Table H.24 (H.27.1 of edition 3) – Electrical/electronic component fault modes table
(1 of 3)

Component type	Short [a]	Open [b]	Remarks
Fixed resistors			
Thin-film [c]		X	Includes SMD type
Thick-film [c]		X	Includes SMD type
Wire-wound [c] (single layer) enamelled or suitably coated		X	
All other types	X	X	
Variable resistors			
(for example, potentiometer/trimmer)			
Wire-wound (single layer)		X	
All other types	X [d]	X	
Capacitors			
X1 and Y types according to IEC 60384-14		X	
Metallized film according to IEC 60384-16 and IEC 60384-17		X	
All other types	X	X	
Inductors			
Wire-wound		X	
All other types	X	X	
Diodes			
All types	X	X	
Semiconductor type devices like transistors			
All types (for example, bipolar; LF; RF; microwave; FET; thyristor; Diac; Triac; Uni junction)	X [d]	X	[e]
Hybrid circuit	[f]	[f]	
Integrated circuits			
All types not covered by H.11.12	X [g]	X	For IC outputs, footnote e applies
Optocouplers			
According to IEC 60335-1	X [h]	X	
Relays			
Coils		X	
Contacts	X [i]	X	
Reed-relays	X	X	Contacts only
Transformers			
According to IEC 61558-2-6 or IEC 61558-2-16		X	
All other types	X [d]	X	
Crystals	X	X	[j]
Switches	X	X	[k]
Connections (jumper wire)		X	[l]
Cable and wiring		X	

Table H.24 *(2 of 3)*

Component type	Short [a]	Open [b]	Remarks
Printed circuit board conductors According to IEC 62326 series	X [m]	X [n]	
Sensors Polymeric type **thermistors** Ceramic type **thermistors**	 X 	 X X	 [o]

[a]   The conditions which have led to the design of the **clearances** and **creepage distances** according to Clause 20 on the assembly for which exclusion from the **fault** mode "short" is claimed shall be maintained over the lifetime of the **control.**

These conditions shall be declared or documented as follows.

Control pollution situation (Table 1, requirement 49).

Pollution situation in the **micro-environment** of the **creepage distance** or **clearance**, if cleaner than that of the **control**, and how this is designed (documentation) (Table 1, requirement 79).

Rated impulse voltage of the **control** (Table 1, requirement 75).

Rated impulse voltage for the **creepage distance** or **clearance**, if different from that of the **control**, and how this is ensured (documentation) (Table 1, requirement 80).

The values designed for tolerances of distances for which the exclusion from **fault** mode "short" is claimed. (declaration and documentation) (Table 1, requirement 81).

[b]   Only opening of one pin at any one time.

[c]   These components may be used for **protective impedance**, if the impedance of components complies with H.20.1.15.3 and withstands the impulse voltage test of 20.1.12 for at least **overvoltage category** III.

[d]   Short-circuit each pin in turn with every other pin; only two pins at a time.

[e]   For discrete or integrated thyristor type devices such as Triacs and SCRs, fault conditions shall include short circuit of any terminals with the third terminal open-circuited. The effect of any full wave type of component, such as a Triac going into a half-wave condition, either controlled or uncontrolled (thyristor or diode, respectively) shall be considered.

Failure of a field effect based electronic power switching device (FET, MOSFET, IGBT) by loss of gate (base) control* resulting in a partial turn-on mode, causing an undefined state shall be considered. Testing and assessment criteria shall correspond to the specific **control** function and circuitry. Guidance might be given in parts 2.

*Loss of gate control might occur due to, for example, an insufficient solder connection of the FET.

[f]   **Failure** modes for individual components of the **hybrid circuit** are applicable as described for the individual components in this table.

[g]   The short circuit of any two adjacent terminals and the short circuiting of

-   each terminal to the IC-supply, when applicable at the IC;

-   each terminal to the IC-ground, when applicable at the IC.

The number of tests implied for **integrated circuits** may normally make it impracticable to apply all the relevant **fault** conditions or to assess the likely **hazards** from an appraisal of the circuit diagram of the **integrated circuit.**

It is therefore permissible first to analyse in detail all the possible mechanical, thermal and electrical **faults** which may develop either in the **control** itself or its output, due to the malfunction of the **electronic devices** or other circuit components, separately or in any combination.

Except for types evaluated by H.11.12, a **fault**-tree analysis shall be conducted to include the results of multiple steady-state conditions to outputs and programmed bi-directional terminals for the purpose of identifying additional **fault** conditions for consideration. The **failure** mode "short circuit" is excluded between isolated sections for such ICs that have isolated sections. The isolation between the sections shall comply with the requirements of 13.2 for **functional insulation.**

[h]   When optocouplers comply with 29.2.2 of IEC 60335-1:2010, the shorting between the input and output pins is not considered.