



**Electric Water Heater Element Failures**

The information in this bulletin is intended to acquaint you with the various types of electric heating element field failures. It will also help you distinguish between defects covered by warranty and those which are beyond the scope of the parts warranty period.



Fig. 1

Excessive Scale Build-Up

Warranty YES  NO

Fig. 1

Manufacturers of elements consider a nominal thickness of scale greater than 1/16 inch as excessive. Excessive scale build-up will reduce the effectiveness of the heating element. Normal expansion and contraction serves to keep the element reasonably free of deposits, but some scale build-up is inevitable. Although normally found in hard water areas, softened water can also cause scaling. The scale tends to act as an insulator around the element. Heat is no longer being transferred to the water at the proper rate. A build-up of heat in the element occurs, exceeding the operating temperatures of the element, resulting in element failure. Inspect the elements annually and gently brush away the scale build-up. Use a new rubber element gasket when reinstalling the element.



Fig. 2

Dry-fired Elements

Warranty YES  NO

Fig. 2

A common heating element is designed to operate only when submerged in water. A dry-fired element occurs when the heating element is not submerged in water. Within a matter of seconds, the heating element gets very hot and usually becomes damaged. The nichrome filament wire inside the copper sheath burns in two and the heating element is damaged beyond repair. The copper sheathing becomes very soft (see picture) and easy to bend with your hands due to the excessive temperature applied to the element. You cannot easily bend the copper sheathing of a good element. Notice the melted plastic sleeves (see also Fig. 3b) at the end of the element caused by excessive heat. To prevent dry firing, make sure the heater is full of water before applying power to the unit.



Fig. 3

Power Surge or Lightning Strike

Warranty YES  NO

Fig. 3

This type of failure does not require a direct hit by lightning, but can also occur as a result of an induced voltage surge from electrical storms in the vicinity. Element has a small crater-like pinhole on the heating element side of the element head. Element will usually have a swollen or split sheath and will often show signs of spalling (a glob of molten sheath that results from the extreme voltage and instantly cools to a small ball-shape). You may also see black soot ( Fig. 3a) on the element head near the screw terminals. If it is known that a heater was involved in a lightning strike, all thermostats and elements should be replaced. Notice the melted plastic sleeves at the end of the element (Fig 3b) . This is caused by excessive heat.

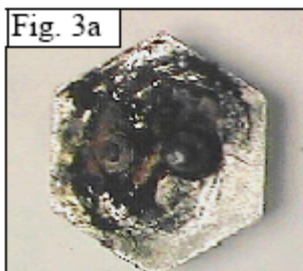


Fig. 3a

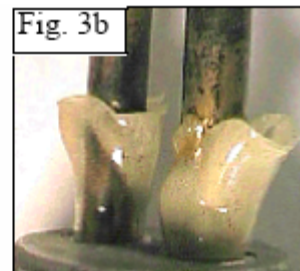


Fig. 3b



Electric Water Heater Element Failures



Fig. 4

Defective Staking

Fig. 4

Characterized by water leaking through the terminal block. The element is usually still operable and no sheath damage is evident.

Warranty YES  NO

Bad Terminal Weld

Fig. 5

Terminals come loose from the terminal pin which may protrude through the block

Warranty YES  NO



Fig. 5



Fig. 6

Split Sheath

Fig. 6

Characterized by a split along the sheath or in the bend of the sheath. Could be caused by a small pinhole in the sheath which was enlarged due to chemical reaction. Inside the sheath there is a magnesium oxide powder that aids in the transfer of heat. If the powder gets wet, it will expand and cause the sheath to split. Notice the plastic sleeves do not show signs of melting. This indicates the damage to the element was not caused by excessive heat or voltage.

Warranty YES  NO



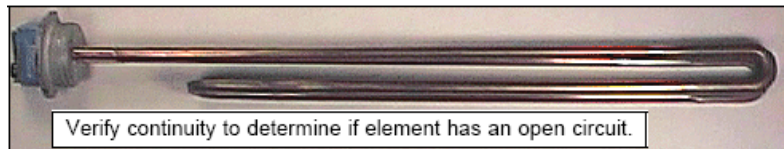
Fig. 7

Vibration Break

Fig. 7

Heating element broken off flush with the screw plug due to excessive vibration. This is more common with fold-back elements than with the straight type.

Warranty YES  NO



Open Circuit

Fig. 8

The heating element sheath is intact, but there is not continuity. Apparently, the nichrome filament wire has broken someplace and the element should be replaced. Figure 8 shows what happens when there is an open circuit inside the sheath. You cannot see this damage. The only test is to verify continuity through the heating element. Fig 8a on the left will show continuity; Fig. 8b on the right will not show continuity.

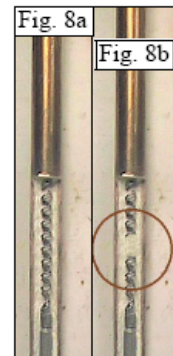


Fig. 8a

Fig. 8b

Warranty YES  NO