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INTERWORKING OF SIGNALLING SYSTEMS

INTERWORKING OF SIGNALLING SYSTEM No. 7 ISUP, TUP AND SIGNALLING SYSTEM No. 6 USING ARROW DIAGRAMS

ITU-T Recommendation Q.698

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation Q.698 was prepared by the ITU-T Study Group XI (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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INTERWORKING OF SIGNALLING SYSTEM No. 7 ISUP, TUP AND SIGNALLING SYSTEM No. 6 USING ARROW DIAGRAMS

(Helsinki, 1993)

1 General

1.1 Introduction

This Recommendation defines the use of arrow diagrams to provide a comprehensive view of the signalling handshake between ISDN-UP and other common channel signalling systems. The use of primitives as defined in Recommendation Q.699 is also included to gain a further level of understanding in an interworking situation. Detailed signalling interworking information still has to refer to the signalling procedures defined in respective Recommendations.

1.2 Scope

This Recommendation provides arrow diagrams for basic calls in which ISDN-UP interworks with other common channel signalling systems. National options are not covered whereas supplementary services are for further study. Typical selective interworking cases are dealt with and references are made to relevant Recommendations. Mapping tables are used to cover interworking situations where there is no one to one correspondence between signals of different common channel signalling systems.

1.3 Relationship to other Recommendations

References to other Recommendations are made to clarify the procedures in a number of interworking cases. The following Recommendations are referred to in this Recommendation: Q.118, Q.254-Q.268, Q.699, Q.722-Q.725, Q.762-Q.764.

2 Methodology

The interworking model used in this Recommendation is essentially the same as defined in 2.2/Q.699. The use of primitives is also consistent with that interworking model. The symbols used in this Recommendation are described in Table 1.

3 Interworking arrow diagrams for successful call set-up

3.1 Signalling System No. 6 to Signalling System No. 7 ISUP

3.1.1 Normal call with calling party disconnect

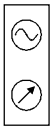
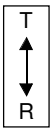
Figure 1 shows normal call set-up. When the calling party sends a CLF, the call is cleared. An REL message (Cause 16) is sent to the succeeding exchange indicating normal clearing.

3.1.2 Normal call with called party disconnect

Figure 2 shows normal call set-up. When the called party hangs up, a CLB1 signal is sent to the preceding exchange indicating normal call clearing.

TABLE 1/Q.698

Symbols used

	Reservation of an incoming/outgoing circuit without through connection
	Disconnection of path through the exchange
	Through connection of path in both directions
	Release of circuit
	Indicates I/C and O/G primitives are unconditionally related
	Continuity check transceiver
	Loop for continuity check
(CI)	Continuity check required in nature of connection indicators
(NI)	Network initiated in suspend/resume indicators

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3.2 ISUP to Signalling System No. 6

3.2.1 Normal call with calling party disconnect

Figure 3 shows normal call set-up. When an REL message (Cause 16) is received from the preceding exchange, a CLF signal is sent to the succeeding exchange to indicate normal call clearing.

3.2.2 Normal call with called party disconnect

Figure 4 shows normal call set-up. When the called party hangs up, a CLB1 signal is received from the succeeding exchange. An SUS message is then sent to the preceding exchange to indicate normal call clearing.

3.3 Signalling System No. 7 TUP to ISUP

3.3.1 Normal call with calling party disconnect

Figure 5 shows normal call set-up. When the calling party sends a CLF, the call is cleared. An REL message (Cause 16) is sent to the succeeding exchange indicating normal clearing.

3.3.2 Normal call with called party disconnect

Figure 6 shows normal call set-up. When the called party hangs up, a CLB signal is sent to the preceding exchange indicating normal call clearing.

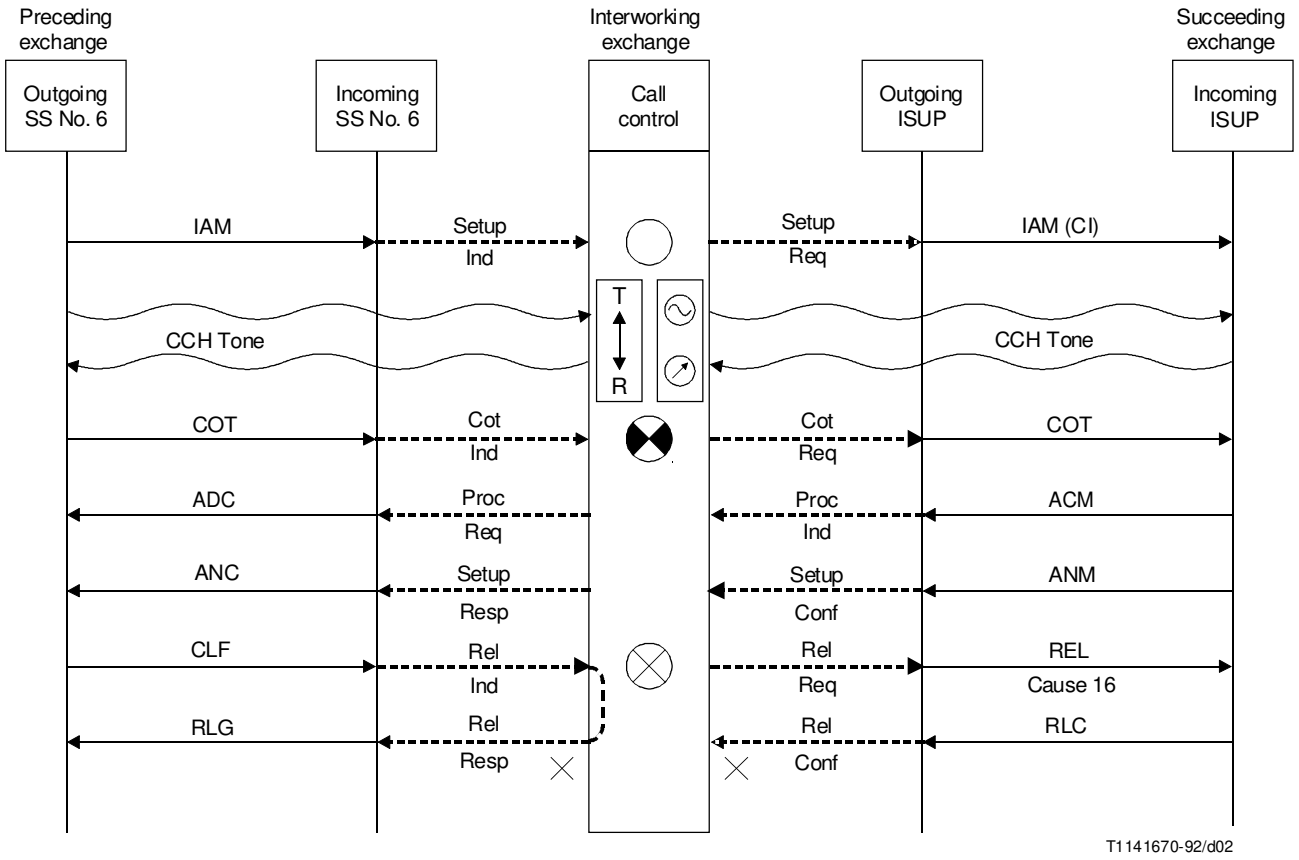
3.4 Signalling System No. 7 ISUP to TUP

3.4.1 Normal call with calling party disconnect

Figure 7 shows normal call set-up. When the calling party sends a Release Message (REL), the call is cleared. A CLF message is sent to the succeeding exchange indicating normal clearing.

3.4.2 Normal call with called party disconnect

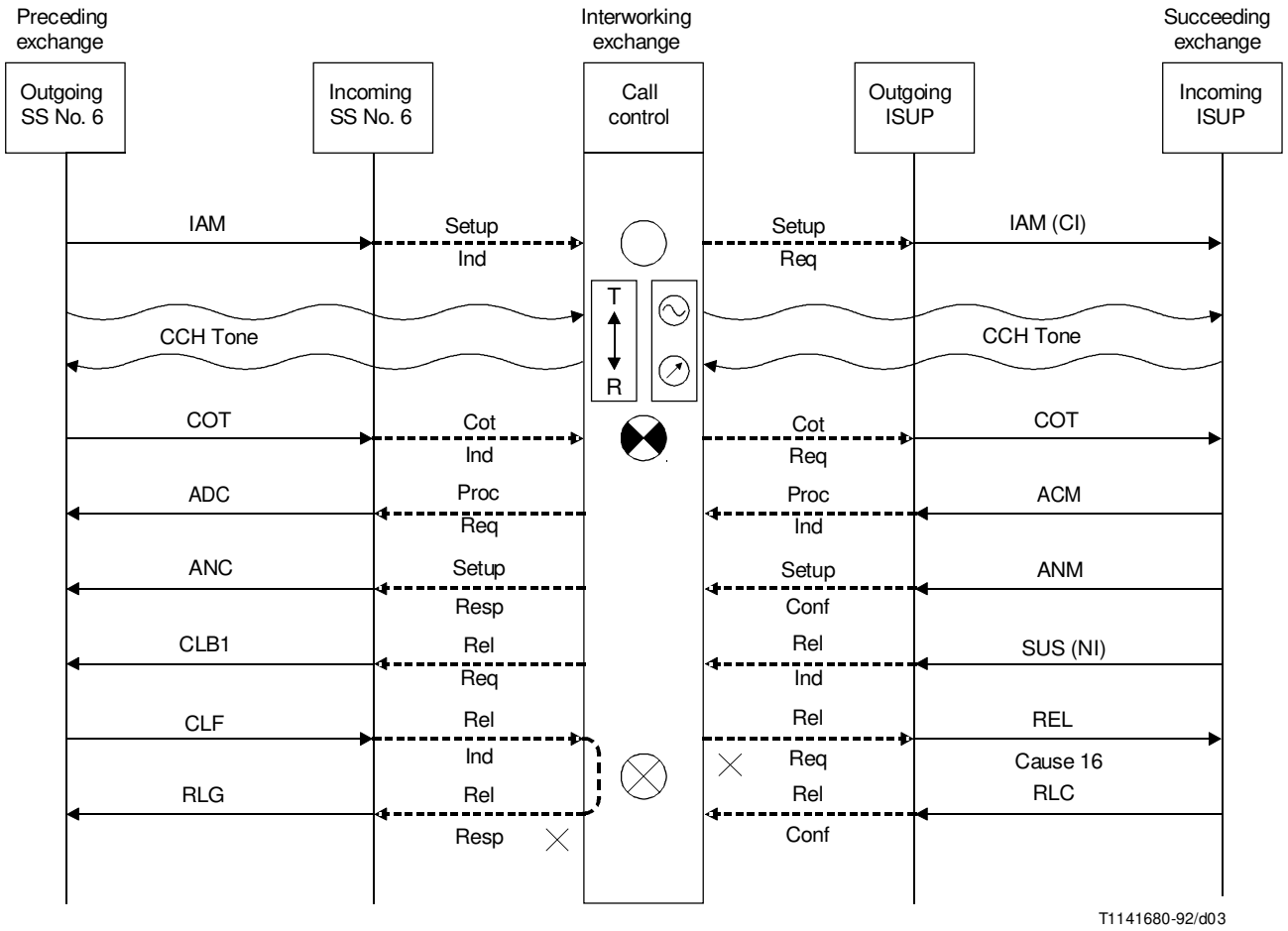
Figure 8 shows normal call set-up. When the called party hangs up, an SUS signal is sent to the preceding exchange indicating normal call clearing.



NOTE – Cause 16 = Normal clearing.

FIGURE 1/Q.698

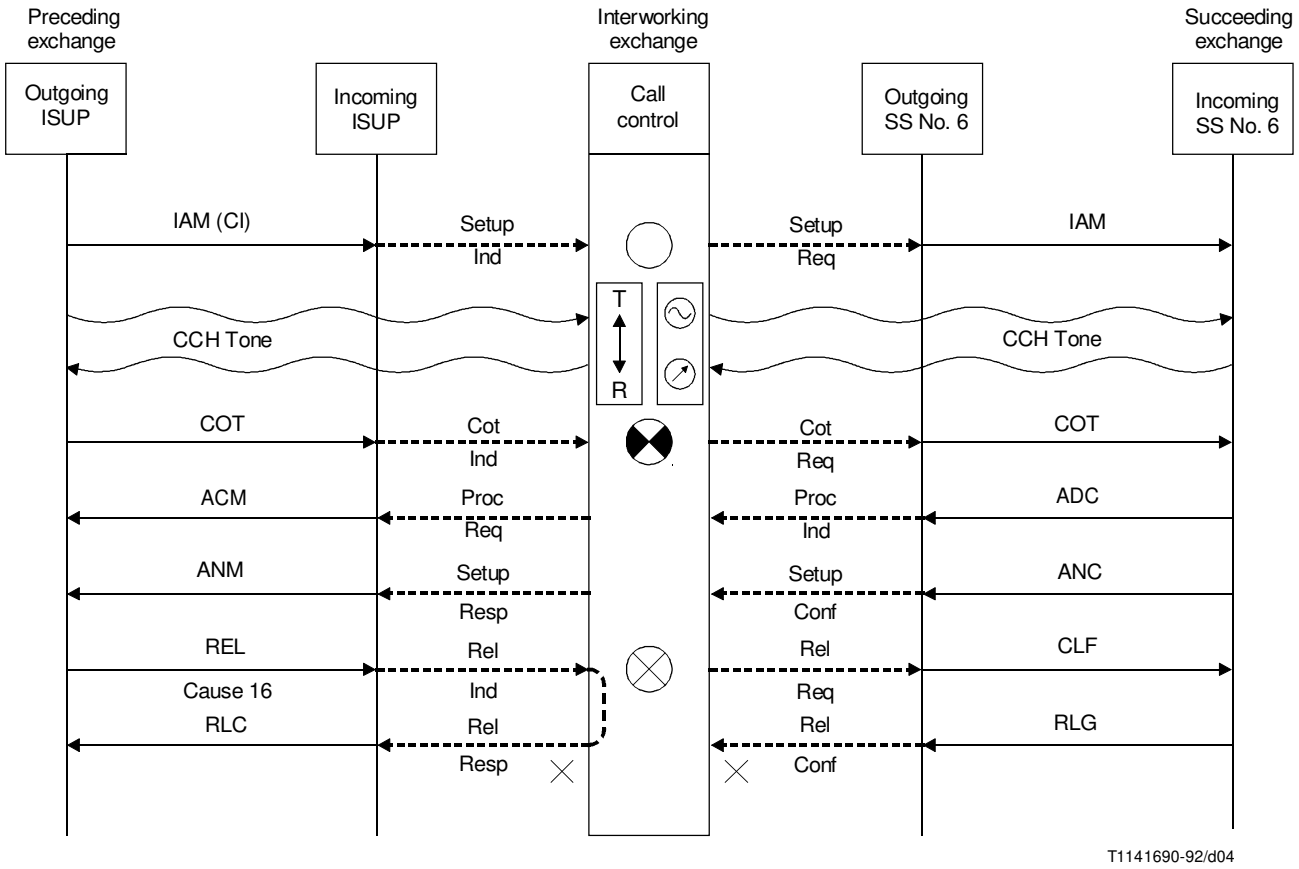
SS No. 6 to ISDN-UP
Normal call with calling party disconnect



NOTE – Cause 16 = Normal clearing.

FIGURE 2/Q.698

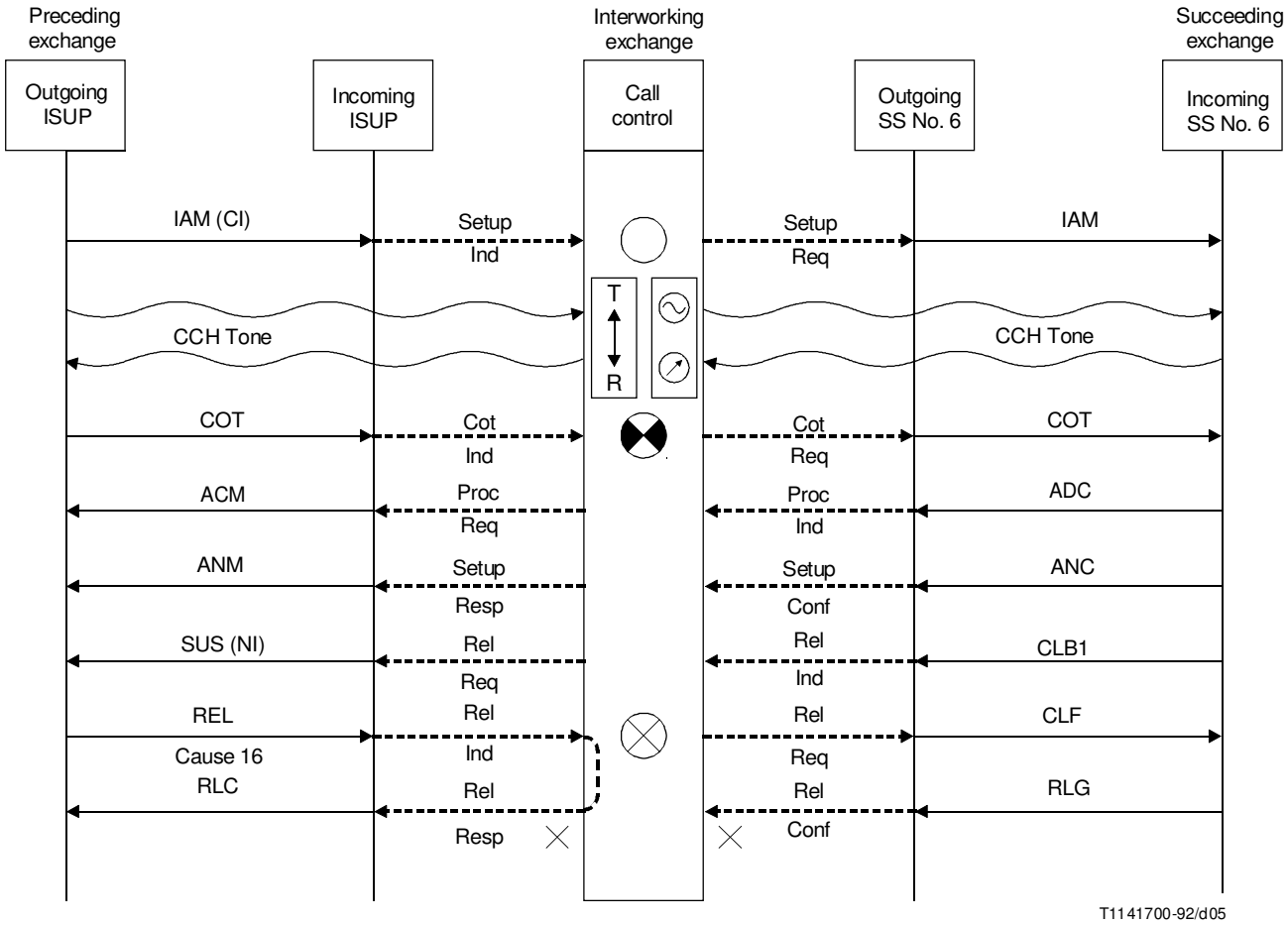
SS No. 6 to ISDN-UP
Normal call with called party disconnect



NOTE – Cause 16 = Normal clearing.

FIGURE 3/Q.698

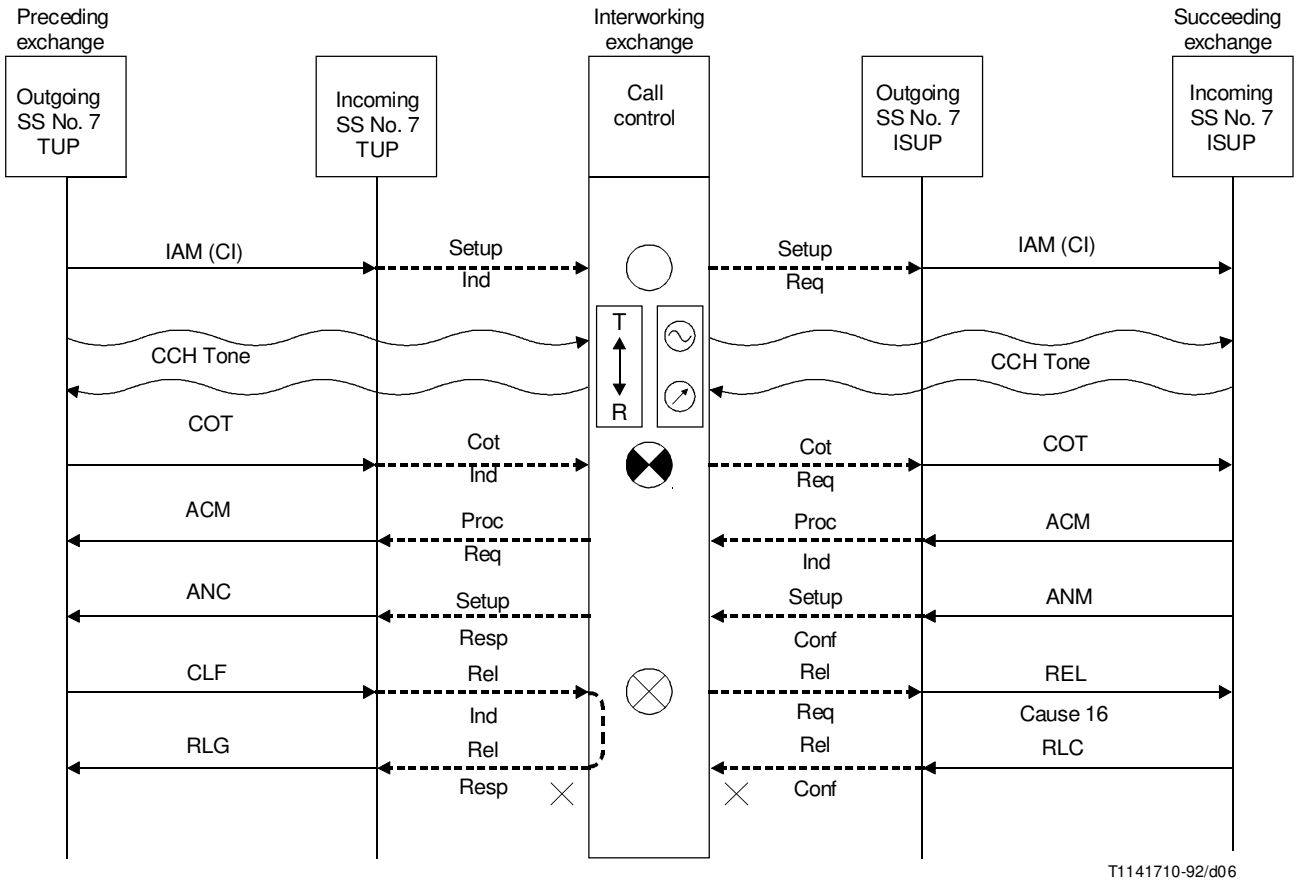
ISDN-UP to SS No. 6
Normal call with calling party disconnect



NOTE – Cause 16 = Normal clearing by calling party before T_6 expires [2.5.1.3 c)/Q.767].

