Hydronic HVAC Systems

FloCon Watchman™

SAV SYSTEMS

Rev: 3.0 07/2015

Patent Numbers: GB2376066, GB2416866, GB1725813

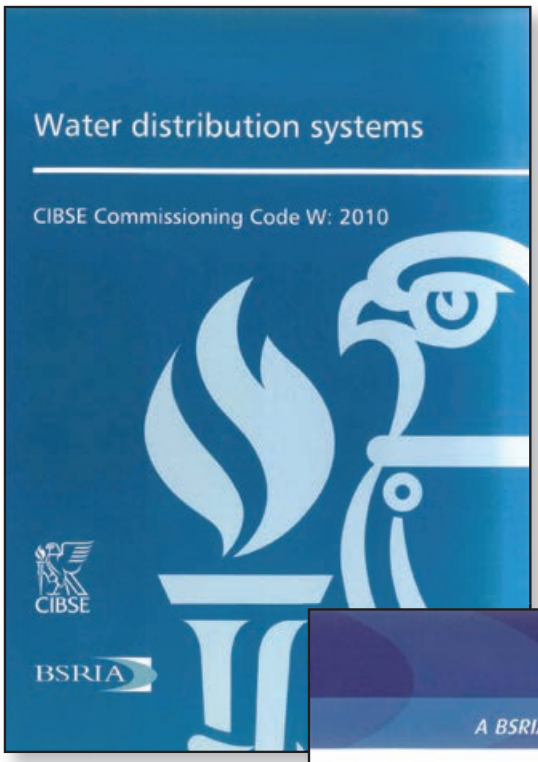
CIBSE/BSRIA guidelines 2011

FloCon modules aim to follow the latest industry guidance relating to pipework design, commissioning and cleaning. This guidance is enshrined in the following publications:

1. CIBSE Code W Water distribution systems (2010)

Updated in 2010 specifically to cover:

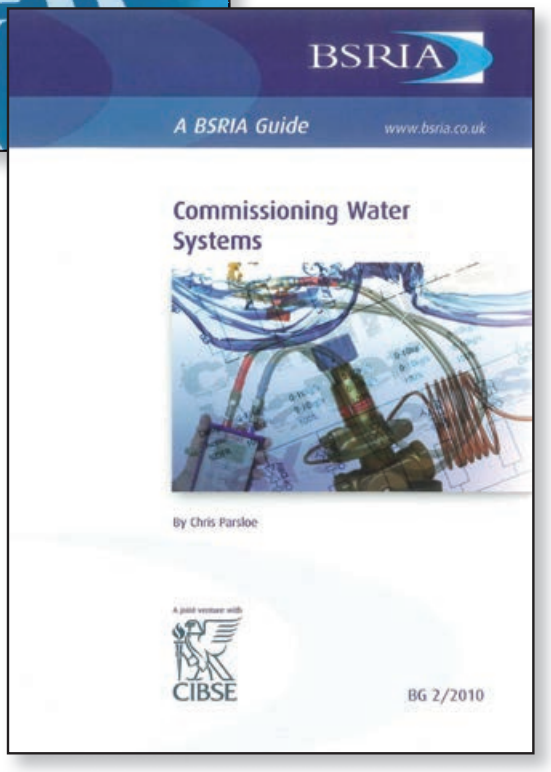
- valve solutions for variable flow systems (including valve modules such as FloCon)
- how to deal with "ultra-low" flow rates (i.e. flow rates too small to be measured by standard orifice type flow measurement devices)



1

2. BSRIA Guide BG2/2010 Commissioning Water Systems

Updated in 2010 for the same reasons as above relating to Code W.

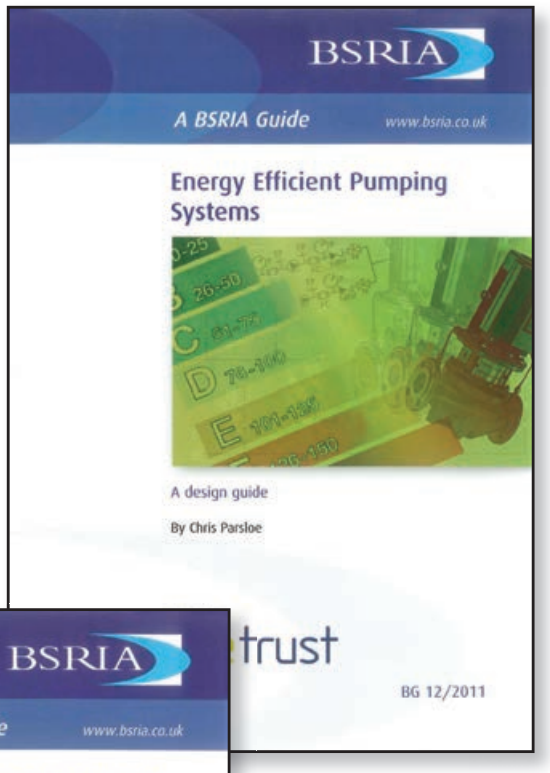


2

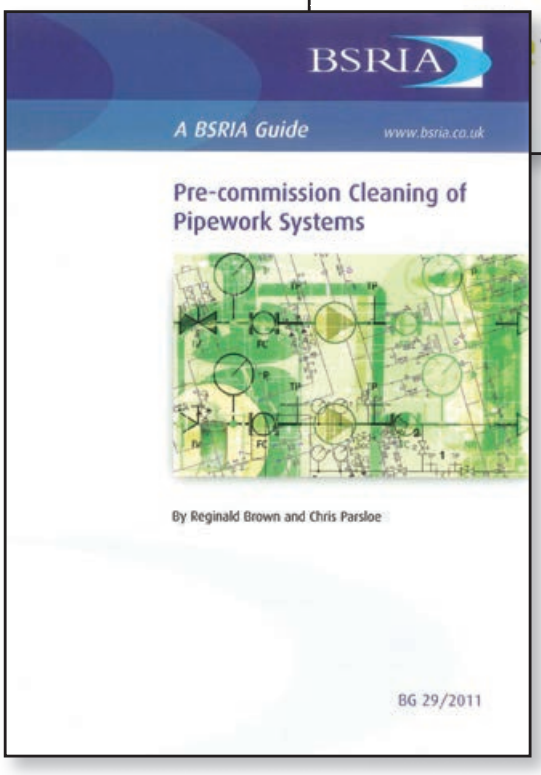
3. BSRIA Guide BG12/2011 Design of Energy Efficient Pumping Systems

Released in 2011 with recommendations on how to minimise pump energy consumption in pipework systems.

