



## Ufer and Tower Grounding

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### Summary

An interconnected concrete tower base can help the tower ground system.

### Ufer and Tower Grounding

Concrete is a fair conductor and can be used safely and effectively to augment your tower grounding system. The characteristic which makes this practical is the concrete's ability to quickly absorb moisture and release it slowly over a long period of time. The pH of the released moisture in turn enhances the conductivity of the surrounding soil.

It is a common misconception to think that a lightning strike will blow up a concrete pad. However, consider first, a myth-perpetuating case of an improperly designed system where the tower leg "J"-bolts are imbedded directly into the concrete pad. In this case, due to the poor nature of the tower ground system, each of these J-bolts will actually share a significant amount of strike current which in turn will flow through the concrete. Since the surface area interface between the J-bolts and the concrete is small, the surge current density is very large. The corresponding heat generated by the energy transfer can turn the concrete moisture into steam and possibly crack the pad. We have only seen this happen once on a mountain top in the Nevada desert. However, a few poorly implemented occurrences can give a valuable technique a bad reputation.

If during construction, all of the rebar in the concrete pad becomes an integral part of your ground system, the overall surge current density will be several orders of magnitude lower than the myth-perpetuating case above. With the surge current distributed over all of the rebar there will be little to no opportunity to develop the temperatures necessary to vaporize the imbedded moisture. The pad will not crack.

To successfully implement a Ufer ground system it is necessary to bond each of the independent pieces of rebar together. This is best accomplished using an exothermic process. Failure to bond all elements of rebar could allow for a spark gap between the unconnected elements and thus an opportunity for localized heating of the imbedded moisture. The electrically unified rebar is connected to the tower leg with a pigtail as shown in the sketches. The subsurface radial lines, used with ground rods to further dissipate the strike energy, are also bonded to the rebar. The Ufer ground, enhanced by the local earth resistance, will be lower due to the leaching of the concrete pH into the earth which in turn lowers its impedance. The better the ground system, the more current flows through the tower leg into the Ufer ground. Also, since the strike charge is all of the same polarity, it naturally wants to spread out. With the large surface area of the rebar closer to the earth surface than the tower J-bolts, the current passes easily through the concrete to get to earth where it continues to spread out even further.

As well as the Ufer ground works, it should not be used alone. We always recommend that radials or radials with ground rods be used as the main ground system and that the Ufer ground be used to further reduce the ground resistance of your system. Many tests have been done, dating back to 1968, which prove that the Ufer is a safe and very effective way of augmenting a ground system.