INTERNATIONAL STANDARD

ISO/IEC 11572

Third edition
2000-03-15

Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Circuit mode bearer services — Inter-exchange signalling procedures and protocol

Technologies de l'information — Télécommunications et échange d'information entre systèmes — Réseau privé à intégration de services — Services porteurs en mode circuit — Procédures et protocole de signalisation d'interéchange

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Reference number
ISO/IEC 11572:2000(E)

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Tel. + 41 22 749 01 11
Fax + 41 22 734 10 79
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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 11572 was prepared by ECMA (as ECMA-143) and was adopted, under a special "fast-track procedure", by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

This third edition cancels and replaces the second edition (ISO/IEC 11572:1997), which has been technically revised.

Annexes A, ZA, ZB and ZC form a normative part of this International Standard. Annexes B to G are for information only.

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Introduction

This International Standard is one of a series of standards defining services and signalling protocols applicable to Private Integrated Services Networks (PISNs). The series uses ISDN concepts as developed by ITU-T and conforms to the framework of International Standards for Open Systems Interconnection as defined by ISO/IEC.

This International Standard defines the signalling protocol for use at the Q-reference point in support of bearer circuit-switched services. The protocol defined in this International Standard forms part of the PSS1 protocol (informally known as QSIG).

This International Standard is based upon the practical experience of ECMA member companies and the results of their active and continuous participation in the work of ISO/IEC JTC1, ITU-T, ETSI and other international and national standardization bodies. It represents a pragmatic and widely based consensus.

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Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Circuit mode bearer services — Inter-exchange signalling procedures and protocol

1 Scope

This International Standard defines the signalling procedures and protocol for the purpose of circuit-switched Call Control at the Q-reference point between Private Integrated Network Exchanges (PINXs) connected together within a Private Integrated Services Network (PISN).

The Q reference point is defined in ISO/IEC 11579-1.

This International Standard is based upon that described in ITU-T Recommendation Q.931, including the provisions for symmetrical operation described in annex D of that recommendation.

Service specifications are produced in three stages and according to the method specified in ETS 300 387. This International Standard contains the stage 3 specification for the Q reference point and satisfies the requirements identified by the stage 1 and stage 2 specifications in ECMA-142, ECMA-148 and ISO/IEC 11584.

This International Standard is applicable to PINXs which interconnect to form a PISN.

Annex ZC is an integral part of this International Standard.

2 Conformance

In order to conform to this International Standard, a PINX shall satisfy the requirements identified in the Protocol Implementation Conformance Statement (PICS) proforma in annex A.

3 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 8886:1996, *Information technology — Open Systems Interconnection — Data link service definition.*

ISO/IEC 11571:1998, *Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Addressing.*

ISO/IEC 11579-1:1994, *Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Part 1: Reference configuration for PISN exchanges (PINX).*

ETS 300 387:1994, *Private Telecommunication Network (PTN); Method for the specification of basic and supplementary services.*

ITU-T Rec. E.164:1991, *Numbering plan for the ISDN era.*

CCITT Rec. I.330:1988, *ISDN numbering and addressing principles (Blue Book).*

ITU-T Rec. Q.931:1993, *ISDN user-network interface layer 3 specification for basic call control.*

CCITT Rec. T.50:1988, *International Alphabet No. 5 (Blue Book).*

4 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

4.1 Private Integrated Services Network (PISN) : An ISDN providing services to a specific set of users (contrary to a public ISDN which provides services to the general public).

NOTE - This definition does not include legal and regulatory aspects and does not indicate any aspects of ownership.

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4.2 Private Integrated Network Exchange (PINX) : A PISN nodal entity which provides automatic connection handling functions used for the provision of telecommunication services based on the definitions of the public ISDN services.

A PISN nodal entity consists of one or more nodes.

4.3 Side, Incoming Side and Outgoing Side : The term Side is used to describe either of the two PINXs at each end of an Inter-PINX link, and in particular to describe the PSS1 Protocol entity within a PINX.

In the context of a call, the Outgoing Side is the Side which routes the call over the Inter-PINX link and the Incoming Side is the Side which receives the call.

See figure 1.

4.4 Outgoing Call and Incoming Call : From the point of view of the Outgoing Side a call is an Outgoing Call.

From the point of view of the Incoming Side a call is an Incoming Call.

4.5 Originating PINX, Terminating PINX and Transit PINX : Within the context of a call, the PINX to which the calling user is attached is known as the Originating PINX.

Within the context of a call, the PINX to which the called user is attached is known as the Terminating PINX.

Within the context of a call, any PINX through which the call passes, excluding the Originating PINX the Terminating PINX, an Incoming gateway PINX and an Outgoing gateway PINX, is known as a Transit PINX.

See figure 1.

4.6 Gateway PINX, Incoming Gateway PINX and Outgoing Gateway PINX : Within the context of a call, a PINX which performs interworking between PSS1 and another signalling system, either ISDN or non-ISDN, is known as a Gateway PINX.

A Gateway PINX which routes an incoming call from a route employing another signalling system on to an Inter-PINX link employing PSS1 signalling is known as an Incoming Gateway PINX.

A Gateway PINX which routes an incoming call from an Inter-PINX link employing PSS1 signalling on to a route employing another signalling system is known as an Outgoing Gateway PINX.

See figure 1.

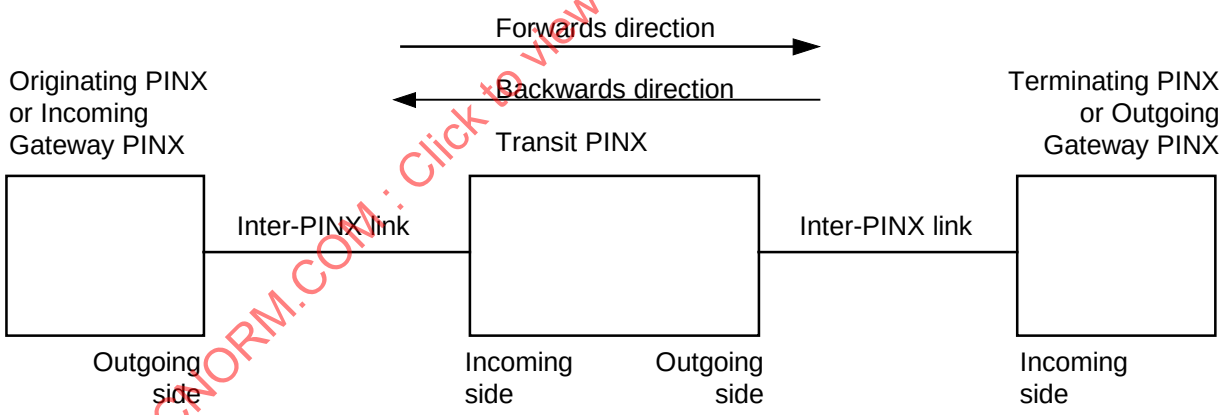

Figure 1 - Illustration of terminology through example of a call routed over two Inter-PINX links employing PSS1

4.7 Preceding PINX and Subsequent PINX : Within the context of a call, from the point of view of a PINX acting as the Incoming Side of an Inter-PINX link, the PINX at the other end of the link, acting as the Outgoing Side, is known as the Preceding PINX.

Within the context of a call, from the point of view of a PINX acting as the Outgoing Side of an Inter-PINX link, the PINX at the other end of the link, acting as the Incoming Side, is known as the Subsequent PINX.

4.8 Inter-PINX link : The totality of a signalling channel connecting two PINXs and the user information channels under the control of that signalling channel, as seen by each PINX.

NOTE - An Inter-PINX link can be provided by various types of Signalling Carriage Mechanism involving different types of physical interface. The signalling and user information channels referred to in this International Standard are independent of the channels or timeslots at a physical interface.

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4.9 Route : A number of user information channels at the Q reference point that have the same characteristics (e.g. transmission capacity, time sequence integrity).

4.10 Signalling Carriage Mechanism (SCM) : The infrastructure that transports messages between Protocol Control entities in two interconnected PINXs.

4.11 Unrecognised message : An unrecognised message is defined as a message which is not specified in clause 13 of this International Standard or in any other Standard relating to PSS1 Protocol to which the PINX claims conformance (e.g., a Standard specifying generic procedures for supplementary services).

NOTE - The handling of national/private messages is outside the scope of this International Standard (see annex D).

4.12 Unexpected message : Within the context of a particular Protocol Control state, an unexpected message is a message which is recognised, but for which no procedures are defined in clauses 9.3 and 10, and annex ZA of this International Standard (or in any other Standard relating to PSS1 Protocol to which the PINX claims conformance) for receipt in that Protocol Control state.

4.13 Unrecognised information element : An unrecognised information element is defined as an information element received in a particular message which is not specified as part of that message in clause 13 of this International Standard or in any other Standard relating to PSS1 Protocol to which the PINX claims conformance (e.g., a Standard specifying generic procedures for supplementary services).

NOTE - The handling of national/private information elements is outside the scope of this International Standard (see annex D).

4.14 Information elements with invalid contents : An information element with invalid contents is defined as an information element which is recognised, but whose contents cannot be interpreted as valid using the rules specified in clause 14 of this International Standard, or contains field values which are marked as "reserved" in clause 14 of this International Standard.

NOTE - The receipt of reserved codepoints in octets 5, 6, and 7 of a Bearer Capability information element, shall not be treated as having invalid contents (see clause 14.5.5).

5 List of acronyms

ANF	Additional Network Feature
DSS1	Digital Subscriber Signalling System Number 1
IE	Information Element
ISDN	Integrated Services Digital Network
MP	Mapping (functional grouping)
PICS	Protocol Implementation Conformance Statement
PISN	Private Integrated Services Network
PINX	Private Services Network Exchange
PSS1	Private Integrated Signalling System Number 1
SCM	Signalling Carriage Mechanism
TE	Terminal Equipment

6 General principles

The Basic Call is a single invocation of a basic service. This International Standard specifies the signalling procedures for establishing, maintaining and clearing a circuit-mode Basic Call at an interface between two PINXs. These signalling procedures are defined in terms of messages exchanged over a Signalling Carriage Mechanism (SCM) connection within the signalling channel of the Inter-PINX link. The result of successful Basic Call establishment is a connection for the purpose of user information transfer. This connection uses a user information channel of the Inter-PINX link.

Throughout this International Standard, the term user information channel is used to indicate any channel other than the signalling channel.

Conceptually, an Inter-PINX link is attached to a PINX at the Q-reference point, and comprises a signalling channel and one or more user information channels. In practice, these channels are provided by bearer services of an intervening network (ISDN or non-ISDN).

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6.1 Protocol model

Figure 2 shows the relationship, within the Control Plane, between the signalling procedures and protocol at Q, and the adjacent layers.

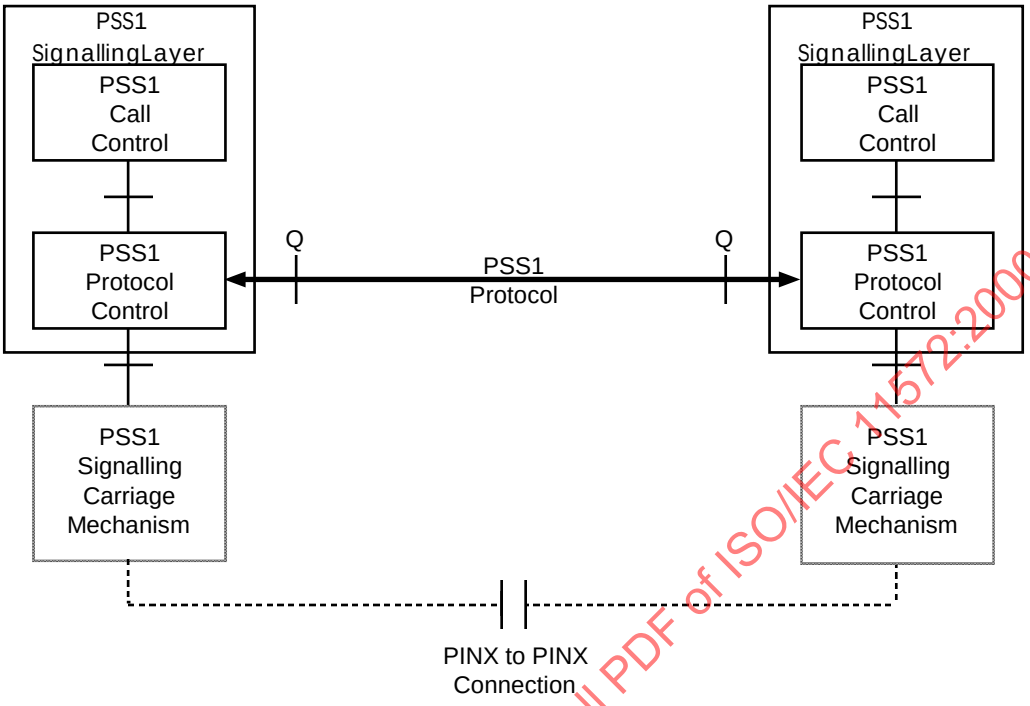

Figure 2 - Control Protocol Model

The Protocol Control entity provides services to Call Control. Call Control corresponds to the Call Control functional entity identified for the Basic Call at Stage 2 (see ECMA-142). Primitives exchanged across the boundary between Call Control and Protocol Control correspond to the information flows exchanged between the Call Control functional entities, as identified at Stage 2. Protocol Control provides the mapping between these primitives and the messages transferred across the Inter-PINX link.

In order to transfer messages, Protocol Control uses the services of the Signalling Carriage Mechanism. The actual protocols visible at the C-reference point (see ISO/IEC 11579-1) are dependent upon the PINX interconnection scenario.

6.2 Services provided to Call Control

Protocol Control provides services to Call Control whereby Call Control can send information flows to and receive information flows from the peer Call Control. A primitive from Call Control to Protocol Control of type “request” or “response” normally results in the associated information flow being presented to the peer Call Control as a primitive of type “indication” or “confirmation” respectively. The following primitives are used:

– SETUP-REQUEST/INDICATION/RESPONSE/CONFIRMATION for the establishment of a call;

– MORE_INFORMATION-REQUEST/INDICATION for requesting more destination addressing information during call establishment;

– INFORMATION-REQUEST/INDICATION for providing more destination addressing information during call establishment;

– PROCEED-REQUEST/INDICATION for indicating that sufficient destination addressing information has been received and call establishment is proceeding;

– ALERTING-REQUEST/INDICATION for indicating that the destination user is being alerted;

– PROGRESS-REQUEST/INDICATION for indicating interworking conditions and/or the availability of in-band patterns;

– REJECT-REQUEST/INDICATION for the immediate rejection of a call;

– DISCONNECT-REQUEST/INDICATION for the initiation of call release;

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– RELEASE-REQUEST/INDICATION for the completion of call release;

– DL_RESET-INDICATION for indicating to Call Control that a SCM reset has occurred.

6.3 Services required of the Signalling Carriage Mechanism

The services required of the Signalling Carriage Mechanism can be defined in terms of the services provided by ISO/IEC 8886. Protocol Control uses the following acknowledged information transfer services and their associated primitives:

– Data transfer (i.e. Protocol Control message transfer), using the DL-DATA-REQUEST/INDICATION primitives;

– Establishment, using the DL-ESTABLISH-REQUEST/INDICATION/CONFIRM primitives;

– Termination, using the DL-RELEASE-REQUEST/INDICATION primitives.

NOTE - An implementation is not constrained to use the ISO/IEC 8886 Protocol in order to provide these primitives.

7 Protocol Control states

Protocol Control procedures for calls and layer management are specified in terms of:

a) messages which are transferred across the Inter-PINX link,

b) the primitives to and from Call Control at each PINX,

c) the information processing and actions that take place within Protocol Control at each PINX, and

d) the states that can exist within Protocol Control at each PINX.

State machines are deemed to exist for each circuit-mode call. Further state machines are deemed to exist for layer management.

7.1 States for circuit-mode Call Control

The states below are used in association with call references other than the global call reference.

7.1.1 Null State (0)

No call exists.

7.1.2 Call Initiated (1)

This state exists for an outgoing call when the Outgoing Side has sent a request for call establishment to the Incoming Side but has not yet received a response.

7.1.3 Overlap Sending (2)

This state exists for an outgoing call when the Outgoing Side has received acknowledgement that the Incoming Side is able to receive additional call information in overlap mode.

7.1.4 Outgoing Call Proceeding (3)

This state exists for an outgoing call when the Outgoing Side has received acknowledgement that the Incoming Side has received all call information necessary to effect call establishment.

7.1.5 Call Delivered (4)

This state exists for an outgoing call when the Outgoing Side has received from the Incoming Side an indication that the called user is being alerted.

7.1.6 Call Present (6)

This state exists for an incoming call when the Incoming Side has not yet responded to the request from the Outgoing Side for call establishment.

7.1.7 Call Received (7)

This state exists for an incoming call when the Incoming Side has indicated to the Outgoing Side that the called user is being alerted.

7.1.8 Connect Request (8)

This state exists for an incoming call when the Incoming Side has indicated to the Outgoing Side that the called user has answered the call.

NOTE - "answered" is the act of the end user accepting the call.

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7.1.9 Incoming Call Proceeding (9)

This state exists for an incoming call when the Incoming Side has sent to the Outgoing Side acknowledgement that it has received all call information necessary to effect call establishment.

7.1.10 Active (10)

This state exists for an incoming call when the Incoming Side has received from the Outgoing Side an acknowledgement of the indication that the called user has answered the call. This state exists for an outgoing call when the Outgoing Side has received from the Incoming Side an indication that the called user has answered the call.

NOTE - "answered" is the act of the end user accepting the call.

7.1.11 Disconnect Request (11)

This state exists when a Side has sent to the other Side a request to disconnect the user information connection and is waiting for a response.

7.1.12 Disconnect Indication (12)

This state exists when a Side has received from the other Side a request to disconnect the user information connection and has not yet responded.

7.1.13 Release Request (19)

This state exists when a Side has sent to the other Side a request to release the call and has not yet received a response.

7.1.14 Overlap Receiving (25)

This state exists for an incoming call when the Incoming Side has sent acknowledgement to the Outgoing Side that it is able to receive additional call information in overlap mode.

7.2 States for layer management

The states below are used in association with the global call reference.

7.2.1 Null State (Rest 0)

No transaction exists.

7.2.2 Restart Request (Rest 1)

This state exists for a restart transaction when the Side has sent a restart request to the other Side but has not yet received an acknowledgement.

7.2.3 Restart (Rest 2)

This state exists for a restart transaction when the Side has received a restart request from the other Side but has not yet sent an acknowledgement.

8 Call Control

In addition to specifying Protocol Control, this International Standard also specifies those aspects of Call Control which are necessary for PINXs to cooperate in the control of calls through a PISN. Although the behaviour of a Protocol Control entity with respect to a call is dependent on whether the PINX is the Outgoing Side or the Incoming Side of the Inter-PINX link, its behaviour is independent of whether the PINX is a Transit PINX, an End (Originating or Terminating) PINX, or a Gateway PINX. Call Control requirements, on the other hand, are dependent on whether the PINX is a Transit PINX, an Originating PINX, a Terminating PINX, an Incoming Gateway PINX or an Outgoing Gateway PINX.

Subclause 10.4 specifies the special Call Control requirements of a Transit PINX for coordinating the two Protocol Control entities. The requirements of subclause 10.4 are in addition to the requirements of Protocol Control, which are to be satisfied for both the Incoming Inter-PINX link and the Outgoing Inter-PINX link. An SDL representation of Call Control for a Transit PINX appears in annex F.

Subclause 10.5 specifies the special Call Control requirements for Originating PINXs. The requirements of subclause 10.5 are in addition to the requirements of Protocol Control, which are to be satisfied on the Outgoing Inter-PINX link.

Subclause 10.6 specifies the special Call Control requirements for Terminating PINXs. The requirements of subclause 10.6 are in addition to the requirements of Protocol Control, which are to be satisfied on the Incoming Inter-PINX link.

Subclause 10.7 specifies the special Call Control requirements for Incoming Gateway PINXs. The requirements of subclause 10.7 are in addition to the requirements of Protocol Control, which are to be satisfied on the Outgoing Inter-PINX link.

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Clause 10.8 specifies the special Call Control requirements for Outgoing Gateway PINXs. The requirements of subclause 10.8 are in addition to the requirements of Protocol Control, which are to be satisfied on the Incoming Inter-PINX link.

8.1 States for Transit PINX Call Control

The states below are used in association with calls in Call Control of a Transit PINX.

NOTE - These states are used in order to describe the behaviour of the Transit PINX Call Control function. These internal states are a descriptive tool and are not intended to constrain implementations.

8.1.1 TCC_Idle (0)

No call exists.

8.1.2 TCC_Await Digits (1)

This state exists when Call Control has received a request for call establishment from the Preceding PINX and is awaiting additional call information in order to select a route to the Subsequent PINX.

8.1.3 TCC_Await Additional Digits (2)

This state exists when Call Control has sent a request for call establishment to the Subsequent PINX and is awaiting possible additional call information from the Preceding PINX.

8.1.4 TCC_Overlap (3)

This state exists when Call Control is awaiting possible additional call information from the Preceding PINX, having received acknowledgement that the Subsequent PINX is able to receive additional call information in overlap mode.

8.1.5 TCC_Incoming Call Proceeding (4)

This state exists when Call Control has determined that it has received all call information necessary to effect call establishment and has informed the Preceding PINX, but no response to the request for call establishment has been received from the Subsequent PINX.

8.1.6 TCC_Transit Call Proceeding (5)

This state exists when Call Control has received from the Subsequent PINX a response to the request for call establishment and is no longer expecting additional call information to pass to the Subsequent PINX in overlap mode.

8.1.7 TCC_Call Alerting (6)

This state exists when Call Control has received from the Subsequent PINX an indication that the called user is being alerted and has relayed the indication on to the Preceding PINX.

8.1.8 TCC_Call Active (7)

This state exists when Call Control has received from the Subsequent PINX and relayed on to the Preceding PINX an indication that the called user has answered the call.

NOTE - "answered" is the act of the end user accepting the call.

8.1.9 TCC_Await Incoming Release (8)

This state exists when Call Control has initiated call clearing towards the Preceding PINX and is awaiting an acknowledgement.

8.1.10 TCC_Await Outgoing Release (9)

This state exists when Call Control has initiated call clearing towards the Subsequent PINX and is awaiting an acknowledgement.

8.1.11 TCC_Await Two-Way Release (10)

This state exists when Call Control has initiated call clearing towards the Preceding PINX and towards the Subsequent PINX and is awaiting an acknowledgement from each.

8.1.12 TCC_Await Incoming Disconnect (11)

This state exists when Call Control has applied an in-band tone or announcement towards the Preceding PINX and is awaiting the initiation of clearing procedures.

8.1.13 TCC_Await Outgoing Disconnect (12)

This state exists when Call Control has applied an in-band tone or announcement towards the Subsequent PINX and is awaiting the initiation of clearing procedures.

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8.1.14 TCC_Await Two-Way Disconnect (13)

This state exists when Call Control has applied an in-band tone or announcement towards both the Preceding PINX and the Subsequent PINX and is awaiting the initiation of clearing procedures.

9 General procedures

9.1 Use of the services of Signalling Carriage Mechanism

This clause specifies the use by PSS1 of the services of the Signalling Carriage Mechanism.

NOTE - The SCM provides a defined service of quality.

9.1.1 Establishment of a Signalling Carriage Mechanism connection

Before the procedures for Call Control, layer management or any of the general procedures in clauses 9.2, 9.3 and annex ZA can be performed, a SCM connection shall be established. If a SCM connection has not already been established, Protocol Control shall request establishment by sending a DL-ESTABLISH-REQUEST primitive to the Signalling Carriage Mechanism. Receipt of a DL-ESTABLISH-CONFIRMATION primitive or a DL-ESTABLISH-INDICATION primitive from the Signalling Carriage Mechanism indicates that a SCM connection has been established.

9.1.2 Transfer of data

A PSS1 message (or message segment) is transmitted by including it with a DL-DATA-REQUEST primitive to the Signalling Carriage Mechanism.

A PSS1 message (or message segment) appears included with a DL-DATA-INDICATION primitive from the Signalling Carriage Mechanism.

9.1.3 Signalling Carriage Mechanism reset

Receipt of a DL-ESTABLISH-INDICATION primitive from the Signalling Carriage Mechanism subsequent to establishment of the SCM connection indicates a spontaneous SCM reset. The procedures specified in subclause 9.2.8 shall apply.

9.1.4 Signalling Carriage Mechanism failure

Receipt of a DL-RELEASE-INDICATION primitive from the SCM indicates a SCM malfunction. The procedures specified in subclause 9.2.9 shall apply.

9.2 Handling of protocol error conditions

The procedures of clauses 9.3, 10, 11 and 12 of this specification are applicable only to those messages which pass the checks described in subclauses 9.2.1 through 9.2.7.

Subclauses 9.2.1 through 9.2.7 are listed in order of precedence.

9.2.1 Protocol discriminator error

When a message is received with a protocol discriminator not in accordance with subclause 14.2, that message shall be ignored. “Ignore” means to do nothing, as if the message had never been received.

9.2.2 Message too short

When a message is received that is too short to contain a complete message type information element, that message shall be ignored.

9.2.3 Call reference error

9.2.3.1 Invalid call reference format

If the Call reference information element octet 1, bits 5 through 8 do not equal “0000”, then the message shall be ignored.

If octet 1, bits 1 through 4 of the call reference information element indicates a length greater than the maximum length supported by the receiving equipment, then the message shall be ignored.

If a message containing the Dummy call reference is received, except when used in the context of other Standards which define its use, the message shall be ignored.

9.2.3.2 Call reference procedural errors

Whenever any message except SETUP, STATUS, RELEASE or RELEASE COMPLETE is received specifying a call reference (other than the global call reference) which is not recognised as relating to an active call or to a call in progress, the

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receiving entity shall send a RELEASE COMPLETE message and remain in the null state. The RELEASE COMPLETE message shall contain the call reference of the received message and cause number 81, “invalid call reference value”.

Alternatively, the receiving entity may send a RELEASE message (in place of the RELEASE COMPLETE message) in this situation, but this is not the preferred option. The RELEASE message shall contain the call reference of the received message and cause number 81, “invalid call reference value”.

When a SETUP message is received specifying a call reference which is not recognised as relating to an active call or to a call in progress, and with a call reference flag incorrectly set to ONE, this message shall be ignored.

When a STATUS message is received specifying a call reference which is not recognised as relating to an active call or to a call in progress, the procedures of subclause 9.3.2 shall apply.

When a RELEASE message is received specifying a call reference which is not recognised as relating to an active call or to a call in progress, the receiving entity shall send a RELEASE COMPLETE message. The RELEASE COMPLETE message shall contain the call reference of the received message and cause number 81, “invalid call reference value”.

When a RELEASE COMPLETE message is received specifying a call reference which is not recognised as relating to an active call or to a call in progress, no action shall be taken.

When a SETUP message is received specifying a call reference which is recognised as relating to an active call or to a call in progress, this SETUP message shall be ignored.

When any message except RESTART, RESTART ACKNOWLEDGE or STATUS is received specifying the global call reference, no action shall be taken on this message and a STATUS message specifying the global call reference with cause number 81 “invalid call reference value” shall be returned.

9.2.4 Message type or message sequence errors

Whenever an unrecognised or unexpected message is received in any state other than the Null state, a STATUS message shall be returned with a cause information element. The cause value used shall be number 98 “message not compatible with call state or message type non-existing or not implemented”. If the receiving entity can distinguish between unimplemented (or non-existing) message types and implemented message types which are incompatible with the call state, then the cause used shall be:

– cause number 97 “message type non-existing or not implemented”; or

– cause number 101 “message type not compatible with the call state”

Alternatively, a STATUS ENQUIRY message may be sent requesting the Protocol Control state of the peer entity.

There are two exceptions where a STATUS or STATUS ENQUIRY message shall not be sent. The first exception is when the outgoing or incoming side receives an unexpected RELEASE message (e.g., if the DISCONNECT message was corrupted by undetected transmission errors). In this case the receiving entity shall: disconnect and release the information channel; return RELEASE COMPLETE message to the originator; release the call reference; stop all timers; enter the Null state; and inform Call Control.

The second exception is when the outgoing or incoming side receives an unexpected RELEASE COMPLETE message. In this case, the receiving entity shall: disconnect and release the information channel; release the call reference; stop all timers; enter the Null state; and inform Call Control.

9.2.5 General information element errors

9.2.5.1 Duplicated information elements

If an information element is repeated in a message more times than is permitted for that particular message, only the contents of the occurrences of that information element up to the limit of repetitions shall be handled. All subsequent occurrences of the element shall be ignored.

9.2.5.2 Information elements exceeding maximum length

Information elements with a length exceeding the maximum length (given in clause 14) shall be treated as information elements with content error.

9.2.5.3 Information elements out of sequence

If a variable length information element is received out of sequence (i.e. its code value is lower than that of the previous variable length information element) the receiving entity may ignore this information element and continue to process the message.

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NOTE - If the information element is mandatory and the receiver chooses to ignore the element, the error handling procedures of 9.2.6.1 will be followed. If the ignored information element is non-mandatory, the receiver will continue to process the message.

Some implementations may choose to process all the information elements received, regardless of the order in which they are received.

9.2.6 Mandatory information element errors

9.2.6.1 Mandatory information element missing

When a message other than SETUP, DISCONNECT, RELEASE, or RELEASE COMPLETE is received which has one or more mandatory information elements missing, no action shall be taken on the message and no state change shall occur. A STATUS message shall then be returned with cause number 96 “mandatory information element is missing”.

When a SETUP message is received which has one or more mandatory information elements missing, a RELEASE COMPLETE message with cause number 96 “mandatory information element is missing” shall be returned.

When a DISCONNECT message is received with one or more mandatory information elements missing, the actions taken shall be the same as if a DISCONNECT message with cause number 31 “normal, unspecified” was received (see clause 10.2), with the exception that the RELEASE message returned shall contain cause number 96 “mandatory information element missing”.

When a RELEASE message is received as the first clearing message with one or more mandatory information elements missing the actions taken shall be the same as if a RELEASE message with cause number 31 “normal, unspecified” was received (see subclause 10.2), except that if a RELEASE COMPLETE message is sent it shall contain cause number 96 “mandatory information element is missing”.

When a RELEASE COMPLETE message is received as the first clearing message, with one or more mandatory information elements missing, it shall be assumed that a RELEASE COMPLETE message was received with cause number 31 “normal, unspecified”.

9.2.6.2 Mandatory information element content error

When a message other than SETUP, DISCONNECT, RELEASE, or RELEASE COMPLETE is received which has one or more mandatory information elements with invalid content, no action shall be taken on the message and no state change shall occur. A STATUS message shall then be returned with cause number 100 “invalid information element contents”.

When a SETUP message is received which has one or more mandatory information elements with invalid content, a RELEASE COMPLETE message with cause number 100 “invalid information element contents” shall be returned.

When a DISCONNECT message is received with invalid content of the cause information element, the actions taken shall be the same as if a DISCONNECT message with cause number 31 “normal, unspecified” was received (see subclause 10.2.), with the exception that the RELEASE message returned shall contain cause number 100 “invalid information element contents”.

When a RELEASE message is received with invalid content of the cause information element, the actions taken shall be the same as if a RELEASE message with cause number 31 “normal, unspecified” was received (see subclause 10.2), except that if a RELEASE COMPLETE message is sent, it shall contain cause number 100 “invalid information element contents”.

When a RELEASE COMPLETE message is received with invalid content of the cause information element, it shall be assumed that a RELEASE COMPLETE message was received with cause number 31 “normal, unspecified”.

9.2.7 Non-mandatory information element errors

9.2.7.1 Non-mandatory information element not recognised

When a message is received which has one or more non-mandatory information elements which are unrecognised, the receiving entity shall check whether they indicate “comprehension required” (refer to table 22 for the information element identifiers reserved with this meaning). If any information element is encoded to indicate “comprehension required” then the procedures in subclause 9.2.6.1 shall apply.

If all unrecognised information elements are not encoded to indicate “comprehension required”, the following actions shall apply:

– The receiving entity shall take action on the message and on those information elements which are recognised and have valid content;

– When the received message is other than a DISCONNECT, RELEASE or RELEASE COMPLETE, a STATUS message may be returned containing one Cause information element. The Cause information element shall contain cause number 99 “information element non-existent or not implemented”, and the diagnostic field, if present, shall contain the unrecognised information element identifier for each information element that is unrecognised. The STATUS message shall indicate the

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call state which the receiving entity enters after processing the message in which the unrecognised information element was received.

– If a DISCONNECT message is received with one or more unrecognised information elements, the actions taken shall be the same as if a DISCONNECT message was received without these unrecognised information elements (see subclause 10.2) with the exception that the RELEASE message returned shall contain cause number 99 “information element non-existent or not implemented”. This cause information element may contain a diagnostic field which shall contain the information element identifier for each unrecognised information element.

– If a RELEASE message is received with one or more unrecognised information elements, the actions taken shall be the same as if a RELEASE message was received without these unrecognised information elements (see subclause 10.2) with the exception that the RELEASE COMPLETE message returned shall contain cause number 99 “information element non-existent or not implemented”. This cause information element may contain a diagnostic field which shall contain the information element identifier for each unrecognised information element.

– If a RELEASE COMPLETE message is received with one or more unrecognised information elements, the actions taken shall be the same as if a RELEASE COMPLETE message without those unrecognised information elements was received.

9.2.7.2 Non-mandatory information element content error

When a message other than DISCONNECT, RELEASE or RELEASE COMPLETE is received which has one or more non-mandatory information elements with invalid content, action shall be taken on the message and those information elements which are recognised and have valid content. A STATUS message may be returned containing a cause information element with cause number 100 “invalid information element contents”, and the diagnostic field, if present, shall contain the information element identifier for each information element with invalid content. The STATUS message shall indicate the call state which the receiving entity enters after processing the message in which the information element content error was received.

If a DISCONNECT, RELEASE or RELEASE COMPLETE message is received which has one or more non-mandatory information elements with invalid content, normal call clearing procedures (defined in subclause 10.2) shall apply.

9.2.8 Signalling Carriage Mechanism reset

Whenever Protocol Control is informed of a spontaneous SCM reset by means of the DL-ESTABLISH-INDICATION primitive, the following procedures shall apply:

– for calls in the Overlap Sending state and the Overlap Receiving state, the entity shall initiate clearing by sending a DISCONNECT message with cause number 41 “Temporary Failure”, and following the procedures of clause 10.2.

– for calls in the disestablishment phase (states 11, 12, and 19) no action shall be taken.

– calls in the establishment phase (states 1, 3, 4, 6, 7, 8, and 9) and in the Active state shall be maintained. Optionally, a STATUS message may also be sent to report the current Protocol Control state to the peer entity or a STATUS ENQUIRY message may be sent to verify the Protocol Control state of the peer entity.

9.2.9 Signalling Carriage Mechanism failure

Whenever Protocol Control is notified by its Signalling Carriage Mechanism entity via the DL-RELEASE-INDICATION primitive that there is a SCM malfunction, the following procedure shall apply:

– any calls not in the active state shall be cleared internally. For any call in the active state, timer T309 shall be started.

  If timer T309 is already running, it shall not be restarted.

– the PSS1 entity shall request SCM re-establishment by sending a DL-ESTABLISH-REQUEST primitive.

When informed of SCM re-establishment by means of the DL-ESTABLISH-CONFIRMATION primitive, the following procedure shall apply, for each active call:

– timer T309 shall be stopped;

– either: the PSS1 entity shall send a STATUS message to report the current Protocol Control state to the peer entity, or the PSS1 entity shall perform the status enquiry procedure to verify the Protocol Control state of the peer entity.

  Cause number 31 “normal, unspecified” is recommended to be used in the STATUS message.

If timer T309 expires prior to SCM re-establishment, Protocol Control shall: release all resources; release the call reference; and enter the Null state. Call Control shall be informed of the failure of the call.

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9.3 Status and status enquiry protocol procedures

9.3.1 Status enquiry procedure

Whenever Protocol Control wants to check the correctness of a Protocol Control state at a peer PSS1 entity, a STATUS ENQUIRY message may be sent requesting the Protocol Control state.

Upon sending the STATUS ENQUIRY message, timer T322 shall be started in anticipation of receiving a STATUS message. While timer T322 is running, only one outstanding request for Protocol Control state shall exist. Therefore if timer T322 is already running, it shall not be restarted. If a clearing message is received before timer T322 expires, timer T322 shall be stopped, and the call clearing shall continue.

Upon receipt of a STATUS ENQUIRY message, the receiving entity shall respond with a STATUS message, reporting the current Protocol Control state and containing cause number 30 “responding to STATUS ENQUIRY”. Receipt of the STATUS ENQUIRY message shall not result in a state change.

The sending or receipt of the STATUS message in such a situation will not directly affect the Protocol Control state of either the sending or receiving entity. The side having received the STATUS message shall inspect the cause information element. If the STATUS message contains any cause other than cause number 30 “responding to STATUS ENQUIRY”, timer T322 shall continue to time for an explicit response to the STATUS ENQUIRY message.

If a STATUS message is received that contains cause number 30 “response to STATUS ENQUIRY” the timer T322 shall be stopped, and the “appropriate actions” shall be taken.

