_Connection
Waiting_for_End_Of_Temporary_Connection
TC_Release_Pending
Set Tssf to last used time interval and restart Tssf
CallActive := FALSE
Int_TC_Released
Int_Error
Waiting_For_Instructions
Complete_all_FCI_record
No
'Default call handling = continue call?'
Yes
No
'armed TDPs for this CSI?'
Yes
Wait_For_Request
Idle

Figure 5.22 l

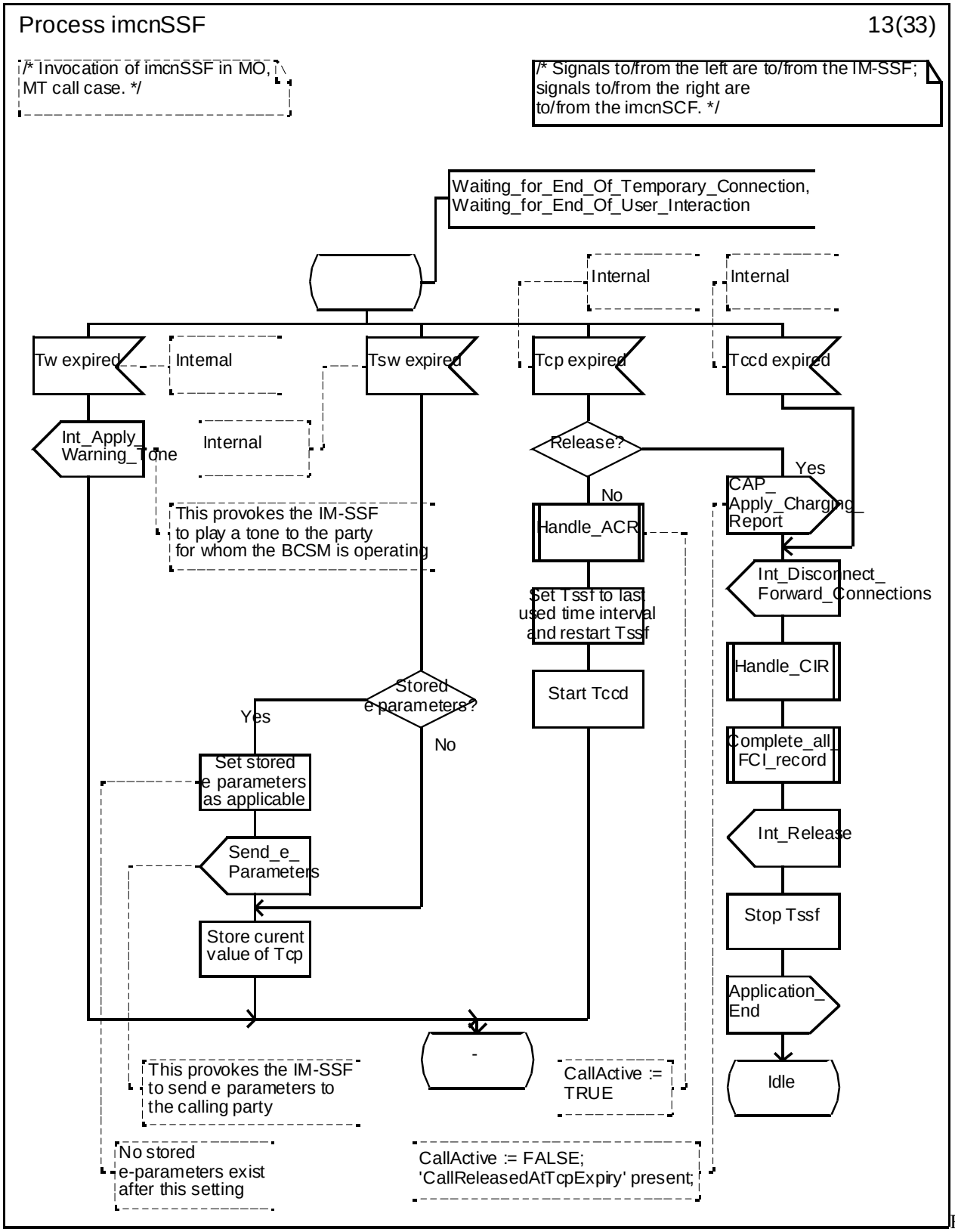

Process imcnSSF
13(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
Waiting_for_End_Of_Temporary_Connection, Waiting_for_End_Of_User_Interaction
Internal
Internal
Tw expired
Internal
Tsw expired
Tcp expired
Tccd expired
Int_Apply_ Warning_Tone
Internal
Release?
Yes
No
CAP_ Apply_Charging_ Report
This provokes the IM-SSF to play a tone to the party for whom the BCSM is operating
Handle_ACR
Int_Disconnect_ Forward_Connections
Set Tssf to last used time interval and restart Tssf
Handle_CIR
Stored e-parameters?
Start Tccd
Yes
No
Complete_all_ FCI_record
Set stored e parameters as applicable
Int_Release
Send_e_ Parameters
Stop Tssf
Store curent value of Tcp
Application_ End
-
Idle
This provokes the IM-SSF to send e parameters to the calling party
CallActive := TRUE
No stored e-parameters exist after this setting
CallActive := FALSE; 'CallReleasedAtTcpExpiry' present;

Figure 5.22m

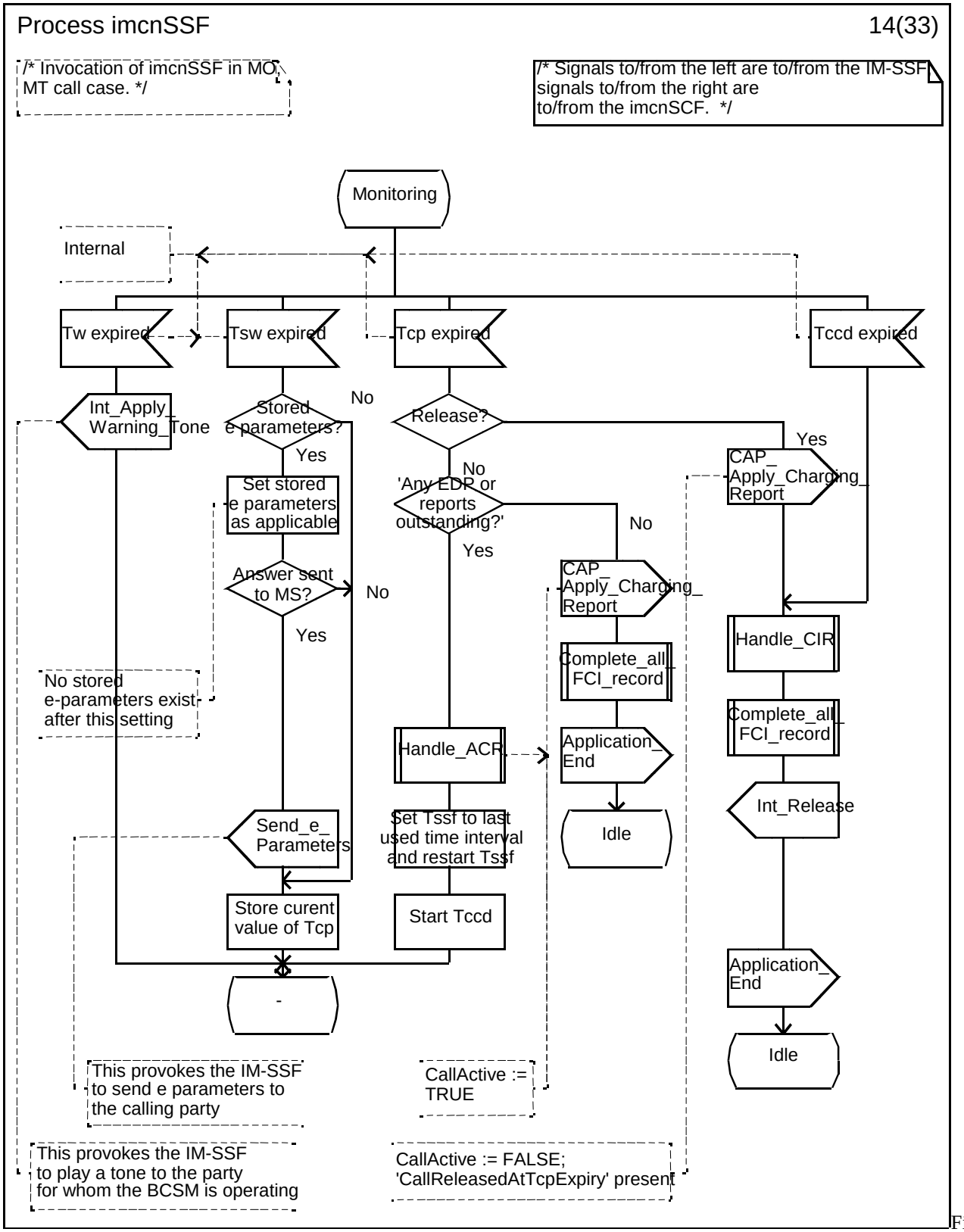

Process imcnSSF
14(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the left are to/from the IM-SSF signals to/from the right are to/from the imcnSCF. */
Monitoring
Internal
Tw expired
Tsw expired
Tcp expired
Tccd expired
Int_Apply_ Warning_Tone
Stored e parameters?
No
Yes
Release?
Yes
No
CAP_ Apply_Charging_ Report
Set stored e parameters as applicable
'Any EDP or reports outstanding?'
No
Yes
Answer sent to MS?
No
Yes
CAP_ Apply_Charging_ Report
Handle_CIR
No stored e-parameters exist after this setting
Complete_all_ FCI_record
Complete_all_ FCI_record
Handle_ACR
Application_ End
Int_Release
Send_e_ Parameters
Set Tssf to last used time interval and restart Tssf
Idle
Store curent value of Tcp
Start Tccd
Application_ End
-
Idle
This provokes the IM-SSF to send e parameters to the calling party
CallActive := TRUE
This provokes the IM-SSF to play a tone to the party for whom the BCSM is operating
CallActive := FALSE; 'CallReleasedAtTcpExpiry' present

