

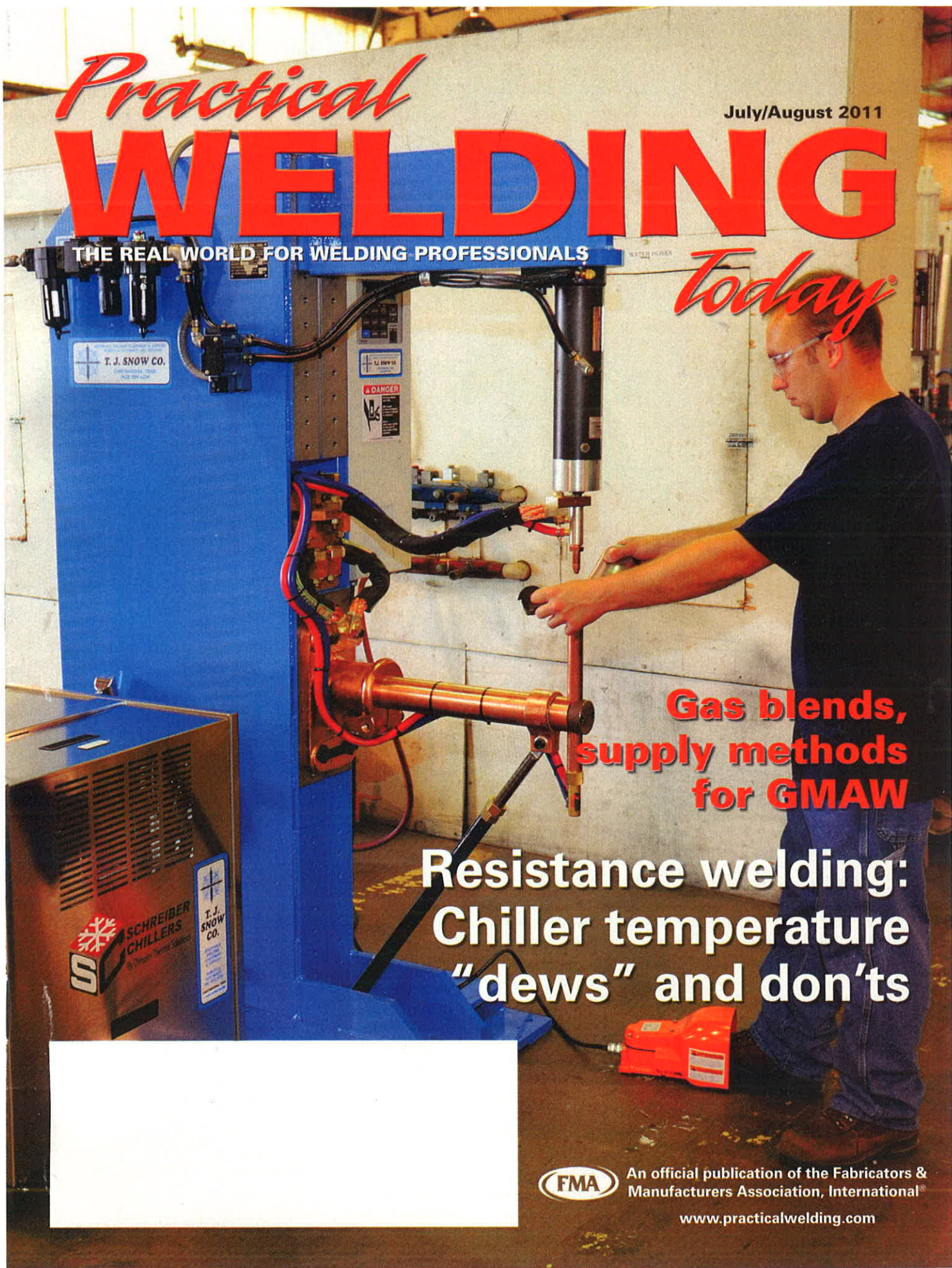
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**Resistance welding:
Chiller temperature
"dews" and don'ts**



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Chillers are a great tool for resistance welding applications. However, they can lead to extensive internal damage if the temperature is not set correctly.

Combating internal condensation in your resistance welding machine

Chiller temperature "dews" and don'ts

By Tom Snow

Imagine a cold glass of Coke® on a hot summer day. Typically, condensation will form on the outside of the glass which, for the most part, is harmless. Now imagine that same condensation forming inside your resistance welding machine ...