FIGURE 4/Q.698

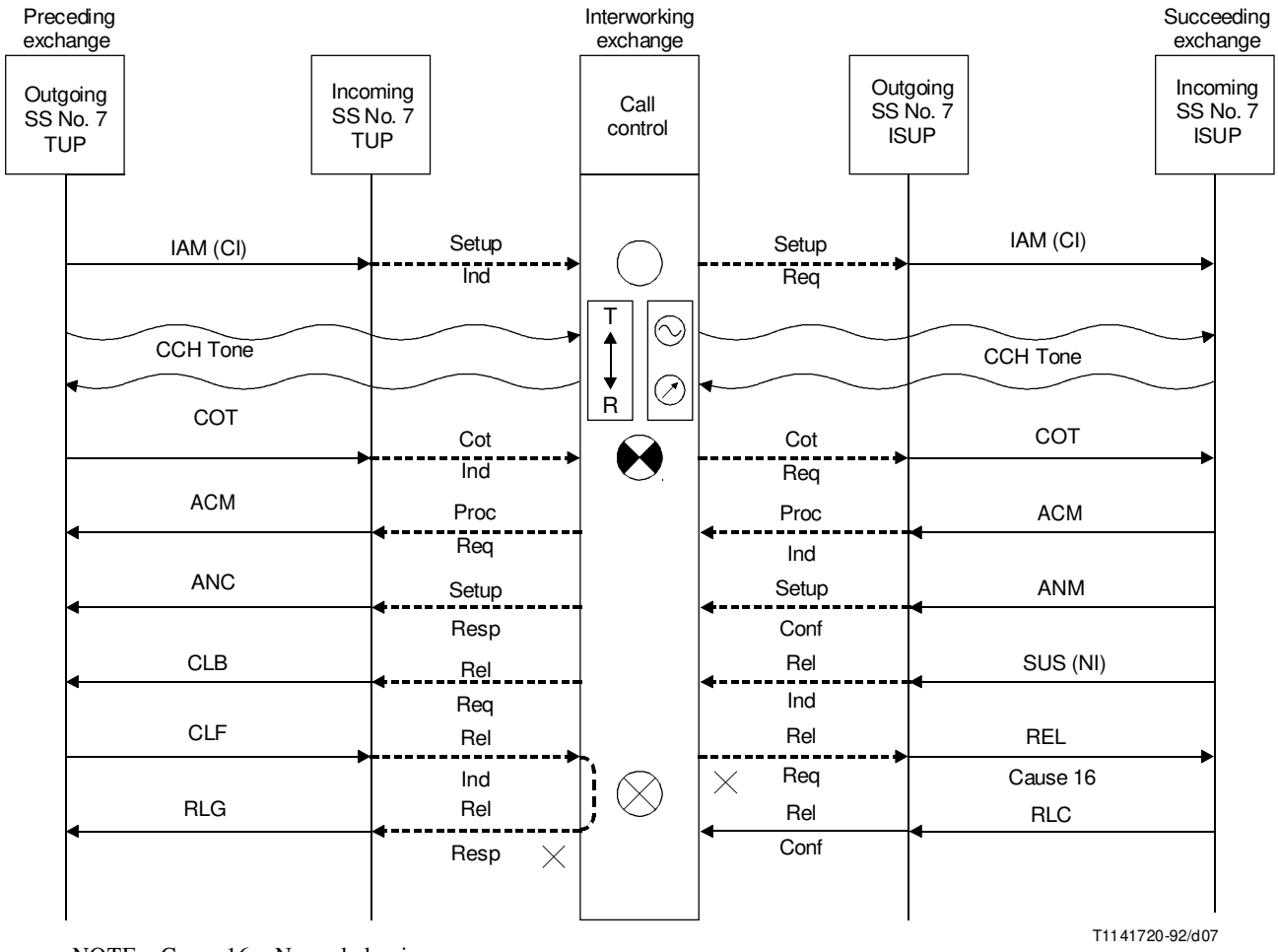
ISDN-UP to SS No. 6
Normal call with called party disconnect



NOTE – Cause 16 = Normal clearing.

FIGURE 5/Q.698

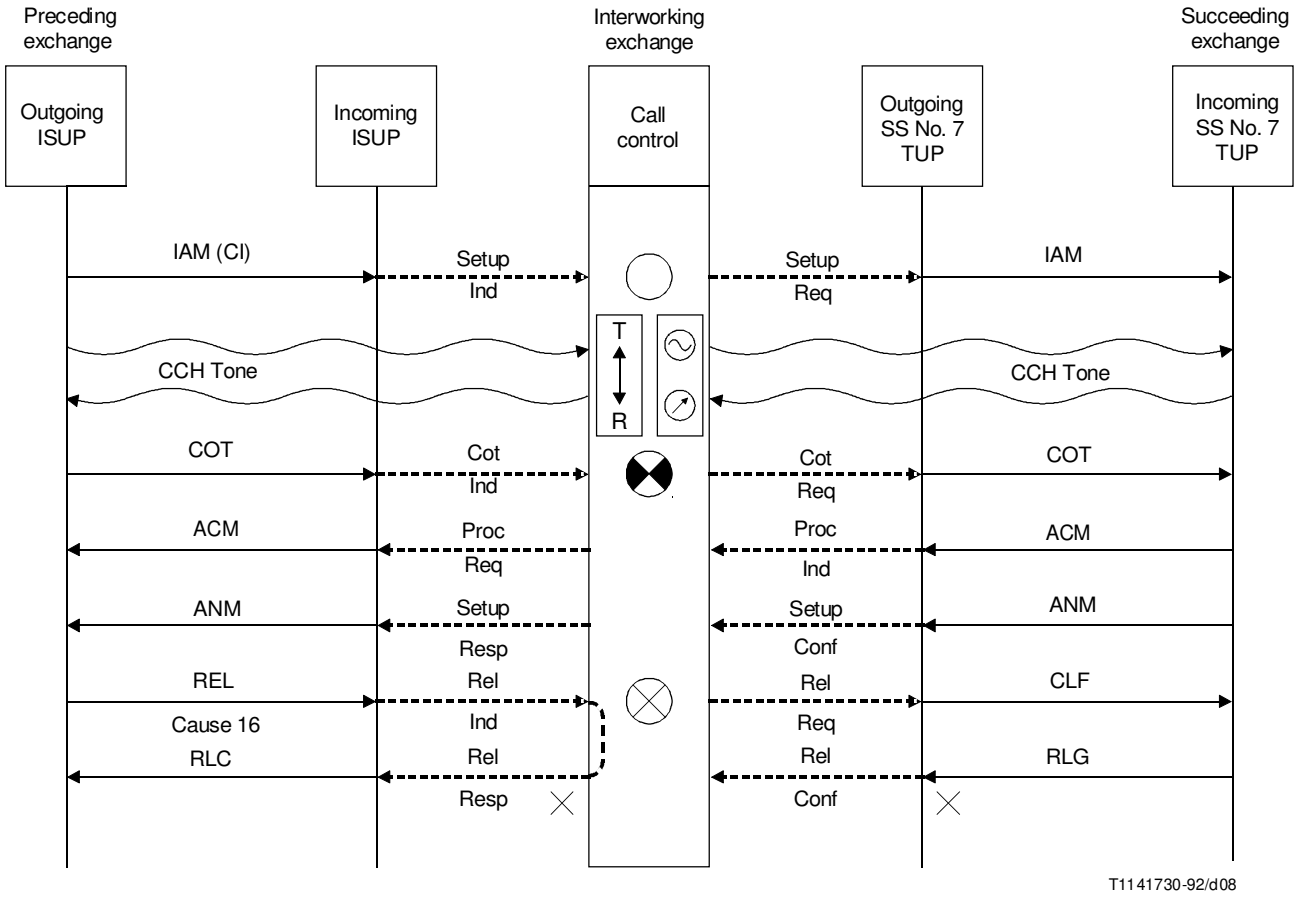
SS No. 7 TUP to ISUP
Normal call with calling party disconnect



NOTE – Cause 16 = Normal clearing.

FIGURE 6/Q.698

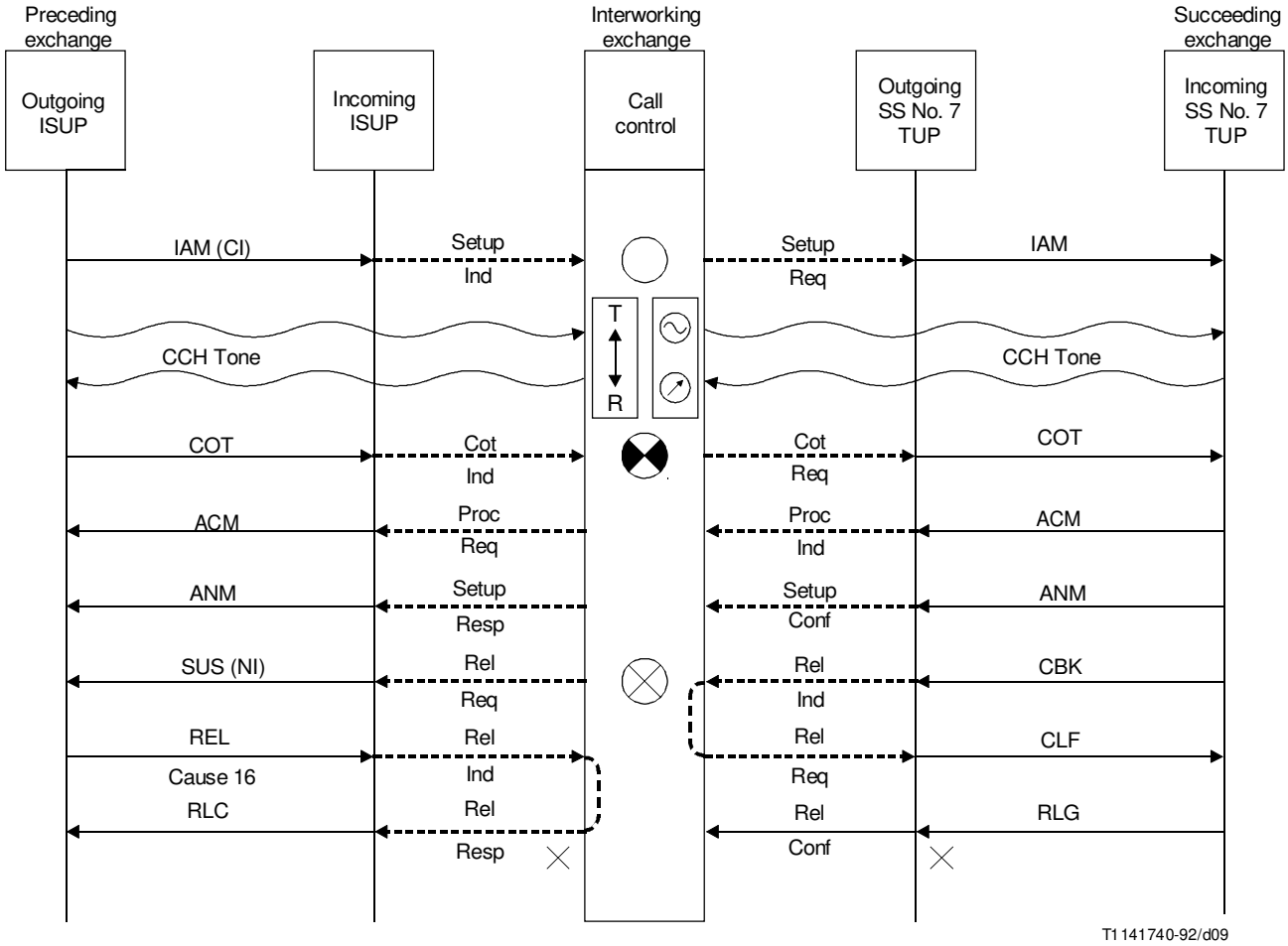
SS No. 7 TUP to ISUP
Normal call with called party disconnect



NOTE – Cause 16 = Normal clearing.

FIGURE 7/Q.698

Interworking of Signalling System No. 7 ISUP to No. 7 TUP
Normal call with calling party disconnect



NOTE – Cause 16 = Normal clearing by called party before T_6 expires (2.5.1.3. c)/Q.767.

FIGURE 8/Q.698

Interworking of Signalling System No. 7 ISUP to No. 7 TUP
Normal call with calling party disconnect

4 Interworking arrow diagrams for unsuccessful call set-up

4.1 Signalling System No. 6 to ISUP

4.1.1 Continuity failure on an incoming No. 6 circuit

Figure 9 shows the check-tone not being looped within its timeout period of two seconds. A BLO signal is issued by the preceding exchange. After the reception of a BLA signal, the CLF/RLG sequence is exchanged. On the outgoing side, an REL message (Cause 127) is sent to the succeeding exchange. The RLC message completes the release sequence. A repeat attempt is made on another circuit by the preceding exchange.

4.1.2 Continuity failure on an outgoing ISDN-UP circuit

Figure 10 shows the failure to receive the continuity check-tone from the succeeding exchange within its timeout period of two seconds. A COT (failure) message is sent to the succeeding exchange. A repeat attempt will be made on another circuit and it is assumed that the repeat attempt also fails. In such a case of double failure, a CFL (call failure) signal is sent to the preceding exchange. On the incoming side, a CLF/RLG sequence completes the signalling sequence.

4.1.3 Release signal received before address complete

Figure 11 shows the REL message received from the succeeding exchange. The cause value in the message will determine which CCITT No. 6 signal will be sent to the preceding exchange. The mapping table in the same figure shows this information. An RLC message is sent to the succeeding exchange. On the incoming side, a CLF/RLG sequence completes the signalling sequence.

4.1.4 Timeout on address complete message

Figure 12 shows the failure to receive an ACM signal within its 20-30 second timeout. A REL message (Cause 31) is sent to the succeeding exchange indicating the failure condition. On the incoming side, a CFL (call failure) signal is sent to the preceding exchange. Then, a CLF/RLG sequence completes the signalling sequence.

4.1.5 Timeout on answer message

Figure 13 shows the failure to receive an ANM message within its 1.5-3 minute timeout. After the timeout period, the call is cleared in both directions. A call failure message (CFL) is sent to the preceding exchange and the REL message (Cause 19) is sent to the succeeding exchange. An RLC message is then returned by the succeeding exchange. On the incoming side, RLG signal is returned on receipt of CLF signal.

4.1.6 Reset circuit received before ACM

Figure 14 shows the RSC signal received before the succeeding exchange sends back the ACM message. An RLC message is sent to the succeeding exchange and a repeat attempt is made on another circuit.

4.1.7 Reset circuit received after ACM

Figure 15 shows the RSC message received after the succeeding exchange sends back the ACM message. An RLC message is sent to the succeeding exchange. On the incoming side, a CFL signal is sent to the preceding exchange. Then, a CLF/RLG sequence completes the signalling sequence.

4.1.8 Dual seizure (controlling exchange)

Figure 16 shows the IAM message received from the succeeding exchange in a dual seizure situation. The incoming IAM message is ignored and call set-up continues as if it were a normal call.

4.1.9 Dual seizure (non-controlling exchange)

Figure 17 shows the IAM message received from the succeeding exchange in a dual seizure situation. The incoming IAM message is processed as a normal call. The non-controlling exchange backs off and attempts to set up a call on other circuits of the same or an alternate route.

4.2 ISUP to Signalling System No. 6

4.2.1 Continuity failure on an incoming ISUP circuit

Figure 18 shows the check-tone timing out after its two second timeout period. The preceding exchange issues a COT (failure) message. On the outgoing side, a CLF/RLG sequence completes the signalling sequence.

4.2.2 Continuity failure on an outgoing No. 6 circuit

Figure 19 shows the failure to receive the continuity check-tone from the succeeding exchange within its two second timeout. A BLO signal is sent to the succeeding exchange. When a BLA signal is received, the CLF/RLG sequence is exchanged. A repeat attempt is made on another circuit and it is assumed that the reattempt also fails. In such a case of double continuity failure an REL message (Cause 127) is sent to the preceding exchange. An RLC message completes the signalling sequence.

4.2.3 Congestion signal received after address complete

Figure 20 shows the CGC signal received after ADC signal. On the incoming side an REL message (Cause value 34) is sent to the preceding exchange indicating the congestion condition. An RLC message completes the signalling sequence.

4.2.4 Timeout on address complete message

Figure 21 shows the failure to receive an ADC signal within its 20-30 second timeout. An CLF is sent to the succeeding exchange to clear the call. An RLG is then returned by the succeeding exchange. On the incoming side an REL message (Cause 127) is sent to the preceding exchange to indicate the failure. An RLC message is returned by the preceding exchange to complete the signalling sequence.

4.2.5 Timeout on answer message

Figure 22 shows the failure to receive an ANC message within its 1.5-3 minute timeout. After the timeout period, an REL message (Cause 19) is sent to the preceding exchange and an RLC message is received by the interworking transit to complete the signalling sequence. In parallel, a CLF is sent towards the succeeding exchange.

4.2.6 Reset circuit received before ADC

Figure 23 shows the RSC signal received before the ADC signal is sent back by the succeeding exchange. A CLF signal is sent to the succeeding exchange. After an RLG signal is received, a repeat attempt is made on another circuit.

4.2.7 Reset circuit received after ADC

Figure 24 shows the RSC signal received after the succeeding exchange sends back the ADC signal. A CLF/RLG sequence is exchanged. On the incoming side, an REL message (Cause 31) is sent to the preceding exchange. An RLC message received from the preceding exchange completes the signalling sequence.

4.2.8 Dual seizure (controlling exchange)

Figure 25 shows an IAM signal received from the succeeding exchange in a dual seizure situation. The incoming IAM signal is ignored and call set-up continues as if it were a normal call.

4.2.9 Reset circuit (non-controlling exchange)

Figure 26 shows an IAM signal received from the succeeding exchange in a dual seizure situation. The incoming IAM signal is processed as a normal call. The non-controlling exchange backs off and attempts to set up a call on other circuits of the same or an alternate route.

4.3 Signalling System No. 7 TUP to ISUP

4.3.1 Continuity failure on an incoming Signalling System No. 7 TUP circuit

Figure 27 shows the check-tone not being looped within its timeout period of two seconds. On the outgoing side, an REL message (Cause 31) is sent to the succeeding exchange. The RLC message completes the release sequence. A repeat attempt is made on another circuit by the preceding exchange. On the incoming side, a CCF message is received.

4.3.2 Continuity failure on an outgoing ISDN-UP circuit

Figure 28 shows the failure to receive the continuity check-tone from the succeeding exchange within its timeout period of two seconds. A COT (failure) message is sent to the succeeding exchange. A repeat attempt will be made on another circuit and it is assumed that the repeat attempt also fails. In such a case of double failure, a CFL (call failure) signal is sent to the preceding exchange. On the incoming side, a CLF/RLG sequence completes the signalling sequence.

4.3.3 Release signal received before address complete

Figure 29 shows the REL message received from the succeeding exchange. The cause value in the message will determine which Signalling System No. 7 TUP message will be sent to the preceding exchange. The mapping table in the same figure shows this information. An RLC message is sent to the succeeding exchange. On the incoming side, a CLF/RLG sequence completes the signalling sequence.

4.3.4 Timeout on address complete message

Figure 30 shows the failure to receive an ACM signal within its 20-30 second timeout. An REL message (Cause 31) is sent to the succeeding exchange indicating the failure condition. On the incoming side, a CFL (call failure) signal is sent to the preceding exchange. Then, a CLF/RLG sequence completes the signalling sequence.

4.3.5 Timeout on answer message

Figure 31 shows the failure to receive an ANM message within its 1.5-3 minute timeout. After the timeout period the call is cleared in both directions. A call failure message (CFL) is sent to the preceding exchange and the REL message (Cause 19) is sent to the succeeding exchange. An RLC message is then returned by the succeeding exchange. On the incoming side, RLG signal is returned on receipt of CLF signal.

4.3.6 Reset circuit received before ACM

Figure 32 shows the RSC signal received before the succeeding exchange sends back the ACM message. An RLC message is sent to the succeeding exchange and a repeat attempt is made on another circuit.

4.3.7 Reset circuit received after ACM

Figure 33 shows the RSC message received after the succeeding exchange sends back the ACM message. An RLC message is sent to the succeeding exchange. On the incoming side, a CFL signal is sent to the preceding exchange. Then, a CLF/RLG sequence completes the signalling sequence.

4.3.8 Dual seizure (controlling exchange)

Figure 34 shows the IAM message received from the succeeding exchange in a dual seizure situation. The incoming IAM message is ignored and call set-up continues as if it were a normal call.

4.3.9 Dual seizure (non-controlling exchange)

Figure 35 shows the IAM message received from the succeeding exchange in a dual seizure situation. The incoming IAM message is processed as a normal call. The non-controlling exchange backs off and attempts to set up a call on other circuits of the same or an alternate route.

4.4 Signalling System No. 7 ISUP to TUP

4.4.1 Continuity failure on incoming ISUP circuit

Figure 36 shows the check-tone timing out after its two second timeout period. The preceding exchange issues a COT (failure) message. On the outgoing side, a CLF/RLG sequence completes the signalling sequence.

4.4.2 Continuity failure on an outgoing No. 7 TUP circuit

Figure 37 shows the failure to receive the continuity check-tone from the succeeding exchange within its two second timeout. A CCF signal is sent to the succeeding exchange. A repeat attempt is made on another circuit and it is assumed that the reattempt also fails. In such a case of double continuity failure, an REL message (Cause 127) is sent to the preceding exchange. An RLC message completes the signalling sequence.

4.4.3 Congestion signal received after address complete

Figure 38 shows the CGC signal received after ADC signal. On the incoming side an REL message (Cause value 34) is sent to the preceding exchange indicating the congestion condition. An RLC message completes the signalling sequence.

4.4.4 Timeout on address complete message

Figure 39 shows the failure to receive an ADC signal within its 20-30 second timeout. A CLF is sent to the succeeding exchange to clear the call. An RLG is then returned by the succeeding exchange. On the incoming side an REL message (Cause 127) is sent to the preceding exchange to indicate the failure. An RLC message is returned by the preceding exchange to complete the signalling sequence.

4.4.5 Timeout on answer message

Figure 40 shows the failure to receive an ANC message within its 1.5-3 minute timeout. After the timeout period an REL message (Cause 19) is sent to the preceding exchange and an RLC message is received by the interworking transit to complete the signalling sequence. In parallel, a CLF is sent towards the succeeding exchange.

4.4.6 Reset circuit received before ADC

Figure 41 shows the RSC signal received before the ADC signal is sent back by the succeeding exchange. A CLF signal is sent to the succeeding exchange. After an RLG signal is received, a repeat attempt is made on another circuit.

