

toughness of 20ft-lbs at 0° F and 40ft-lbs at 70° F and meeting the Supplemental Toughness Requirements for Welding Materials included in *FEMA-353, Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications*. For structures with lower service temperatures than 50° F, these qualification temperatures should be reduced accordingly.

*Commentary: Principles of fracture mechanics demonstrate the importance of notch toughness to resist fracture propagation from flaws, cracks, and backing bars or other stress concentrations that may be pre-existing or inherent, or that may be caused by applied or residual stresses. The 1997 AISC Seismic Provisions require the use of welding consumables with a rated Charpy V-Notch toughness of 20 ft.-lbs. at -20° F, for Complete Joint Penetration groove welds used in the seismic-force-resisting system. The 1997 AISC Seismic Provisions, Supplement No. 1, February 15, 1999 (AISC, 1999), changes this requirement to include “all welds used in primary members and connections in the Seismic-Force-Resisting System”. The rating of the filler metal is as determined by AWS classification or manufacturer certification.*

*Studies conducted under this project have indicated that not all weld consumables that are rated for 20 ft-lbs of toughness at -20° F will provide adequate toughness at anticipated service temperatures. The supplemental toughness requirements contained in FEMA-353 are recommended to ensure that weld metal of adequate toughness is obtained in critical joints.*

*Most of the beam-column connection tests conducted under this project were made with filler metal conforming to either the E70T6 or E70TGK2 designations. These filler metals generally conform to the recommended toughness requirements. Other filler metals may also comply.*

### **3.3.2.6 Weld Backing, Weld Tabs, and Other Welding Details**

Weld backing and runoff tabs should be removed from CJP flange welds, unless otherwise noted in the connection prequalification or demonstrated as not required by project-specific qualification testing. Refer to *FEMA-353, Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications*, for special requirements for weld backing, weld tabs and other welding details for moment-frame joints.

*Commentary: It was originally hypothesized, following the 1994 Northridge earthquake that weld backing created an effective crack equal to the thickness of the backing and that this phenomena was responsible for many of the fractures that had occurred. Finite element analyses of welded joints (Chi, et. al., 1997) have shown that although the backing does create some notch effect, far more significant is the fact that when backing is left in place, it obscures effective detection of significant flaws that may exist at the weld root. These flaws represent a significantly more severe notch condition than does the backing itself.*