Energy Efficient Pumping Systems

A design guide

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ABBREVIATIONS

BMS  Building energy management system
CFR  Constant flow regulator
DRV  Double regulating valve
DPCV Differential pressure control valve
OP   Orifice plate flow measurement device
DRV  Double regulating valve
PICV Pressure independent control valve
TRV  Thermostatic radiator valve

For detailed explanation of valve functions, refer to Appendix A.

SYMBOLS

- Isolating valve
- Drain off cock
- Lockshield valve
- Double regulating valve
- Fixed orifice flow measurement device (orifice plate)
- Fixed orifice double regulating valve (commissioning set)
- Constant flow regulator
- Differential pressure control valve
- Two-port control valve
- Three-port control valve
- Four-port control valve
- Thermostatic radiator valve
- Pressure independent control valve
- Pump
- Safety relief valve
- Pressure gauge
- Temperature gauge
- Flexible coupling
- Strainer
- Blanked flange pipe end
- Pressure test point
- Non-return valve
- Automatic air vent
1 INTRODUCTION

1.1 SCOPE

This application guide provides recommendations on the design of energy efficient pumping systems.

The potential for reducing pump energy consumption is substantial. The US Department of Energy estimates that pumping accounts for 20% of the world’s energy use by electric motors[1]. Europump (a pan European association of pump manufacturers) estimates that systems could be 30 to 50% more energy efficient by careful consideration of components, design and installation[2]. This guide shows some ways in which this efficiency may be achieved.

The recommendations presented here are based on analyses of alternative pipe sizing methods, pipework layouts, valve selections, pump control options and system control measures. Separate research reports for each recommendation are also available from BSR1A.

In building services applications, heating and cooling systems usually incur the largest pumping loads. This guide therefore focuses mainly on these applications. Cooling systems usually offer the best scope for pump energy savings due to the larger flow rates involved.

Most of the guidance is applicable to both heating and cooling applications. Some sections are written specifically for heating systems, including district heating, because a lack of regard for pump energy may lead to missed energy savings elsewhere. For example, excess flows tend to lower system temperature differentials, thereby reducing the effectiveness of some low carbon emission or renewable energy heat sources.

1.2 GUIDE STRUCTURE

Section 2 provides an executive summary of the main design recommendations. The research process, its findings, and conclusions are explained in Sections 3 to 6.