4.4.7 Reset circuit received after ADC

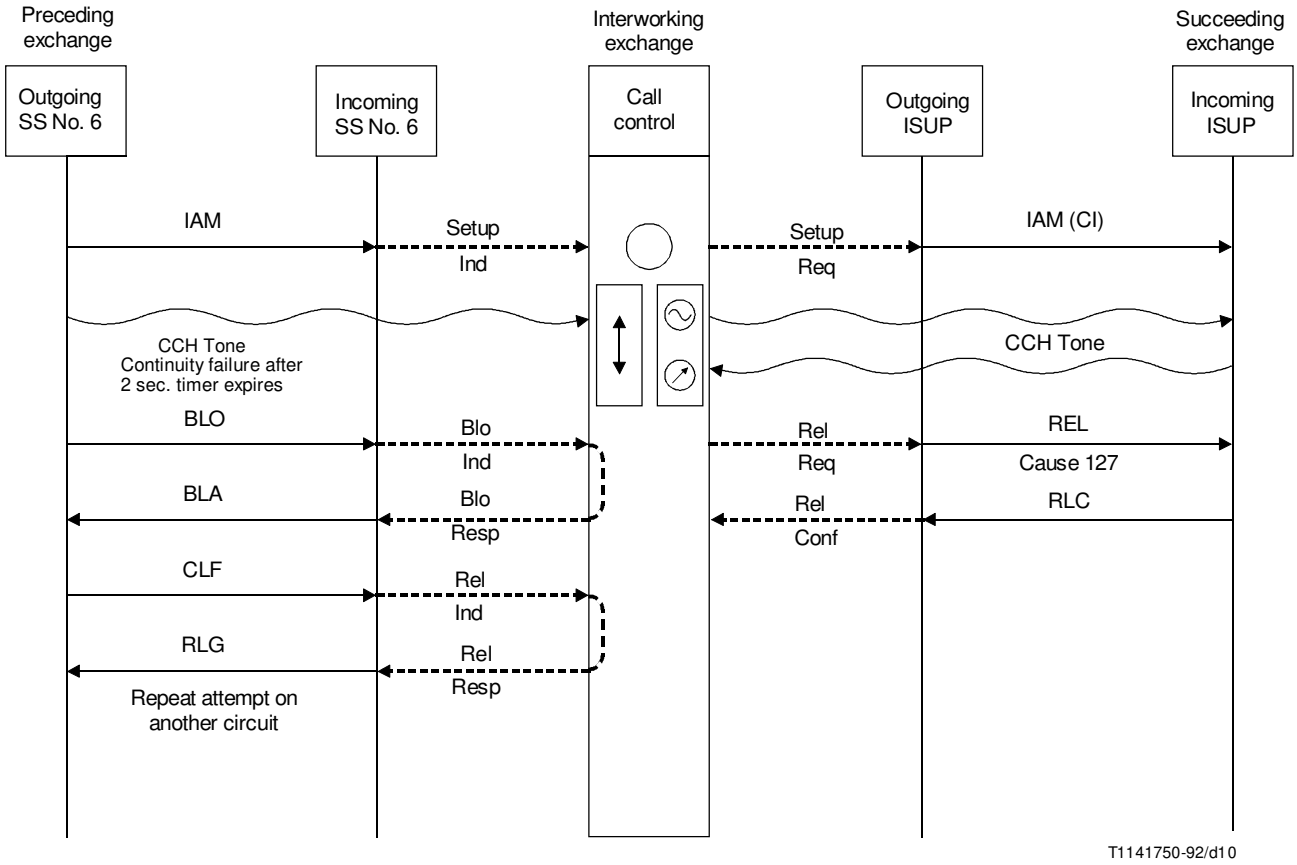
Figure 42 shows the RSC signal received after the succeeding exchange sends back the ADC signal. A CLF/RLG sequence is exchanged. On the incoming side, an REL message (Cause 31) is sent to the preceding exchange. An RLC message received from the preceding exchange completes the signalling sequence.

4.4.8 Dual seizure (controlling exchange)

Figure 43 shows an IAM signal received from the succeeding exchange in a dual seizure situation. The incoming IAM signal is ignored and call set-up continues as if it were a normal call.

4.4.9 Reset circuit (non-controlling exchange)

Figure 44 shows an IAM signal received from the succeeding exchange in a dual seizure situation. The incoming IAM signal is processed as a normal call. The non-controlling exchange backs off and attempts to set up a call on other circuits of the same or an alternate route.



NOTE – Cause 127 = Interworking unspecified.

FIGURE 9/Q.698

SS No. 6 to ISDN-UP
Continuity failure on I/C No. 6 circuit

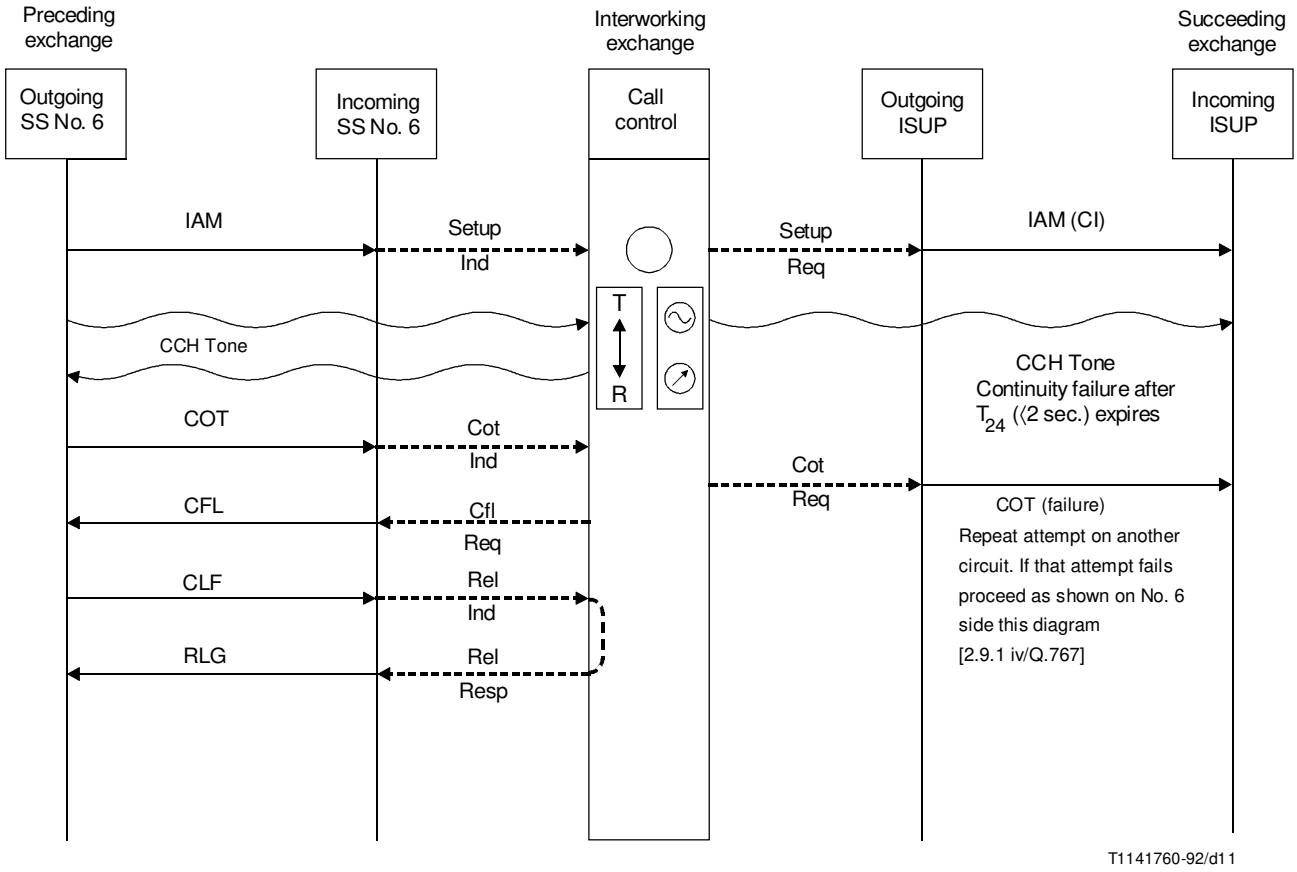
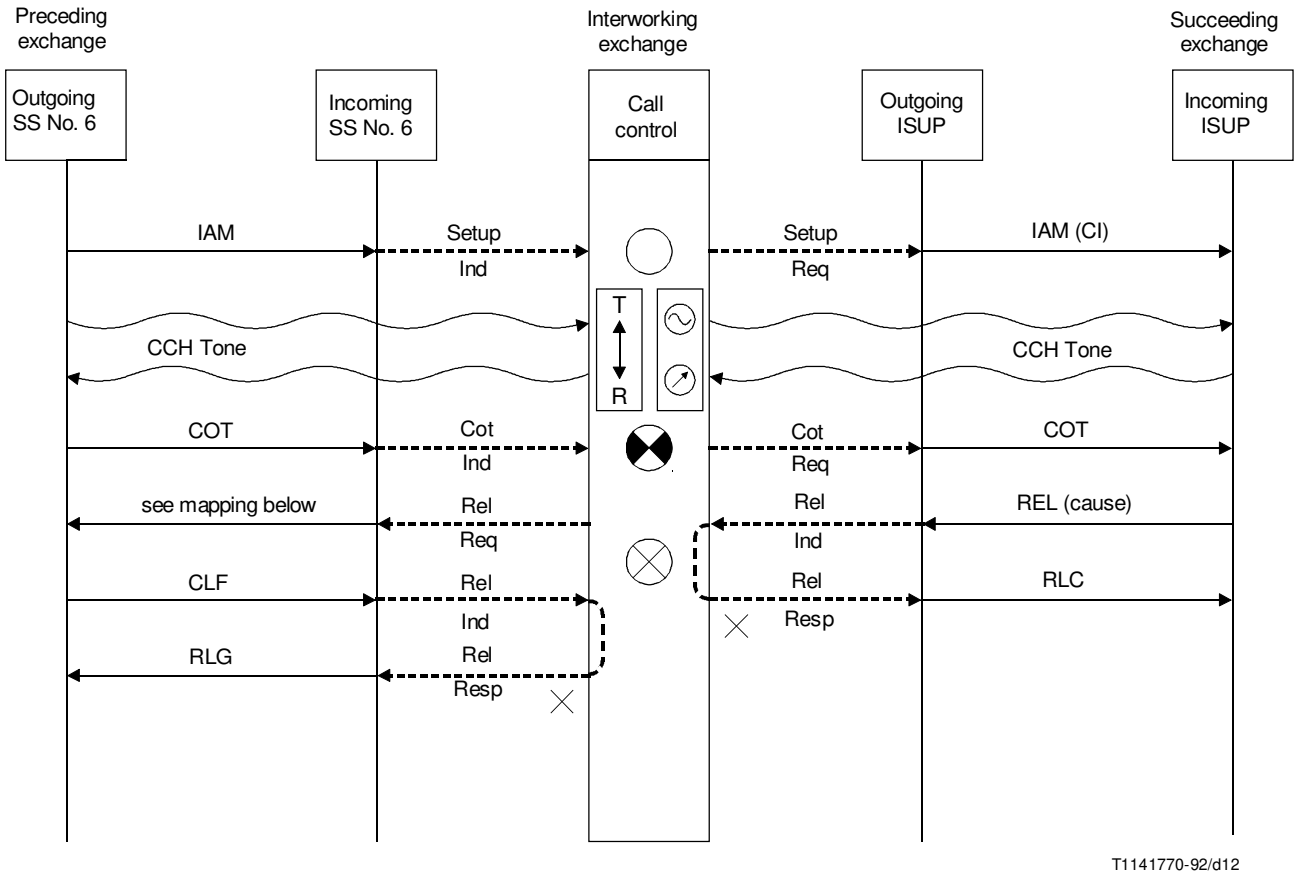


FIGURE 10/Q.698

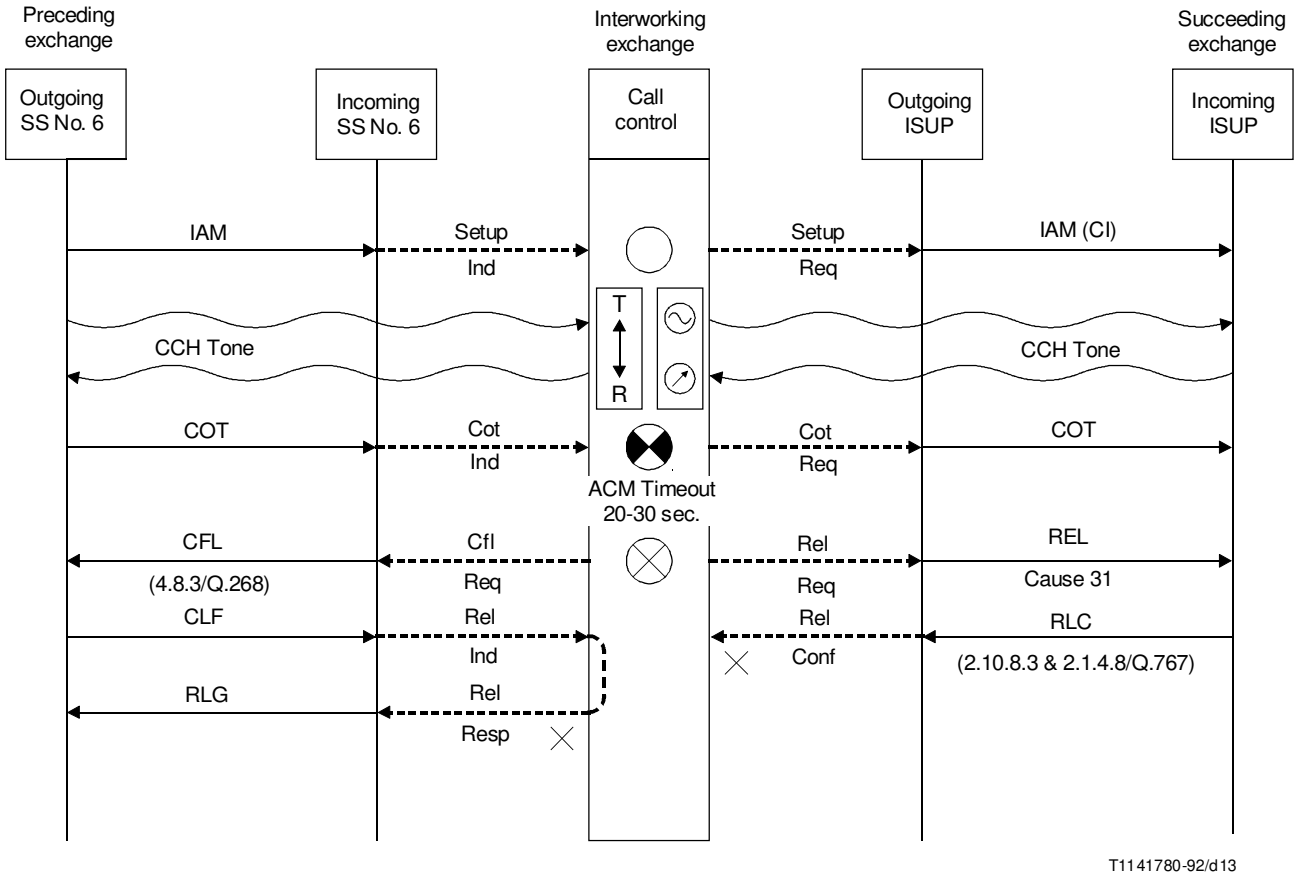
SS No. 6 to ISDN-UP
Continuity failure on outgoing No. 7 circuit



Cause value in REL message	SS No. 6 signal
1	UNN
34	CGC
42	SEC
17	SSB
28	ADI
27	LOS
4	SST
Other	CFL

FIGURE 11/Q.698

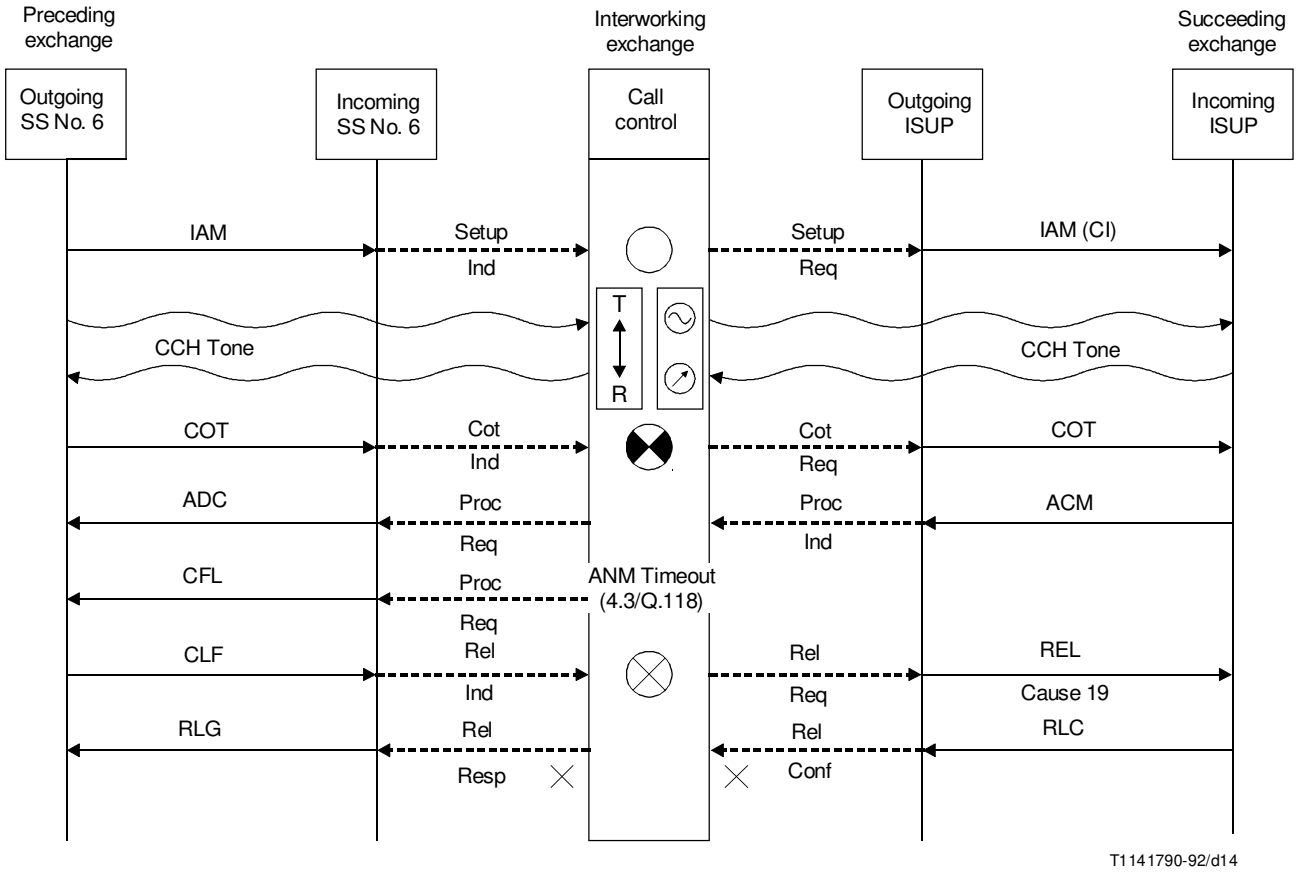
SS No. 6 to ISDN-UP
Release signal received before address complete



NOTE – Cause 31 = Normal unspecified.

FIGURE 12/Q.698

SS No. 6 to ISDN-UP
Timeout on address complete message (ACM)



NOTE – Cause 19 = No answer from user.

