SAFE BOILER OPERATION

The most important part of a service technician's job is to insure that the equipment he is servicing is operating safely. We recently saw a 50' high chimney which was blown apart as the result of an explosion last winter. The boiler was a 400 horsepower unit and the breeching was also blown across the boiler room, it is a miracle no one was injured when the accident occurred.

A service technician had been in the boiler room the day before the accident. The insurance investigation proved the service technician, and the company he worked for, were not at fault. Irregardless, they could have been at fault, and certainly accidents like this are not good for a reputation.

In order to avoid problems like this, we have to be certain that the equipment is operating safely when we leave it. This will naturally not mean that something won't malfunction, but at least we will know we performed our job properly.

Starting up the new burner

Our first step in starting up a new burner is to remove the drawer assembly and be sure the nozzles are tight and check the nozzle size. Never light off a new burner without first checking out the drawer assembly. Compare the nozzle size with the burner rating and the burner rating with the boiler rating and fire box size. This way we will know, in advance, if a potential problem exists.

Next check the pilot assembly to be certain the electrode setting is proper and that they are not cracked or broken. In the case of a spark ignited burner this is checked when we remove the drawer assembly.

Visually check the oil piping system and be certain the piping is correct. If there is a two pipe system, make sure the regulator is in the proper position and the supply and return lines are installed correctly. Check pipe sizes and the location of the fuel tank, also what grade of fuel is in it. Remove the basket from the oil strainer and be certain that it is rated for the oil in the tank. If there are not pressure and vacuum gauges, install them.

If there is a gas pilot line, you should visually check it. There should be a gas pressure regulator installed and a gas pressure gauge would be helpful.

Electrical System

Before we turn on the electricity, there are certain things we should check. First, be sure the voltage feed corresponds with the motors and control voltages. Check the ground terminal in the cabinet to be certain there is continuity between the terminal and the cabinet itself.

If we have 220 volt supply to the burner and a 110 volt control circuit, the 110 volts should come from a transformer fed by our 220 volt circuit. One leg of the 110 volts coming out of the transformer should be grounded to the cabinet. If a separate 110 volt feed is run, it is possible to shut off the main 220 volt disconnect and still power our control circuit, oil valves, gas valves, etc.

Another example of a recent accident occurred when there was a 110 volt control circuit fed separately from the burner motor circuit. Someone had accidently shut off the 220 volt motor supply. The operating control made, starting the programming control. The only protection to stop the cycle was an air flow switch which was not operating. The programmer opened the 110 volt oil valve and let oil into the hot fire box.

Oil pressure was being supplied from a separate pump set and as the oil entered the hot fire box, it filled the breeching and boiler with white gases. The gases ignited and the breeching was blown off, along with the refractory in the boiler. If the control circuit was wired properly, this would never have happened. (See Fig. 1)

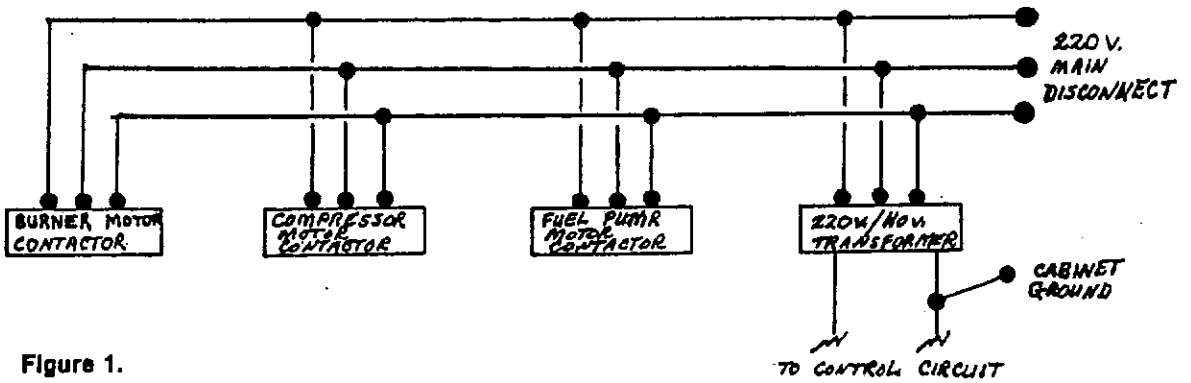

Figure 1.

If there is a separate oil transfer pump, it should also be wired from the main emergency disconnect. This way, if an oil line broke and there was a fire, the one switch will cut off the burner as well as the oil supply.

Turn the burner on and check the motor rotations and amps. Be sure the various overload heaters and fuses are rated properly.

