

# ENGINEERING REPORT

## TOPIC: ACTUAL OPERATING TEMPERATURE OF BIMETAL LINKS – UL33 RATED

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There is information being distributed to engineers that bimetal links rated at 160°F and 212°F will not actually operate at that temperature. It is reputed the actual temperature of link operation under heated air conditions is much higher: 290°F and 445°F. This inaccurate information is based on partial information from UL33 testing of links under the time temperature rise test.

Four items affect the performance of links and their operating temperatures:

1. Link shape
2. Entire mass of the link device
3. Metal conductivity
4. Air velocity over link

Note: Operation speed increases as the air velocity increases.

UL33 link testing establishes the temperature at which a link operates. In the first part of this test, the link is submerged in water or oil and the liquid is heated until the link's operating temperature is reached. The second part of the test is an air oven test in which the link is heated at a prescribed rate. The link must operate before the temperature reaches a maximum temperature in a short period of time. This is where the so-called "high temperature rating" is derived, and is a wrong interpretation of the test.

In the real world, there is air velocity moving across the damper – either from the air conditioning system or from heat generated by the fire. This air velocity will increase the response time of the link and make it operate at a temperature very close to the liquid bath temperature used by UL to establish the link's temperature rating.

To check the increased response time theory, Ruskin has tested bimetal and fusible links with as little as 50 fpm flowing across the link, raising the temperature until the link operates. This shows the liquid rating is equal to the air flow temperature and confirms the link will operate at the published temperature rating under air flow conditions. Bear in mind, the link operates even faster if the velocity is increased to normal system operating conditions.

Don't be fooled by misleading statements! The actual link operating temperature is not higher than the UL listing temperature; operation actually does occur at or before the UL listing temperature even under low air flow conditions.

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