

## SUCCESS STORY 70

### FLAME ANNEALING AND HARDENING OF METALS



#### KEY FACTS

**Industry**  
Metals manufacturing

**Customer's End Product**  
Automotive metal parts, structural metals and airplane construction

**Automotive examples:**

- Turbocharger impeller
- Motorcycle kick start
- Drive shafts

**Construction examples**

- I-beams
- Channels
- Angles
- Plates

**Process Temperatures**  
370-425°C/698-797°F

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How can flame annealing and hardening of metals be accurately measured?

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#### Situation and background

After structural metals and metal shapes are manufactured, certain sections of the metal need to be annealed or tempered. For instance, the ends of the I-beams have to be annealed to prevent damage to the beam when it is joined to another beam at a construction site. Another example is the kick starter on a motorcycle where the center portion of the kick starter needs to be tempered to withstand the high amount of torque placed upon it when someone tries to start the motorcycle. The process can be done using flames, which may not be completely clean (blue or clear color) and can be even luminescent (partially orange). Clean flames are easier to see through with an infrared (IR) thermometer. However, if the wrong IR is selected and is looking at the orange flame, it will indicate an inaccurately high temperature.

If this occurs in the I-beam example, the user will think the beams are annealed. Beams that are improperly annealed will be soft and will bend during assembly by

#### PRODUCT AND BENEFITS

##### Raytek MMTT

- Reduced rework of structural metals (\$20K from returned product)
- Reduced cycle time avoids overheating and minimizes backlog

the customer. Beams returned for re-work can cost several thousand dollars in rework fees. In the kick start example, a backlog of kickstarter pieces can result when the hardening operation cycle time is increased because the user incorrectly estimates the time needed for this process based on inaccurate readings when the IR thermometer is looking through the dirty (orange) flame.

### **The winning solution**

- Selecting the correct instrument wavelength is the key to being successful in this application. The shortest wavelength rule may not apply. If the flame is dirty, the Raytek@MMMT sensor will do a much better job of reading the correct temperature. If a shorter wavelength is used, the pyrometer will have a bigger influence from the flame and indicate a higher temperature.
- By providing an analog output of temperature, the user can drive a PLC to stop the flame from heating when the metal is at the right temperature. Part cycle times can be minimized and over heating, due to unknown product temperature can be avoided.

### **Savings made**

Using the MMT can save the structural steel manufacturer rework costs, which can amount to \$20k (shipping and re-work fees). The motorcycle kick start user had accumulated a backlog of 3 months due to inefficient hardening practices, which were eliminated when that MMT was installed.