

## The Temperature Dependence of Tensile Properties for Alloy 25, Alloy 3 and ToughMet® 3 Rod

The temperature dependence of the tensile properties for various tempers of ToughMet 3 (C72900), Alloy 25 (C17200) and Alloy 3 (C17510) rod were measured from -195 °C (-320 °F) to 345 °C (650 °F) in accordance with ASTM E21. All of these copper alloys showed increased strength at sub-zero temperature and a loss of strength and ductility at elevated temperature.

### Elevated Temperature Properties

The standard specifications for alloys from Materion Performance Alloys provide tensile properties at “room temperature,” about 22 °C (72 °F). When designing with these materials at other temperatures, knowledge of the temperature dependence of the tensile properties may be needed. To provide this information, Materion has measured the temperature dependence of the tensile properties for standard tempers of ToughMet 3 (C72900), Alloy 25 (C7200) and Alloy 3 (C17510) rod. Testing was performed in accordance with ASTM E21, “Standard Test Methods for Elevated Temperature Tension Tests of Metallic Materials.”

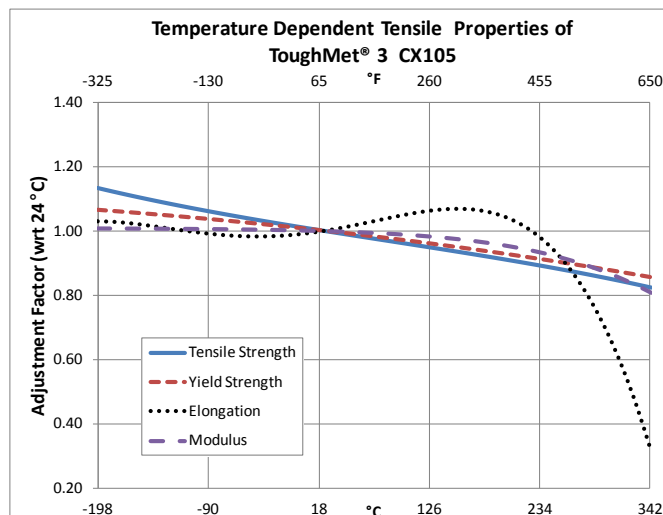
When designing below room temperature, these tensile tests with short time exposure at temperature are adequate. At elevated temperature, especially above 200 °C (400 °F), elevated temperature aging effects and creep rupture properties should be considered. Materion Tech Brief AT0061, “The Temperature Stability of Alloy 25, Alloy 3 and ToughMet® 3 Tensile Properties up to 650°F/340°C,” details the permanent changes to room temperature tensile properties for Materion alloys exposed to

