

## Hot Appliance Couplers

Guaranteed operating safety and compatibility for "Hot" Appliance Couplers

**Electric grills, heating devices, powerful projectors, data servers or lighting systems: these are all appliances that generate a high degree of heat during operation. Such appliances place special demands on the power supply. Inherent risks such as overheating, short circuits, burns or electric shocks must be reliably prevented for safe operation. Hot appliance inlets according to the IEC 60320-1 component standard guarantee this safety, as well as the compatibility of products from one manufacturer to the next.**



**SCHURTER's 1681 IEC appliance inlet**

The IEC 60320-1 component standard is a worldwide specification for appliance inlets and connectors, covering various current ranges, protection classes as well as maximum pin temperatures and ambient temperature for the connectors. Until the introduction of this standard, appliance couplers were covered under the DIN 49491 standard and were commonly called "waffle iron plugs", since they were frequently used in electric irons and waffle irons. A porcelain insulator, with a steel tongue to establish the safety contact, was installed in the appliance. The coupler was surrounded by a Duroplast (Bakelite) housing and was typically fabricated using low quality cords with a fabric or rubber sheath. This type of hot appliance inlet design concealed serious safety risks:

- Short circuits inside the socket, due to a lack of heat resistant insulation on the cord
- Charring, caused by overheating of the plug components
- Electric shocks, due to insufficiently recessed conductive contacts on the plug

With products manufactured according to the IEC 60320-1 standard, these risks can be eliminated, for the most part, with proper use: meaning users and appliances are properly protected, as is any related consequential

damages to the equipment or surroundings. An additional advantage of IEC 60320-1 is the complete compatibility of products from a wide range of manufacturers.

### Use

High temperature appliance inlets are used universally for the operation of appliances with high heat generation, for example, electric grills, table grills, raclette makers or electric heaters. Hot appliance inlets are also frequently used in other applications such as: IT equipment (e.g., high-powered computers, data servers), powerful projectors, lighting systems, medical devices, measurement instruments, power supplies or other industrial types of equipment.

### Criteria

From the user's perspective, power supply safety is crucial. The IEC 60320 set of

standards establish basic criteria for protection class, rated current, pin temperature, and provide specific measurements for the different coupler shapes. Based on the maximum permitted pin temperature, the IEC 60320-1 component standard distinguishes three main categories:

- Appliance couplers for cold conditions maximum pin temperature 70°C
- Appliance couplers for warm conditions maximum pin temperature 120°C
- Appliance couplers for hot conditions maximum pin temperature 155°C

These three temperature categories (cold, warm and hot appliances) are established only for the 10 A inlet styles. The remaining styles have only one or two temperature categories (see Table 1).

Mating Appliance Coupler IEC60320-1					Appliance Inlets													
					Gender Male													
					Symbol													
					Type	C6	C8	C8p	C10	C14	C16	C16A	C18	C20	C22	C24		
					Current [A]	2.5	2.5	2.5	6	10	10	10	10	16	16	16		
					Temperature [°C]	70	70	70	70	70	120	155	70	70	155	70		
					Protection classe	1	2	2	2	1	1	1	2	1	1	2		
IEC60320 Connectors	Gender Female	Symbol	Type	Current [A]	Temperature [°C]	Protection classe	1	•										
			C5	2.5	70	1												
			C7	2.5	70	2		•										
			C7p	2.5	70	2			•									
			C9	6	70	2				•								
			C13	10	70	1					•			□				
			C15	10	120	1					□	•		□				
			C15A	10	155	1					□	□	•	□				
			C17	10	70	2									•			
			C19	16	70	1										•		□
			C21	16	155	1										•	•	•
			C23	16	70	2												•

**Table 1: Coupler categories (source: SCHURTER AG)**

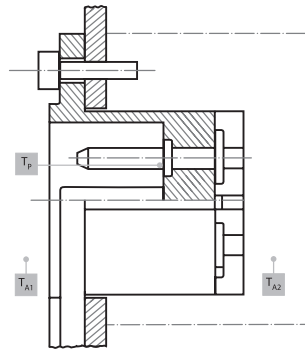
Protection classes I and II are another criterion for distinction. Protection class I describes appliance couplers with a protective ground conductor. Protection class II (also called protective insulation II) is distinguished by increased or doubled insulation. In IEC 60320-1, nominal current values of 2.5 A, 6 A, 10 A and 16 A are referred to as rated current, thereby defining the current rating according to that which the manufacturer has conformed to for appliance coupler design.

Besides the limit values described above, the standard defines added general criteria such as pull-out forces, test procedures, minimum number of insertion cycles with and without an electrical load as well as the number of flexions in the attached cords. The standard's scope is limited to appliance couplers from 250 VAC to a maximum 16 A.

In the IEC 60320-1 standard, the different connectors and appliance inlets are categorized and labeled with the letter C followed by a number (e.g. C14). The outlets (female, contact-protected appliance outlets) receive an uneven number (e.g. C21); the mating inlets (male) receive the following even number (e.g. C22).

### Pin temperature

The classification according to cold, warm and hot appliance couplers results from the maximum pin temperature (PT), which is the maximum that can occur during nominal current operation. The ambient temperature (AT1) provided for standard operation of the appliance is 25°C. On occasion, a temperature may reach 35°C according to the standard 1. The pin temperature is measured where the pin projects from the plastic surface. However, besides the ambient temperature, the temperature reached in the interior of the appliance (AT2) during operation also has an effect on the pin temperature. This again depends on the type and design of the appliance.



**Lateral section view of an appliance inlet and its relevant temperatures (source: SCHURTER AG)**

### Contours

Different coupler contours encode the matching couplers, ensuring that the appliances are safely operated and prevent improper use. Normally, the appliance inlet and outlet parameters match, as defined in the IEC 60320-1 standard. This solution is preferred if possible. An inlet, however, can also be supplied with current from an outlet with a higher rated value. So an appliance inlet from protection class II can be connected to an appliance outlet from protection class I, but not vice-versa. The higher value principle also applies to the pin temperature: it is also possible to connect outlets with a greater temperature resistance to inlets with a lower temperature resistance without affecting the safety of both appliance and user in the process.

Explanations about the ranges and terms described here can be found on the SCHURTER website: [schurter.com/gst](http://schurter.com/gst). If you have any questions or suggestions to improve the information we provide, please contact us.



**Headquarters in Lucerne**

### Company

SCHURTER continues to be a progressive innovator and manufacturer of electronic and electrical components worldwide. Our products ensure safe and clean supply of power, while making equipment easy to use. We offer a broad range of standard products including circuit protection, connectors, EMC products, switches and input systems, as well as electronic manufacturing services. Moreover, SCHURTER is ready to work with our customers to meet their application specific requirements, not covered in our standard range. You can rely on SCHURTER's global network of companies and partners to guarantee a high level of local service and product delivery.

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