Figure 5.22n

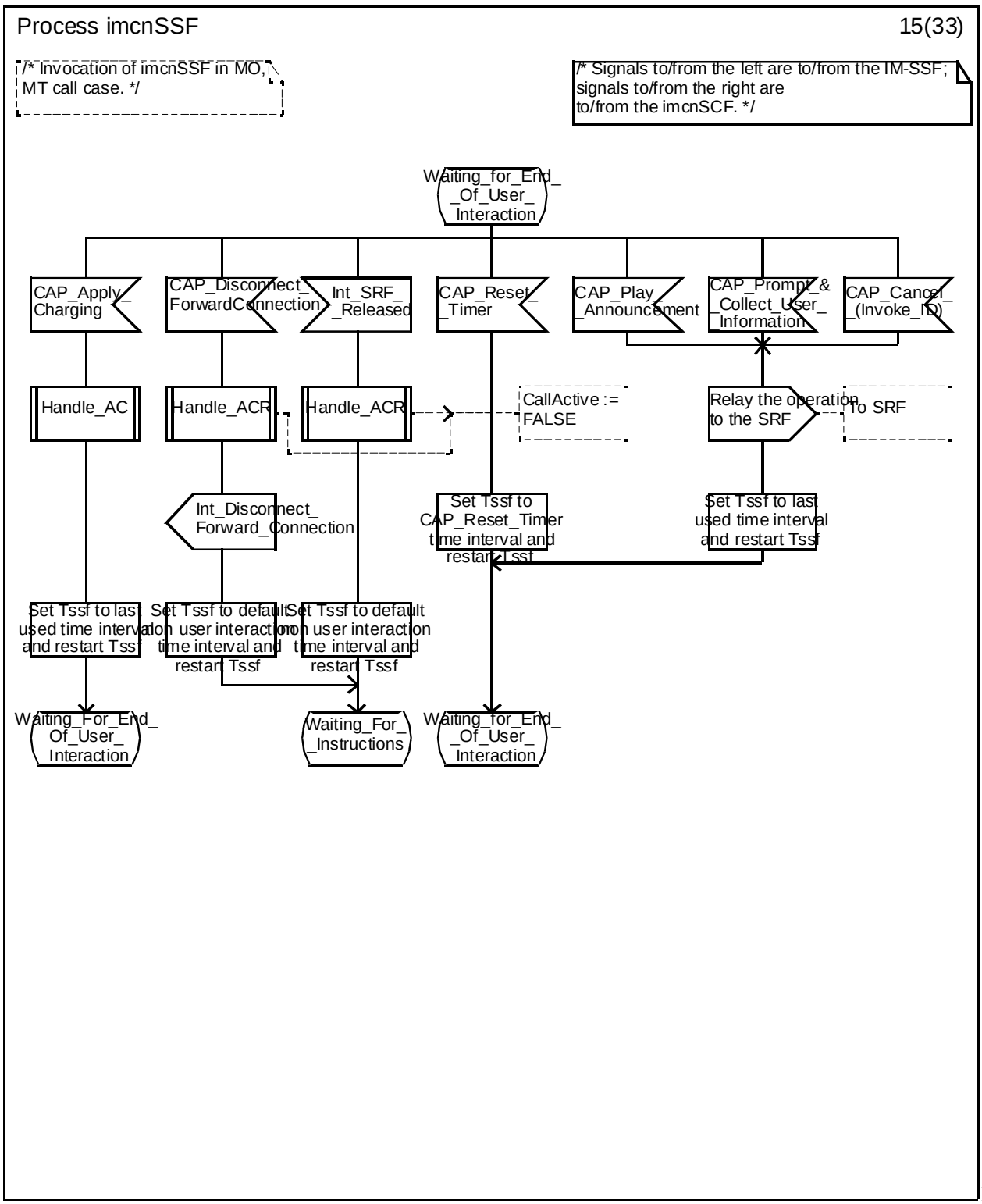

Process imcnSSF
15(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
Waiting_for_End_Of_User_Interaction
CAP_Apply_Charging
CAP_Disconnect_ForwardConnection
Int_SRF_Released
CAP_Reset_Timer
CAP_Play_Announcement
CAP_Prompt_&_Collect_User_Information
CAP_Cancel_(Invoke_ID)
Handle_AC
Handle_ACR
Handle_ACR
CallActive := FALSE
Relay the operation to the SRF
To SRF
Int_Disconnect_Forward_Connection
Set Tssf to CAP_Reset_Timer time interval and restart Tssf
Set Tssf to last used time interval and restart Tssf
Set Tssf to last used time interval and restart Tssf
Set Tssf to default non user interaction time interval and restart Tssf
Set Tssf to default non user interaction time interval and restart Tssf
Waiting_For_End_Of_User_Interaction
Waiting_For_Instructions
Waiting_for_End_Of_User_Interaction

Figure 5.22o

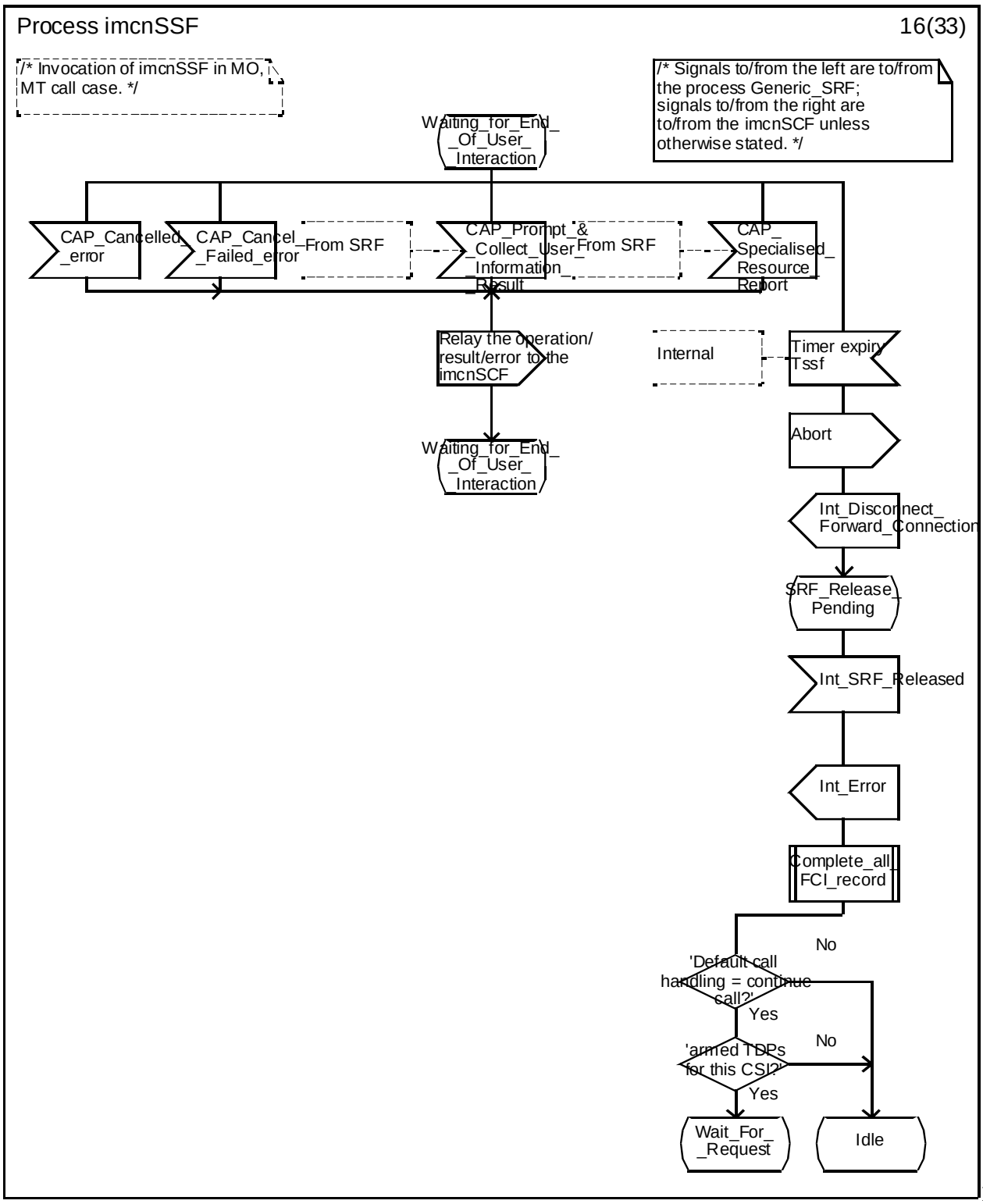

Process imcnSSF
16(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the left are to/from the process Generic_SRF; signals to/from the right are to/from the imcnSCF unless otherwise stated. */
Waiting_for_End_Of_User_Interaction
CAP_Cancelled_error
CAP_Cancel_Failed_error
From SRF
CAP_Prompt_&_Collect_User_Information_Result
From SRF
CAP_Specialised_Resource_Report
Relay the operation/ result/error to the imcnSCF
Waiting_for_End_Of_User_Interaction
Internal
Timer expiry Tssf
Abort
Int_Disconnect_Forward_Connection
SRF_Release_Pending
Int_SRF_Released
Int_Error
Complete_all_FCI_record
No
'Default call handling = continue call?'
Yes
No
'armed TDPs for this CSI?'
Yes
Wait_For_Request
Idle

Figure 5.22p

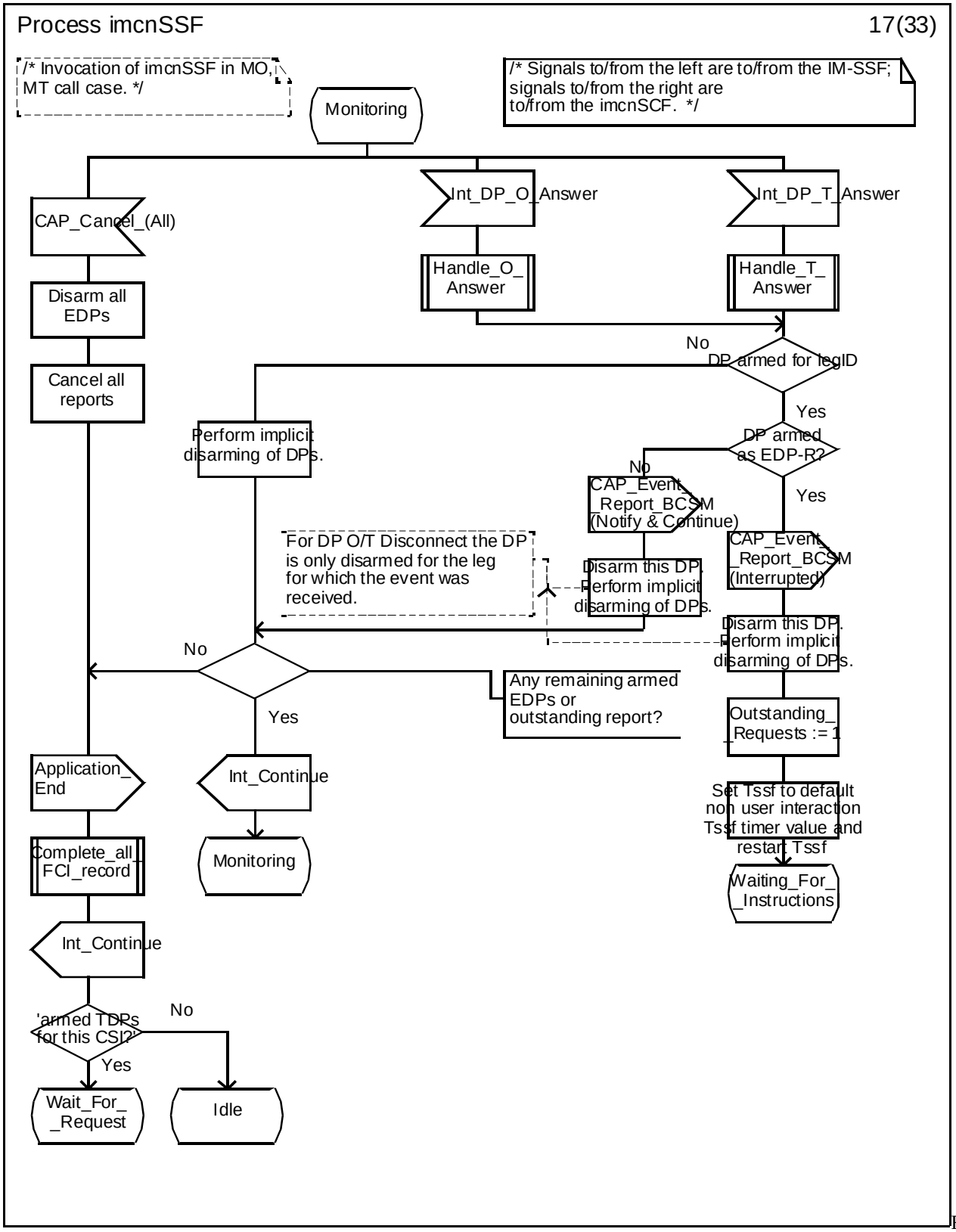

Process imcnSSF
17(33)
/* Invocation of imcnSSF in MO, MT call case. */
Monitoring
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
CAP_Cancel_(All)
Int_DP_O_Answer
Int_DP_T_Answer
Disarm all EDPs
Handle_O_ Answer
Handle_T_ Answer
Cancel all reports
No
DP armed for legID
Yes
Perform implicit disarming of DPs.
DP armed as EDP-R?
No
CAP_Event _Report_BCSM (Notify & Continue)
Yes
CAP_Event _Report_BCSM (Interrupted)
For DP O/T Disconnect the DP is only disarmed for the leg for which the event was received.
Disarm this DP. Perform implicit disarming of DPs.
Disarm this DP. Perform implicit disarming of DPs.
No
Any remaining armed EDPs or outstanding report?
Yes
Outstanding_ _Requests := 1
Application_ End
Int_Continue
Set Tssf to default non user interaction Tssf timer value and restart Tssf
Complete_all_ FCI_record
Monitoring
Waiting_For_ _Instructions
Int_Continue
'armed TDPs for this CSI?'
No
Yes
Wait_For_ _Request
Idle

