International Standard 4902

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Data communication — 37-pin and 9-pin DTE/DCE interface connectors and pin assignments

Téléinformatique — Affectation des broches et description des connecteurs 37 et 9 broches à la jonction entre ETTD et ETCD

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

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It has been approved by the member bodies of the following countries :

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Belgium	Italy	Spain
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Data communication — 37-pin and 9-pin DTE/DCE interface connectors and pin assignments

1 Scope and field of application

This International Standard specifies the 37-pin and 9-pin connectors and the assignment of connector pin numbers at the interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) where CCITT[1] Recommendation V.24 together with Recommendations V.10 and V.11 are applicable. Use of the 9-pin connector only applies when a backward channel capability is implemented in an interface.

2 References

ISO 2110, *Data communication — 25-pin DTE/DCE interface connector and pin assignments.*

ISO 4903, *Data communication — 15-pin DTE/DCE interface connector and pin assignments.*

CCITT Recommendation V.10 (or X.26), *Electrical characteristics for unbalanced double-current interchange circuits for general use with integrated circuit equipment in the field of data communications.*

CCITT Recommendation V.11 (or X.27), *Electrical characteristics for balanced double-current interchange circuits for general use with integrated circuit equipment in the field of data communications.*

CCITT Recommendation V.21, *200-baud modem standardized for use in the general switched telephone network.*

CCITT Recommendation V.23, *600/1 200-baud modem standardized for use in the general switched telephone network.*

CCITT Recommendation V.24, *List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE).*

CCITT Recommendation V.26, *2 400 bits per second modem standardized for use on 4-wire leased telephone-type circuits.*

CCITT Recommendation V.26 bis, *2 400/1 200 bits per second modem standardized for use in the general switched telephone network.*

CCITT Recommendation V.27, *4 800 bits per second modem with manual equalizer standardized for use on leased telephone-type circuits.*

CCITT Recommendation V.27 bis, *4 800 bits per second modem with automatic equalizer standardized for use on leased telephone-type circuits.*

CCITT Recommendation V.27 ter, *4 800/2 400 bits per second modem standardized for use in the general switched telephone network.*

CCITT Recommendation V.28, *Electrical characteristics for unbalanced double-current interchange circuits.*

CCITT Recommendation V.29, *9 600 bits per second modem standardized for use on leased telephone-type circuits.*

CCITT Recommendation V.36, *Modems for synchronous data transmission using* (60 — 108 kHz) *group band circuits.*

1) International Telegraph and Telephone Consultative Committee.

3 Connectors

Figures 1 to 7 illustrate the 37-pin interface connector and the 9-pin interface connector. Only those dimensions that are essential to mating are shown. Figures 1a) and 1b) illustrate the DTE interface connector(s) which have female contacts and male shells. Contact numbering is specified in these figures. The DCE interface connector(s) shall be equipped with the two latching blocks as specified in figures 2a) and 2b). The DTE interface connector(s) shall be equipped with means for latching to these blocks. The means for latching the DTE connector(s) to the blocks on the DCE connector(s) is subject to the national regulations. The means for latching, however, is to be accomplished within the shaded space shown in figure 3. The means for latching shall be such that the connector(s) can be latched and disconnected within the access space available for both arrangements illustrated in figure 4. This will permit DCE interface connectors to be mounted with the clearances shown for either of the two arrangements in figure 4. Figure 5 illustrates the dimensions for the pin layout. Figures 6 and 7 illustrate the dimensions of the pin and mating socket respectively.

The specification for the connectors in this International Standard is provided for mechanical compatibility only. It is also intended to be mechanically compatible with the detailed connector specification currently being developed by the IEC.

4 Assignment of pin numbers

The pin assignments for the selected interchange circuits specified in CCITT Recommendation V.24 that may be implemented in modems complying with CCITT Recommendations V.21, V.23, V.26, V.26 bis, V.27, V.27 bis, V.27 ter, V.29 and V.36 are given in tables 1 and 2. Although tables 1 and 2 provide the total list of interchange circuits designated in all the above listed modem CCITT Recommendations, only the set of interchange circuits required for the particular equipment needs to be implemented. Application of the 9-pin connector assignments in table 2 is only necessary when the backward channel capability for the interface is implemented. Table 3 gives a list of the applicable interchange circuits and their description. Additionally, notes 5 and 6 for table 1 provide preferred pin assignments for some optional circuits which may be applied for national use.

5 Interconnecting configurations for mixed use of electrical characteristics

Considerations for interworking of equipment implementing V.10 on one side of the interface with equipment meeting V.11 on the other side of the interface are given in annex 2 of CCITT Recommendations V.10 and V.11. In addition, definition of the category 1 and 2 receiver configurations is provided in V.10. Guidance concerning possible interconnecting configurations that may be applied is given in annex A.

Guidance concerning adaptation necessary when there is a need for a DTE or DCE implementing V.10 characteristics to interwork with a DCE or DTE implementing V.28 characteristics, is given in annex B. Any adapters required to accomplish the interworking with V.28 and ISO 2110 shall be provided with the equipment meeting ISO 4902. No revisions or modifications shall be required in the existing equipment using V.28 electrical characteristics.

NOTE — Annexes A and B are not an integral part of this International Standard.

Table 1 — Pin assignments for the 37-pin connector[7]

First segment assignment[2]			Second segment assignment[2]			Receiver category[4]	Direction to	
Pin number	Circuit number	Interchange points[3]	Pin number	Circuit number	Interchange points[3]		DTE	DCE
1	See note 1	—				—	—	—
2	N	A-A′	20	102b	C-B′	2	X	
3	N	A-A′	21	N	See note 5	See note 5		
4	103	A-A′	22	103	B/C-B′	1		X
5	114	A-A′	23	114	B/C-B′	1	X	
6	104	A-A′	24	104	B/C-B′	1	X	
7	105	A-A′	25	105	B/C-B′	1		X
8	115	A-A′	26	115	B/C-B′	1	X	
9	106	A-A′	27	106	B/C-B′	1	X	
10	141	A-A′	28	N	A-A′	2		X
11	107	A-A′	29	107	B/C-B′	1	X	
12	108*	A-A′	30	108*	B/C-B′	1		X
13	109	A-A′	31	109	B/C-B′	1	X	
14	140	A-A′	32	N	A-A′	2		X
15	125	A-A′	33	N	A-A′	2	X	
16	111 or 126+	A-A′	34	N	A-A′	2		X
17	113	A-A′	35	113	B/C-A′	1		X
18	142	A-A′	36	N	A-A′	2	X	
19	102	C-C′	37	102a	C-B′			X

Legend : N — Pin number permanently reserved for national use. (See note 6.)

* — Circuit 108/1 or 108/2.

\+ — Two circuits sharing same pin assignment.

Table 2 — Pin assignments for the 9-pin connector[7]

First segment assignment[2]			Second segment assignment[2]			Receiver category[4]	Direction to	
Pin number	Circuit number	Interchange points[3]	Pin number	Circuit number	Interchange points[3]		DTE	DCE
1	See note 1	—				—	—	—
2	122	A-A′	6	102b	C-B′	2	X	
3	118	A-A′	7	120	A-A′	2		X
4	119	A-A′	8	121	A-A′	2	X	
5	102	C-C′	9	102a	C-B′			X

NOTES

1 Pin 1 is assigned for connecting the shields between tandem sections of the shielded interface cable. The shield may be connected either to protective ground or to signal ground at either the DTE or DCE or both in accordance with national regulations.

Signal ground may be further connected to protective ground in accordance with national safety regulations. Caution should be exercised to prevent establishment of ground loops carrying high currents.

2 The pin assignments for each segment have been aligned to specify pairing and connection to multipaired interconnecting cable. Each row of the table presents the respectively paired pins, i.e, 2 and 20, 3 and 21, etc. (table 1); 2 and 6, 3 and 7, etc. (table 2).

