

Application Case Study: Thermal Protection in Outdoor Entertainment Heating



Many of us have been guests at an outdoor event where we might have felt it a little too cold outside, our minds silently urging the happenings along so that we could get back to the warmth indoors. No matter if it's a wedding, a concert, a community church event, a work social hour, or any other of a thousand different types of entertainment event held outside, we all can appreciate the desire to get out of the elements and back into a nicely conditioned space.

As it so happens, this universal human trait has sprung up a mini-industry of equipment manufacturers and renting distributors that provide solutions for exactly this application – using portable heating and cooling equipment to condition environments within temporary outdoor structures. Events held for commercial purposes such as farmer’s markets and corporate meetings draw large crowds, calling for robust, industrial-grade conditioning equipment that can handle large air volumes and energy loads.

Whitman was called upon by a national equipment rental agency to help solve a temperature control problem in their fleet of portable indirect fired heater units, and thinking of all the people who will at some point seek refuge from the cold in outdoor shelters heated by these units, we couldn’t say no.

About Us

As a veteran-owned small business, Whitman Controls is dedicated to supplying premium quality, reliable, technologically advanced instrumentation for use in nearly any application. Our Bristol, CT manufacturing facility embodies over 40 years of engineering, fabrication, and customer service expertise, serving both end-user and manufacturing customers nationwide through direct and distribution channels.

Application Summary

Indirect fired heaters combust fuel (in our case, diesel) to generate heat into one side of a heat exchanger. Clean, filtered air flows through the opposite side of the heat exchanger and picks up heat along the way, without any exposure to the harmful combustion byproducts physically contained on the combustion side of the heat exchanger.

Flexible, temporary ducting is used to route this clean, heated airflow from the heater out to the venue enclosure, providing comfortable air to guests inside. Indirect heaters are also highly fuel efficient, as they can receive back warm return air from the venue and recirculate it again across the heat exchanger, reducing fuel consumption.

Indirect heaters are sensitive to overheating in two ways: one, too high of discharge air temperature can overheat the ducting’s surface, risking contact burns and combustible material ignition leading to fires; and two, unconstrained combustion in the burner train can cause the

heat exchanger to fracture, sending dangerous combustion gasses into the human-occupied venue, risking breathing in hazardous gases, oxygen displacement, and asphyxiation.

Challenge

After spending time reviewing and understanding our client's application, we summarized that their fleet of rental indirect air heaters needed a robust temperature control solution to address three concerns:

1. **Human Safety** – assuring complete and perpetual human safety was our client's top priority, and rightfully so. To protect against harmful emissions and unsafe temperatures making their way into venue spaces, our client required ultra-reliable burner temperature controls that would react immediately should heat rise beyond a safe setpoint.
2. **Fire and Smoldering Protection** – different ducting materials can smolder or ignite at lower temperatures than others, requiring that burner temperature controls be adjustable to match the materials and conditions present at each different event. In addition, ducting laid over dry grass or other ignitable materials can be problematic even at lower temperatures, driving increased necessity to precisely control burner temperatures over a wide setpoint range.
3. **Consistent Human Comfort** – after safety and hazards, our client's next highest priority was to ensure fast, accurate, repeatable response from their burner controls, striving to keep temperature swings to within a few degrees so as to provide consistent, comfortable air to the venue.

As a national rental company, our client's reputation is directly tied to short, high-visibility engagements with event organizers and guests, which requires a practically perfect record of success. Guests and sponsors who are unhappy with their event venue's air comfort are more likely to complain on social media, naming the rental company should they see their logo on the heater units. On top of clearly unacceptable major equipment failures and fires, our client was keen to state that temperature controls must even solve for mild guest discomfort so that such public outlashes were avoided.

"With our tow-behind heaters, we might have a hundred or more of these out on rent for events at any given time across the country. Every single one has to keep people warm, keep them safe, keep them happy, so that they don't even think about the ventilation. Whitman's temperature switches

help the burners turn on and off just as they should, and have worked perfectly since we put them in."

- Corporate Safety and Quality Manager, Confidential Equipment Rental Company

Solution

Carefully reviewing the above three main priorities provided by our client, we distilled the objective down to a single task at hand driven mostly by the need to protect human safety: select a temperature probe that can extend into the air pathway leaving the heat exchanger, within the heater chassis, and sample a large enough airflow area to accurately sense increasing temperatures immediately.

We also identified the features we did 'not' want to pursue: the unit could not be a fixed setpoint as different applications called for different setpoints; could not be a surface-mount sensor as we needed to get an in-stream measurement directly; and could not be economy-grade as it would be on a mobile, outdoor piece of equipment.

With these parameters in place, our application engineers returned a single preferred option, the [Whitman T150D Temperature Switch](#). With a Stainless Steel Type 316L housing, adjustable setpoint up to 510°F, 800°F rated body, and a direct contact, saturated vapor sensor mounted in a long cylindrical probe, the T150D temperature switch perfectly embodied the reliability and sensitivity that our client was after. In addition, we provided custom ducting adaptor fittings to allow for easy installation into their fleet of heaters.

Beyond specifying and providing these sensors, Whitman also helped define the control loop to be integrated into these heaters. The switch would monitor for a high temperature setpoint derived from the lowest safe ducting surface temperature value spanning all available temporary ducting materials.

All switches would be set to this setpoint, and renters would need to specify if they required higher temperature air for any reason (also requiring confirmation of ducting materials and installation conditions).

If a high temperature value is sensed, the switch would react immediately, cutting power to the heater's fuel supply valve while also opening the emergency stop circuit, requiring a physical

human reset and restart. Lastly, we suggested redundant sensors to be installed so that if the first switch failed, a second sensor would still provide protection.

Results

At last count, Whitman has now provided several hundred sensors for these rental heater units, which means we've indirectly attended several hundred corporate sales meetings, training retreats, industry trade shows, health and wellness drives, and even a few comic conventions.

Even better, our client's reputation for providing powerful, ultra-safe conditioning equipment has grown as they continue to serve more and more of these events. We consider the project a success, and will be looking to spot their equipment with our instruments inside out behind the next outdoor event venue we visit. We hope it's a fishing convention!

Data Bullets

- **+/- 1.3°F** switching repeatability minimum
- **8%** decrease in heater fuel consumption due to tighter temperature control
- **2-4** days' lead time on Whitman T150D temperature sensors
- **12%** longer corporate happy hours thanks to more comfortably heated outdoor venues

Here at Whitman Controls, our values drive us to provide the highest level of servant partnership that you can find. To discuss your applications or to learn more about our capabilities, please contact us at (866) 614-9236, via email at info@whitmancontrols.com, or online at www.whitmancontrols.com.