FIGURE 13/Q.698

SS No. 6 to ISDN-UP
Timeout on answer message

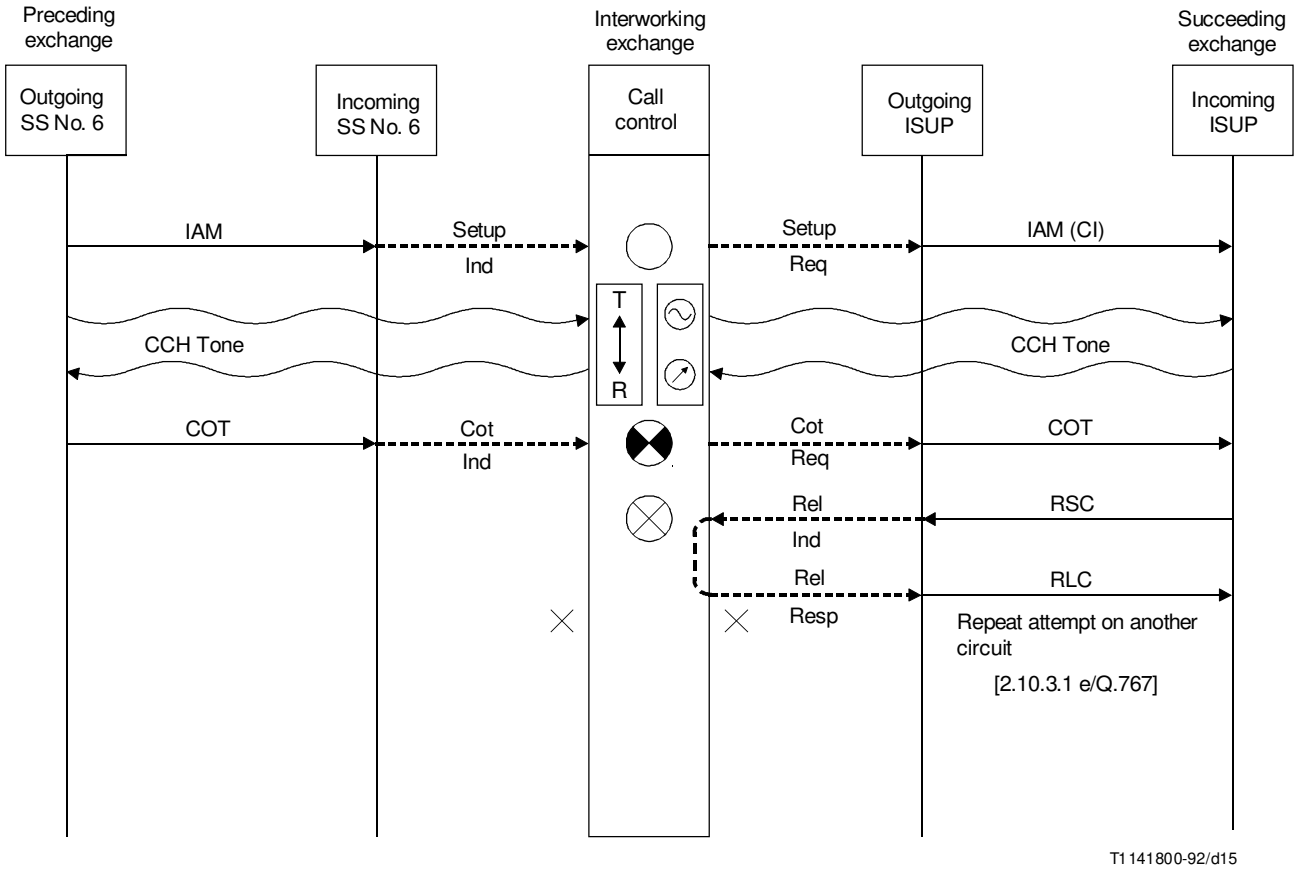


FIGURE 14/Q.698

SS No. 6 to ISDN-UP
Reset circuit received before ACM

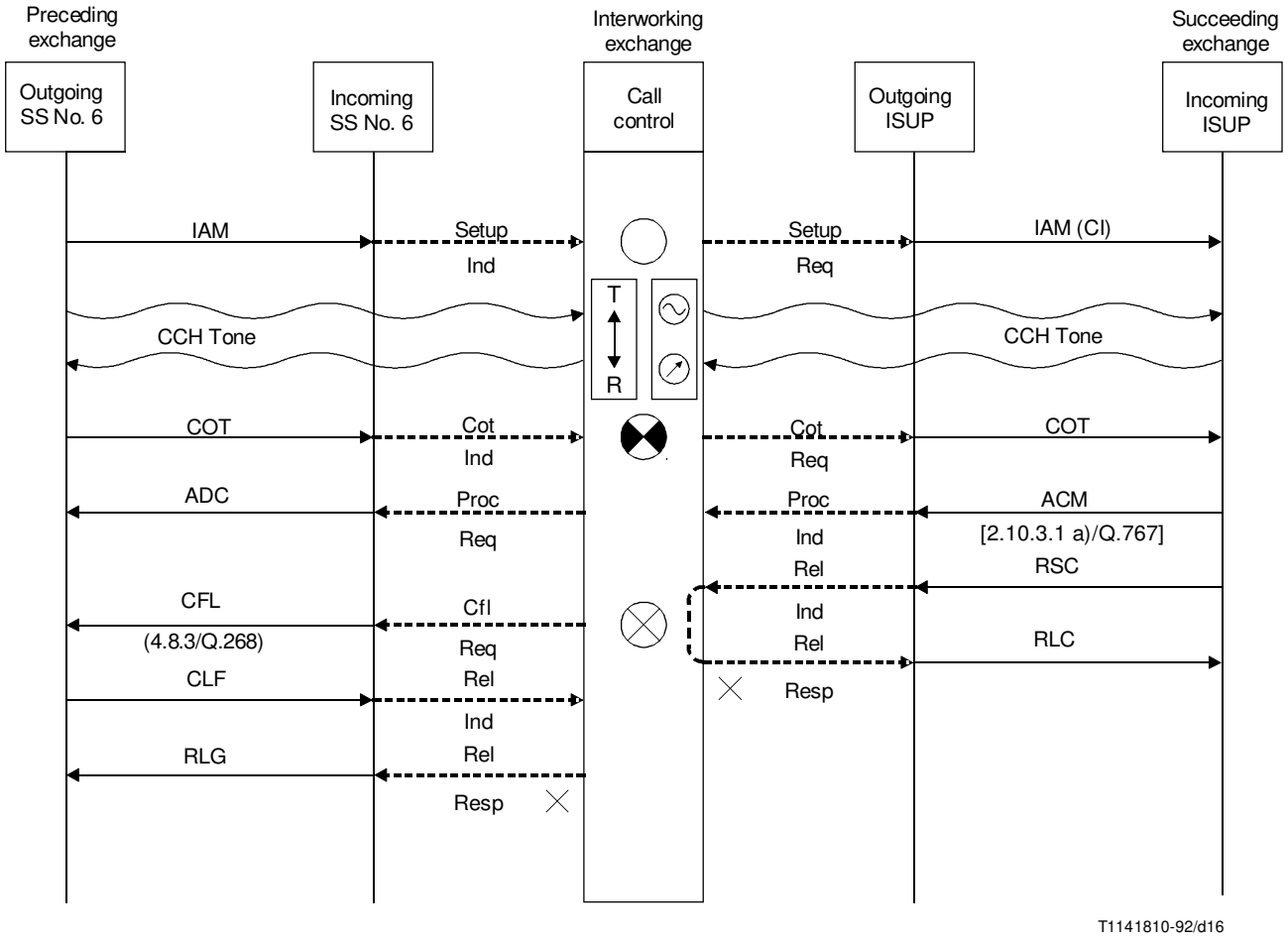


FIGURE 15/Q.698

SS No. 6 to ISDN-UP
Reset circuit received after ACM

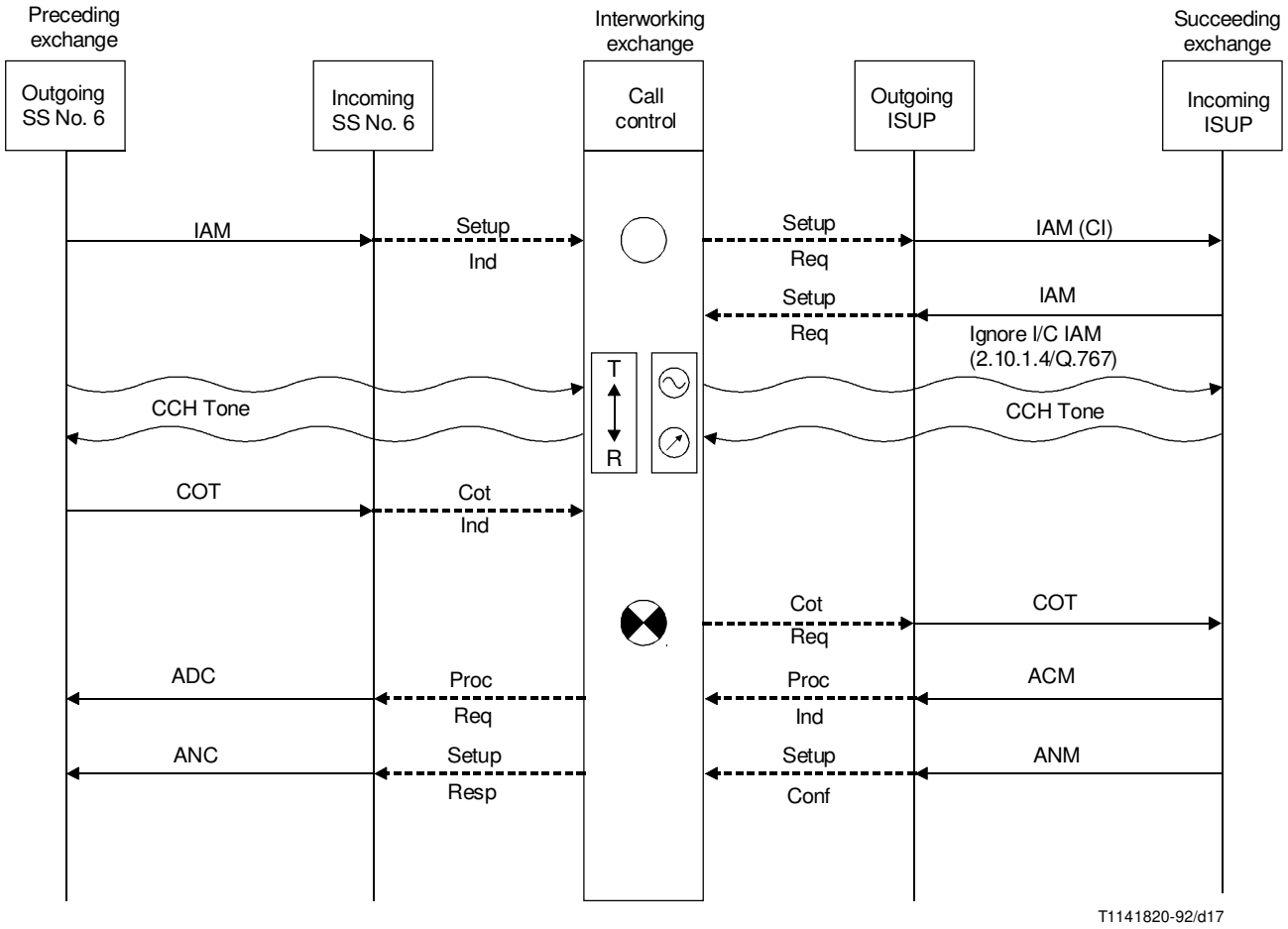


FIGURE 16/Q.698

SS No. 6 to ISDN-UP
Dual seizure (controlling exchange)

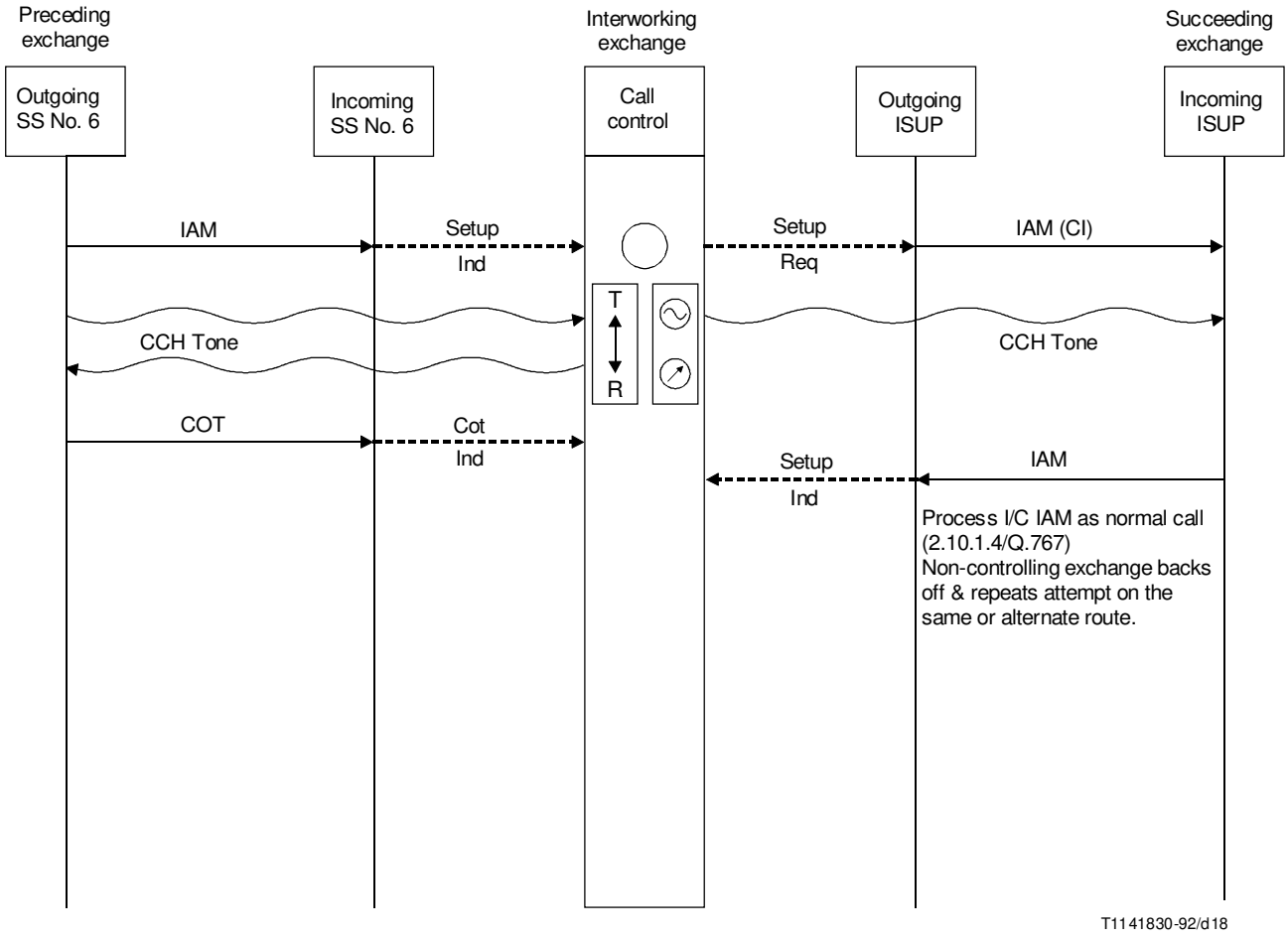


FIGURE 17/Q.698

SS No. 6 to ISDN-UP
Dual seizure (non-controlling exchange)

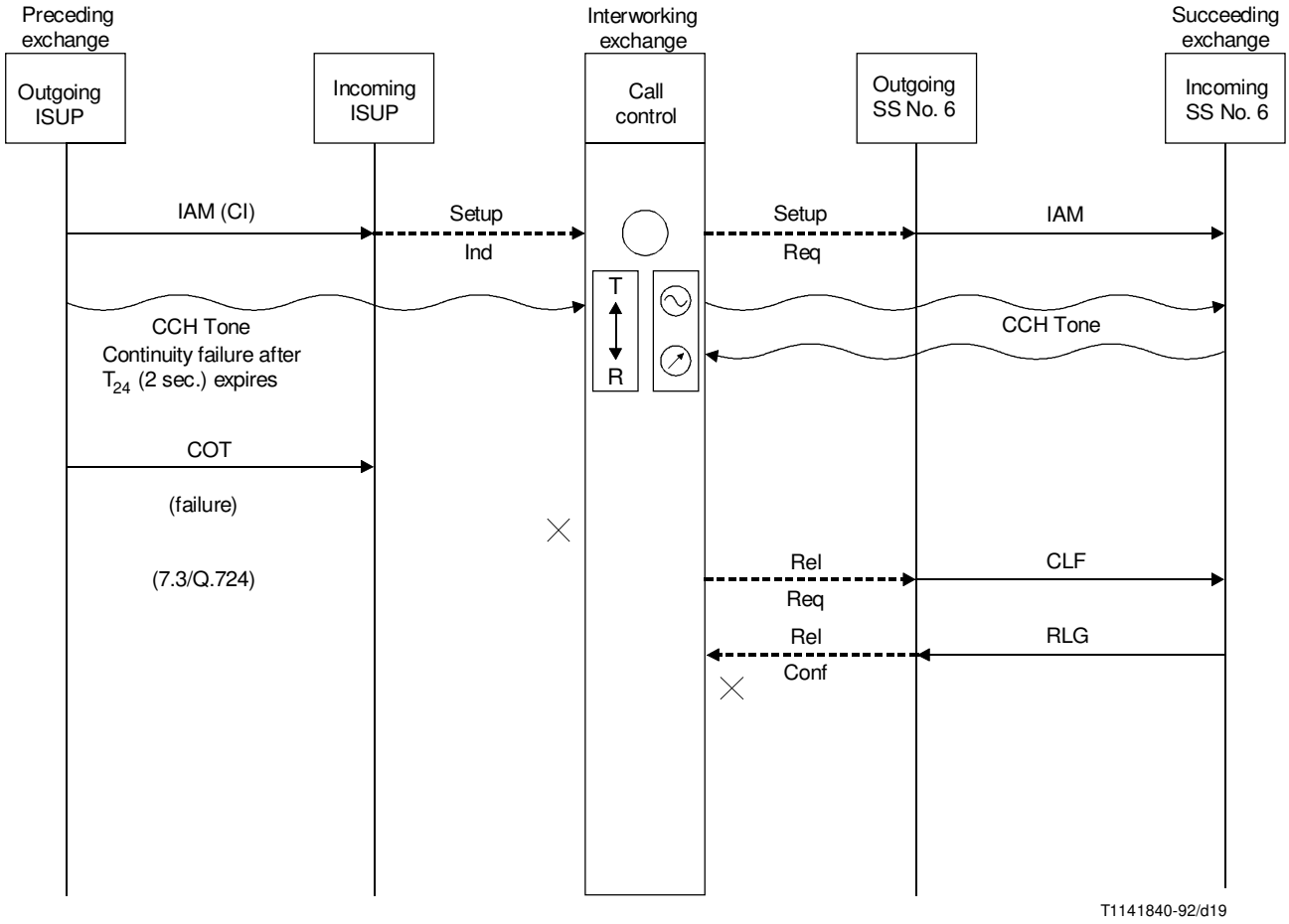
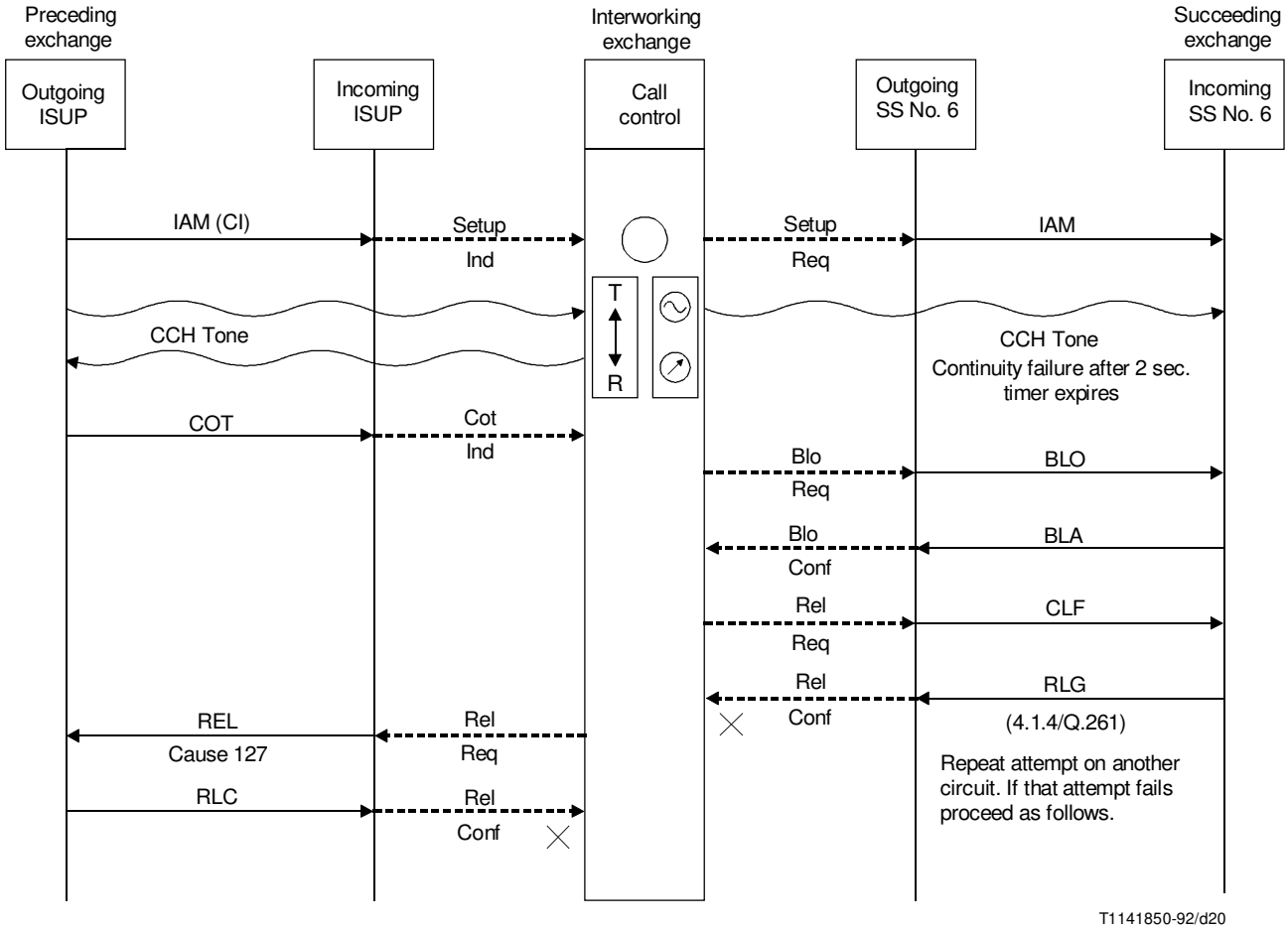


FIGURE 18/Q.698

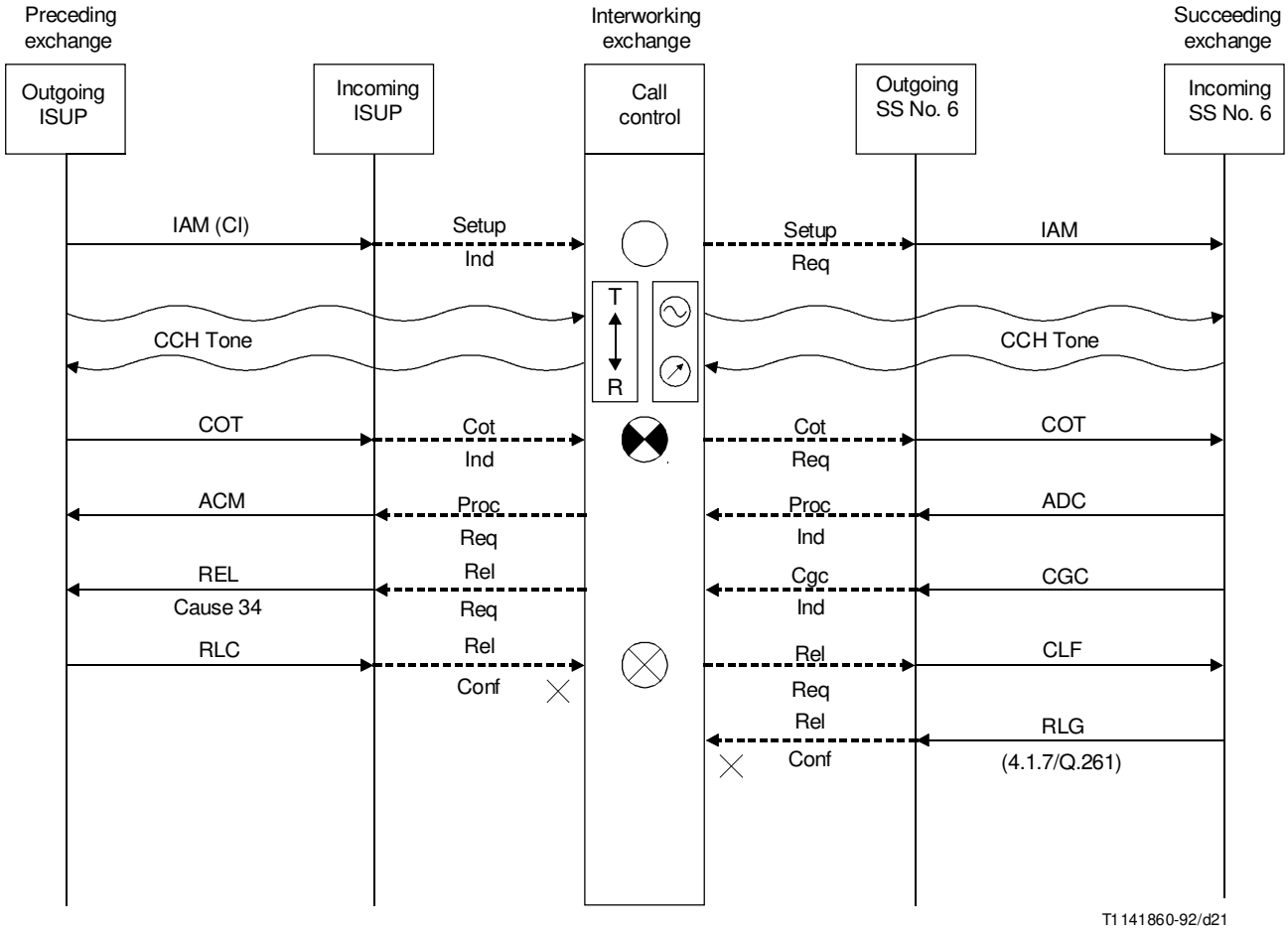
ISDN-UP to SS No. 6
Continuity failure on I/C No. 7 circuit



NOTE – Cause 127 = Interworking unspecified.