3 A, A′, B, B′, C and C′ indicate the associated interchange points as designated in figure 2 of CCITT Recommendations V.10 and V.11. Where B/C is indicated in table 1, the B designation applies only when a V.11 generator is used and the C designation applies only when a V.10 generator is used. (See annex A.)

4 The receiver categories are as designated in V.10. Where category 1 receivers apply, either V.10 or V.11 generators may be used except for V.36 wideband modems where only V.11 generators may be used for circuits 103, 104, 113, 114, 115. Where category 2 receivers apply, V.10 generators are used.

5 Pins 3 and 21, which are permanently reserved for national use, may each be used individually for interconnection of A-A′ interchange points with category 2 receivers. These two circuits must be in the same direction. Alternatively pins 3 and 21 may be combined for interconnection of a pair of interchange points with one category 1 receiver. In this case, pin 21 would be used to interconnect interchange points B/C-B′ while pin 3 interconnects interchange points A-A′.

6 Preferred assignments of circuits which may be applied for national use are as follows :

Pin number	Circuit number	Description
2	112	Data signalling rate selector (DCE source)
28	135*	Terminal available for service
32	116	Select standby
33	110	Data signal quality detector
34	136*	New signal
36	117	Standby indicator

* These circuits are a subject of further study and have not been approved by the CCITT.

7 When the V.28 electrical characteristics are used for CCITT Recommendations V.21, V.23, V.26, .26 bis, V.27, V.27 bis, V.27 ter and V.29, the connectors and pin assignments of ISO 2110 apply.

Table 3 — List of interchange circuits

Circuit number	Description
102	Signal ground or common return
102a	DTE common return
102b	DCE common return
103	Transmitted data
104	Received data
105	Request to send
106	Ready for sending
107	Data set ready
108/1	Connect data set to line
108/2	Data terminal ready
109	Data channel received line signal detector
111	Data signalling rate selector (DTE source)
113	Transmitter signal element timing (DTE source)
114	Transmitter signal element timing (DCE source)
115	Receiver signal element timing (DCE source)
118	Transmitted backward channel data
119	Received backward channel data
120	Transmit backward channel line signal
121	Backward channel ready
122	Backward channel received line signal detector
125	Calling indicator
126	Select transmit frequency
140	Remote loopback for point-to-point circuits
141	Local loopback
142	Test indicator

Dimensions in millimetres

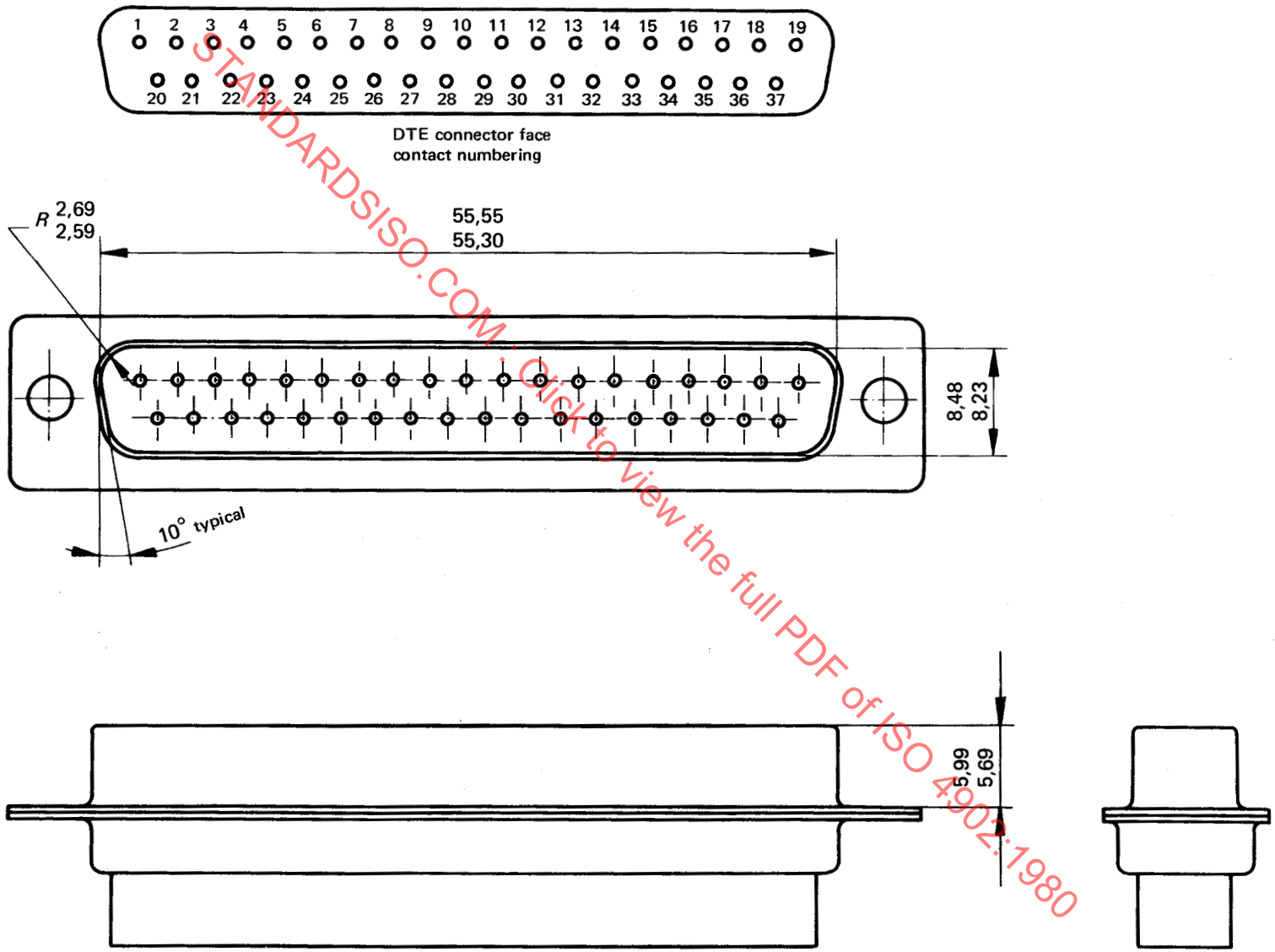
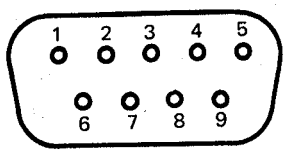