3



4



4. BSRIA Guide BG29/2011 Pre-commission Cleaning of Water Systems

Revised in 2011 to address (amongst other issues) the problem of dirt settlement in pipes carrying ultra-low flow rates.

FloCon Watchman™

Hydronic HVAC Systems

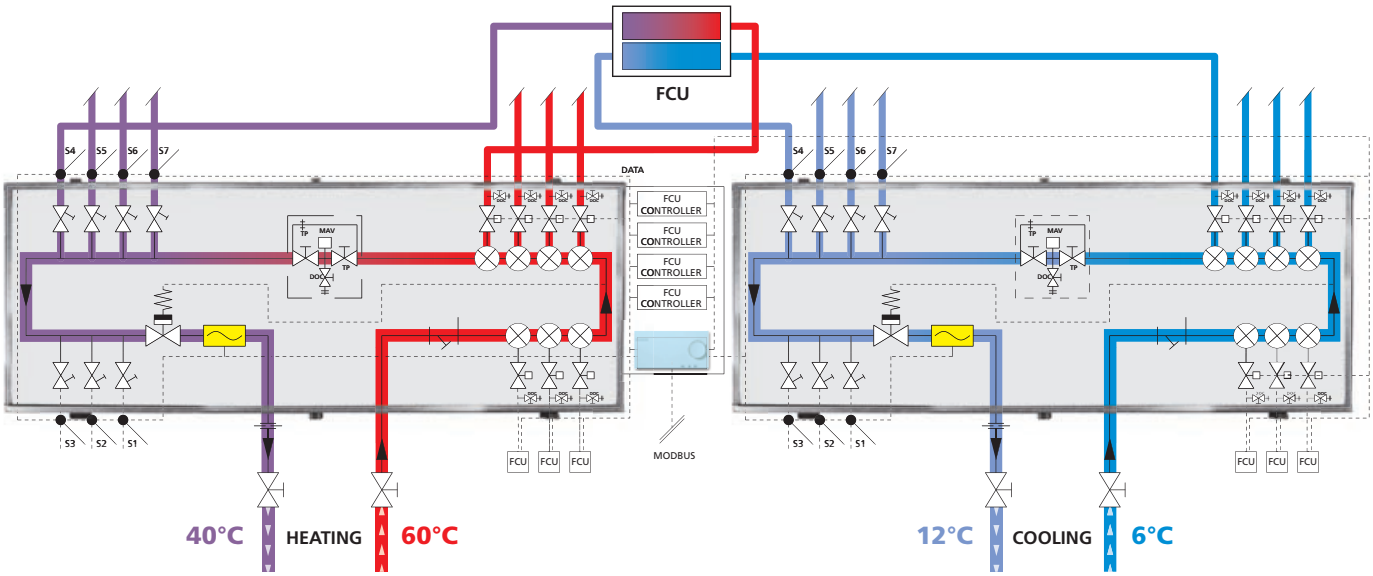
Watchman - Continuous Digital Monitoring

CHALLENGE:

Is a building's HVAC system achieving its design stage predictions?

SOLUTION:

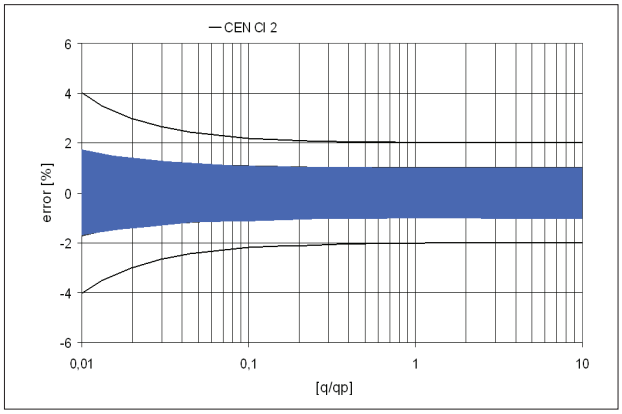
Continuous digital monitoring of flow rates, temperature differentials and energy consumption is fundamental to achieving both an optimum indoor environment and with least possible energy wastage!



Watchman digital flow rate commissioning

The Sonometer 1100 is an ultrasonic energy meter. This not only permits a very high flow measuring accuracy, but also makes the meter insensitive to dirt. The meter also continuously monitors flow and return temperatures across the commissioning module.

Measuring accuracy to EN 1434 MID Class 2



- Ultrasonic
- MID approved
- Mbus output
- Energy meter

Commissioning using the ‘subtraction method’

