RoHS II Exemption Request

Lead in Solder for Ignition Modules

Additional Information

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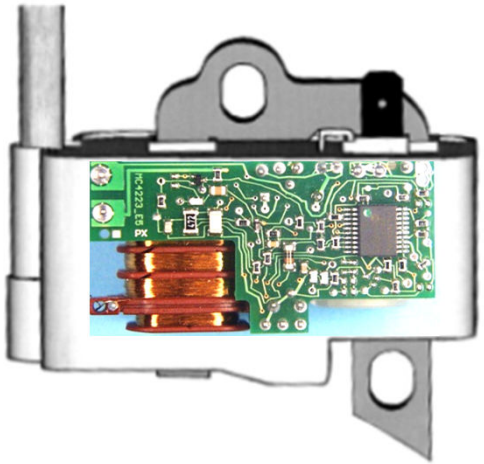
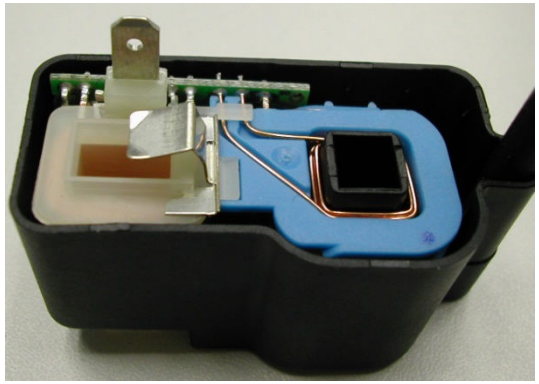
The ignition module





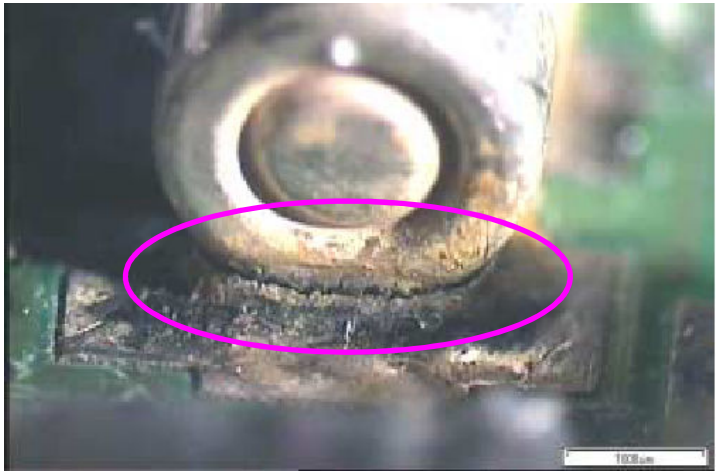
Module before sealing with epoxy resin

Data for a typical module for ignition and engine management of small spark ignition engines

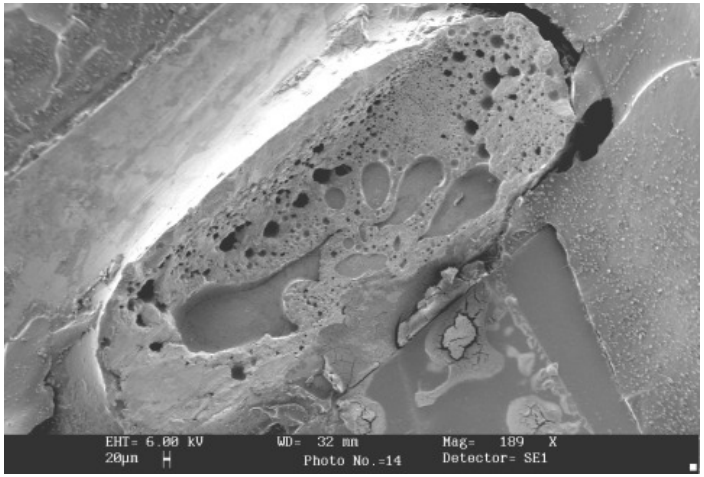
- Typical size: 55 x 40 x 27 mm
- Total weight 105 g
  - Steel 32 g
  - Copper 32 g
  - Resin for sealing (epoxy resin) 24 g
  - Plastic (PA, PBT) 10 g
  - Circuit board with components 5 g
  - Solder (37% lead) 2 g (0,74 g lead)
- Sealing with epoxy resin is necessary because of
  - Broad temperature range in operation -30°C … 110°C
  - Vibrations > 80g
  - Dielectric strength needed for >30 kV
  - Sealing against water (a chain saw has to function under wet conditions)
  - Sealing against fuel and oil

Major failure mechanisms for ignition modules

Fracture of solder joint due to thermal stress

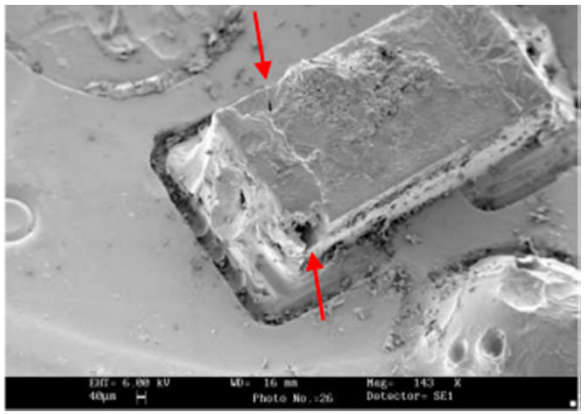


Solder joint is torn from the component



Fracture of the component (between the arrows)

SMD resistor on ceramic substrate



- A considerable R&D effort was made by STIHL and suppliers to minimize the failure of ignition modules

Suppliers

- The suppliers for our ignition modules have little experience and no equipment for lead-free solder
- Most other customers do not demand lead-free solder
- Considerable investment in production facilities needed since a lot of equipment would have to be doubled (one for lead containing and one for lead-free)

Conclusion

- So far we have no reliable data on the use of lead free solder in ignition modules for small engines
- Lead-free solder differs from the solder used today:
  - Process temperature (20°C higher)
  - Porosity
  - Adhesion on component
- The overall effect poses a high risk for a decrease of durability.
  - Comprehensive study needed in production
  - Changed components would have to undergo extensive field testing to minimize the risk
- The module would probably have to be replaced more often during the life time of the product.
  - More waste is produced
  - Modules are difficult to recycle because of necessary sealing with epoxy resin