Figure 1a) — DTE 37-pin interface connector

Dimensions in millimetres



DTE connector face
contact numbering

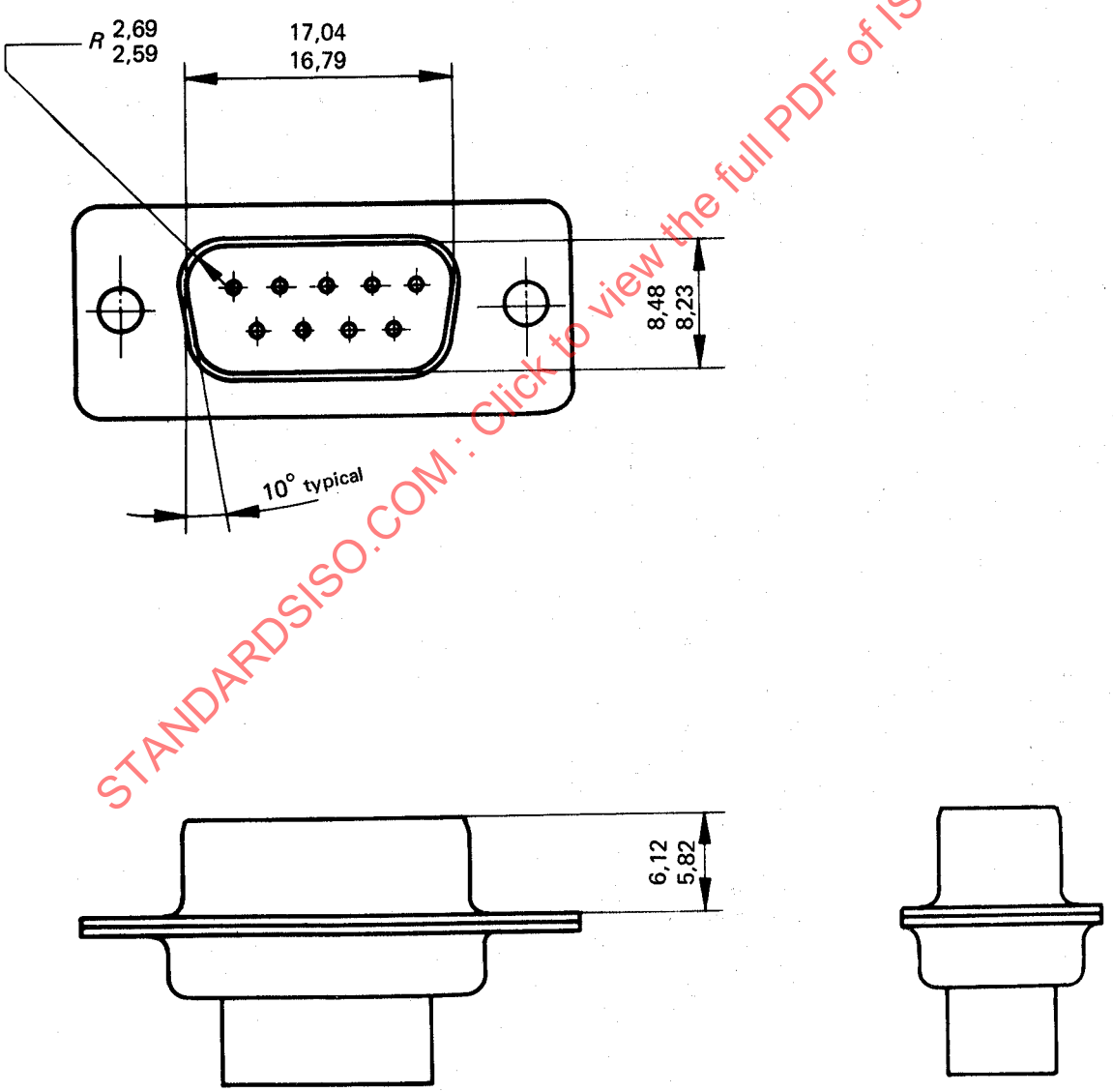


Figure 1b) — DTE 9-pin interface connector