These “appropriate actions” are implementation dependent. However, the actions prescribed in 9.3.2 below shall apply.

If the sender’s Protocol Control state changes after STATUS ENQUIRY has been sent, this shall be taken into account when checking for a compatible Protocol Control state in the received STATUS message.

If timer T322 expires, and no STATUS message was received, the STATUS ENQUIRY message may be transmitted a number of times until a response is received.

The number of times the STATUS ENQUIRY message may be retransmitted is a implementation dependent value. If the limit is exceeded, that call shall be cleared. The cause that should be used when clearing in this situation is cause number 41 “temporary failure”. Call Control shall be notified of the failure of the call.

If T322 expires and a STATUS message, with a cause value other than number 30 “response to STATUS ENQUIRY”, was received the actions taken shall be an implementation option, which may be to process the received Protocol Control state in the same way as if the cause in the received STATUS message was number 30 “response to STATUS ENQUIRY”.

9.3.2 Receiving a STATUS message

On receipt of a STATUS message containing a call reference value other than the Global Call Reference, the receiving entity shall check whether the Protocol Control state reported in the STATUS message is compatible with the state associated with that call reference internally. Table 1 indicates which Protocol Control states shall be considered compatible.

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Table 1 - Compatible Protocol Control states

Internal Protocol Control state associated with call reference		Reported Protocol Control state in STATUS message	
0	Null	0	Null
1	Call Initiated	6	Call Present
2	Overlap Sending	25	Overlap Receiving
3	Outgoing Call Proceeding	9	Incoming Call Proceeding
4	Call Delivered	7	Call Received
6	Call Present	1	Call Initiated
7	Call Received	4	Call Delivered
8	Connect Request	10	Active
9	Incoming Call Proceeding	3	Outgoing Call Proceeding
10	Active	10	Active
		8	Connect Request
11	Disconnect Request	11	Disconnect Request
		12	Disconnect Indication
12	Disconnect Indication	11	Disconnect Request
19	Release Request	19	Release Request
25	Overlap Receiving	2	Overlap Sending

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9.3.2.1 Receipt of a STATUS message reporting an incompatible Protocol Control state

On receipt of a STATUS message reporting an incompatible Protocol Control state, the receiving entity shall either: clear the call by sending an appropriate clearing message with cause number 101 “message not compatible with call state”; or, take other actions which attempt to recover from a mismatch. These actions are an implementation decision.

The following rules shall, however, apply:

– if a STATUS message indicating any Protocol Control state except the Null state is received in the Null state, then a RELEASE COMPLETE message shall be sent.

  Alternatively, in this case a RELEASE message may be sent in place of the RELEASE COMPLETE message, but this is not the recommended option.

– if a STATUS message indicating any Protocol Control state except the Null state is received in the Release Request state, no action shall be taken.

– if a STATUS message, indicating the Null state, is received in any state except the Null state, the receiver shall release all resources and move into the Null state. Call Control shall be informed of the failure of the call.

  When in the Null state, the receiver of a STATUS message indicating the Null state shall take no action other than to discard the message and shall remain in the Null state.

9.3.2.2 Receipt of a STATUS message reporting a compatible Protocol Control state

No action shall normally be taken on receipt of a STATUS message indicating a compatible Protocol Control state except where the STATUS message contains one of the following causes:

– cause number 96 “mandatory information element is missing”

– cause number 97 “message type non-existent or not implemented”;

– cause number 99 “information element non-existent or not implemented”; or,

– cause number 100 “invalid information element contents”.

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In these cases, the actions to be taken are an implementation option. The receiving entity should attempt to analyse the contents of the received STATUS message considering the current stage of the call in order to determine whether or not the call can continue. If successful analysis and recovery are not possible, the call may be cleared as described in subclause 10.2.

NOTE - To improve interworking between implementations that support the requirements of ECMA-165 and implementations that do not, it is recommended that the diagnostic field should be included in the Cause information element when sending a STATUS message with cause values 97 or 100. It is also recommended that a call should not be cleared on receipt of a STATUS message containing either of these cause values. Implementations that do not support ECMA-165 will normally return a STATUS message on receipt of a message or information element defined in ECMA-165. The clearing of the call in such situations should not be the normal behaviour.

9.3.2.3 Receiving a STATUS message containing the global call reference

On receipt of a STATUS message containing the Global Call Reference, the receiving entity shall check whether the reported layer management state is compatible with its own internal layer management state, according to table 2. Layer management shall be informed if the STATUS message reports an incompatible state in Restart or Restart Request states (1 or 2), otherwise no action shall be taken.

NOTE - The Call Reference flag of the Global Call Reference applies to the Restart procedures. As a result, the state received in a STATUS message containing the Global call reference shall be compared with the layer management state of the specific Global Call Reference identified by the setting of the Call Reference flag.

Table 2 - Compatible layer management states

Internal layer management state associated with global call reference		Reported layer management state in STATUS message	
0	Null	0	Null
1	Restart Request	2	Restart
2	Restart	1	Restart Request

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10 Circuit-switched Call Control procedures

The specification of the procedures for the control of circuit-switched calls across the network is contained in four parts.

– The first part (subclauses 10.1 - 10.3) specifies the procedures and message flows over a symmetrical interface between two peer PINXs.

  Detailed specification and description language (SDL) diagrams for the procedures specified in these clauses are contained in annex E.

– The second part (subclause 10.4) specifies how the procedures and message flows over either side of a Transit PINX are interrelated.

  Detailed specification and description language (SDL) diagrams for the procedures specified in this clause are contained in annex F.

– The third part (subclauses 10.5 and 10.6) specifies the requirements for Call Control at an End PINX.

– The fourth part (subclauses 10.7 and 10.8) specifies the requirements for Call Control at a Gateway PINX.

10.1 Call establishment

10.1.1 Call request

Call establishment shall be initiated by the Outgoing Side sending a SETUP message, and starting T303. The Outgoing Side shall select a channel (not known to be busy) for use by the call and indicate this in the channel identification information element. If the Outgoing Side knows all appropriate channels controlled by the signalling channel are in use, it shall not send a SETUP message.

If no response (as prescribed in 10.1.4) is received from the Incoming Side before timer T303 expires, the SETUP message may optionally be retransmitted and timer T303 restarted.

If no response is received before timer T303 expires for a second time, the Outgoing Side shall send a RELEASE COMPLETE message to the Incoming Side. This message should contain Cause number 102 “recovery on timer expiry”. Call Control shall be notified of the failure of the call.

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The SETUP message shall always contain a call reference, selected according to the procedures given in subclause 14.3. It shall also contain all the information required by the Incoming Side to process the call. The number digits within the Called party number information element may optionally be incomplete, thus requiring the use of overlap sending (see subclause 10.1.3). The SETUP message may optionally contain the Sending complete information element in order to indicate that the number is complete.

NOTE - If enbloc signalling only is used between two adjacent PINXs, overlap receiving procedures need not be tested.

Following the transmission of the SETUP message, the Outgoing Side shall enter the Call Initiated state. On receipt of the SETUP message the Incoming Side shall enter the Call Present state.

10.1.2 Information channel selection

In the SETUP message, the Outgoing Side shall include the Channel identification information element indicating the selected channel(s), encoded as defined in 14.5.12.

All the channels indicated shall be within a Route containing channels for which time sequence integrity is maintained.

If the information transfer rate implied by the channel(s) indicated in the Channel identification information element does not match the information transfer rate indicated in the Bearer capability information element, the procedures of 9.2.6.2 shall apply.

The Channel identification information element shall indicate one of the following in the channel identification information element, in addition to the selected channel number:

a) channel(s) are indicated, no acceptable alternative; or,

b) channel(s) are indicated, any alternative is acceptable.

In both cases, if the indicated channel(s) are available, the Incoming Side shall reserve them for the call.

In case b) if the indicated channel(s) are not available, the Incoming Side shall reserve any available information channel associated with the signalling channel (within the constraints of the channel assignment specified above).

The selected information channel(s) shall be indicated in the first message returned by the Incoming Side in response to the SETUP message (i.e. a SETUP ACKNOWLEDGE or CALL PROCEEDING message). The receipt of an ALERTING or CONNECT message as the first response to SETUP shall not Cause a protocol error, even though they would not normally be sent as the first responding message by Protocol Control.

In case a) if the specified channel(s) are not available, or, in case b) if no channels, or insufficient channels are available, a RELEASE COMPLETE message containing a Cause information element shall be sent by the Incoming Side as described in subclause 10.2. Cause number 44 “requested circuit/channel not available” shall be the Cause sent in case a) and Cause number 34 “no circuit/channel available” shall be the Cause sent in case b). Call Control shall be informed of the failure of the call.

In case b) if the channel(s) indicated in the CALL PROCEEDING or SETUP ACKNOWLEDGE message are unacceptable to the Outgoing Side, the call shall be cleared in accordance with clause 10.2. The cause value used shall be appropriate to the clearing circumstances. For example, cause number 6 “channel unacceptable” or cause number 82 “identified channel does not exist”. Call Control shall be informed of the failure of the call.

10.1.3 Overlap sending

NOTE - If enbloc signalling only is used between two adjacent PINXs, overlap receiving procedures need not be tested.

If the received SETUP message does not contain a Sending complete information element, and contains either:

– incomplete called number information; or,

– called number information which the Incoming Side cannot determine to be complete

The Incoming Side shall start timer T302, send a SETUP ACKNOWLEDGE message to the Outgoing Side, and enter the Overlap Receiving state.

When the SETUP ACKNOWLEDGE message is received, the Outgoing Side shall enter the Overlap Sending state, stop T303, and start timer T304.

After receiving the SETUP ACKNOWLEDGE message, the Outgoing Side shall send the remainder of the Called party number digits (if any) in one or more INFORMATION messages.

The Outgoing Side shall restart timer T304 when each INFORMATION message is sent.

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The INFORMATION message which completes the information sending may contain a “Sending complete” information element. The Incoming Side shall restart timer T302 on the receipt of every INFORMATION message not containing a Sending complete indication if it cannot determine that the Called party number is complete.

If timer T304 expires the Outgoing Side shall initiate call clearing using the procedures in subclause 10.2. The Cause that should be used towards the calling user is Cause number 28 “invalid number format”; towards the called user, the Cause used should be Cause number 102 “recovery on timer expiry”. Call Control shall be informed of the failure of the call.

At the expiry of timer T302, the Incoming Side shall:

– if it determines that the call information is incomplete, initiate call clearing in accordance with clause 10.2 with Cause number 28 “invalid number format”;

– otherwise send a CALL PROCEEDING message and enter the Incoming Call Proceeding state.

10.1.4 Call proceeding

10.1.4.1 Call proceeding, enbloc sending

If enbloc sending is used (i.e. the Incoming Side can determine it has received sufficient information in the SETUP message from the Outgoing Side to establish the call) the Incoming Side shall send a CALL PROCEEDING message to the Outgoing Side to acknowledge the SETUP message and to indicate that the call is being processed. Upon receipt of the CALL PROCEEDING message, the Outgoing Side shall enter the Outgoing Call Proceeding state, stop timer T303 and, if applicable, start T310. After sending the CALL PROCEEDING message, the Incoming Side shall enter the Incoming Call Proceeding state.

NOTE - T310 is optional in the case of a Transit PINX and mandatory in the case of an Originating PINX (see 12).

If, following the receipt of a SETUP message, the Incoming Side determines that for some reason the call cannot be supported, then the Incoming Side shall initiate call clearing as defined in subclause 10.2. Some of the Causes that may be used are given in subclause 10.1.8. This is not exhaustive.

10.1.4.2 Call proceeding, overlap sending

NOTE 1 - If enbloc signalling only is used between two adjacent PINXs, overlap receiving procedures need not be tested.

Following the occurrence of one of these conditions:

– the receipt by the Incoming Side of a Sending complete indication; or,

– analysis by the Incoming Side that all call information necessary to effect call establishment has been received;

and if the Incoming Side can determine that access to the requested service is available, the Incoming Side shall: send a CALL PROCEEDING message to the Outgoing Side; stop timer T302; and enter the Incoming Call Proceeding state.

If, following the receipt of a SETUP message or during overlap sending the Incoming Side determines that for some reason the call cannot be supported, then the Incoming Side shall initiate call clearing as defined in subclause 10.2. Some of the Causes that may be used are given in subclause 10.1.8. This list is not exhaustive.

NOTE 2 - The CALL PROCEEDING message is sent to indicate that the requested call establishment has been initiated, and no more call establishment information will be accepted.

When the Outgoing Side receives the CALL PROCEEDING message it shall enter the Outgoing Call Proceeding state, stop timer T304 and if applicable, start timer T310.

NOTE 3 - T310 is optional in the case of a Transit PINX and mandatory in the case of an Originating PINX (see 12).

Upon receiving an indication that the called party is alerting or that the call has been answered, the incoming side shall stop timer T302 and send an ALERTING or CONNECT message, respectively, to the Outgoing Side. When the Outgoing Side receives a CONNECT or an ALERTING message, timer T304 shall be stopped.

Any INFORMATION message received by the Incoming side, after having sent a CALL PROCEEDING, ALERTING or CONNECT message to the Outgoing side, shall be discarded and no further action shall be taken.

10.1.4.3 Expiry of timer T310

On expiry of T310 (i.e. if the Outgoing Side does not receive an ALERTING, CONNECT, DISCONNECT or PROGRESS message [containing CCITT progress description number 1 “call is not end to end ISDN, further information may be available in band” or number 8 “in band information or appropriate pattern now available”]) the Outgoing Side shall initiate clearing

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procedures as described in subclause 10.2. The clearing Cause sent to the Incoming Side should be Cause number 102 “Recovery On Timer Expiry”. Call Control shall be notified of the failure of the call.

10.1.5 Call confirmation indication

Upon receiving an indication that the called party is alerting, the Incoming Side shall send an ALERTING message to the Outgoing Side and enter the Call Received state. The ALERTING message shall only be sent after a SETUP ACKNOWLEDGE or a CALL PROCEEDING message has been sent across the interface. When the Outgoing Side receives the ALERTING message it shall enter the Call Delivered state, stop T310, if running, and optionally start T301.

Any INFORMATION message received by the Incoming side, after having sent a CALL PROCEEDING, ALERTING or CONNECT message to the Outgoing side, shall be discarded and no further action shall be taken.

If T301 expires prior to the receipt of a CONNECT message then the Outgoing Side shall clear the call in accordance with the procedures contained in subclause 10.2. The clearing Cause used should be Cause number 19 “No answer from user (user alerted)”.

10.1.6 Call connected

Upon receiving an indication from Call Control that the call has been answered and requires through connection in both the backward and forward directions, the Incoming Side shall send a CONNECT message to the Outgoing Side and either: start timer T313 and enter the Connect Request state; or enter the Active state. The CONNECT message shall not be sent before a SETUP ACKNOWLEDGE or a CALL PROCEEDING message has been sent across the interface.

The CONNECT message indicates to the Outgoing Side that a connection has been established through the network and stops a possible local indication of alerting.

On receipt of the CONNECT message, the Outgoing Side shall: stop T310, T301 or T304 (if running), send a CONNECT ACKNOWLEDGE message to the Incoming Side and enter the Active state.

If, on receipt of the CONNECT ACKNOWLEDGE message the Incoming Side is in the Connect Request state, it shall enter the Active state and cancel timer T313. If the Incoming Side is in the Active state when a CONNECT ACKNOWLEDGE message is received, the message shall be ignored.

Any INFORMATION message received by the Incoming side, after having sent a CALL PROCEEDING, ALERTING or CONNECT message to the Outgoing side, shall be discarded and no further action shall be taken.

If T313 expires prior to the receipt of a CONNECT ACKNOWLEDGE message, then the Incoming Side shall initiate call clearing procedures by sending a DISCONNECT message to the Outgoing Side, as described in subclause 10.2. The Cause value used in this situation should be number 102 “recovery on timer expiry”.

NOTE - If by mutual agreement T313 is not implemented, the sending of CONNECT ACKNOWLEDGE message is optional.

10.1.7 Use of the PROGRESS message

10.1.7.1 During call establishment

During call establishment, the call may leave the PISN environment (e.g. because of interworking with another network). When this situation occurs, a Progress indicator information element containing the appropriate progress description value may be sent over the PISN in the direction of the calling user.

Where this indication cannot be sent in a Call Control message (e.g. ALERTING) it shall be sent in a PROGRESS message. On receipt of a PROGRESS message, no state change shall occur, but timer T310 (if running) should be stopped when CCITT progress description number 1 “call is not end to end ISDN, further progress information may be available in-band” , number 2 "destination address is non-ISDN", or number 8 “in-band information or appropriate pattern now available” is received.

10.1.7.2 During call failure

If an in-band tone or announcement is to be applied to indicate to the calling user failure of a call which has not yet reached the active state, the Incoming Side shall send a PROGRESS message to ensure that the information channel is through connected from the provider of the tone to the calling user. If an in-band tone or announcement is applied to indicate to a user failure of a call that has reached the Active state, the in-band tone or announcement may be applied without sending a PROGRESS message, as the information channel would already be through connected in both directions.

If used, the PROGRESS message shall contain CCITT progress description number 8 “in-band information or appropriate pattern now available” and a Cause information element indicating the failure Cause value.

NOTE - Normal call clearing will follow later, initiated either by the user receiving the in-band tone or announcement (potentially during the tone or announcement) or by the entity providing the tone or announcement if no clearing indication is received by the user within an appropriate time.

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10.1.8 Failure of call establishment

In the Call Present, Overlap Receiving, Incoming Call Proceeding or Call Received states, the Incoming Side may initiate clearing as described in subclause 10.2 with Cause. Examples of some of the Causes that may be used to clear the call, when the Incoming Side is in the Call Present, Overlap Receiving, or Incoming Call Proceeding state are as follows:

– number 1 “unassigned (unallocated) number”

– number 3 “no route to destination”

– number 17 “user busy”

– number 18 “no user responding”

– number 22 “number changed”

– number 28 “invalid number format”

– number 34 “no circuit channel available”

– number 44 “requested circuit channel not available”

– number 58 “bearer capability not presently available”

– number 65 “bearer capability not implemented”

Examples of two of the Causes that may be used to clear the call when the Incoming Side is in the Call Received state are as follows:

– number 19 “no answer from user (user alerted)”

– number 21 “call rejected by user”

10.2 Call clearing

10.2.1 Terminology

The following terms are used in this International Standard in the description of clearing procedures:

– A channel is “connected” when the channel is part of a PISN connection established according to this International Standard.

– A channel is “disconnected” when the channel is no longer part of a PISN connection, but is not yet available for use in a new connection.

– A channel is “released” when the channel is not part of a PISN connection and is available for use in a new connection.

  Similarly, a call reference that is “released” is available for reuse.

10.2.2 Exception conditions

Apart from the exceptions listed below, call clearing shall be initiated when the Outgoing Side or the Incoming Side sends a DISCONNECT message and follows the procedures defined in subclause 10.2.3. The exceptions to the above rule are as follows:

– The rejection of a SETUP message by the Incoming Side when no responding message has previously been sent (e.g. because of the unavailability of a suitable information channel) shall be accomplished by returning a RELEASE COMPLETE message, releasing the call reference, and entering the null state.

– Unsuccessful termination of the information channel selection procedure by the side offering the call shall be accomplished by sending a RELEASE message to the other side. The RELEASE message shall contain a cause value appropriate to the clearing circumstances. For example cause number 6 “channel unacceptable” or cause number 82 “identified channel does not exist”.

– During call establishment, call clearing may be initiated towards the called user before a information channel has been agreed between the Outgoing and Incoming Sides. In this case, clearing shall be accomplished by sending either a DISCONNECT or a RELEASE message containing a Cause information element to the Incoming Side. The Cause value used shall be appropriate to the clearing circumstances. For example, if the failure was due to the calling user clearing before the call reaches its destination node, the Cause value would be the value supplied by the calling user, e.g. Cause number 31 “normal, unspecified”.

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10.2.3 Clearing

Apart from the exceptions identified in subclauses 10.2.2 and 9.2, the clearing procedures are symmetrical and may be initiated by either the Outgoing or the Incoming Side. In the interest of clarity, the following procedures describe only the case where the Outgoing Side initiates clearing.

On sending or receiving any call clearing message, any protocol timer other than T305 or T308 shall be terminated.

The Outgoing Side shall initiate clearing by: sending a DISCONNECT message; starting timer T305; disconnecting the information channel(s); and entering the Disconnect Request state. Following the receipt of the DISCONNECT message, the Incoming Side shall consider the call to be in the Disconnect Indication state.

On receipt of the DISCONNECT message the Incoming Side shall: disconnect the information channel(s) used in the call; send a RELEASE message to the Outgoing Side; start timer T308; and enter the Release Request state.

On receipt of the RELEASE message the Outgoing Side shall: cancel timer T305; release the information channel(s); send a RELEASE COMPLETE message; release the call reference; and return to the Null state.

On receipt of a RELEASE COMPLETE message from the Outgoing Side, the Incoming Side shall: stop timer T308; release both the information channel(s) and the call reference; and return to the Null state.

If the Outgoing Side does not receive a RELEASE message in response to the DISCONNECT message before timer T305 expires, it shall send a RELEASE message to the Incoming Side with the Cause number originally contained in the DISCONNECT message, start timer T308 and enter the Release Request state.

If in the Release Request state, a RELEASE COMPLETE message is not received before the first expiry of timer T308, the RELEASE message shall be retransmitted and timer T308 shall be restarted. If no RELEASE COMPLETE message is received before timer T308 expires a second time, the side that expected the message shall; place the information channel(s) in a maintenance condition; release the call reference; and return to the Null state.

10.2.4 Clear collision

Clear Collision occurs when both the Incoming and Outgoing Sides simultaneously transfer DISCONNECT messages specifying the same call reference value. When either side receives a DISCONNECT message whilst in the Disconnect Request state, the side shall stop timer T305; disconnect the information channel(s) (if not already disconnected); send a RELEASE message to the other side; start timer T308 and enter the Release Request state.

Clear collision can also occur when both sides simultaneously transfer RELEASE messages related to the same call reference value. The receiving side shall (on receiving such a RELEASE message in the Release request state) stop T308; release the call reference and information channel(s); and enter the null state (without sending a RELEASE COMPLETE message).

10.3 Call collisions

In symmetric arrangements, call collisions can occur when both sides simultaneously transfer a SETUP message indicating the same channel or, in the case where multiple channels are indicated, one or more channels indicated by both sides. One side shall be designated side “A” and the other side “B” at the time the network is provisioned. Each side shall have knowledge of whether it has been designated “A” or “B”. In the three possible scenarios where the same channel or channels have been indicated by both sides, the following procedure shall apply:

– “A” side preferred, “B” side preferred: The “A” side shall be awarded the channel(s), and alternative channel(s) (if free channels exist) shall be indicated in the first response to the SETUP message sent from side “B”.

– “A” side exclusive, “B” side exclusive: The “A” side shall be awarded the channel(s), and the call establishment attempt at side “B” shall be cleared with a RELEASE COMPLETE message. The Cause used shall be Cause number 44 “requested circuit/channel not available”.

– “A” side exclusive, “B” side preferred; or “A” side preferred, “B” side exclusive: The side with an exclusive channel indicator in a SETUP message shall be awarded the channel(s) and one or more alternative channel(s) (assuming free channels exist) shall be indicated in the first response to the side that used a preferred indicator in the SETUP message.

In order to minimise the chances of call collisions, it is recommended that side “A” assign the lowest available channel numbers and that side “B” assign the highest available channel numbers.

10.4 Transit PINX Call Control requirements

NOTE - The provision of transit PINX functionality is an option. When provided, the procedures contained herein are mandatory.

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This clause specifies those aspects of call control at a Transit PINX that are necessary for coordinating the incoming side and outgoing side protocol entities.

These procedures refer to the Preceding PINX and the Subsequent PINX. These PINX's are either side of Transit PINX. This terminology is used in order to clarify the text. The adjectives (Preceding/Subsequent) only have meaning when used in the context of a particular call. The call attempt will have passed from the Preceding PINX, through the Transit PINX, to the Subsequent PINX.

Figure 3 shows the conceptual relationship between the Call Control and Incoming and Outgoing Protocol Control within a Transit PINX.

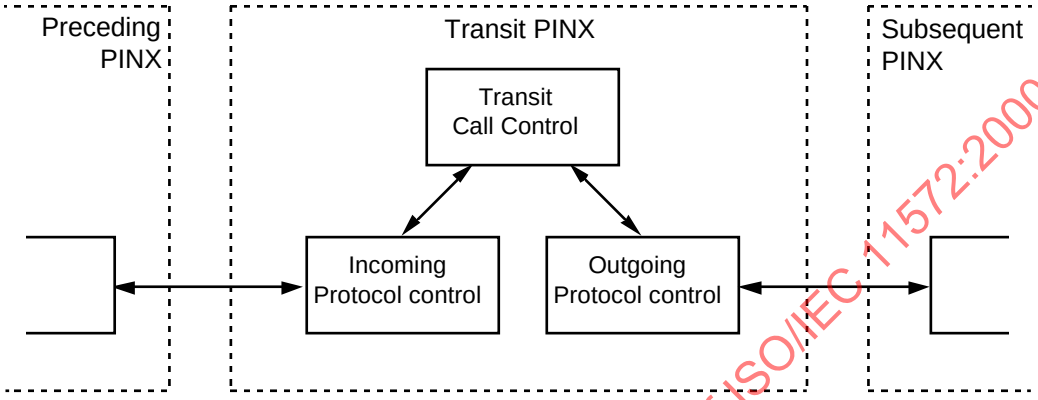

Figure 3 - Conceptual relationship of Call Control to Protocol Control

The Transit PINX's Call Control states used in this clause are a different set of states from the Protocol States described in earlier clauses. The Transit PINX's Call Control states are marked as such by "TCC_" in front of their names. These states are conceptual and used only as an aid to description of the actions required at a Transit PINX. As such, they are not directly visible in the protocol and cannot be tested directly. A short description of each of the states is given in subclause 7.1.

On receipt of a SETUP message (possibly followed by one or more INFORMATION messages containing additional Called party number information) if the Call Control of the PINX chooses to route the call onwards on a further inter-PINX link employing PSS1 signalling, it shall conform to the procedures for a Transit PINX contained in this clause. The procedures defined in this clause show how the message flows of the two interfaces either side of a Transit PINX are interrelated.

Detailed specification and description language (SDL) diagrams for the procedures specified in this clause are contained in annex F.

10.4.1 Receipt of address information

On receipt of a SETUP message from the Preceding PINX, the call request shall be processed.

If the call processing is successful, and the Transit PINX determines that all the address information has been received in the SETUP message, a CALL PROCEEDING message shall be sent to the Preceding PINX, a SETUP message shall be sent to the Subsequent PINX, and the Transit PINX shall enter the TCC_Incoming_Call_Proceeding State.

If the call processing is successful, and the Transit PINX determines that not all the address information has been received in the SETUP message or cannot determine that the address information is complete, a SETUP ACKNOWLEDGE message shall be sent to the Preceding PINX. If enough digits have been received to route the call a SETUP message shall be sent by the Transit PINX to the subsequent PINX and the Transit PINX shall enter the TCC_Await_Additional_Digits state; else the Transit PINX shall enter the TCC_Await_Digits state.

NOTE - The method by which the Transit PINX determines that the address information is adequate for the particular use is beyond the scope of this International Standard.

If the call processing is not successful, then a RELEASE COMPLETE message shall be sent to the Preceding PINX, and the Transit PINX shall remain in the TCC_Idle state.

10.4.2 State TCC_Await_Digits

Additional address information is received in INFORMATION messages. Once enough address information has been received in order to route the call, a SETUP message shall be sent to the Subsequent PINX. If, on analysis of the digits, the Transit PINX identifies that there are no more digits expected, a CALL PROCEEDING message shall be sent to the preceding PINX

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and the Transit PINX shall enter the TCC_Incoming_Call_Proceeding state; otherwise the Transit PINX shall enter the TCC_Await_Additional_Digits state.

NOTE - The method by which the Transit PINX determines that the address information is adequate for the particular use is beyond the scope of this International Standard.

If a DISCONNECT message is received from the Preceding PINX, the call shall be cleared as described in clause 10.4.10. If a RELEASE or RELEASE COMPLETE message is received from the Preceding PINX, the call shall be cleared as described in subclause 10.4.10.

If, for any reason, the Transit PINX decides to abort the call, it shall clear the call by sending a DISCONNECT message to the Preceding PINX and continuing normal clearing procedures as described in subclause 10.4.10.

If the Protocol Control of the Incoming Side of the interface notifies the Transit Call Control that T302 has expired, then the PINX may either clear the call by sending DISCONNECT to the Preceding PINX, or attempt some other (unspecified) procedure.

10.4.3 State TCC_Await_Additional_Digits

Any additional address information which is received in INFORMATION messages shall be buffered in the Transit PINX whilst waiting for a response to the SETUP message that has been sent to the Subsequent PINX. If the Transit PINX determines that the address information it has received is complete (e.g. on receipt of CALL PROCEEDING from the Subsequent PINX, on receipt of a Sending complete information element from the Preceding PINX, or by digit analysis), a CALL PROCEEDING message shall be sent to the preceding PINX and the Transit PINX shall enter the TCC_Incoming_Call_Proceeding state; otherwise it shall remain in the TCC_Await_Additional_Digits state.

If a SETUP ACKNOWLEDGE message is received from the Subsequent PINX, and the channel(s) indicated are acceptable, then the Transit PINX shall enter the TCC_Overlap state and may through connect the information channel(s). Any buffered address information shall be forwarded to the subsequent PINX in an INFORMATION message. If the channel(s) indicated are not acceptable, the call shall be cleared towards the Subsequent PINX using a RELEASE message and the PINX shall either clear the call towards the Preceding PINX using a DISCONNECT message, or may attempt some other (unspecified) procedure.

If a RELEASE COMPLETE message is received from the Subsequent PINX the call may either be cleared as described in clause 10.4.10, or the PINX may attempt some other (unspecified) procedure.

If a CALL PROCEEDING message is received from the Subsequent PINX and the channel(s) indicated are acceptable, no more address information shall be sent to the Subsequent PINX, and the Transit PINX shall enter the TCC_Transit_Call_Proceeding state and may through connect the information channel(s). Any buffered address information shall be discarded and any further INFORMATION messages received shall be ignored. If the channel(s) indicated are not acceptable the call shall be cleared towards the Subsequent PINX using a RELEASE message and the PINX shall either clear the call towards the Preceding PINX using a DISCONNECT message, or may attempt some other (unspecified) procedure.

If a DISCONNECT message is received from the Preceding PINX, the call shall be cleared as described in clause 10.4.10.

If a RELEASE or RELEASE COMPLETE message is received from the Preceding PINX, the call shall be cleared as described in subclause 10.4.10.

If an ALERTING message is received from the Subsequent PINX and the channel(s) indicated are acceptable, the transit node may through connect the information channel(s). An ALERTING message shall be sent to the Preceding PINX and the Transit PINX shall enter the TCC_Call_Alerting state. If the received ALERTING message contained CCITT progress description number 1 “call is not end to end ISDN, further information may be available in band” or number 8 “in band information or appropriate pattern now available”, the information channel(s) shall be through connected in the backward direction, if this has not already occurred. If the channel(s) indicated are not acceptable the call shall be cleared towards the Subsequent PINX using a RELEASE message and the PINX shall either clear the call towards the Preceding PINX as described in subclause 10.4.10, or may attempt some other (unspecified) procedure.

If a CONNECT message is received from the Subsequent PINX and the channel(s) indicated are acceptable, the transit node shall through connect the information channel(s) (in both directions) - if not already connected - send an CONNECT message to the Preceding PINX and enter the TCC_Call_Active state. If the channel(s) indicated are not acceptable the call shall be cleared towards the Subsequent PINX using a RELEASE message and the PINX shall either clear the call towards the Preceding PINX as described in clause 10.4.10, or may attempt some other (unspecified) procedure.

If, for any reason, the Transit PINX decides to abort the call, it shall clear the call in both directions as described in subclause 10.4.10.

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If the Protocol Control of the Incoming Side of the interface notifies Transit Call Control that T302 has expired, then the PINX shall either send a CALL PROCEEDING message to the Preceding PINX and enter the TCC_Incoming_Call_Proceeding state, or may attempt some other (unspecified) procedure.

10.4.4 State TCC_Overlap

Any additional address information which is received in INFORMATION messages shall be sent on to the Subsequent PINX in INFORMATION messages. If it is known that the address information is complete, a Sending complete information element may optionally be sent in an INFORMATION message.

If a CALL PROCEEDING message is received from the Subsequent PINX, no more address information shall be sent to the Subsequent PINX, and the Transit PINX shall enter the TCC_Transit_Call_Proceeding state.

If the Transit PINX determines that it has received all the address information (e.g. on receipt of CALL PROCEEDING from the Subsequent PINX, on receipt of a Sending complete information element from the Preceding PINX, or by digit analysis) a CALL PROCEEDING message shall be sent to the Preceding PINX, and the Transit PINX shall enter the TCC_Transit_Call_Proceeding state; else it shall stay in the TCC_Overlap state.

If a PROGRESS message is received from the Subsequent PINX, a PROGRESS message shall be sent to the Preceding PINX. If this message contains CCITT progress description number 1 “call is not end to end ISDN, further information may be available in band” or number 8 “in band information or appropriate pattern now available”, the information channel(s) shall be through connected in the backward direction, if this has not already occurred.

If an ALERTING message is received from the Subsequent PINX an ALERTING message shall be sent to the Preceding PINX, and the Transit PINX shall enter the TCC_Call_Alerting state. If this message contains CCITT progress description number 1 “call is not end to end ISDN, further information may be available in band” or number 8 “in band information or appropriate pattern now available”, the information channel(s) shall be through connected in the backward direction, if this has not already occurred.

If a CONNECT message is received from the Subsequent PINX, a CONNECT message shall be sent to the Preceding PINX and the PINX shall through connect the information channel(s) in both directions (unless it has already done so) and enter the TCC_Call_Active state.

If a DISCONNECT message is received from the Preceding PINX the call shall be cleared as described in subclause 10.4.10.

If a DISCONNECT message is received from the Subsequent PINX the call may either be cleared as described in subclause 10.4.10, or other procedures may be attempted by the Transit PINX; however, the clearing sequence with the subsequent PINX shall be completed as described in subclause 10.4.10.

If a RELEASE or RELEASE COMPLETE message is received from the Preceding PINX the call shall be cleared as described in subclause 10.4.10.

If a RELEASE or RELEASE COMPLETE message is received from the Subsequent PINX’s the call may either be cleared using procedures as described in subclause 10.4.10, or other procedures may be attempted by the Transit PINX.

If the Protocol Control of the Incoming Side of the interface notifies the Transit Call Control that T302 has expired, then the PINX shall either send a CALL PROCEEDING message to the Preceding PINX and enter the TCC_Transit_Call_Proceeding state, or attempt some other (unspecified) procedure.

If, for any reason, the Transit PINX decides to abort the call, it shall clear the call in both directions as described in subclause 10.4.10.

10.4.5 Channel through connection procedures

During call setup, the Transit PINX shall through connect the agreed information channel(s) to the Subsequent PINX as outlined below.

The earliest point at which through connection may occur (in either forward, backward or both directions) is when the Transit PINX receives the first response to an outgoing SETUP message.

The latest point that through connection in the backward direction shall occur is on receipt of ALERTING or PROGRESS message (with CCITT progress description number 1 “call is not end to end ISDN, further information may be available in band” or number 8 “in band information or appropriate pattern now available”) or CONNECT from the Subsequent PINX. The latest point that through connection in the forward direction shall occur is on the receipt of a CONNECT message from the subsequent PINX.

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NOTE - It is recommended that through connection in both directions is achieved as early as possible during call set up. This is particularly appropriate for services providing the conveyance of speech information. Delaying through connection, particularly in the backward direction, to a later stage during call setup may lead to “speech clipping”.

10.4.6 State TCC_Incoming_Call_Proceeding

If a SETUP ACKNOWLEDGE message is received from the Subsequent PINX and the channel(s) indicated are acceptable, the Transit PINX may through connect the information channel(s) and shall enter the TCC_Transit_Call_Proceeding state. If the channel(s) indicated are not acceptable, the call shall be cleared towards the Subsequent PINX using a RELEASE message and the PINX shall either clear the call towards the Preceding PINX using a DISCONNECT message, or may attempt some other (unspecified) procedure.

If a RELEASE COMPLETE message is received from the Subsequent PINX the call shall either be cleared using procedures as described in subclause 10.4.10, or other procedures may be attempted by the Transit PINX.

If a CALL PROCEEDING message is received from the Subsequent PINX and the channel(s) indicated are acceptable, the Transit PINX may through connect the information channel(s) and shall enter the TCC_Transit_Call_Proceeding state. If any further INFORMATION messages are received they shall be ignored. If the channel(s) indicated are not acceptable, the call shall be cleared towards the Subsequent PINX using a RELEASE message. The PINX shall either clear the call towards the Preceding PINX using a DISCONNECT message, or may attempt some other (unspecified) procedure.