Figure 5.22 q

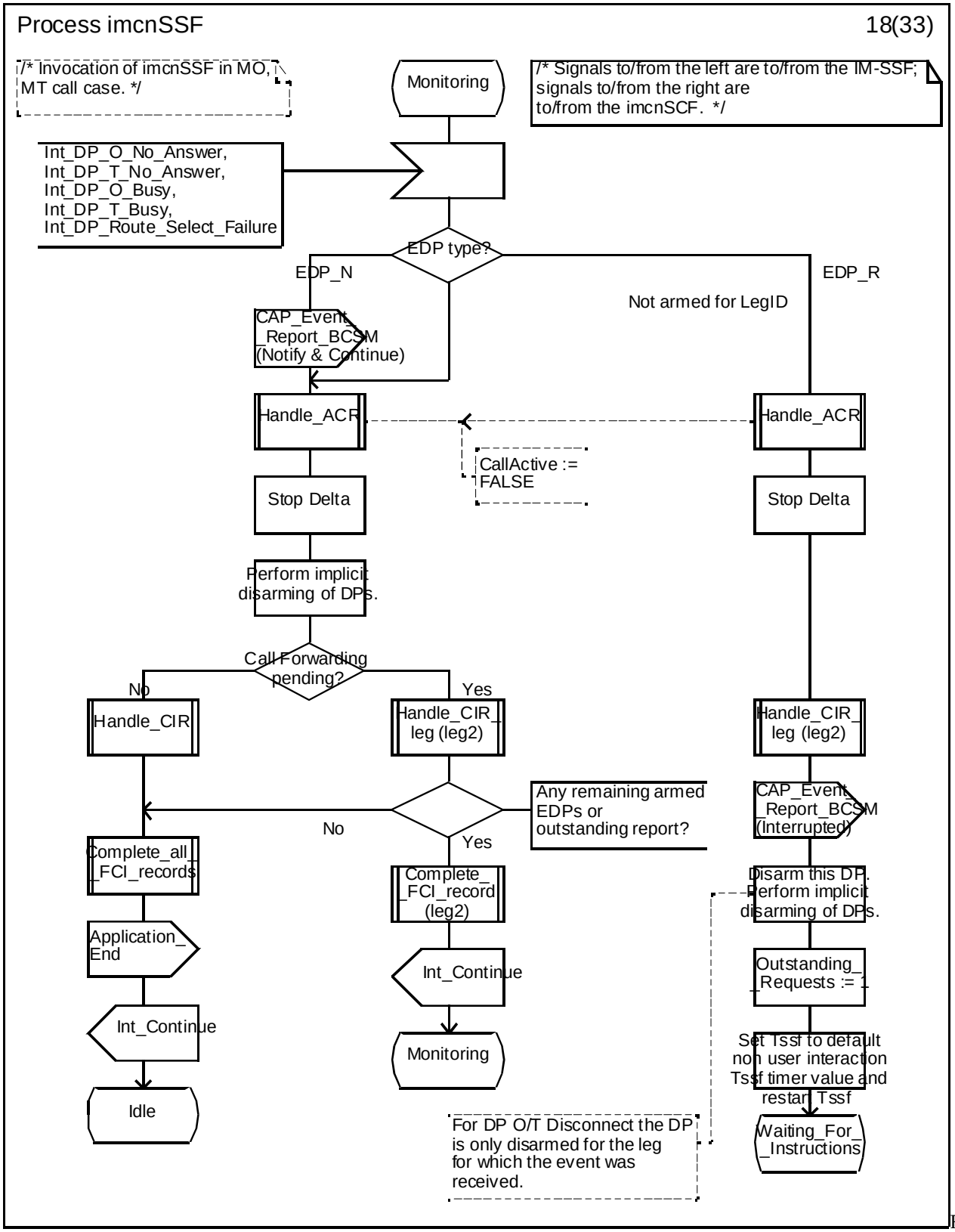

Process imcnSSF
18(33)
/* Invocation of imcnSSF in MO, MT call case. */
Monitoring
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
Int_DP_O_No_Answer,
Int_DP_T_No_Answer,
Int_DP_O_Busy,
Int_DP_T_Busy,
Int_DP_Route_Select_Failure
EDP type?
EDP_N
EDP_R
Not armed for LegID
CAP_Event_Report_BCSM (Notify & Continue)
Handle_ACR
Handle_ACR
CallActive := FALSE
Stop Delta
Stop Delta
Perform implicit disarming of DPs.
Call Forwarding pending?
No
Yes
Handle_CIR
Handle_CIR_leg (leg2)
Handle_CIR_leg (leg2)
Any remaining armed EDPs or outstanding report?
No
Yes
CAP_Event_Report_BCSM (Interrupted)
Complete_all_FCI_records
Complete_FCI_record (leg2)
Disarm this DP. Perform implicit disarming of DPs.
Application_End
Int_Continue
Outstanding_Requests := 1
Int_Continue
Monitoring
Set Tssf to default non user interaction Tssf timer value and restart Tssf
Idle
For DP O/T Disconnect the DP is only disarmed for the leg for which the event was received.
Waiting_For_Instructions

Figure 5.22r

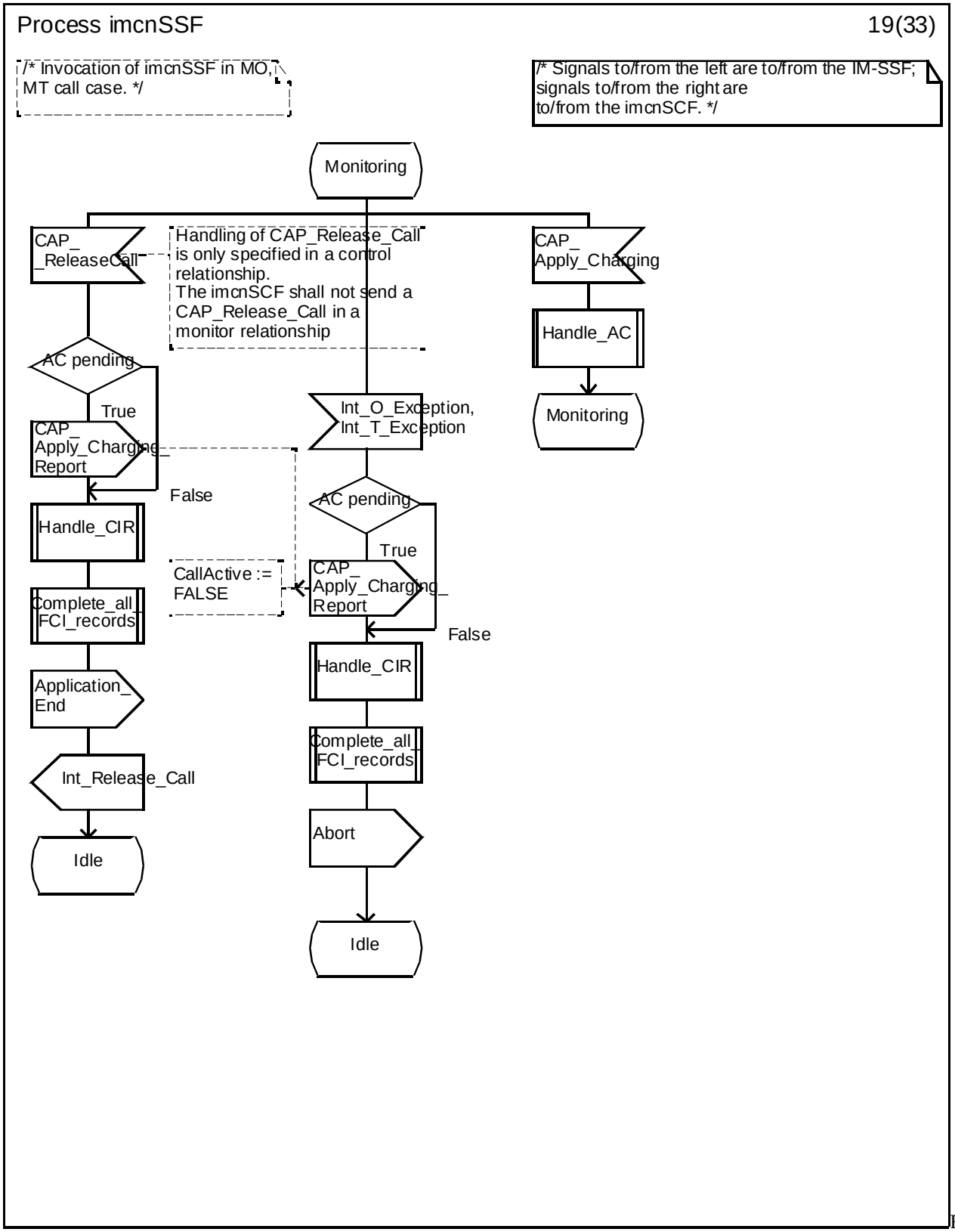

Process imcnSSF
19(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
Monitoring
CAP_ _ReleaseCall
Handling of CAP_Release_Call is only specified in a control relationship. The imcnSCF shall not send a CAP_Release_Call in a monitor relationship
CAP_ Apply_Charging
Handle_AC
Monitoring
AC pending
True
CAP_ Apply_Charging_ Report
False
Handle_CIR
Complete_all_ FCI_records
Application_ End
Int_Release_Call
Idle
Int_O_Exception, Int_T_Exception
AC pending
True
CAP_ Apply_Charging_ Report
CallActive := FALSE
False
Handle_CIR
Complete_all_ FCI_records
Abort
Idle

