7 HANDLING & USE IN PRODUCTION

7.1 Storage, transport

Storage

Relays should be stored in a clean area within the specified temperature limits. Extreme humidity and condensation can cause corrosion of the metal parts on the inside as well as the outside of the relay.

Increasing contact resistance, with time, due to the formation of oxides and other layers is to be expected for most contact materials. This degradation is dependant on the ambient atmosphere and is more rapid at high temperatures. Special care has to be taken if relays are tested or used with low contact loads after being stored for prolonged periods.

Deterioration of contact resistance during storage is reduced in the case of plastic or hermetically sealed relays.

Transport

In transit, care has to be taken to avoid excessive shock and vibration. Mechanical stress can lead to changes in operating characteristics or to internal damage of the relay (see vibration and shock resistance). If mechanical stress is suspected, the relay should be checked and tested before use.

Packaging

Different packaging is used depending on the relay type and with regard to any specific requirements during shipment or production.

Environmental awareness is leading to new developments in packaging technology, replacing PVC and foam products with recyclable materials.

7.2 Production handling/processing

Handling

Modern relays are high precision components which are sensitive to mechanical stress and abusive handling. Care must be taken when handling the relay during all stages of production.

Testing

During incoming inspection, special care has to be taken not to bend the relay terminals, internal failure (e.g. breaking of coil wires) or the degradation of sealing properties could be the consequence.

Automatic handling
The handling pressure or force of automatic feeders or robots has to be adjusted to avoid mechanical damage such as cracking of the relay case. The design of the relay should be such that when held by its case or inserted into a socket, it does not become detached.

Insertion
When inserting the relay into the PCB do not stress or use undue force on the pins as this may compromise the pin seal or effect the integrity of the coil connections.

Clinching
Terminals should not be bent to hold the relay in place on the PCB to aid flow soldering. Bending or cutting the pins after insertion generates extreme mechanical stress, especially in the case of rectangular shaped PCB terminals.

Neither the relay performance nor sealing of flux resistant and plastic or hermetically sealed relays can be guaranteed if the terminals have been bent.

Self clinching terminals are available for some types of PCB relays.

Fluxing
Fluxing has to be carefully considered depending on the type of relay.

Unsealed relays should be hand soldered to avoid flux contamination of the relay. Flux should be used sparingly and evenly and joints examined after soldering.

If flow soldering however, the flux level should be set so that it cannot flood onto the PCB. This is particularly critical if the PCB is dual tracked and there are unused holes under the body of the unsealed relay.

Flux resistant and sealed relays may be used with most fluxing procedures due to the seal between the pins and the relay base. The PCB should not be flooded as normally only the pins are sealed and flux could possibly penetrate the relay by capillary action between the relay cover and base.

If there is any doubt about the fluxing process, fully sealed relays (plastic or hermetically sealed) should be used.

Preheating
Before flow soldering, the complete PCB should be preheated. This is to dry the flux and prevent it from penetrating the relay during soldering. Also, better quality solder joints are achieved as a result of more uniform temperature distribution. Preheating should be carried out at 100°C for approximately 1 minute.
Excessive exposure to high temperatures may affect the relay's characteristics.

Soldering procedures

Automatic soldering

The automated soldering process has to be controlled carefully in order not to impair the performance of the relays. Flux resistant and sealed relays can be used with most dip or wave soldering processes. The solder bath temperature should be 260°C maximum and the soldering time should not exceed 5 seconds. The solder level has to be adjusted so that it does not flood the printed circuit board surface.

SMT soldering

Some subminiature power relays are available in a surface mount version. The use of plastic materials that are resistant to high temperatures make these relays suitable for the reflow process, such as infrared or vapour phase.

Hand soldering

If the relays are soldered by hand, the process should be completed as quickly as possible. The same temperature and time limits as for wave soldering apply.

Cooling

After flow soldering, the assemblies should be cooled in order to reduce thermal stress and to minimize the pressure differential between the inside of the relay and the atmosphere. This is particularly important if the board is to be vapour washed. If a pressure differential exists, the relay will suck cleaning fluid along with dissolved flux into the relay as it cools down. Ingress of flux into the relay can either cause the armature to stick, preventing operation, or contamination of the contact surfaces leading to contact failure. Vapour washing of flux resistant relays is not recommended.

Chemical cleaning

Unsealed relays: only the base of the PCB should be cleaned to prevent penetration of solvent and dissolved flux into the relay. Any other cleaning method involving potential contamination of unsealed relays should be avoided.

Flux resistant relays: immersion cleaning is not possible with these types of relays. Only the soldered side should be washed and care has to be taken not to allow washing solution to flood the PCB surface.

Sealed relays: only fully sealed relays should be immersion cleaned. Even then the PCB should be allowed to cool before the washing process in order not to damage the seal due to thermal shock or pressure differential.

When using high pressure cleaning processes special care has to be taken to avoid any ingress into the relay. Liquids under high pressure can damage the seal of the relay.

Ultrasonic cleaning is not recommended as this can cause friction welding of the contacts, especially in the case of gold plated contacts.

If ultrasonic cleaning cannot be avoided, it should be completed as quickly as possible. The following maximum parameters are recommended:

cleaning temperature	< 50°C,
ultrasonic duration	< 5mins,
ultrasonic pressure	< 0.5 bar.

Modern cleaning equipment uses water or alkaline solutions which are more environmentally friendly than CFC's.

If other cleaning solvents are used, ensure that the chemicals are suitable for the relay. The use of unsuitable solvents can cause cracking or discolouring of the plastic parts.

Suitable solvents include chlorinated fluor hydrocarbons (freon based solvents), isopropyl alcohol (alcohol based solvents), water with wetting agents.

Unsuitable solvents include acetone, ethyl acetate, aqueous alkalines, phenolic combinations, thinner based solvents, chlorosene based solvents, trichlene based solvents and chlorine.

Venting

After the washing process, sealed relays should be vented by breaking off the tab on the relay case. This allows the relay to "breathe" and operate up to the limits of its specification. If the relay cannot be vented, a derating of the switching current or a reduction of the switching rate may be necessary for reliable operation.

Coating

A coating is sometimes used to improve the insulation resistance of the PCB and to protect the copper tracks from corrosion.
Some coating materials are chemically active and have a detrimental effect on the relays. This may damage the case, destroy the seal and/or cause contact failures. In any case silicone compounds should be avoided.

Dust cover and flux resistant relays should not be coated as the coating material may penetrate the relay and reduce contact reliability.

Other chemicals

Silicone compounds have to be kept away from relays at all costs as gases emitted penetrate the relay causing arcing and the deposition of silicone oxides on the contacts resulting in contact failure.

If the use of a silicone compound is unavoidable, a fully sealed or hermetically sealed relay has to be used.

Handling the PCB

Relay covers are not designed to be strong enough to lift the weight of a PCB assembly, doing so may cause the relay cover to come loose.

Mechanical operations

Machining (e.g. cutting, drilling, etc.) of the assembled board can cause dust or other particles to get into the relay, leading to malfunction or failure.

Wiring

When connecting using Faston terminals, limit the connection force to 7 kg.

Soldering sockets

Relay sockets should be soldered without the relay in place to avoid flux getting onto the contacts and to prevent deformation of parts of the relay due to heat.

7.3 Check of handling - summary

HANDLING & USE IN PRODUCTION			
PARAMETER	CHARACTERISTIC	SELECT	CHECK
packaging	type of packaging	✔	
processing	testing		✔
	fluxing		✔
	soldering		✔
	cleaning		✔
	wiring		✔