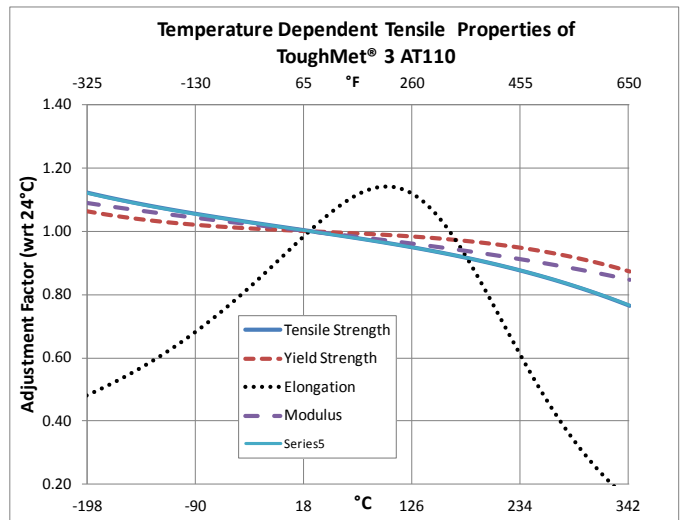
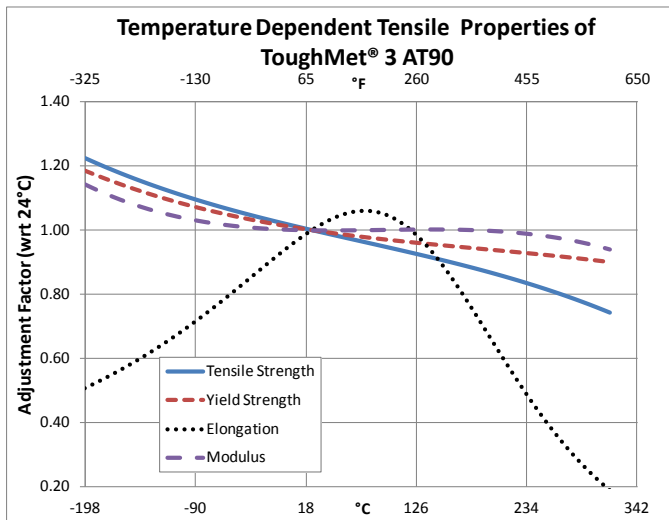
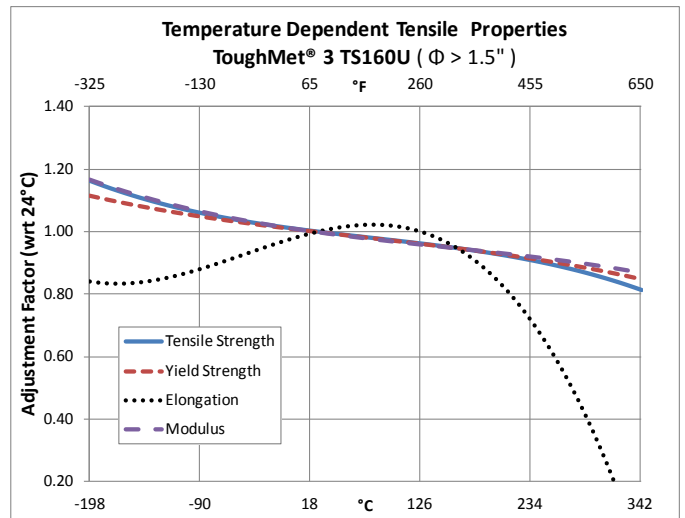
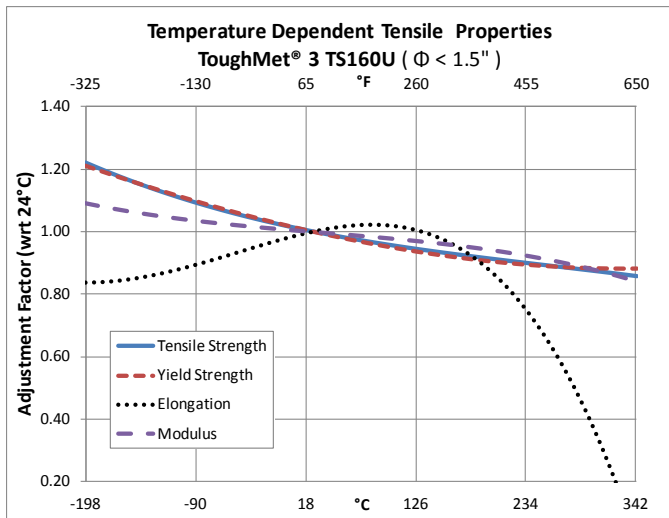
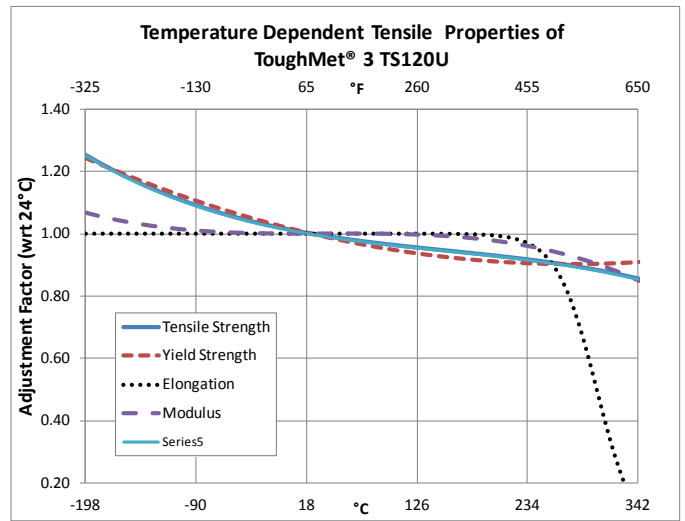
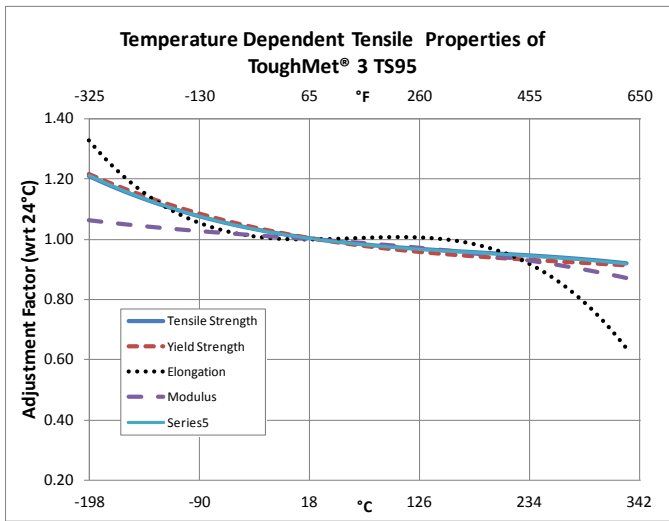
elevated temperature. Documentation on other effects at elevated temperature, such as creep and stress rupture, may be available from the Materion Technical Services.