Watch your vacuum and pressure gauges, be sure they are steady. If we have a two-pipe system carrying 5 psig when the burner is off, make sure we hold our pressure when the burner is running. If our pressure slowly drops, it is a sign that either our regulator is not operating properly or that our transfer pumps are not carrying enough oil. On extremely long runs we will probably starve for oil and go into flame failure.

Once the fire is lit, before adjusting, check all of the limit and operating controls. The most common safety switches found on commercial boilers are: air flow; low draft; air compressor; oil pressure (high and low); low oil temperature; low water cut-off; operating control; high limit; and auxilary switches on contactors.

Never remove a wire to check a safety switch. This only tells us that it is wired properly. The only way we can be certain a safety switch will perform properly is to simulate the unsafe condition.

Air flow switch

To adjust the air flow switch, we run the burner and turn the switch down until the burner cuts off. We then back it out a few turns so the switch will stay made. Relight the burner to be certain it will light with the switch in this position. Shut the burner off and disconnect the wires from the motor, or the motor side of the contactor. The reason we do not remove the wire from the coil on the starter is that if there are auxilary contacts on the starter they will also stop the burner from operating. We are concerning oursleves only with the air flow switch. The burner motor may have internal overload protection, or just be burned up, the contactor may be made and the motor not operating. Turn the burner on and observe the operation.

Low draft proving switch

This safety switch is used primarily when there is an induced draft fan. Usually the fan is belt driven; if the belt breaks, we have to be certain the burner will not operate.

The adjustment and checking out is done in the same manner as the air flow switch, and for the same reasons.

Air compressor switch

The air compressor switch is used on air atomized burners to prove primary air. Again a coupling or belt may be broken, or the compressor may just have gone bad, but the motor may still be running. We must check and adjust this safety switch in the same manner as the previous two to be certain the switch functions properly.

Low and high oil pressure switch

We again must try and simulate high and low oil pressure. Usually by closing off the oil supply, in the case of a low oil pressure switch. In the case of the high oil pressure switch, it may be more difficult, unless there is a valve after the switch so we can build up the pressure. If there is no valve, we must turn the pump off and set the control below the normal operating pressure and turn the pump on to see if the switch operates properly. Adjusting these switches is done in the same manner as the previous ones.

Low water cut-off

In order to check a low water cut-off properly, we must drain the boiler slowly. Blowing down the float on a control will not tell us if the control will operate under unsafe conditions, which would be much slower. Some controls will hang up or stick when we slowly drain the boiler. We must shut off all make up water to the boiler and should open a drain as far away from the control as possible.

Auxilary switches on contactors

The only way we can check these is to remove the coil wire to the contactor. First, however, we must jump out the safety switch supervising the same piece of equipment--for example, the blower motor contactor. If we simply remove the coil wire, we will not know if the auxilary contacts have the burner out or the air flow switch. For this reason, we must jump the air flow switch to isolate the auxilary switch. Remember to remove all jumpers as soon as you have performed your test.

Operating control

Our boiler should be getting warmed up by now so we may check our operating and limit control. First observe the positioning of them; they should always be installed in the

boiler, if possible. If they are installed in the header, be certain they are before the main valve. We are concerned with maintaining the temperature or pressure in the boiler, not the header. If there is any valve between the boiler and the operating control (or limit), someone could accidently close the valve and nothing would protect the boiler. We also should try to have these two controls as close to each other as possible because the temperature difference through the boiler could cause the high limit to trip.

We may simply turn down the operating control for a pre-check but the actual test must be made at the desired pressure/temperature, and with the burner running normally.

High limit

The high pressure or temperature limit is checked next. We will have to jump out the operating control to test this switch. If our high limit is manual reset, we must be certain to set it high enough so our boiler will not override after the operating control shuts off, thereby tripping the manual reset switch. We must, however, keep the setting within the safe operating range of the boiler.

Relief valve

To check the relief valve, we should jump the high limit and let the boiler run. Check the pressure when the valve starts to weep and when it finally pops. Shut the burner off and let the valve relieve the pressure, noting at what pressure it closes. Check the relief valve and be certain it is sized properly for the boiler.

This procedure may seem lengthy but it can be performed in a very short time once we are used to it. When adjusting these controls, we must set them within a reasonable range; we want them to work. Do not set them so high (or low) that they will not work until an accident occurs. We want them to prevent an accident.

Always remember we are dealing with potentially dangerous equipment and we must be thorough. If the customer does not want the safety repaired or replaced, note it on your service ticket to protect yourself and your company. One accident can destroy a good reputation built upon millions of service calls.