Industrial Heat Processing Equipment Reliability  
(It’s about dirt and heat)

Equipment reliability is at the core of production. Industrial facilities can’t operate and meet expected production standards and timelines when the combustion equipment utilized to create their product keeps tripping out, if the burners won’t stay lit, or if temperatures aren’t remaining consistent through the operating cycle. Production suffers, operators get irritated and overworked, product quality is diminished, and energy costs such as fuel dollars are being wasted.

Most combustion systems only have one device that is in normal operation as compared to almost any other type of manufacturing machine. This is a fan or blower system. It’s rare that fan and blower mechanical issues, like bearings, become a problem overtime; impacting combustion system reliability. Instead, by far, the issues seem to surround dirt and the ambient conditions that safety interlock components are asked to exist within. The two main culprits that have a negative impact on combustion system reliability are dirt and heat.

Fuel Delivery Systems Dirt & Contamination Issues

Reliable fuel delivery systems are about making sure there is no dirt or other contaminants, and that proper pressures are maintained.

Oil

If operating on oil, make sure the fuel and everything it touches is always very clean. Dirt and contamination issues are the number one problem with oil. This means the possibility of adding biocides to oil that gets stored and used infrequently; cleaning lines and strainers, installing duplex strainers to aide cleaning, and making sure nozzle tips are clean before their use.

Gas

Gas systems can also have their share of contamination. This means that great caution must be taken if the piping system has to be dismantled. Just the act of opening piping tends to move sediments around. Ensure that all fuel trains are protected with drip legs (dirt legs) and strainers. Drip legs need to be installed with sufficient room to allow removal of the pipe cap for cleaning. Emptying of this drip leg should occur with routine maintenance and be scheduled based on past experience with contamination in the fuel train. Strainers must be oriented correctly so the screen can effectively capture particles. Strainer screens that have 100 mesh (150 micron) or higher are highly recommended.
Combustion Air Fan Dirt

One of the most troubling of all combustion equipment reliability issues is the accumulation of dirt from combustion air fans in air switch lines, burner orifices, and even pilot lines. Some designs have the capability of incorporating filters for fans. However, caution is required because when applying filters to combustion systems on fans, it is very easy to disrupt fuel air ratios and make for unstable flames which could create conditions that can lead to an explosion. If installing filters, it is recommended that they be oriented vertically to prevent the buildup of dirt when the blower is not operating. If operating in a very dirty environment, consider trying to reposition the air intake or duct in cleaner air (possibly from outside). Also, make sure that regular flame observation and/or flue gas analysis spot checks occur to verify that fuel air conditions are correct.

Regulator Vent Terminations

Regulator vent line terminations must be kept free of debris and plugging. Oftentimes, insects build nests in the ends affecting the regulator’s ability to breathe or reference itself to atmospheric pressure properly. This will eventually lead to downtime. Safety codes for combustion equipment require vent termination protection to keep insects out. Make sure that all vent lines have a protective device attached to the end and that the end termination is protected from rain.

Ambient Temperature Issues

Fuel train pressure switches, flame detectors, and burner management systems need to be protected from high temperatures, corrosive conditions, high humidity, and excessive vibration. The maximum ambient temperature environment for a number of popular components is identified below. Check the rating of your specific brand of components.

Burner Management Systems (BMS) Systems

Honeywell RM7800 Series: Recommended operating temperature range of -40 to 140°F.

Flame Detectors

a. Non-self checking C7027, A1023 (0 to 215°F)

b. Non self-checking C7027, A1031 (-40 to 215°F)

c. Self-checking C7012E (-20 to 175°F)

Note: Detector temperatures can sometimes be reduced with cooling air and insulating bushings

Safety Shutoff Valves

Honeywell V4055 (Valve body and actuators): Recommended operating temperature range (40 to 150°F)

Honeywell V9055 Series: Maximum ambient (125°F)

Maxon 5000 Series: Recommended operating temperature (-20 to 140°F)

Pressure Switches

Honeywell Model C437 - Recommended operating temperature (32 to 125°F)
Operating outside of the ranges identified will lead to reduced useful life and reliability issues. Excessive temperatures for flame detectors are another common problem in many plants due to their location relative to the burner. If fuel train components and/or panels are chronically hot, consider cooling air for optical detectors, electrical panel coolers, radiation shields, or the possible relocation of devices.

**It Starts With Commissioning and Design**

Reliability issues should not be discovered as time goes on. These issues should be caught in the design or commissioning process when equipment and piping are installed. Commissioning is the process of making sure that the system is set up, tuned, and tested properly from day one. It means that prior to accepting new equipment, you are certain that it operates reliably and does everything it is required to do under a number of different test conditions. Proper commissioning also means that all of the set points are correct for all high and low gas pressure switches, air switches, operating temperature limits, high temperature limits, and the purge times. It's a best practice to have a complete manual that identifies preventive maintenance tasks and frequencies, and also cut sheets describing each individual fuel train component. Commissioning also means that burners are tuned and documentation is provided identifying each burners fuel/air ratio, or at least the proper fuel delivery pressure is documented for each burner. Optical detectors must also be sighted and pilot spark pick up and pilot turn down tests ran to make sure that the sightings are correct.

However, nothing can substitute for real life 6-months-down-the-road conditions. If reliability issues occur and continue, it may be time to re-examine the design to make your systems more robust so they can start producing as intended. No combustion systems are meant to operate trouble free without any attention. Besides the regular flame observation identified above (which could be daily), additional routine tasks are a necessity. Annual tests on high and low gas pressure switches, flame detectors, air switches, and automatic fuel shutoff valves (for internal leaks and proper function) should be executed, as well as checking burner fuel/air mixtures. These practices, along with keeping equipment and components cool and clean, will go a long way to keeping your industrial heat processing equipment operating reliably for years to come.

Honeywell Combustion Safety, formerly CEC Combustion Safety, LLC, has been in business since 1984. With engineers and staff members that sit on Code committees such as ASME CSD-1, NFPA 56, NFPA 85, NFPA 86, and NFPA 87, our inside expertise is integrated within all of our practices and our global reach ensures that customers around the world are kept safe. Contact us at +1 216.749.2992 or visit www.combustionsafety.com for additional information.