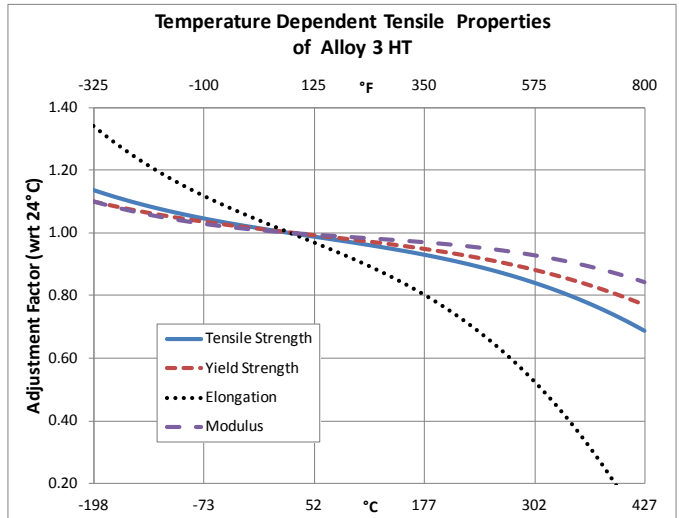
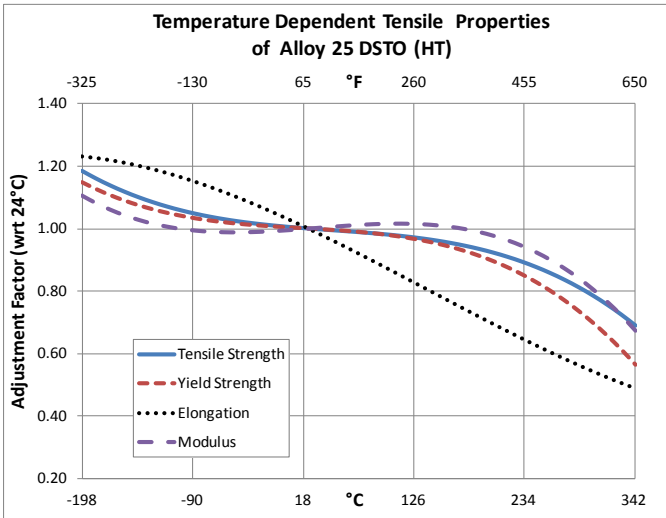
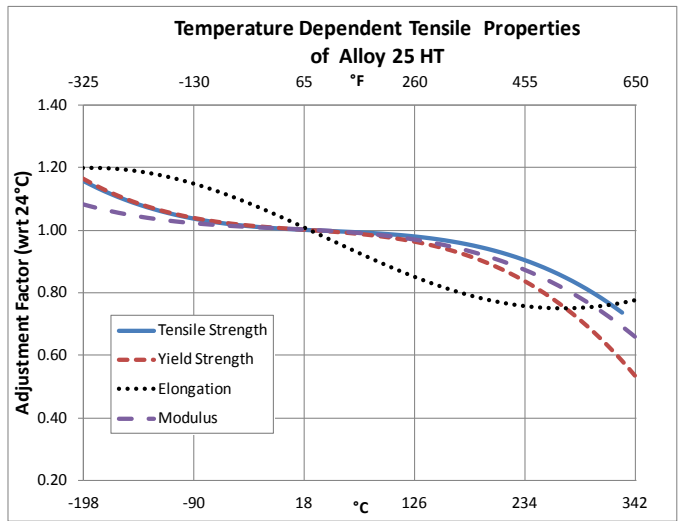
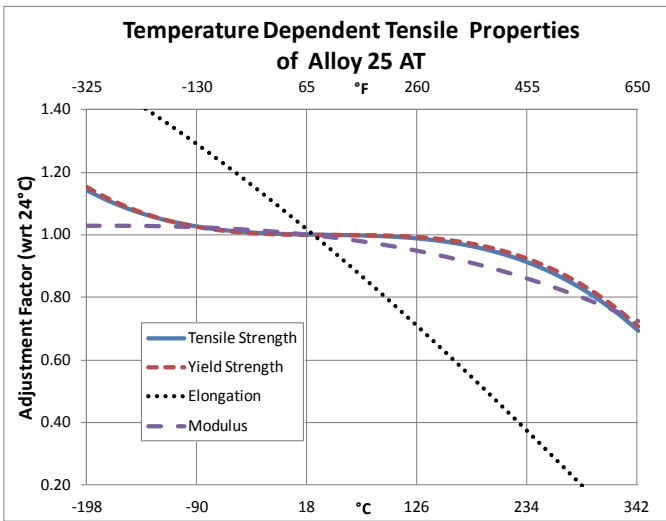
### Temperature Dependence Graphs

