MIDTHERM Engineering Limited

CASE STUDY

Supply, design and installation of mechanical input and extract ventilation systems.

AT A GLANCE

Contractor: Midwest Mechanical & Electrical Services Ltd

Client: HMCS & Wolverhampton City Council

The Challenge: To investigate current combustion issues on site, determining their root cause and offer a compliant fully considered solution to rectify these problems.

All whilst considering the impact of such solutions onto the existing building i.e. aesthetics and potential noise impact.

Solutions and Services:

- Surveying and site investigation.
- Flue calculations to BS EN 13384.
- Ventilation calculations to IGEM UP10, BS:6644 & Building Regulations
- Design, manufacture and installation of new mechanical input and extract ventilation.

The Benefits:

- Ventilation systems which meets legislative requirements.
- Ventilation systems that have low impact on the existing building.

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Following the discovery of combustion issues with the heating boilers, Midtherm Engineering were asked to assess the suitability of the existing flue and ventilation systems on site at Wolverhampton Magistrates Court.

The boilers were located in a basement boiler room, with individual flues into a shared chimney stack. Design calculations proved that the flue routes and diameters were satisfactory and so the possibility of there being a problem with the ventilation systems was considered.

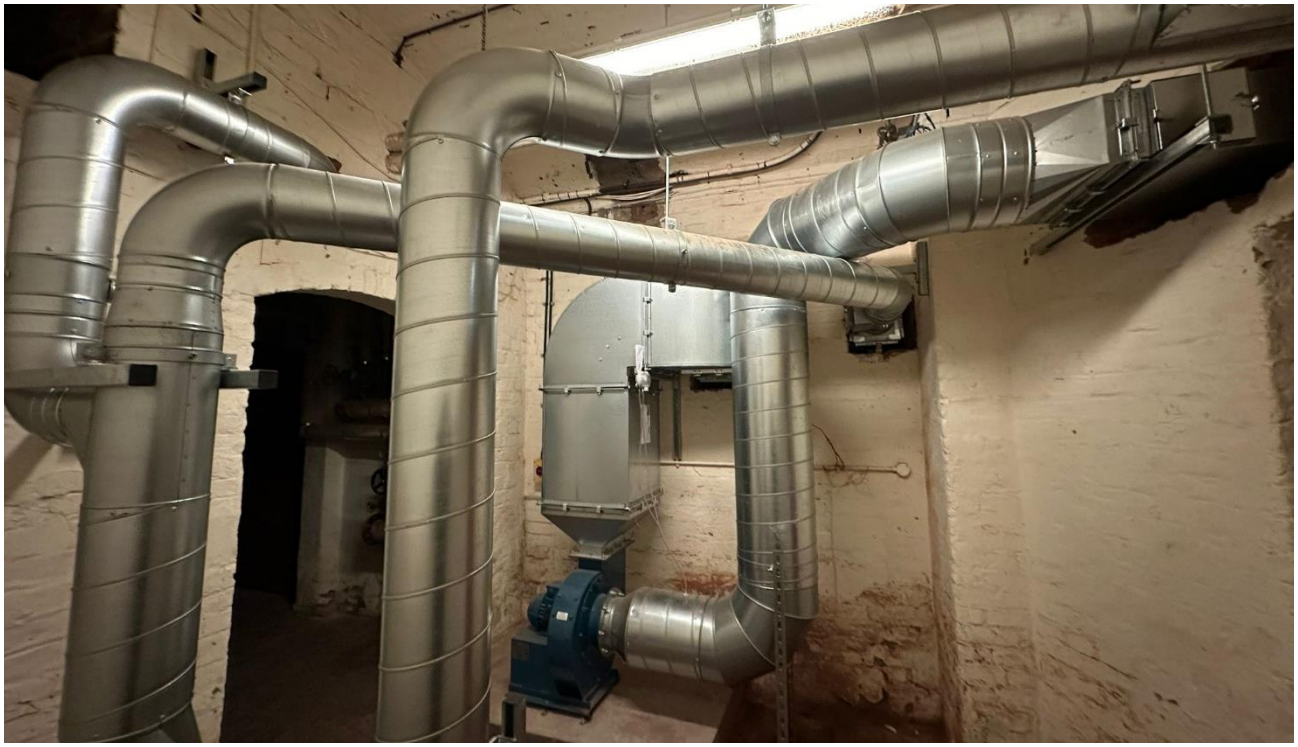
Boiler room extract ventilation fan

The boiler room was served by mechanical input and extract ventilation. The supply fan had failed several times, and the motor had been replaced recently, but issues remained with combustion. The route for the mechanical input duct was arduous to say the least, and it was also noted that a branch had been retrospectively fitted to the positive side of the ductwork to feed air to an adjacent plantroom. Calculations proved that the fan was incapable of delivering the required airflow volume against the resistance caused by the length, cross-section and route of the ductwork. This, coupled with excessive (relative to the amount of supply air) extract ventilation was leading to a noticeable depressurisation of the boiler room, starving the boilers of the required air for combustion.

With the root cause of the combustion issues being identified, we were then tasked with putting forward a proposal for a safe and compliant installation, as well as incorporating some additional background ventilation to two additional rooms.

As is typical with installations of this complexity, routes for the ductwork were changed to overcome challenges inherent with a building which is over 150 years old and of architectural significance. Eventually we arrived at the following arrangement:

- Independent mechanical input system
- Independent mechanical extract system
- Shared mechanical supply duct feeding the other two rooms to drive air change



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Because of the critical nature of the balance required between supply and extract ventilation to the boiler room, the ductwork loss calculations had to be carried out to a high degree of accuracy. Our in-house design software supports this level of detail, taking account of both fluid and thermal dynamic effects of velocity, density, temperature, and heat loss. We prefer to work to this level of detail as early as possible in a project as it can help to eradicate issues later in the timeline.

Noise is a critical consideration in a building of this type, particularly as the ventilation ducts would follow a route where court rooms are located above them. Having selected the most efficient, quiet and economical fans for the individual duties, we then worked with our acoustic partner to select attenuators giving the best balance between sound reduction and reducing the impact on fan duties.

Specialist attenuation installed within our ventilation ductwork.

The duct runs crossed several fire break walls which necessitated the inclusion of fire dampers at each of these points, along with the necessary access doors to allow testing and inspection. As these fire dampers were a new addition to the building, careful consideration had to be given to both avoiding existing services and meeting the exacting requirements of the fire damper manufacturer's installation instructions and certification. This was managed with minimal impact on existing services through close coordination with the client's builder.

To guarantee that the correct supply and extract airflow rates were being achieved, inverters were fitted to each fan to allow them to be accurately commissioned following completion of the installation.
The entire installation took around three weeks to complete, and we were then able to commission the ventilation systems as well as test and certify the fire dampers, providing the client with a system designed, installed and commissioned to regulations and manufacturer's instructions, ultimately allowing the heating boilers to be put back into full operation.

Fire damper and access hatch installed within a fire break wall.

> **"It's unfortunate that we are seeing this kind of situation more frequently, where ventilation systems aren't being correctly designed and the detrimental impact of this isn't fully understood. Plantroom ventilation is a significant component which, when designed correctly, prevents explosive ignition, ensures the plantroom is a safe environment and increases the overall efficiency of the appliances."**
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