WARPED CASTING

With respect to its original shape, the casting shows distortion which develops after a period of storage, or after heat treatment or machining.

Possible Causes

After prolonged storage or machining:
- Distortion occurs due to the partial or complete liberation of residual stresses.

After localized or complete heat treatment:
- Distortion may occur either from release of residual stresses or from one of the following factors:
  - overheating or high thermal gradients,
  - improper support of the casting in the furnace,
  - softening of the alloy at heat treatment temperature, 
  - casting design which makes stacking and support difficult,
  - excessive severity of quenching,
  - high thermal gradients during quenching,
  - alloy structural change (aging) at ambient temperatures.

Remedies

With regard to residual stresses, the most effective way to reduce or eliminate these is by appropriate design of the part, together with gating and risering systems which provide the slowest, most uniform cooling possible.

So far as other causes are concerned, the corrective measures are evident.

METALLIC INCLUSIONS

Metallic or intermetallic inclusions of various sizes which are distinctly different in structure and color from the base material, and most especially different in properties. These defects most often appear after machining.

Possible Causes

- Combinations formed as intermetallics between the melt and metallic impurities (foreign impurities).
- In aluminum alloy die casting, especially Al-Si-Cu alloys containing iron: intermetallic compounds (Fe-Al-Mn-Si combinations) which form locally or throughout the melt in the form of grains or needlelike crystals because of excessively low temperature in the crucible holding furnace. Additional pick-up of iron may occur in the case of cast iron holding crucibles.
- Charge materials or alloy additions (e.g. ferroalloys) which have not completely dissolved in the melt.
- Exposed core wires or rods.
- During solidification, insoluble intermetallic compounds form and segregate, concentrating in the residual liquid.
- Constituents of the alloy which are not completely dissolved, master alloys or foreign metal accidentally introduced forming inclusions during solidification.

Remedies

- Assure that charge materials are clean; eliminate foreign metals.
- Use small pieces of alloying material and master alloys in making up the charge. Be sure that the bath is hot enough when making the additions. Vigorous stirring accelerates melting and solution. Do not make additions too near to the time of pouring.

(continued)