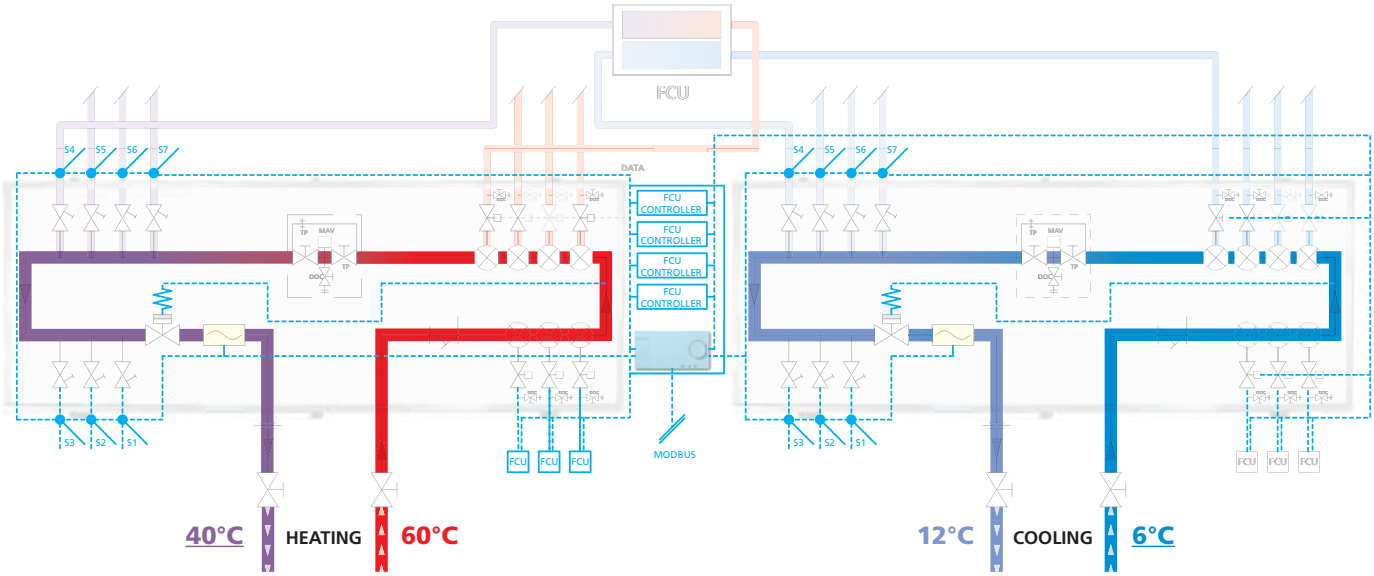
SAV Watchman PICV modules are commissioned in the same way with the digital flow meter allowing real time measurement of PICV circuits *actual* flow rates.

1. The flow through all of the terminal units connected to the commissioning module is measured to obtain a combined flow rate.

2. The difference between isolated terminal unit and combined flow rate of all terminal units is equivalent to the flow rate of the unit that was isolated. The isolation can occur either manually or electronically through the BMS system.

Watchman digital ‘Delta T’ monitoring

Wheras the digital flow meter continuously monitors the ‘Delta T’ across the commissioning module, the Delta ‘T’ monitors the return temperatures from each individual terminal unit.



Watchman BMS interface

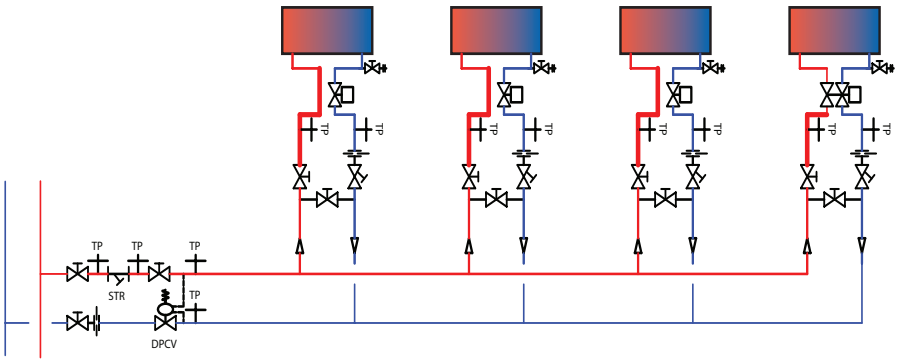
The Interface exports this data and the Ultrasonic flow and energy meter data to the BMS in Modbus.

FloCon Commissioning Module Concept

In traditional systems, commissioning and flushing valves are distributed between main branches and terminal branches. In FloCon modular designs, virtually all valves are centralized. This allows off-site assembly, swift commissioning and effortless maintenance.

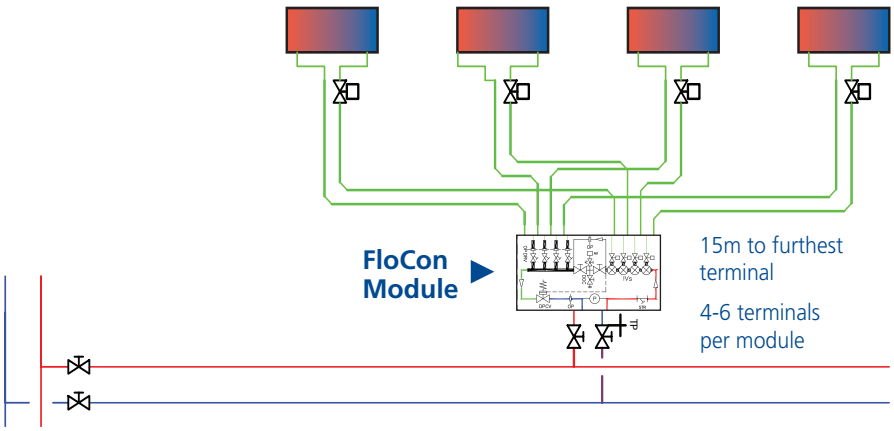
Traditional Design

(4 fan coils, 8 branch tees, min 24 joints)

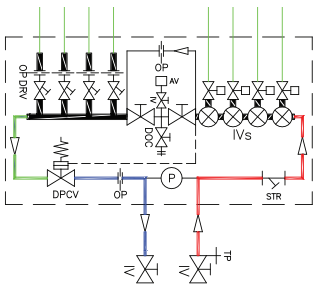


FloCon Modular Design

(4 fan coils, 2 branch tees, ONLY 6 joints)



Expanded view of FloCon Module



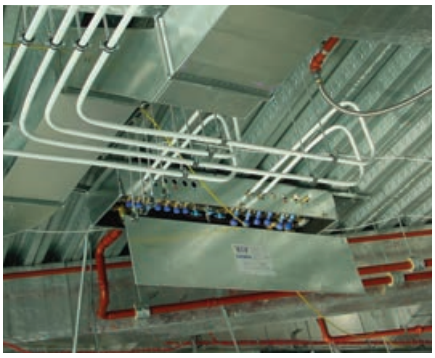
- Strainer
- Constant Bypass
- DPCV

Module vs Traditional

60% less install and commissioning time compared to traditional layouts.*

*BSRIA study 2007. Report no. 19822/02
"Commissioning module study report"

Simple multi-layer pipe installation



Joint-less continuous AluFlex pipe runs from FloCon module to terminal units

AluFlex Composite Pipe - Minimum Flow Velocities

CHALLENGE:

How to address the problem of dirt settlement in pipes carrying ultra-low flow rates.

