Iron & Steel Preservation

September, 24 2014

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Contact Vern Mesler for more information at
meslerv@gmail.com

Flame straightening steel is a process used by craftsmen since the introduction of oxygen fuel cutting and heating in 1904. It is especially valued in the repair, rehabilitation, and restoration of steels. (Oxygen Fuel Equipment History) Whether straightening a damaged wide flange steel bridge beam spanning a highway, channels and angles in a steel truss, or distortion caused by a welding process, flame straightening has proven to be an economical and safe method.

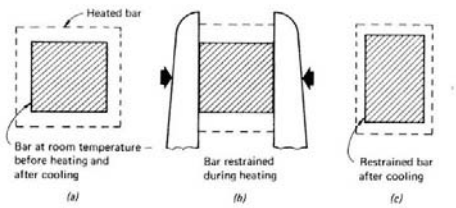
Decision to Flame Straighten

Determining whether to flame straighten a steel structure often falls to an engineer whose responsibility it is to assess the damage and develop a repair procedure within standards such as state and federal highway specifications, American Welding Society codes and specifications, and other standards for situations where flame straightening is permitted.
Understanding how flame straightening works can give those responsible for making decisions assurance in recommending flame straightening for damaged steel structures. To address this need, Lansing Community College will offer flame straightening workshops in 2015. Those interested in receiving notices of please contact Vern Mesler at meslerv@gmail.com

The earliest written information on flame straightening was by Joseph Holt who defined some of the basic concepts in a booklet Contraction as a friend in need in 1938. In 1955 Holt published a two-part article in Welding Engineer: Flame-straightening: a friend in need (October) and a friend in need (December).
Holts description of the concept of flame-straightening and its uses is still applicable today, and many of Holt's heat patterns appear in the FHWA 2008 Guide For Heat-Straightening of Damaged Steel Bridge Members. FHWA Heat Straightening

Flame Straightening, How it Works

Understanding how flame straightening works can start with an illustration from The Procedure Handbook Of Arc Welding, Lincoln Electric Company, 1994 *"If a steel bar is uniformly heated while unrestrained, as in (a), it will expand in all directions and return to its original dimensions on cooling. If restrained, as in (b), during heating, it can expand only in the vertical direction-become thicker. On cooling, the deformed bar contracts uniformly, as shown in (c), and, thus, is permanently deformed. This is a simplified explanation of a basic cause of distortion in welded assemblies."*



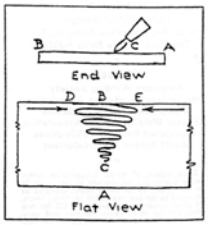


Diagram: Joseph Holt

"[M]etal at (A) and (B) is cold, but at (C) the flame heats it rapidly and forces it to expand. Since (A) and (B) are rigid, the metal can only expand into itself. This inward expansion continues to a greater extent as the heated area widens toward edge (B)."

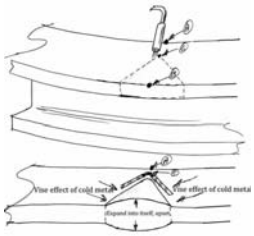


Diagram: Vern Mesler

"Point (A) should not be heated beyond the temperature created by conductivity of the metal. In other words, the cooler point (A) is, the better. This point acts as a hinge (C) and the vee-shape of the heating pattern allows an equalization of stresses."

"To make this method work, there must be portions of the member cold enough, strong enough and so situated as to force "inward" contraction where heated unless outside force can be added.""Point (A) should not be heated beyond the temperature created by conductivity of the metal. In other words, the cooler point (A) is, the better. This point acts as a hinge (C) and the vee-shape of the heating pattern allows an equalization of stresses."

"To make this method work, there must be portions of the member cold enough, strong enough and so situated as to force "inward" contraction

More Art Than Science

"Heat straightening is a skill requiring practice and experience. The proper placement and sequencing of heats combined with control of the heating temperature and jacking forces distinguishes the expert practitioner."
Lansing Community College has demonstrated flame straightening during their Iron & Steel Preservation Conference and workshops.

Participants at the 1st annual conference in Iron and Steel Preservation (March 2010, Lansing Community College, Michigan) get hands-on training in flame straightening from Dan Garijo of National Bridge

"The Road to Repair"
By Martin Anderson
Heat straightening can be an effective tool in working with damaged steel members.

Modern Steel Construction, August 2010 "The Road to Repair"

Repair, Rehabilitation, and Restoration of Metals

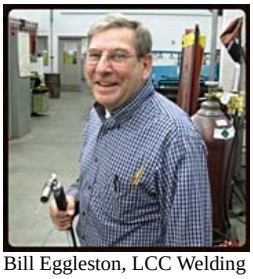
A two day training course at Lansing Community College

Register at (517) 483-9853 or BCI@lcc.edu

- **Date: October 24 & 25, 2014**
- **Time: 8:00am - 5:00pm**
- **Cost: $600.00/participant**
- **Location: Lansing Community College, West Campus Welding Lab, Lansing Michigan**
- **1.45 CEU certificate issued at the end of the second course day**

For more information please visit,
Lansing Communty College ISP Website

Repair, Rehabilitation, and Restoration of Metals, Welding Instructors



Bill Eggleston, LCC Welding Instructor
American Welding Society Certified Welding Inspector (CWI)

Roger Morrison, LCC Welding Instructor and Lab Technician

Belleville Bridge

Article courtesy of Wayne Harrall, PE
Deputy Managing Director - Engineering
Kent County Road Commission
"American Public Works Association (APWA) project of the Year, 1996"

Michigan Wayne County winning submittal to the APWA for its project to relocate and replace the historic Belleville Bridge.

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