FIGURE 19/Q.698

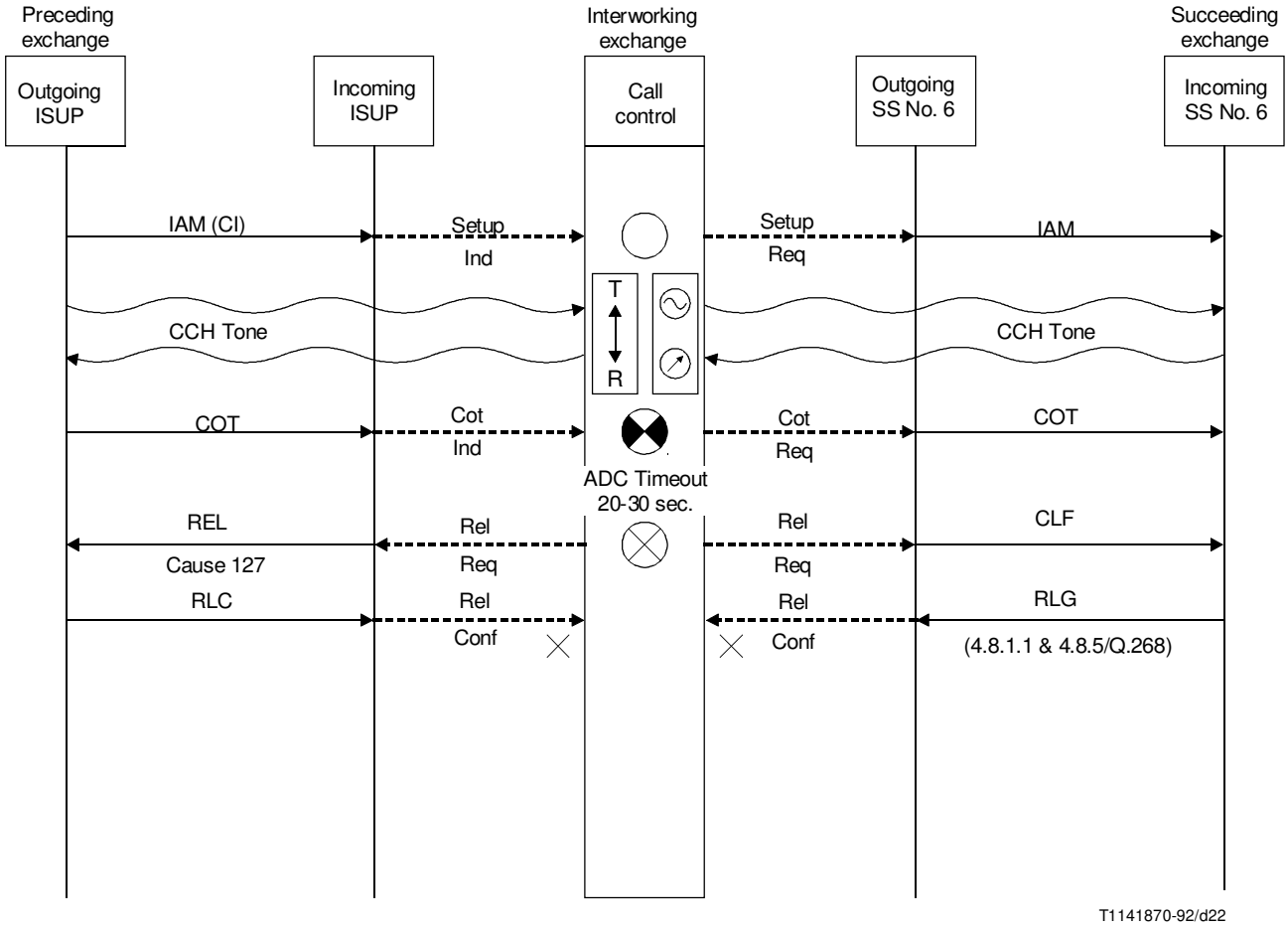
ISDN-UP to SS No. 6
Continuity failure on outgoing No. 6 circuit



NOTE – Cause 34 = No circuits available.

FIGURE 20/Q.698

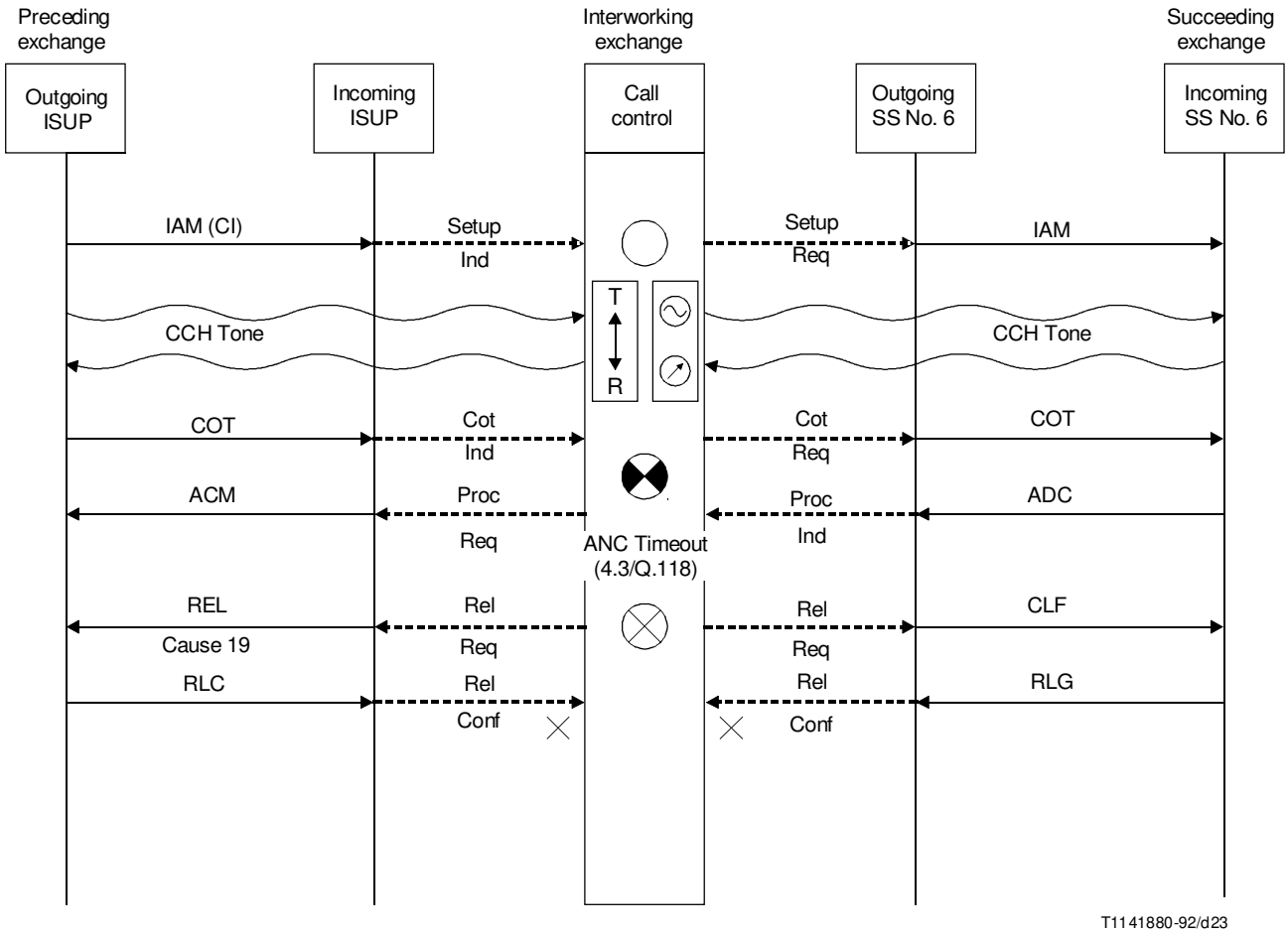
ISDN-UP to SS No. 6
Congestion signal received after address complete



NOTE – Cause 127 = Interworking unspecified.

FIGURE 21/Q.698

ISDN-UP to SS No. 6
Timeout on address complete message (ADC)



NOTE – Cause 19 = No answer from user.

FIGURE 22/Q.698

ISDN-UP to SS No. 6
Timeout on answer message

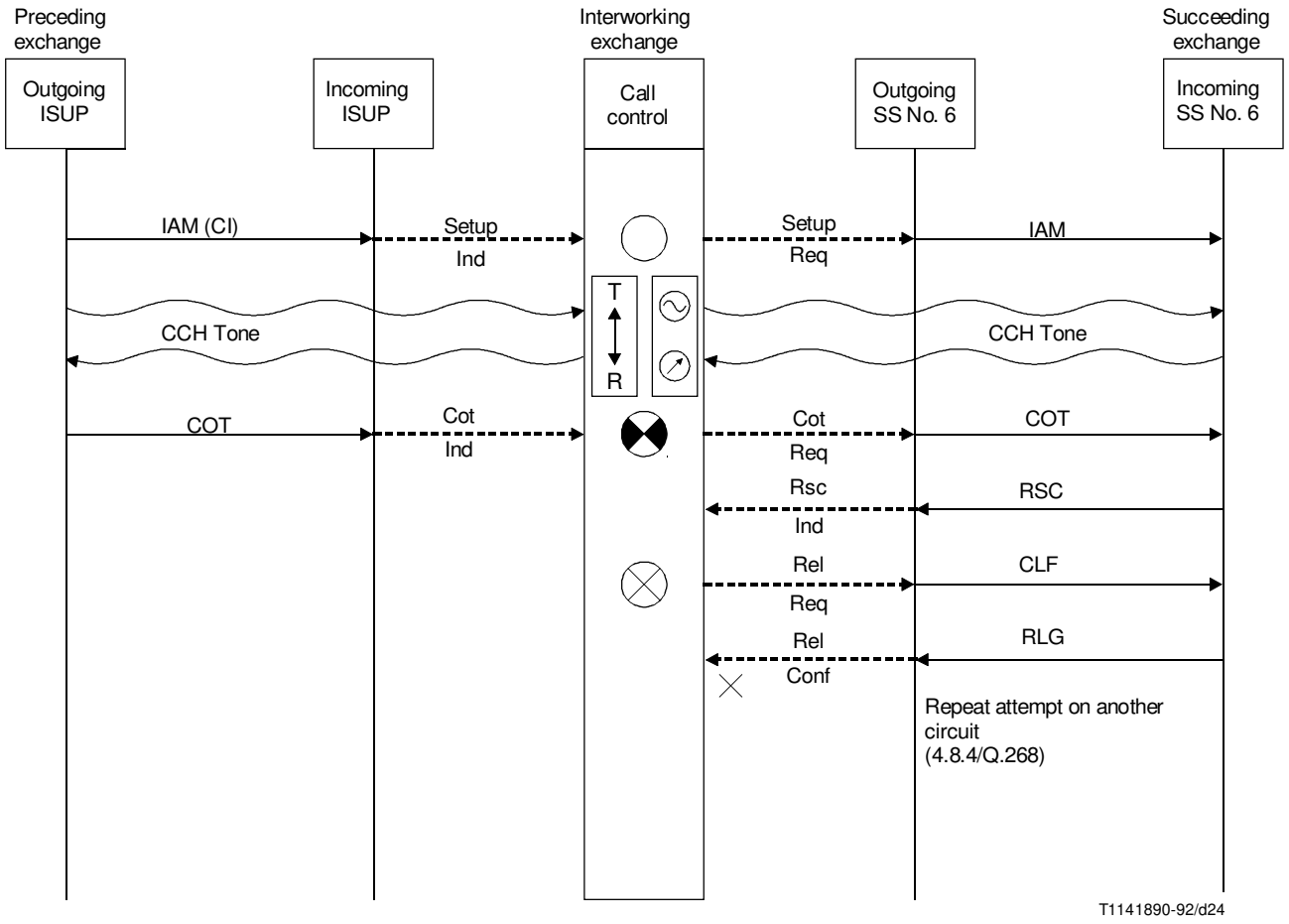
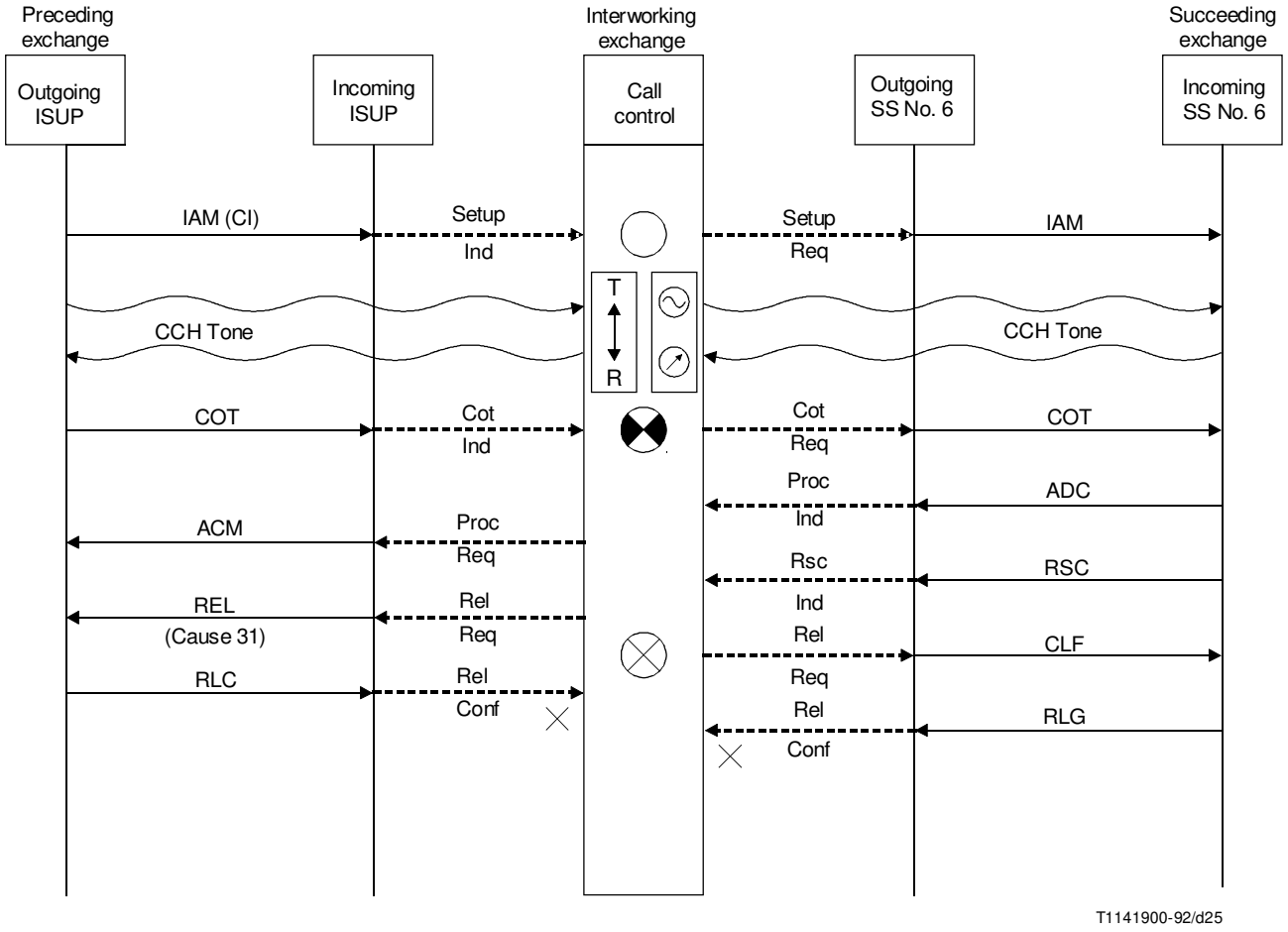


FIGURE 23/Q.698

ISDN-UP to SS No. 6
Reset circuit received before ADC



NOTE – Cause 31 = Normal unspecified.

FIGURE 24/Q.698

ISDN-UP to SS No. 6
Reset circuit received after ADC

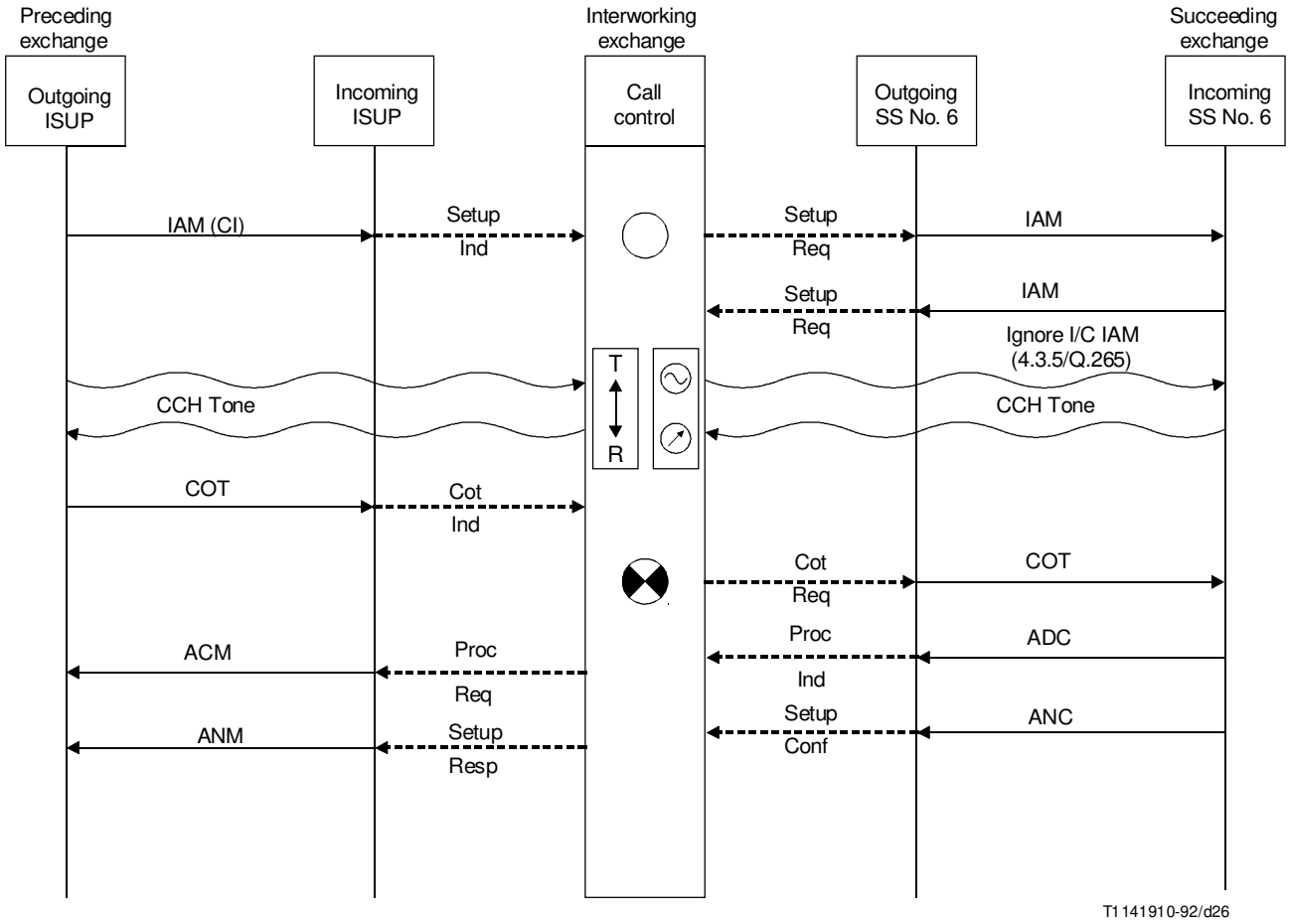


FIGURE 25/Q.698

ISDN-UP to SS No. 6
Dual seizure (controlling exchange)

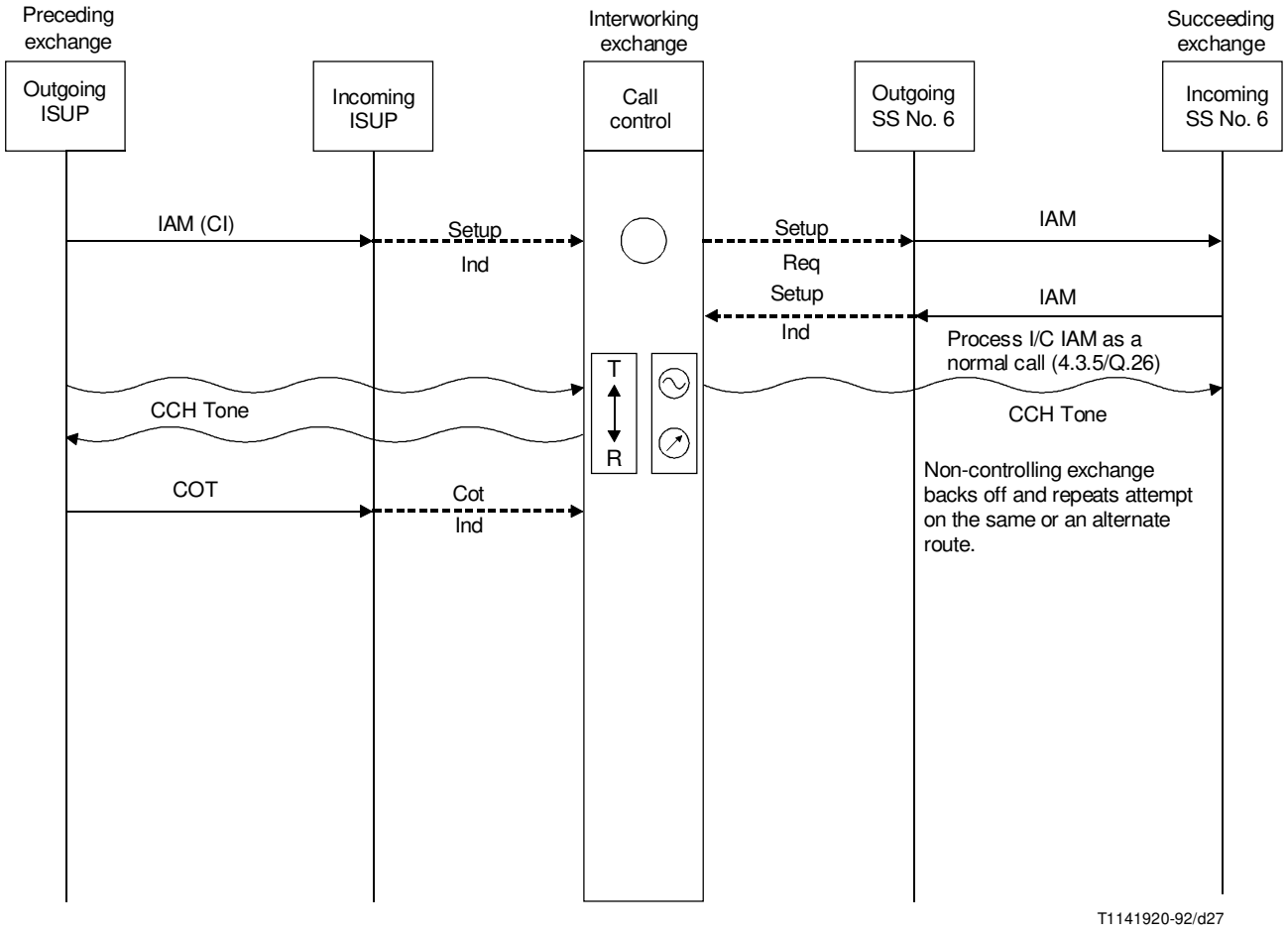
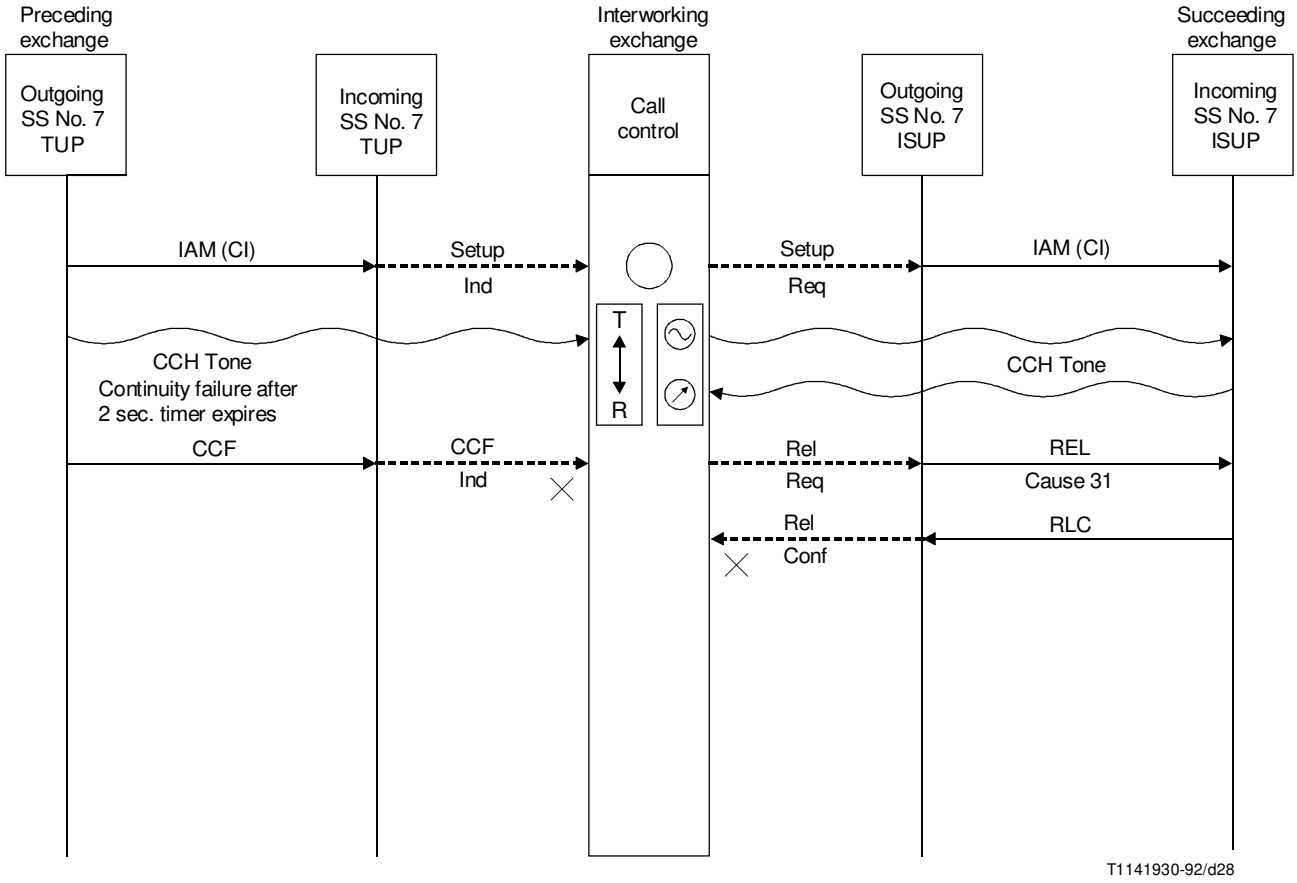


FIGURE 26/Q.698

ISDN-UP to SS No. 6
Dual seizure (non-controlling exchange)



NOTE – Cause 31 = Normal unspecified.