SOLUTION:

SAV's AluFlex flexible piping systems are available down to 14mm nominal diameter (10mm internal diameter) pipes to help increase water velocity.

Copper		AluFlex	
Nom. Diameter	Flow Rate (l/s) at 0.5m/s	Nom. Diameter	Flow Rate (l/s) at 0.5m/s
15	0.072	14	0.039
22	0.158	16	0.057
28	0.262	20	0.100

AluFlex flexible piping systems

SAV's AluFlex piping systems are ideal for use with SAV Commissioning Modules, enabling faster and more reliable installation with no requirements for elbows or bends. Connections are made with secure Pressfit fittings.

- No hidden joints reduces the risk of leaks.
- Rated for temperatures up to 95degC and a working pressure of 12 bar
- Life expectancy of 50 years, full guarantee for 10 years.
- Gas-tight against oxygen, reduced risk of corrosion.
- Option for pre-insulation.

Also available pre-insulated in closed cell Armaflex® Tuffcoat

FloCon - Variable Speed Pump Control

CHALLENGE:

How to minimise pump energy consumption in pipework systems.

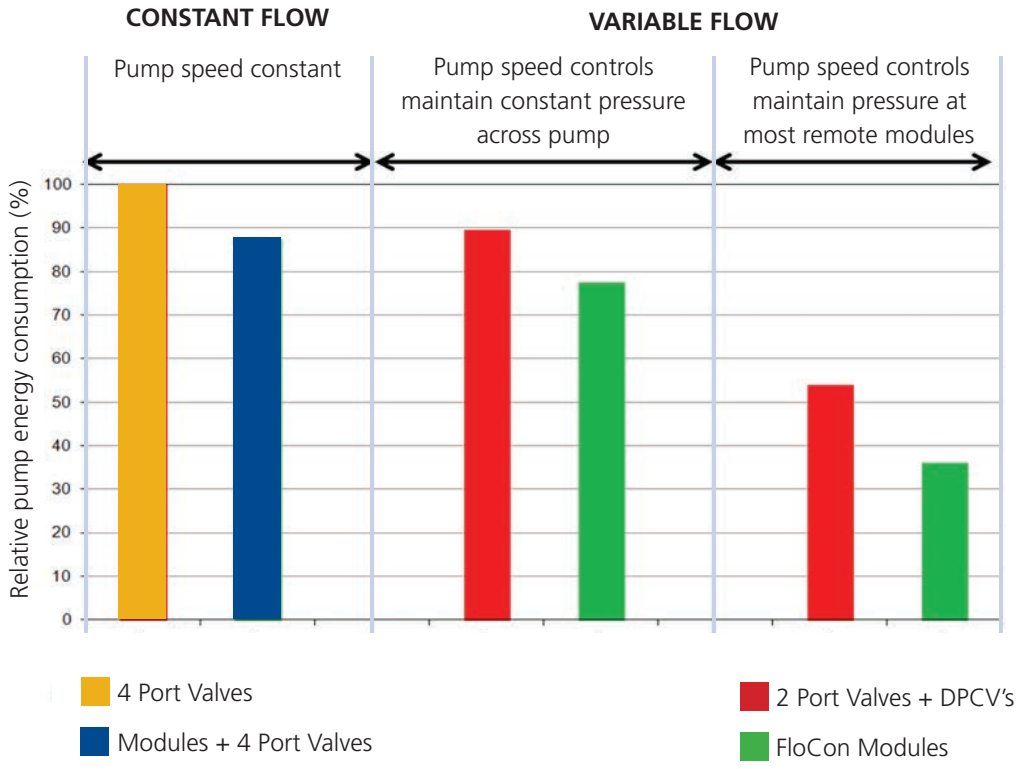
SOLUTION:

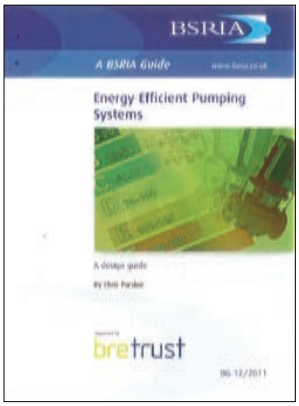
SAV Commissioning Modules can be used in conjunction with 'remote sensor' pump control, delivering higher efficiencies than those achieved with constant flow systems.

Using remote sensor control, the pump speed is controlled such that the pressure differential across the pump reduces towards the design pressure differential across the most remote pressure controlled sub-branches (or modules). Differential pressure sensors, wired back to the BMS or pump, are required across the selected sub-branches/modules.

Variable speed pump control

Used in conjunction with properly designed variable speed pump control, modules can achieve energy savings in the range of between 65 -70% relative to traditional constant flow systems (source BSRIA Guide BG12/2011 - page 15, figure 12). The bar chart below summarises the potential energy savings attributable to modular based designs for a typical system.





