GUIDANCE NOTE – GN 3
TROUBLE SHOOTING RADIATOR SYSTEMS

2017 Edition

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TROUBLE SHOOTING RADIATOR SYSTEMS

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Co-ordinated Commissioning of TRV Systems

Introduction

These notes indicate the problems associated with the design, installation, maintenance and commissioning of Thermostatic Radiator Valve (TRV) circuits and the co-ordinated approach to incorporating Differential Pressure Control Valves (DPCV) together with Radiator & Circuit balancing valves.

Commissioning engineers should be aware of the principles associated with balancing radiator and sub circuit flows combined with the requirement to regulate differential pressure within any TRV sub circuit.

Why the need to size TRV's?

One of the main causes of poor TRV control is the UK use of a minimum pipe size of 15mm/½". In general, UK ½" TRVs pass approximately 3600W when fully open (at system start up) in a 11°C delta T situation with a typical pressure differential of 10kPa. Since the average radiator size is 1200W, there are some 2400W to be taken out. This "Overflow" should, in theory be regulated out by means of the radiator lockshield valve, but this is almost never done.

The selecting of TRV bodies having variable Kv values is the ideal solution. This easy to regulate method of optimising the individual radiator flow requirement gives the site engineer the opportunity to preset each valve relative to a heat output from the radiator schedule. The lockshield valve remains fully open.

Why the need for Differential Pressure (DP) Control?

The current practice by the majority of UK designers is to ignore the maximum acceptable differential pressure across TRVs, however, when the TRVs in different areas of a building are controlling the temperature by modulating between open and closed they will at some stage be subjected to differential pressures in excess of design and manufacturers recommendations. If one accepts that the differential pressure varies as the TRVs begin to operate, then it is easy to appreciate that without controlling the DP down to an acceptable level (say 30kPa) the following problems will be encountered:-

1. Noise generation across TRVs.
2. Erosion of TRVs and system components.
3. TRVs unable to control properly.

The best way to ensure that the differential pressures are controlled to an acceptable level is to fit a DPCV in the circuit. DPCV's are self-acting diaphragm operated valves incorporating a capillary connection linking the flow and return of the TRV sub circuit.

As the DP increases when TRVs close, the DPCV senses the change and regulates the DP to a predetermined set point.

As well as controlling the DP across a TRV sub circuit it is also important to control the mass flow to 100% of design. This can be done one of four ways:

a) by means of a variable orifice DRV
b) with a fixed orifice commissioning set.
c) using a constant flow regulator (see GN2)
d) installing a DPCV that incorporates a maximum flow regulation facility.

Provided that the system flow is regulated to design requirements, then there will be sufficient heat flow to satisfy all radiators at system start up.

Design Considerations

As previously mentioned, it is vital that any TRV sub circuit be designed with a co-ordinated approach to both TRV selection (i.e. pre-settable Kv values) and a suitable means of differential pressure control. Provided that the design engineer understands the characteristics and operating principles of TRV-DP valves then the commissioning engineer should have few on-site challenges.

Commissioning Hints

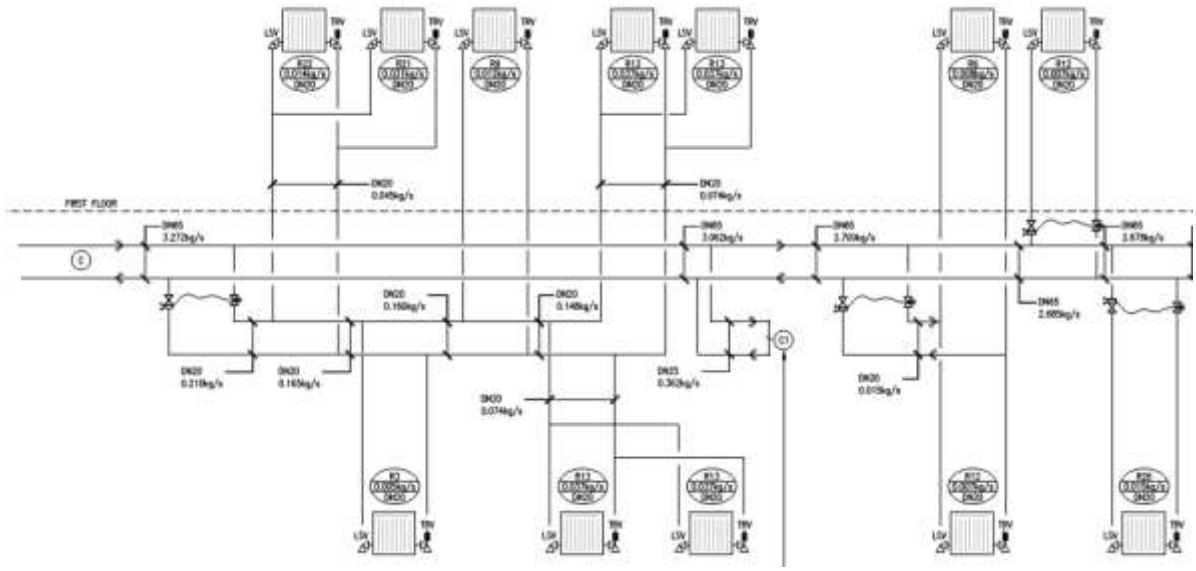
Always check and note the following before proceeding with commissioning:

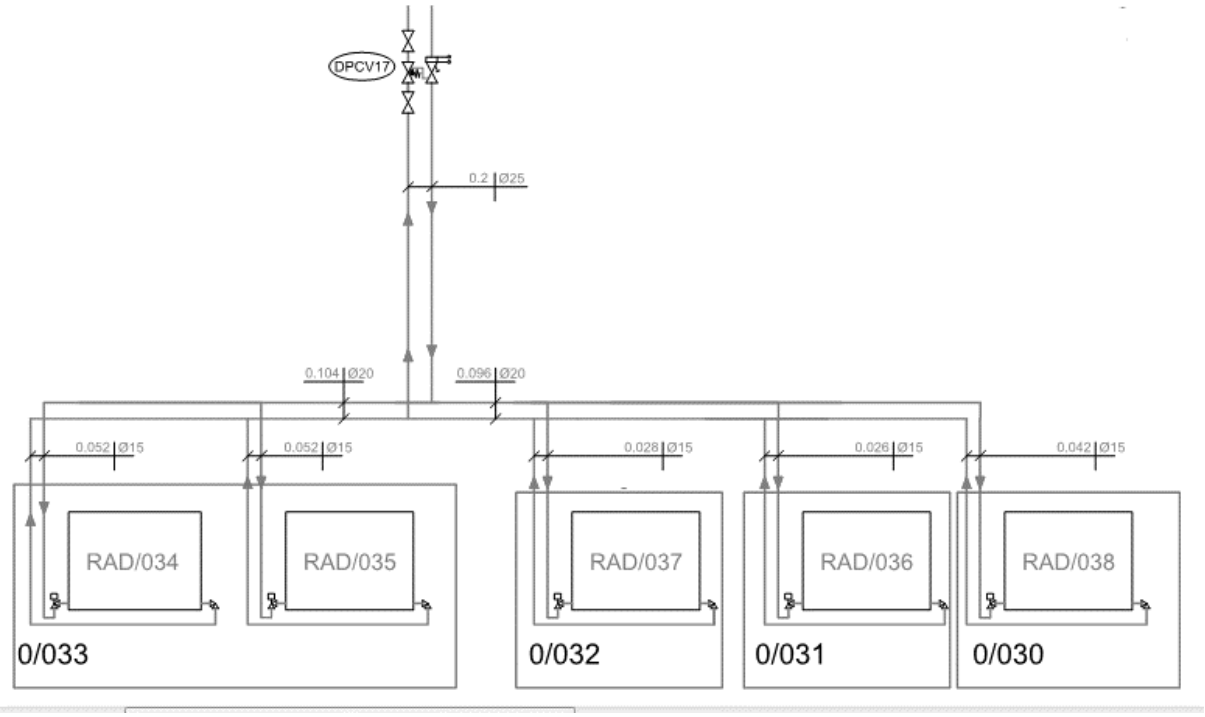
1. All lockshield valves are fully open.
2. All TRV sensors are removed and caps fitted to ensure valves are fully open.
3. Radiator valves are installed correctly, i.e. correct direction of flow.
4. All flow regulation devices are installed in correct direction and positon.
5. All DPCV's are installed in correct direction, position and that DP setting is per design. Confirm capillary is installed correctly and any IV's are fully open. Confirm that diaphragm is free of air.
6. That any strainers are free of sediment or foreign bodies.

7. All sub circuit lV's are fully open.

Note that all strainers installed in TRV sub circuits should be as specified so as to adequately protect the DPCV and TRVs. Flushing of all TRV sub circuits should be carried out in accordance with the BSRIA BG29 2012 Pre-Commission Cleaning of Pipework Systems guidance. The CSA Technical Memorandum TM9 – Water Treatment and The Commissioning Engineer should be considered.

Some typical schematic diagrams indicating radiator circuits and associated valves can be seen below.





Commissioning Procedure

1. Isolate strainer by closing isolating valve and DRV.
2. Remove, clean & refit strainer basket.
3. Check radiator valves are installed correctly, i.e. correct direction flow.
4. All TRV sensors are removed and caps fitted, where necessary, to ensure valves are fully open.
5. If using TRV's with variable Kv values, set to TRV setting schedule.
6. Open fully all lockshield valves.
7. Connect all capillary tubes in accordance with manufacturer's instructions.
8. Confirm that diaphragm is free of air.
9. Attach manometer to flow measuring device and adjust DPCV to obtain 100-110% of design with reference to flow measurement charts.
10. Record all readings and settings.
11. Close all test points and disconnect manometer.
12. Once all DPCV's are commissioned, refit TRV heads and adjust to correspond with design room temperature.
13. Take a sample sub circuit, close 50% of TRV's and ensure DP across circuit remains under control.

Note: Check with the TRV manufacturer whether fitting the cap as item 4 closes or opens the TRV.

TROUBLE SHOOTING GUIDE

Problem	Possible Cause	Possible Solution
Chattering TRV	TRV installed incorrectly	Reposition TRV
TRV not isolating	Dirt under seat	Clean seat or replace
	Excessive pump head	Check DPCV performance Check DPCV max. DP is within range
Fluctuation response time of radiator system	Air in DPCV diaphragm	Bleed air from diaphragm
Fluctuating flow rates	Circuit DP lower than minimum DP setting of DPCV	Increase circuit DP with means of common DRV
		Fit DPCV with lower DP limit if available
	Air in TRV sub circuit	Vent circuit Check AAV's if fitted
Design Flow Rate (DFR) below required value	Circuit DP greater than maximum setting of DPCV	Fit DPCV with greater DP limit if available
	Insufficient pump flow	Check pump curve
		Check system diversity
Noise in radiators	Air in TRV sub circuit	Vent circuit Check AAV's if fitted
Poor circulation	Blocked strainer(s)	Locate and clean