If an ALERTING message is received from the subsequent PINX and, if one or more channels are indicated in the ALERTING message, the indicated channel number(s) are acceptable, an ALERTING message shall be sent to the Preceding PINX. The Transit PINX shall enter the TCC_Call_Alerting state. If the received ALERTING message contains CCITT progress description number 1 “call is not end to end ISDN, further information may be available in band” or number 8 “in band information or appropriate pattern now available”, the information channel(s) should be through connected in the backward direction if this has not already occurred. If one or more channels are indicated and are not acceptable, the call shall be cleared towards the Subsequent PINX using a RELEASE message. The PINX shall either clear the call towards the Preceding PINX as described in clause 10.4.10, or may attempt some other (unspecified) procedure.

If a CONNECT message is received from the subsequent PINX and, if one or more channels are indicated in the CONNECT message, the indicated channel numbers are acceptable, a CONNECT message shall be sent to the Preceding PINX. The Transit PINX shall through connect the information channel(s) in both directions (unless it has already done so) and enter the TCC_Call_Active state. If a one or more channels are indicated and are not acceptable, the call shall be cleared towards the Subsequent PINX using a RELEASE message. The PINX shall either clear the call towards the Preceding PINX as described in clause 10.4.10, or may attempt some other (unspecified) procedure.

If a DISCONNECT message is received from the Preceding PINX the call shall be cleared as described in subclause 10.4.10.

If a RELEASE or RELEASE COMPLETE message is received from the Preceding PINX the call shall be cleared as described in subclause 10.4.10.

If, for any reason, the Transit PINX decides to abort the call, it shall clear the call in both directions as described in subclause 10.4.10.

10.4.7 State TCC_Transit_Call_Proceeding

If a PROGRESS message is received from the Subsequent PINX a PROGRESS message shall be sent to the Preceding PINX. If this message contains CCITT progress description number 1 “call is not end to end ISDN, further information may be available in band” or number 8 “in band information or appropriate pattern now available”, the information channel(s) shall be through connected in the backward direction if this has not already occurred.

If a CALL PROCEEDING message is received from the Subsequent PINX, the Transit PINX shall remain in the TCC_Transit_Call_Proceeding state. If any further INFORMATION messages are received they shall be ignored.

If an ALERTING message is received from the Subsequent PINX an ALERTING message shall be sent to the Preceding PINX, and the Transit PINX shall enter the TCC_Call_Alerting state. If this message contains CCITT progress description number 1 “call is not end to end ISDN, further information may be available in band” or number 8 “in band information or appropriate pattern now available”, the information channel(s) shall be through connected in the backward direction, if this has not already occurred.

If a CONNECT message is received from the Subsequent PINX, a CONNECT message shall be sent to the Preceding PINX and the Transit PINX shall through connect the information channel(s) in both directions (unless it has already done so) and enter the TCC_Call_Active state.

If a DISCONNECT message is received from the Preceding PINX the call shall be cleared as described in subclause 10.4.10.

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If a DISCONNECT message is received from the Subsequent PINX, the call shall either be cleared using procedures as described in subclause 10.4.10, or other procedures may be attempted by the Transit PINX.

If a RELEASE or RELEASE COMPLETE message is received from the Preceding PINX the call shall be cleared as described in subclause 10.4.10.

If a RELEASE or RELEASE COMPLETE message is received from the Subsequent PINX the call shall either be cleared using procedures as described in subclause 10.4.10, or other procedures may be attempted by the Transit PINX.

If, for any reason, the Transit PINX decides to abort the call, it shall clear the call in both directions as described in subclause 10.4.10.

10.4.8 State TCC_Call_Alerting

If a PROGRESS message is received from the Subsequent PINX a PROGRESS message shall be sent to the Preceding PINX. If this message contains CCITT progress description number 1 or number 8, the information channel(s) shall be through connected in the backward direction if this has not already occurred.

If a CONNECT message is received from the Subsequent PINX a CONNECT message shall be sent to the Preceding PINX and the Transit PINX shall through connect the information channel(s) in both directions (unless it has already done so) and enter the TCC_Call_Active state.

If a DISCONNECT message is received from the Preceding PINX the call shall be cleared as described in clause 10.4.10.

If a DISCONNECT message is received from the Subsequent PINX the call shall be cleared as described in clause 10.4.10.

If a RELEASE or RELEASE COMPLETE message is received from the Preceding PINX the call shall be cleared as described in subclause 10.4.10.

If a RELEASE or RELEASE COMPLETE message is received from the Subsequent PINX the call shall be cleared as described in subclause 10.4.10.

If, for any reason, the Transit PINX decides to abort the call, it shall clear the call in both directions as described in subclause 10.4.10.

10.4.9 State TCC_Call_Active

If a DISCONNECT message is received from either the Preceding or Subsequent PINX's, the call shall be cleared as described in subclause 10.4.10.

If a RELEASE or RELEASE COMPLETE message is received from either the Preceding or Subsequent PINX's, the call shall be cleared as described in subclause 10.4.10.

If a PROGRESS message is received from the Subsequent PINX a PROGRESS message shall be sent to the Preceding PINX.

NOTE 1 - As an alternative procedure, the Transit PINX may discard a PROGRESS message received from the Subsequent PINX without sending a PROGRESS message to the Preceding PINX. However, this procedure is not recommended.

If a PROGRESS message is received from the Preceding PINX a PROGRESS message shall be sent to the Subsequent PINX.

NOTE 2 - As an alternative procedure, the Transit PINX may discard a PROGRESS message received from the Preceding PINX without sending a PROGRESS message to the Subsequent PINX. However, this procedure is not recommended.

If, for any reason, the Transit PINX decides to abort the call, it shall clear the call in both directions as described in subclause 10.4.10.

10.4.10 Call clearing at a Transit PINX

10.4.10.1 Call clearing not initiated by the Transit PINX

On receipt of a DISCONNECT, RELEASE or RELEASE COMPLETE message from the Preceding PINX, the Transit PINX shall:

– if the information channel(s) to be used have been agreed between the Outgoing Side of the Transit PINX and the Incoming Side of the Subsequent PINX, disconnect the appropriate information channel(s), and send a DISCONNECT message to the Subsequent PINX. If a DISCONNECT message was received from the Preceding PINX, a RELEASE message shall be sent to the Preceding PINX.

  The Transit PINX shall enter the TCC_Await_Outgoing_Release state. When a RELEASE message is received from the Subsequent PINX the Transit PINX shall release any assigned resources and revert to the TCC_Idle state.

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– if the information channel(s) to be used have not been agreed between the Outgoing Side of the Transit PINX and the Incoming Side of the Subsequent PINX (i.e. the first response to an outgoing SETUP message has not been received), proceed according to the current Call Control state:

  i) If Call Control is in either of the TCC_Await_Additional_Digits or TCC_Incoming_Call_Proceeding states, the Transit PINX shall either send:

    – a RELEASE message to the Subsequent PINX. If DISCONNECT was received from the Preceding PINX, a RELEASE message shall be sent to the Preceding PINX. The Transit PINX shall enter the TCC_Idle state; or,

    – a DISCONNECT message to the Subsequent PINX. If DISCONNECT was received from the Preceding PINX, a RELEASE message shall be sent to the Preceding PINX. The Transit PINX shall enter the TCC_Await_Outgoing_Release state.

  ii) if Call Control is in the TCC_Await_Digits state, the Transit PINX shall send a RELEASE message to the Preceding PINX (if DISCONNECT was received from the Preceding PINX) and enter the TCC_Idle state.

On receipt of a DISCONNECT, RELEASE or RELEASE COMPLETE message from the Subsequent PINX, the Transit PINX shall disconnect the appropriate information channel(s) and send a DISCONNECT message to the Preceding PINX. Alternatively, during call establishment, if the call has not yet reached the TCC_Call_Alerting state, the Transit PINX may attempt some other (unspecified) procedure instead of sending DISCONNECT to the Preceding PINX. If a DISCONNECT message was received from the Subsequent PINX, the Transit PINX shall send a RELEASE message to the Subsequent PINX.

If a DISCONNECT message was sent to the Preceding PINX, the Transit PINX shall enter the TCC_Await_Incoming_Release state. When a RELEASE message is received from the Preceding PINX, the Transit PINX shall release any assigned resources and revert to the TCC_Idle state.

10.4.10.2 Call clearing initiated by the Transit PINX

If a Transit PINX decides to abort a call it may send, in both directions, a clearing message appropriate to the current Protocol Control state. Each side of the PINX shall then continue normal clearing procedures independently of the other.

Alternatively, where an in-band tone or announcement is appropriate (i.e. if it conveys information which is not conveyable by PSS1), the Transit PINX, instead of sending a clearing message, may connect an in-band tone or announcement to either (or both) sides of the PINX and transmit a PROGRESS message, containing CCITT progress description number 8 “in band information or appropriate pattern now available” and an appropriate Cause. If Call Control is in the TCC_Call_Active state, the announcement may optionally be applied without sending a PROGRESS message, as the information channel(s) will be through connected in both directions at this stage.

Call Control of the Transit PINX shall ensure that, for each side, if an indication of clearing has not been received by the time the tone or announcement is complete (or has been applied for sufficient time), normal clearing procedures (described in subclause 10.4.10) shall be invoked.

10.4.11 Handling of Basic Call information elements at a Transit PINX

This clause applies only to information elements which are contained within messages and which may (but need not) be passed on by a Transit PINX. (Examples of these messages are SETUP, INFORMATION, ALERTING, CONNECT, PROGRESS and DISCONNECT).

10.4.11.1 Mandatory information elements

All mandatory information elements will (by definition) appear in messages on both sides of the Transit PINX. Where necessary they will be processed within Transit PINX and may be different either side of the PINX.

10.4.11.2 Non-mandatory information elements

Non-mandatory information elements fall into three categories:

Category 1: If they are present, they shall be processed in the Transit PINX and shall be passed on to the next PINX if the message is passed on. They may be locally generated.

Category 2: If they are present, they shall not be processed at a Transit PINX and shall be passed transparently onto the next PINX.

Category 3: If they are present, they shall be processed at the Transit PINX and may be passed on to the next PINX. They may be locally generated.

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The three categories are identified using their information element identifiers. Table 3 defines to which of the three categories each of the non-mandatory information elements belong.

Table 3 - Non-mandatory information element categories

Information Element	Category 1	Category 2	Category 3	Notes
Called party number	•			May be modified
Called party subaddress		•		
Calling party number	•			May be modified
Calling party subaddress		•		
Cause (in PROGRESS)	•			
Connected number	•			May be modified
Connected subaddress		•		
High layer compatibility		•		
Low layer compatibility		•		
Progress indicator	•			
Sending complete			•	

10.5 Originating PINX Call Control requirements

This clause specifies requirements for Call Control at an Originating PINX on the Outgoing Side of an Inter PINX link. These requirements are additional to the Protocol Control procedures specified in clauses 9, 10.1 to 10.3 and 12.

The following requirements apply when an Originating PINX chooses to route a call over an Inter PINX link employing PSS1 signalling and has selected a information channel to be used.

Any reference to messages received shall be interpreted as meaning a message which has passed the validation checks of Protocol Control and which has therefore resulted in a notification being given to Call Control.

10.5.1 Transmission of the SETUP message

The Originating PINX shall transmit a SETUP message. The SETUP message shall include optional information elements according to the following rules.

a) Sending complete. The Originating PINX may optionally send this information element if it can determine that the number in the Called party number information element is complete or if this has been indicated by the calling terminal.

b) Progress indicator. The Originating PINX shall pass on, by means of the Progress indicator information element, progress information received from the calling user.

   The Originating PINX may insert a Progress indicator information element containing CCITT progress description 3 “Origination address is non-ISDN” if neither the calling terminal nor the combination of the PINX and the calling terminal has the functionality of an ISDN terminal.

c) Calling party number. The Originating PINX shall include the calling party number information element identifying the calling user. The presentation indicator shall have the value “presentation restricted” if supplementary service Calling/Connected Line Identification Restriction (see ECMA-148) has been invoked at the calling user. Otherwise the presentation indicator, if present, shall have the value "presentation allowed".

d) Calling party subaddress. The Originating PINX shall include the calling party subaddress information element if a calling party subaddress is available.

e) Called party subaddress. The Originating PINX shall include the called party subaddress information element if a called party subaddress is available.

f) Low layer compatibility. The Originating PINX shall include the low layer compatibility information element if low layer compatibility information is available.

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g) High layer compatibility. The Originating PINX shall include the high layer compatibility information element if high layer compatibility information is available.

10.5.2 Agreement of the information channel

On receipt of a SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING or CONNECT message agreeing the channel(s) proposed in the SETUP message or suggesting one or more alternative channels which the Originating PINX finds acceptable, the Originating PINX may optionally connect the information channel(s) in the forward direction, in the backward direction or in both directions.

NOTE 1 - It is recommended that information channel(s) are connected in both directions at this stage, particularly for services involving the conveyance of speech information. Leaving the information channel(s) unconnected until a later stage, particularly in the backward direction, may lead to the "clipping" of speech. However, there may be reasons for delaying connection, particularly in the forward direction, e.g., to avoid the onward transmission of in-band signalling information from the user's access.

NOTE 2 - If the received message is an ALERTING or CONNECT message, 10.5.4 or 10.5.5 shall apply, respectively.

10.5.3 Receipt of Progress indicators

Information received in a Progress indicator information element in a PROGRESS message, an ALERTING message or a CONNECT message, shall be conveyed to the calling user - dependent on the ability of the calling user's equipment to receive such information.

On receipt of a Progress indicator information element with CCITT progress description number 8 "in-band information or appropriate pattern now available" or CCITT progress description number 1 "call is not end-to-end ISDN, further call progress information may be available in-band" the Originating PINX shall connect the information channel(s) in the backward direction if it has not already done so.

10.5.4 Receipt of ALERTING message

On receipt of an ALERTING message, an indication of alerting may be given to the calling user.

Through connection may occur at this point. If the received message contains a Progress indicator information element with CCITT progress description number 8 "in-band information or appropriate pattern now available" or CCITT progress description number 1 "call is not end-to-end ISDN, further call progress information may be available in-band" the Originating PINX shall connect the information channel(s) in the backward direction if it has not already done so.

10.5.5 Receipt of CONNECT message

On receipt of a CONNECT message, the Originating PINX shall connect the information channel(s) in both directions, if it has not already done so, and shall indicate connection to the calling user.

If the CONNECT message contains a Connected number information element and/or a Connected subaddress information element, this information may be used for purposes such as the provision of the Connected Line Identification Presentation supplementary service to the calling user.

If the CONNECT message contains a Low Layer Compatibility information element, the information may be passed on to the calling user.

10.5.6 Call clearing initiated by the Originating PINX

The Originating PINX may initiate clearing on the inter-PINX link employing PSS1 signalling if a clear request is received from the calling user or if a failure condition occurs. Clearing is initiated by informing Protocol Control and supplying a Cause.

Alternatively, for services for which an in-band tone or announcement is appropriate, the Originating PINX may connect an in-band tone or announcement to the outgoing information channel(s) and may optionally transmit a PROGRESS message containing a Progress indicator information element with CCITT progress description 8 "in-band information or appropriate pattern now available" and an appropriate Cause. If an indication of clearing has not been received from Protocol Control by the time the tone or announcement is complete or has been applied for sufficient time, the Originating PINX shall instruct Protocol Control to initiate clearing.

NOTE - It is recommended that an in-band tone or announcement be provided by the Originating PINX only if it conveys call failure information which is not conveyable by PSS1.

10.5.7 Receipt of an indication of call clearing

On receipt of an indication of call clearing from Protocol Control, the Originating PINX shall either indicate to the calling user that the call has cleared or take some other implementation dependent action.

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10.6 Terminating PINX Call Control requirements

This clause specifies requirements for Call Control at a Terminating PINX on the Incoming Side of an inter-PINX link. These requirements are additional to the Protocol Control procedures specified in clauses 9, 10.1 to 10.3 and 12.

NOTE - If enbloc signalling only is used between two adjacent PINXs, overlap receiving procedures need not be tested.

The following requirements apply when a PINX receives a SETUP message, possibly followed by one or more INFORMATION messages conveying additional Called party number information, and determines that the destination is a user on that PINX. The PINX therefore becomes a Terminating PINX.

Any reference to messages received shall be interpreted as meaning a message which has passed the validation checks of Protocol Control and which has therefore resulted in a notification being given to Call Control.

10.6.1 Receipt of the SETUP message

Optional information elements in the received SETUP message shall be used as follows.

a) Progress indicator. If the SETUP message contains a Progress indicator information element, the information therein may optionally be passed on to the called user.

b) Low layer compatibility, high layer compatibility and called party subaddress. If the SETUP message contains one or more of these information elements, and if the user is connected by means of an ISDN interface at the S reference point, the information element(s) shall be conveyed to the called user and the user may act upon the information therein. If the user is connected by means of a non-ISDN interface, conveyance of the information to the user depends on the user's ability to receive it.

c) Calling party number and calling party subaddress. Information in the calling party number information element, and also in the optional calling party subaddress information element, may be used for purposes such as the provision of the Calling Line Identification Presentation supplementary service to the called user.

10.6.2 Transmission of ALERTING message

The Terminating PINX shall transmit an ALERTING message when it is aware that the called user is being alerted.

For services which require an in-band tone or announcement to be supplied to the calling user during the period of alerting, the Terminating PINX is responsible for connecting the appropriate tone or announcement to the information channel(s) in the backwards direction. If a tone or announcement is connected, the Terminating PINX shall include a Progress indicator information element with CCITT progress description number 8 “in-band information or appropriate pattern now available” in the ALERTING message.

10.6.3 Transmission of Progress indicators

The Terminating PINX shall pass on, by means of the Progress indicator information element, progress information received from the called user, either before or after the transmission of an ALERTING message.

The Terminating PINX may send a Progress indicator information element containing CCITT progress description number 2 “Destination address is non-ISDN” if neither the called terminal nor the combination of the PINX and the called terminal has the functionality of an ISDN terminal.

A Progress indicator information element shall be transmitted in an ALERTING message or a CONNECT message if an ALERTING message or a CONNECT message is being sent at the time. Otherwise it shall be transmitted in a PROGRESS message.

10.6.4 Transmission of CONNECT message

When the Terminating PINX is aware that the called user has accepted the call, it shall connect the information channel(s) in both directions and send a CONNECT message. Any in-band tone or announcement shall be disconnected.

The Terminating PINX shall include in the CONNECT message the Connected number information element. The presentation indicator shall have the value “presentation restricted” if supplementary service Calling/Connected Line Identification Restriction (see ECMA-148) has been invoked at the called user. Otherwise the presentation indicator, if present, shall have the value "presentation allowed".

The Terminating PINX shall include in the CONNECT message the Connected subaddress information element if a Connected subaddress is available.

The Terminating PINX may include in the CONNECT message the low layer compatibility information element if low layer compatibility information has been supplied by the called terminal.

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10.6.5 Call clearing initiated by the Terminating PINX

The Terminating PINX may initiate clearing on the inter-PINX link employing PSS1 signalling if it is not able to proceed with call establishment, if a failure condition occurs after the call has been established, or if a clear request is received from the called user. Clearing is initiated by informing Protocol Control and supplying a Cause.

Alternatively, for services for which an in-band tone or announcement is appropriate, the Terminating PINX may connect an in-band tone or announcement to the incoming information channel(s) and transmit a PROGRESS message containing a Progress indicator information element with CCITT progress description 8 “in-band information or appropriate pattern now available” and an appropriate Cause. If an indication of clearing has not been received from Protocol Control by the time the tone or announcement is complete or has been applied for sufficient time, the Terminating PINX shall instruct Protocol Control to initiate clearing. The sending of the PROGRESS message is optional in the Active state but mandatory in other states.

NOTE - It is recommended that an in-band tone or announcement be provided by the Terminating PINX only if it conveys call rejection or failure information which is not conveyable by PSS1.

10.6.6 Receipt of an indication of call clearing

On receipt of an indication of call clearing from Protocol Control, the Terminating PINX shall either indicate to the called user that the call has cleared or take some other implementation dependent action.

10.7 Incoming Gateway PINX Call Control requirements

This clause specifies requirements for Call Control at an Incoming Gateway PINX on the Outgoing Side of an inter-PINX link. These requirements are additional to the Protocol Control procedures specified in clauses 9, 10.1 to 10.3 and 12.

The following requirements apply when a call entering the PISN is routed, by the Incoming Gateway PINX, over an inter-PINX link employing PSS1 signalling, an information channel on that link having been selected.

Any reference to messages received shall be interpreted as meaning a message which has passed the validation checks of Protocol Control and which has therefore resulted in a notification being given to Call Control.

10.7.1 Transmission of the SETUP message

The Incoming Gateway PINX shall transmit a SETUP message. The SETUP message shall include optional information elements according to the following rules.

a) Sending complete. The Incoming Gateway PINX may optionally send this information element if it can determine that the number in the Called party number information element is complete or if this has been indicated by the other network.

b) Progress indicator. The inclusion of a Progress indicator information element by the Incoming Gateway PINX shall be in accordance with clause 10.7.2.

c) Calling party number. If the other network has supplied a calling party number with or without an indication that presentation is restricted or a restriction indication only, the Incoming Gateway PINX shall include this information in the SETUP message within the calling party number information element. Otherwise the calling party number information element shall either contain the presentation indicator value “number not available due to interworking” or be omitted.

d) Calling party subaddress. If the other network is a public ISDN and supplies a calling party subaddress information element, the Incoming Gateway PINX shall pass on the information element unchanged in the SETUP message. The Incoming Gateway PINX may also include a calling party subaddress information element in the SETUP message if calling party subaddress information has been supplied by a non-ISDN.

e) Called party subaddress. If the other network is a public ISDN and supplies a called party subaddress information element, the Incoming Gateway PINX shall pass on the information element unchanged in the SETUP message. The Incoming Gateway PINX may also include a called party subaddress information element in the SETUP message if called party subaddress information has been supplied by a non-ISDN.

f) Low layer compatibility. If the other network is a public ISDN and supplies a low layer compatibility information element, the Incoming Gateway PINX shall pass on the information element unchanged in the SETUP message. The Incoming Gateway PINX may also include a low layer compatibility information element in the SETUP message if low layer compatibility information has been supplied by a non-ISDN.

g) High layer compatibility. If the other network is a public ISDN and supplies a high layer compatibility information element, the Incoming Gateway PINX shall pass on the information element unchanged in the SETUP message. The Incoming Gateway PINX may also include a high layer compatibility information element in the SETUP message if high layer compatibility information has been supplied by a non-ISDN.

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10.7.2 Interworking indications in the SETUP Message

The inclusion of the Progress indicator information element in the SETUP message shall be as specified below. If none of the specified conditions apply, no Progress indicator information element shall be included.

10.7.2.1 Interworking indications received from a public ISDN

If the call has arrived from a public ISDN and a Progress indicator information element containing one of the following CCITT progress descriptions has been received from the public ISDN, that information element shall be passed on:

– 1 “call is not end-to-end ISDN, further call progress information may be available in-band”

– 3 “origination address is non-ISDN”

10.7.2.2 Interworking with a non-ISDN

If the call has entered the PISN from a network (public or private) which is not ISDN, a Progress indicator information element may be sent containing CCITT progress description number 1 “call is not end-to-end ISDN, further call progress information may be available in-band”.

NOTE - Terminals in the PISN that support only the "Speech" bearer capability can only accept calls indicating either "Speech" bearer capability or "3.1kHz audio" bearer capability together with progress indicator containing CCITT progress description number 1 "call is not end to end ISDN, further call progress information may be available in-band". It is recommended that this is taken into account when providing an incoming gateway function to a non-ISDN network supporting speech based telephony.

10.7.3 Agreement of the information channel

On receipt of a SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING or CONNECT message agreeing the channel(s) proposed in the SETUP message or suggesting one or more alternative channels which the Incoming Gateway PINX finds acceptable, the Incoming Gateway PINX may optionally connect the information channel(s) in the forward direction, in the backward direction or in both directions.

NOTE - It is recommended that the information channel(s) are connected in both directions at this stage, particularly for services involving the conveyance of speech information. Leaving the information channel(s) unconnected until a later stage, particularly in the backward direction, may lead to the “clipping” of speech. However, there may be reasons for delaying connection, particularly in the forward direction, e.g., to avoid the onward transmission of in-band signalling information from the other network.

10.7.4 Receipt of Progress indicators

Information received in a Progress indicator information element in a PROGRESS message, an ALERTING message, or a CONNECT message shall be passed on to the other network if the signalling system permits and if relevant.

On receipt of a Progress indicator information element with CCITT progress description number 8 “in-band information or appropriate pattern now available” or CCITT progress description number 1 “call is not end-to-end ISDN, further call progress information may be available in-band” the Incoming Gateway PINX shall connect the information channel(s) in the backward direction if it has not already done so.

10.7.5 Receipt of ALERTING message

On receipt of an ALERTING message, an indication of alerting may be given to the other network if the signalling system permits.

If the ALERTING message contains a Progress indicator information element with CCITT progress description number 8 “in-band information or appropriate pattern now available” or CCITT progress description number 1 “call is not end-to-end ISDN, further call progress information may be available in-band” the Incoming Gateway PINX shall connect the information channel(s) in the backward direction if it has not already done so.

10.7.6 Receipt of CONNECT message

On receipt of a CONNECT message, the Incoming Gateway PINX shall connect the information channel(s) in both directions, if it has not already done so, and shall indicate connection to the other network if the signalling system permits.

If the CONNECT message contains a low layer compatibility information element, the information element shall be conveyed unchanged to the other network if that network is a public ISDN. Where the other network is non-ISDN, low layer compatibility information may be conveyed to the other network if the signalling system permits.

If the CONNECT message contains a Connected number information element, conveyance of the information therein to the other network depends on the capability of the signalling system and whether the Connected number has significance in the other network. Translation of a number into the numbering plan of the other network may be performed in order to yield a number which has significance in the other network.

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If the CONNECT message contains a Connected subaddress information element, the information element shall be conveyed unchanged to the other network if that network is a public ISDN. Where the other network is non-ISDN, Connected subaddress information may be conveyed to the other network if the signalling system permits.

If the received Connected number information element has the presentation indicator value “presentation restricted”, presentation of the number to the other network is outside the scope of this International Standard, but will depend on such factors as the other network’s commitment to honour the restriction.

10.7.7 Call clearing initiated by the Incoming Gateway PINX

The Incoming Gateway PINX may initiate clearing on the inter-PINX link employing PSS1 signalling if a clear request is received from other network or if a failure condition occurs. Clearing is initiated by informing Protocol Control and supplying a Cause.

Alternatively, for services for which an in-band tone or announcement is appropriate, the Incoming Gateway PINX may connect an in-band tone or announcement to the outgoing information channel(s) and may optionally transmit a PROGRESS message containing a Progress indicator information element with CCITT progress description number 8 “in-band information or appropriate pattern now available” and an appropriate Cause. In cases where the other network indicates that it is providing an in-band tone or announcement in preparation for clearing, the Incoming Gateway PINX may transmit a PROGRESS message containing a Progress indicator information element with CCITT progress description number 8 “in-band information or appropriate pattern now available”.

In all the above cases:

– if an indication of clearing has not been received from Protocol Control by the time the tone or announcement is complete or has been applied for sufficient time, the Incoming Gateway PINX shall instruct Protocol Control to initiate clearing.

– the sending of the PROGRESS message is optional in the Active state, but mandatory in other call states.

NOTE - It is recommended that an in-band tone or announcement be provided by the Incoming Gateway PINX only if it conveys call failure information which is not conveyable by PSS1.

10.7.8 Receipt of an indication of call clearing

On receipt of an indication of call clearing from Protocol Control, the Incoming Gateway PINX shall either indicate to the other network that the call has cleared or take some other implementation dependent action.

10.8 Outgoing Gateway PINX Call Control requirements

This clause specifies requirements for Call Control at an Outgoing Gateway PINX on the Incoming Side of an inter-PINX link. These requirements are additional to the Protocol Control procedures specified in clauses 9, 10.1 to 10.3 and 12.

The following requirements apply when a PINX receives a SETUP message, possibly followed by one or more INFORMATION messages conveying additional Called party number information, and determines that the call is to be routed directly (not via any further PINX) to another network. The PINX therefore becomes an Outgoing Gateway PINX.

Any reference to messages received shall be interpreted as meaning a message which has passed the validation checks of Protocol Control and which has therefore resulted in a notification being given to Call Control.

10.8.1 Receipt of the SETUP message

Information elements in the received SETUP message shall be used as follows.

a) Progress indicator. If the SETUP message contains a Progress indicator information element, the information therein shall be passed on to the other network if the signalling system permits and if relevant.

b) Low layer compatibility, high layer compatibility, called party subaddress and calling party subaddress. If the SETUP message contains one or more of these information elements, the information element(s) shall be conveyed unchanged to the other network if that network is a public ISDN. Where the other network is non-ISDN, information from these elements may be conveyed to the other network if the signalling system permits. However, the calling party subaddress information element shall not be sent to the network if the presentation indicator in the received calling party number information element has the value “presentation restricted”.

c) Calling party number. If the SETUP message contains a calling party number information element, conveyance of the information therein to the other network depends on the capability of the signalling system and whether the calling party number has significance in the other network. Translation of a number into the numbering plan of the other network may be performed in order to yield a number which has significance in the other network. If the received calling party number information element has the presentation indicator value "presentation restricted", presentation of the number to the other network is outside the scope of this International Standard, but will depend on such factors as the other network's commitment to honour the restriction.

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10.8.2 Connection of the information channel

The Outgoing Gateway PINX may optionally connect the information channel(s) in the forward direction, in the backward direction or in both directions as soon as the channel(s) to the other network have been agreed.

NOTE - It is recommended that the information channel(s) are connected in both directions at this stage, particularly for services involving the conveyance of speech information. Leaving the information channel(s) unconnected until a later stage, particularly in the backward direction, may lead to the "clipping" of speech or the loss of in-band tones or announcements. However, there may be reasons for delaying connection, particularly in the forward direction, e.g., while transmitting in-band signalling information.

10.8.3 Transmission of interworking indications

The Outgoing Gateway PINX shall transmit Progress indicator information elements as specified below. A Progress indicator information element shall be transmitted in a PROGRESS message, an ALERTING message or a CONNECT message as soon as the information becomes available, subject to a SETUP ACKNOWLEDGE or CALL PROCEEDING message having already been sent. A PROGRESS message shall be used unless an ALERTING or CONNECT message is to be sent at the time. All appropriate interworking indications shall be transmitted by the Outgoing Gateway PINX.

10.8.3.1 Interworking indications received from a public ISDN

If the call has entered a public ISDN and a Progress indicator information element containing one of the following CCITT progress descriptions has been received from the public ISDN, that information element shall be passed on:

- 1 "call is not end-to-end ISDN, further call progress information may be available in-band"
- 2 "destination address is non-ISDN"
- 4 "call has returned to the ISDN"
- 8 "in-band information or appropriate pattern now available"

In the case of progress description number 1 "call is not end to end ISDN, further information may be available in band" and number 8 "in band information or appropriate pattern now available", the Outgoing Gateway PINX shall connect the information channel in the backward direction if it has not already done so.

10.8.3.2 Interworking with a non-ISDN

If the call is to enter a network (public or private) which is not ISDN, a progress indicator information element may be sent containing CCITT progress description number 1 "call is not end-to-end ISDN, further call progress information may be available in-band". If this Progress indicator information element is sent, the Outgoing Gateway PINX shall connect the information channel in the backward direction if it has not already done so.

10.8.4 Transmission of ALERTING message

The Outgoing Gateway PINX shall transmit an ALERTING message when it receives an indication from the other network that the called user is being alerted. Some other networks may be unable to indicate alerting.

For services which require an in-band tone or announcement to be supplied to the calling user during the period of alerting, the Outgoing Gateway PINX is responsible for connecting the appropriate tone or announcement to the information channel(s) in the backwards direction, unless an appropriate tone or announcement is being provided by the other network. If a tone or announcement is being provided either by the Outgoing Gateway PINX or by the other network, the Outgoing Gateway PINX shall include a Progress indicator information element with CCITT progress description 8 "in-band information or appropriate pattern now available" in the ALERTING message.

10.8.5 Transmission of CONNECT message

When the Outgoing Gateway PINX receives an answer signal from the other network, it shall connect the information channel(s) in both directions, if it has not already done so, and send a CONNECT message.

If the other network is not always able to supply an indication of call acceptance, the Outgoing Gateway PINX shall connect the information channel(s) in both directions and send a CONNECT message when a suitable time interval has elapsed following the sending of call information to the other network. The time interval chosen should take account of the shortest likely time to indicate the call acceptance. If, subsequent to sending a CONNECT message, an indication of call acceptance is received from the other network, the Outgoing Gateway PINX shall not send a second CONNECT message.

If the other network has supplied a Connected number with or without an indication that presentation is restricted or a restriction indication only, the Outgoing Gateway PINX shall include this information in the CONNECT message within the Connected number information element. Otherwise the Connected number information element shall either contain the presentation indicator value "number not available due to interworking" or be omitted.

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If the other network is a public ISDN and supplies a Connected subaddress information element, the Outgoing Gateway PINX shall pass the information element on unchanged in the CONNECT message. The Outgoing Gateway PINX may also include a Connected subaddress information element in the CONNECT message if Connected subaddress information has been supplied by a non-ISDN.

If the other network is a public ISDN and supplies a low layer compatibility information element, the Outgoing Gateway PINX may pass the information element on unchanged in the CONNECT message. The Outgoing Gateway PINX may also include a low layer compatibility information element in the CONNECT message if low layer compatibility information has been supplied by a non-ISDN.

10.8.6 Call clearing initiated by the Outgoing Gateway PINX

The Outgoing Gateway PINX may initiate clearing on the inter-PINX link employing PSS1 signalling if it is not able to proceed with call establishment, if a failure condition occurs after the call has been established, or if a clear request is received from the other network. Clearing is initiated by informing Protocol Control and supplying a Cause.

Alternatively, for services for which an in-band tone or announcement is appropriate, the Outgoing Gateway PINX may connect an in-band tone or announcement to the incoming information channel(s) and transmit a PROGRESS message containing a Progress indicator information element with CCITT progress description 8 “in-band information or appropriate pattern now available” and an appropriate Cause. A PROGRESS message containing a Progress indicator information element with CCITT progress description number 8 “in-band information or appropriate pattern now available” may also be sent in cases where the other network indicates that it is providing an in-band tone or announcement in preparation for clearing.

In all of the above cases:

- If an indication of clearing has not been received from Protocol Control by the time the tone or announcement is complete or has been applied for sufficient time, the Outgoing Gateway PINX shall instruct Protocol Control to initiate clearing.
- The sending of the PROGRESS message is optional in the Active state but mandatory in other states.

NOTE - It is recommended that an in-band tone or announcement be provided by the Outgoing Gateway PINX only if it conveys call rejection or failure information which is not conveyable by PSS1.

10.8.7 Receipt of an indication of call clearing

On receipt of an indication of call clearing from Protocol Control, the Outgoing Gateway PINX shall either indicate to the other network that the call has cleared or take some other implementation dependent action.

11 Procedures for layer management

11.1 Restart procedures

The restart procedure may be used to return a single channel, or all channels associated with the signalling channel, to the idle condition and calls associated with these channels to the Null state. The procedure may be invoked when the adjacent PINX does not respond to Call control messages, a failure has occurred or a maintenance action has taken place or for some other (unspecified) reason (e.g. following a SCM failure; or following the second expiry of timer T308 due to the absence of response to a clearing message).

11.1.1 Sending RESTART

A RESTART message may be sent by either side in order to return an indicated channel, multiple indicated channels or all channels associated with the signalling channel to the idle state. The Restart indicator information element shall be present in the RESTART message to indicate whether one or more indicated channels or all channels are to be restarted. If the Restart indicator is coded as “indicated channel”, then the Channel identification information element shall be present to indicate which channel(s) are to be returned to the idle condition. In the case where multiple channels (but not all channels associated with the signalling channel) are to be restarted, the Channel identification information element shall be present to indicate the channels to be restarted. If the Restart indicator information element is coded “all channels”, then the Channel identification information element shall not be included.

Upon transmitting the RESTART message the sending entity shall enter the Restart Request state, start timer T316, and wait for a RESTART ACKNOWLEDGE message. No further RESTART messages shall be sent until a RESTART ACKNOWLEDGE message is received or timer T316 expires.

Receipt of a RESTART ACKNOWLEDGE message shall stop timer T316, free the channels and Call reference values (associated with the channels identified by the RESTART message) for reuse, and cause the receiving entity to enter the Null state.

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If a RESTART ACKNOWLEDGE message is not received prior to expiry of timer T316 one or more subsequent RESTART messages may be sent until a RESTART ACKNOWLEDGE message is returned - the limit of the number of times RESTART may be sent is implementation dependent.

Meanwhile, no calls shall be placed or accepted on the channels identified in the RESTART message by the originator of the message. When the limit for the number of restarts is reached, the originator shall make no further restart attempts. An indication shall be provided to the appropriate maintenance entity. The channels identified shall be considered to be in an out-of-service condition until maintenance action has been taken.

The RESTART and RESTART ACKNOWLEDGE messages shall contain the Global call reference value with which the Restart Request state is associated.