BSRIA Guide BG12/2011 Design of Energy Efficient Pumping Systems

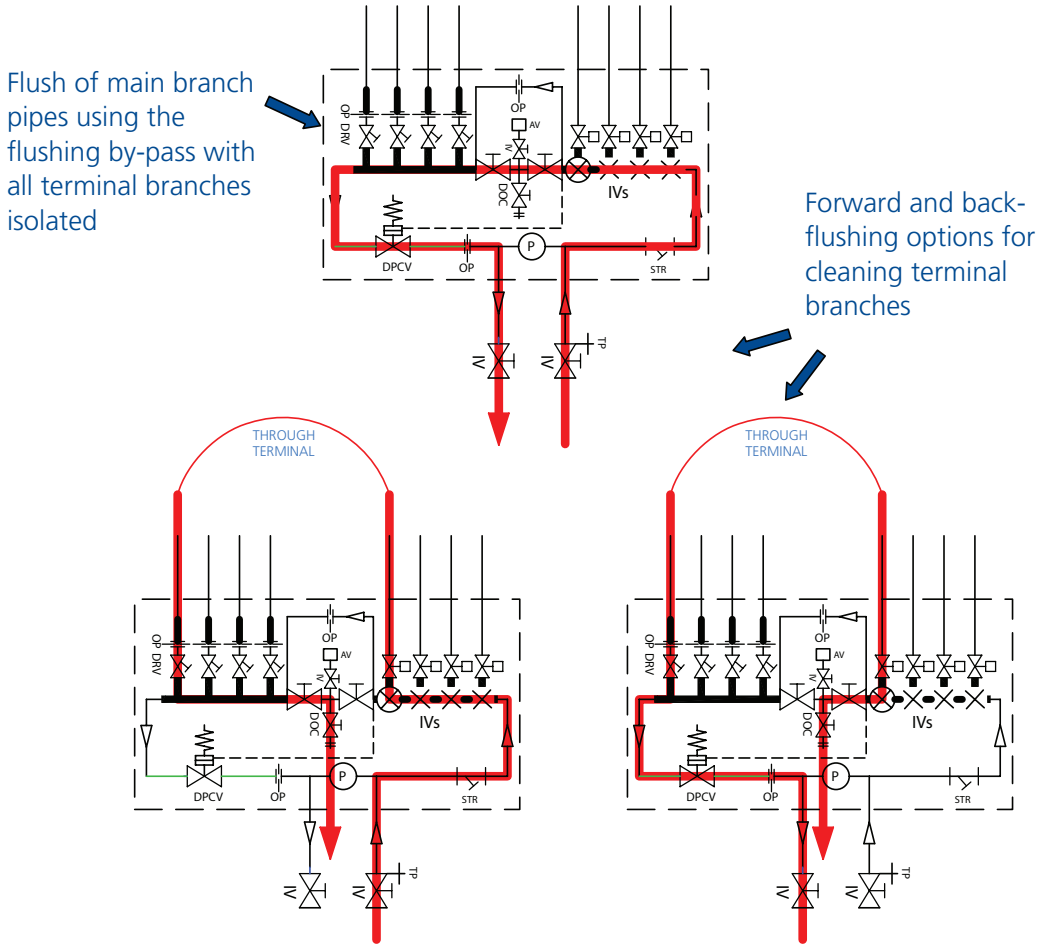
Released in 2011 with recommendations on how to minimise pump energy consumption in pipework systems.

Flushing and venting

BSRIA Guide BG29/2011 Pre-commission Cleaning of Water Systems recommends that all terminal units are provided with flushing by-passes and localised flushing drains.

Flushing by-passes are required so that the main distribution pipes can be flushed and chemically cleaned without having to circulate dirty water and chemicals through terminal units and control valves. Localised flushing drains are required so that terminal units can be flushed with cleaned water before they are connected to the main system.

FloCon modules achieve these objectives from a centralised combination of fittings.

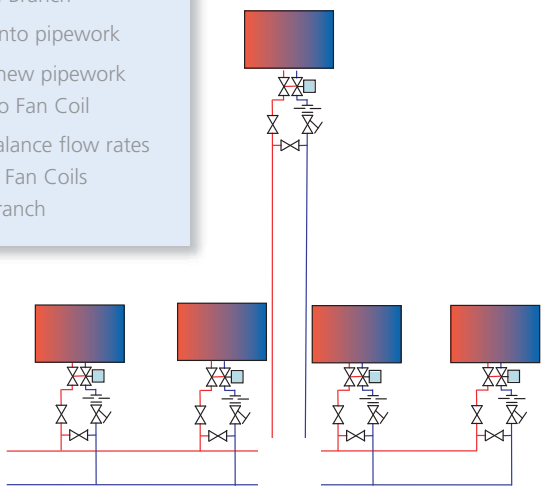


Air vents in each module enable air from groups of terminals to be vented during system fill (instead of having to vent each terminal unit individually).

FloCon Modules - Change and Churn

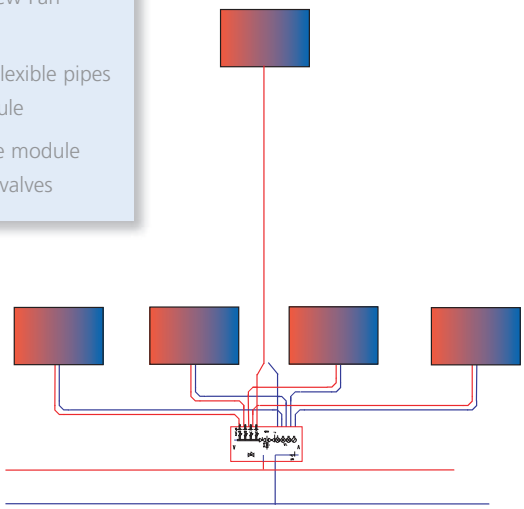
Adding a fan coil

1. Drain Branch
2. Cut into pipework
3. Run new pipework out to Fan Coil
4. Re-balance flow rates to all Fan Coils on branch