FIGURE 27/Q.698

Signalling System No. 7 TUP to ISUP
Continuity failure on incoming TUP circuit

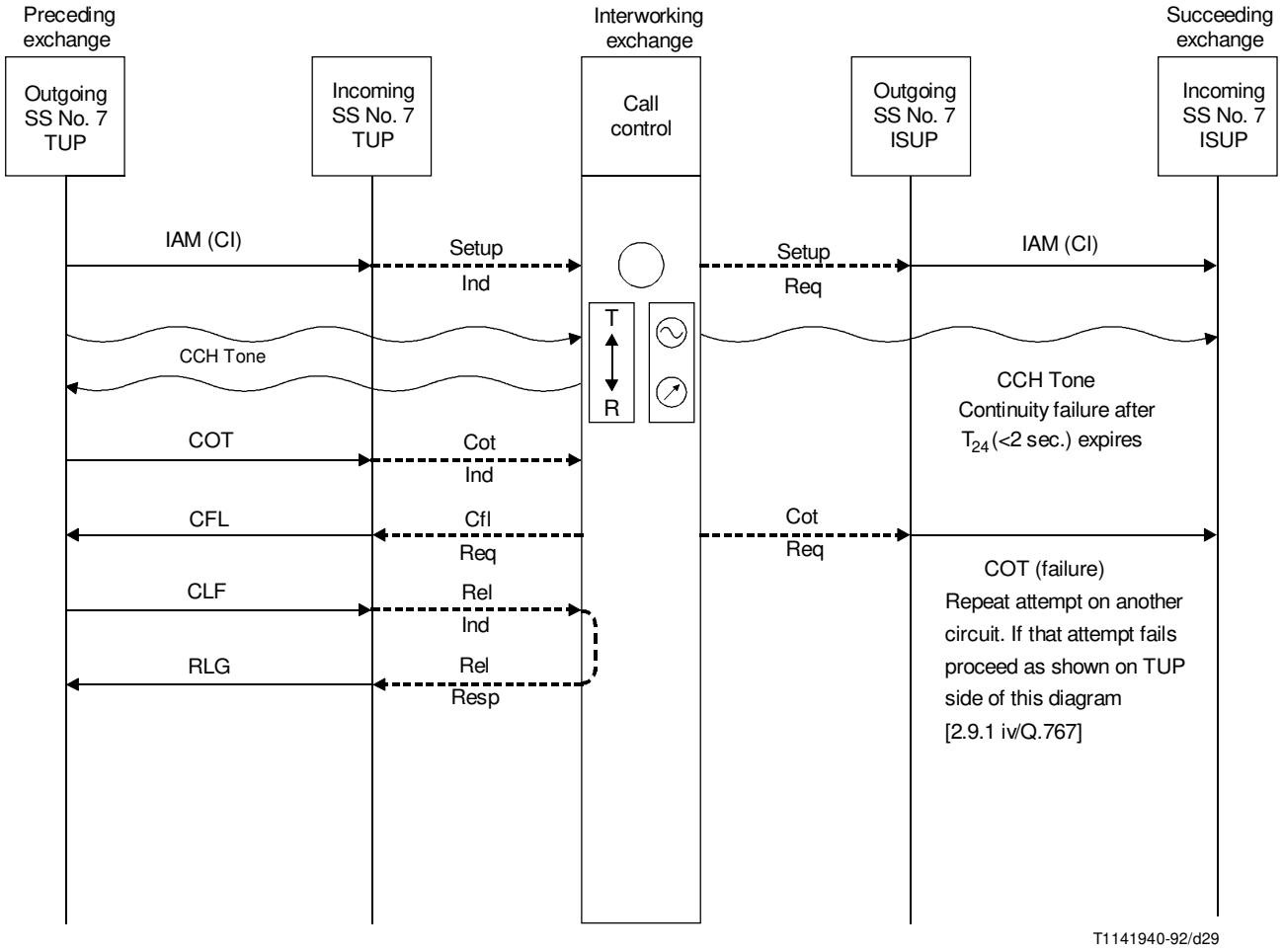
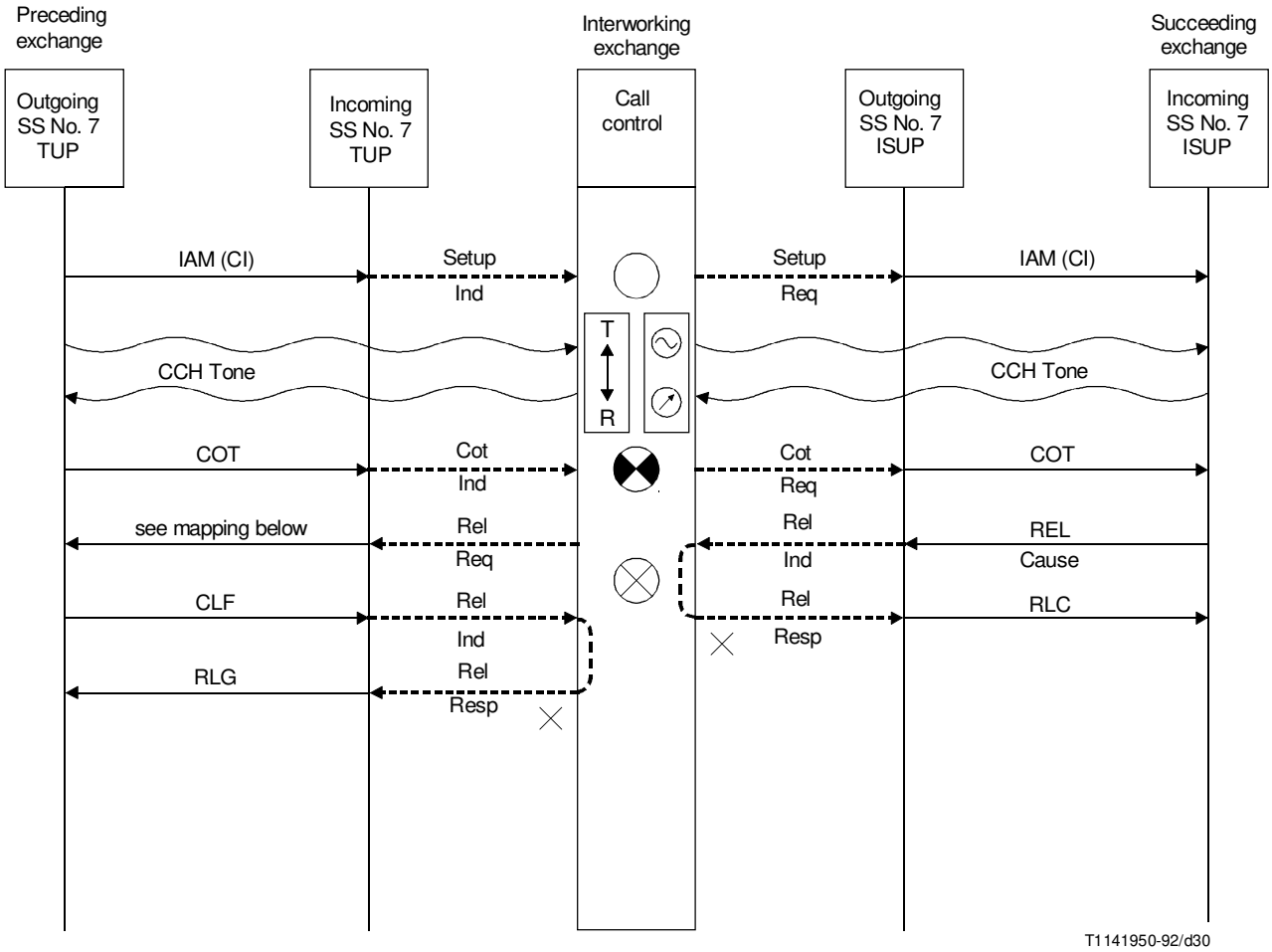


FIGURE 28/Q.698

SS No. 7 TUP to ISUP

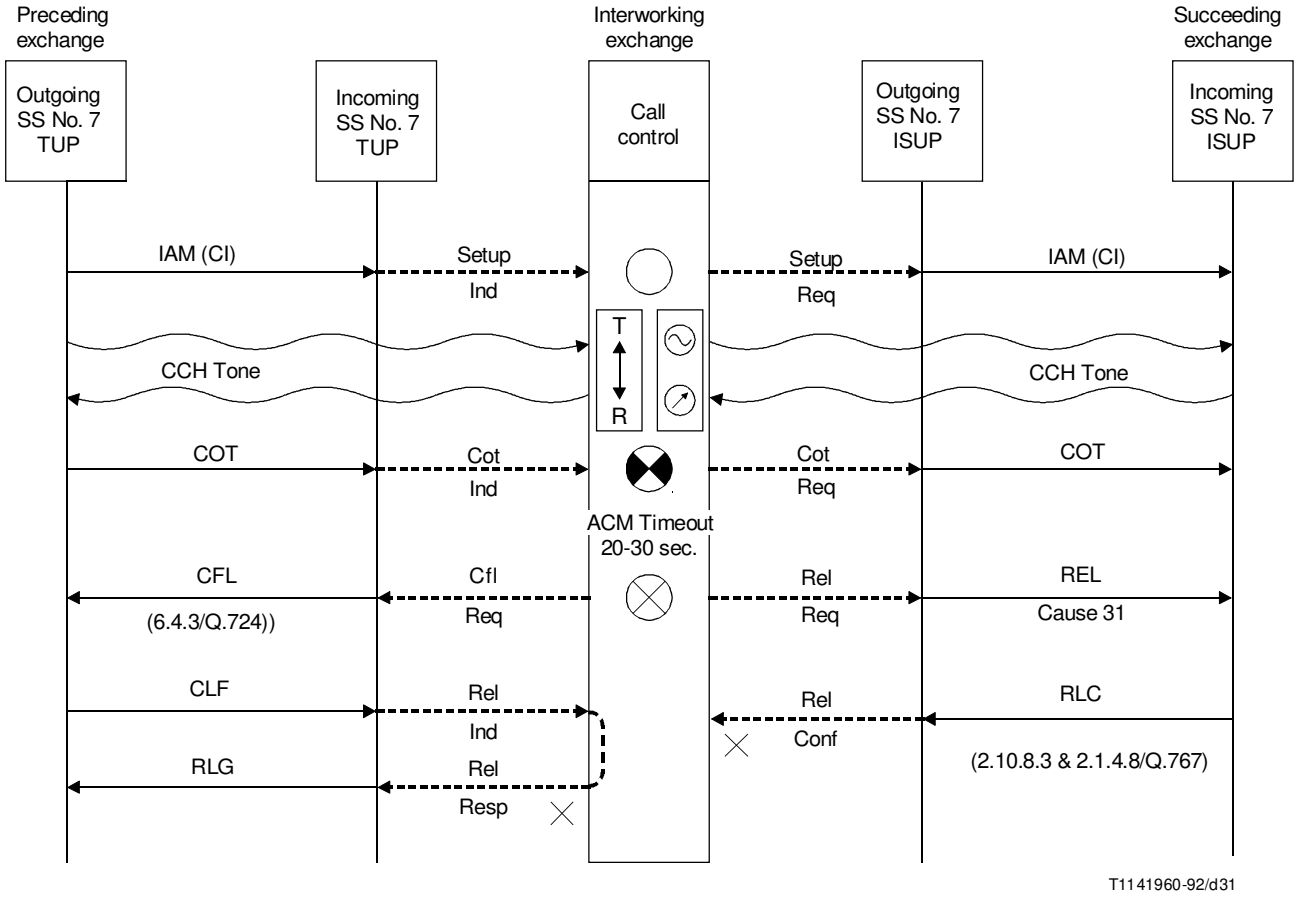
Continuity failure on outgoing ISUP circuit



Cause value in REL message	SS No. 7 TUP signal
42	SEC
34	CGC
28	ADI
1	UNN
17	SSB
27	LOS
4	SST
65	DPN
Other	CFL

FIGURE 29/Q.698

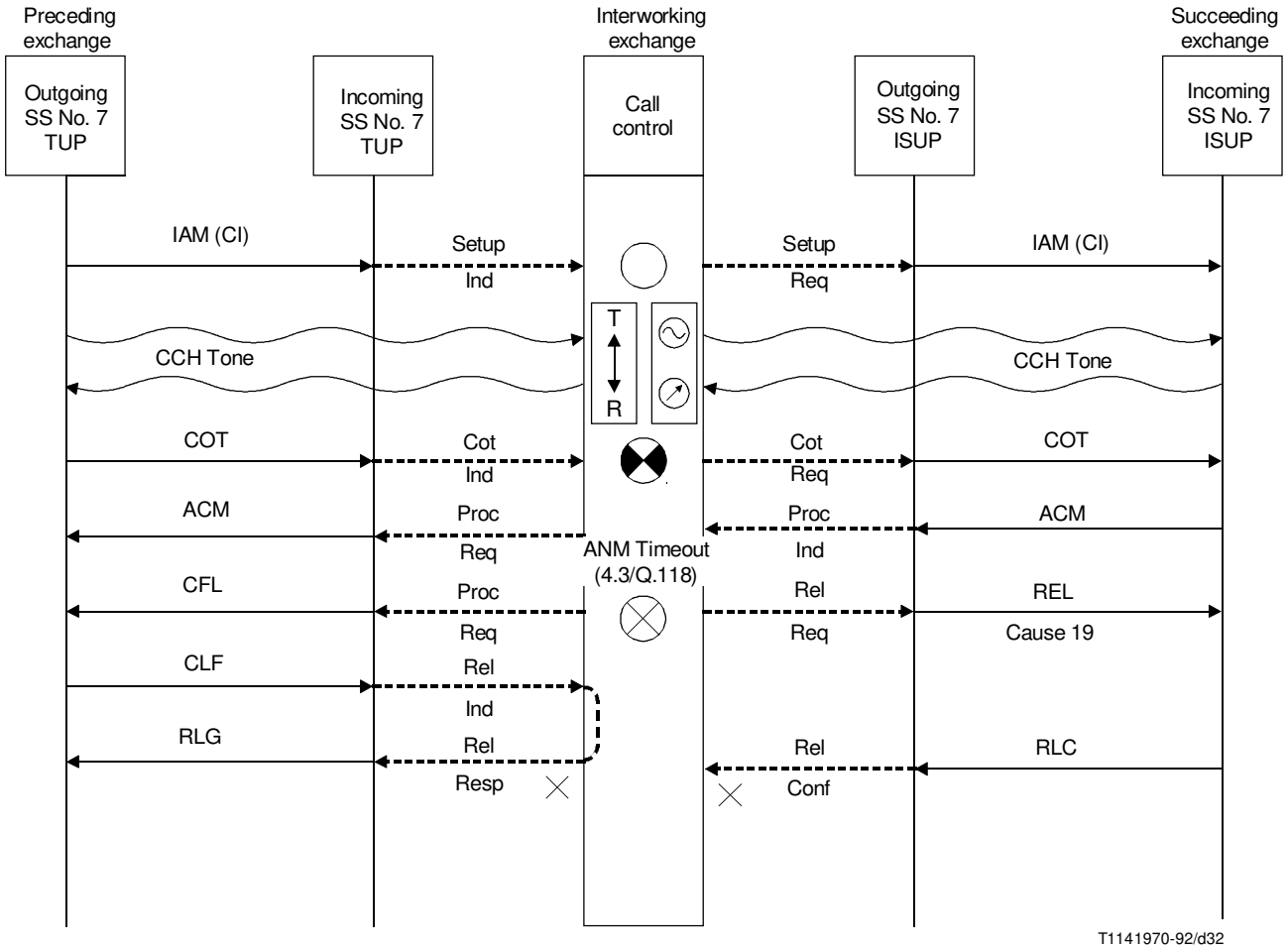
SS No. 7 TUP to ISUP
Release signal received before address complete



NOTE – Cause 31 = Normal unspecified.

FIGURE 30/Q.698

SS No. 7 TUP to ISUP
Timeout on address complete message (ACM)



NOTE – Cause 19 = No answer from user.