11.1.2 Receipt of RESTART

Upon receiving a RESTART message the recipient shall enter the Restart state associated with the Global call reference. It shall then initiate the appropriate internal actions to return the specified channels to the idle condition and call reference(s) associated with those channels to the Null state. Upon completion of internal clearing a RESTART ACKNOWLEDGE message shall be transmitted to the originator, and the transmitting entity shall enter the Null state.

Even if all Call references are in the Null state and all channels are in the idle condition, the receiving entity shall transmit a RESTART ACKNOWLEDGE message to the originator on receiving a RESTART message.

If the Restart indicator information element is coded as “indicated channel” and the Channel identification information element is not included, the procedures of 9.2.6.1 shall apply.

11.1.3 Restart collision

Restart collision occurs at Inter-PINX link when both sides of the inter-PINX link simultaneously transmit a RESTART message. The Call reference flag of the Global call reference applies to the restart procedures. In the case when both sides on an inter-PINX link initiate simultaneous restart requests, they shall be handled independently. In the case when the same channel(s) are specified, they shall not be considered for re-use until all the relevant restart procedures are completed.

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12 Protocol timers

The protocol timers are defined in table 4. All timer values given in this table have a tolerance of 10%.

Legend to table 4, columns 7 and 8:

- M The timer is mandatory
- O The timer is optional
- M(I) The timer is mandatory if the associated procedures are implemented.

Table 4 - Protocol timer definitions

Timer Number	Timer Value	Call State	Cause For Start	Normally terminated (note 1, note 2)	Action To Be Taken When Timer Expires	Incoming side	Outgoing side
T301	note 3	Call Delivered	ALERTING received	On CONNECT received	Clear Call as specified in clause 10.1.5		O
T302	Minimum 14 s, Maximum 16 s	Overlap Receiving	Sending of SETUP ACKNOWLEDGE Restarted on receipt of INFORMATION message	On the sending of CALL PROCEEDING, ALERTING or CONNECT	Clear call if information is definitely incomplete (as specified in clause 10.1.4.2) else send CALL PROCEEDING	M	
T303	Minimum 4 s, Maximum 6 s	Call Initiated	On Sending SETUP	On receipt of CALL PROCEEDING, CONNECT, ALERTING, SETUP ACK. or RELEASE COMPLETE	Retransmit SETUP and restart T303, or clear the call as specified in clause 10.1.1		M
Second T303	Minimum 4 s, Maximum 6 s	Call Initiated	On retransmission of SETUP	On receipt of CALL PROCEEDING, CONNECT, ALERTING, SETUP ACK. or RELEASE COMPLETE	Clear Call as specified in clause 10.1.1		O
T304	Minimum 20 s	Overlap Sending	Receipt of SETUP ACK. Retransmission of INFORMATION restarts T304	Receiving CALL PROCEEDING, ALERTING or CONNECT	Clear the call using procedures specified in clause 10.1.3		M
T305	Minimum 4 s, Maximum 30 s	Disconnect Request	On Sending DISCONNECT	Receipt of RELEASE or DISCONNECT	Send RELEASE, start T308	M	M
T308	Minimum 4 s, Maximum 6 s	Release Request	On Sending RELEASE	On Receiving RELEASE or RELEASE COM.	Retransmit RELEASE, restart T308	M	M

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Second T308	Minimum 4 s, Maximum 6 s	Release Request	On retransmission of RELEASE	On receiving RELEASE or RELEASE COMPLETE	Release Call Reference; place info channel in maintenance condition. (optionally initiate RESTART procedures)	M	M
T309	90 s note 4	Any State	SCM disconnection. Calls in Stable states are not lost	On SCM re-establishment	Clear connection, release call reference and info channel	M	M
T310	note 5	Outgoing Call Proceeding	On receipt of CALL PROCEEDING	On Receipt of ALERTING, CONNECT, PROGRESS (#1, #2 or #8), DISCONNECT or RELEASE	Clear the call as specified in clause 10.1.4.3		M (Optional for a Transit PINX)
T313	Minimum 4 s, Maximum 6 s	Connect Request	On sending CONNECT	On receipt of CONNECT ACKNOWLEDGE	Clear call as specified in 10.1.6	O	
T316	120 s	Restart request	On sending of RESTART	On Receipt of RESTART ACKNOWLEDGE	Retransmit RESTART, restart T316	M	M
Final T316 note 6	120 s	Restart request	On Final retransmission of RESTART	On Receipt of RESTART ACKNOWLEDGE	Notify maintenance: 'Channel/inter-PINX link out of service'	M	M
T322	Minimum 4 s, Maximum 6 s	Any call state except null.	STATUS ENQUIRY sent	STATUS, DISCONNECT, RELEASE or RELEASE COMPLETE received	STATUS ENQUIRY may be transmitted several times - implementation dependant.	M (I)	M (I)

NOTE 1 - All protocol Timers, except T316, if running, should be terminated on entering the null state.

NOTE 2 - Timers T301, T302, T303, T304, T310 and T313 are all stopped (if running) on receipt or transmission of any clearing message.

NOTE 3 - The optional timer T301 is implementation dependent and is not specified as part of this International Standard.

NOTE 4 - Additional (implementation specific) values for this timer may be supported.

NOTE 5 - The value of this timer is implementation dependent and shall be equal to, or greater than, 30 seconds. In the case of operation of certain call handling supplementary services in a PISN, the receipt of an ALERTING or CONNECT message may be delayed significantly beyond that expected for a normal call. In order to ensure that unnecessary failure of these services can be avoided, it is recommended that T310 be given a value of at least 110 seconds.

NOTE 6 - The number of times T316 is restarted is an implementation option.

13 Functional definition of messages

This clause provides an overview of the structure of messages used in this International Standard and defines the function and information contents (i. e. semantics) of each message.

Whenever a message is sent, according to the procedures of clauses 9, 10 and 11, it shall contain the mandatory information elements, and optionally any combination of the optional information elements, specified in this clause for that message.

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Each definition includes:

a) A brief description of the message direction and use.

b) A table listing the information elements of codeset 0 in the order of their appearance in the message (same relative order for all message types).

c) Indications for each information element in the table, specifying:

- the clause of this International Standard describing the information element;
- whether inclusion is mandatory (“M”) or optional (“O”);
- the length (or length range) of the information element, where “*” denotes an undefined maximum length which may be network or service dependent. Note that certain optional information elements may be present in the message, but empty (length = 2 octets), but this case is not considered in the tables.

d) Further explanatory notes, as necessary.

Other messages and information elements may be required for the support of supplementary services and additional network features; these will be defined in other standards.

Unless otherwise qualified by an individual note, information elements marked as optional in the definition of a message should be included whenever the sender is able to provide the information (i.e. the information is available at the sending side of a link), if it has not been sent before.

13.1 Messages for general procedures

13.1.1 STATUS

This message is sent by either side in response to a STATUS ENQUIRY message or at any time during a call to report certain error conditions.

Table 5 - STATUS message content

Message Type: STATUS
Direction: both

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M (note 1)	3
Message type	14.4	M	1
Cause	14.5	M	4-32
Call state	14.5	M	3

NOTE 1 - This message may be sent with the global call reference.

13.1.2 STATUS ENQUIRY

This message may be sent by either side at any time to solicit a STATUS message from the peer signalling entity.

Table 6 - STATUS ENQUIRY message content

Message Type: STATUS ENQUIRY
Direction: both

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M	3
Message type	14.4	M	1

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13.2 Messages for Circuit Mode Call Control

13.2.1 ALERTING

This message is sent by the incoming side to the outgoing side to indicate that called user alerting has been initiated.

Table 7 - ALERTING message content

Message Type: ALERTING
Direction: incoming to outgoing

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M	3
Message type	14.4	M	1
Channel identification	14.5	O (note 1)	4-*
Progress indicator	14.5	O	4

NOTE 1 - Mandatory if ALERTING is the first response to a SETUP message.

13.2.2 CALL PROCEEDING

This message is sent by the incoming side to indicate that the requested call establishment has been initiated and no more call establishment information will be accepted.

Table 8 - CALL PROCEEDING message content

Message Type: CALL PROCEEDING
Direction: incoming to outgoing

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M	3
Message type	14.4	M	1
Channel identification	14.5	O (note 1)	4-*

NOTE 1 - Mandatory if CALL PROCEEDING is the first response to a SETUP message.

13.2.3 CONNECT

This message is sent by the incoming side to the outgoing side to indicate call acceptance by the called user.

Table 9 - CONNECT message content

Message Type: CONNECT
Direction: incoming to outgoing

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M	3
Message type	14.4	M	1
Channel identification	14.5	O (note 1)	4-*
Progress indicator	14.5	O	4
Connected number	14.5	O	4-*
Connected subaddress	14.5	O	4-23
Low layer compatibility	14.5	O	4-16

NOTE 1 - Mandatory if CONNECT is the first response to a SETUP message.

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13.2.4 CONNECT ACKNOWLEDGE

This message is sent by the outgoing side to acknowledge the receipt of a CONNECT message.

Table 10 - CONNECT ACKNOWLEDGE message content

Message Type: CONNECT ACKNOWLEDGE
Direction: outgoing to incoming

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M	3
Message type	14.4	M	1

13.2.5 DISCONNECT

This message is sent by either side as an invitation to terminate the connection.

Table 11 - DISCONNECT message content

Message Type: DISCONNECT
Direction: both

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M	3
Message type	14.4	M	1
Cause	14.5	M	4-32

13.2.6 INFORMATION

This message is sent by the outgoing side to provide additional information during call establishment (in the case of overlap sending).

Table 12 - INFORMATION message content

Message Type: INFORMATION
Direction: outgoing to incoming

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M	3
Message type	14.4	M	1
Sending complete	14.5	O (note 1)	1
Called party number	14.5	O (note 1)	4-*

NOTE 1 - Either “sending complete” or “called party number” or both should normally be present.

13.2.7 PROGRESS

This message is sent by the incoming side to indicate the progress of a call in the event of interworking or by either side in the connection with the provision of optional in-band information/patterns.

Table 13 - PROGRESS message content

Message Type: PROGRESS
Direction: both

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M	3
Message type	14.4	M	1
Cause	14.5	O (note 1)	4-32
Progress indicator	14.5	M	4

NOTE 1 - Included if a call failure has to be reported and inband tones/announcements are provided.

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13.2.8 RELEASE

This message is used to indicate that the equipment sending the message has disconnected the channel (if any) and intends to release the channel and the call reference, and that the receiving equipment should release the channel and prepare to release the call reference after sending RELEASE COMPLETE.

Table 14 - RELEASE message content

Message Type: RELEASE
Direction: both

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M	3
Message type	14.4	M	1
Cause	14.5	O (note 1)	4-32

NOTE 1 - Mandatory in the first call clearing message.

13.2.9 RELEASE COMPLETE

This message is used to indicate that the equipment sending the message has released the channel (if any) and call reference, the channel is available for re-use, and the receiving equipment shall release the call reference.

Table 15 - RELEASE COMPLETE message content

Message Type: RELEASE COMPLETE
Direction: both

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M	3
Message type	14.4	M	1
Cause	14.5	O (note 1)	4-32

NOTE 1 - Mandatory in the first call clearing message.

13.2.10 SETUP

This message is sent by the outgoing side to the incoming side to initiate call establishment.

Table 16 - SETUP message content

Message Type: SETUP
Direction: outgoing to incoming

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M	3
Message type	14.4	M	1
Sending complete	14.5	O	1
Bearer capability	14.5	M	4-12
Channel identification	14.5	M	4-*
Progress indicator	14.5	O	4
Calling party number	14.5	O	4-*
Calling party subaddress	14.5	O	4-23
Called party number	14.5	M	4-*
Called party subaddress	14.5	O	4-23
Low layer compatibility	14.5	O	4-16
High layer compatibility	14.5	O	4-5

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13.2.11 SETUP ACKNOWLEDGE

This message is sent by the incoming side to indicate that call establishment has been initiated, but additional information may be required.

Table 17 - SETUP ACKNOWLEDGE message content

Message Type: SETUP ACKNOWLEDGE
Direction: incoming to outgoing

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M	3
Message type	14.4	M	1
Channel identification	14.5	M	4-*

13.3 Messages for layer management

13.3.1 RESTART

This message is used to request the recipient to restart (i.e. return to idle condition) the indicated channel(s).

Table 18 - RESTART message content

Message Type: RESTART
Direction: both

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M (note 1)	3
Message type	14.4	M	1
Channel identification	14.5	O (note 2)	4-*
Restart indicator	14.5	M	3

NOTE 1 - This message is sent with the global call reference.

NOTE 2 - Included when the Restart indicator information element indicates that a particular channel is to be restarted.

13.3.2 RESTART ACKNOWLEDGE

This message is used to acknowledge the receipt of a RESTART message and to indicate that the requested restart is complete.

Table 19 - RESTART ACKNOWLEDGE message content

Message Type: RESTART ACKNOWLEDGE
Direction: both

Information Element	Reference	Type	Length
Protocol discriminator	14.2	M	1
Call reference	14.3	M (note 1)	3
Message type	14.4	M	1
Channel identification	14.5	O (note 2)	4-*
Restart indicator	14.5	M	3

NOTE 1 - This message is sent with the global call reference.

NOTE 2 - Included when the Restart indicator information element indicates that a particular channel has been restarted.

14 General message format and coding of information elements

The figures and text in this section describe message contents. Within each octet, the bit designated “bit 1” is transmitted first, followed by bit 2, 3, 4 etc. Similarly, the octet shown at the top of each figure is sent first.

Whenever a message is sent, according to the procedures of clauses 9, 10 and 11, it shall be coded as specified in this clause, except where the message is segmented according to the procedures of annex ZA, in which case each message segment shall be coded as specified in that annex.

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14.1 Overview

The coding rules follow ITU-T Recommendation Q.931.

Every message consists of:

a) Protocol discriminator,

b) Call Reference,

c) Message type,

d) other information elements, as required.

Information elements a), b) and c) are common to all messages and shall always be present, while elements d) are specific to each message type.

8	7	6	5	4	3	2	1	
Protocol discriminator								octet 1
0	0	0	0	Length of call reference value				octet 2
Call reference value								octet 3
0	Message type							etc.
Other information elements as required								

Figure 4 - General message organisation example

A particular message may contain more information than a particular (PISN) equipment needs or can understand. All equipment shall be able to ignore any extra information that is present in a message, but is not required for the proper operation of that equipment.

Unless specified otherwise, a particular information element shall be present only once in a given message.

The term “default” implies that the value defined shall be used in the absence of any assignment or negotiation of alternative values.

When a field, such as the call reference value, extends over more than one octet, the order of bit values progressively decreases as the octet number increases. The least significant bit of the field is represented by the lowest numbered bit of the highest numbered octet of the field.

14.2 Protocol discriminator

The purpose of the protocol discriminator is to distinguish messages of this specification from any protocol units which also use services of the SCM, but are coded according to other standards. The protocol discriminator is the first part of every message.

The protocol discriminator is coded according to table 20.

8	7	6	5	4	3	2	1	
Protocol discriminator								octet 1

Figure 5 - Protocol discriminator

Table 20 - Protocol discriminator

Bits								
8	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
0	0	0	0	1	0	0	0	ITU-T Q.931(I.451) user-network call control message (note 1)
All other values are reserved								

NOTE 1 - For the purposes of this International Standard, this protocol discriminator should be understood to mean "PISN inter-exchange signalling messages".

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14.3 Call reference

The purpose of the call reference is to identify the call at the local inter-PINX link to which the particular message applies. The call reference does not have end-to-end significance across PISNs.

The call reference is the second part of every message. The call reference is coded as shown in figure 6.

8	7	6	5	4	3	2	1	
0	0	0	0	Length of call reference value (in octets)				octet 1
CR-Flag	Call reference value							octet 2
Call reference value (cont.)								octet 3

Figure 6 - Call Reference

The coding of the CR-Flag (octet 2 bit 8) shall be as follows:

CR-Flag: 0 message is sent from the side that originated the CR (i.e. from the outgoing side)
1 message is sent to the side that originated the CR (i.e. from the incoming side)

Length of call reference value (octet 1)

The call reference value as defined for PSS1 shall always be two octets long; other length values are reserved. The receipt of a call reference value of one octet may not cause a protocol error. The actions taken by the receiver are based on the numerical value of the call reference and are independent of the length of the call reference information element.

The call reference information (octet 2 etc.) comprises two fields: the call reference value and the call reference flag.

Call reference values

Call reference values are assigned by the outgoing side of an inter-PINX link for a call. These values are unique to the outgoing side only within a particular signalling channel SCM logical link connection. The call reference value is assigned at the beginning of a call and remains fixed for the lifetime of a call. After a call ends, the associated call reference value may be reassigned to a later call. Two identical call reference values on the same signalling channel SCM logical link connection may be used when each value pertains to a call originated at opposite ends of the link.

Call reference flag

The call reference Flag can take the values ZERO or ONE. The call reference flag is used to identify which end of the layer two logical link originated a call reference. The outgoing side always sets the call reference flag to ZERO. The incoming side always sets the call reference flag to ONE.

Hence the call reference flag identifies the side which allocated the call reference value for this call and the only purpose of the call reference flag is to resolve simultaneous uses of the same call reference value.

Global call reference

The numerical value of the “global call reference” is zero. It is coded as shown in figure 7. The equipment receiving a message containing the global call reference should interpret the message as pertaining to all call references associated with the SCM connection.

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	1	0	octet 1
0/1	0	0	0	0	0	0	0	octet 2
0	0	0	0	0	0	0	0	octet 3

Figure 7 - Global call reference

Dummy call reference

The Dummy call reference consists of a single octet with all zeros as defined in ITU-T Q.931. Its use is beyond the scope of this International Standard.

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14.4 Message type

The purpose of the message type is to identify the function of the message being sent.

The message type is the third part of every message and it is coded as shown in figure 8 and table 21.

Bit 8 is reserved for possible future use as an extension bit.

8	7	6	5	4	3	2	1	
0	Message type							octet 1

Figure 8 - Message Type

Table 21 - Message types

Bits 8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Escape to national or private message type (note 1)
0	0	0						*Call Establishment messages:*
			0	0	0	0	1	ALERTING
			0	0	0	1	0	CALL PROCEEDING
			0	0	1	1	1	CONNECT
			0	1	1	1	1	CONNECT ACKNOWLEDGE
			0	0	0	1	1	PROGRESS
			0	0	1	0	1	SETUP
			0	1	1	0	1	SETUP ACKNOWLEDGE
0	1	0						*Call clearing messages:*
			0	0	1	0	1	DISCONNECT
			0	1	1	0	1	RELEASE
			1	1	0	1	0	RELEASE COMPLETE
			0	0	1	1	0	RESTART
			0	1	1	1	0	RESTART ACKNOWLEDGE
0	1	1						*Miscellaneous messages:*
			0	0	0	0	0	SEGMENT (note 2)
			1	1	0	1	1	INFORMATION
			1	1	1	0	1	STATUS
			1	0	1	0	1	STATUS ENQUIRY
All other values are reserved								

NOTE 1 - The handling of national/private messages is outside the scope of this International Standard (see annex D).

NOTE 2 - This message type is only used in conjunction with the message segmentation and re-assembly procedures defined in annex ZA.

14.5 Other information elements for Basic Call control (codeset 0)

14.5.1 Coding rules

The coding of other information elements follows the coding rules described below. These rules are formulated to allow each equipment which processes a message to find information elements important to it, and yet remain ignorant of information elements not relevant to that equipment.

Two categories of information elements are defined:

a) single octet information elements (see figures 9 and 10);

b) variable length information elements (see figure 11).

Table 22 summarises the coding of the information element identifier bits for those information elements of codeset 0 which are used in PSS1.

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The descriptions of the information elements below are ordered alphabetically. However, there is a particular order of appearance for each information element in a message within each codeset. The code values of the information element identifier for the variable length formats are assigned in ascending numerical order, according to the actual order of appearance of each information element in a message. This allows the receiving equipment to detect the presence or absence of a particular information element without scanning through an entire message. The receiving entity is entitled to disregard any information elements (of variable length) which are out of order.

Single octet information elements may appear at any point in the message. Two types of single octet information elements have been defined. Type 1 elements provide the information element identification in bit positions 7, 6, 5. The value “010” in these bit positions is reserved for type 2 single octet elements.

Where the description of information elements in this specification contains spare bits, these bits are indicated as being set to “ZERO”. In order to allow compatibility with future implementations, message should not be rejected simply because a spare bit is set to “ONE”.

The second octet of a variable length information element indicates the total length of the contents of that information element (i.e. the length starting with octet 3). It is the binary coding of the number of octets of the contents, with bit 1 as the least significant bit (2^0).

An optional variable length information element may be present, but empty. For example, a SETUP message may contain a calling party number information element, the content of which is of zero length. This should be interpreted by the receiver as equivalent to that information element being absent. Similarly, an absent information element should be interpreted by the receiver as equivalent to that information element being empty.

The following rules apply for the coding of the contents of variable length information elements (octets 3 etc.):

a) The first digit in the octet number identifies one octet or a group of octets (i.e. the octets are numbered in a way that reflects the structuring of an information element into groups of one or more octets).

b) Each octet group is a self contained entity. The internal structure of an octet group may be defined in alternative ways.

c) An octet group is formed by using some extension mechanism. The preferred extension mechanism is to extend an octet (N) to the next octet(s) (Na, Nb, etc.) by using bit 8 in each octet as an extension bit. The bit value “ZERO” indicates that the octet continues through the next octet. The bit value “ONE” indicates that this octet is the last octet of the group. If one octet (e.g. Nb) is present, the preceding octets (N and Na) must also be present.

   In the format descriptions of the following paragraphs, bit 8 is marked “0/1 ext” if another octet follows. Bit 8 is marked “1” or “1 ext” if this is the last octet in the extension domain (octet group).

   Additional octets may be defined later (“1 ext” changed to “0/1 ext”) and equipments shall be prepared to receive such additional octets, although the equipment need not be able to interpret or act upon the content of these octets.

d) In addition to the extension mechanism defined above, an octet (N) may be extended through the next octet(s) (N.1, N.2 etc.) by indications in bits 7-1 of octet N.

e) The mechanisms in c) and d) may be combined.

f) Optional octets are marked with asterisks (*).

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8	7	6	5	4	3	2	1	
1	Information element identifier			Contents of information element				octet 1

Figure 9 - Single octet information element format (type 1)

8	7	6	5	4	3	2	1	
1	0	1	0	x	x	x	x	octet 1
	Information element identifier							

Figure 10 - Single octet information element format (type 2)

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8	7 6 5 4 3 2 1	
0	Information element identifier	octet 1
Length of contents of information element (octets)		octet 2
Contents of information element		octet 3 etc.

Figure 11 - Variable length information element format

Table 22 - Information element identifier coding (codeset 0)

Coding 8 7 6 5 4 3 2 1		Reference	Max Length (octets)
1 : : : - - - -	*Single octet information elements:*		
0 0 0 - - - -	reserved		
0 0 1 - - - -	shift	14.5.3	1
0 1 0 0 0 0 1	Sending complete	14.5.19	1
0 : : : : : : :	*Variable length information elements:*		
0 0 0 0 0 0 0	Segmented message	annex ZA	note 1
0 0 0 0 1 0 0	Bearer capability	14.5.5	12
0 0 0 1 0 0 0	Cause	14.5.11	32
0 0 1 0 1 0 0	Call state	14.5.6	3
0 0 1 1 0 0 0	Channel identification	14.5.12	note 1
0 0 1 1 1 1 0	Progress indicator	14.5.17	4
1 0 0 1 1 0 0	Connected number	14.5.13	note 1
1 0 0 1 1 0 1	Connected subaddress	14.5.14	23
1 1 0 1 1 0 0	Calling party number	14.5.9	note 1
1 1 0 1 1 0 1	Calling party subaddress	14.5.10	23
1 1 1 0 0 0 0	Called party number	14.5.7	note 1
1 1 1 0 0 0 1	Called party subaddress	14.5.8	23
1 1 1 1 0 0 1	Restart indicator	14.5.18	3
1 1 1 1 1 0 0	Low layer compatibility	12.5.16	16
1 1 1 1 1 0 1	High layer compatibility	14.5.15	5
All other values are reserved (note 2)			

NOTE 1 - Network dependent.

NOTE 2 - The reserved values with bits 5-8 coded “0000” are for future information elements for which comprehension by the receiver is required.

14.5.2 Extension of codesets

There is a certain number of possible information element identifier values using the formatting rules described in clause 14.5.1; 128 from the variable length information element format and at least 8 from the single octet information element format.

One value in the single octet format is specified for the shift operations described below. One other value in both the single octet and variable length format is reserved. This leaves at least 133 information element identifier values available for assignment.

It is possible to expand this structure to eight codesets of at least 133 information element identifier values each. One common value in the single octet format is employed in each codeset to facilitate shifting from one codeset to another. The contents of this shift information element identifies the codeset to be used for the next information element or elements. The codeset in use at any given time is referred to as the “active codeset”. By convention, codeset 0 is the initially active codeset.

Two codeset shifting procedures are possible: Locking shift and non-locking shift.

Transition from one active codeset to another (i.e. by means of the locking shift procedure) may only be made to a codeset with a higher numerical value than the codeset being left.

An information element belonging to one codeset may appear in between information elements belonging to another codeset (being the active codeset) by using the non-locking shift procedure.

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An equipment shall have the capability to recognise a shift information element and to treat the subsequent information element(s) as belonging to the specified shift. Information elements from non-supported shifts shall be treated as unrecognised if received in a message. The error procedures for unrecognised information elements apply.

Codeset 4 is used for ISO defined information elements. Codeset 5 is used by ETSI for information elements that are defined in addition to those defined by ITU-T or ISO. The rules for handling information elements of codeset 0 apply to codesets 4 and 5 too.

Codeset 6 and/or codeset 7 may be used for conveying non-standardised information between adjacent PINXs (e.g. for manufacturer or network specific purposes).

14.5.3 Locking shift procedure

The locking shift procedure employs an information element to indicate the new active codeset. The specified codeset remains active until another locking shift information element is encountered which specifies the use of another codeset. For example, codeset 0 is active at the start of message content analysis. If a locking shift to another codeset is encountered, the next information elements will be interpreted according to the information element identifiers assigned in the new codeset, until another shift information element is encountered.

This procedure shall only be used to shift to a higher order codeset than the one being left.

The locking shift is valid only within the message that contains the locking shift information element. At the start of every message content analysis, the active codeset is codeset 0.

The locking shift information element uses the single octet information element format and is coded as shown in figure 12 and table 23.

8	7	6	5	4	3 2 1	
1	0	0	1	0	New codeset identification	octet 1

Bits 7-5 are the shift identifier
Bit 4 = “ZERO” indicates locking shift

Figure 12 - Locking shift information element

Table 23 - Locking/non-locking shift information element

Codeset identification		
Bits		
3 2 1		
0 0 0	Codeset 0:	ITU-T Q.931 information elements (initially active codeset)
1 0 0	Codeset 4:	Information elements defined by ISO
1 0 1	Codeset 5:	Information elements defined by ETSI
1 1 0	Codeset 6:	Information elements specific to the local network (public or private)
1 1 1	Codeset 7:	User-specific information elements
All other values are reserved (note 1)		

NOTE 1 - The handling of national/private information elements is outside the scope of this International Standard (see annex D).

14.5.4 Non-locking shift procedure

The non-locking shift procedure provides a temporary shift to the specified lower or higher codeset. It uses a single octet information element to indicate the codeset to be used to interpret the next single information element. After the interpretation of that information element, the active codeset is again used for interpreting any following information elements. For example, codeset 0 is active at the beginning of message content analysis. If a non-locking shift to another codeset is encountered, only the next information element is interpreted according to the information element identifiers assigned in that codeset. After that codeset 0 will again be used to interpret the following information elements. A non-locking shift information element indicating the current codeset shall not be regarded as an error.

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A locking shift information element shall not follow directly on a non-locking shift information element. If this combination is received it shall be interpreted as though a locking shift information element only had been received.

The single octet non-locking shift information element format and coding is shown in figure 13 and table 23.

8	7	6	5	4	3	2	1	
1	0	0	1	1	Temporary codeset identification			octet 1

Bits 7-5 are the shift identifier
Bit 4 = “ONE” indicates non-locking shift

Figure 13 - Non-locking shift information element

14.5.5 Bearer capability

The purpose of the bearer capability information element is to indicate a requested ECMA-142or ISO/IEC 11584 bearer capability to be provided by the network.

The bearer capability information element is coded as shown in figure 14 and table 24.

NOTE - This encoding represents a subset of ITU-T Rec. Q.931.

8	7	6	5	4	3	2	1	
0	Bearer capability Information element identifier							octet 1
Length of bearer capability contents								octet 2
1 ext	Coding standard	Information transfer capability						octet 3
1 ext	Transfer mode	Information transfer rate						octet 4 note 1
1 ext	Multiplier							octet 4.1* note 2
0/1 ext	0	1	User information layer 1 protocol					octet 5* note 3
	Layer ID(1)							

NOTE 1 - As only default values are used for all fields of ITU–T Rec. Q.931 octets 4a and 4b, these octets shall not be used. The following values shall be assumed:

Structure:	circuit mode: 8kHz integrity
Configuration:	point-to-point
Establishment:	demand
Symmetry:	bidirectional symmetric

NOTE 2 - This octet shall be included if the Information transfer rate in octet 4 indicates ‘multi-rate’. Otherwise, it shall not be included.

NOTE 3 - The contents of optional octets 5a, 5b, 5c, 5d, 6 and 7 have no impact at the Q reference point, and are therefore not specified in this International Standard. One or more of these octets may be included, in accordance with ITU-T Rec. Q.931.
Receipt of any of these octets regardless of content shall not cause a protocol error.

Figure 14 - Bearer capability information element

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Table 24 - Bearer capability information element

Coding standard (octet 3)

Bits

7	**6**	
0	0	CCITT standardized coding

All other values are reserved

Information transfer capability (octet 3)

Bits

5	**4**	**3**	**2**	**1**	
0	0	0	0	0	Speech
0	1	0	0	0	unrestricted digital information
0	1	0	0	1	Restricted digital information (applicable only in interworking situations)
1	0	0	0	0	3.1 kHz audio
1	0	0	0	1	Unrestricted digital information with tones / announcements

All other values are reserved

Transfer mode(octet 4)

Bits

7	**6**	
0	0	circuit mode

All other values are reserved

Information transfer rate (octet 4)

Bits

5	**4**	**3**	**2**	**1**	
1	0	0	0	0	64 kbit/s
1	0	0	1	1	384 kbit/s (note 1)
1	0	1	0	1	1536 kbit/s (note 1)
1	0	1	1	1	1920 kbit/s (note 1)
1	1	0	0	0	multi-rate (64 kbit/s base rate) (note 2)

All other values are reserved

Multiplier (octet 4.1)

Bits

7	**6**	**5**	**4**	**3**	**2**	**1**	
0	0	0	0	0	1	0	2
0	0	0	0	0	1	1	3
0	0	0	0	1	0	0	4
0	0	0	0	1	0	1	5
0	0	0	0	1	1	0	6
0	0	0	0	1	1	1	7
0	0	0	1	0	0	0	8
0	0	0	1	0	0	1	9
0	0	0	1	0	1	0	10
0	0	0	1	0	1	1	11
0	0	0	1	1	0	0	12
0	0	0	1	1	0	1	13
0	0	0	1	1	1	0	14
0	0	0	1	1	1	1	15
0	0	1	0	0	0	0	16
0	0	1	0	0	0	1	17
0	0	1	0	0	1	0	18
0	0	1	0	0	1	1	19
0	0	1	0	1	0	0	20

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0	0	1	0	1	0	1	21
0	0	1	0	1	1	0	22
0	0	1	0	1	1	1	23
0	0	1	1	0	0	0	24
0	0	1	1	0	0	1	25
0	0	1	1	0	1	0	26
0	0	1	1	0	1	1	27
0	0	1	1	1	0	0	28
0	0	1	1	1	0	1	29
0	0	1	1	1	1	0	30

All other values are reserved

User information layer 1 protocol (octet 5) (note 3, note 4, note 5)

Bits					
5	**4**	**3**	**2**	**1**	
0	0	0	1	0	CCITT Recommendation G.711 μ-law
0	0	0	1	1	CCITT Recommendation G.711 A-law

All other values are beyond the scope of this International Standard

NOTE 1 - This codepoint may be used as an alternative to the combination of 'multi-rate' in octet 4 and a 'Multiplier' value in octet 4.1 as indicated below:

Information transfer rate	Multiplier value
384 kbit/s	6
1536 kbit/s	24
1920 kbit/s	30

NOTE 2 - If this codepoint is indicated, octet 4.1 shall be included, otherwise octet 4.1 shall be omitted.

NOTE 3 - If the transfer mode is "circuit mode", and if the information transfer capability is "unrestricted digital information" or "restricted digital information", octet 5 may be omitted. The receipt of octet 5 shall not cause a protocol error for invalid information element contents.

NOTE 4 - If the Transfer mode is "circuit mode" and the information transfer capability is 3.1kHz audio, octet 5 shall indicate either 00010 "G.711 μ-law" or 00011 "G.711 A-law".

NOTE 5 - If the Transfer mode is "circuit mode" and the information transfer capability is speech, octet 5 shall indicate either 00010 "G.711 μ-law" or 00011 "G.711 A-law".

14.5.6 Call state

The purpose of the call state information element is to indicate the current state of a call or a global call reference state. The call state information element is coded as shown in figure 15 and table 25.

8	7	6	5	4	3	2	1	
Call state								
0	0	0	1	0	1	0	0	octet 1
Information element identifier								
Length of call state contents)								octet 2
Coding Standard	Call state value/ Global call reference state value							octet 3

Figure 15 - Call state information element

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Table 25 - Call state information element

Coding standard (octet 3)

Bits

8	**7**	
0	0	CCITT standardized coding

All other values are reserved

Call state value (octet 3)

Bits

6	**5**	**4**	**3**	**2**	**1**	**Value**	**Circuit Mode Protocol Control State**
0	0	0	0	0	0	0	Null
0	0	0	0	0	1	1	Call initiated
0	0	0	0	1	0	2	Overlap sending (note 1)
0	0	0	0	1	1	3	Outgoing call proceeding
0	0	0	1	0	0	4	Call delivered
0	0	0	1	1	0	6	Call present
0	0	0	1	1	1	7	Call received
0	0	1	0	0	0	8	Connect request
0	0	1	0	0	1	9	Incoming call proceeding
0	0	1	0	1	0	10	Active
0	0	1	0	1	1	11	Disconnect Request
0	0	1	1	0	0	12	Disconnect Indication
0	1	0	0	1	1	19	Release request
0	1	1	0	0	1	25	Overlap receiving (note 1)

Global call reference state value(octet 3)

Bits

6	**5**	**4**	**3**	**2**	**1**	**State**
0	0	0	0	0	0	REST 0 - null
1	1	1	1	0	1	REST 1 - restart request
1	1	1	1	1	0	REST 2 -restart

NOTE 1 - If enbloc signalling only is used between two adjacent PINXs, overlap receiving procedures need not be tested.

14.5.7 Called party number

The purpose of the called party number information element is to identify the called party of a call. The called party number information element is coded as shown in figure 16 and table 26.

The maximum length of the called party number information element is network dependent and therefore outside the scope of this International Standard.

8	7	6	5	4	3	2	1	
0	Called party number Information element identifier							octet 1
Length of called party number contents								octet 2
1	Type of number			Numbering plan identification				octet 3
0 spare	Number digits(note 1)							octet 4 repeated

NOTE 1 - The number digits appear in multiple octets 4 in the same order in which they would be entered, i.e. the number digit which would be entered first is located in the first octet 4.

Figure 16 - Called party number information element

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Table 26 - Called party number information element

Numbering Plan identification (octet 3)

Bits 4	3	2	1	
0	0	0	0	Unknown (note 1)
0	0	0	1	ISDN/Telephony numbering plan (ITU-T Rec. E.164/E.163)
1	0	0	1	Private numbering plan (ISO/IEC 11571)

All other values are reserved

Type of number (octet 3) when Numbering Plan identification is ISDN/Telephony numbering plan (note 2)

Bits 7	6	5	
0	0	0	Unknown (note 3)
0	0	1	International Number (note 4)
0	1	0	National Number (note 4)
1	0	0	Subscriber Number (note 4)

All other values are reserved

Type of number (octet 3) when Numbering Plan identification is Private numbering plan (note 2)

Bits 7	6	5	
0	0	0	Unknown
0	0	1	Level 2 Regional Number
0	1	0	Level 1 Regional Number
0	1	1	PISN specific number
1	0	0	Level 0 Regional Number

All other values are reserved

Type of number (octet 3) when Numbering Plan identification is Unknown (note 2)

Bits 7	6	5	
0	0	0	Unknown

All other values are reserved

Number digits (octet 4)

This field is coded with CCITT Recommendation T.50 characters, according to the formats specified in the appropriate numbering/dialling plan.

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NOTE 1 - The numbering plan identification “unknown” is used when the user or the network has no knowledge of the numbering plan identification. In this case the number digits field is organised according to the network dialling plan; prefix or escape digits might be present.

NOTE 2 - Only the numbering combinations shown in this table may be used.

NOTE 3 - The type of number “unknown” is used when the user or the network has no knowledge of the type of number, e.g. international number, national number, etc. In this case the number digits field is organised according to the network dialling plan; prefix or escape digits might be present.