With Traditional Layout

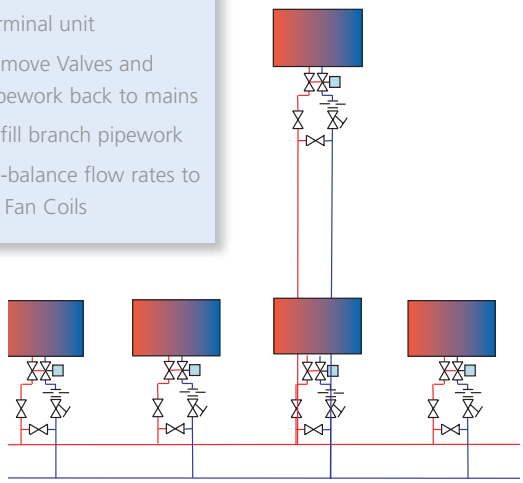
1. Position new Fan Coil unit
2. Run new flexible pipes from module
3. Re-balance module balancing valves



With FloCon Modules

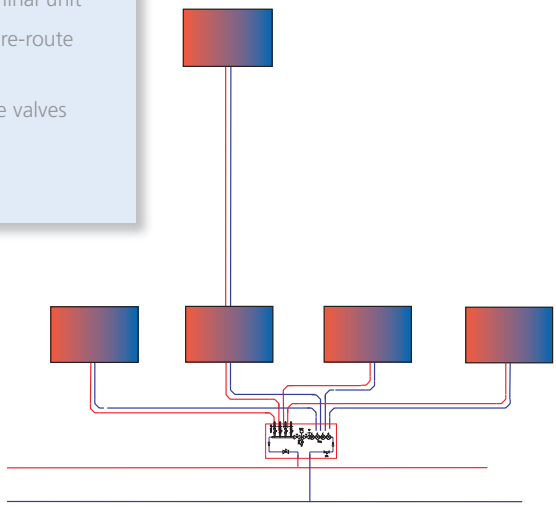
Moving a fan coil

1. Drain Branch / Move terminal unit
2. Remove Valves and pipework back to mains
3. Refill branch pipework
4. Re-balance flow rates to all Fan Coils



With Traditional Layout

1. Move terminal unit
2. Extend or re-route pipework
3. Re-balance valves in module



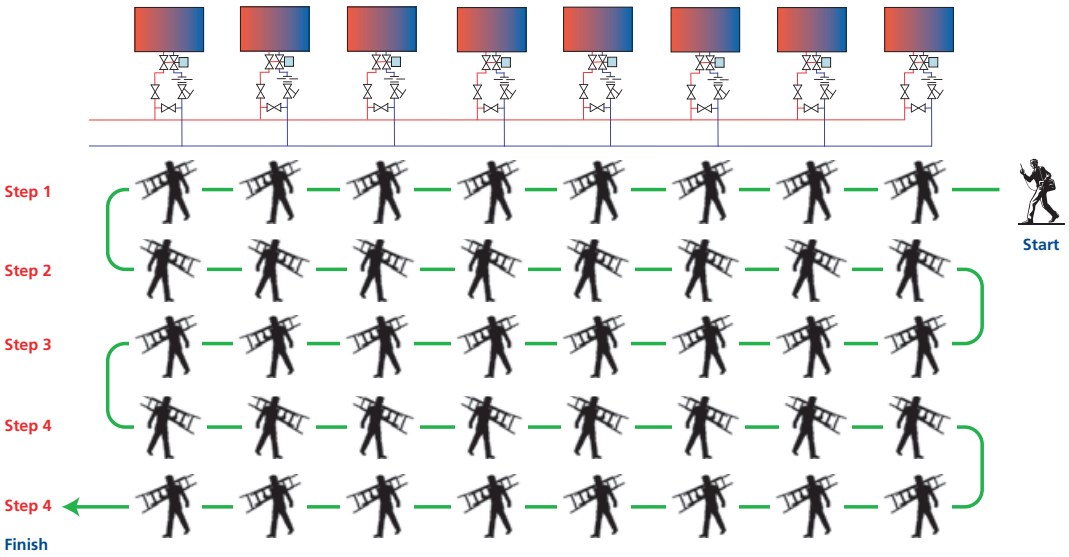
With FloCon Modules

Commissioning

Traditional Commissioning

Extremely laborious - decentralized valves at remote terminal units mean much use of stepladders!

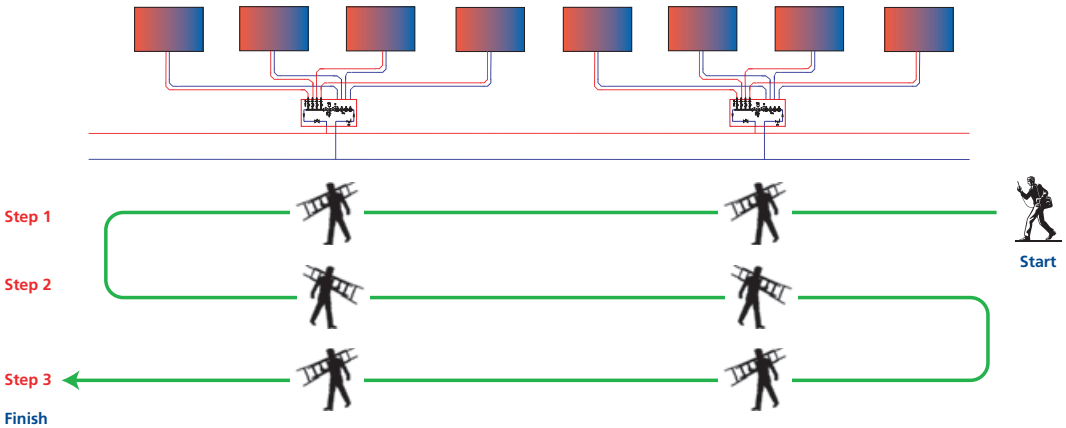
Step 1: Flush Pipework up to Fan Coil **Step 2:** Vent Fan Coils **Step 3:** Back-Flush Fan Coils **Step 4:** Proportional Flow Balance



FloCon Commissioning Modules

Grouping makes life so much easier.