FIGURE 31/Q.698

SS No. 7 TUP to ISUP
Timeout on answer message

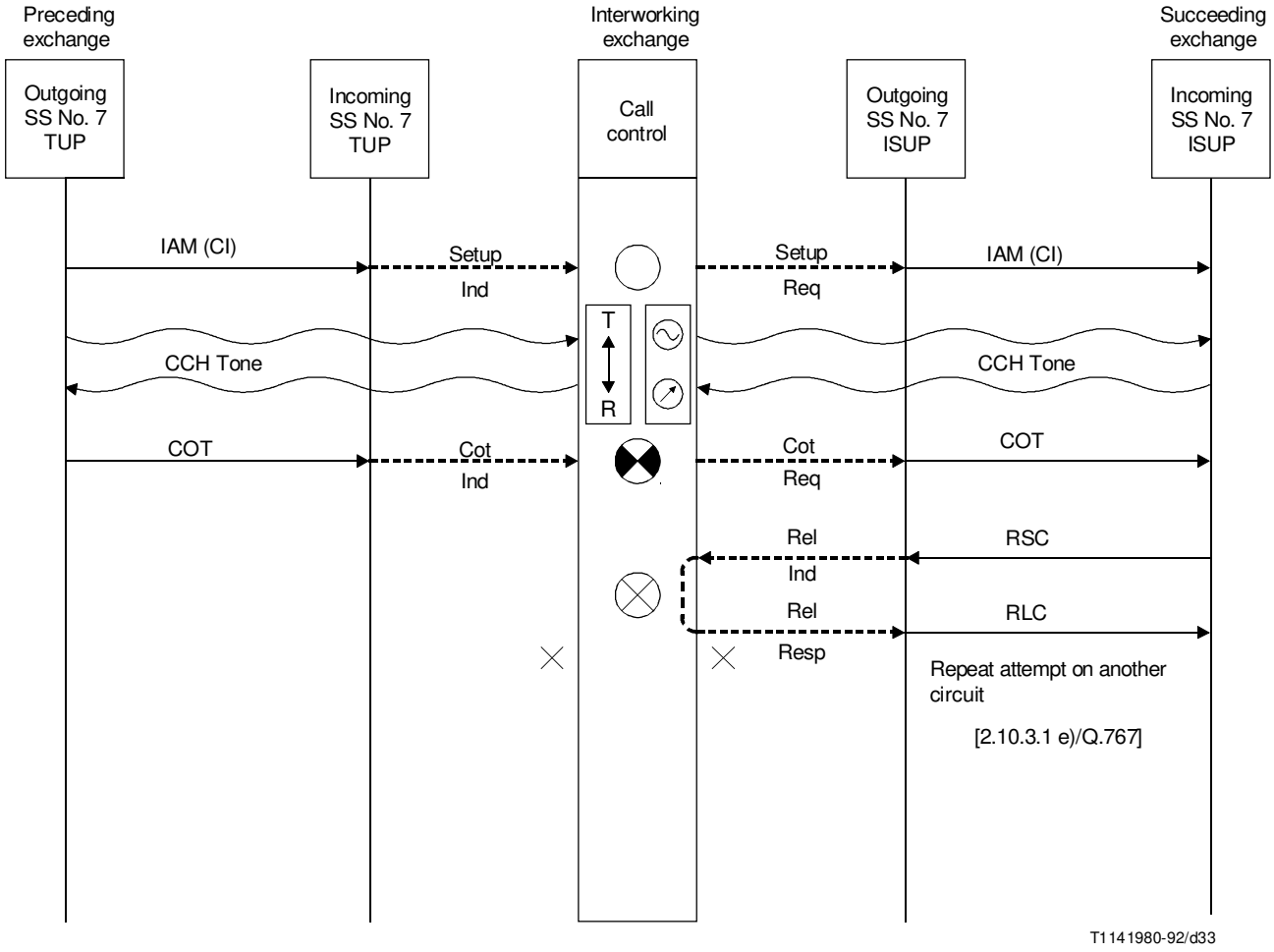


FIGURE 32/Q.698

SS No. 7 TUP to ISUP
Reset circuit received before ACM

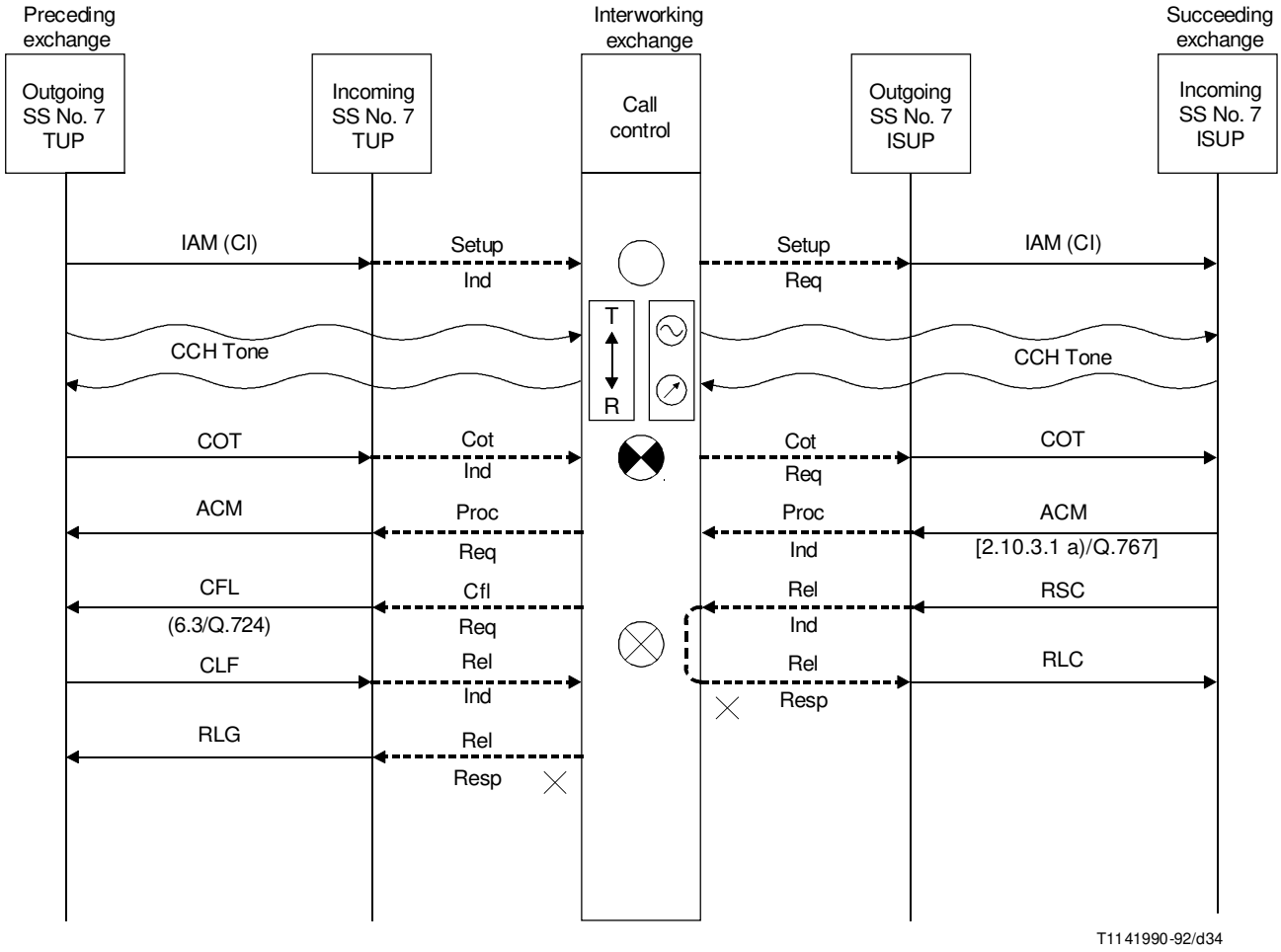


FIGURE 33/Q.698

SS No. 7 TUP to ISUP
Reset circuit received after ACM

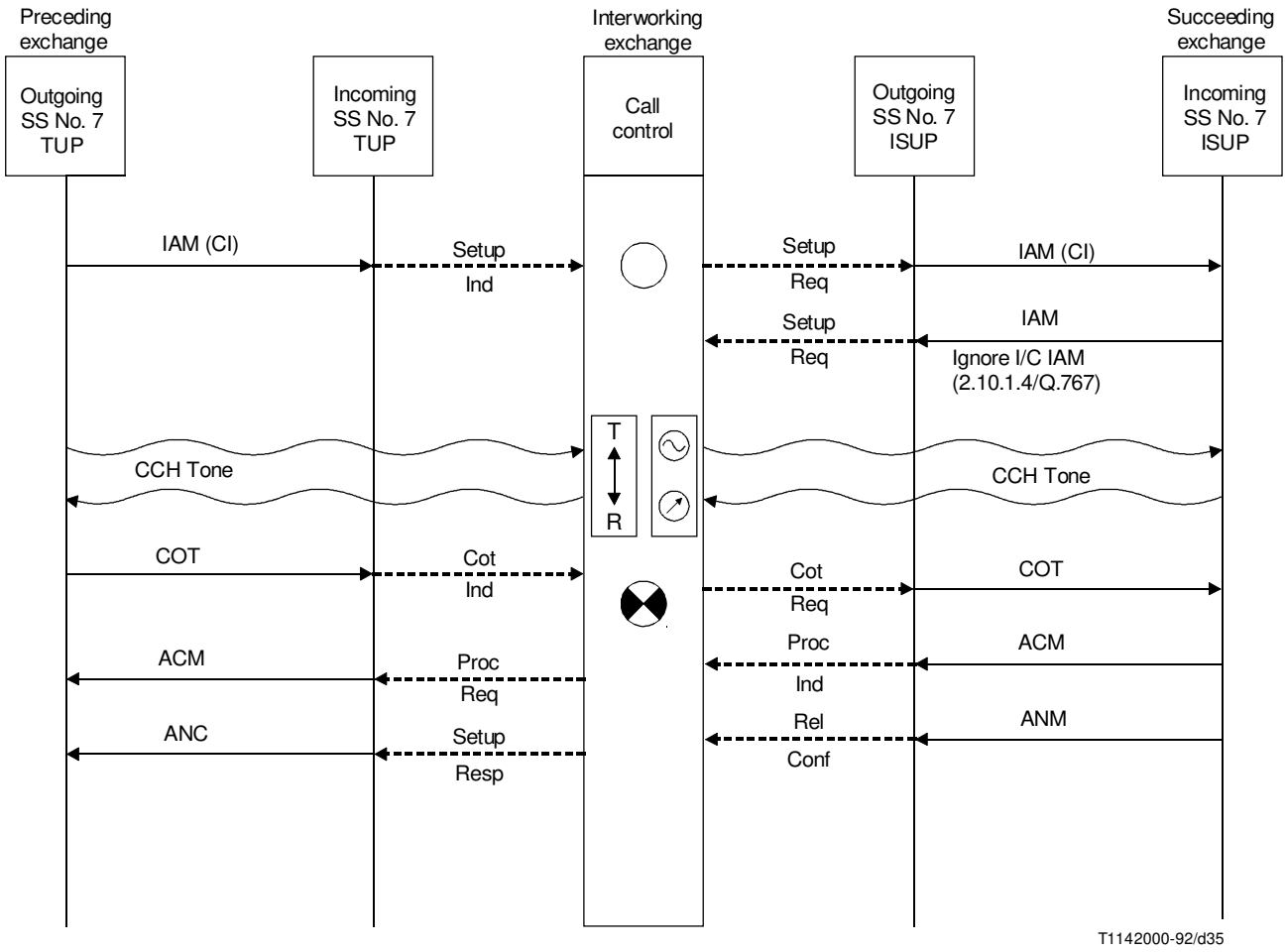


FIGURE 34/Q.698

SS No. 7 TUP to ISUP
Dual seizure (controlling exchange)
Reset circuit received after ACM

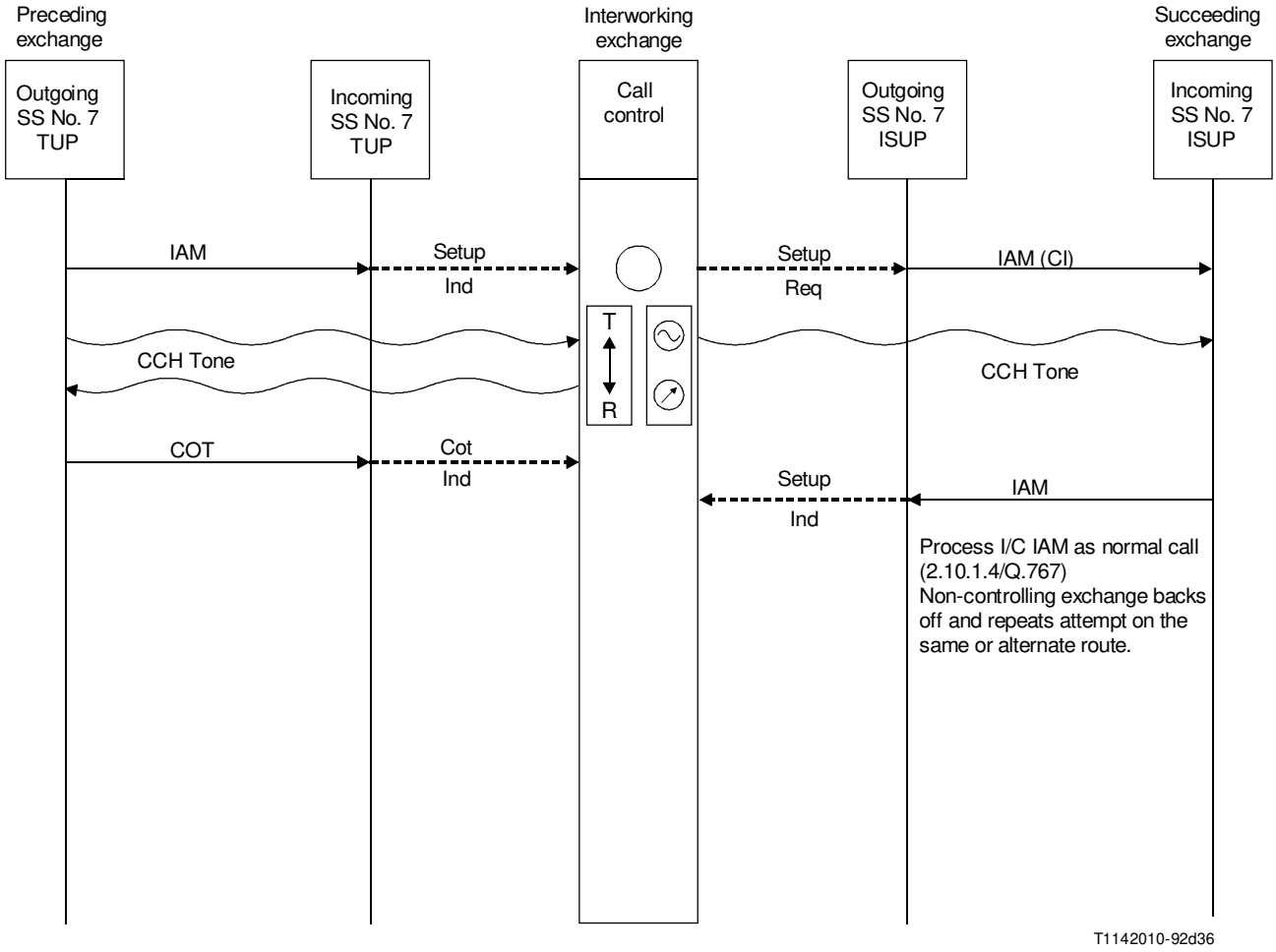


FIGURE 35/Q.698

SS No. 7 TUP to ISUP
Dual seizure (non-controlling exchange)

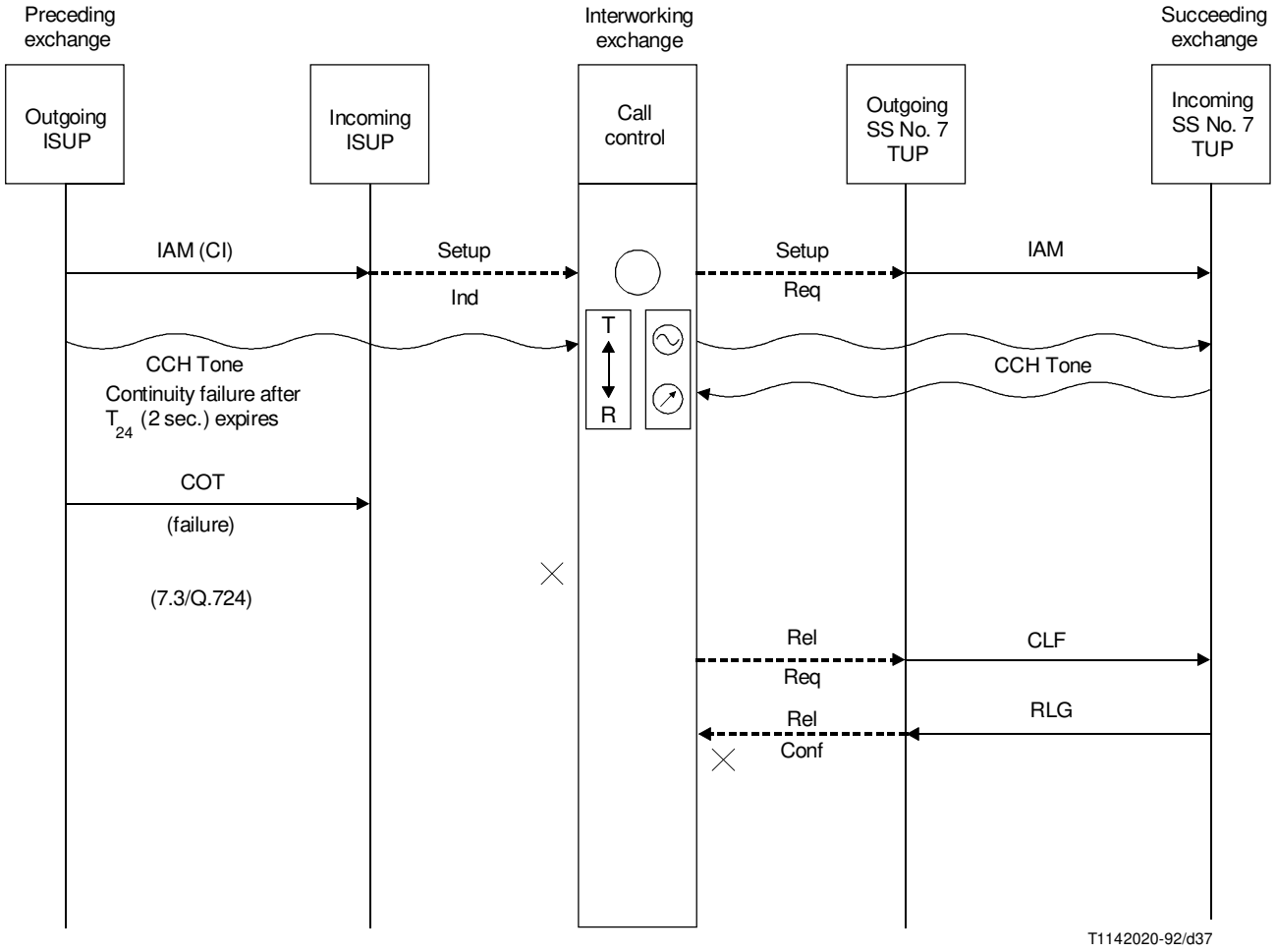
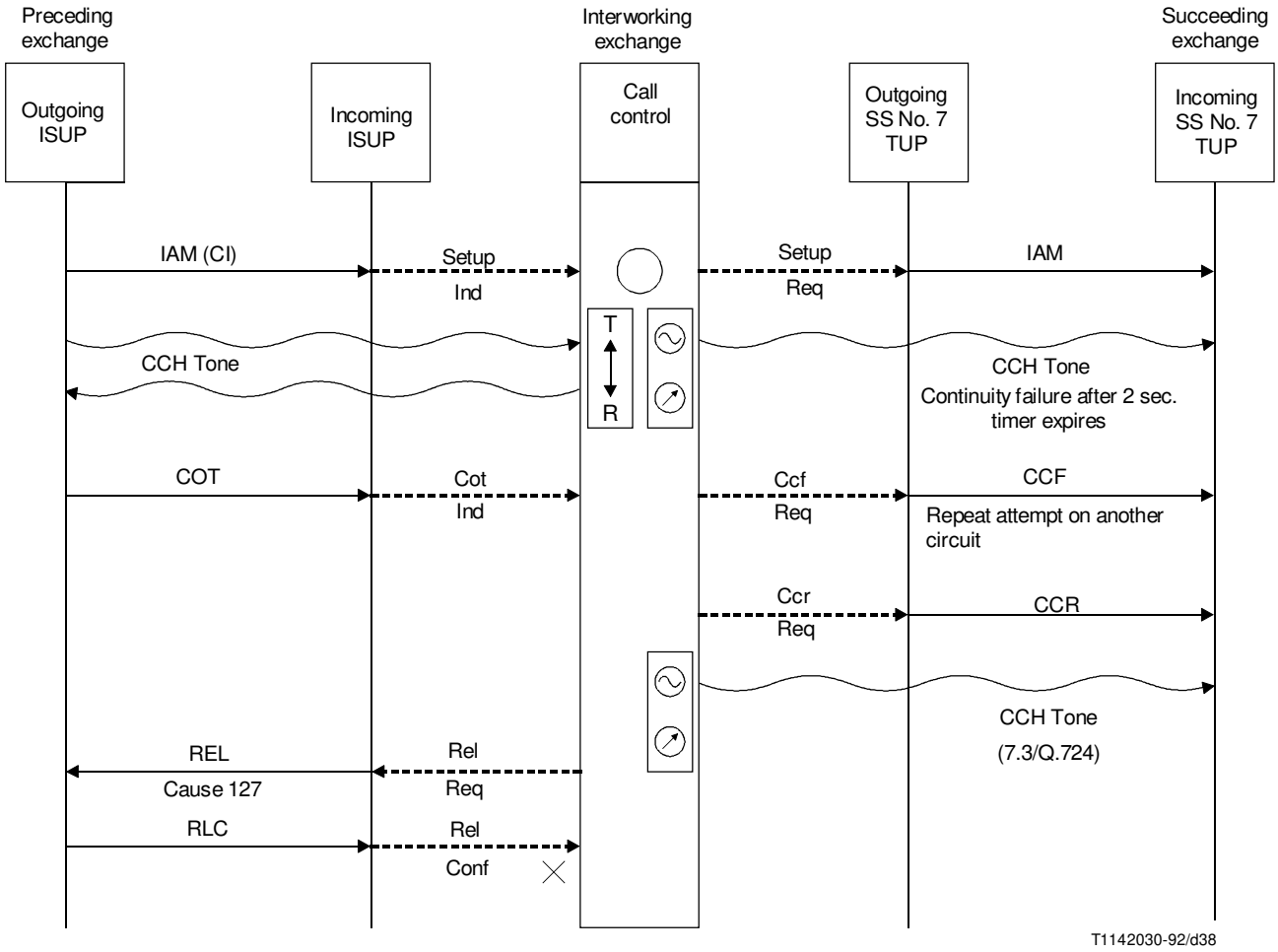


FIGURE 36/Q.698

Interworking of Signalling System No. 7 ISUP to No. 7 TUP
Continuity failure on incoming ISUP circuit



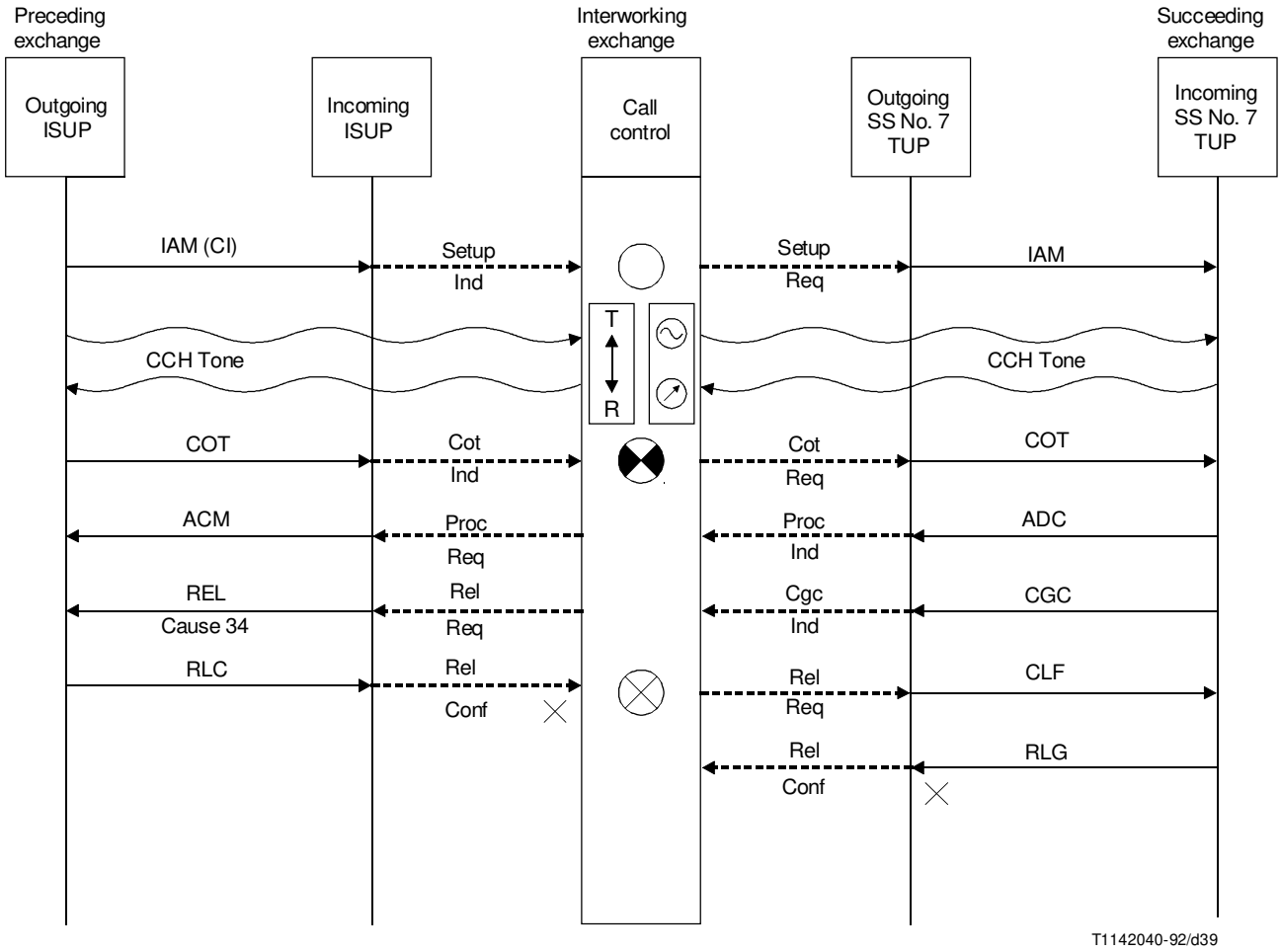
NOTES

1 Cause 127 = Interworking unspecified.

2 CCR is sent to 1-10 s after failure detection.

FIGURE 37/Q.698

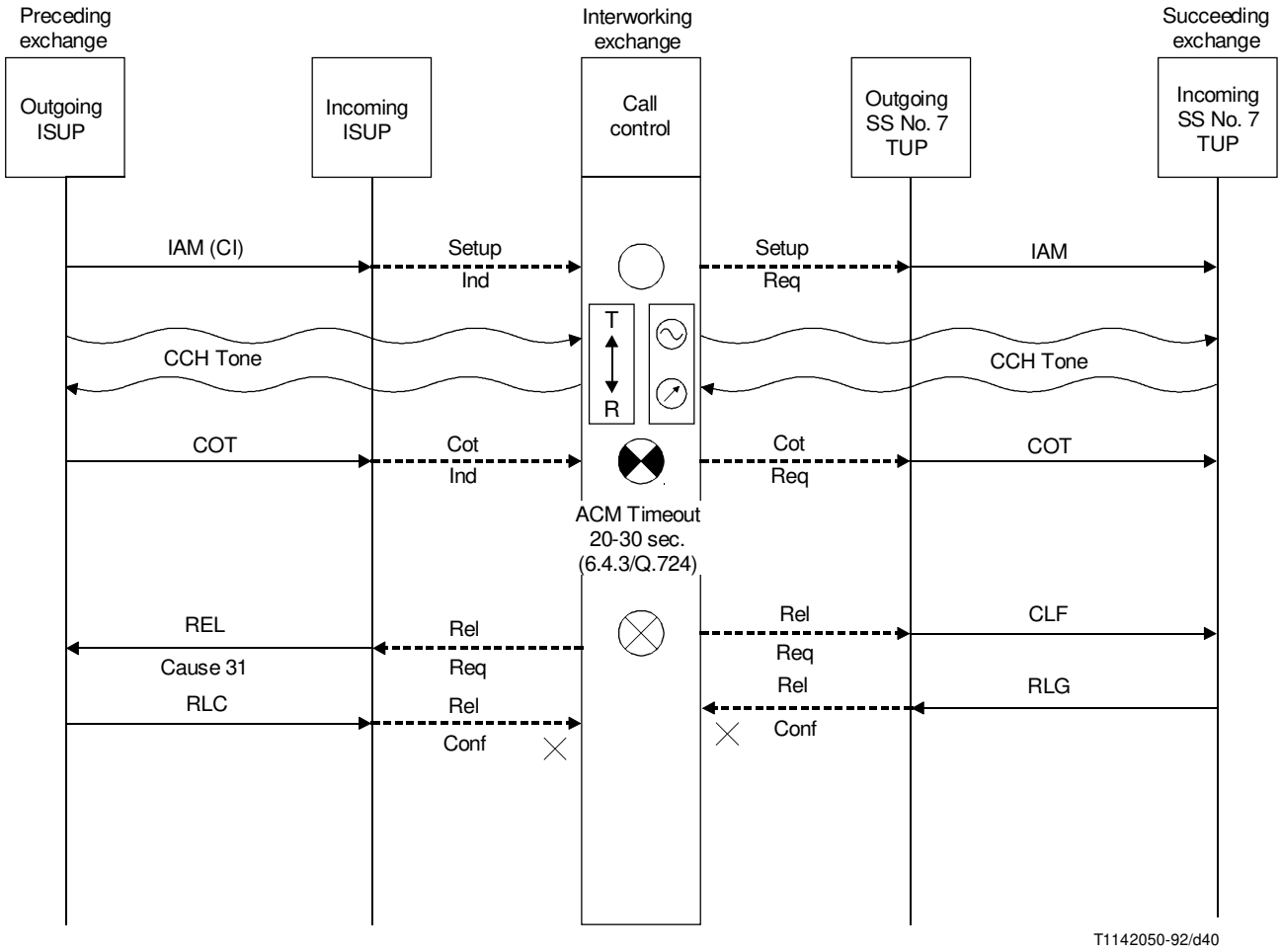
Interworking of Signalling System No. 7 ISUP to No. 7 TUP
Continuity failure on outgoing TUP circuit



NOTE – Cause 34 = No circuits available.