NOTE 4 - For the definition of international, national and subscriber number, see CCITT Recommendation I.330. Prefix or escape digits shall not be included in these numbers.

14.5.8 Called party subaddress

The purpose of the called party subaddress information element is to identify the subaddress of the called party of a call.

NOTE 1 - For the definition of subaddress, see ISO/IEC 11571.

Refer to ITU-T Rec. Q.931 for coding rules for this information element.

The maximum length of the called party subaddress information element is 23 octets.

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NOTE 2 - The encoding of this information element is not specified in this International Standard for it is defined as transparent to the PSS1 protocol.

14.5.9 Calling party number

The purpose of the calling party number information element is to identify the origin of a call.

The calling party number information element is coded as shown in figure 17 and table 27.

The maximum length of the calling party number information element is network dependent and therefore outside the scope of this International Standard.

8	7	6	5	4	3	2	1	
0	Calling party number 1 1 0 1 1 0 0 Information element identifier							octet 1
Length of calling party number contents								octet 2 (note 1)
0/1 ext	Type of number			Numbering plan identification				octet 3 (note 1)
1 ext	Presentation indicator		0	0	0	Screening indicator		octet 3a* (note 1)
			Spare					
0 spare	Number digits							octet 4 * (repeated)

NOTE 1 - Octets 2, 3 and 4 of this information element are coded as in the “called party number” information element.

Figure 17 - Calling party number information element

Table 27 - Calling party number information element

<u>Presentation indicator (octet 3a)</u> note 1

Bits 7	6	
0	0	Presentation allowed
0	1	Presentation restricted
1	0	Number not available due to interworking
1	1	Reserved

<u>Screening indicator (octet 3a)</u> note 2

Bits 2	1	
0	0	User provided, not screened
0	1	User provided, verified and passed
1	0	Reserved
1	1	Network provided

NOTE 1 - If octet 3a is omitted “00-Presentation allowed” is assumed.

NOTE 2 - If octet 3a is omitted “00-User provided, not screened” is assumed.

14.5.10 Calling party subaddress

The purpose of the calling party subaddress information element is to identify a subaddress associated with the origin of a call.

NOTE 1 - For the definition of subaddress, see ISO/IEC 11571.

Refer to ITU-T Rec. Q.931 for coding rules for this information element.

The maximum length of the calling party subaddress information element is 23 octets.

NOTE 2 - The encoding of this information element is not specified in this International Standard for it is defined as transparent to the PSS1 protocol.

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14.5.11 Cause

The purpose of the cause information element is to describe the reason for generating certain messages, to provide diagnostic information in the event of procedural errors, and to indicate the location of the cause originator.

The cause information element is coded as shown in figure 18 and tables 28, 29, 30.

The maximum length of the cause information element is 32 octets.

8	7	6	5	4	3	2	1	
0	Cause 0 0 0 1 0 0 0 Information element identifier							octet 1
Length of cause contents								octet 2
1 ext	Coding standard		0 spare	Location				octet 3 (note 1)
1 ext	Cause value							octet 4
Diagnostics (if any)								octet 5*

NOTE 1 - The optional octet 3a of ITU-T Rec. Q.931 has been omitted here since only the default value "Recommendation Q.931" is used. As stated in clause 14.5.1, an implementation shall be prepared to receive an extension octet 3a, which will not result in a protocol error for invalid contents.

Figure 18 - Cause information element

Table 28 - Cause information element

Coding standard (octet 3)

Bits

7	**6**	
0	0	CCITT standardized coding as described below

All other values are reserved

Location (octet 3)

Bits

4	**3**	**2**	**1**	
0	0	0	0	User
0	0	0	1	Private network serving the local user
0	0	1	0	Public network serving the local user
0	0	1	1	Transit network
0	1	0	0	Public network serving the remote user
0	1	0	1	Private network serving the remote user
0	1	1	1	International network
1	0	1	0	Network beyond interworking point

All other values are reserved

Cause value (octet 4)

The following rules apply to the coding of cause values:

a) All values in the range 0 through 127 shall be accepted as valid cause values.

b) Table 29 lists cause values which are explicitly mentioned elsewhere in this International Standard. These cause values are coded according to ITU-T Rec. Q.931: The value is divided into two fields, a class (bits 5 through 7) and a value within the class (bits 1 through 4).
The class indicates the general nature of the event:
Class (000): normal event
Class (001): normal event
Class (010): resource unavailable
Class (011): service or option not available

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Class (100): service or option not implemented
Class (101): invalid message (e.g. parameter out of range)
Class (110): protocol error (e.g. unknown message)
Class (111): interworking

Refer to Q.931 for further details.

c) The list of cause values in table 29 is not exclusive, in the sense that the sending entity may choose values from Q.931 other than those listed in table 29, except where PSS1 procedures specify the use of particular cause values, in which case those values should be used.

Diagnostics (octet 5)

Diagnostic information is not available for every cause; see tables 29 and 30 on the following pages. The inclusion of diagnostics is optional.
If the diagnostic information cannot be interpreted this shall not lead to a protocol error.

8	7	6	5	4	3	2	1	
0/1 ext	Attribute number							octet 5 (note 1, note 2)
0/1 ext	Rejected attribute							octet 5a (note 1, note 2)
1 ext	Available attribute							octet 5b* (note 1, note 2)

NOTE 1 - When diagnostic information is provided, octets 5 and 5a shall be present, octet 5b is optional.

NOTE 2 - Octets 5 through 5b may be repeated to report multiple rejected attributes.

Figure 19 - Cause information element - Diagnostic field for causes 57, 58, and 65

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Table 29 - Cause information element

Cause value		Cause	Cause	Diagnostics
Class	Value	no.		
765	4321			
000	0001	1.	Unallocated (unassigned) number	note 1
000	0011	3.	No route to destination	note 1
000	0110	6.	Channel unacceptable	----
001	0000	16.	Normal call clearing	note 1
001	0001	17.	User busy	----
001	0010	18.	No user responding	----
001	0011	19.	No answer from user (user alerted)	----
001	0101	21.	Call rejected	User supplied diagnostics note 1, note 2
001	0110	22.	Number changed	New destination note 3
001	1011	27.	Destination out of order	----
001	1100	28.	Invalid number format	----
001	1110	30.	Response to STATUS ENQUIRY	----
001	1111	31.	Normal, unspecified	----
010	0010	34.	No circuit/channel available	----
010	1001	41.	Temporary failure	----
010	1100	44.	Requested circuit/channel not available	----
011	1001	57.	Bearer capability not authorized	note 4
011	1010	58.	Bearer capability not presently available	note 4
011	1111	63.	Service or option not available, unspecified	----
100	0001	65.	Bearer capability not implemented	note 4
101	0001	81.	Invalid call reference value	----
101	0010	82.	Identified channel does not exist	----
101	1000	88.	Incompatible destination	Incomp. param. note 5.
110	0000	96.	Mandatory information element is missing	Info elem ID(s) note 6
110	0001	97.	Message type non-existent or not implemented	Message type
110	0010	98.	Message not compatible with call state or message non-existent or not implemented	Message type
110	0011	99.	Information element non-existent or not implemented	Info elem ID(s) note 6, note 7
110	0100	100.	Invalid information element contents	Info elem ID(s) note 6
110	0101	101.	Message not compatible with call state	Message type
110	0110	102.	Recovery on timer expiry	Timer number note 8
110	1111	111.	Protocol error, unspecified	---

NOTE 1 - The following coding is used:

Bit 8: 1
Bit 7 - 3: 00000
Bit 2 - 1: persistence of condition as follows:
00 - unknown
01 - permanent
10 - transient

NOTE 2 - User supplied diagnostics field is encoded according to the user specification, subject to the maximum length of the cause information element. The coding of the user supplied diagnostics should be made in such a way that it does not conflict with the coding described in note 1.

NOTE 3 - “New destination” is formatted as called party information element, including the information element identifier.

NOTE 4 - The format of the diagnostic field for cause number 57, 58, and 65 is as shown in figure 19 and in table 30.

NOTE 5 - Incompatible information element identifier.

NOTE 6 -

a) Locking and non-locking shift procedures are applied.

b) In principle, information element identifiers are ordered in the same order as the information elements in the received message.

NOTE 7 - When only a locking shift information element is included and no variable length information element identifier follows, it means that the codeset in the locking shift itself is not implemented.

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NOTE 8 - The timer is coded in CCITT Recommendation T.50 characters, e.g. T308 is coded as “3” “0” “8” in bits 7-1 of octets 5, 5a, and 5b, with bit 8 being ZERO (spare).

Table 30 - Coding of diagnostics field for causes 57, 58 and 65

Attribute number (octet 5)

Bits 7	6	5	4	3	2	1	No.	Attribute
0	1	1	0	0	0	1	1	Information transfer capability
0	1	1	0	0	1	0	2	Information transfer mode
0	1	1	0	0	1	1	3	Information transfer rate
0	1	1	0	1	0	0	4	Structure (note 1)
0	1	1	0	1	0	1	5	Configuration (note 1)
0	1	1	0	1	1	0	6	Establishment (note 1)
0	1	1	0	1	1	1	7	Symmetry (note 1)
0	1	1	1	0	0	0	8	Information transfer rate (dest --> orig) (note 1)
0	1	1	1	0	0	1	9	Layer identification (Layer 1, 2, 3)

Rejected attribute (octet 5a) / Available attribute (octet 5b)

Attribute No

1 Information transfer capability
- Bits 7 - 6: 00
- Bits 5 - 1: according to table 24, octet 3

2 Information transfer mode
- Bits 7 - 6: according to table 24, octet 4
- Bits 5 - 1: 00000

3 Information transfer rate
- Bits 7 - 6: 00
- Bits 5 - 1: according to table 24, octet 3

4 Structure
- Bits 7 - 5: according to Rec. Q.931, table 4-6/Q.931, octet 4a (note 1)
- Bits 4 - 1: 0000

5 Configuration
- Bits 7 - 5: 000
- Bits 4 - 3: according to Rec. Q.931, table 4-6/Q.931, octet 4a (note 1)
- Bits 2 - 1: 00

6 Establishment
- Bits 7 - 3: 00000
- Bits 2 - 1: according to Rec. Q.931, table 4-6/Q.931, octet 4a (note 1)

7 Symmetry
- Bits 7 - 6: according to Rec. Q.931, table 4-6/Q.931, octet 4b (note 1)
- Bits 5 - 1: 00000

8 Information transfer rate (dest --> orig)
- Bits 7 - 6: 00
- Bits 5 - 1: according to Rec. Q.931, table 4-6/Q.931, octet 4b (note 1)

9 Layer identification
- Bits 7 - 1: according to table 24, octet 5 (Layer 1) or Rec. Q.931, table 4-6

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NOTE 1 - Attributes 4-8 each have only one value specified in this International Standard, and therefore these attributes should not normally be the subject of the diagnostic field.

14.5.12 Channel identification

The purpose of the channel identification information element is to identify a channel which is controlled by these signalling procedures.

NOTE - All the channel identification information relates to Inter-PINX link channels.

The channel identification information element is coded as shown in figures 20 and 21, and table 31.

The default maximum length of the channel identification information element is network dependent.

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8	7	6	5	4	3	2	1	
0	Channel identification 0	0	1	1	0	0	0 Information element identifier	octet 1
Length of channel identification contents								octet 2
1 ext	0	1	0 spare	pref./ Excl.	Signalling channel ind.	Info Channel selection		octet 3 (note 1)
1 ext	Coding standard		Number/ Map	Channel type				octet 3.2
0/1 ext	Channel number							octet 3.3 (note 2) (note 3)
Channel map								octet 3.3 (note 2)

NOTE 1 - Since the interface is never explicitly identified at the Q reference point, octet 3.1 of ITU-T Rec. Q.931 is always omitted.

NOTE 2 - Channel number shall be used unless there is a bilateral agreement to use channel map.

NOTE 3 - This octet may be repeated to indicate multiple channels in the case of a multirate service, as defined in ISO/IEC 11584. See figure 21a.

Figure 20 - Channel identification information element

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Table 31 - Channel identification information element

Preferred/Exclusive (octet 3) note 1

Bit

4

0 indicated channel is preferred

1 exclusive; only the indicated channel is acceptable

Signalling channel indicator (octet 3) note 2

Bit

3

0 the channel identified is not the signalling channel

1 reserved

Information channel selection (octet 3) note 3

Bits

2 1

0 1 as indicated in the following octets

All other values are reserved

Coding standard (octet 3.2)

Bits

7 6

0 0 CCITT standard

All other values are reserved

Number/Map (octet 3.2)

Bits

5

0 channel is indicated by the number in the following octet

1 channel map

Channel type (octet 3.2)

Bits

4 3 2 1

0 0 1 1 B channel units (64 kbit/s)

All other values are reserved

Channel number/Map (octet 3.3) note 4

Binary number assigned to the channel. Channels are numbered from 1 upwards (note 5).

Bit position(s) in the slot map, see figure 21, correspond to the equivalent information channels. The use of a particular channel shall be encoded by means of a "1" in the appropriate bit position in the slot map (note 6).

NOTE 1 - Preferred/exclusive has significance only for information channel selection.

NOTE 2 - Signalling channel indication has significance in signalling channel use. No other information affects signalling channel use.

NOTE 3 - The information channel selection does not apply to the signalling channel.

NOTE 4 - Either “channel number” or channel map is used exclusively, depending on the “Number/Map” information in octet 3.2 bit 5.

NOTE 5 - This octet may be extended if the channel number exceeds 127, (figure 21a).

NOTE 6 - Length of the channel map is decided by combination of channel unit size on which the channel map is mapped (e.g. B-channel) and map element.

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8	7	6	5	4	3	2	1	
								octet 3.3.x-3 (note 1)
						etc.	17	octet 3.3.x-2 (note 1)
16	15	14	13	12	11	10	9	octet 3.3.x-1 (note 1)
8	7	6	5	4	3	2	1	octet 3.3.x (note 1)

NOTE 1 - The limit of x is outside the scope of this International Standard.

Figure 21 - Channel map field

8	7	6	5	4	3	2	1	
1	0	0	0	1	0	0	1	octet 3.3.1
1	0	0	0	1	0	1	0	octet 3.3.2
0	0	0	0	0	0	0	1	octet 3.3.3
1	0	0	0	0	0	1	1	octet 3.3.4

Figure 21a – Example of channel number list: channels 9, 10 and 131

14.5.13 Connected number

The purpose of the connected number information element is to indicate which number is connected to a call. The connected number may be different from the Called party number because of changes (e.g. call redirection, transfer) during the lifetime of the call.

The connected number information element is coded as shown in figure 22 and table 27 (see clause 14.5.9, Calling party number).

8	7	6	5	4	3	2	1	
0	Connected number Information element identifier							octet 1
Length of connected number contents								octet 3
0/1 ext	Type of number			Numbering plan identification				octet 3
1 ext	Presentation indicator		0	0	0	Screening indicator		octet 3a*
0 spare	Number digits							octet 4 * (repeated)

Figure 22 - Connected number information element

14.5.14 Connected subaddress

The purpose of the connected subaddress information element is to identify the subaddress of the connected party of a call. The connected subaddress may be different from the called party subaddress because of changes (e.g. call redirection, transfer) during the lifetime of the call.

NOTE 1 - For the definition of subaddress, see ISO/IEC 11571.

The connected subaddress information element is coded in the same way as the called party subaddress IE, apart from the IE identifier (octet 1).

The maximum length of the connected subaddress information element is 23 octets.

NOTE 2 - The encoding of this information element is not specified in this International Standard for it is defined as transparent to the protocol at the 'Q' reference point.

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14.5.15 High layer compatibility (layers 4-7)

The purpose of the High layer compatibility information element is to provide a means which, in association with the Bearer capability and Low layer compatibility information elements, may be used by the remote user for compatibility checking.

Refer to ITU-T Rec. Q.931 for the coding of the high layer compatibility information element.

The maximum length of the high layer compatibility information element is 5 octets.

The receipt of values not defined in ITU-T Rec. Q.931 shall not cause a protocol error, provided the maximum length is not exceeded.

NOTE - The encoding of this information element is not specified in this International Standard for it is defined as transparent to the protocol at the 'Q' reference point.

14.5.16 Low layer compatibility (layers 1-3)

The purpose of the Low layer compatibility information element is to provide a means which, in conjunction with the Bearer capability and High layer compatibility information elements, may be used by the addressed entity (e.g. remote user) for compatibility checking.

Refer to ITU-T Rec. Q.931 for the coding of the low layer compatibility information element.

The maximum length of the low layer compatibility information element is 16 octets.

The receipt of values not defined in ITU-T Rec. Q.931 shall not cause a protocol error, provided the maximum length is not exceeded.

NOTE - The encoding of this information element is not specified in this International Standard for it is defined as transparent to the protocol at the 'Q' reference point.

14.5.17 Progress indicator

The purpose of the progress indicator information element is to describe an event which has occurred during the life of a call.

The progress indicator information element is coded as shown in figure 23 and table 32.

The maximum length of the progress indicator information element is 4 octets.

The progress indicator information element may be repeated in a message up to three times.

8	7	6	5	4	3	2	1	
0	Progress indicator 0 0 1 1 1 1 0 Information element identifier							octet 1
Length of progress indicator contents								octet 2
1 ext	Coding standard		0 spare	Location				octet 3
1 ext	Progress description							octet 4

Figure 23 - Progress indicator information element

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Table 32 - Progress indicator information element

Coding standard (octet 3)

Bits

7	**6**	
0	0	CCITT standardized coding as described below

All other values are reserved (note 5)

Location (octet 3)

Bits

4	**3**	**2**	**1**	
0	0	0	0	User
0	0	0	1	Private network serving the local user
0	0	1	0	Public network serving the local user
0	0	1	1	Transit network
0	1	0	0	Public network serving the remote user
0	1	0	1	Private network serving the remote user
0	1	1	1	International network
1	0	1	0	Network beyond interworking point

All other values are reserved

Progress description (octet 4) (note 5)

Bits

7	**6**	**5**	**4**	**3**	**2**	**1**	**No.**	
0	0	0	0	0	0	1	1	Call is not end-to-end ISDN, further call progress information may be available in-band (note 1)
0	0	0	0	0	1	0	2	Destination address is non-ISDN (note 2)
0	0	0	0	0	1	1	3	Origination address is non-ISDN (note 3)
0	0	0	0	1	0	0	4	Call has returned to the ISDN (note 4)
0	0	0	1	0	0	0	8	In-band information or appropriate pattern now available

All other values are reserved (note 5)

NOTE 1 - Progress description 1 indicates that interworking with a non-ISDN has occurred within the network or networks which the call has traversed.

NOTE 2 - Progress description 2 indicates that the destination user equipment is non-ISDN equipment.

NOTE 3 - Progress description 3 indicates that origination user equipment is non-ISDN equipment.

NOTE 4 - Progress description 4 indicates that a call which has left the ISDN has returned at the same point it had left due to redirection within the non-ISDN.

NOTE 5 - Additional progress descriptions are specified in annex ZB.

14.5.18 Restart indicator

The purpose of the restart indicator is to identify the entity to be restarted or which has been restarted.

The restart indicator information element is coded as shown in figure 24 and table 33.

8	7	6	5	4	3	2	1	
0	Restart indicator Information element identifier							octet 1
Length of restart indicator contents								octet 2
1 ext	0	0	0	0	Class			octet 3

Figure 24 - Restart indicator information element

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Table 33 - Restart indicator information element

Class (octet 3) note 1			
Bits			
3	**2**	**1**	**Meaning**
0	0	0	indicated channel (note 2)
1	1	1	All channels (note 3)
All other values are reserved			

NOTE 1 - Since the interface is never explicitly identified at the Q reference point, the codepoint 110 “single interface” in the class field of ITU-T Rec. Q.931 is not used.

NOTE 2 - The channel identification information element shall be included, indicating which channel is to be restarted or which has been restarted.

NOTE 3 - All channels means the signalling channel on which the restart indicator is carried and all user information channels associated with that signalling channel.

14.5.19 Sending complete

The purpose of the sending complete information element is to optionally indicate completion of the called party number.

The sending complete is a single octet information element coded as shown in figure 25.

8	7	6	5	4	3	2	1	
	Sending complete							
1	0	1	0	0	0	0	1	octet 1
	Information element identifier							

Figure 25 - Sending complete information element

14.6 Information elements of codeset 5

Codeset 5 contains information elements defined by ETSI.

In general the coding rules described in clause 14.5.1 for codeset 0 apply to codeset 5 also.

Table 34 lists the information element identifiers for information elements of codeset 5 used in this International Standard.

Table 34 - Information element Identifier coding (Codeset 5)

Coding									Ref.	Length
8	**7**	**6**	**5**	**4**	**3**	**2**	**1**			
1	:	:	:	-	-	-	-	*Single Octet information elements:*		
	0	0	0	-	-	-	-	Reserved		
	0	0	1	-	-	-	-	Shift	14.5.3	1
0	:	:	:	:	:	:	:	*Variable length information elements:*		
	0	1	1	0	0	1	0	Party category	annex ZC	3
All other values are reserved.										

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Annex A

(normative)

Protocol Implementation Conformance Statement (PICS) for ISO/IEC 11572

A.1 Introduction

The supplier of a protocol implementation which is claimed to conform to International Standard ISO/IEC 11572 shall complete the following Protocol Implementation Conformance Statement (PICS) proforma.

A completed PICS proforma is the PICS for the implementation in question. The PICS is a statement of which capabilities and options of the protocol have been implemented. The PICS can have a number of uses, including use:

- by the protocol implementor, as a check list to reduce the risk of failure to conform to the International Standard through oversight;
- by the supplier and acquirer - or potential acquirer - of the implementation, as a detailed indication of the capabilities of the implementation, stated relative to the common basis for understanding provided by the Standards PICS proforma;
- by the user or potential user of the implementation, as a basis for initially checking the possibility of interworking with another implementation

  NOTE - While interworking can never be guaranteed, failure to interwork can often be predicted from incompatible PICS's.
- by a protocol tester, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

A.2 Instructions for completing the PICS proforma

A.2.1 General structure of the PICS proforma

The PICS proforma is a fixed format questionnaire divided into sub-clauses each containing a group of individual items. Each item is identified by an item number, the name of the item (question to be answered), and the reference(s) to the clause(s) that specifies (specify) the item in the main body of this International Standard.

The "Status" column indicates whether an item is applicable and if so whether support is mandatory or optional. The following terms are used:

m	mandatory (the capability is required for conformance to the protocol);
o	optional (the capability is not required for conformance to the protocol, but if the capability is implemented it is required to conform to the protocol specifications);
o.<n>	optional, but support of at least one of the group of options labelled by the same numeral <n> is required;
x	prohibited;
c.<cond>	conditional requirement, depending on support for the item or items listed in condition <cond>;
<item>:m	simple conditional requirement, the capability being mandatory if item number <item> is supported, otherwise not applicable;
<item>:o	simple conditional requirement, the capability being optional if item number <item> is supported, otherwise not applicable.

Answers to the questionnaire items are to be provided either in the "Support" column, by simply marking an answer to indicate a restricted choice (Yes or No), or in the "Not Applicable" column (N/A).

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A.2.2 Additional information

Items of Additional Information allow a supplier to provide further information intended to assist the interpretation of the PICS. It is not intended or expected that a large quantity will be supplied, and a PICS can be considered complete without any such information. Examples might be an outline of the ways in which a (single) implementation can be set up to operate in a variety of environments and configurations.

References to items of Additional Information may be entered next to any answer in the questionnaire, and may be included in items of Exception information.

A.2.3 Exception information

It may occasionally happen that a supplier will wish to answer an item with mandatory or prohibited status (after any conditions have been applied) in a way that conflicts with the indicated requirement. No pre-printed answer will be found in the Support column for this: instead, the supplier is required to write into the support column an x.<i> reference to an item of Exception Information, and to provide the appropriate rationale in the Exception item itself.

An implementation for which an Exception item is required in this way does not conform to ISO/IEC 11572.

NOTE - A possible reason for the situation described above is that a defect in the International Standard has been reported, a correction for which is expected to change the requirement not met by the implementation.

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A.3 PICS Proforma

A.3.1 Implementation Identification

Supplier (note 1)	
Contact point for queries about the PICS (note 1)	
Implementation Name(s) and Version(s) (note 1, note 2)	
Other information necessary for full identification - e.g., name(s) and version(s) for machines and/or operating systems; System name(s)	

NOTE 1 - Only the first three items are required for all implementations; other information may be completed as appropriate in meeting the requirement for full identification.

NOTE 2 - The terms Name and Version should be interpreted appropriately to correspond with a suppliers terminology (e.g. Type, Series, Model).

A.3.2 Protocol Summary, ISO/IEC 11572

Protocol version	Third Edition
Addenda Implemented (if applicable)	
Amendments Implemented	
Have any exception items been required ?	No[ ] Yes[ ] (The answer Yes means that the implementation does not conform to ISO/IEC 11572)
Date of Statement	

A.3.3 Bearers Supported

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
Z1	Support of the 64kbit/s Unrestricted Bearer	14.5.5	o.1		Yes[ ] No[ ]
Z2	Support of the 64kbit/s Bearer with Speech Transfer Capability	14.5.5	o.1		Yes[ ] No[ ]
Z3	Support of the 64kbit/s Bearer with 3.1kHz/Audio Transfer Capability	14.5.5	o.1		Yes[ ] No[ ]
Z4	Support of the Multi-rate Unrestricted Bearer	14.5.5	o.1		Yes[ ] No[ ]
Z5	Support of A-law User Information layer 1 protocol	14.5.5	(Z2 OR Z3):o.3	[ ]	Yes[ ] No[ ]
Z6	Support of µ-law User Information layer 1 protocol	14.5.5	(Z2 OR Z3):o.3	[ ]	Yes[ ] No[ ]
Z7	Support of the unrestricted digital information with tones / announcements bearer	14.5.5	o		Yes[ ] No[ ]

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A.3.4 General procedures

A.3.4.1 Use of the services of the Signalling Carriage Mechanism

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
A1	Use of the services of the Signalling Carriage Mechanism	9.1	m		Yes[ ]

A.3.4.2 Handling of Protocol Error Conditions

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
A6	Treatment of protocol discriminator error	9.2.1	m		Yes[ ]
A7	Treatment of message too short	9.2.2	m		Yes[ ]
A8	Treatment of call reference error	9.2.3	m		Yes[ ]
A9	Treatment of message type or message sequence errors	9.2.4	m		Yes[ ]
A10	Treatment of information element errors	9.2.5 - 9.2.7	m		Yes[ ]
A11	Signalling Carriage Mechanism reset	9.2.8	m		Yes[ ]
A12	Signalling Carriage Mechanism failure	9.2.9	m		Yes[ ]

A.3.4.3 Status and Status Enquiry protocol procedures

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
A13	Receipt of a STATUS ENQUIRY message	9.3.1	m		Yes[ ]
A14	Sending of a STATUS ENQUIRY message	9.3.1	o		Yes[ ] No[ ]
A15	Receipt of a solicited STATUS message	9.3.2	c.1		Yes[ ] No[ ]
A16	Receipt of an Unsolicited STATUS message	9.3.2	m		Yes[ ]

c.1 If A14 then mandatory else optional

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A.3.5 Circuit Switched Call Control

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
B1	Is the implementation capable of functioning as an Originating PINX ?	10.5	o.2		Yes[ ] No[ ]
B2	Is the implementation capable of functioning as an Incoming Gateway PINX ?	10.7	o.2		Yes[ ] No[ ]
B3	Is the implementation capable of functioning as a Transit PINX ?	10.4	o.2		Yes[ ] No[ ]
B4	Is the implementation capable of functioning as a Terminating PINX ?	10.6	o.2		Yes[ ] No[ ]
B5	Is the implementation capable of functioning as an Outgoing Gateway PINX ?	10.8	o.2		Yes[ ] No[ ]
B6	Support procedures for call request	10.1.1	c.2	[ ]	Yes[ ]
B7	Does the implementation include a Sending Complete information element in every generated SETUP message ?	10.1.1	c.3	[ ]	Yes[ ] No[ ]
B8	Information channel selection	10.1.2	m	[ ]	Yes[ ]
B9	Overlap Receiving procedures	10.1.3	c.4 (note 1)	[ ]	Yes[ ] (note 1)
B10	Overlap Sending procedures	10.1.3	c.5	[ ]	Yes[ ]
B11	Call Proceeding - Enbloc Sending (Receipt and Origination)	10.1.4/ 10.1.4.1	m	[ ]	Yes[ ]
B12	Receipt of Call Proceeding - Overlap Sending	10.1.4/ 10.1.4.2	B10:m	[ ]	Yes[ ]
B13	Sending of Call Proceeding - Overlap Receiving	10.1.4/ 10.1.4.2	B9:m	[ ]	Yes[ ]
B14	Support of ALERTING origination	10.1.5	c.4	[ ]	Yes[ ]
B15	Support of ALERTING termination	10.1.5	c.2	[ ]	Yes[ ]
B16	Support of call connection procedures	10.1.6	m (note 2)	[ ]	Yes[ ] (note 2)
B17	Sending of call progress information during call establishment	10.1.7	c.6	[ ]	Yes[ ]
B18	Receipt of call progress information during call establishment	10.1.7	m		Yes[ ]
B19	Support of call clearing procedures	10.2	m		Yes[ ]
B20	Support of call collision procedures	10.3	m		Yes[ ]

NOTE 1 - If enbloc signalling only is used between two adjacent PINXs, overlap receiving procedures need not be tested.

NOTE 2 - If by mutual agreement between adjacent PINXs T313 is not implemented, then the sending of CONNECT ACKNOWLEDGE message is optional.

c.2 If B1 OR B2 OR B3 then mandatory else N/A

c.3 If B1 OR B2 OR B3 then optional else N/A

c.4 If B3 OR B4 OR B5 then mandatory else N/A

c.5 If (B1 OR B2 OR B3) AND NOT B7 then mandatory else N/A

c.6 If (B3 OR B4 OR B5) then optional else N/A

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A.3.6 Call Control at a Transit PINX

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
C1	Call origination/termination procedures	10.4/10.4.1 to 10.4.9	B3:m	[ ]	Yes[ ]
C2	Call abort procedures	10.4.10.2	B3:o		Yes[ ] No[ ]
C3	Call clearing procedures	10.4.10.1	B3:m	[ ]	Yes[ ]
C4	Handling of Category 1, 2 and 3 information elements at a Transit PINX	10.4.11	B3:m	[ ]	Yes[ ]

A.3.7 Call Control at a Originating PINX

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
D1	Call origination procedures	10.5/10.5.1 to 10.5.5	B1:m	[ ]	Yes[ ]
D2	Call clearing procedures	10.5.6	B1:m	[ ]	Yes[ ]

A.3.8 Call Control at a Terminating PINX

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
E1	Call termination procedures	10.6/10.6.1 to 10.6.4	B4:m	[ ]	Yes[ ]
E2	Call clearing procedures	10.6.5	B4:m	[ ]	Yes[ ]

A.3.9 Call Control at an Incoming Gateway PINX

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
F1	Establishment of calls from another network	10.7/10.7.1 to 10.7.6	B2:m	[ ]	Yes[ ]
F2	Call clearing procedures	10.7.7	B2:m	[ ]	Yes[ ]

A.3.10 Call Control at an Outgoing Gateway PINX

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
G1	Establishment of calls to another network	10.8/10.8.1 to 10.8.5	B5:m	[ ]	Yes[ ]
G2	Call clearing procedures	10.8.6	B5:m	[ ]	Yes[ ]

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A.3.11 Procedures for Layer Management

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
H1	Initiation of Restart procedures - All channels	11.1.1	o		Yes[ ] No[ ]
H2	Initiation of Restart procedures - Multiple channels	11.1.1	Z4:o	[ ]	Yes[ ] No[ ]
H3	Initiation of Restart procedures - Single channels	11.1.1	o		Yes[ ] No[ ]
H4	Receipt of RESTART - All channels	11.1.2	m		Yes[ ]
H5	Receipt of RESTART - Single channels	11.1.2	m		Yes[ ]
H6	Receipt of RESTART - multiple channels	11.1.2	Z4:m	[ ]	Yes[ ]
H7	Restart procedures - Restart collision	11.1.3	(H1 OR H2 OR H3):m	[ ]	Yes[ ]

A.3.12 Timers

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
I1	Implementation of T301	12	c.7	[ ]	Yes[ ] No[ ] Value [ ]
I2	Implementation of T302	12	c.8	[ ]	Yes[ ]
I3	Implementation of T303	12	c.9	[ ]	Yes[ ]
I4	Implementation of T304	12	B10:m	[ ]	Yes[ ]
I5	Implementation of T305	12/10.2.3	m		Yes[ ]
I6	Implementation of T308	12/10.2.3	m		Yes[ ]
I7	Implementation of T309	12	m		Yes[ ] Value [ ]
I8	Implementation of T310	12	c.10	[ ]	m:Yes[·] o:Yes[ ] No[ ] Value [ ]
I9	Implementation of T313	12	c.11	[ ]	Yes[ ] No[ ]
I10	Implementation of T316	12/11.1.1	c.12	[ ]	Yes[ ]
I11	Implementation of T322	12/9.3.1	A14:m	[ ]	Yes[ ]

c.7 If B1 OR B2 OR B3 then optional else N/A

c.8 If B3 OR B4 OR B5 then mandatory else N/A

c.9 If B1 OR B2 OR B3 then mandatory else N/A

c.10 If B1 OR B2 mandatory
else If B3 optional
else N/A

c.11 If B3 OR B4 OR B5 then optional else, N/A

c.12 If H1 OR H2 then mandatory else N/A

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A.3.13 Messages and information elements for general procedures

NOTE - Although an implementation may be marked "Yes" for questions regarding sending optional information elements, they will only be sent, for example, if they are received from a terminal or a preceding PINX.

