MAKING BUILDINGS WORK

Guidance Note GN3

Variable Volume Water Systems

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 together with Radiator & Circuit balancing valves.

Technology from the European market is now available in the UK and 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.

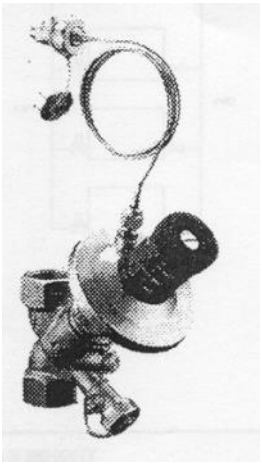
Why the need to size TRV's?

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 passing 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 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. **Errosion 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 differential pressure control valve (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 100% of design, then there will be sufficient heat flow to satisfy all radiators at system start up.

Design Considerations

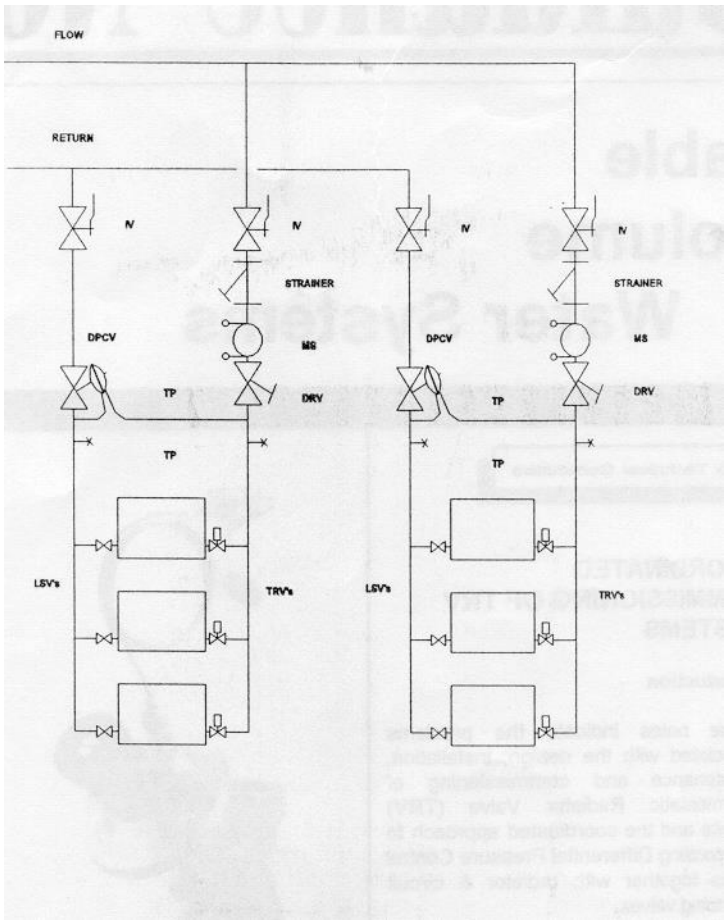
As previously mentioned, it is vital that any TRV sub circuit be designed with a co-ordinated approach to both TRV selection (i.e. pre-settable Kv values) and a suitable means of differential pressure control. Provided that the design engineer understands the characteristics and operating principles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

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 if not of the self air bleeding design.**
6. **That any strainers are free of sediment or foreign bodies.**
7. **All sub circuit IV's are fully open.**

Note that all strainers installed in TRV sub circuits should be fine mesh (0.25mm) so as to adequately protect the DPCV and TRVs. Flushing of all TRV sub circuits should be carried out in accordance with the BSRIA Application Guide on the Chemical Cleaning of Water Systems. The CSA Technical Memorandum TM9 – Water Treatment and The Commissioning Engineer might also be useful.



Commissioning Procedure

1. **Isolate Y type strainer by closing gate/ball 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 manufacturers instructions.**
8. **Confirm that diaphragm is free of air, if not of the self air-bleeding design.**
9. **Attach manometer to flow measuring device and adjust DPCV to obtain 105-110% 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 3 closes or opens the TRV.

TROUBLE SHOOTING GUIDE

Problem	Possible Cause	Possible Solution
Chattering TRV	TRV in return	Fit reverse flow TRV inset Reposition TRV in flow
TRV not isolating	Dirt under seat Excessive Pump Head	Replace seat capsule Renew TRV Check DPCV performance Check DPCV max. DP is within range
Fluctuation of DP	Air in DPCV diaphragm	Bleed air from diaphragm
Excessive response time of rad system	Incorrect Kv setting	Recalibrate TRV settings Check rad outputs & flow rates
Noise in rads	Air in TRV sub circuit	Flush out circuit Check AAV's if fitted
Poor circulation	Blocked strainer(s)	Locate & cleam

This Guidance Note was compiled for the CSA Technical Committee by S. Lines and D. Corner, Oventrop UK Ltd.

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