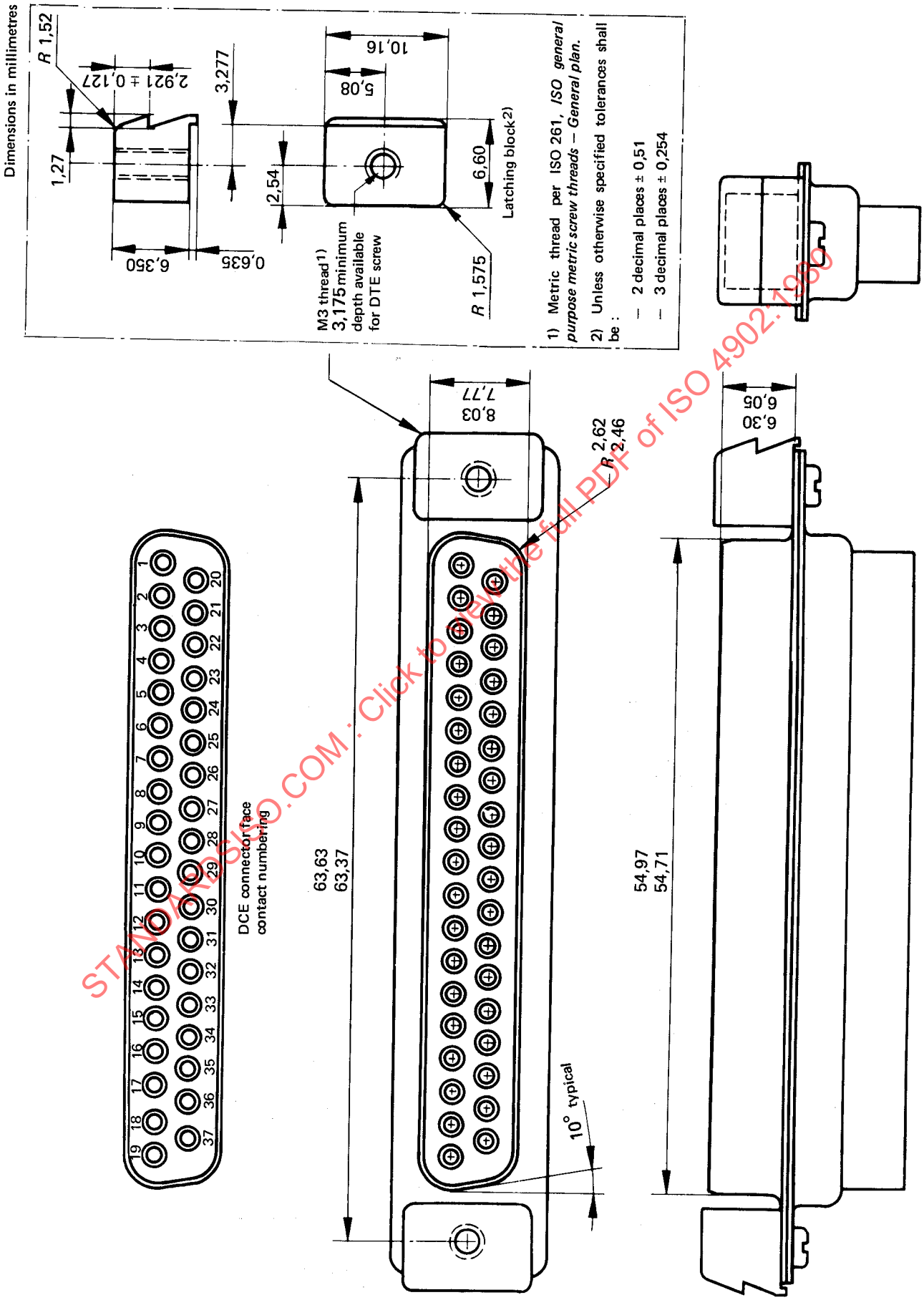


Figure 2a) — DCE 37-pin interface connector

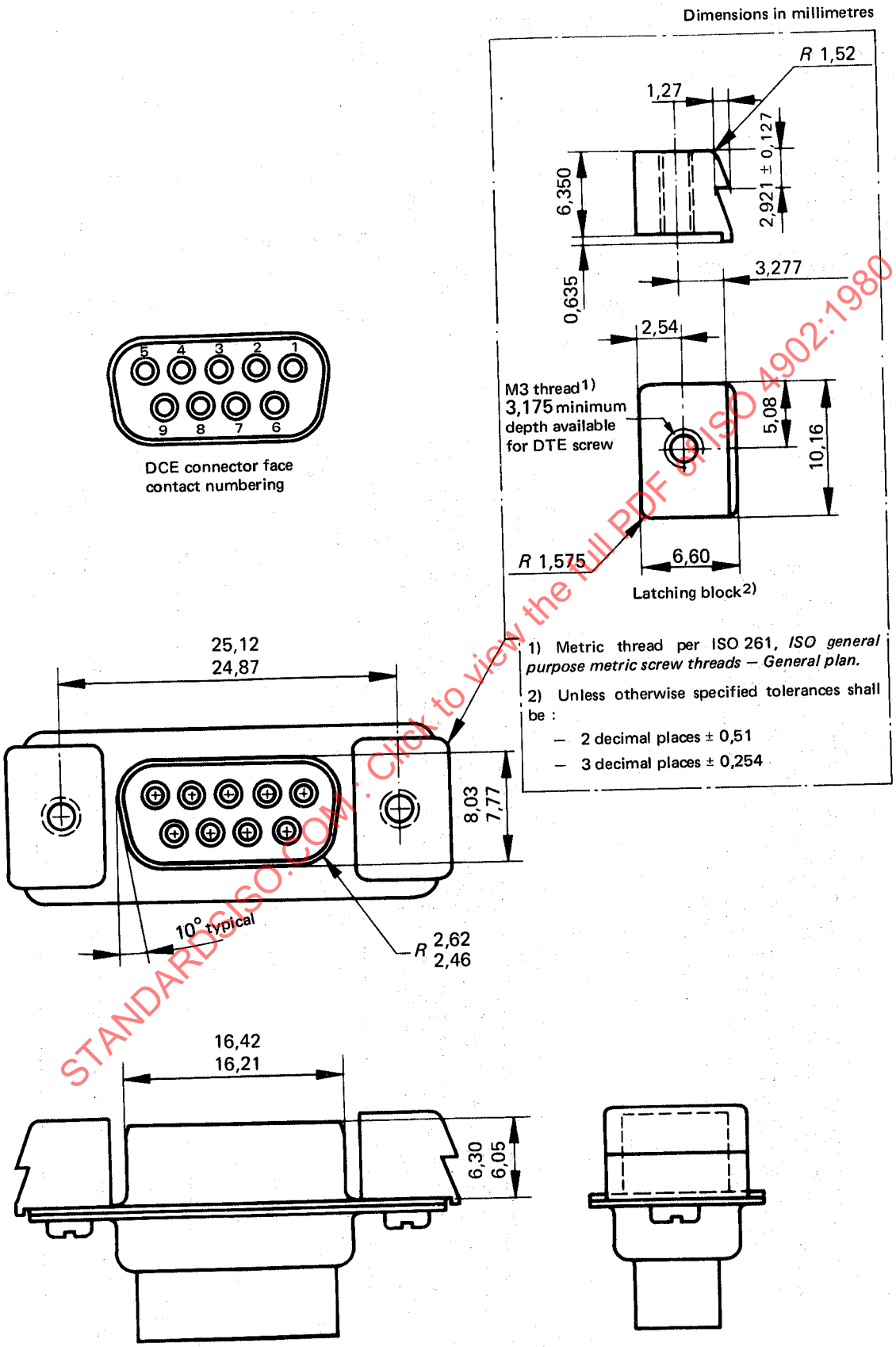
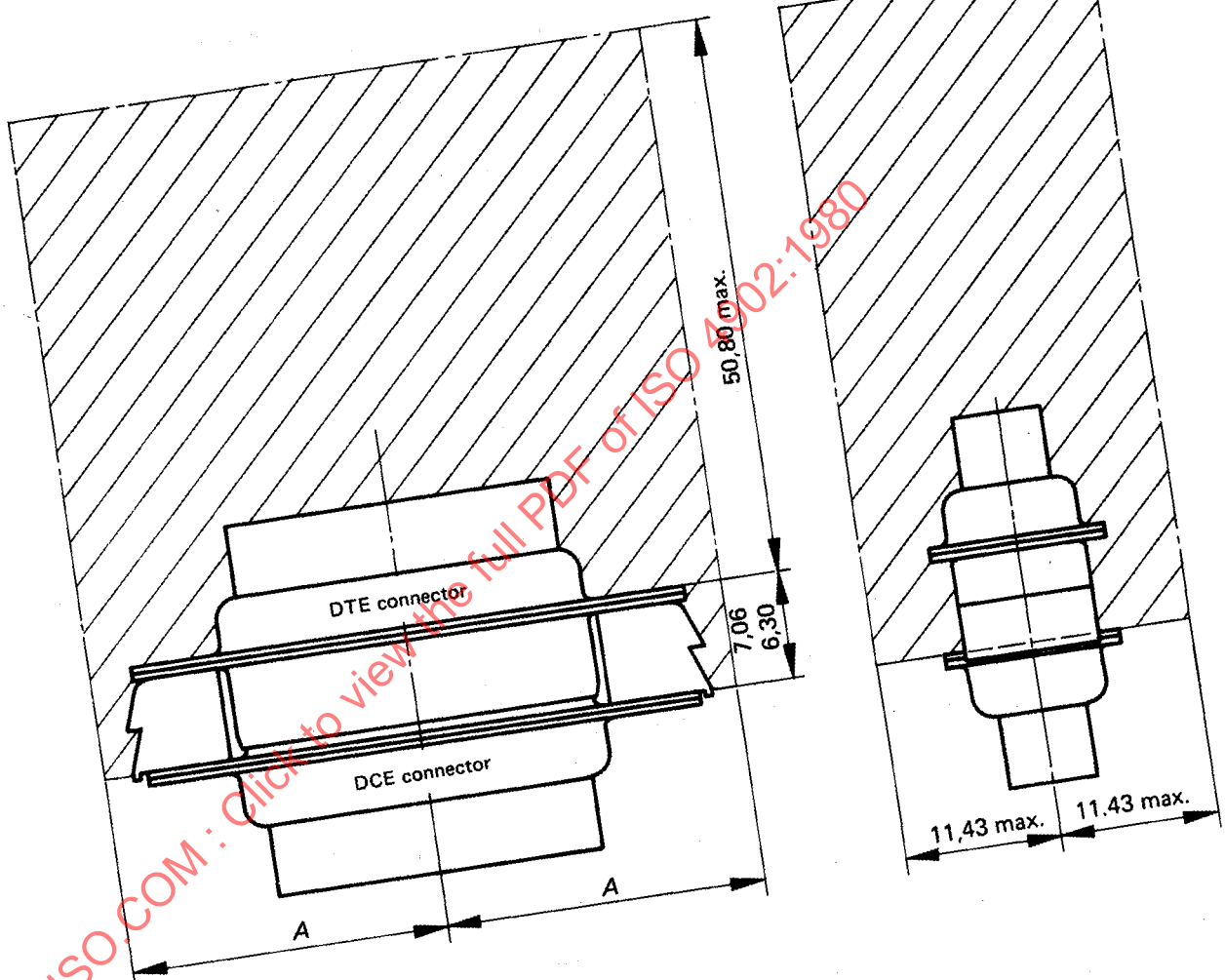