The graphs below show the temperature dependence of the ultimate tensile strength, 0.2% offset yield strength, elongation (4D) and elastic modulus. These are all plotted as the ratio with respect to their value at room temperature. The minimum test temperature was -196 °C (-320 °F), the temperature of liquid nitrogen. The maximum test temperature was 430 °C (800 °F) for Alloy 3 and 345 °C (650 °F) for the others. Before testing at elevated temperatures, samples were soaked for 30 minutes.

Each graph represents data from one heat of the material in rod form with diameters ranging from 1.0 to 3.5 inches (25 - 90 mm). They show the general behavior of these alloys but are not guaranteed for use as specific design values. For additional literature, further information, or technical assistance contact Materion Performance Alloys at (800)-375-4205 or [BrushAlloys-Info@materion.com](mailto:BrushAlloys-Info@materion.com).







#### Safe Handling Of Copper Beryllium

Handling copper beryllium in solid form poses no special health risk. Like many industrial materials, beryllium-containing materials may pose a health risk if recommended safe handling practices are not followed. Inhalation of airborne beryllium may cause a serious lung disorder in susceptible individuals. The Occupational Safety and Health Administration (OSHA) has set mandatory limits on occupational respiratory exposures. Read and follow the guidance in the Safety Data Sheet (SDS) before working with this material. For additional information on safe handling practices or technical data on copper beryllium, contact Materion Performance Alloys, Technical Service Department at 1-800-375-4205.