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
J1	Receipt of the messages in accordance with the procedures supported, and receipt of all the permitted information elements in those messages	13	m		Yes[ ]
J2	Sending of messages, including for each message those information elements marked as mandatory for that message, in accordance with the procedures supported	13	m		Yes[ ]
J3	Sending of the Channel Identification information element when mandatory in a SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING or CONNECT message when that message is the first response to a SETUP message	13	m		Yes[ ]
J4	Sending of a Sending Complete information element in an INFORMATION message when overlap sending is complete	13.2.6	o		Yes[ ] No[ ]
J5	Sending of a Progress Indicator information element in an ALERTING message (except when relaying at a Transit PINX in accordance with C4)	13.2.1	o		Yes[ ] No[ ]
J6	Sending of a Progress Indicator information element in a CONNECT message (except when relaying at a Transit PINX in accordance with C4)	13.2.3	o		Yes[ ] No[ ]
J7	Sending of a Low layer compatibility information element in a CONNECT message (except when relaying at a Transit PINX in accordance with C4)	13.2.3	o		Yes[ ] No[ ]
J8	Sending of a Connected Number information element in a CONNECT message (except when relaying at a Transit PINX in accordance with C4)	13.2.3	o		Yes[ ] No[ ]
J9	Sending of a Connected Subaddress information element in a CONNECT message (except when relaying at a Transit PINX in accordance with C4)	13.2.3	o		Yes[ ] No[ ]
J10	Sending of a Cause information element in a PROGRESS message (except when relaying at a Transit PINX in accordance with C4)	13.2.7	o		Yes[ ] No[ ]
J11	Sending of a Cause information element in a RELEASE or a RELEASE COMPLETE message when it is not the first clearing message	13.2.8, 13.2.9	o		Yes[ ] No[ ]
J12	Sending of a Sending Complete information element in a SETUP message when enbloc sending	13.2.10	o		Yes[ ] No[ ]
J13	Sending of a Progress Indicator information element in a SETUP message (except when relaying at a Transit PINX in accordance with C4)	13.2.10	o		Yes[ ] No[ ]
J14	Sending of a Calling Party Number information element in a SETUP message (except when relaying at a Transit PINX in accordance with C4)	13.2.10	o		Yes[ ] No[ ]

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J15	Sending of a Calling Party Subaddress information element in a SETUP message (except when relaying at a Transit PINX in accordance with C4)	13.2.11	o		Yes[ ] No[ ]
J16	Sending of a Called Party Subaddress information element in a SETUP message (except when relaying at a Transit PINX in accordance with C4)	13.2.11	o		Yes[ ] No[ ]
J17	Sending of a Low Layer Compatibility information element in a SETUP message (except when relaying at a Transit PINX in accordance with C4)	13.2.10	o		Yes[ ] No[ ]
J18	Sending of a High Layer Compatibility information element in a SETUP message (except when relaying at a Transit PINX in accordance with C4)	13.2.10	o		Yes[ ] No[ ]
J19	Sending of a Channel Identification information element in a RESTART message	13.3.1	H2:m	[ ]	Yes[ ]
J20	Sending of a Channel Identification information element in a RESTART ACKNOWLEDGE message	13.3.2	o		Yes[ ] No[ ]
J21	Support of channel map	14.5.12	o		Yes[ ] No[ ]
J22	Type of number supported for ISDN/Telephony Numbering Plan: Unknown International number National number Subscriber number	14.5.7	o		 Yes[ ] No[ ] Yes[ ] No[ ] Yes[ ] No[ ] Yes[ ] No[ ]
J23	Type of number supported for Private Numbering Plan: Unknown Level 2 regional number Level 1 regional number PISN specific number Level 0 regional number Abbreviated number	14.5.7	o		 Yes[ ] No[ ] Yes[ ] No[ ] Yes[ ] No[ ] Yes[ ] No[ ] Yes[ ] No[ ] Yes[ ] No[ ]
J24	Type of number supported for Unknown Numbering Plan: Unknown	14.5.7	o		 Yes[ ] No[ ]
J25	Message formats and codings for messages and information elements supported	14	m		Yes[ ]

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A.3.14 Message segmentation / re-assembly procedures

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
K1	Maximum message size generated	ZA.3	m		Size [ ]
K2	Maximum message size received	ZA.3	m		Size [ ]
K3	Is length of signalling carriage mechanism information field < max. generated message size	ZA.3	o		Yes [ ] No [ ]
K4	Is length of signalling carriage mechanism information field < max. received message size	ZA.3	o		Yes [ ] No [ ]
K5	Procedures for messages segmentation	ZA.3.1	c.12		Yes [ ]
K6	Procedures for messages re-assembly	ZA.3.2	c.13	[ ]	Yes [ ]
K7	Message formats and codings for segmented messages and information elements supported	ZA.4, ZA.5	c.14	[ ]	Yes [ ]
K8	Implementation of T314	ZA.6	c.13	[ ]	Yes [ ]

c.12 If K3, then mandatory else, prohibited

c.13 If K4, then mandatory else, not applicable

c.14 If K3 or K4, then mandatory else, not applicable

A.3.15 Additional progress descriptions

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
M1	Up to three Progress indicator information elements within the same message	annex ZB	m		Yes [ ]
M2	Additional progress descriptions	annex ZB	m		Yes [ ]

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A.3.16 Party category functionality

ITEM	QUESTION/FEATURE	REFERENCE	STATUS	N/A	SUPPORT
N1	Party category functionality	ZC.2	o		Yes [ ] No [ ]
N2	Behaviour as Originating PINX for Party category functionality	ZC.2.3.1	c.21	[ ]	Yes [ ]
N3	Behaviour as Incoming Gateway PINX for Party category functionality	ZC.2.4.1	c.22	[ ]	Yes [ ]
N4	Behaviour as Transit PINX for Party category functionality	ZC.2.3.3	c.23	[ ]	Yes [ ]
N5	Behaviour as Terminating PINX for Party category functionality	ZC.2.3.2	c.24	[ ]	Yes [ ]
N6	Behaviour as Outgoing Gateway PINX for Party category functionality	ZC.2.4.2	c.25	[ ]	Yes [ ]
N7	Sending of a Party category information element in a SETUP message	ZC.2.3, ZC.2.4	c.26	[ ]	Yes [ ] No [ ]
N8	Sending of a Party category information element in an ALERTING message	ZC.2.3, ZC.2.4	c.27	[ ]	Yes [ ] No [ ]
N9	Sending of a Party category information element in a CONNECT message	ZC.2.3, ZC.2.4	c.27	[ ]	Yes [ ] No [ ]

c.21 If B1 and N1 then mandatory else, not applicable
c.22 If B2 and N1 then mandatory else, not applicable
c.23 If B3 and N1 then mandatory else, not applicable
c.24 If B4 and N1 then mandatory else, not applicable
c.25 If B5 and N1 then mandatory else, not applicable
c.26 If N2 or N3 or N4 then optional else, not applicable
c.27 If N4 or N5 or N6 then optional else, not applicable

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Annex B

(informative)

Use of the cause information element

B.1 Definition of cause values

Cause Number 1 "Unallocated (unassigned) number"
This cause indicates that the destination requested by the calling user cannot be reached because, although the number is in a valid format, it is not currently assigned (allocated).

Cause Number 3 "No route to destination"
This cause indicates that the called user cannot be reached because the network through which the call has been routed does not serve the desired destination.

Cause Number 6 "Channel unacceptable"
This cause indicates that the channel most recently identified is not acceptable to the sending entity for use in this call.

Cause Number 16 "Normal call clearing"
This cause indicates that one of the users involved in the call has requested that the call be cleared.

Cause Number 17 "User busy"
This cause is used when the user equipment is compatible with the call but called user resources are temporarily unavailable.

Cause Number 18 "No user responding"
This cause is used when the called user's equipment does not respond to a call establishment message with either an alerting or a connect indication within the prescribed period of time allocated.

Cause Number 19 "No answer from user (user alerted)"
This cause is used when a user has provided an alerting indication but has not provided a connect indication within a prescribed period of time.

Cause Number 21 "Call rejected"
This cause indicates that the called user does not wish to accept this call, although his equipment is neither busy nor incompatible.

Cause Number 22 "Number changed"
This cause is returned to a calling user when the called party number indicated by the calling user is no longer assigned. The new called party number may optionally be included in the diagnostic field.(If a network does not support this capability, cause number 1 "Unallocated (unassigned) number" shall be used).

Cause Number 27 "Destination out of order"
This cause indicates that the destination indicated by the user cannot be reached because the interface to the destination is not functioning correctly, i.e. a signalling message could not be delivered to the remote user (e.g., a Signalling Carriage Mechanism failure at the remote user, user equipment off-line, etc).

Cause Number 28 "Invalid number format (address incomplete)"
This cause indicates that the called user cannot be reached because the called party number is not a valid format or is not complete.

Cause Number 30 "Response to STATUS ENQUIRY"
This cause is included in the STATUS message when the reason for generating the STATUS message was the prior receipt of a STATUS ENQUIRY message.

Cause Number 31 "Normal unspecified"
This cause is used to report a normal event only when no other cause in the normal class applies.

Cause Number 34 "No circuit/channel available"
This cause indicates that there is no appropriate circuit /channel presently available to handle the call.

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Cause Number 41 "Temporary failure"
This cause indicates that the network is not functioning correctly and that the condition is not likely to last a long period of time. (The user may wish to try another call attempt almost immediately).

Cause Number 44 "Requested circuit/channel not available"
This cause is returned when the circuit or channel indicated by the requesting entity cannot be provided by the other side of the interface/by the peer entity.

Cause Number 57 "Bearer capability not authorized"
This cause indicates that the user has requested a bearer capability which is implemented by the equipment generating this cause but which the user is not authorized to use.

Cause Number 58 "Bearer capability not presently available"
This cause indicates that the user has requested a bearer capability which is implemented by the equipment generating this cause but which is not available at this instant.

Cause Number 63 "Service or option not available, unspecified"
This cause is used to report a service or option not available event only when no other cause in the service or option not available class applies.

Cause Number 65 "Bearer capability not implemented"
This cause indicates that the equipment sending this cause does not support the bearer capability requested.

Cause Number 81 "Invalid call reference value"
This cause indicates that the equipment sending this cause has received a message with a call reference which is not currently in use on that particular link.

Cause Number 82 "Identified channel does not exist"
This cause indicates that the equipment sending this cause has received a request to use a channel not activated on the inter PINX link.

Cause Number 88 "Incompatible destination"
This cause indicates that the equipment sending this cause has received a request to establish a call which has LLC, HLC, or other compatibility attributes (e.g. data rate) which cannot be accommodated.

Cause Number 96 "Mandatory information element is missing"
This cause indicates that the equipment sending this cause has received a message which is missing an information element that must be present in order for that message to be processed.

Cause Number 97 "Message type non-existent or not implemented"
This cause indicates that the equipment sending this cause has received a message with a message type it does not recognise either because this is a message not defined or defined but not implemented by the equipment sending this cause.

Cause Number 98 "Message not compatible with call state or message type non-existent or not implemented"
This cause indicates that the equipment sending this cause has received a message which it does not recognise or which is not compatible with the call state.

Cause Number 99 "Information element non-existent or not implemented"
This cause indicates that the equipment sending this cause has received a message which includes information elements not recognised because the information element identifier is not defined or it is defined but not implemented by the equipment sending the cause.

Cause Number 100 "Invalid information element contents"
This cause indicates that the equipment sending this cause has received an information element which it has implemented; however, one or more of the fields in the information element are coded in a way that has not been implemented by the equipment sending this cause.

Cause Number 101 "Message not compatible with call state"
This cause indicates that the equipment sending this cause has received a message which is incompatible with the call state, or a STATUS message indicating an incompatible call state.

Cause Number 102 "Recovery on timer expiry"
This cause indicates that a procedure has been initiated by the expiry of a timer in association with the PSS1 error handling procedures.

Cause Number 111 "Protocol error, unspecified"
This cause is used to report a protocol error event only when no other cause in the protocol error class applies.

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B.2 Use of causes for busy conditions

The following cause values are used in PSS1 for busy (= congestion) cases:

- cause number 34 “no circuit /channel available” should be generated by the side (incoming or outgoing) that determines that no suitable inter-PINX information channel is available to establish the call;
- cause number 44 “requested circuit /channel not available” should be generated by the incoming side if it is unable to accept the particular inter-PINX information channel proposed by the outgoing side.

In both cases the location field should be coded “PISN serving the local user”. This coding may be changed to “PISN serving the remote user” when received from another private network.

Note that cause number 17 “user busy” should not be generated when congestion is encountered at the Q-reference point.

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Annex C

(informative)

Examples of message sequences

C.1 Enbloc sending

C.1.1 Successful call setup

Figure C.1 shows an example of the message sequences across the PISN when a call is initiated from TE A to TE B (which is free) and the called party number in the original SETUP message is complete.

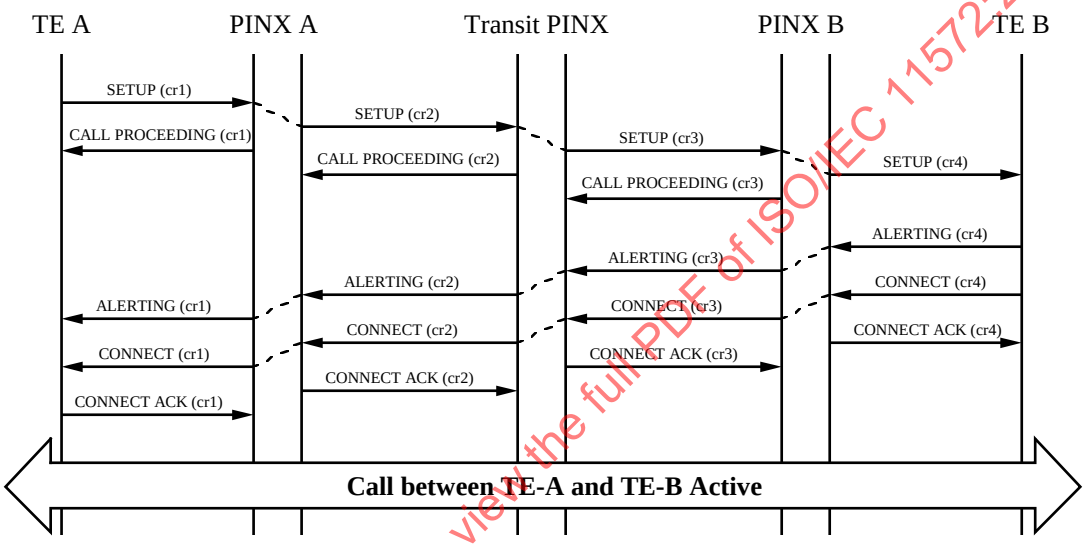

Figure C.1 - Enblock setup, successful call

C.1.2 Unsuccessful call setup

Figure C.2 shows an example of the message sequences across the PISN when a call is initiated from TE A to TE B (which is busy) and the called party number in the original SETUP message is complete.

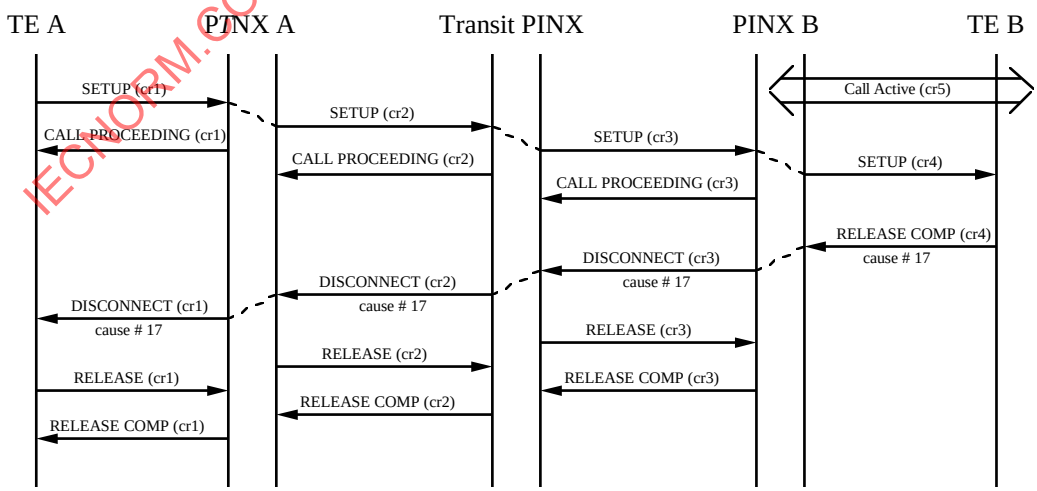

Figure C.2 - Enblock setup, unsuccessful call

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C.2 Overlap sending

C.2.1 Successful call setup

Figure C.3 shows an example of the message sequences across the PISN when a call is initiated from TE A to TE B (which is free) and the called party number in the original SETUP message is empty.

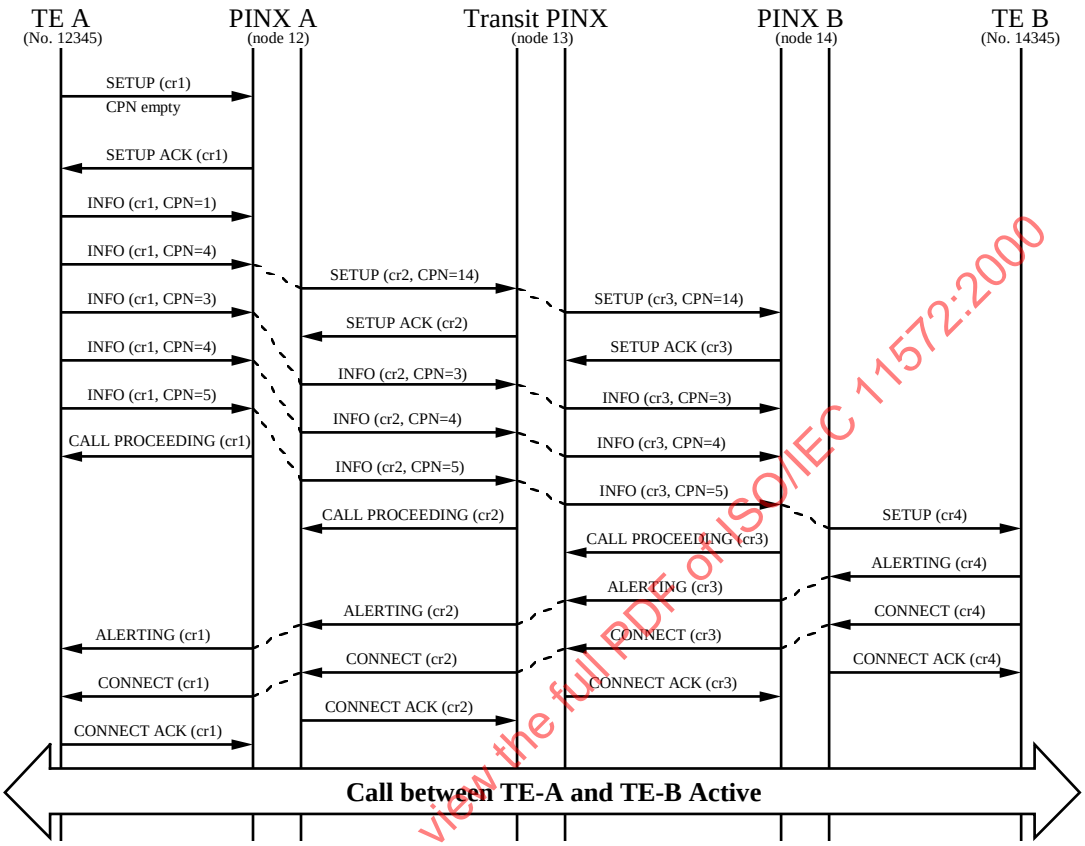

Figure C.3 - Overlap setup, successful call

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C.2.2 Unsuccessful call setup

Figure C.4 shows an example of the message sequences across the PISN when a call is initiated from TE A to TE B (which is busy) and the called party number in the original SETUP message is empty.

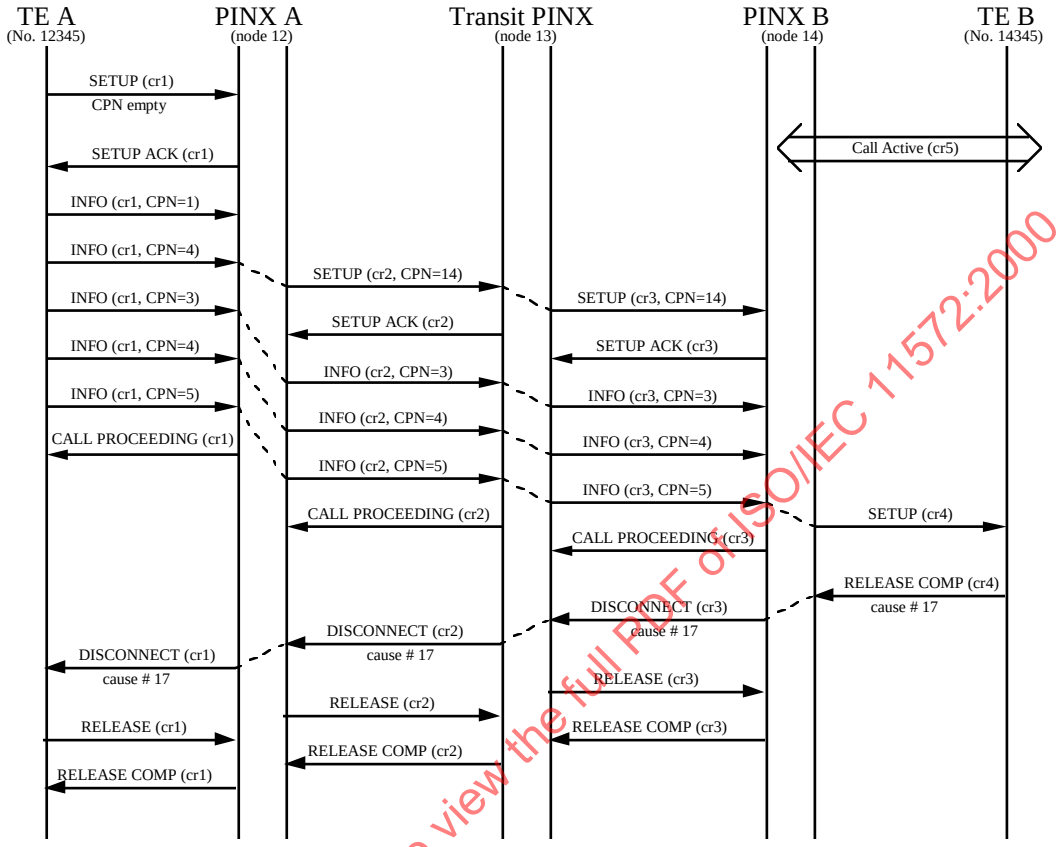

Figure C.4 - Overlap setup, unsuccessful call

C.3 Call clearing

C.3.1 Normal call clearing (from originator)

Figure C.5 shows an example of call clearing from the active state, initiated by TE A when TE A goes on hook.

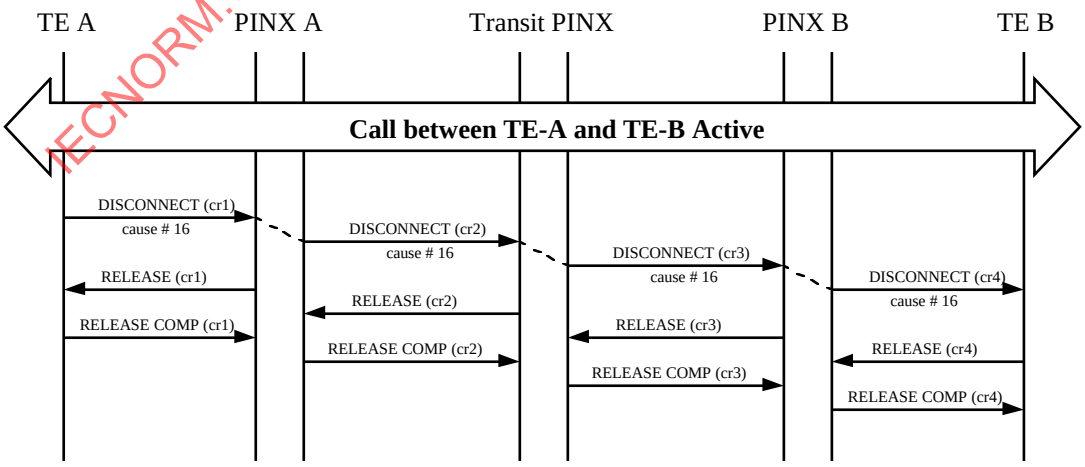

Figure C.5 - Normal call clearing by originator

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C.3.2 Call abort by a Transit PINX

Figure C.6 shows an example of a transit PINX aborting a call (for some reason) which is in the active state, without tones and announcements being provided. The use of cause number 41 "temporary failure" is shown only as an example, and is not intended to preclude the use of other cause values in this situation.

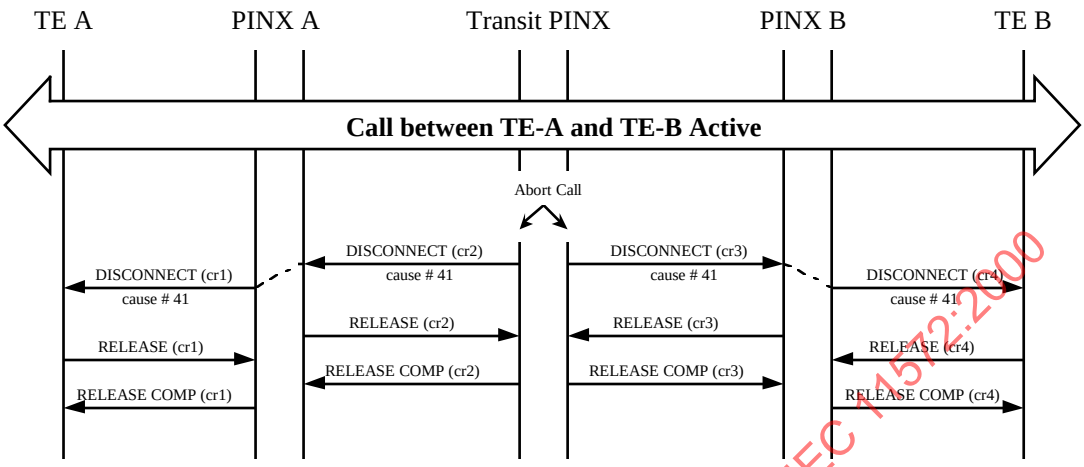

Figure C.6 - Call abort by Transit PINX

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Annex D

(informative)

Manufacturer specific information

PSS1 permits the inclusion in messages of non-standardised information which is specific to a particular design of PINX, a particular network, etc. This information is known as Manufacturer Specific Information.

This International Standard also permits the use of non-standardised messages and information elements between adjacent PINXs. No procedures are defined in this International Standard for the handling of these messages and information elements at PINXs except the error procedures defined in clauses 9.2.4 and 9.2.7, which will apply in the event of an unrecognised message or information element being received by a PINX.

NOTE - Ambiguity may arise when two implementations use the same message identifier or information element identifier for different purposes.

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Annex E

(informative)

SDL diagram for the procedures over a symmetrical link between two peer PINX's

E.1 Protocol Control SDL diagram

Figure E.2 in this annex contains an SDL diagram which provides an example of the Protocol Control procedures as described in clauses 10.1 to 10.3 of this International Standard. The procedures illustrated are not intended to be exhaustive, and several potential situations that may occur have been omitted from the SDL (e.g. some error conditions and procedures).

Figure E.1 provides the key to the symbols used in figure E.2. The primitive symbols contain primitives which come from a number of sources, each identified by a prefix to the primitive name as indicated in table E.1

Table E.1 - Key to primitive types in Protocol Control SDL diagram

Prefix	Primitive from/to:
CC_	Call Control
GCC_	Global Call Control
DL_	Signalling Carriage Mechanism
Event_	An entity which provides Protocol Control with notification of protocol related events other than receipt of incoming messages or primitives from Call Control, Global Call Control or the Signalling Carriage Mechanism

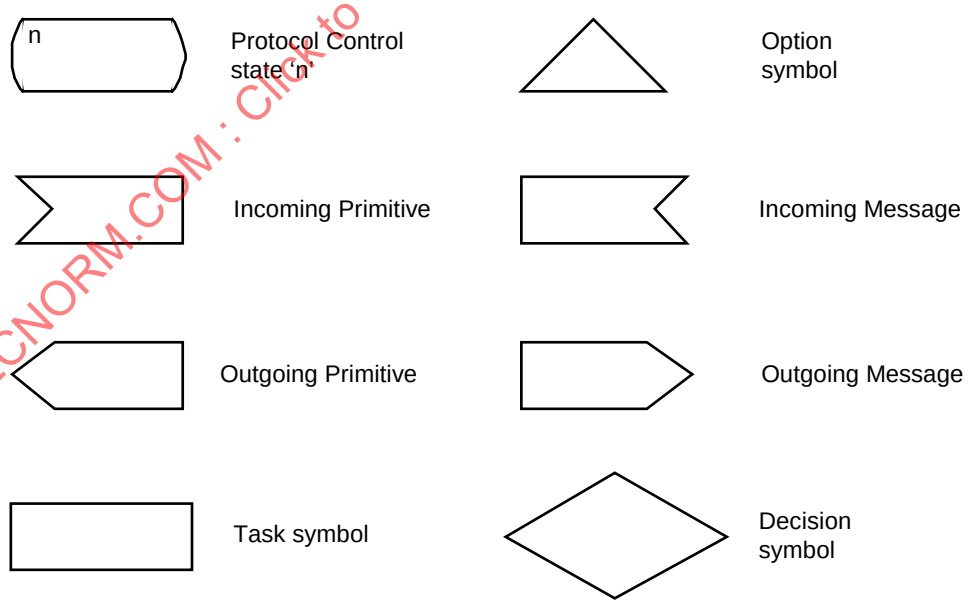

Figure E.1 - Key to symbols used in the Protocol Control SDL diagram

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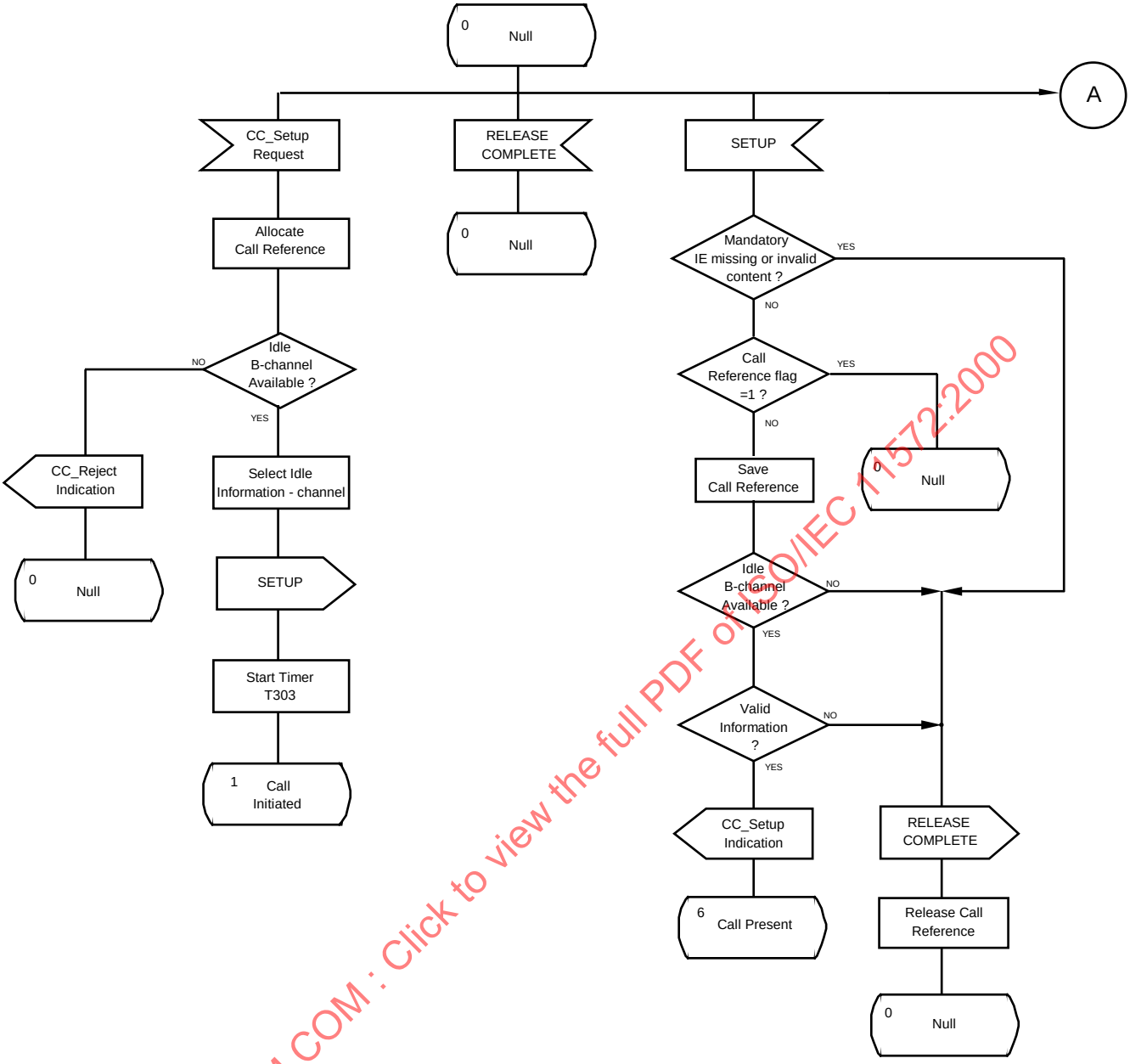

Figure E.2 - Protocol Control SDL diagram (sheet 1 of 22)

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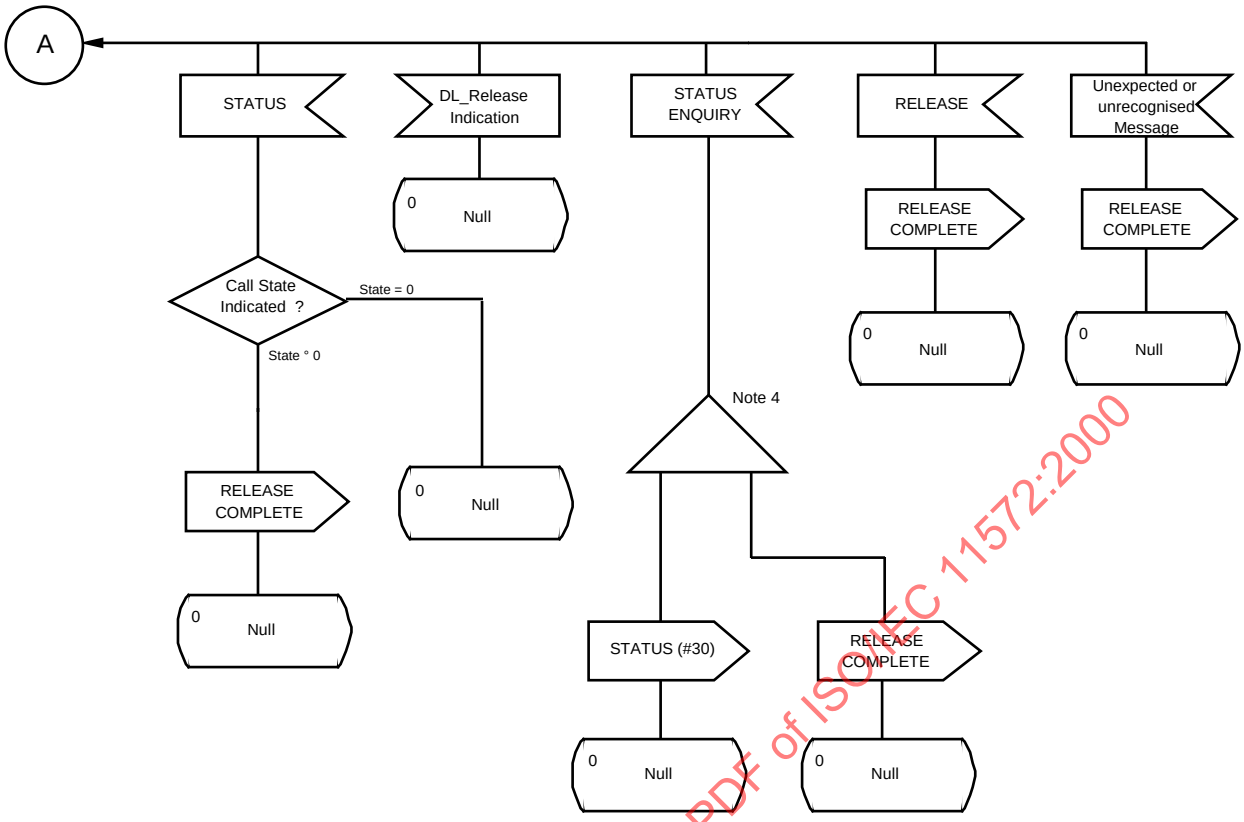

Figure E.2 - Protocol Control SDL diagram (sheet 2 of 22) (continued)

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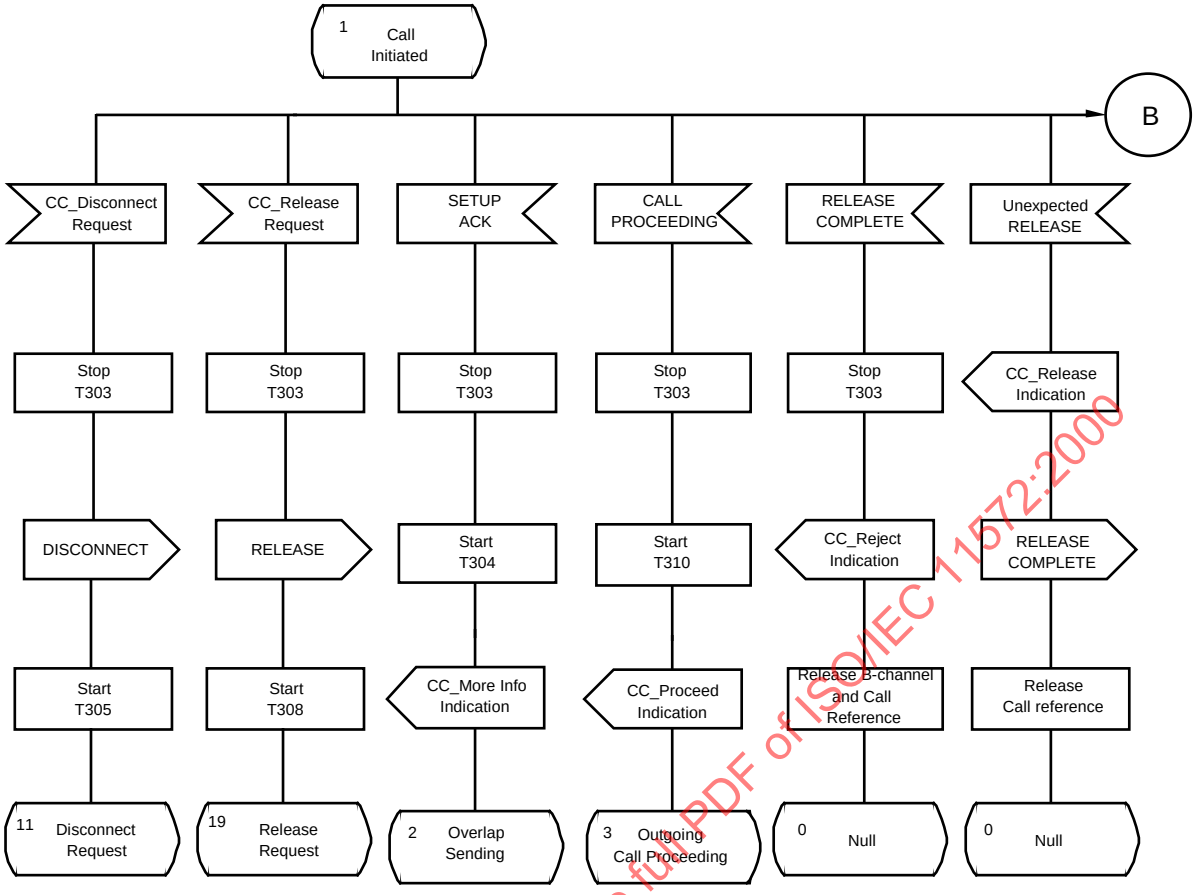

Figure E.2 - Protocol Control SDL diagram (sheet 3 of 22) (continued)