Step 1: Flush Valve Module **Step 2:** Vent, Back-Flush & Flow Balancing can be performed at one visit. **Step 3:** Balance modules against each other



Summary of CIBSE and BSRIA recommendations

The table below summarises the key CIBSE and BSRIA recommendations and points raised. Each lettered item can be cross referred to the preceding schematics to see how FloCon modules comply.

	Design requirement	Source Doc.*
A	Straight pipe lengths around FMDs for accurate measurement	1,2
B	Correct pipe diameters at entries to FMDs	1,2
C	FMDs sized to achieve a signal of greater than 1kPa	1,2
D	DRVs selected to be more than 25% open after balancing	1,2
E	Pressure tappings across terminal branches	1,2
F	A flushing by-pass to terminal units	4
G	A flushing drain for terminal units	4
H	A localised DPCV to limit pressure across 2 port control valves	3
J	A strainer to remove debris	4
K	An air vent to facilitate system filling	1,2
L	Pipes sized at velocities that avoid air or dirt settlement	2,4
M	Ultra low flow rates measureable by "subtraction method"	1,2
N	A fixed by-pass to maintain flow through pump	3
O	Optional differential pressure sensor for pump speed control	3

It can be seen that FloCon modules follow the guidance of the CIBSE and BSRIA recommendations using a single pre-assembled product.

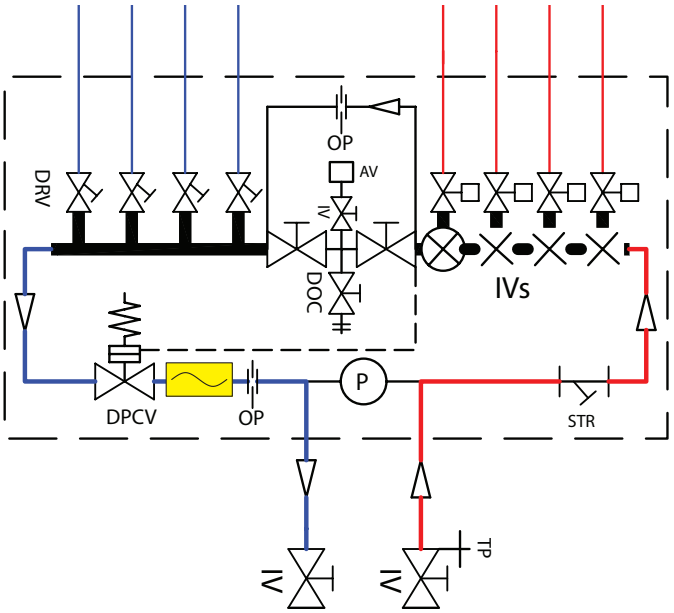
PICVs

Pressure independent control valves (PICVs) incorporate 2 port control valve, DRV, and DPCV within a single valve body. If required, PICVs can be fitted at the terminals or within the modules.

*** Sources documents:**

1. CIBSE Code W Water distribution systems (2010)
2. BSRIA Guide BG2/2010 Commissioning Water Systems
3. BSRIA Guide BG12/2011: Design of Energy Efficient Pumping Systems
4. BSRIA Guide BG29/2011 Pre-commission Cleaning of Water Systems

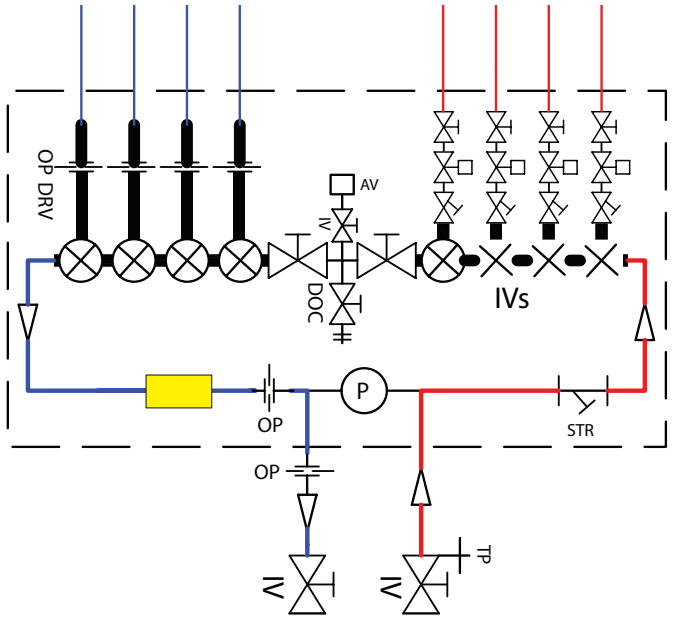
SAV FloCon Commissioning Modules - schematics



DPCV module

Ideal for low flow heating systems:

- control valves optional
- DRVs are incorporated into return manifold
- Ultra low flows measured using "subtraction method"
- option to use temperature gauges on return ports for temperature balancing
- *PICVs can be fitted on ports instead of 2 port valves and DPCV*



PICV module

IV ISOLATING VALVE

DOC DRAIN OFF COCK

DRV DOUBLE REGULATING VALVE

ENERGY METER

OP ORIFICE PLATE FLOW MEASUREMENT DEVICE (FMD)

STR STRAINER

TP PRESSURE TEST POINT

2 PORT CONTROL VALVE

DPCV DIFFERENTIAL PRESSURE CONTROL VALVE

AV AIR VENT

Pressure independent control balancing valve (PICV)

CIM 717LF / CIM 717HF

CIM 717PLF / CIM 717PHF

LOW FLOW	Cim 717LF - Cim 717PLF		
Size	Flow (l/h)	Flow (l/s)	Flow (gpm*)
1/2" DN 10	43 ÷ 150	0,0119 ÷ 0,0416	0,189 ÷ 0,659
3/4" DN 15	86 ÷ 347	0,0240 ÷ 0,0965	0,380 ÷ 1,530

HIGH FLOW	Cim 717HF - Cim 717PHF		
Size	Flow (l/h)	Flow (l/s)	Flow (gpm*)
1/2" DN 10	86 ÷ 347	0,0240 ÷ 0,0965	0,380 ÷ 1,530
3/4" DN 15	96 ÷ 483	0,0266 ÷ 0,1341	0,422 ÷ 2,125
1" DN 20	180 ÷ 900	0,0500 ÷ 0,2500	0,792 ÷ 3,960
1 1/4" DN 25	340 ÷ 1700	0,094 ÷ 0,4720	1,496 ÷ 7,480

Service Recommendations: Cim 717 balancing valves are designed for automatic balancing of heating (LPHW) and cooling systems, regardless of fluctuating pressure conditions of the system.