Figure 2b) — DCE 9-pin interface connector

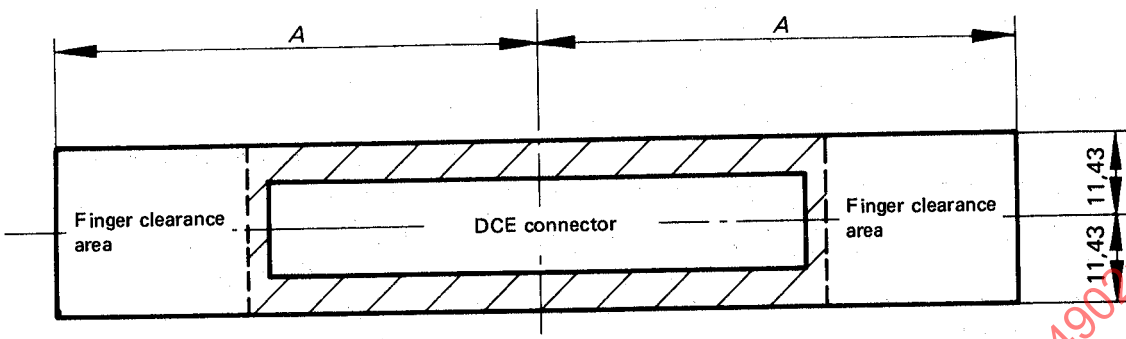
Dimensions in millimetres



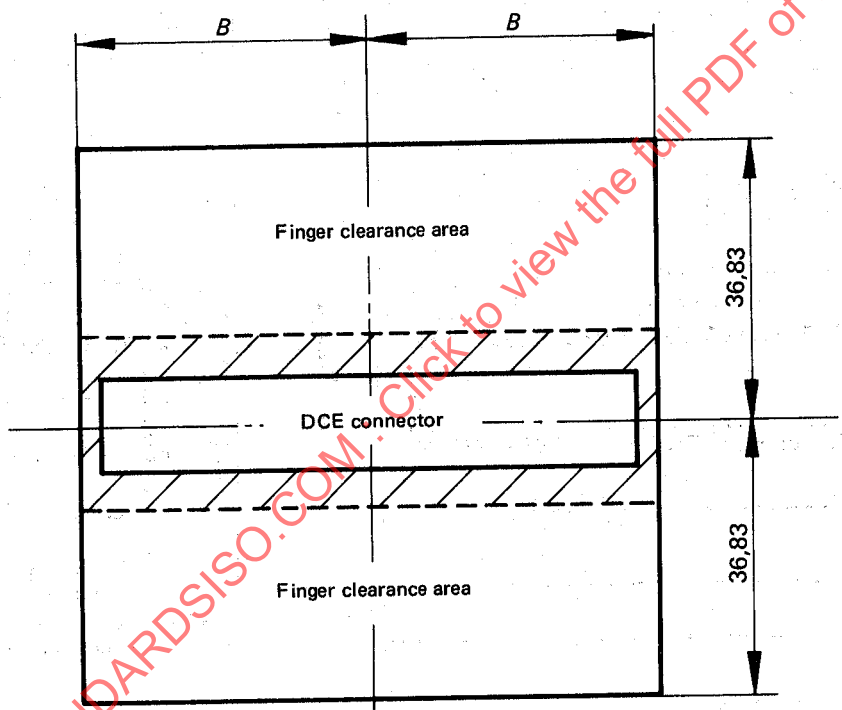
Connector	*A* dimension
37-pin	38,10 max.
9-pin	18,85 max.

Figure 3 — Maximum size of DTE connectors including cover, cable clamp, and latching devices

Dimensions in millimetres



Access space at end



Access space at side

Connector	Dimensions	
	A	*B*
37-pin	63,50 min.	38,10 min.
9-pin	44,25 min.	18,85 min.