Figure 5.22s

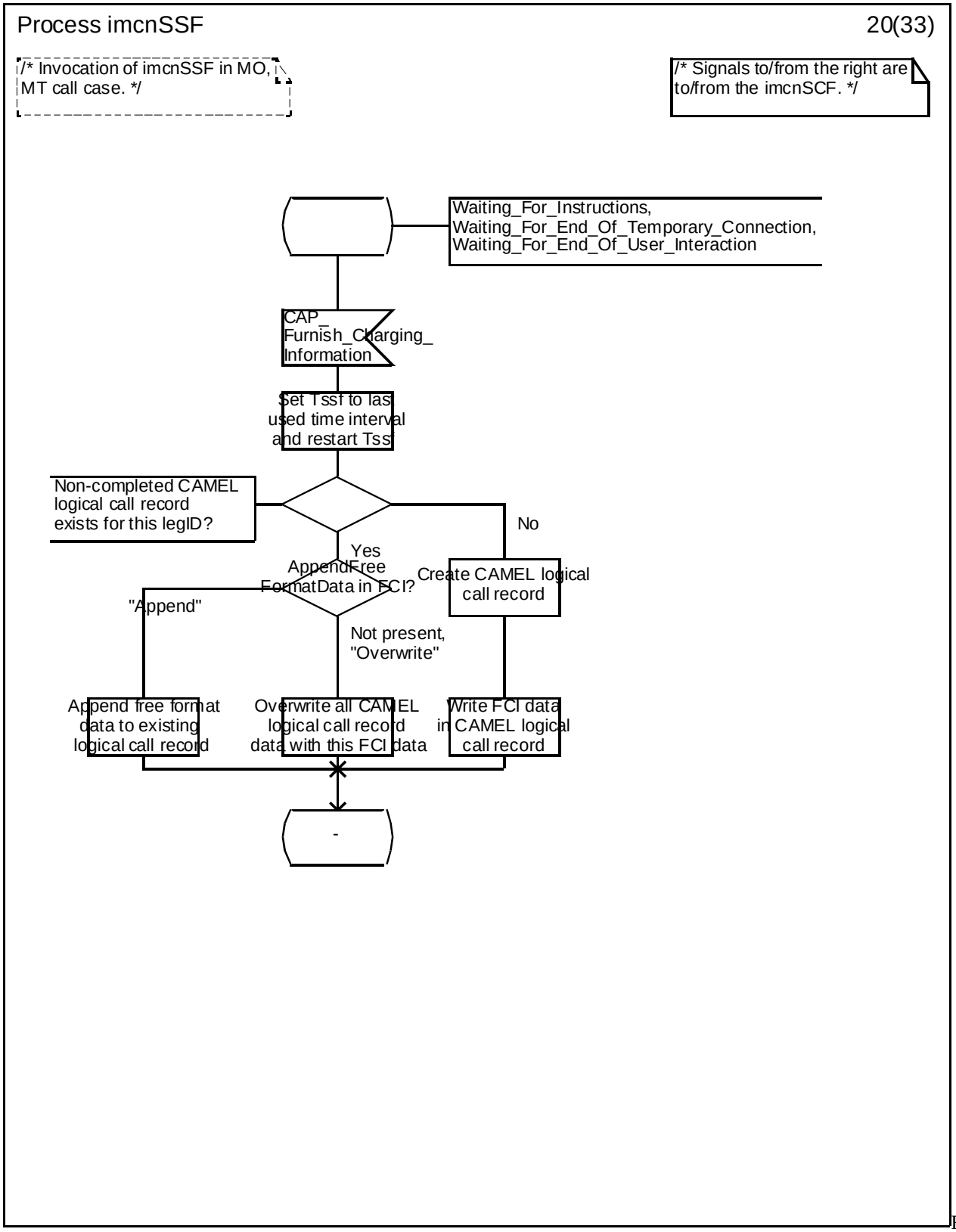

Process imcnSSF
20(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the right are to/from the imcnSCF. */
Waiting_For_Instructions, Waiting_For_End_Of_Temporary_Connection, Waiting_For_End_Of_User_Interaction
CAP_ Furnish_Charging_ Information
Set Tssf to last used time interval and restart Tssf
Non-completed CAMEL logical call record exists for this legID?
No
Yes
AppendFree FormatData in FCI?
Create CAMEL logical call record
"Append"
Not present, "Overwrite"
Append free format data to existing logical call record
Overwrite all CAMEL logical call record data with this FCI data
Write FCI data in CAMEL logical call record
-

Figure 5.22t

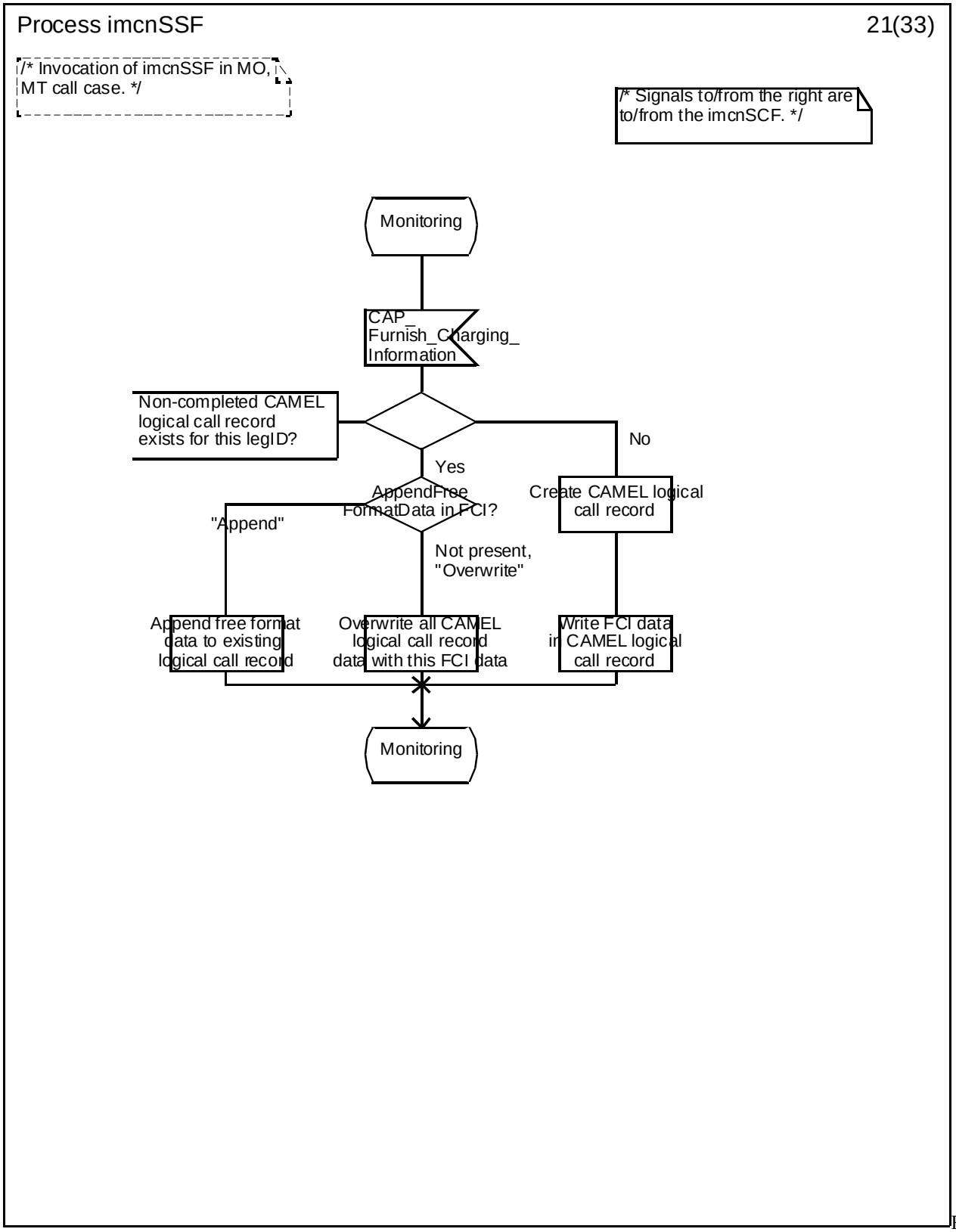

Process imcnSSF
21(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the right are to/from the imcnSCF. */
Monitoring
CAP_ Furnish_Charging_ Information
Non-completed CAMEL logical call record exists for this legID?
No
Yes
AppendFreeFormatData in FCI?
Create CAMEL logical call record
"Append"
Not present, "Overwrite"
Append free format data to existing logical call record
Overwrite all CAMEL logical call record data with this FCI data
Write FCI data in CAMEL logical call record
Monitoring

Figure 5.22u

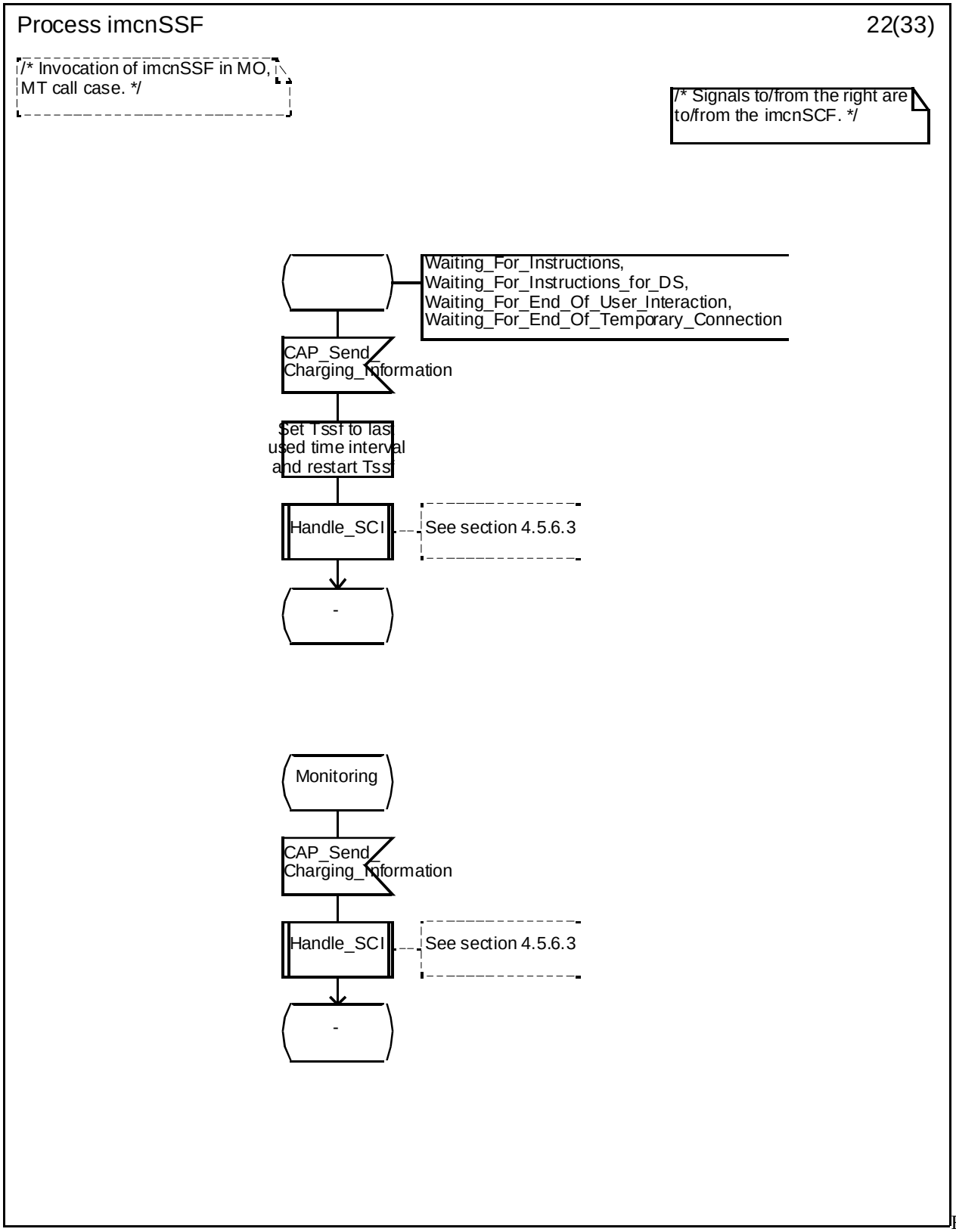

Process imcnSSF
22(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the right are to/from the imcnSCF. */
Waiting_For_Instructions,
Waiting_For_Instructions_for_DS,
Waiting_For_End_Of_User_Interaction,
Waiting_For_End_Of_Temporary_Connection
CAP_Send_Charging_Information
Set Tssf to last used time interval and restart Tssf
Handle_SCI
See section 4.5.6.3
-
Monitoring
CAP_Send_Charging_Information
Handle_SCI
See section 4.5.6.3
-