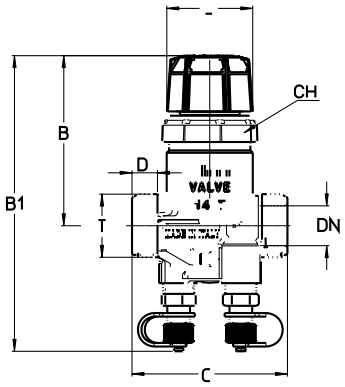
Cim 717 are available in DZR brass.

Thanks to its unique design, Cim 717 balancing valves are able to perform three functions, in particular:

Regulation: Selection of required flow rate;

Control: Constant flow rate regardless of pressure fluctuations;

Modulation: "Full authority" flow rate modulation.



DN	Grms.	A	B	B1	C	D	CH
1/2"	450	35	75	130	53	9	38
3/4"	490	35	75	134	65	11	38
1"	790	35	88	148	82	11	38
1 1/4"	935	35	88	148	104	11	38

Technical Data

Flow Capacities Max. Working Temperature: 95°C Max. Working Pressure: 10bar

Note: Manifold ports can be adapted to receive different pipe sizes. Hence a mixture of sub-circuit sizes from the same manifold is possible.

Inlet Pipe Size mm (OD)	Maximum Flow (l/s)
15	0.12
20	0.29
26	0.54
32	1.12

Terminal Pipe Sizes		Maximum Flow (l/s)
mm (Outer Diameter)	mm (Internal Diameter)	
14	10	0.04
16	12	0.08
20	16	0.16
26	20	0.28

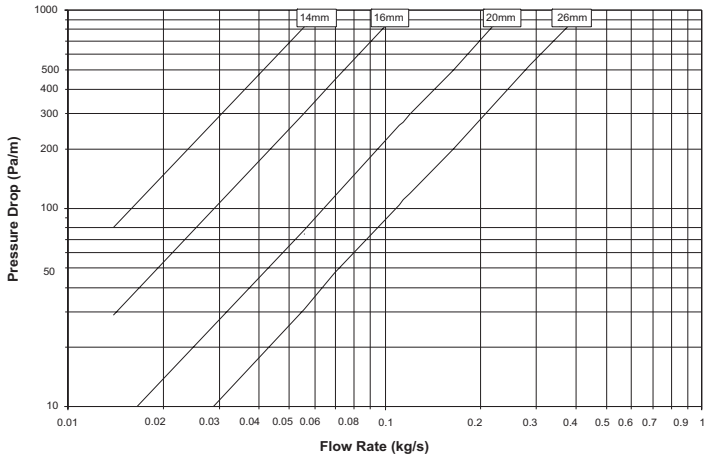
Terminal Unit Flow Equation: Q=kW/(4.2*Δt) where Q = flow in l/s, kW = Term.
Unit duty in kW, Δt = difference between Flow & Return temperatures in °C

Commissioning Sets

Nom. Size	Flow Range (l/s)	Maximum balancing pressure (kPa)	kv	kvs
15 LL	0.014 – 0.028	54200 Q^2	0.473	0.473
15 ML	0.028 – 0.055	54200 Q^2	0.825	0.976
15 SL	0.055 – 0.095	54200 Q^2	0.85	1.799
15 SS	0.095 – 0.12	2366 Q^2	1.911	1.799
20	0.12 – 0.29	1250 Q^2	4.427	4.057
25	0.21 – 0.54	1203 Q^2	7.648	7.452
32	0.46 – 1.12	284 Q^2	16.56	16.628

Equations: $\Delta P(Pa) = \zeta \rho v^2/2$ or $\Delta P(kPa) = (Qx36/kv)^2$ Where Q = flow kg/s, ρ = density kg/m³, v = velocity m/s

Pipe Pressure Losses Outer Diameter



NB: Pressure losses are for straight pipe

2 pv Type VZL2

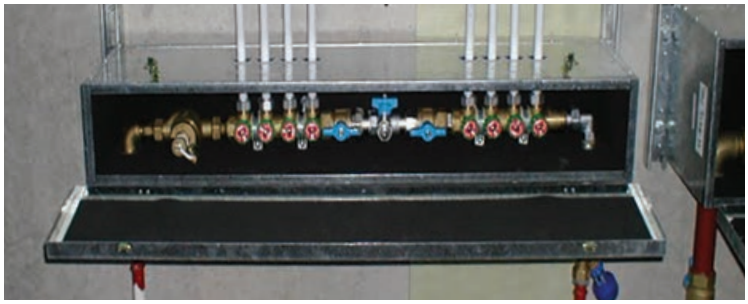
2 port valve			
mm	kvs	mm	kvs
15	0.25	15	1.60
15	0.40	15	2.50
15	0.63	20	2.50
15	1.00	20	4.00

DPCV AVP-F

DPCV			
DN mm	kvs	DN mm	kvs
15	1.60	20	6.30
15	2.50	25	8.00
15	4.00	32	10.00

SAV SYSTEMS

Low Carbon Energy Solutions for Building Services



For further information contact:

SAV Head Office: Scandia House, Boundary Road, Woking, Surrey GU21 5BX **Tel:** +44 (0)1483 771910

SAV North West: Stockport Business & Innovation Centre, Broadstone Mill, Broadstone Road, Stockport SK5 7DL **Tel:** +44 (0)161 443 4231

Web: www.sav-systems.com E-mail: info@sav-systems.com