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Flueless Gas Fires – the importance of correct installation and commissioning

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As with any appliance installation, the importance of ensuring that all of the installation criteria are met and the appliance is correctly commissioned cannot be emphasised enough. Tragically this has recently been highlighted following a fatality in South Wales where a 14 year old child and a pet dog died from carbon monoxide (CO) poisoning.

The case in question involved a flueless gas fire that had been installed in an open-plan living space in November 2004. In March 2005, while the flueless gas fire was in operation, large amounts of CO were generated, which quickly built up in the atmosphere resulting in the fatal incident.

In many cases, when a gas appliance is installed, both the installation process and the commissioning process should be considered as one combined process. However, in this article I will deal with the two processes separately to clarify what happened with regard to this fatality.

The technical information contained within this article is taken from the formal investigation report of the incident which was carried out by CORGI at the request of the Gwent Police authority. This report, along with the expert testimony of the CORGI Investigator was used during the trial of the CORGI Registered gas installer who carried out the installation.

Incident investigation - Installation checks

The appliance, which was a flueless catalytic gas fire, was visually inspected and other than the discolouration of the wall above the appliance itself, it could be seen that most of the installation criteria set by the appliance manufacturer appeared to have been met and the installation was considered satisfactory. Important aspects checked were that:

- The room volume was appropriate for the size of appliance installed;
- There was an openable window to outside air;
- The appliance was correctly located and securely fixed;
- There was a correctly sized purpose-provided combustion air vent installed in the living space;
- The gas supply appeared to be correctly sized, although it was observed that an appliance isolation valve had not been fitted.

The initial inspection identified that the incident was not caused by an installation fault and whilst the location of the combustion air vent complied with the appliance manufacturer's installation instructions in force at the time, its close proximity to the fire may have contributed to the continuing operation of the appliance when it was operating under fault conditions (see **Observations**).

With regard to the lack of an appliance isolation valve, this contravened Regulation 26(6) of the Gas Safety (Installation and Use) Regulations 1998 (GSIUR) which requires that such a device be fitted unless it is not reasonably practicable to do so. However the lack of an appliance isolation valve whilst inconvenient is unlikely to have had any adverse effect on the safe operation of the appliance.

Incident investigation - Operational checks

Following the initial visual inspection of the appliance, a series of operational checks were undertaken.

A check was made of the operating pressure at the gas meter and this proved to be set correctly at 22mbar which is between the 19mbar to 23mbar required. The operating pressure was also checked at the inlet to the flueless gas fire, this was measured at 22mbar, indicating that the gas installation pipework was correctly sized.

When the operating pressure was initially checked at the inlet to the appliance, the flame picture was observed and this was noted as being unstable and "lifting off" the burner in several places. The appliance burner operating pressure was then checked; it was also measured at 22mbar. This did not correspond with the requirements of the appliance manufacturer's instructions that required 7.5mbar (+/- 0.25) when hot. It could clearly be seen that the gas fire was significantly over gassed; this was confirmed by the gas rating check carried out at the gas meter. The appliance manufacturer's installation instructions stated that the appliance heat input rating should be 2.6kW (0.25m³/hr), however when measured, the heat input rating was actually 5.4kW (0.49m³/hr), which confirmed that the appliance was over gassed.

When the appliance's gas valve was inspected, it was apparent that the regulator adjustment screw was wound fully out and the marking/sealing paint applied by the appliance manufacturer had not been disturbed. This highlighted two things:

1. The appliance itself was probably supplied by the manufacturer in an incorrectly adjusted state.
2. The appliance operating pressure was not checked or adjusted by the installing operative during the commissioning process.

With regard to the first point, this was highlighted during the Court case and CORGI understands that investigations were made by Trading Standards authorities into the appliance manufacturer concerned and their internal quality control and auditing processes were reviewed.