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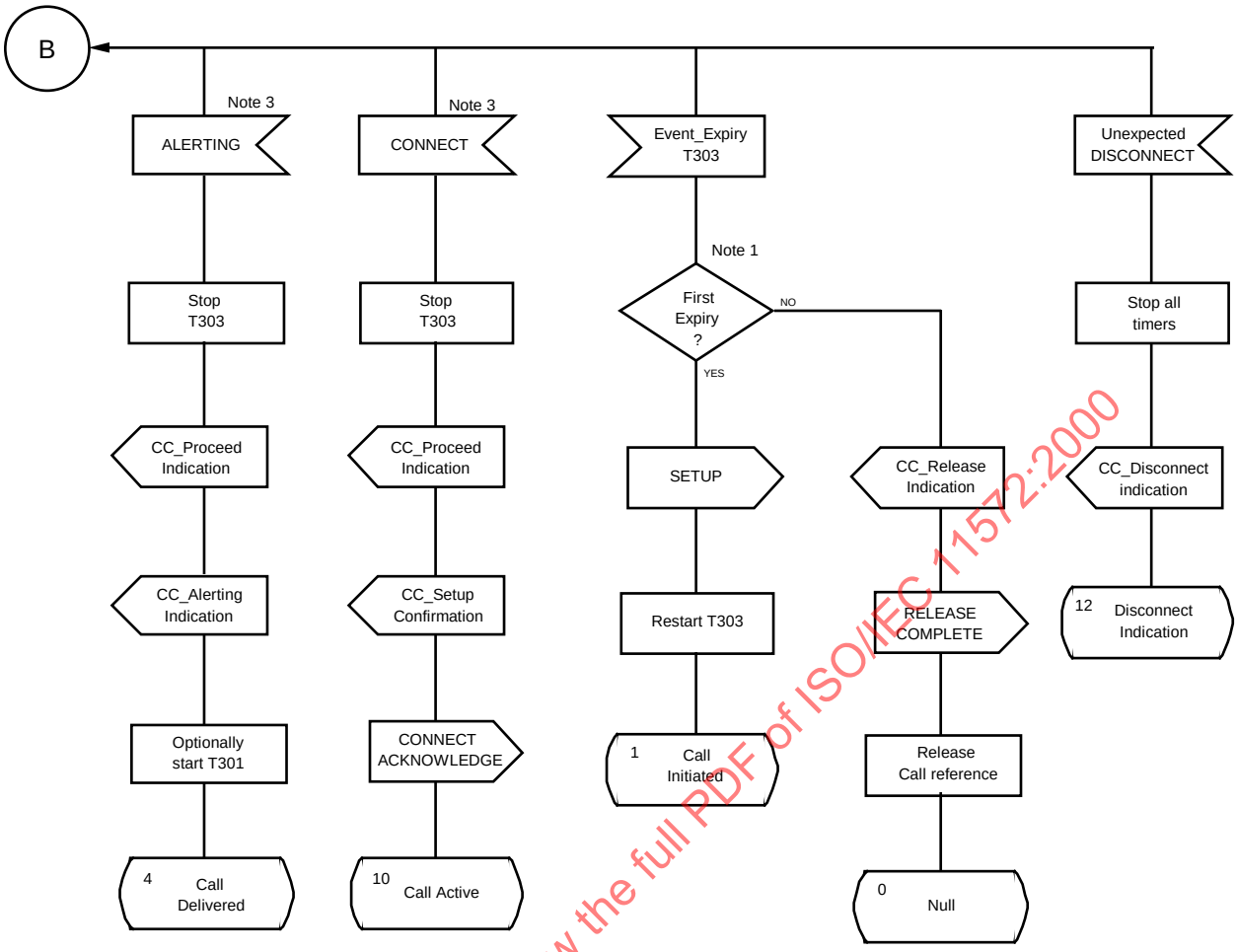

Figure E.2 - Protocol Control SDL diagram (sheet 4 of 22) (continued)

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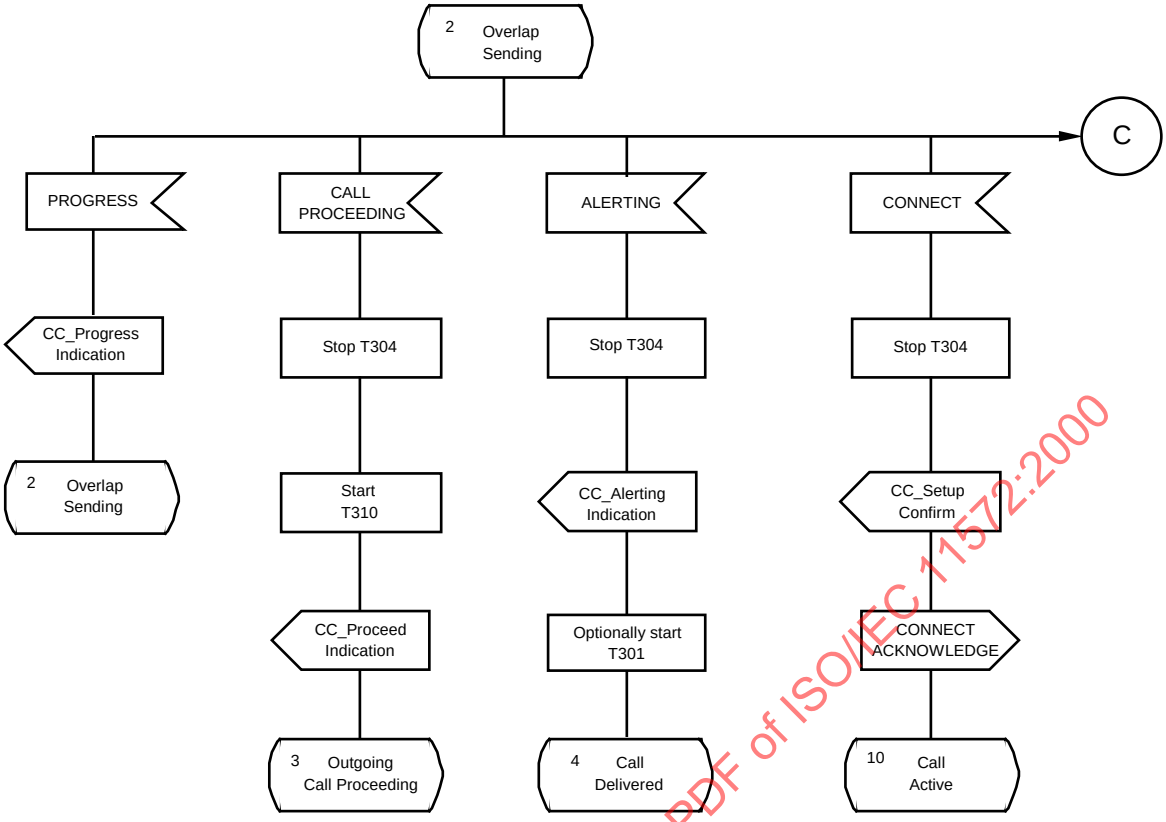

Figure E.2 - Protocol Control SDL diagram (sheet 5 of 22) (continued)

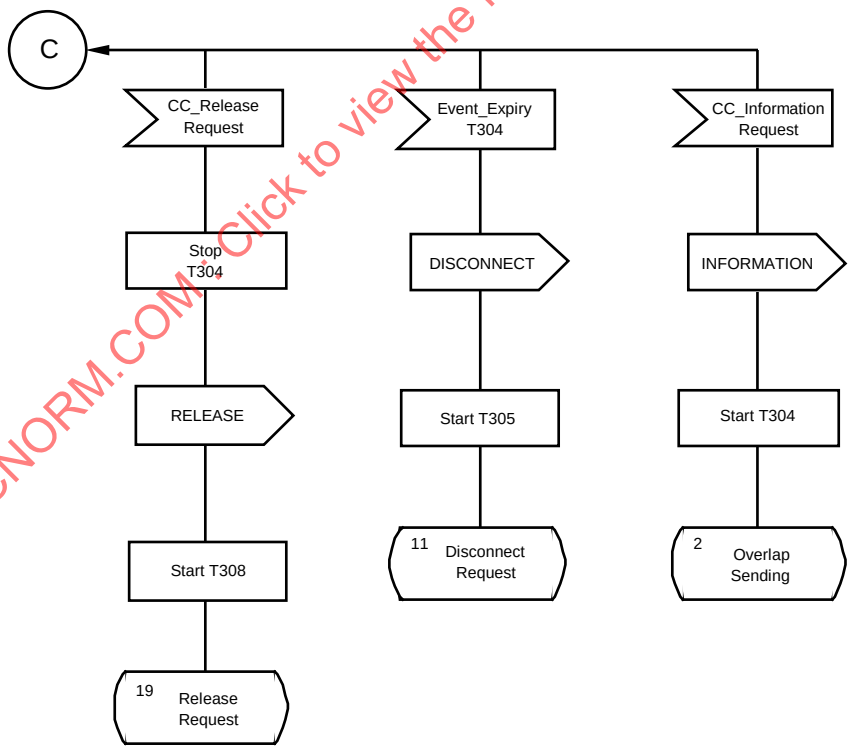

Figure E.2 - Protocol Control SDL diagram (sheet 6 of 22) (continued)

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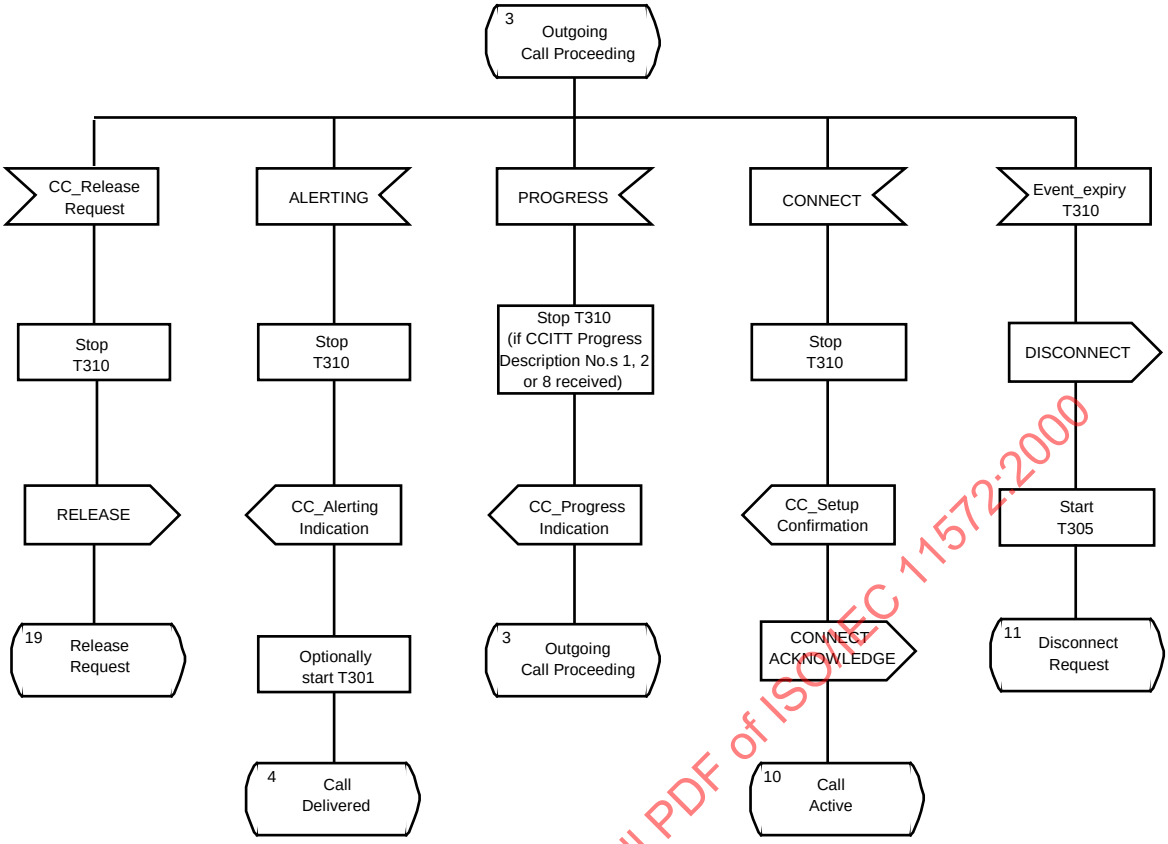

Figure E.2 - Protocol Control SDL diagram (sheet 7 of 22) (continued)

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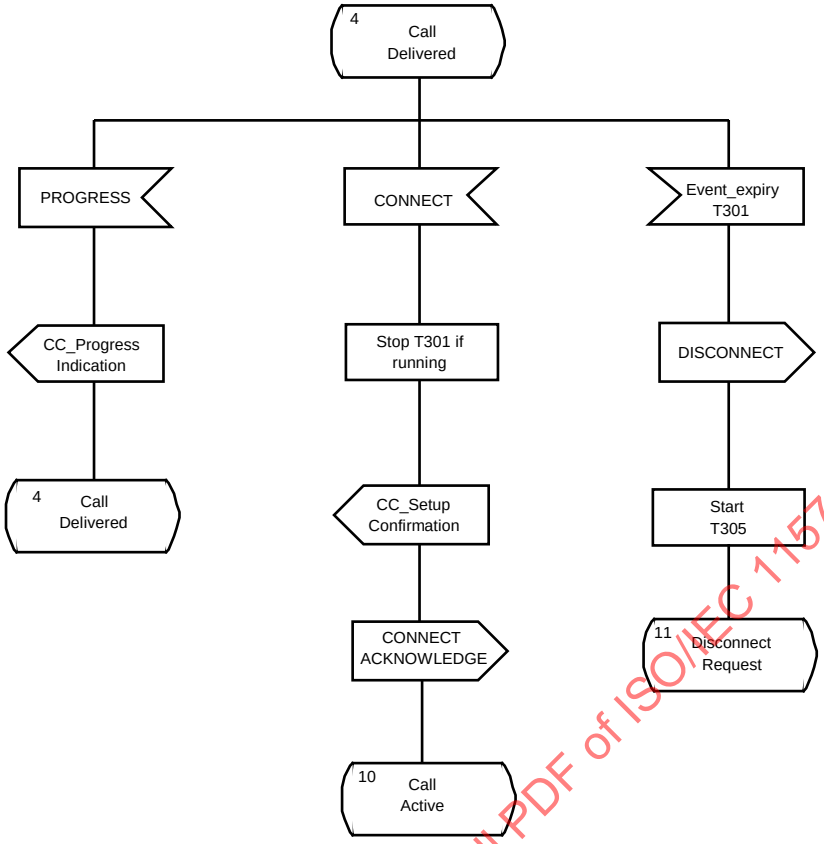

Figure E.2 - Protocol Control SDL diagram (sheet 8 of 22) (continued)

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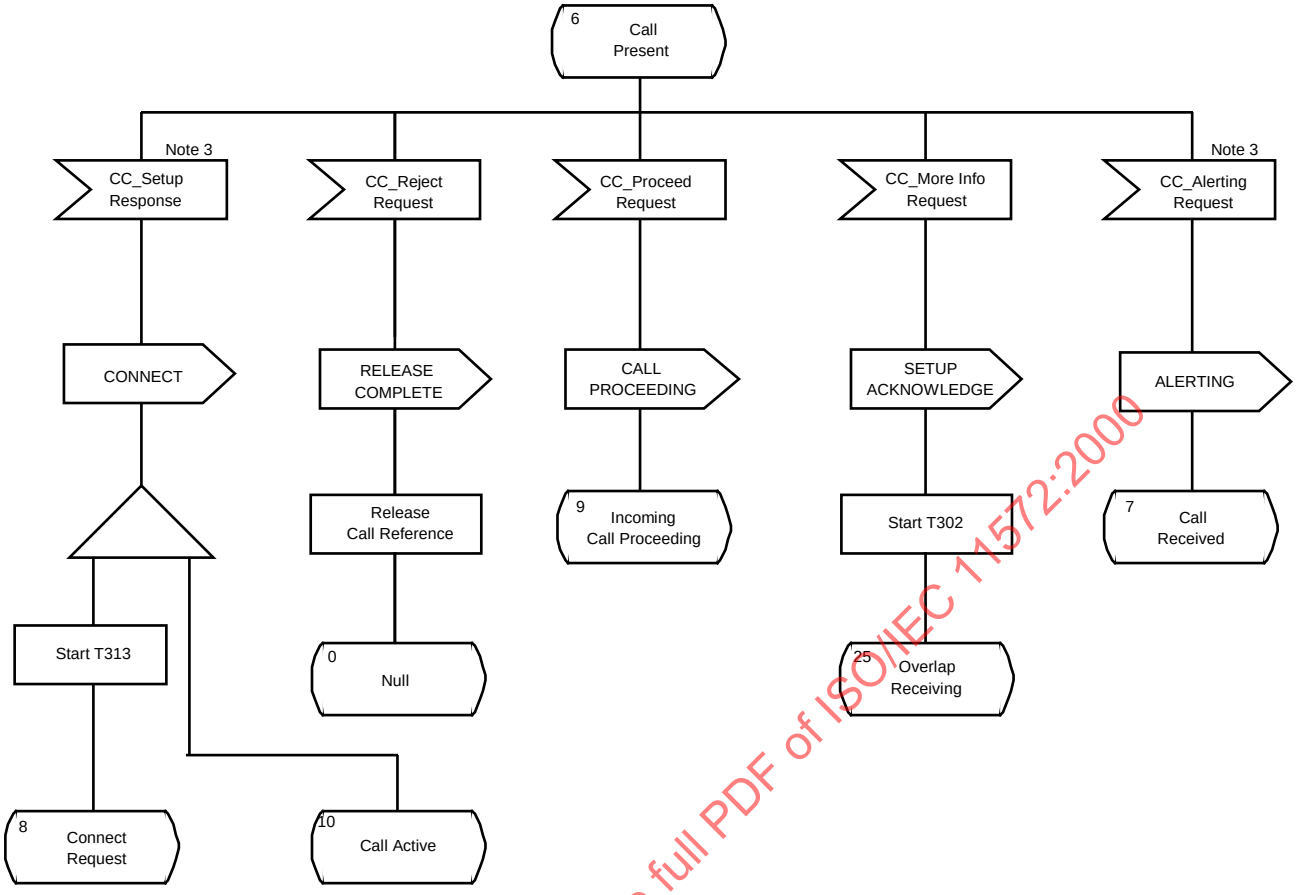

Figure E.2 - Protocol Control SDL diagram (sheet 9 of 22) (continued)

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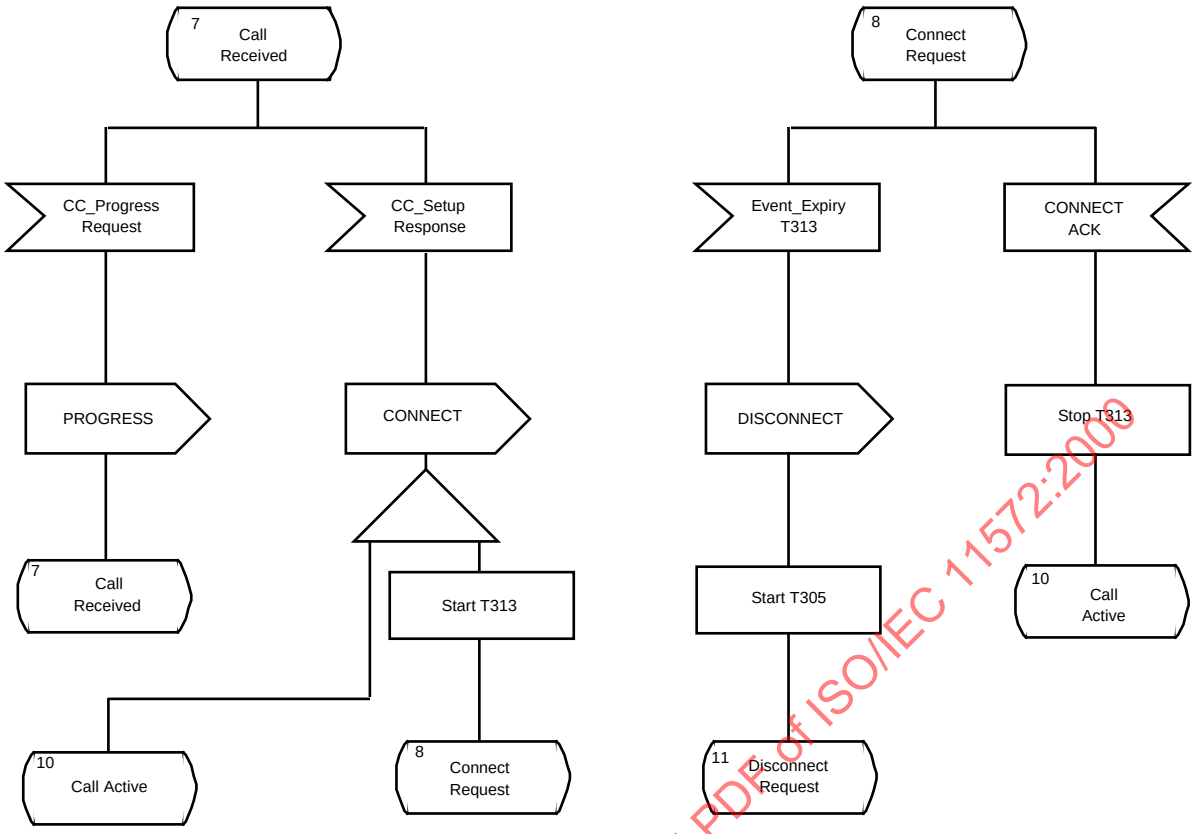

Figure E.2 - Protocol Control SDL diagram (sheet 10 of 22) (continued)

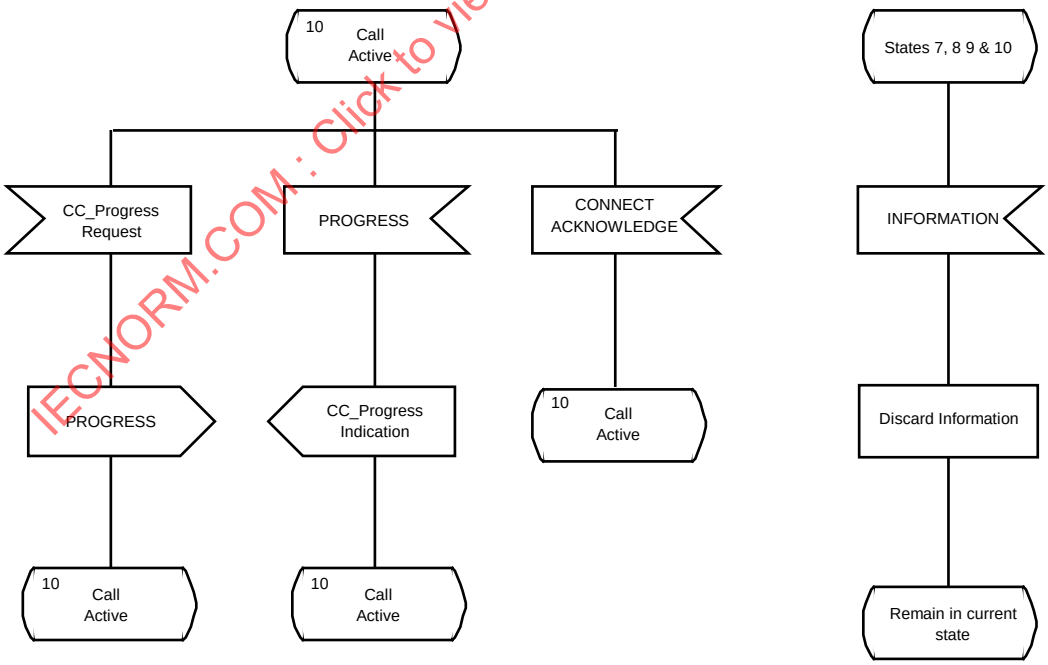

Figure E.2 - Protocol Control SDL diagram (sheet 11 of 22) (continued)

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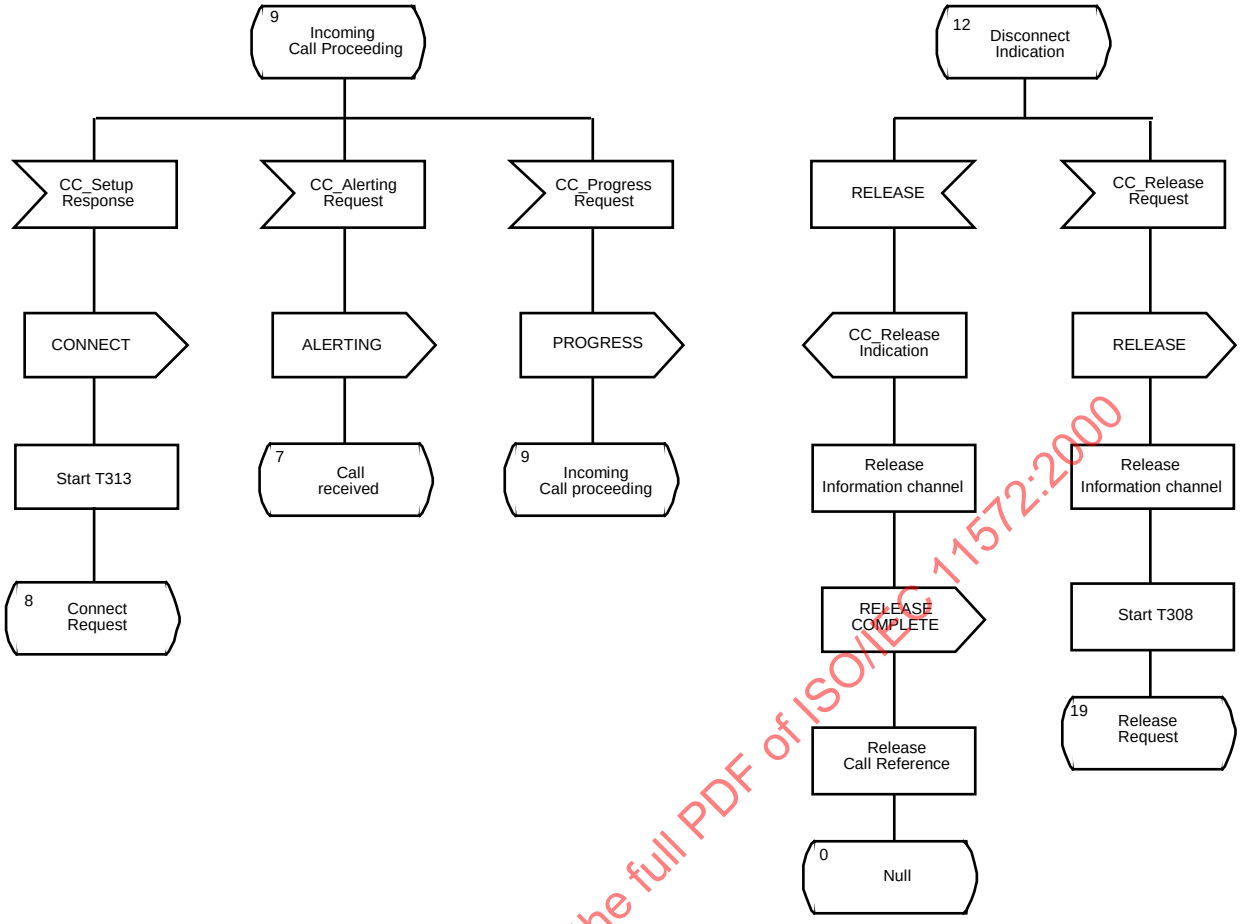

Figure E.2 - Protocol Control SDL diagram (sheet 12 of 22) (continued)

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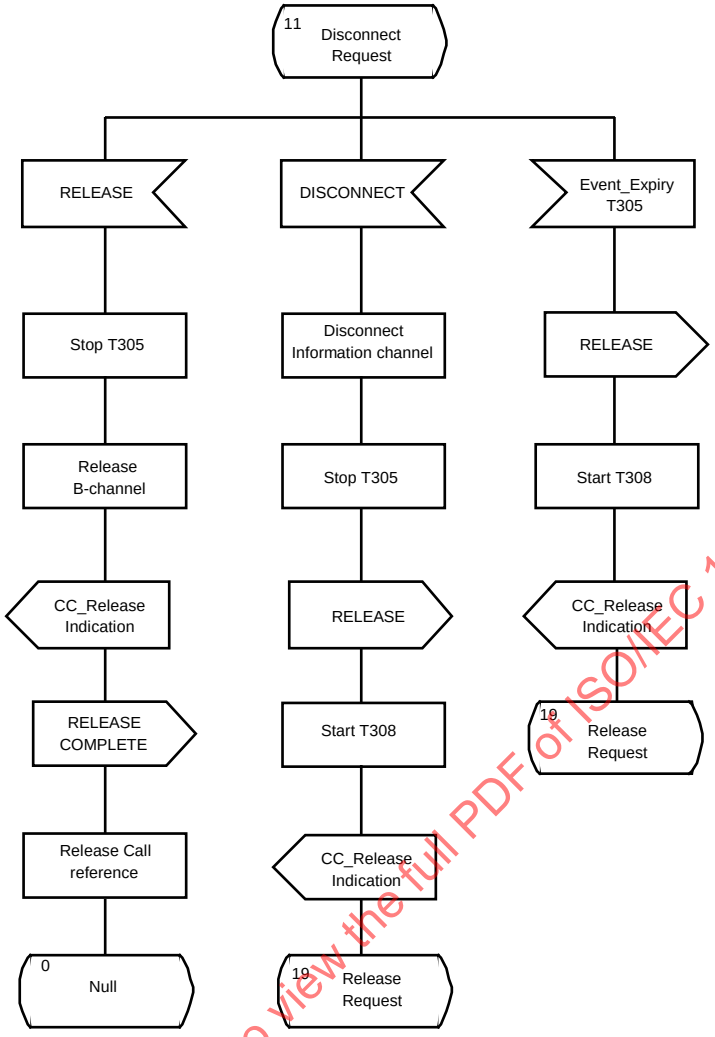

Figure E.2 - Protocol Control SDL diagram (sheet 13 of 22) (continued)

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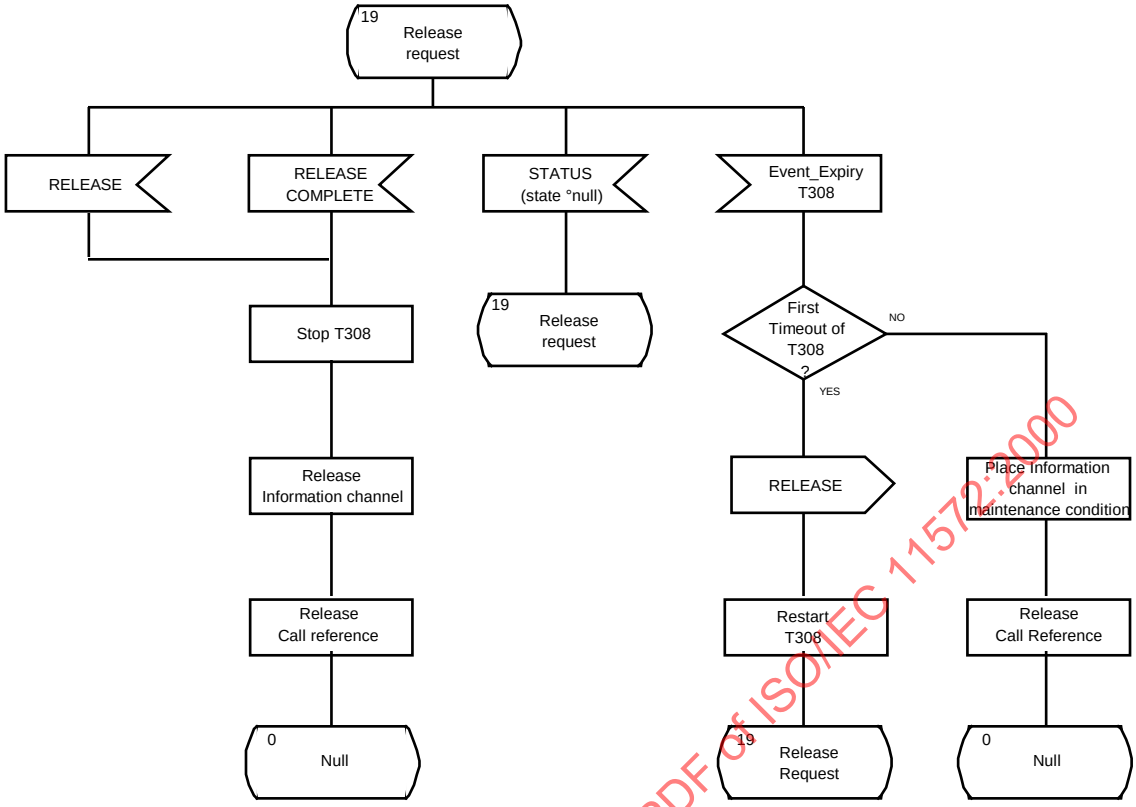

Figure E.2 - Protocol Control SDL diagram (sheet 14 of 22) (continued)

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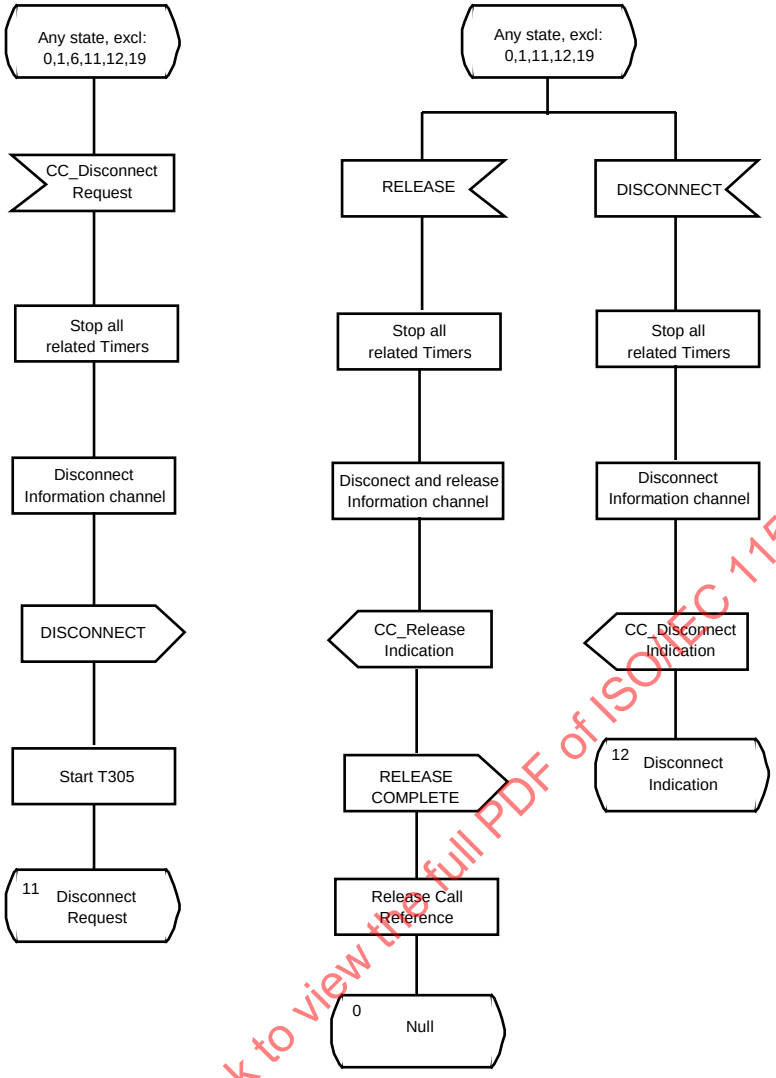

Figure E.2 - Protocol Control SDL diagram (sheet 15 of 22) (continued)