Figure 5.22v

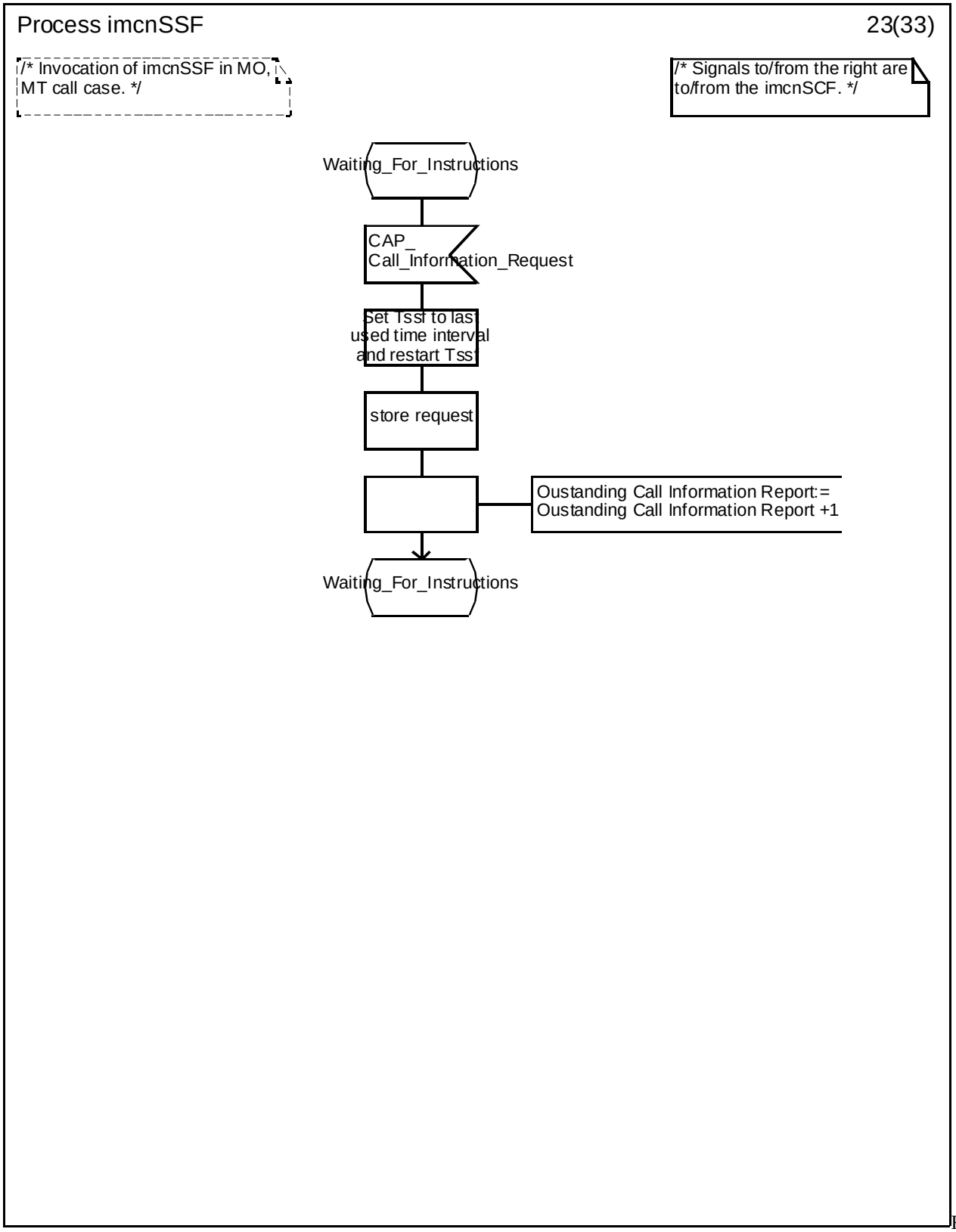

Process imcnSSF
23(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the right are to/from the imcnSCF. */
Waiting_For_Instructions
CAP_ Call_Information_Request
Set Tssf to last used time interval and restart Tssf
store request
Oustanding Call Information Report:= Oustanding Call Information Report +1
Waiting_For_Instructions

Figure 5.22w

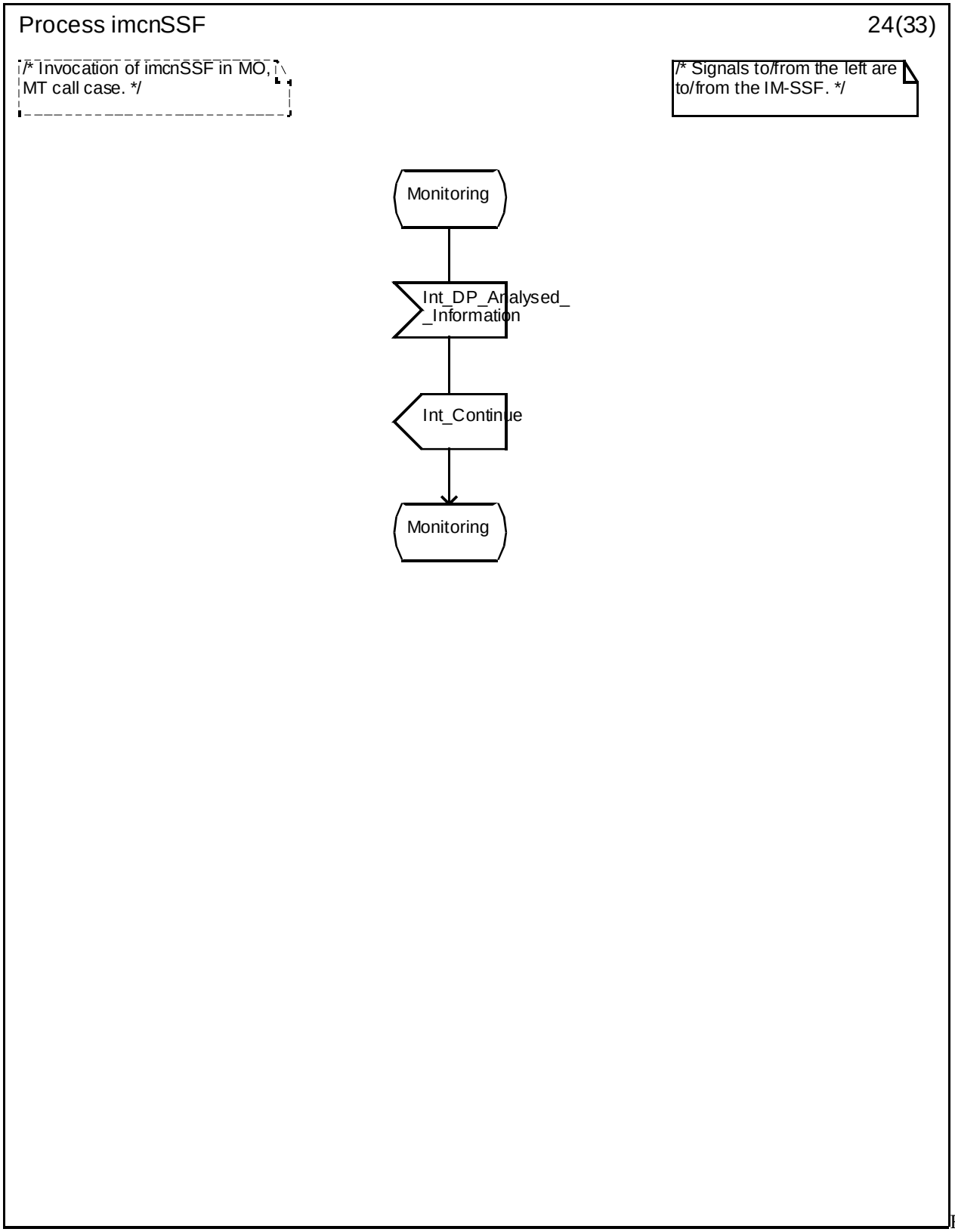

Process imcnSSF
24(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the left are to/from the IM-SSF. */
Monitoring
Int_DP_Analysed_Information
Int_Continue
Monitoring