Resistance welding transformers generate a lot of heat, which is why most of them are designed to be water-cooled with internal water circuits (See **Figure 1**). Self-contained, chilled-water recirculators have become popular over the past few years because they conserve water and prolong electrode life. But when the

chiller temperature is set improperly, it can cause internal problems that, when they go unnoticed, can cause the transformer to short out. Welding machines cooled by tap or well water can have the same issues when the temperature of the water falls below the prevailing dew point.

To avoid problems, which can include expensive downtime, it's helpful if you understand what causes internal condensation and how you can prevent it.

Do the Dew Point

Humidity refers to the amount of water vapor in the air. While humidity may bother humans, the dew point tem-

perature is what has an impact on the machine. But what is a dew point? Dew point is the temperature at which air becomes saturated. Dew points are always lower than or equal to the prevailing air temperature. Cooling air to the dew point causes condensation because dew point is the temperature at which air can no longer hold all its water vapor, forcing some of it to condense into liquid. Remember that ice-cold glass of Coke that makes a puddle on the table as it "sweats"?

In warm, humid conditions, the dew point temperature often reaches 75 degrees F and sometimes can exceed 80 degrees. Therefore, if you lower

the temperature of an industrial water chiller and run 50- or 60-degree water through a resistance welding machine, you are asking for trouble. Why? When a chiller cools a resistance welding machine at a temperature set below the prevailing dew point, the machine often starts sweating like the Coke glass, especially if you leave the water on when the machine is not in use.

External condensation on water-cooled tips and tooling often results in a puddle of water on the floor and usually is nothing more than a nuisance. However, similar condensation inside the transformer's windings or in the high-voltage section of the control causes serious problems. Water and electricity are never a good combination, especially when all that separates the transformer's internal 480-V coils are thin layers of insulation, which can break down after being saturated with water day after day, year after year. When this happens, a transformer's windings or tap switch can short out catastrophically.

Transformer repair or replacement usually is not available on short notice, and problems that arise from internal condensation often result in expensive downtime.

Don DeCorte, vice president of RoMan Mfg., Grand Rapids, Mich., a manufacturer and rewinder of resistance welding transformers, said condensation caused by overcooling with chilled water is the second most common reason for transformer failure. The most common cause is a lack of adequate water flow.

"For long transformer life, we recommend the RWMA [Resistance Welding Manufacturing Alliance] standard of at least 1 GPM of water flow per circuit at a temperature above the prevailing dew point. It is also important to understand that adequate flow is much more important than a low water temperature and that it's OK to use water that's up to 90 degrees F as long as there's enough flow," DeCorte said.

Although not as common as transformer blowups, condensation can also

cause problems with water-cooled silicon-control rectifier (SCR) contactors in the high-voltage section of welder controls, which can short out when they drip water over a long period of time (see **Figure 2**).

Combating Condensation

You can prevent condensation developing in your resistance welding transformers and controls by following these tips:

- Be sure to set the chiller's water temperature above the prevailing dew point.
- Specify transformers with windings that are fully potted internally with epoxy. This can help reduce or eliminate condensation.
- Specify transformers that have optional antisweat thermostats installed

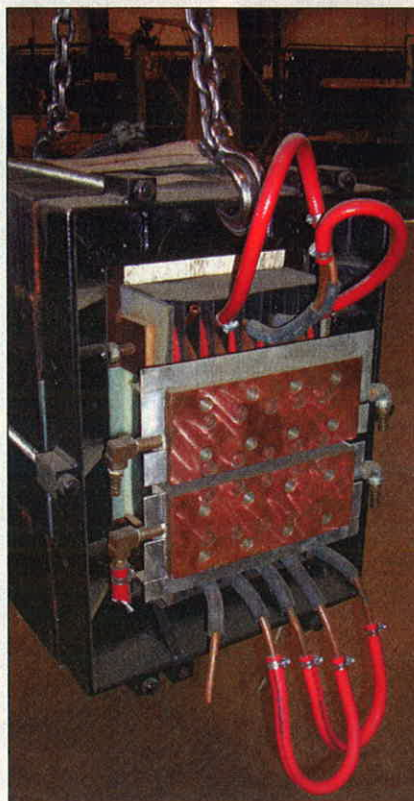


FIGURE 1

This water-cooled transformer has been removed from a resistance welding machine because of internal condensation damage. Water-cooling circuits and high-voltage transformer coils are separated only by thin layers of insulation.

internally. These should be connected to a solenoid-operated water flow valve that turns on the transformer's cooling water only when it is needed. Any accumulated moisture is eliminated by the transformer's internal operating heat.

