SECTION 13B

AUTOMATIC BURNER IGNITION AND SAFETY SHUTOFF DEVICES

THE APPLICATION OF PILOT BURNERS AND THERMOCOUPLES

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FOREWORD

Pilot burners are probably the least expensive of purchased parts on a gas heating appliance but very often are the biggest service problem we have. Pilots and their associated components are not usually at fault. The primary problem is one of application which we can control and this is what we will deal with here.

PILOT CHOICE

The choosing of a pilot burner almost always confines the choice to either a primary aerated or a non-primary aerated type. The wall heaters, room heater, water heater, range and clothes dryer are more suited for the non-primary or secondary aerated pilot as these appliances seem to have an affinity for dirt and lint. Moreover their comparative low inputs reduce the pilot outage problem that comes with high rates and small combustion chambers.

The central heating appliance pilot outages are usually caused by rollout, flue product recirculation, and concussion; problems that are not normally found in the small appliances. Therefore, a very stable pilot application is a must. Although the primary aerated pilot is accepted as being the more stable of the two, with proper tests as outlined, the secondary aerated pilot will work very satisfactorily.

LOCATION

The position of the pilot in the appliance should be such that the igniting flame will be within 3/8 of an inch of the burner or carry-over flame, keeping in mind that the thermocouple should not be enveloped by the main burner flame. There are many good applications where the couple tip is in the main burner flame. Of course, these have been temperature checked and proven safe.

Applications where the secondary air flow or any other draft is directly against the base of, or the complete pilot flame, should be avoided as low millivolt output and pilot outage might occur.

TESTING

Normal ignition should be checked both at cold start and after the unit has reached equilibrium. The cycling should be done rapidly so as to stimulate a loose connection or a thermostat "jiggler". If the pilot extinguishes because of rollout or recirculation during the fast cycling it should be baffled or reapplied.

If there is any main burner concussion on natural, 1400 LP gas-air, or LP gases on extinction, it is usually an indication that the burner should be modified as this condition will cause pilot outage. Pilot outage on extinction on 1400 LP gas-air is not a failure at A.G.A. but I believe it is more important than any of the tests on 1400 LP gas-air in the A.G.A. requirements. It closely simulates the effect peak-shaving gas has on burner extinction. Pilot outage on main burner extinction with any gas requires relocation or baffling.

Millivoltage output on thermocouples (single or self-generating) or the amount of heat needed to actuate other types of safety shutoff devices should come directly from the control manufacturer. It not only varies between companies but also may vary from time to time. For this reason, one should consider the use of automatic burner ignition and safety shutoff systems whose components are manufactured or merchandised by one company. In case of field problems one company is responsible for the whole system.

The accepted limit in gas pressure for

the drop out is that the turndown point should occur below .5" water column for natural gas. This protects against nuisance shut downs. Also, closed circuit millivoltage should not drop off more than 10 per cent when the unit is on. Sometimes drop-off will occur because of the cold-junction absorbing radiant heat from the burner.

Pilot turndown ignition should be tried at the lowest millivoltage output possible that will energize the safety shutoff switch or valve. Two millivolts is the accepted figure for the single thermocouple application at this time. Turndown millivolts for the self-generating systems vary, and is specified by the manufacturer. The calculation used to figure pilot turndown is: open circuit pilot turndown millivolts is equal to the sum of the thermocouple resistance plus coil resistance, multiplied by the milliamperes required to energize the coil. Turndown ignition should occur within one second after the gas enters the burner. The amount of delay allowed at A.G.A. varies among the different appliance requirements but the one second factor mentioned insures against delayed ignitions in the field and also gives some leeway for the pilot turndown that A.G.A. runs on 1400 LP gas-air mixtures.

Every pilot application should also pass pilot turndown lighting at 1/3 main burner rate without severe concussion. A.G.A. does not run this test, but it can be very important especially if the appliance is used in areas where there is periodic reduced main line pressure.

All the pilot turndown tests mentioned here should be run with the slowest and fastest opening valves intended for use with the appliance.

Pilot and thermocouple temperature limitations should be secured from the control company involved and carefully tested by attaching thermocouples per the A.G.A requirements. Experience is more helpful here than in any of the other tests, so previous successful pilot applications should be examined for forming the criterion. Practical safeguards such as keeping away from main burner impingement, ceramic combustion chamber radiation and the unacceptable increasing or decreasing of millivolts output while the main burners are on should be noted.

METHOD OF MOUNTING

The ideal construction of the pilot application is when the pilot is attached directly to the main burner and they are removable as one assembly. This eliminates need for separate bracket and assures positive mounting. The pilot should be removable with a minimum of effort so as to decrease field service time and all pilots used should use the same pilot mounting. This will also give less service problems and better production methods.