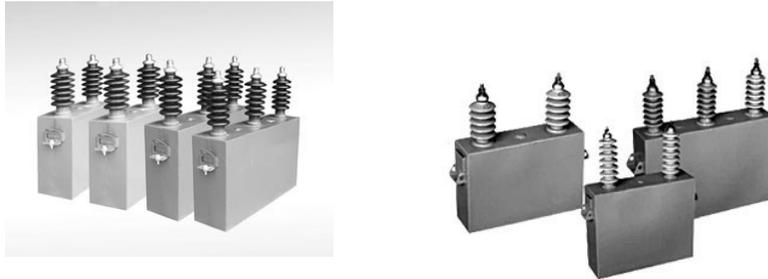




## Capacitor Packaging Guidelines

### Large Capacitors



**Composition:** A capacitor is a passive two-terminal electrical component used to store energy in an electric field. The forms of capacitors vary widely, but all contain at least two electrical conductors separated by a dielectric (insulator). Most large capacitors consist of metal foils separated by a thin layer of insulating film. Prior to 1979, capacitors contained PCB oil as a dielectric fluid.

**Hazards:** Capacitors may retain a charge long after power is removed from a circuit; this charge can cause dangerous or even potentially fatal shocks or damage connected equipment.

#### US DOT Description:

##### PCB Containing Capacitors

Proper Shipping Name	Polychlorinated Biphenyls, liquid
Hazard Class	9
Identification Number	UN2315
Packing Group	III*

\* When transported by highway or rail, PCBs are reclassified as Packing Group III in accordance with Special Provision 140

##### Non-PCB Containing Capacitors

Proper Shipping Name	Non-DOT regulated
Hazard Class	N/A (None)
Identification Number	N/A
Packing Group	N/A

#### US DOT Packaging Requirements:

49 CFR 173.21 Forbidden Materials

(c) Electrical devices, such as batteries and battery-powered devices, which are likely to create sparks or generate a dangerous evolution of heat, unless packaged in a manner which precludes such an occurrence.

Although this section of the regulations references batteries, capacitors do have the potential to store sufficient quantities to pose a hazard in transport. As such, large capacitors (>10 lb. each) must be transported as follows.

- PCB containing capacitors must be packaged in DOT specification containers unless specification packagings are impractical. If specification packaging are impractical, non-specification packaging may be used or the item itself may be considered the packaging provided it meets the general packaging requirements of the hazardous material regulations. When the capacitors themselves are the package, the capacitors must be secured to pallets adequate to support the weight of the capacitors.
- Capacitors must be transported in a discharged state.
- Each large capacitor must be shunted or grounded. This is accomplished by using a conductor to connect the terminals or connecting the terminals to a ground.

**US EPA Regulations:** As noted above capacitors manufactured prior to 1979 contain PCBs and must be managed in accordance with the TSCA regulations. Each PCB article must be marked with the M<sub>L</sub> marker. PCB articles transported for disposal must be accompanied by hazardous waste manifest that includes the serial number of the article or container number if it is a PCB article container and the out of service date for the article. If multiple articles or article containers are listed on the same manifest, a continuation page must be included with the manifest noting the serial/container numbers and out of service dates.



## Small Oil Filled Film Capacitors



**Composition:** are the most commonly available of all types of capacitors, consisting of a relatively large family of capacitors with the difference being in their dielectric properties. Oil filled film type capacitors are available in capacitance ranges from as small as 5pF to as large as 100uF depending upon the actual type of capacitor and its voltage rating. Film capacitors also come in an assortment of shapes and case styles. Prior to 1979, capacitors contained PCB oil as a dielectric fluid.

**Hazards:** Capacitors may retain a charge long after power is removed from a circuit; this charge can cause dangerous or even potentially fatal shocks or damage connected equipment.

### US DOT Description:

#### PCB Containing Capacitors

Proper Shipping Name	Polychlorinated Biphenyls, liquid
Hazard Class	9
Identification Number	UN2315
Packing Group	III*

\* When transported by highway or rail, PCBs are reclassified as Packing Group III in accordance with Special Provision 140

#### Non-PCB Containing Capacitors

Proper Shipping Name	Non-DOT regulated
Hazard Class	N/A (None)
Identification Number	N/A
Packing Group	N/A

### US DOT Packaging Requirements:

Capacitor manufactured prior to 1979 may contain PCBs in a concentrated form. As such, a container of capacitors may exceed the reportable quantity (1 pound) and be regulated as a hazardous material when transported by highway. When transported by air or water,

PCB containing small capacitors must be packaged in DOT specification containers rated for packing group III when transported by highway or rail.

**US EPA Regulations:** As noted above capacitors manufactured prior to 1979 contain PCBs and must be managed in accordance with the TSCA storage, manifesting and disposal regulations. However, in accordance with 40 CFR 761.60(b)(2) small capacitors that are generated for disposal by any person other than a manufacturer of small capacitors are exempt from the disposal and manifesting requirements of 40 CFR 761. Small capacitors are defined as those capacitors that contain less than 3 pounds of dielectric fluid. As a general rule any capacitor that is less than nine pounds gross weight will meet this definition. Although exempt from EPA regulation, these capacitors may be subject to state hazardous waste rules.