

# CRAFTSMAN'S CRIBSHEET

NUMBER  
**56**

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## Stress Cracks in Steel Bar Products

"Stress cracks are defined as transverse or near transverse open crevices created when concentration of residual stresses exceed the local yield strength at the temperature of crack formation. These stresses can be mechanically induced or attributable to extreme temperature differences and /or phase transformations. They can originate at almost any point in the manufacture of the steel." – AISI Manual Detection, Classification and Elimination of Rod and Bar Surface Defects

Stress cracks are often seen in locations that experience bending or straightening. They are also referred to as "cross cracks" or "transverse cracks." Originally, they were identified in mill billet and bloom products prior to rolling.

**Micro examination can help determine crack origin by noting:**

- Orientation
- Intergranular nature
- Presence of scale
- Presence of subscale

Additional microstructural characteristics can reveal the thermal history of heating and cooling at the crack location.

**Causes and corrective action:**

- Excessive load during straightening can exceed the local yield strength of the material, causing it to crack. Reduce load applied by machine, or consider tempering or stress relieving material prior to straightening or further cold work.
- Cooling too quickly can also induce stress cracks. Critical cooling rates are highly dependent on steel chemistry. Crack-sensitive chemistries (medium carbon steels, high carbon steels, medium and high carbon steels with straight chromium or straight manganese additions.) These steels should be slowly cooled through transformation temperatures to minimize the occurrence.



- Design faults such as:
  - Heavy sections adjacent to light sections and sharp corners
  - Failure to fillet sharp corners
  - Use of fillets rather than tapers
  - Undercuts
  - Overloading the material during fabrication, processing or application.

Detection of stress cracks is problematic as their transverse orientation makes them difficult to detect on equipment setup to detect longitudinal defects.

**Final Caveat:**

The term "stress crack" is arbitrarily defined based on industrial usage in the market. It does not necessarily imply anything about the specific metallurgical nature of the crack. I know a number of people use the term "stress crack" to describe longitudinal cracks on steel bar products, which the AISI calls "strain cracks."