On the second point, when a new appliance is installed, Regulation 33(1) of GSIUR applies and this states:

"Where a person installs a gas appliance at a time when gas is being supplied to the premises in which the appliance is installed, he shall immediately thereafter test its connection to the installation pipework to verify that it is gastight and examine the appliance and the gas fittings and other works for the supply of gas and any flue or means of ventilation to be used in connection with the appliance for the purpose of ascertaining whether -

- a) the appliance has been installed in accordance with these Regulations;*
- b) the operating pressure is as recommended by the manufacturer;*
- c) the appliance has been installed with due regard to any manufacturer's instructions provided to accompany the appliance; and*
- d) all gas safety controls are in proper working order"*

Regulation 26(9) of GSIUR also applies as gas work has been carried out and it requires that the following checks are undertaken:

- The effectiveness of any flue;
- The supply of combustion air;
- The appliance operating pressure or heat input, or, where necessary both;
- Its operation so as to ensure safe functioning.

If, as required by both Regulation 26(9) and Regulation 33(1), the appliance operating pressure or gas heat input rating had been checked by the gas operative, the incorrectly adjusted appliance would have been identified and corrected, then this action alone may have prevented the fatal incident occurring in the first place.

As the appliance was operating at an increased gas pressure for a period of time, this affected the flame picture and resulted in the catalytic converter on the appliance being coated in a layer of soot which prevented its prime function and therefore its correct operation from taking place. This resulted in the products of combustion not being "cleansed" and therefore large quantities of CO were discharged into the property.

Observations

One question that will no doubt be asked is "why did the atmosphere sensing device (ASD) not operate and cut the appliance off sooner?" This is something that CORGI cannot answer at this time but there are several possible causes that need to be considered.

The first issue to be considered is the room in which the appliance was installed. In this case, the room was an open-plan living space with a staircase leading to the first floor accommodation. As the products of combustion were taken away by the heated (convected) air due to the open-plan nature of the space, it is possible that the products of combustion would not build up in the vicinity of the appliance and therefore the change in atmosphere may not have been detected by the ASD.

There is also the possibility that because an ASD is designed to function normally when the combustion quality is good and due to the fact that in this case the combustion at the appliance was so poor to start with, combined with the rapid rise in CO level in such a short space of time, it is likely that the ASD would not have failed safe in the short time needed to prevent the incident occurring.

One final point that may have affected the operation of the ASD was the close proximity of the combustion air vent to the appliance. As the products of combustion are hot and will naturally rise away from the appliance, the denser cooler combustion air supplied by the air vent would have been delivered at a low level in the area of the ASD, therefore preventing any vitiated atmosphere from affecting the flame and in turn preventing the flame from lifting off and moving away from the thermocouple.

CORGI understands that this final point has now been considered by the appliance manufacturer involved in this incident and has been reflected in the current installation instructions for this appliance which now recommends that the air vent be located no closer than 500mm to the appliance.

The draft British Standard for the installation of flueless gas fires (BS 5871-4), when published is likely to recommend that no air vent should be sited closer than one metre to the appliance. However individual appliance manufacturers may specify different dimensions which again highlight the need to always refer to the specific manufacturer's installation instructions.

The above British Standard when published will clearly state that flueless gas fires are intended only as a secondary heat source and should only be installed where a primary heat source such as a central heating radiator or night storage heater is present. The reason for this requirement is that condensation may occur with rapid warming and cooling of the space in which the appliance is installed.

Summary

During the Court case, it was said of the gas operative that "you did not cause the fault, you failed to find it".

As with most fatalities, there were several factors that lead to this incident, but the main factor that could have prevented the incident from occurring was that the appliance had not been commissioned in accordance with the manufacturer's instructions and as required by Regulation 33(1) of GSIUR.

Yes the gas rate of the appliance was probably incorrectly set when it left the factory, but the final line of defence for the customer is the correct installation and commissioning of the appliance following its installation by the competent CORGI registered gas operative.

It is also important to remember that gas operatives must only perform work in areas in which they have proved themselves to be competent, either via ACS or an aligned N/SVQ.

CORGI has always emphasised the importance of following the appliance manufacturer's installation and commissioning instructions and also carrying out the checks required by Regulation 26(9) of GSIUR to confirm that the appliance is safe.

Sometimes CORGI receives comments about articles published in *Gas Installer* criticising the author for quoting regulations rather than other guidance. I think you will agree that this is definitely a case where it is important to highlight the legislative requirements placed on all persons carrying out gas work and the importance of rigidly applying those requirements.