Figure 5.22x

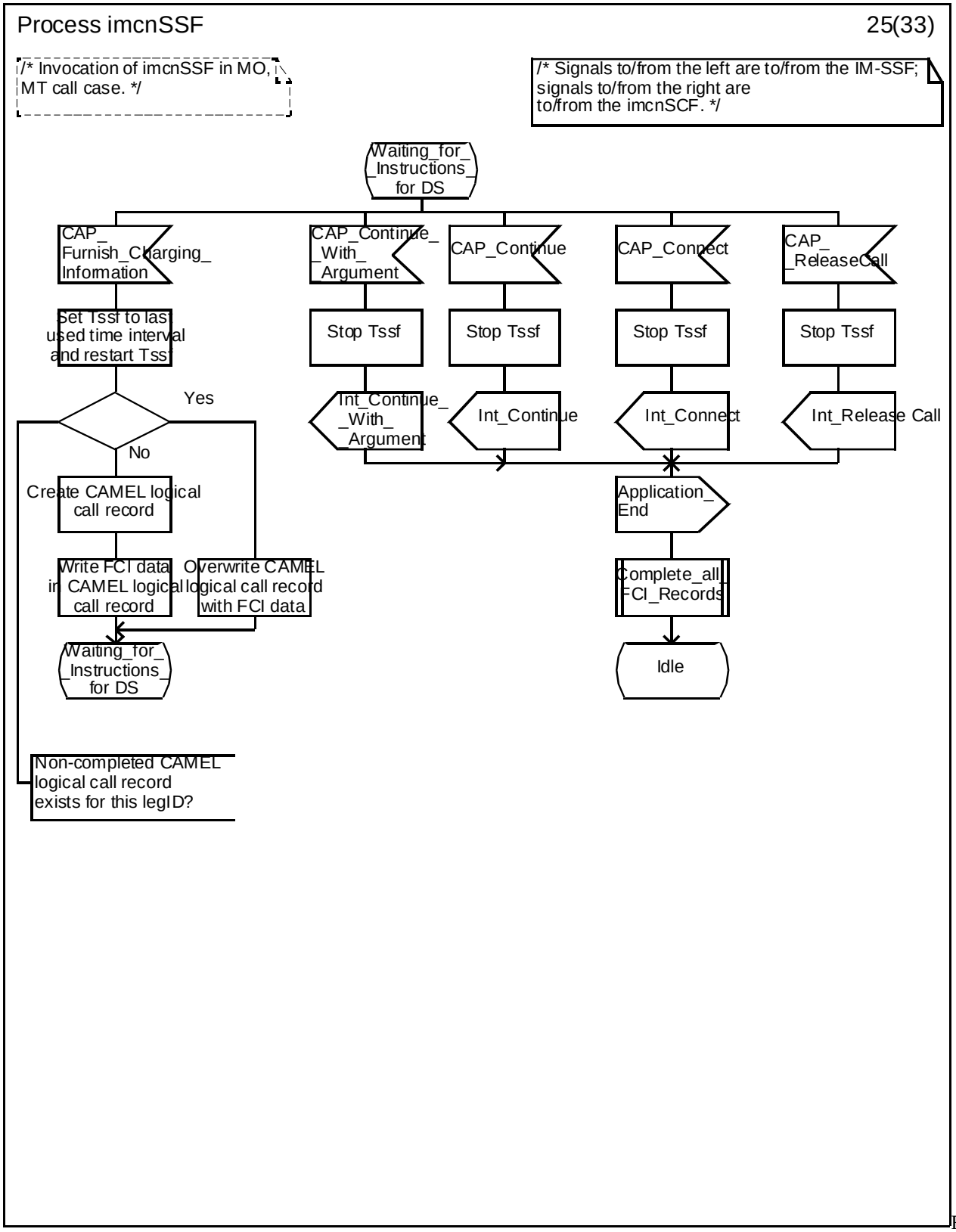

Process imcnSSF
25(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
Waiting_for_Instructions_for DS
CAP_Furnish_Charging_Information
CAP_Continue_With_Argument
CAP_Continue
CAP_Connect
CAP_ReleaseCall
Set Tssf to last used time interval and restart Tssf
Stop Tssf
Stop Tssf
Stop Tssf
Stop Tssf
Yes
No
Int_Continue_With_Argument
Int_Continue
Int_Connect
Int_Release Call
Create CAMEL logical call record
Application_End
Write FCI data in CAMEL logical call record
Overwrite CAMEL logical call record with FCI data
Complete_all_FCI_Records
Waiting_for_Instructions_for DS
Idle
Non-completed CAMEL logical call record exists for this legID?

Figure 5.22y

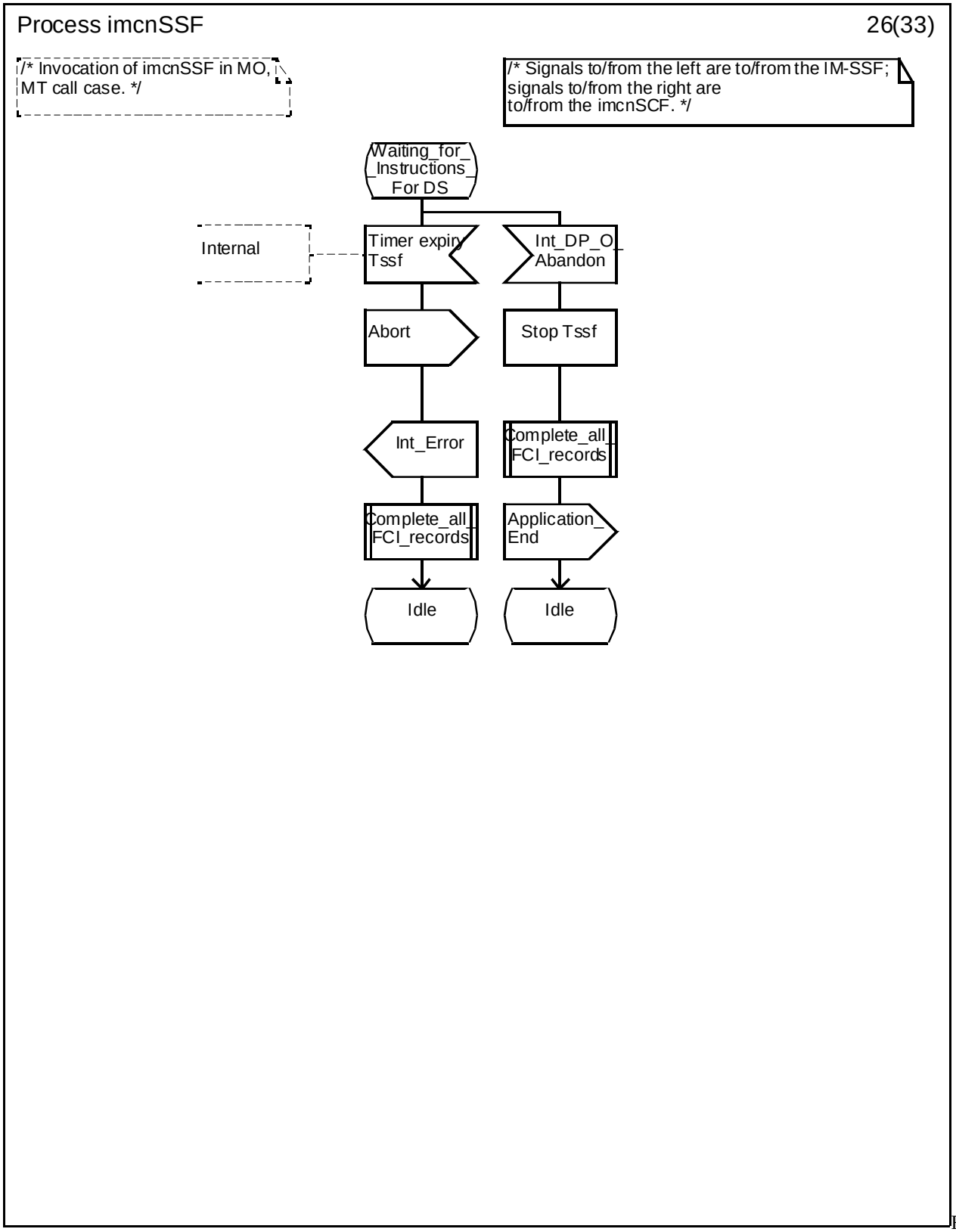

Process imcnSSF
26(33)
/* Invocation of imcnSSF in MO, MT call case. */
/* Signals to/from the left are to/from the IM-SSF; signals to/from the right are to/from the imcnSCF. */
Waiting_for_Instructions_For DS
Internal
Timer expiry Tssf
Int_DP_O_Abandon
Abort
Stop Tssf
Int_Error
Complete_all_FCI_records
Complete_all_FCI_records
Application_End
Idle
Idle

