# Is Oxygen Trim Worth the Price?

The amount of oxygen in the flue gas off of a boiler indicates how much excess air is in the flue gas mixture. The lower the amount of excess air is, the higher the boiler efficiency is. In other words, the more efficient your fuel dollars are being spent.

Oxygen Trim systems gather the amount of oxygen and then position the air damper to the proper position to maintain a set point. In that way barometric, fuel temperature and other factors don't force the boiler to run less efficiently than it is capable of being.

If the excess air could be cut from 20% to 10% there would be about a 1% reduction in fuel expense. That sounds good but these systems cost a good deal of money and many times they are not capable of yielding the return on investment that was promised or anticipated.

How can you tell if an oxygen trim system is a good investment?

There are a couple of factors that determine if the answer is "yes" or "no."

Can the burner perform better after the thousands of dollars have been spent? Many burners have mixing heads that are not capable of operating over a wide range of fuel inputs without requiring that a lot of excess air to provide sufficient air and fuel mixing to achieve low and safe carbon monoxide values.

If the burner cannot run efficiently (say less than 50 PPM of CO) at low fire then oxygen trim is probably not worthwhile.

To determine this, place the burner on low fire. Adjust the air damper so that excess air is decreased to where the level of carbon monoxide is around 50 PPM. Then watch to see if the values are stable. If they are you must ask yourself why they were not set to that point before you started this adventure. Ask the burner technician that set the burner up that way. He may tell you that he noticed higher CO values at that excess air level on the day he set the burner up. If that is the case . . . oxygen trim is probably not a good investment.

Most local and National Codes require that at least 15% excess air (3% oxygen) to used unless an oxygen trim system is installed. Therefore note what the $O_2$ value is. If it is not in the 1.5% to 2.0% range then we don't recommend oxygen trim.
If the CO values remain stable AND the $O_2$ value is above 3%, then re-tune the burner all along its range of firing rates. Then continue to monitor the CO values to ensure long term safe operation of the burner at these more efficient

settings. But don't invest in oxygen trim for the sake of saving money because it will not do that in this case.

If the $O_2$ value is below the applicable Code's minimum amount required without oxygen trim then further evaluation needs to be made before deciding. Try to determine the efficiency gain at various firing rates and the savings that could be realized at each of those rates. Then try to determine the number of hours (that you can translate to dollars) that the burner will run at those rates. At that point an economic prediction can be made that might make your decision look like a "yes."

If "yes" looks like the right answer there are other considerations. How much does it cost to keep the oxygen trim system running? How long do the sensors last? How much does a replacement cost? How much maintenance is required? How often does the system need to check or calibrated? How much does that cost? If the answers still look like you should proceed then you must determine:

Does the system being considered actually work? Some don't.

There is a period of time between when a molecule of fuel is burned until the time that the control is able to make a decision. The gasses need to travel through the boiler and then to the sensor. The sensor has to analyze the sample and give the information to the control. Only then can the air damper be trimmed open or shut in response to the measure value of $O_2$ and the set point.

Some systems perform a "trim" operation and then wait to measure what happened. If the "trim" was not the right amount the control performs another "trim." That type of operation works quite well UNLESS the modulation control changes the firing rate even slightly. If the firing rate changes then the control starts all over again in respect to controlling oxygen. For safety sake, the control can be commissioned so that it will position the air damper at a more open than optimal position and then wait for the next sample time. But then there is no fuel savings at that instance. So in affect, there is no trimming on this burner unless the burner stays at a precise firing rate for an extended time. That doesn't happen too often. If the control is commissioned to be aggressive, then there is too long of a time for feedback to reach the control. Therefore the control's set point must be at a higher than optimal excess air level to assure safety. So in affect there is no trimming this way either.

A good oxygen trim system will "learn" during commissioning what the affect is to the boiler system for every single trim that it performs. This takes the time lag problem away and allows for full time oxygen trim operation regardless of how often OR how rapidly the firing rate changes.