NOTES

1 Shaded area represents maximum area of DTE connector including latch and cable clamp.

2 Finger clearance area may be shared by two connectors.

Figure 4 — Minimum spacing for DCE connector mountings

Dimensions in millimetres

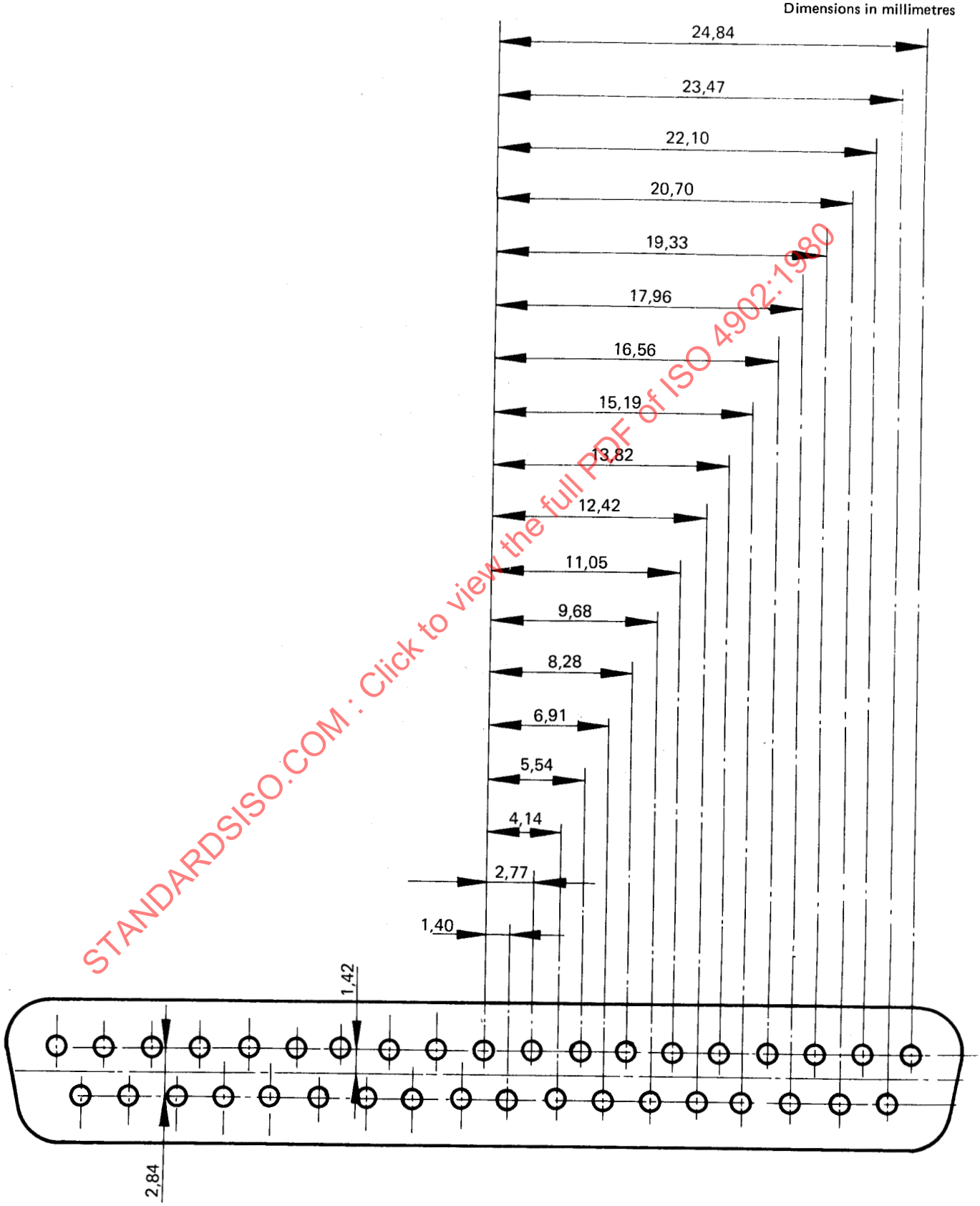


Figure 5a) — 37-pin insert arrangement

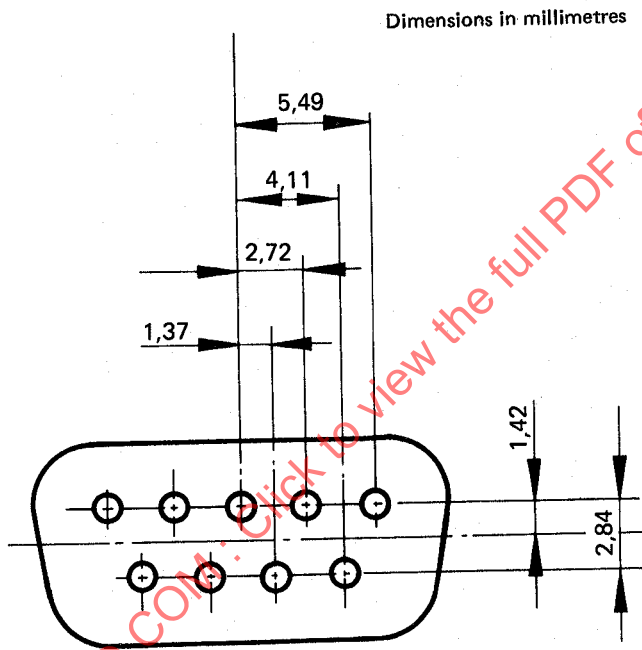


Figure 5b) — 9-pin insert arrangement

Dimensions in millimetres

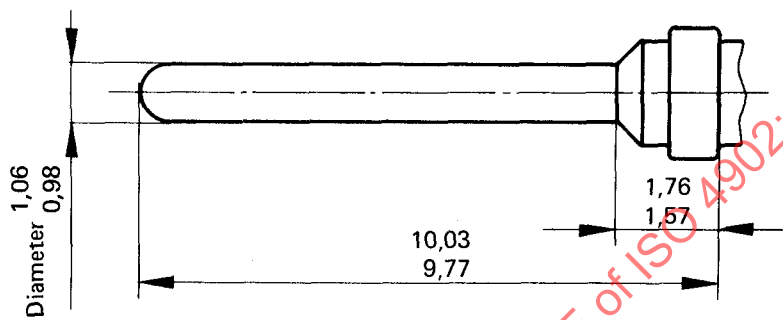
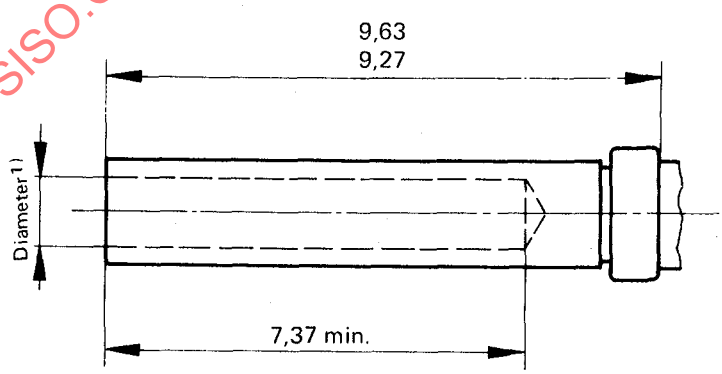


Figure 6 — Male contact

Dimensions in millimetres



1) When the pin is mated with the socket, sufficient force shall be applied by the socket to ensure proper electrical contact.

Figure 7 — Female contact

Annex A

Generator/receiver interconnecting configurations

(This annex provides additional information and does not form an integral part of the International Standard.)

CCITT Recommendation V.10 defines the two basic receiver configurations. Category 1 receivers have both the A′ and B′ interface points accessible through the interface connector. Category 2 receivers have only the individual A′ interface points accessible through the interface connector with all B′ points connected together within the equipment and brought to a single common return circuit through the interface connector. The category 1 receiver configuration can be interconnected with either balanced V.11 or unbalanced V.10 generators. The category 2 receiver configuration is only intended for interconnection with V.10 generators. Figure 8 illustrates three possible interconnecting configurations that may be applied.

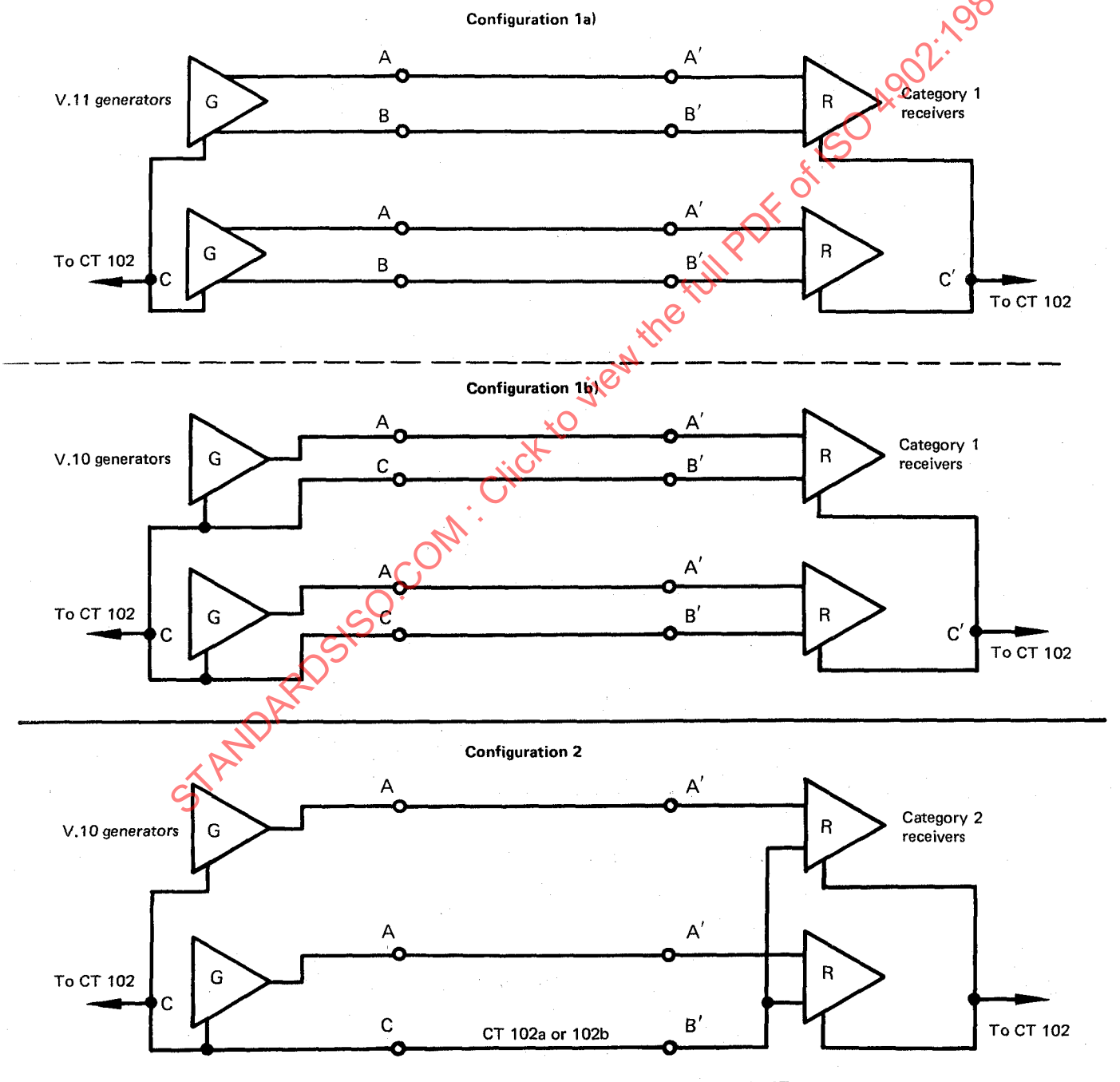


Figure 8 — Generator/receiver interconnecting configurations

Annex B

Interworking requirements with V.28 circuits

(This annex provides additional information and does not form an integral part of the International Standard.)

B.1 Scope and field of application

This annex applies to DTE and DCE which implement V.10 electrical characteristics on all interchange circuits. The necessary adaptation is described to provide compatible interworking of V.10/ISO 4902 equipment with V.28/ISO 2110 equipment. The adaptation is associated solely with the V.10/ISO 4902 equipment so that no retrofits or modifications are necessary for V.28/ISO 2110 equipment.

B.2 Electrical characteristics

This clause describes the necessary adaptation of equipment designed for V.10 characteristics to make it closely resemble the V.28 characteristics. An overlap in values of parameters of V.10 and V.28 has been established such that additional provisions incorporated in the interface circuits using V.10 will make the necessary adjustments to ensure proper operation with V.28 circuits. It should be noted that the performance associated with interworking V.10 circuits with V.28 circuits is limited to that normally associated with V.28 operation.