Figure 5.22z

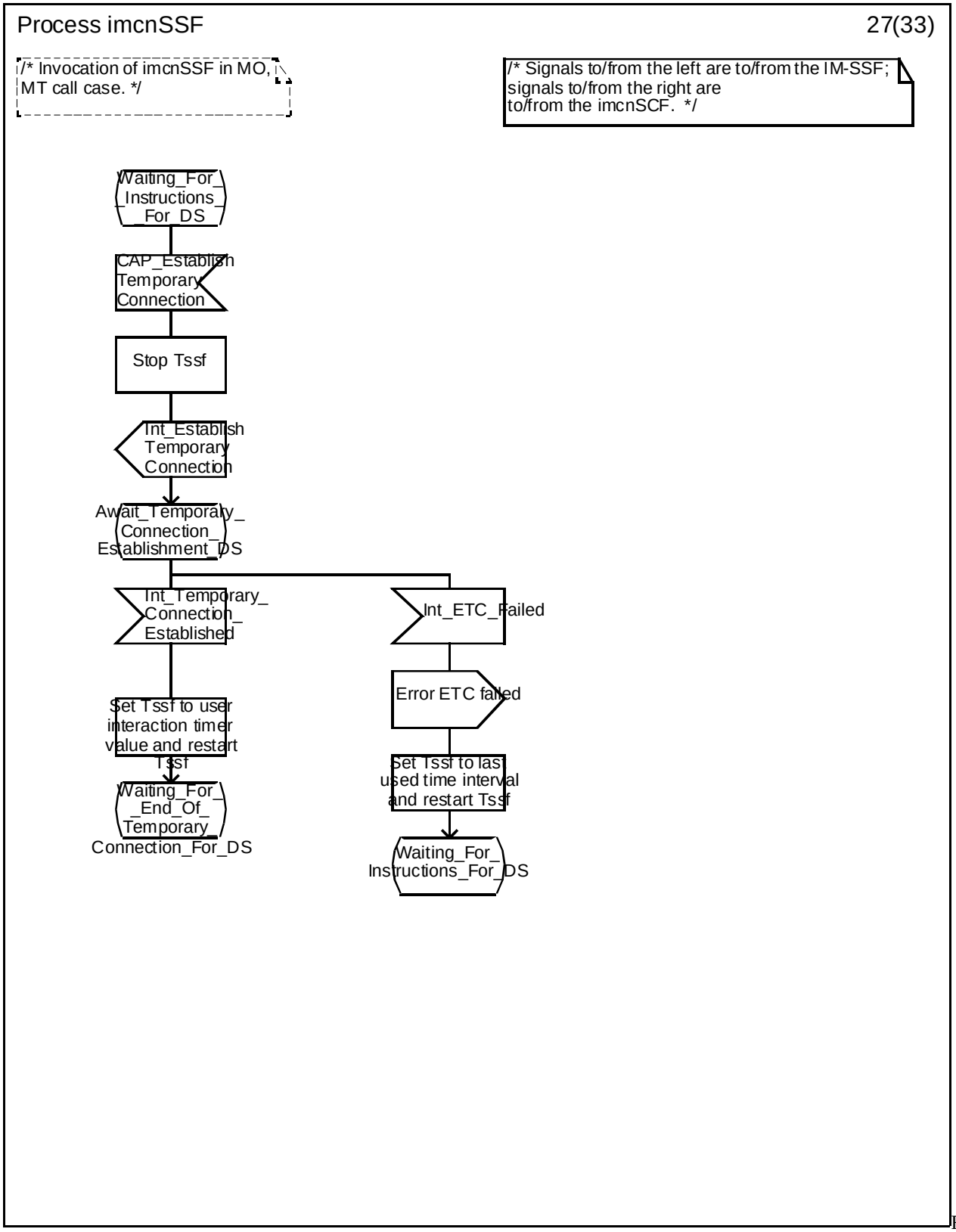


Figure 5.22aa

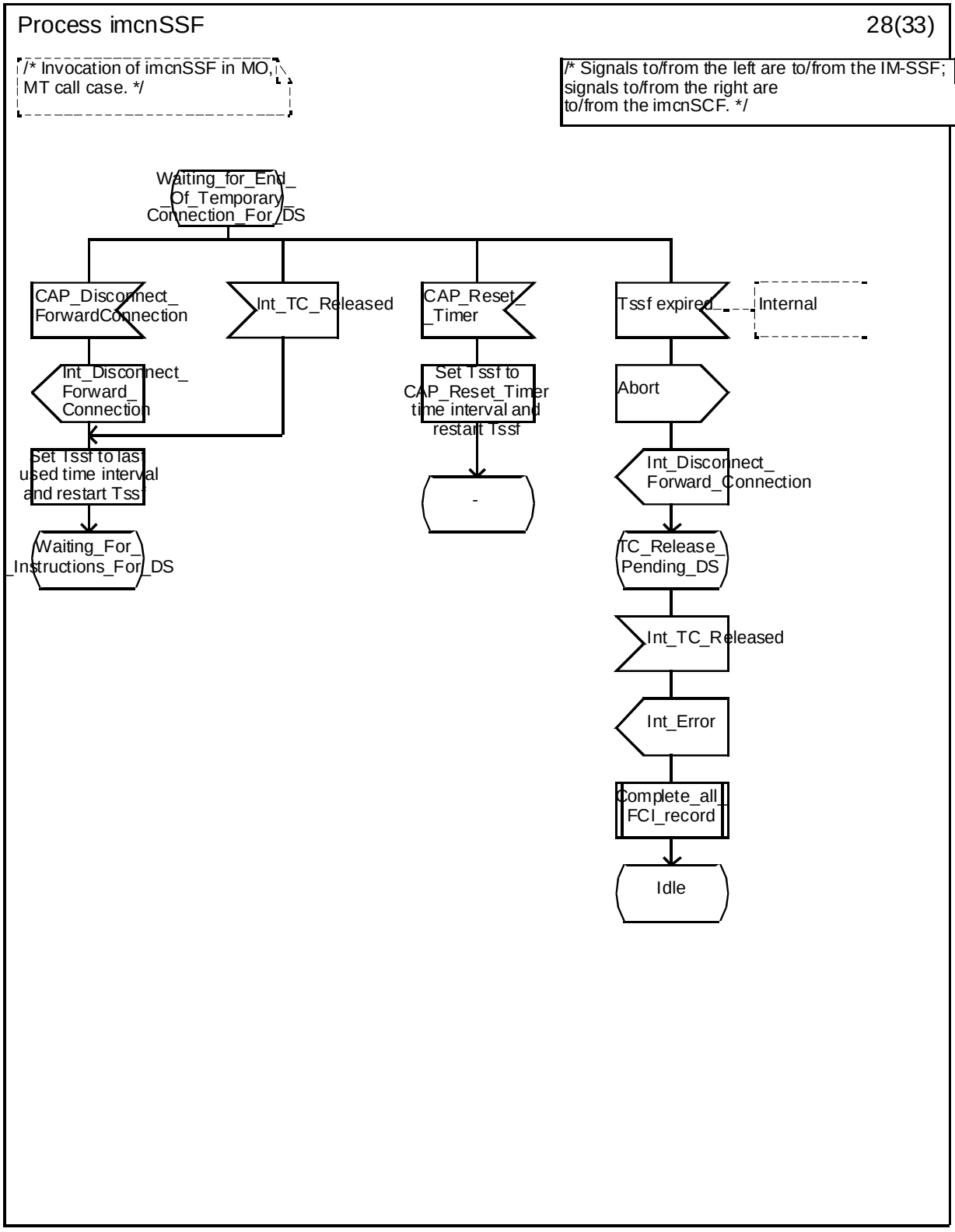


Figure 5.22bb

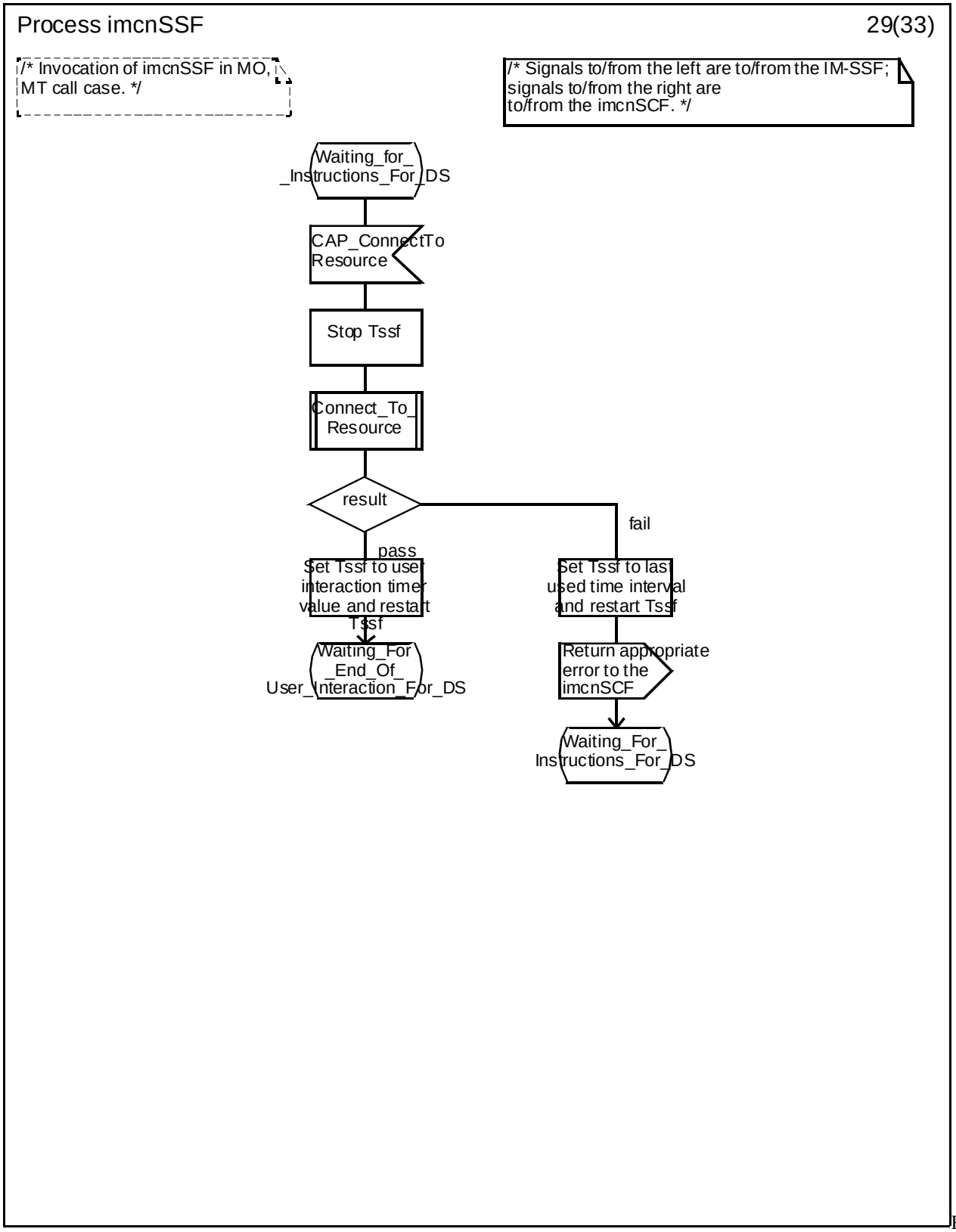


Figure 5.22cc

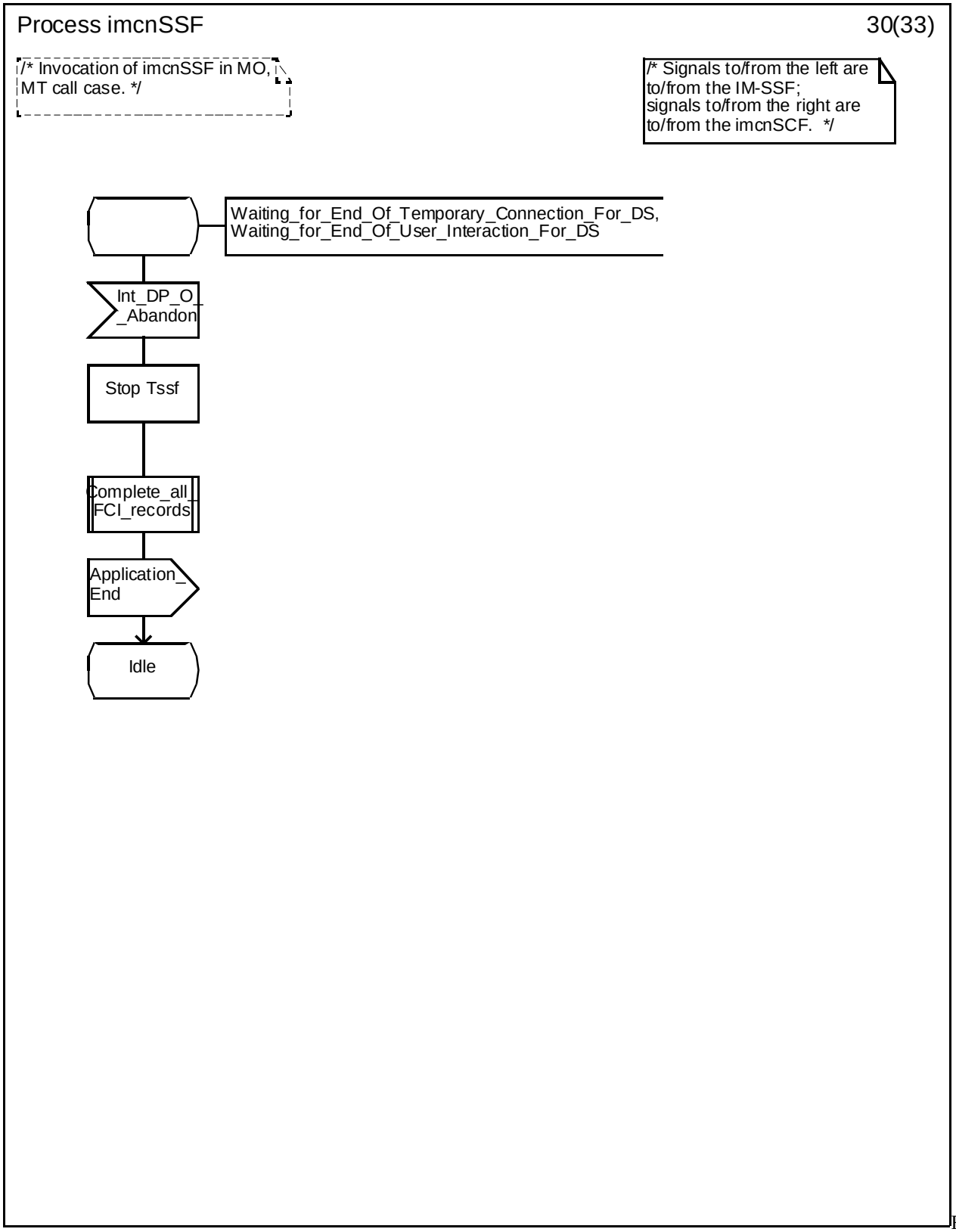


Figure 5.22dd

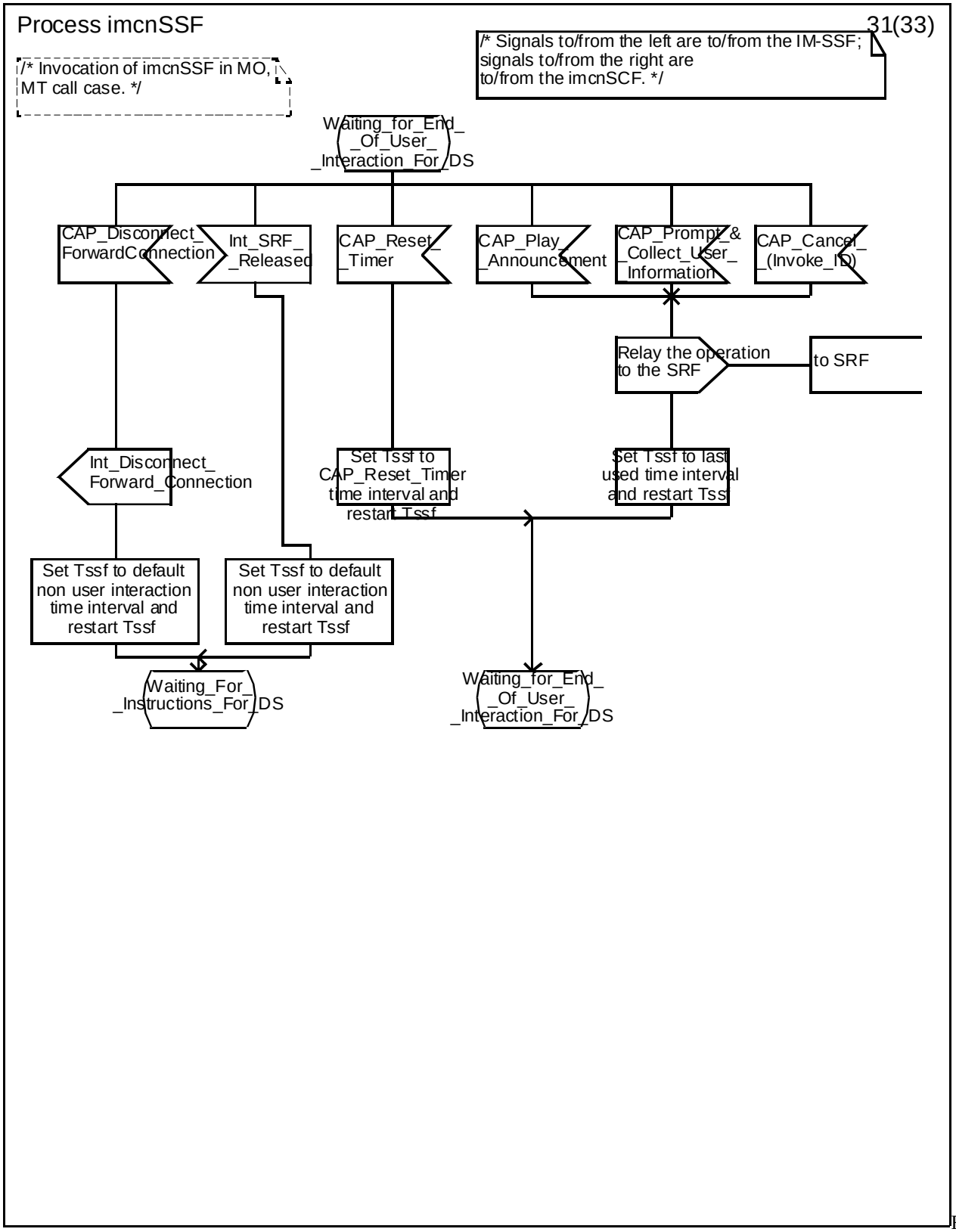


Figure 5.22ee

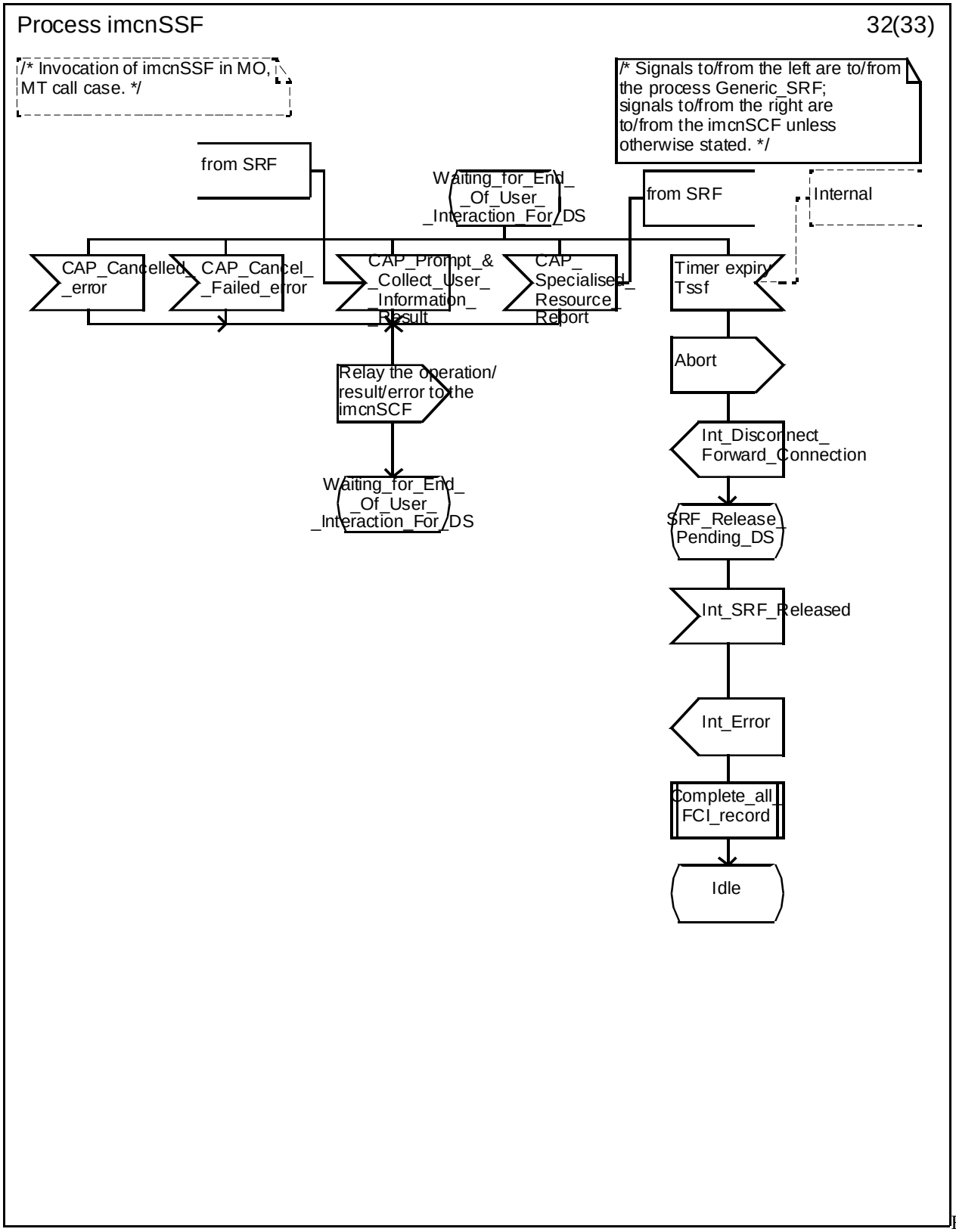


Figure 5.22 ff

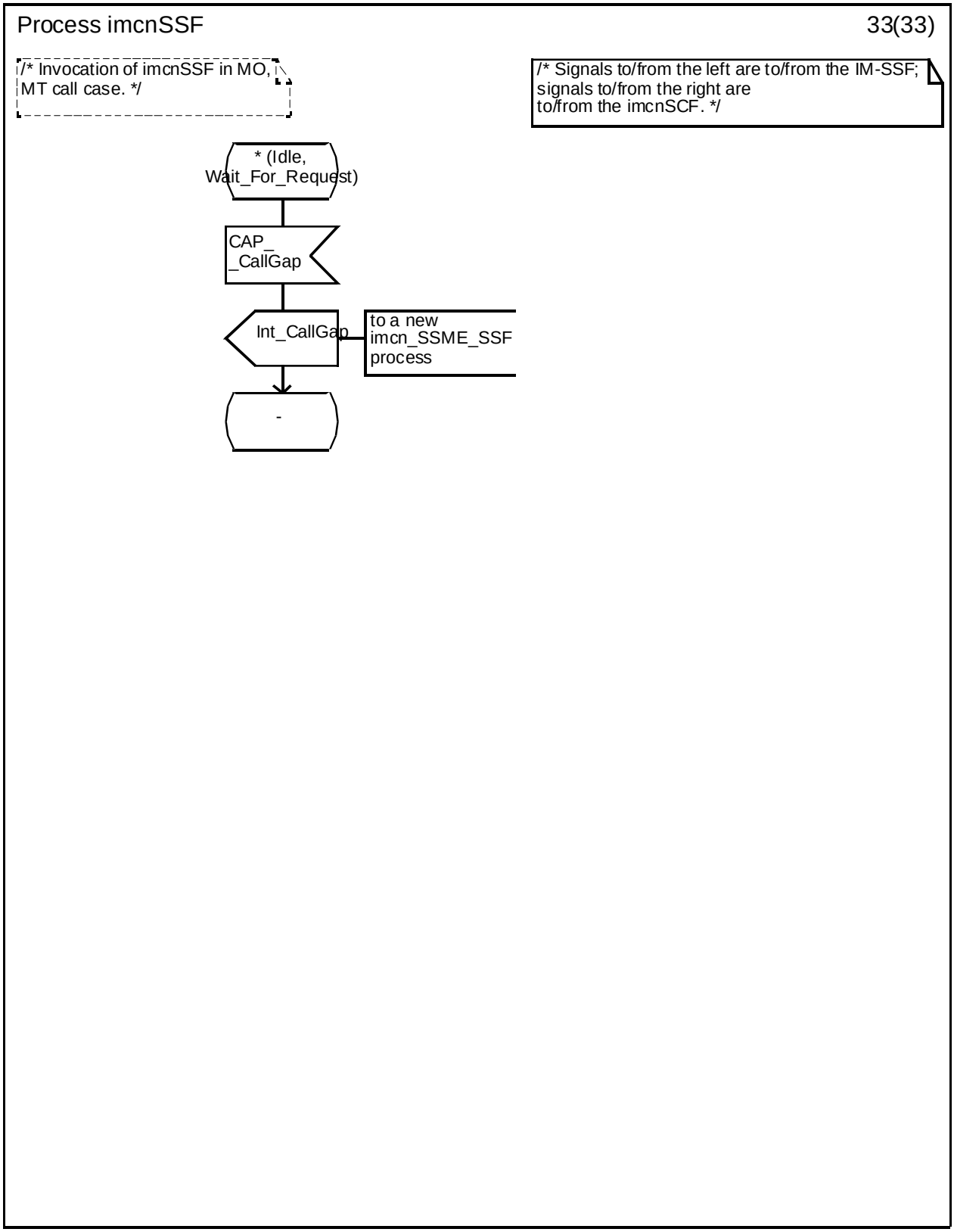


Figure 5.22gg

5.2 Descriptions of information Flows

5.2.1 imcnSSF to gsmSCF information flows

Editor's Note : Place holder for the IF descriptions

5.2.2 gsmSCF to imcnSSF information flows

Editor's Note : Place holder for the IF descriptions

5.2.3 Optional (service logic dependant) gsmSCF to gsmSRF information flows

Editor's Note : Place holder for the IF descriptions

5.2.4 HSS to IM-SSF information flows

Editor's Note : Place holder for the IF descriptions