- Take advantage of the water-saver circuits built into many modern machine controls. When connected to a solenoid-operated water flow switch, these circuits turn on the water after the welding machine starts operating, and turn it off after an appropriate cool-down period when the machine is no longer cycling.

- Invest in a chiller that automatically monitors the temperature/dew point spread and keeps the water temperature above the dew point, thus preventing the machine from sweating because of condensation. This type of chiller is relatively new to the market.

Case Study: Real-world Condensation Woes

During a recent August heat wave, a customer located in Georgia called late on a Friday afternoon with a breakdown crisis. The only machine in the plant capable of resistance welding fusites to refrigeration compressor shells had suddenly blown up, and the entire line was down.

Problem. Tests showed a shorted welding transformer, which was removed for repairs.

The internal windings of the water-cooled transformer were thoroughly soaked with moisture, which caused the insulation in one of the coils to break down and the transformer to short out. This was a sign that condensation had been going on for some time.

Also, the SCRs in the contactor cabinet had been sweating for so long that they were orange with rust. In addition, the cooling-water hoses connected to the SCRs were moldy because of so much moisture within the electrical enclosure.

A service call to the customer's plant revealed that the welding unit was connected to a water chiller that was being

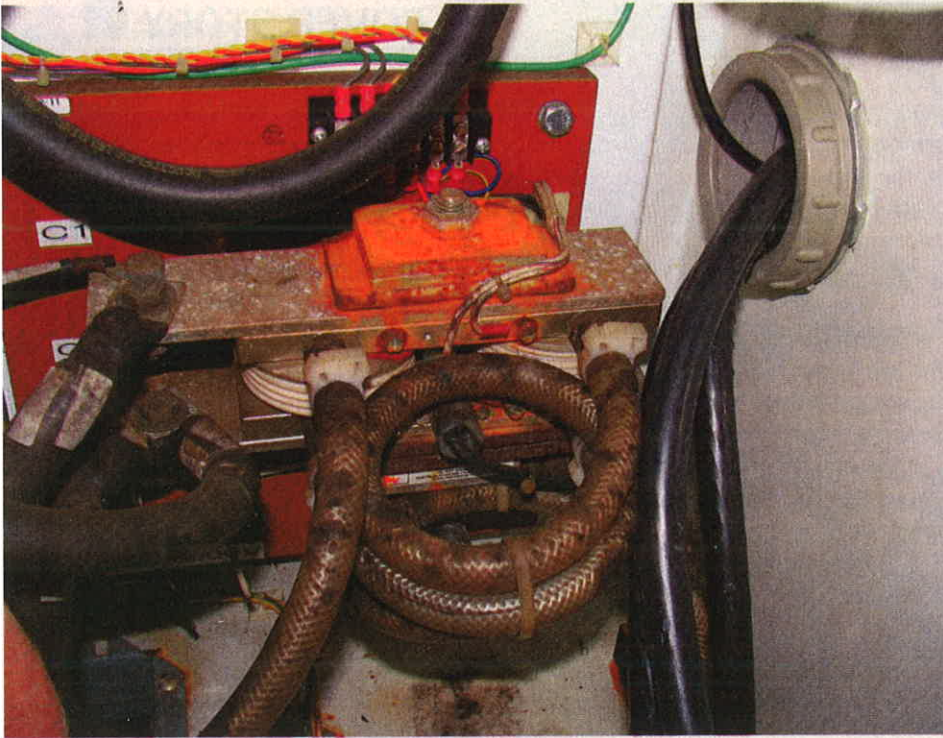


FIGURE 2

A view inside a resistance welding unit's high-voltage contractor cabinet shows rust, mildew, and mold from condensation. The SCR is orange with rust.

used by another machine. That machine required 50-degree-F water, which was well below the prevailing dew point in mid-August, which can be in the 80s F. This caused the welding machine and control to sweat internally, which eventually led to the blowup.

Solution. The customer integrated a separate chiller to use exclusively with the welding machine. Also, they learned the importance of keeping the temperature set *above* the prevailing dew point, to prevent internal condensation. It took the better part of a week before the welding machine was repaired and put back in service. Although the charges to remove, transport, repair, and reinstall the machine were substantial, that expense paled in comparison to the week's worth of lost production. ■

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