B.2.1 Protection

V.10 states that the receivers shall not be damaged by voltages up to 12 V while V.28 generators may produce output voltages up to 25 V. Although many commercially available V.10 receivers have been designed to withstand and operate properly with the higher V.28 voltages, protection will be necessary for those receivers which do not have sufficient tolerance. V.10 generators may also be damaged by the higher V.28 generator voltages if they are inadvertently interconnected or shorted together. Since the short circuit condition between V.28 and V.10 generators is purely a fault situation, any further consideration is left to the equipment designer.

B.2.2 Signal level

The generator output signal levels stated in V.10 and V.28 have an overlap in the 5 to 6 V range. Furthermore, V.10 levels can be as low as 4 V while V.28 levels can be as high as 25 V. The considerations associated with the upper limit levels of V.28 generators operating with V.10 receivers have been covered in B.2.1. On the lower limit, although a V.10 generator output between 4 V and 5 V is not within the V.28 recommendation, satisfactory operation with V.28 receivers having a 3 V transition margin can be expected because of the low source impedance of V.10 generators.

B.2.3 Risetime, data rate, distance

V.28 states that the risetime for the signal to pass through the ± 3 V transition region shall not exceed 3 % of the signal element duration. V.10, on the other hand, generally requires much slower risetimes specified from 10 to 90 % of the total signal amplitude to reduce cross talk for operation over longer distances. It is possible, however, through proper selection of the waveshaping for generators in V.10 equipment to meet the requirements of both V.10 and V.28 simultaneously for data signalling rates applicable to V.28 (i.e., up to 20 kbit/s).

In CCITT Recommendation V.10, a graph is provided of data signalling rate versus cable length. This graph has been translated in figure 9 to show the relationships of risetime with data signalling rate and cable length. As a result, a clear picture is shown of the interactions between these parameters. Figure 9 also illustrates the improved performance associated with linear waveshaping as contrasted with exponential waveshaping. It is expected that the more typical implementation will employ linear waveshaping. The abscissa of figure 9 is the risetime of the signal from the V.10 generator. By reading up to the CABLE LENGTH curve and over to the left hand ordinate scale, the associated maximum cable length can be determined. By reading up to the DATA SIGNALLING RATE curve and over to the right hand ordinate scale, the associated maximum data signalling rate can be determined. Thus, for any specific risetime value both the maximum cable length and maximum data signalling rate can be determined. These values will ensure that the near-end cross talk levels stay below 1 V peak.

Figure 10 shows the overlap in signal risetime characteristics which will allow interworking between V.10 generators and V.28 receivers. There are two sets of curves which represent selected data signalling rates. One set applies to signals with a linear risetime while the other set applies to signals with an exponential risetime. The right hand limit of overlap of risetime between V.10 and V.28 is shown as 1 µs for linear risetimes and 1,25 µs for exponential risetimes. The former is based upon the 1 µs limit on V.10 risetime and the latter is based upon the 15 m limitation generally associated with V.28 operation. This translates to a maximum possible data signalling rate greater than 20 kbit/s and thus permits interworking for all data signalling rates applicable to V.28 without the need for waveshaping options in the V.10 equipment.

In effect three parameters, risetime, generator output voltage (V_0), and data signalling rate, define the area of interworking between V.10 and V.28. This area of interworking is bounded by the 15 m V.28 distance limit line or the 1 µs limit on V.10 risetime on the right side, the data signalling rate line on the left side, the 6 V V_0 line on top , and the 4 V V_0 line on the bottom.