FIGURE 38/Q.698

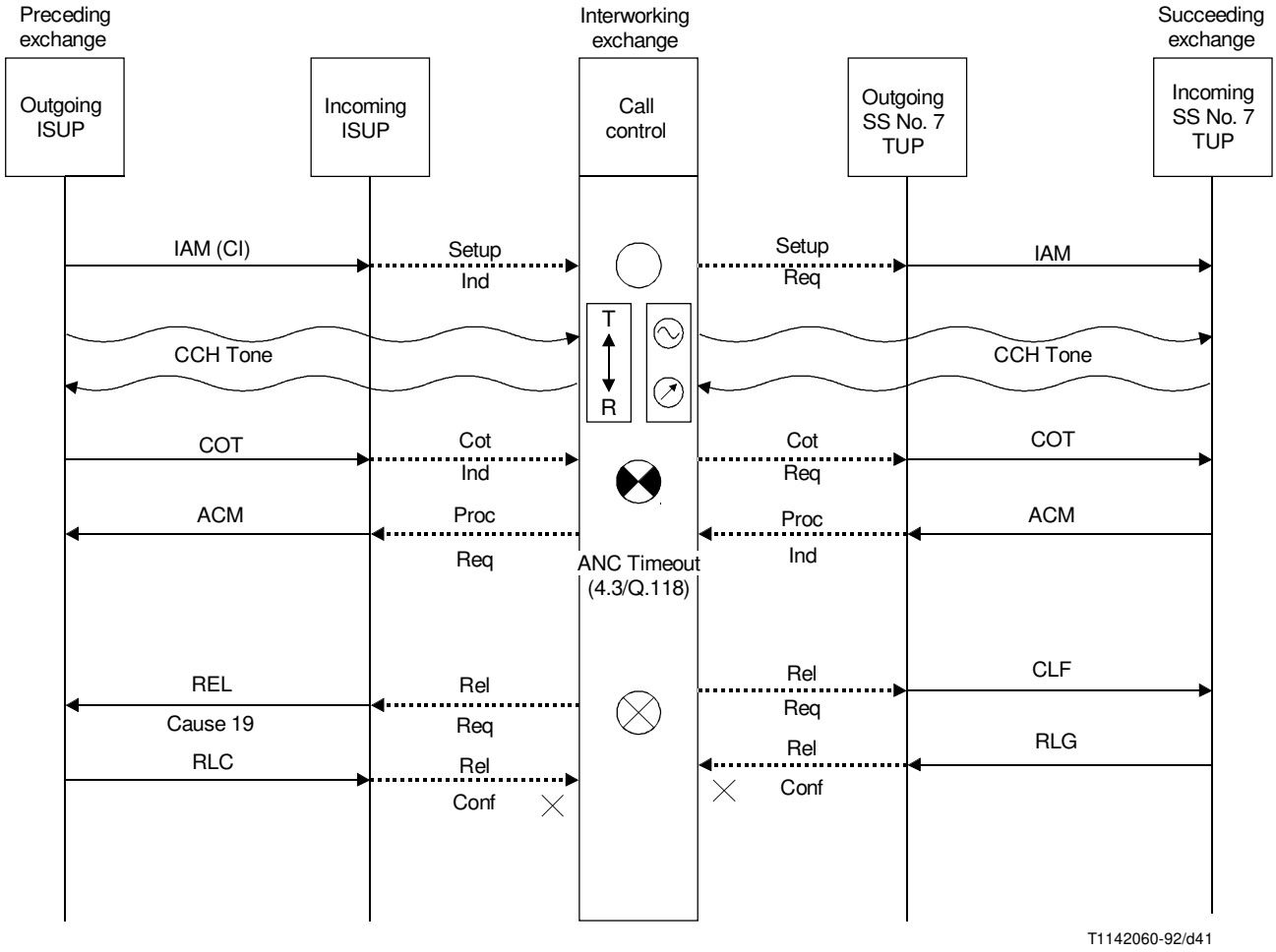
Interworking of Signalling System No. 7 ISUP to No. 7 TUP
Congestion signal received after address complete



NOTE – Cause 127 = Interworking unspecified.

FIGURE 39/Q.698

Interworking of Signalling System No. 7 ISUP to No. 7 TUP
Timeout on address complete message (ACM)



NOTE – Cause 19 = No answer from user.

FIGURE 40/Q.698

Interworking of Signalling System No. 7 ISUP to No. 7 TUP
Timeout on answer message

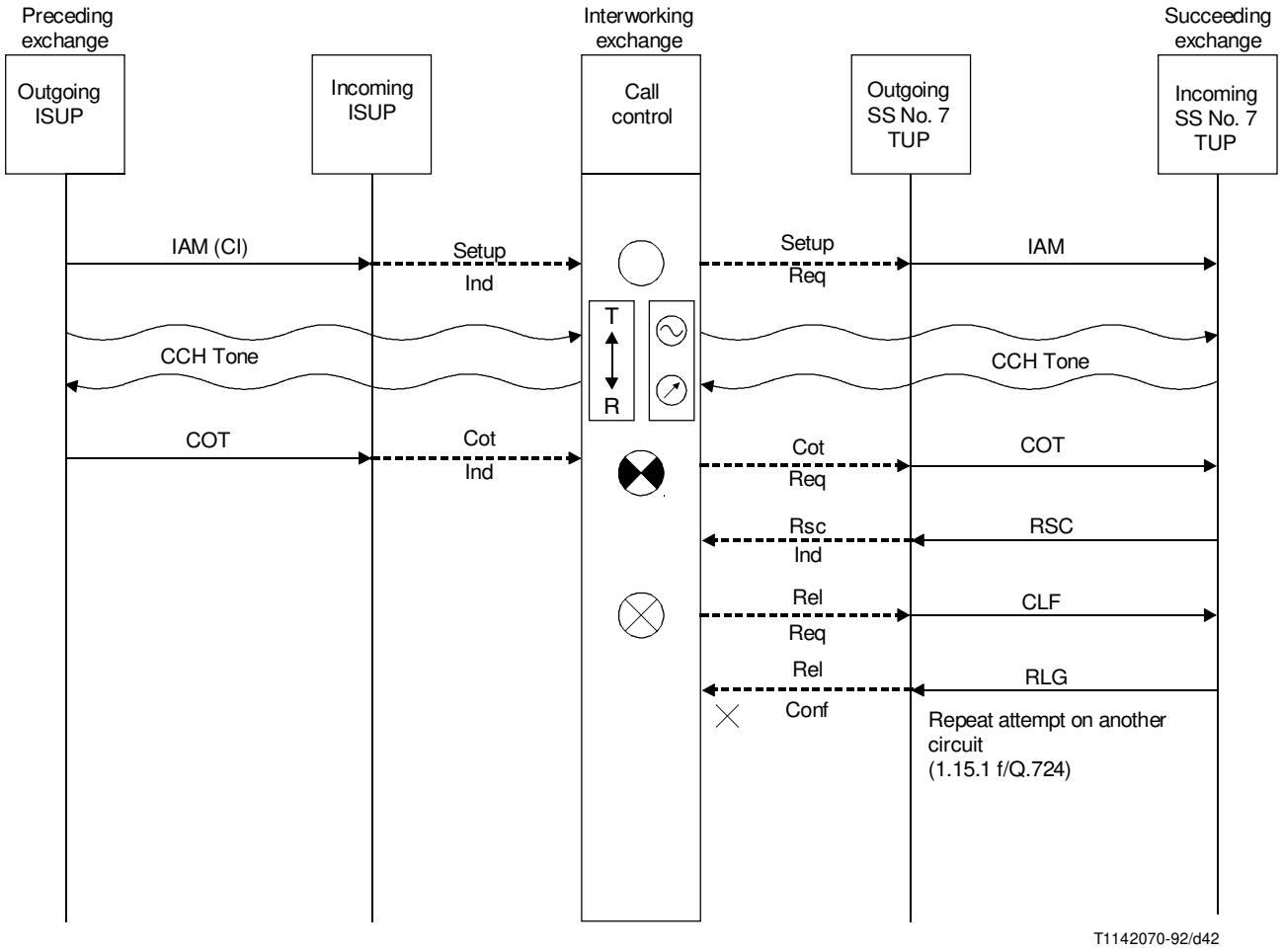
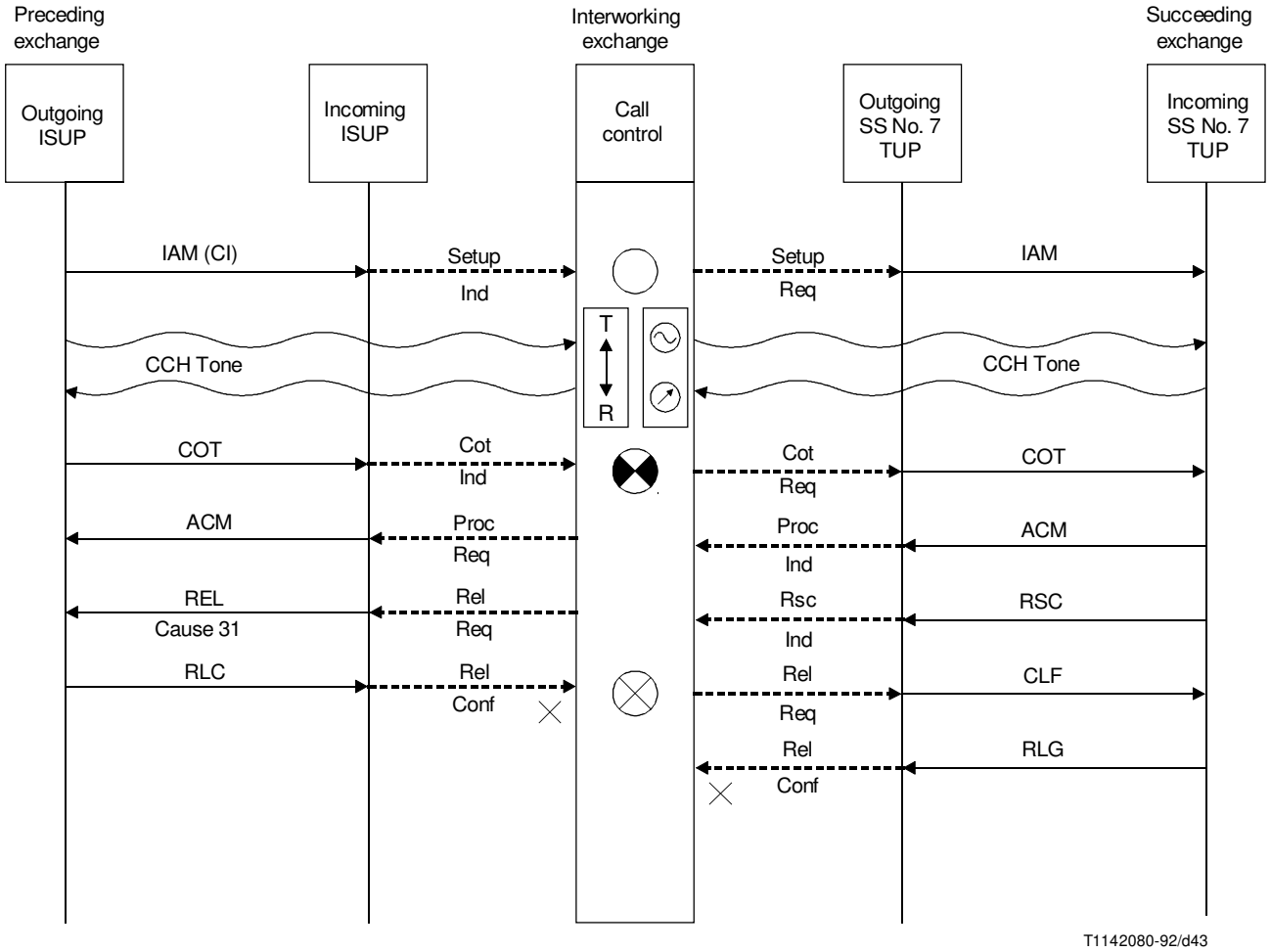


FIGURE 41/Q.698

Interworking of Signalling System No. 7 ISUP to No. 7 TUP
Reset circuit received before ACM



NOTE – Cause 31 = Normal unspecified.

FIGURE 42/Q.698

Interworking of Signalling System No. 7 ISUP to No. 7 TUP
Reset circuit received after ACM

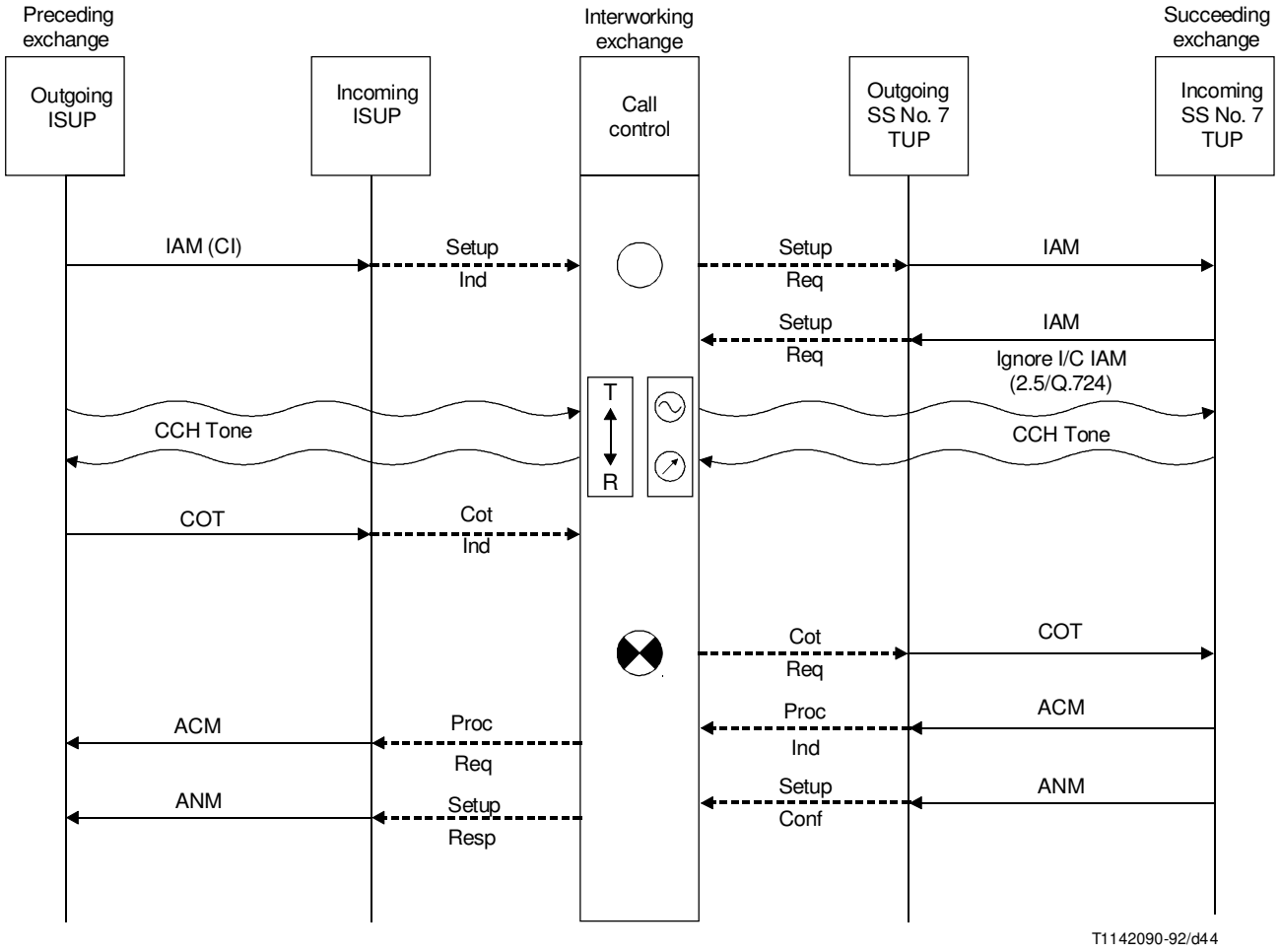


FIGURE 43/Q.698

Interworking of Signalling System No. 7 ISUP to No. 7 TUP
Dual seizure (controlling exchange)

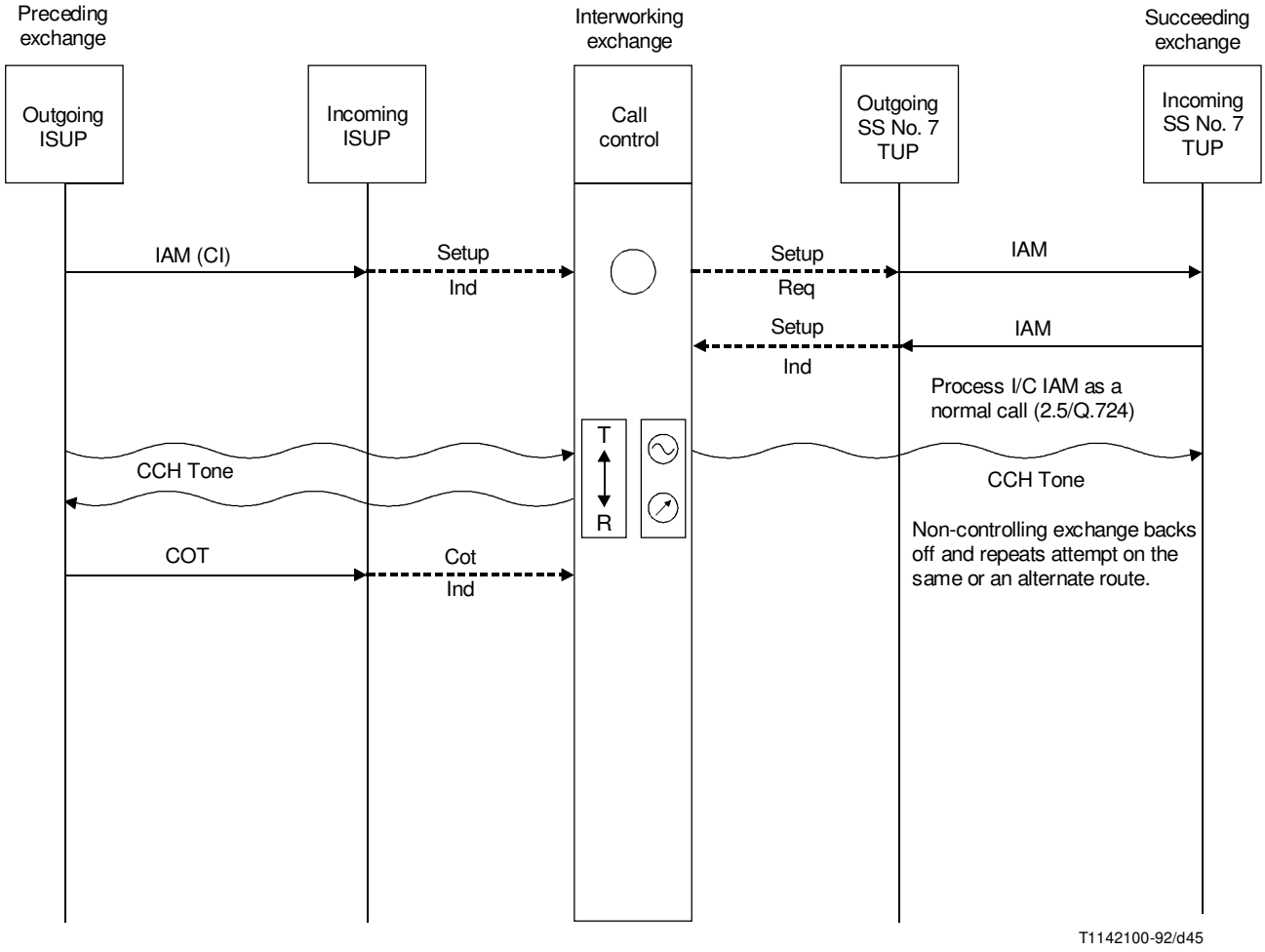


FIGURE 44/Q.698

Interworking of Signalling System No. 7 ISUP to No. 7 TUP
Dual seizure (non-controlling exchange)