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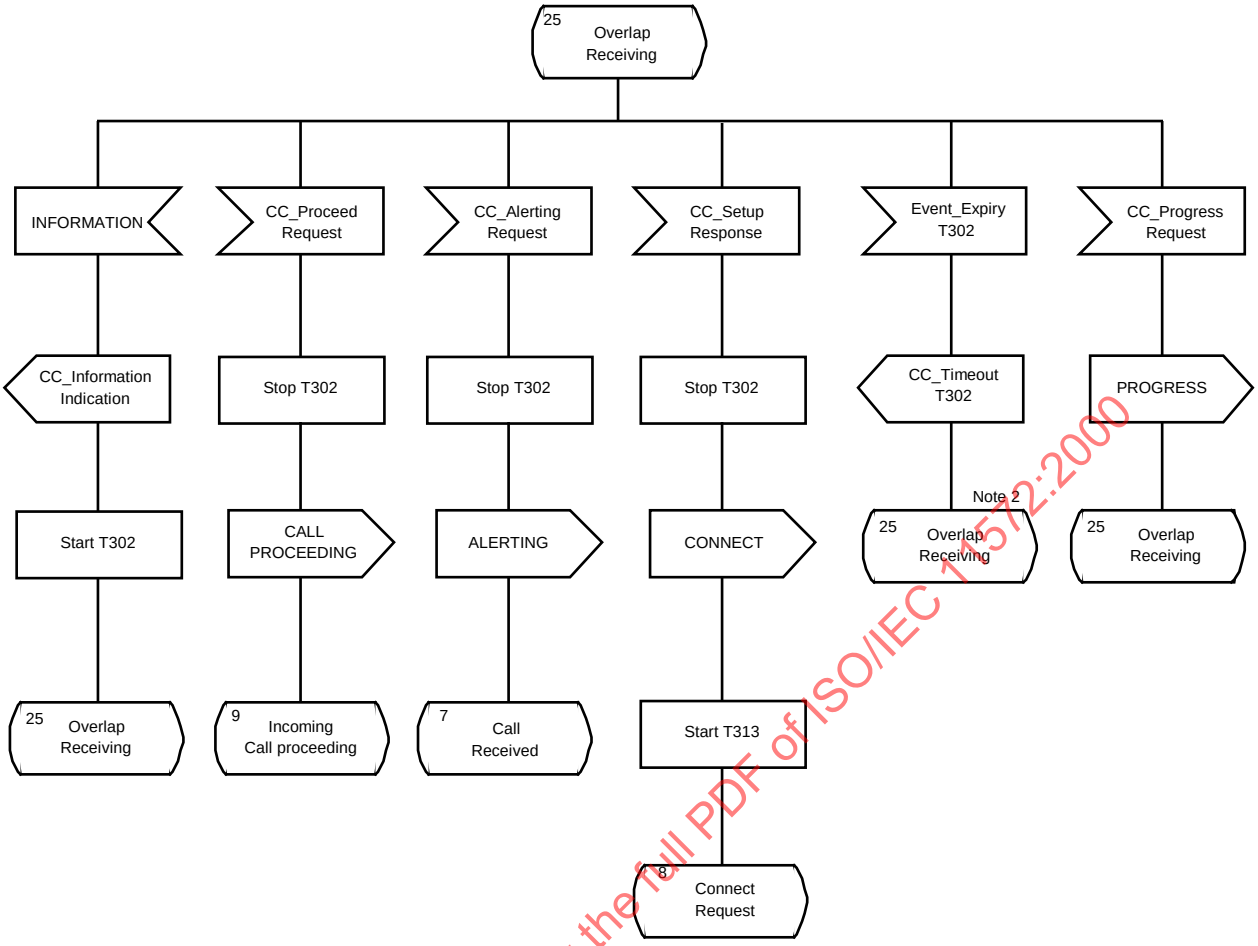

Figure E.2 - Protocol Control SDL diagram (sheet 16 of 22) (continued)

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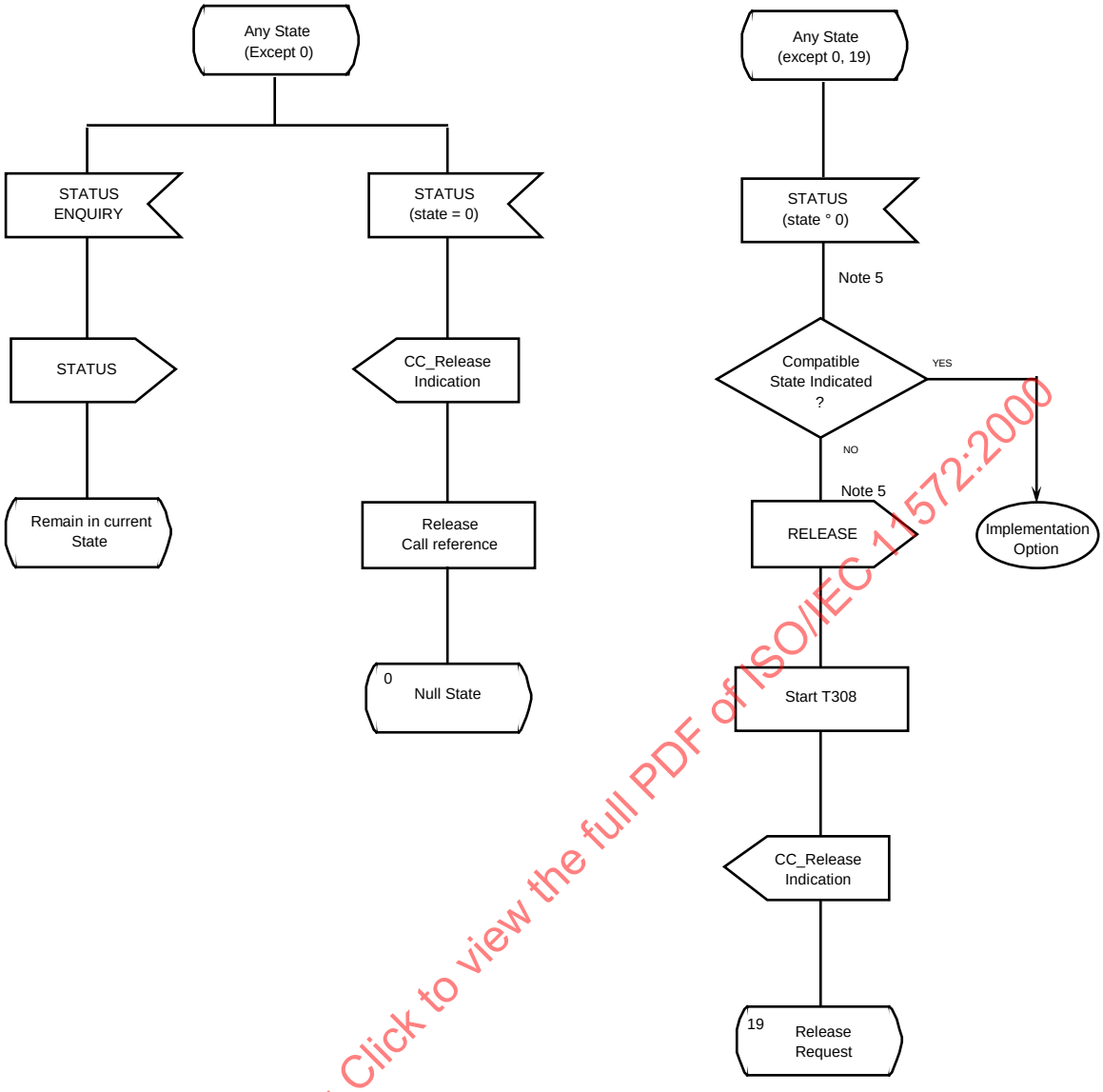

Figure E.2 - Protocol Control SDL diagram (sheet 17 of 22) (continued)

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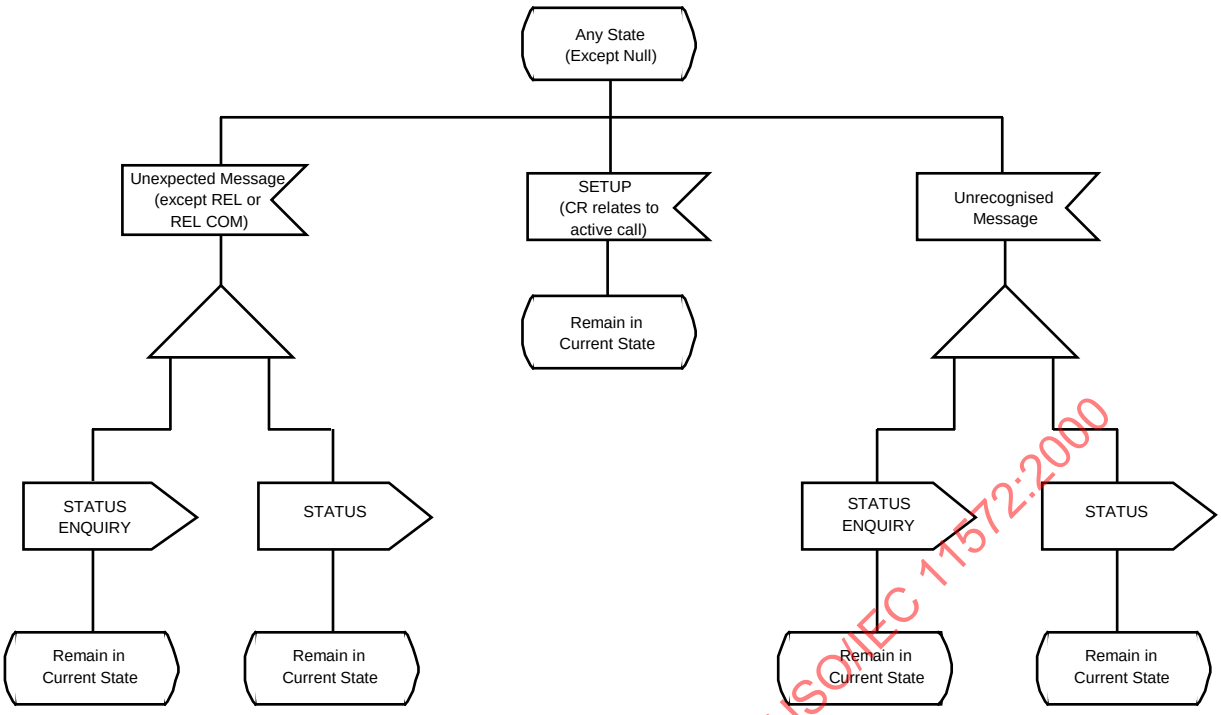

Figure E.2 - Protocol Control SDL diagram (sheet 18 of 22) (continued)

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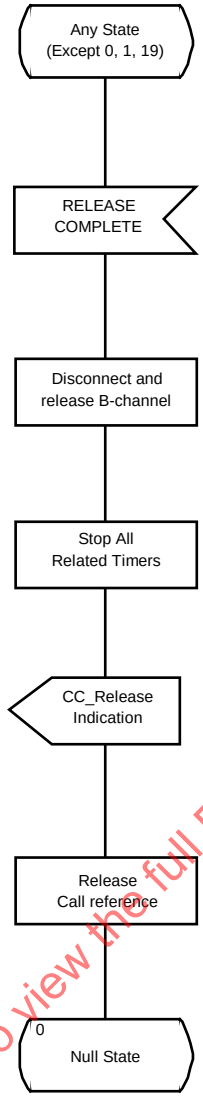

Figure E.2 - Protocol Control SDL diagram (sheet 19 of 22) (continued)

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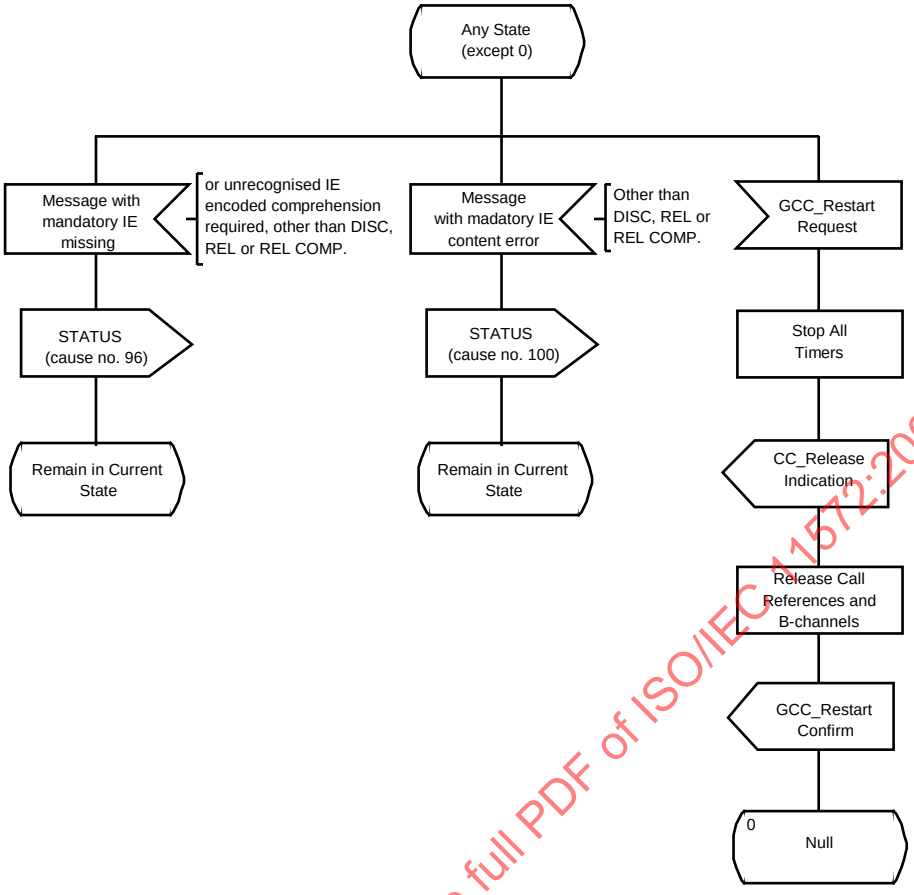

Figure E.2 - Protocol Control SDL diagram (sheet 20 of 22) (continued)

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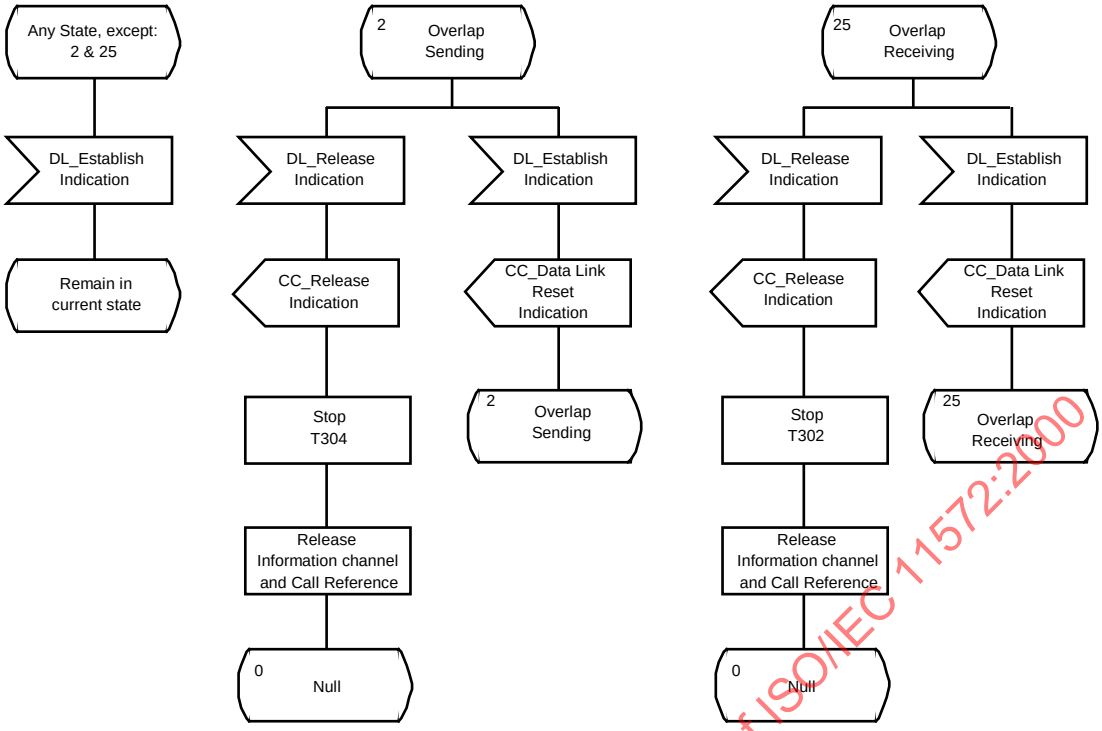

Figure E.2 - Protocol Control SDL diagram (sheet 21 of 22) (continued)

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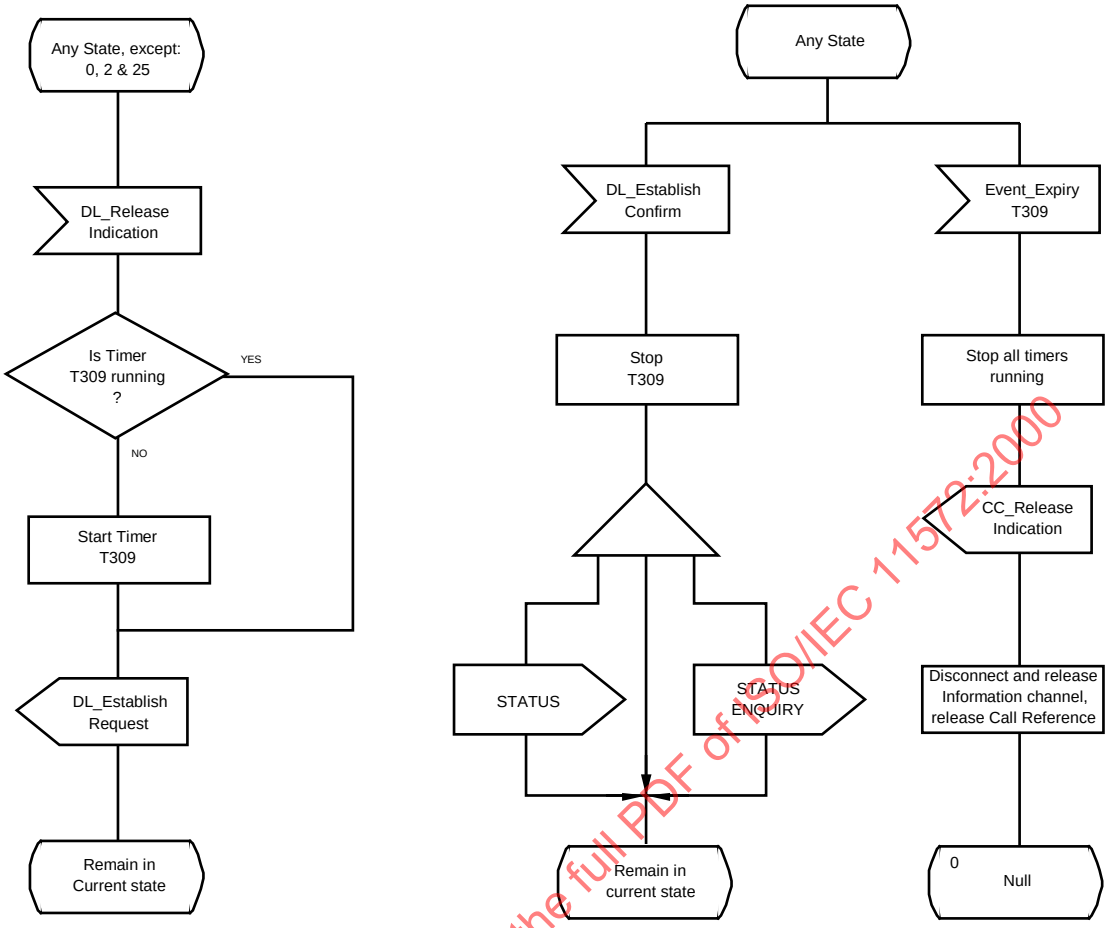

Figure E.2 - Protocol Control SDL diagram (sheet 22 of 22) (concluded)

NOTES to the Protocol Control SDL diagram:

NOTE 1 - The sending of SETUP a second time on expiry of T303 is an implementation option.

NOTE 2 - It is assumed that the decision whether complete information has been received or not, at the expiry of T302, will be made by Call Control.

NOTE 3 - The receipt of ALERTING or CONNECT as a first response to SETUP will not cause a protocol error, even though they would not normally be sent as the first response to the SETUP message.

NOTE 4 - The procedures section allows RELEASE COMPLETE or STATUS as a response to a STATUS ENQUIRY when an entity is in the Null state. Clause 9.2.3.2 allows RELEASE COMPLETE (with cause number 81 “invalid call reference value”) whereas clause 9.3.1 specifies that STATUS (with cause number 30 “response to STATUS ENQUIRY”) should be returned.

NOTE 5 - The action to be taken at this point is an implementation option.

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Annex F

(informative)

SDL diagram for the procedures on either side of a Transit-PINX

F.1 Transit Call Control SDL Diagram

NOTE - The provision of a transit PINX functionality is an option. When provided, the procedures contained in clause 10.4 are mandatory.

Figure F.2 in this annex contains an SDL diagram which provides an example of the Call Control procedures as described in clause 10.4. The procedures illustrated are not intended to be complete, merely an example of the procedures described in the text.

Figure F.1 provides the key to the symbols used in figure F.2. The input symbols from the left hand side contain primitives from a number of sources, each identified by a prefix to the primitive name as indicated in table F.1. The output symbols to the left hand side contain primitives to the Incoming Side Protocol Control entity. The input/output symbols to the right hand side contain primitives which are sent from/to the Outgoing Side Protocol Control entity.

Table F.1 - key to primitive types in Call Control SDL diagram

Prefix	Primitive from/to:
CC_	Protocol Control
Event_	An entity which provides Call Control with notification of call related events.

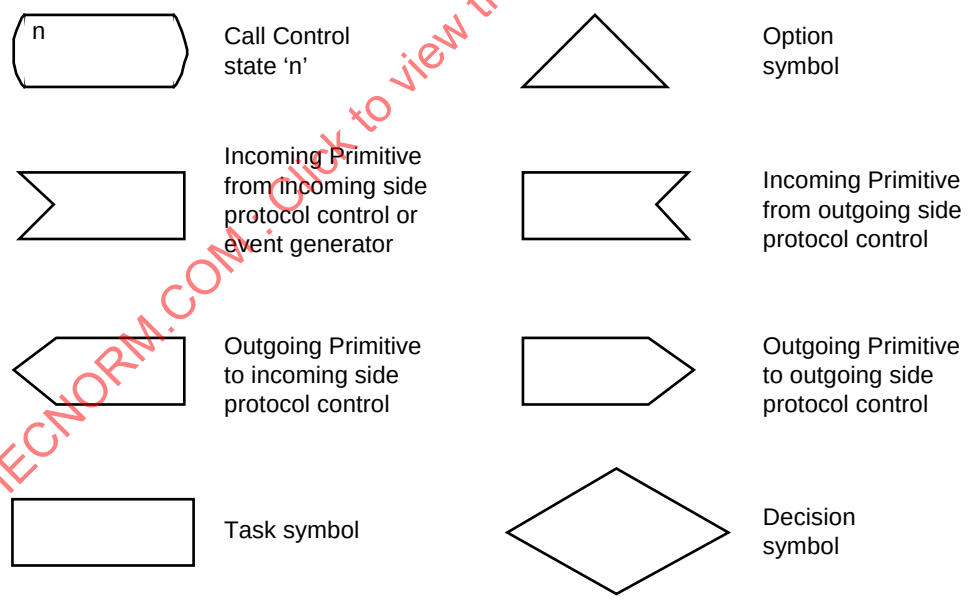

Figure F.1 - Key to symbols used in the transit Call Control SDL diagram

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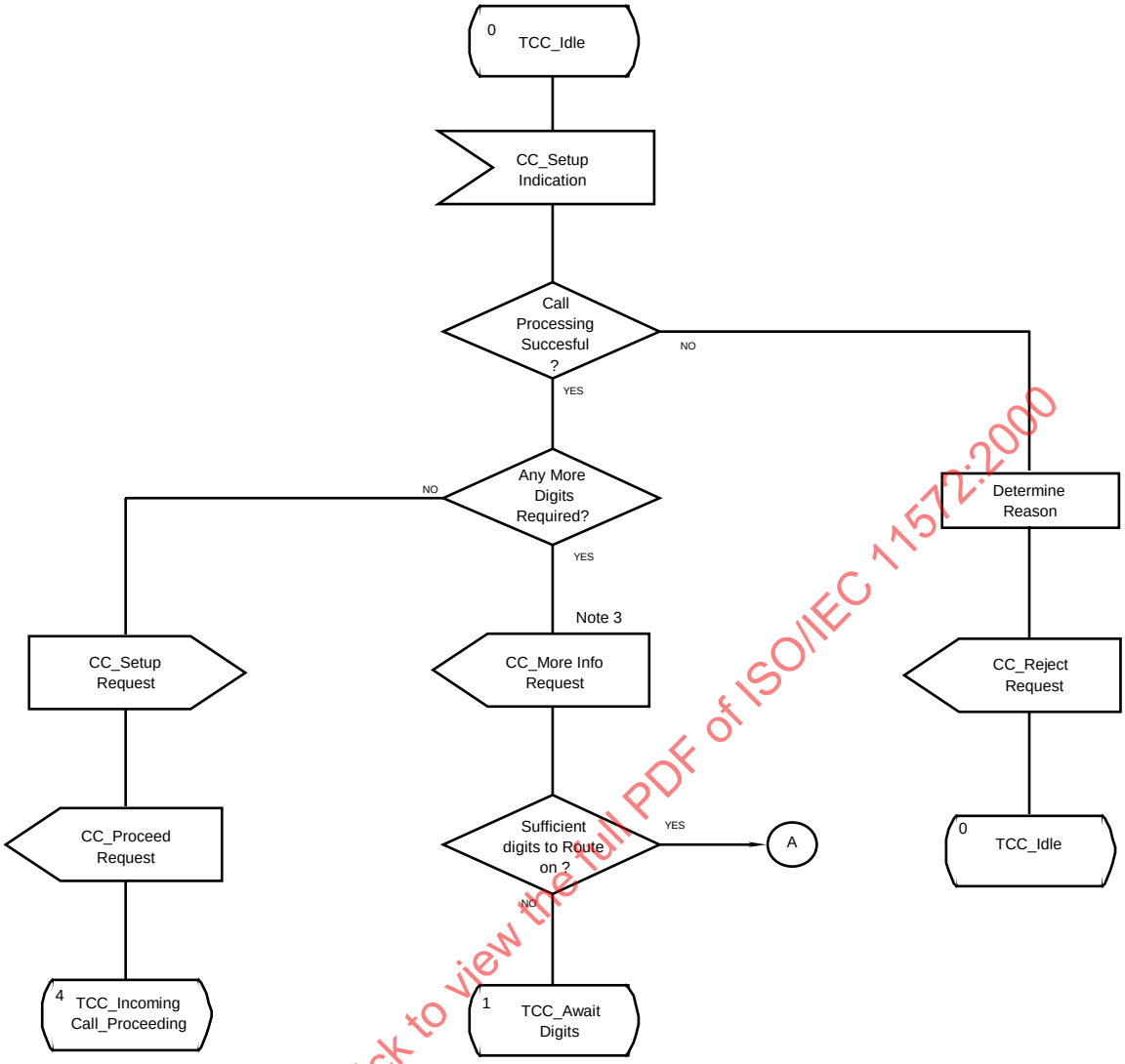

Figure F.2 - Transit Call Control SDL diagram (sheet 1 of 19)

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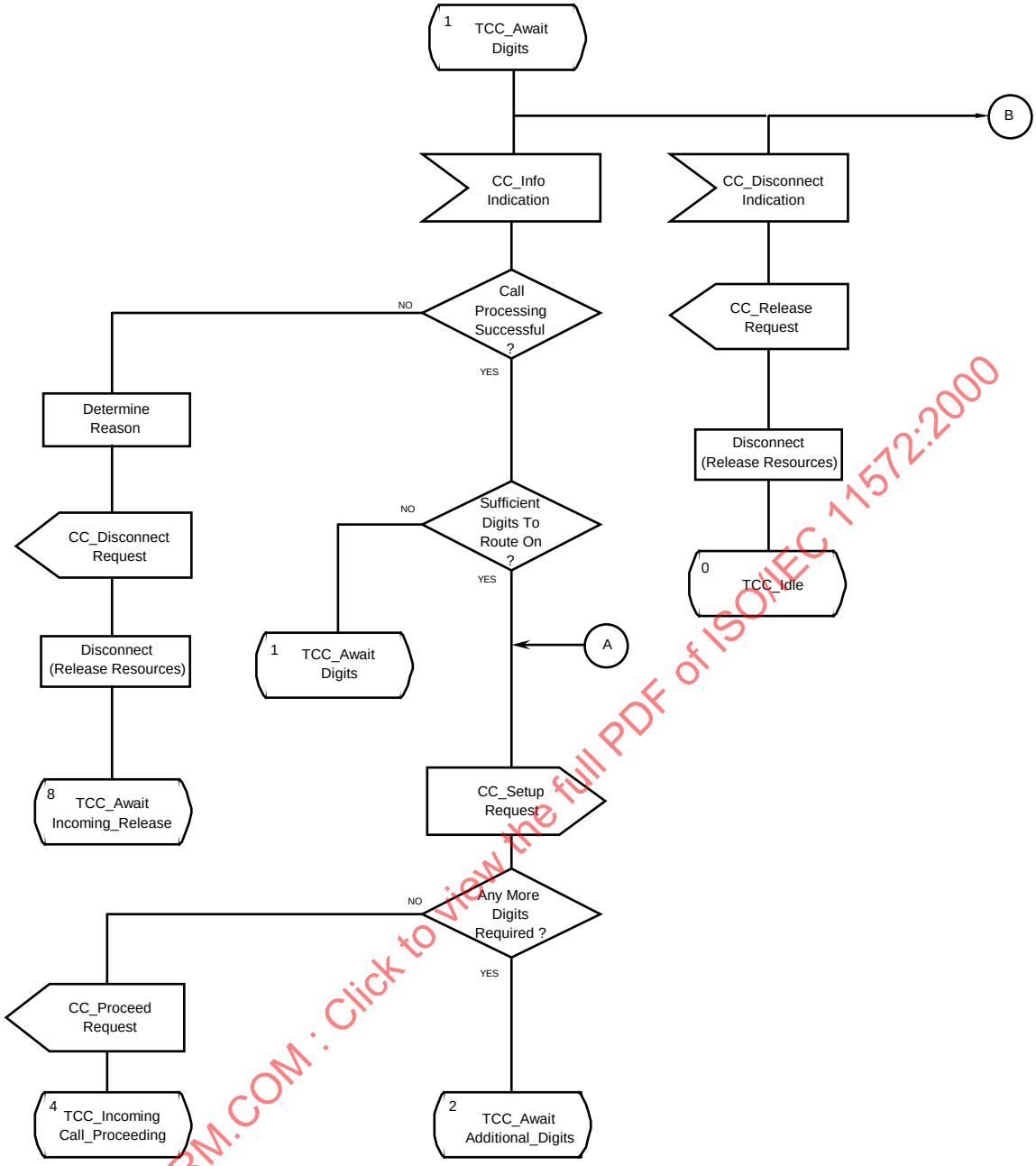

Figure F.2 - Transit Call Control SDL diagram (sheet 2 of 19) (continued)

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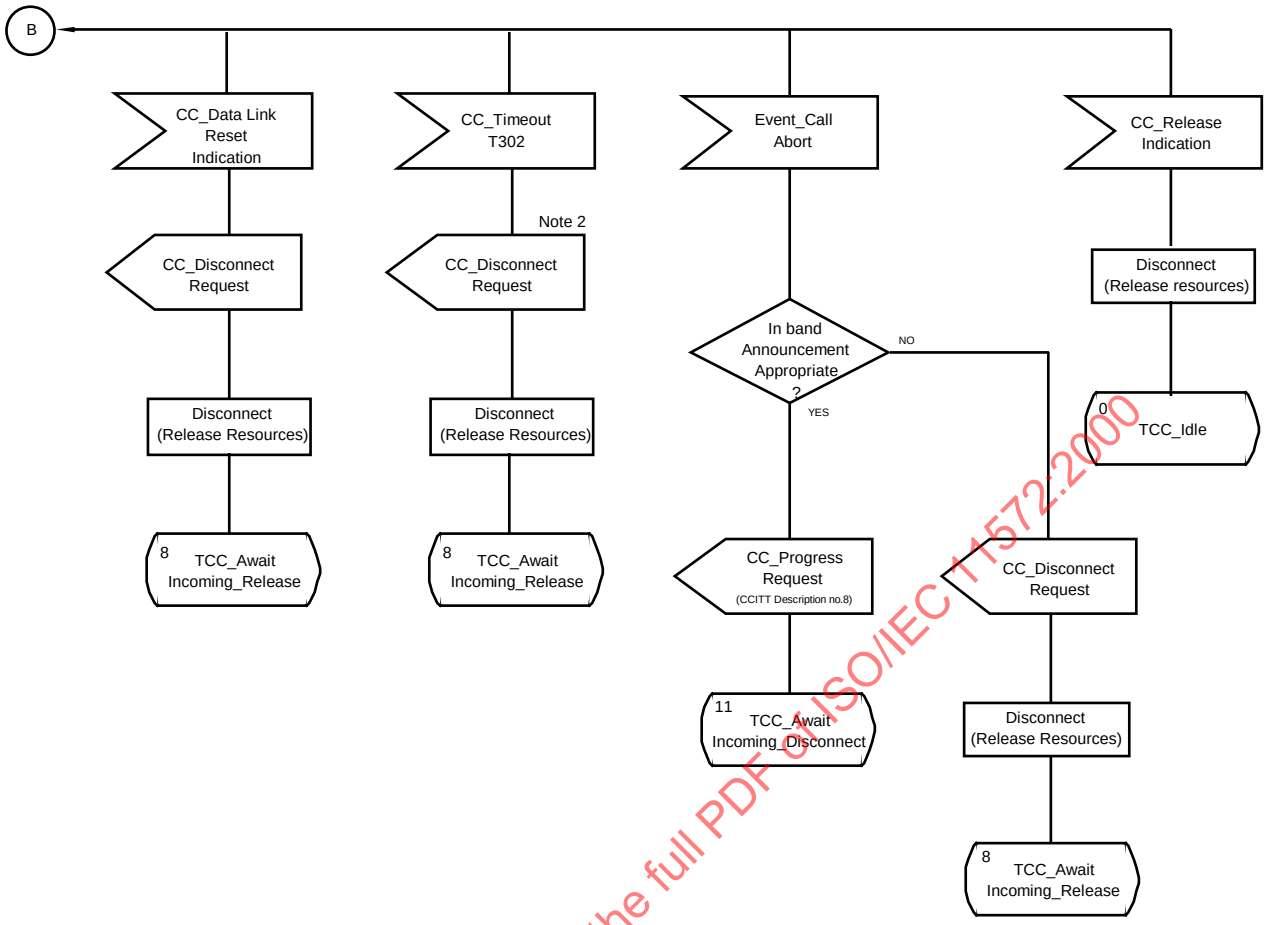

Figure F.2 - Transit Call Control SDL diagram (sheet 3 of 19) (continued)

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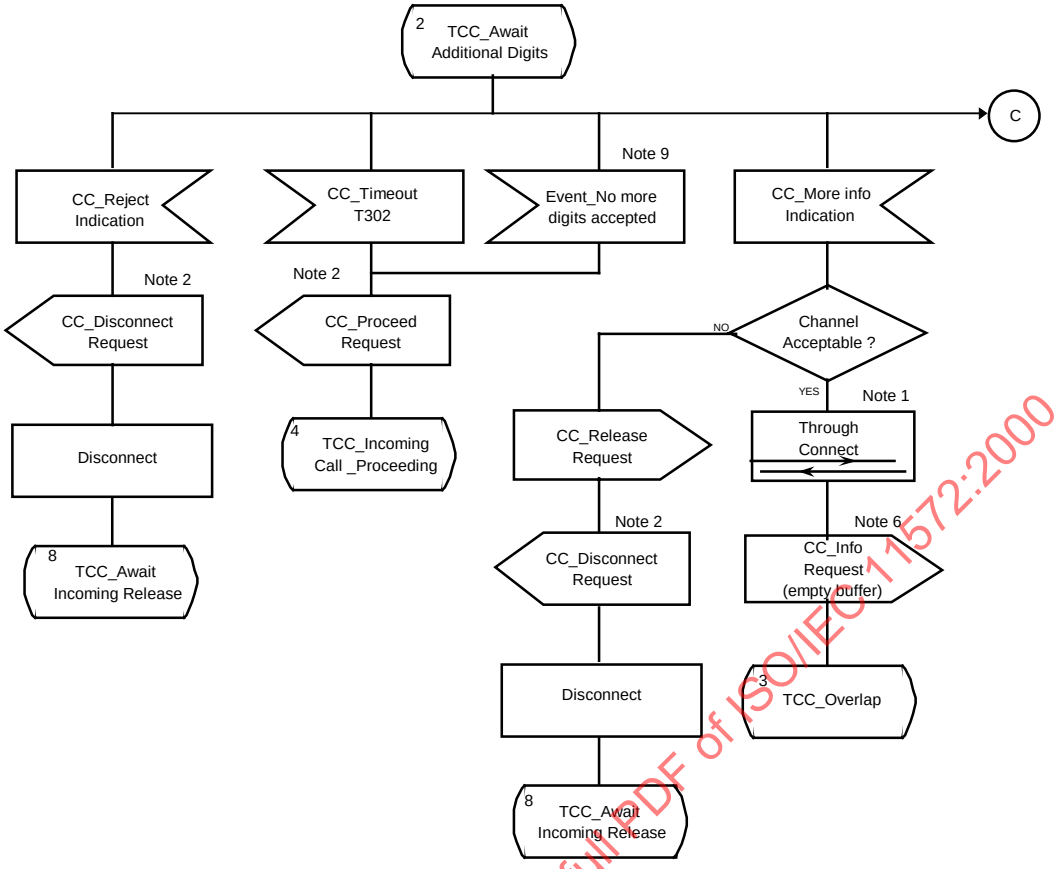

Figure F.2 - Transit Call Control SDL diagram (sheet 4 of 19) (continued)

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