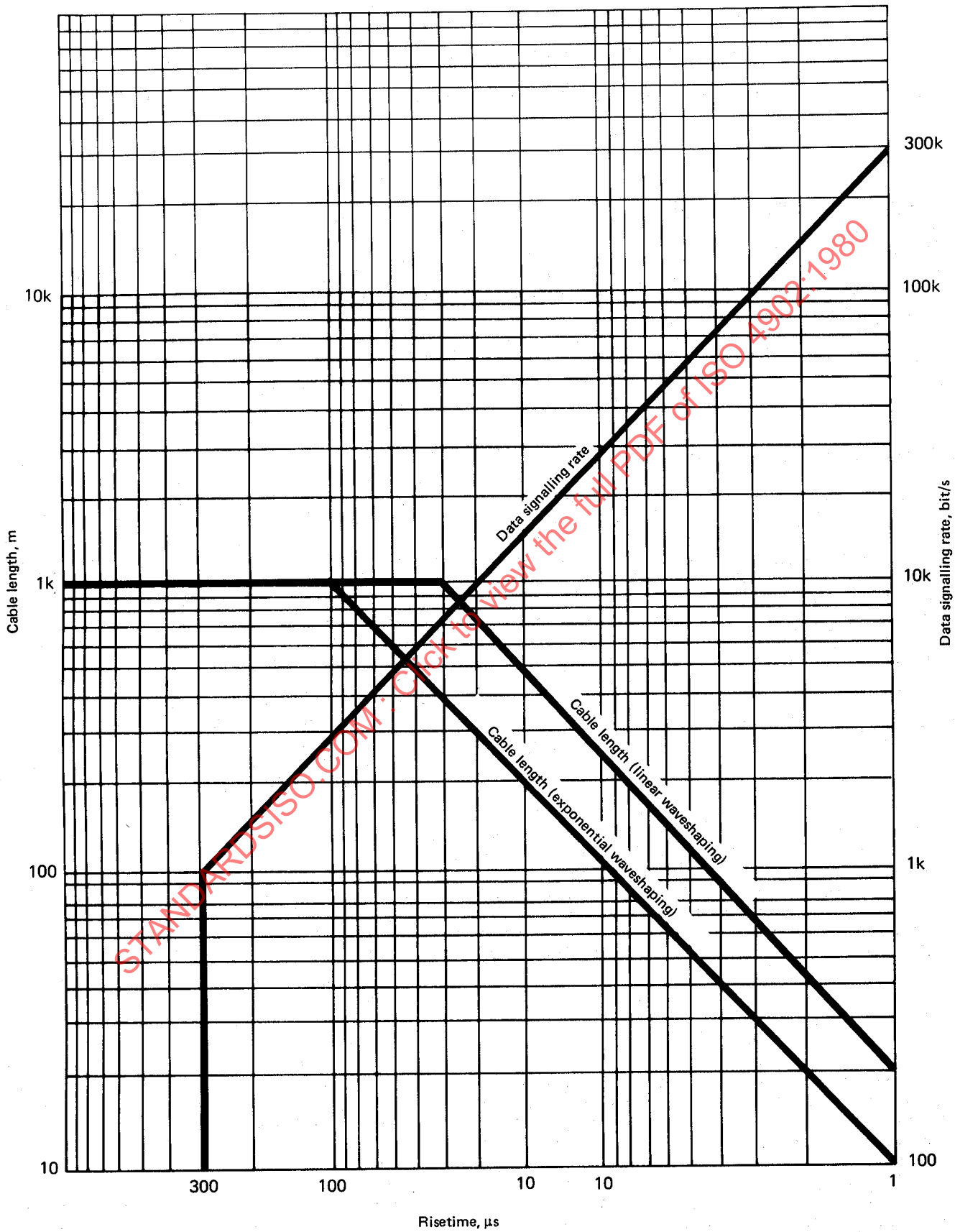


Figure 9 — Data signalling rate and cable length versus risetime

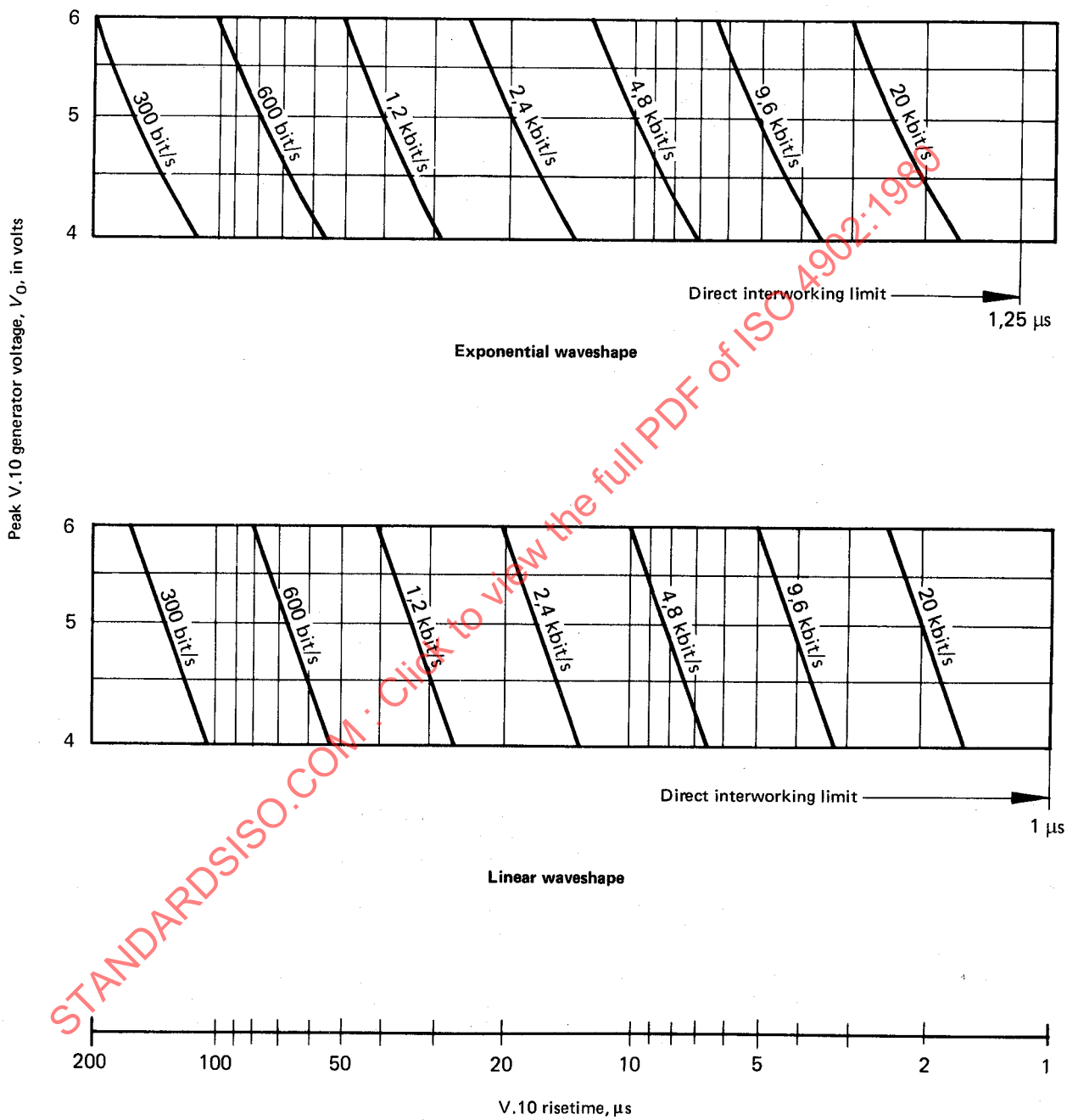


Figure 10 — Risetime relationship to V.10/V.28 interworking

B.2.4 Circuit failure conditions

A V.28 receiver designed to detect either a power-off condition or disconnection of the interconnecting cable will have no problem detecting these conditions when interworking with a V.10 generator. In the reverse situation, the V.28 recommendation allows the generator impedance in the power-off condition to be as low as 300 Ω which is too low for fault detection by a V.10 receiver using the conventional voltage biasing method. As a result, it will be necessary to incorporate a minimum of 2 kΩ in series with the input to the V.10 receiver in order to ensure proper detection of these conditions when the conventional voltage biasing method is used.

B.2.5 Signal return

V.10 requires two signal return circuits, one for each direction of transmission, while V.28 requires only one. It is therefore necessary to connect signal returns 102a, 102b plus 102 of the V.10 equipment with circuit 102 of the V.28 equipment. Additionally, all B' interchange points of the category 2 receivers must also be connected to circuit 102 of the V.28 equipment.

B.3 Mechanical characteristics

ISO 2110 specifies the 25-pin DTE/DCE interface connector and pin assignments for V.28 equipment. V.10 equipment conforming to this International Standard uses 37-pin and 9-pin DTE/DCE interface connectors which belong to the same family of connectors as the 25-pin connector. Therefore, mechanical adaptation is necessary for interworking between these two types of equipment. A 37/25-pin arrangement applies for all such interconnections while a 9/25-pin companion configuration only applies when backward channel circuits are implemented.

B.4 Suggested implementation

The actual method of implementation for satisfying the provisions outlined in clauses B.2 and B.3 is not standardized because a number of innovative approaches are possible. Accordingly, it is left to the designer of equipment meeting the V.10 interface characteristics to incorporate the necessary provisions when interworking with V.28 equipment is desired as a special feature. It should not be assumed that any equipment meeting this International Standard and using all V.10 generators will interwork with V.28 equipment unless a specific reference is made that the requirements for interworking are fulfilled.

One method of satisfying the provisions outlined in clauses B.2 and B.3 has been developed. It is presented in this clause as guidance for implementing V.10 interface characteristics where interworking with V.28 equipment is essential to facilitate an orderly transition to the next equipment generation.

B.4.1 Protection of V.10 receivers

Although V.10 states that receivers need only withstand 12 V without being damaged, a number of integrated circuits are available that can withstand and operate properly with the higher voltages which are possible from V.28 generators. When the V.10 receivers do not have adequate tolerance, however, additional protection will be required. This can be accomplished by the addition of an attenuating L-pad in front of the V.10 receiver input as shown in figure 11. The L-pad with 2 kΩ series resistance and a 3,3 kΩ shunt resistance has an additional effect of appearing as a high impedance source. Therefore, the pad should be no further from the V.10 receiver inputs than 3 m of cable to ensure that near-end cross talk from adjacent circuits does not reach an unacceptable level (1 V peak).

B.4.2 Generator output signals

The V.10 generator signal risetime and output voltage must fall within the area of interworking defined in figure 10.

B.4.3 Fault detection provisions

As specified earlier, a resistance of 2 kΩ in series with the input to the V.10 receiver is required for detection of the power-off condition if the receiver uses the biasing method. This additional resistance is not required, however, if the L-pad is included for receiver protection or if other methods are used for fault detection.

B.4.4 External adapter

A simple external adapter can be used to interconnect V.28 DTE and V.10 DCE and vice versa. Figure 12 shows typical placements of adapters which provide necessary electrical and mechanical conversions where backward channels are not employed. When backward channels are implemented in an interface, a companion adapter including a 9-pin connector will be necessary.

The wiring diagrams of the basic 37/25-pin adapters are shown in figures 13a) and 13b) and of the 9/25-pin companion configurations are shown in figures 13c) and 13d). Connections in addition to those shown in the wiring diagrams may be desirable for national circuits (N-pins) or for circuits introduced in issues of ISO 2110, subsequent to 1972.

The L-pads which may be necessary for the V.10 receiver protection are also shown in figures 13a) to 13d). These pads can be easily implemented using 1/8 W resistors. The strapping of the signal return leads can also be accomplished in the adapters.

As pointed out earlier, the L-pads must be located within 3 m of cable from the V.10 receivers to avoid excessive near-end cross talk.

In the case of the V.28 DTE with V.10 DCE configuration, there is no problem since normally the connectors are located at the DCE. In the other configuration, V.10 DTE with V.28 DCE, placement of the adapter at the DCE would not be acceptable. It may therefore be necessary also to implement the 37-pin connector, plus the 9-pin connector if needed, at the V.10 DTE to enable placement of the adapter within 3 m of cable from the V.10 DTE.