

HVAC Troubleshooting

- A guide to solving indoor environmental
and energy consumption problems

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The logo for the Building Services Research and Information Association (BSRIA). It consists of the letters 'BSRIA' in a large, bold, serif font. The letters are black and have a slightly distressed or textured appearance.

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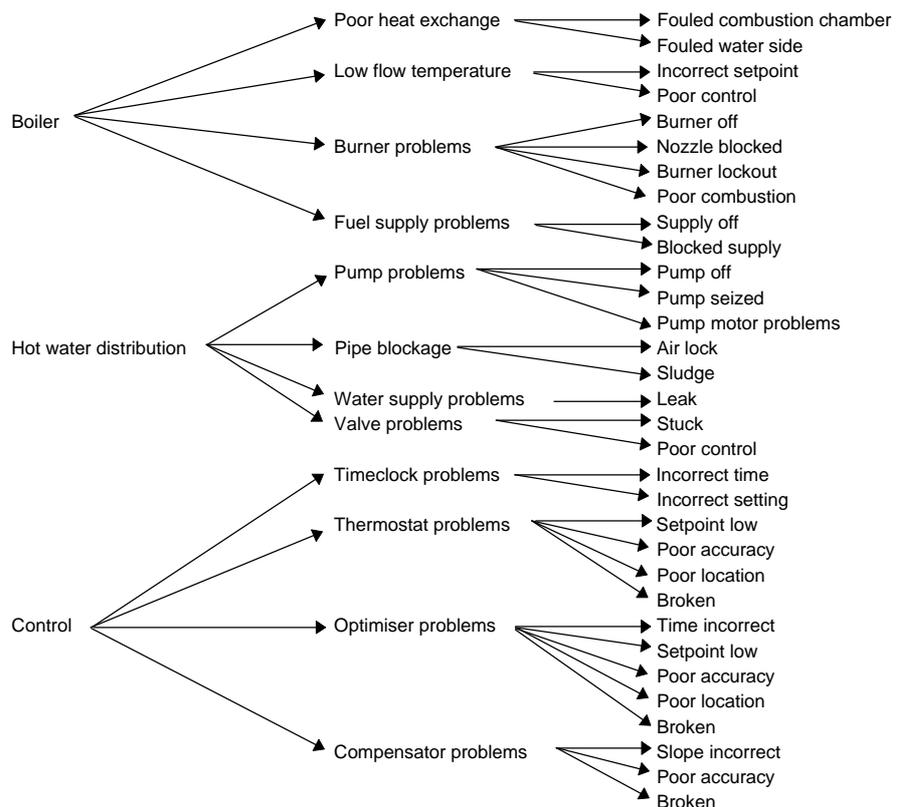
GLOSSARY OF TERMS

AHU	Air handling unit
BMS	Building management system
CAV	Constant air volume
DCV	Demand controlled ventilation
DRT	Dry resultant temperature
HVAC	Heating, ventilation and air conditioning
IEQ	Indoor environmental quality
LTHW	Low temperature hot water
M&T	Monitoring & targeting
RH	Relative humidity
TRV	Thermostatic radiator valve
VAV	Variable air volume

1 INTRODUCTION

This document is an HVAC troubleshooting guide to help facilities managers and maintenance personnel solve indoor environment and energy or water consumption problems. Facilities managers are often the first point of complaint for occupants who are unhappy about their working environment but they may lack the technical expertise required to investigate problems. This document is a step-by-step guide to identifying indoor environmental quality (IEQ) problems that may be caused by the operation of the HVAC system. It allows managers in charge of HVAC facilities, particularly those without a technical background, to initiate investigations, follow their progress and perhaps perform a few simple checks. It does however require some knowledge of the HVAC systems installed. The document also contains a series of troubleshooting procedures for use by the maintenance personnel actually performing the investigations.

Solving HVAC related problems can be relatively difficult as systems can comprise complex plant and controls. For example, even in a building with a relatively simple heating system a complaint of 'too cold' could be caused by a large number of factors relating to any of the sub groups of 'boiler', hot water distribution or 'control' as shown below:



Fortunately, many potential faults/problems rarely occur and this allows those which are relatively common to be checked first.

This document includes troubleshooting procedures for a range of indoor environmental quality (IEQ) problems to assist maintenance personnel who perform investigations. These procedures are particularly useful where the operative has limited knowledge of the building. The troubleshooting procedures are divided into two sections for each IEQ problem, one is a summary which outlines the most likely causes whilst the other shows a detailed list of causes. The summary should be used first and if the problem is not solved, the more detailed troubleshooting procedures can be referred to (Appendix A). The IEQ problems covered by the troubleshooting procedures include the following:

- too hot
- too cold
- stuffy or still air
- draughts
- odours
- noise from the HVAC system
- dry eyes, throat or skin
- lethargy
- headaches.

The document also includes a section on plant problems that can be identified by regular inspection or by monitoring energy consumption, water consumption or by plant performance checks using a BMS. It also shows the level of savings that can be expected.

Appendix B summarises six case studies in which IEQ problems were solved by troubleshooting. One of the six illustrates how the troubleshooting procedures were applied in practice to solve the problem.

A separate document entitled *HVAC Troubleshooting Manual* (BSRIA Report 79400/5) has also been produced. This lists the potential causes of a wide range of plant problems not specifically related to poor IEQ or excessive energy or water consumption.

1.1 COMPETENCY TO PERFORM INVESTIGATIONS

Investigations should only be performed by competent personnel and in accordance with current Health & Safety and other relevant regulations. This particularly applies to work with gas and electricity. Operatives working with gas must be registered with the Council Of Registered Gas Installers (CORGI). Work is covered by the *Gas Safety (Installations and Use) Regulations* and the *Health and Safety Commission Approved Code Of Practice (ACOP) Safety in the Installation and Use of Gas Systems and Appliances*. Work on electricity must be in accordance with the *Electricity at Work Regulations*. Other important considerations include working with chemicals, pressurised systems and water systems. Chemicals are covered by the *Management of Health & Safety at Work Regulations* and the *Control of Substances Hazardous to Health (COSHH) Regulations*. Work with pressurised systems is covered by the *ACOP Safety of Pressure Systems (Pressure Systems and Transportable Gas Containers Regulations)*. Work with water systems should conform with the water authorities water bylaws.

Although 'competent' personnel will be aware of potential dangers the following reiterates general advice on performing investigations safely:

- switch off plant before investigating
- isolate electrical supplies before opening control panels or working with exposed terminals
- do not remove covers or guards whilst plant is operating
- be aware that automatic plant may start without warning
- do not introduce chemicals into ventilation system air streams
- do not vent refrigerants to atmosphere
- be aware of chemicals and gases that are potentially hazardous to health, eg water treatment, refrigerants, boiler emissions
- be aware that piped systems may contain high pressure or temperature gases, vapours or fluids
- be aware of potentially flammable materials, eg natural gas, oil.

Many building operators and facilities managers may not be suitably qualified to perform investigations. However, some of the checks included are purely visible, not requiring intrusive procedures and these would be suitable for non-technical personnel to perform. The following provides examples of suitable checks:

- time clock time and on/off periods
- temperature setpoints (check but do not adjust)
- position of isolators
- activation of interlocks, alarms and circuit breakers
- visual inspection of plant to confirm operation.