

# CRAFTSMAN'S CRIBSHEET

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## Six Reasons Steel is Vacuum Treated

Vacuum treated or vacuum degassed steel is used for critical applications that require steel with an exceptionally high degree of structural uniformity, internal soundness and other characteristics that may be impaired by the effects of uncontrolled amounts of dissolved gases. Vacuum degassing treatments, along with various de-oxidation practices, are specified to control the amounts of dissolved gases in the steel.

### Vacuum treatment of molten steel:

- Reduces hydrogen content. This reduces the tendency of steel to "flake" or become "embrittled."
- Reduces oxygen content. This makes it easier for the steel to conform to restrictive micro-cleanliness requirements.
- Improves the recovery and uniformity of distribution of alloying elements and other additives.
- Helps control the composition of the steel closer than without vacuum treatment.
- Results in higher and more uniform transverse ductility, improved fatigue resistance and improved high temperature performance.
- Can be used to achieve exceptionally low carbon content that are otherwise unobtainable by conventional means.

### What are some situations where vacuum treatment is employed?

- Large forgings and large cross-sections where hydrogen would otherwise remain and contribute to flaking and embrittlement.
- Bearings where uniformity throughout the section is important for critical performance.
- Inverted delta, human-critical safety applications where steel toughness and performance place high demands on the steel's properties in all directions.



Photo credit: Siemens

The removal of oxygen by degassing is a challenge for the steelmaker, because this element is extremely reactive and can exist in the steel in many forms, such as free oxygen, dissolved in the melt as a soluble nonmetallic oxide, combined with carbon to form gaseous oxides and as complex oxides in the accompanying slags and refractories in the process.

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