Potting

General information

Why potting??
Electrical components and Printed Circuit Boards are frequently suspended moisture, extreme temperatures, mechanical loads and chemical effects. Besides more sensitive components must withstand much larger requirements.
Potting technology offers a highly effective protection for sensitive electrical connection and electronics.

Main decision criteria for potting

- Protection from moisture
- Protection from extreme cold or high humidity
- Protection from inadvertent access
- Protection from recognition (Know-how Protection)
- Protection from chemical substances
- Protection from strong mechanical strain
- Protection from temperature variation
- Protection from shock & vibration
- Protection from corrosion
- Good integration from electronic and wire
- Sealing of housings
- Sealing of connectors

What is potting??
Very simply described, potting is when a 1 or 2-component liquid potting compound is applied over a bordered printed circuit board or a housing, until all components are covered.
When the potting compound is dried and hardened, all components are encased into a solid mass. This protects the electrical circuit from humidity, dust, pollution, vibrations and shock. It also enhances electrical insulation, the flame retardation, assembly robusteness during transportation and installation.
Encapsulated PCB assemblies also significantly increase the affection safety against electrical shocks at the point of usage.

Which different potting techniques & potting compounds are there?
Nowadays the potting technology and thus an effective protection, becomes more and more important, the more as the warranties of the manufacturers rise too. Also the trend to compact constructions, particularly in the automotive industry, makes its contribution to it. Here e.g. electrical and electronic connection are placed much nearer to the engine compartment, which possess higher demands on shielding.

As there is a steady process of developement in potting technology, we can only offer a short overview here.
Potting in Hotmelt Low - Pressure Technology

Thermelt
The Thermelt-potting technology e.g. is a procedure for the processing of thermoplastic Hotmelts, on a Polyamid basis as granulates.
The granulates are melted and squirted into a toolmoulding by low pressure technique. For the protection of the components low pressures of approx. 2-50 bar are assigned. The processing temperature is approx. 200 degrees short-time.

Within the range of electronic units, special part protection and cable manufacturing there are very good application possibilities,
e.g. in automotive industry for cable runs, strain reliefs, plug potting or sealing, sticking of components on PCB’s
  e.g. for electronic units as switch/sensors, replacement for housing, protection from moisture, vibration and shock.

Possible applications:

Advantages:
- Low pressures of approx. 2 - 50 bar
- 1-component “Thermelt granulates” versatile applicable in the temperature range -40° C up to 150° C
- chemically neutral, free of solvents
- Flammability class UL94 V0
- Excellent detention characteristics on all kind of plastic
- Released for the automotive industry
- Disposable in domestic refuse
- RoHS compliant
- Comparatively low tooling costs due to low pressures
- Extremely short cycle times
- immediate processing possible
- Can be used as “substitute housing”
- Applicable also for partial encapsulation

Disadvantages:
Electronic units which are continously influenced directly by weather can rather not be protected, because Polyamide take water up and can only give humidity e.g. splash-water or air humidity back again.

Note: processing temperature is approx. 200° C short-time
Encapsulation by common potting method (casting resins)

Here 1. or 2-component, usually Polyurethan and epoxy resin masses are mixed and poured into a housing e.g. Units/transformers and condenser housings. These masses are characterised by the most different properties from soft-flexible to high-strength, filled and unfilled, clear and coloured. There are cold (air-) and hot-hardening (furnace-) potting compounds with good detention characteristics on the most different surfaces, high temperature resistant and with good chemical stability. Some of the standard products exhibit an excellent behaviour in case of fire.

Polyurethan potting compounds (PU)

Advantages:
- Compounds of 1- and 2-components available
- Good chemical stability
- Good detention on nearly all surfaces
- Not much volume shrinking (contraction)
- Raw-material relatively low priced

Disadvantages:
- Danger of blistering by affection of moisture during processing
- In general just little resistance to deformation (low shore hardness)
- Curing time is depending on mass and ambient temperature

Epoxy-resin potting compounds (EP)

Advantages:
- Compounds of 1- and 2-components available
- Cold- and warm-hardening
- Solvent-free, therefore no attack on sensitive plastics
- No smelling nuisance by solvents
- Insensitivity on affection of moisture during processing
- Very good chemical stability
- In general good resistance to deformation (high shore-hardness)
- Excellent detention on metals and plastics. For better removing of the encapsulated units from the form after hardening, the surfaces of the workpieces must be pretreated with a mold-lubricant
- Curing time is less dependent on mass and ambient temperature

Disadvantages:
- Raw-materials relatively expensive
- Strong heating up during the hardening time, too high temperature for most applications in electronics
- High Volume shrinking (contraction)
### Vacuum potting method

Advantages:
For many applications it is essential to accomplish the potting process in vacuum. That applies particularly to workpieces with difficult geometric measurement or very critical space conditions. Here nonporousness can only be achieved by potting in vacuum.

Disadvantages:
- Very expensive.

### Silicone caoutchouc potting compounds ...

... on basis Organo-Polysiloxan

Advantages:
- Cold- and warm-hardening, 1- and 2-component potting compounds
- Cuttable, perfect for any exchange purpose, after removing the defective unit it can be poured again
- Solvent-free, no attack on solvent-sensitive plastics, no smelling nuisance by solvents
- High elasticity, extremely little heat development and small volume shrinking while hardening. Thus perfectly suitable to encapsulate sensitive electronic units, such as glass diodes, sensors and many more.

Disadvantages:
- With condensation-interlacing attitudes a resoftening / reversion of the potting compound is possible
- Relatively expensive
- Silicone caoutchouc resins generally exhibit no good adhesive strength, so that all surfaces, on which the adhesion shall take place, must be pretreated with a wash primer.

### What to care for when potting?

Possible sources of error when potting
- The potting temperature is chosen too high, the soldered connection scales, the plastic moulding melts
- The construction units can be torn from their position, due to potting pressure too strong
- Blistering (e.g. due to humidity)
- Incorrect mixing proportion
- Air cavities can cause short-circuits
- Varying ambient temperatures (climate, open windows a.s.o.)
- Not correct chosen hardening times and temperatures
- Wrong dosage by mechanical engineering
- No complete "wetting-through" of the construction units to be poured, due to high viscosity (thickness) of the potting compound
- Strong expansion of the potting under thermal strain, by air cavities in the inside

Before potting ...
... it is to be guaranteed that the surface of the workpiece which is to be encapsulated is clean, grease-free and dry. Depending upon potting method the use of adhesion mediators or mold lubricants can be necessary (see under the respective potting techniques).
Pottable connectors from WECO

The following overview shows pottable connectors from WECO. Resuming information you will find on the respective product sides. WECO’s pottable connectors, plug and pin strips are developed, that the potting compound cannot penetrate into the clamping area.

Hereby there are two different ways of installing terminal blocks dedicated for potting (see picture on the right):

A terminal block is mounted on PCB edge and mating plug-in contact is facing outside of the board.

B terminal block is installed inside of the potting walls.

A list of our pottable connectors is available on our website [www.wecogroup.com](http://www.wecogroup.com)