

DOMESTIC HEATING CONTROLS ARE EASY

PART 5 - RADIATOR THERMOSTATS



Fig.1. RAS-C² and RAS-D² radiator thermostats with RLV-D lockshield valve

Radiator Thermostats (TRVs), the original and straight forward room temperature controls, today remain essential to the full efficiency of most ‘wet’ domestic central heating systems.

Endorsing this fact, Good Practice Guide 302, the Government’s authoritative document covering domestic heating controls, recommends radiator thermostats for all ‘wet’ systems (both combi and regular boilers), whether these are installed to defined ‘Minimum Set’ or ‘Best Practice’ standards. It specifies ‘*TRVs on all radiators except in rooms with a room thermostat*’ for every one of these classifications.

TRVs were invented by Danfoss and first became available as long ago as 1943. Continuous development since then has resulted in modern versions that, although based on original principles, are smaller, more efficient, more stylish and easier to use.

Despite the arrival of numerous competitors attracted over the years by the product’s success, Danfoss still supplies over 50% of world demand and is firmly established as the market leader in the UK.

Installers and specifiers seeking information and advice on radiator thermostats and their application will find no better source than Danfoss.

FUNCTION

Radiator thermostats, fitted to individual radiators, control desired room temperatures very accurately, allowing only essential heat to be generated in the process. Furthermore, they enable lower temperatures to be maintained in unoccupied rooms or where appropriate, thus reducing heating costs and enhancing comfort.

Requiring no external power to operate, TRVs sense room temperature changes in individual rooms – including extraneous ‘free heat’ from sunlight, appliances, occupants, etc. – and adjust the flow of heated water through the relevant radiators to maintain desired comfort levels and reduce costs. Using conventional room thermostats alone provides just single-zone temperature control based on one sensing point and one temperature setting.

CONSTRUCTION

Radiator thermostats comprise two basic sub-assemblies – **valve bodies** and **sensors** that can be purchased individually or in boxed sets.

Valve bodies. Available in many sizes and configurations – straight, vertical angle and horizontal angle - to suit various applications, valve bodies provide the means of regulating the flow of heated water through radiators. There are also special valves, e.g. presetting types or high flow versions for single pipe systems.



Fig.2. Danfoss valve bodies for radiator thermostats

Sensors. Settable for desired comfort levels, these monitor room temperatures and adjust valve operation accordingly.

These two component parts need to be fixed together correctly and positively.

OPERATION

A wax, liquid or gas charged capsule-and-bellows assembly within the sensor head expands and contracts with changes in room temperature, operating a piston that acts on the valve pressure pin (spindle). As the room temperature increases, the valve throttles back the flow. A powerful spring returns the piston promptly when contraction (cooling) occurs. Fig. 3 shows the internal components of a typical modern radiator valve.

Construction

- 1. Actuator
- 2. Setting dial
- 3. Safety spring
- 4. Gland seal
- 5. Pressure pin
- 6. Securing union nut
- 7. Spindle
- 8. Bi-directional valve cone
- 9. Revolver
- 10. Valve body

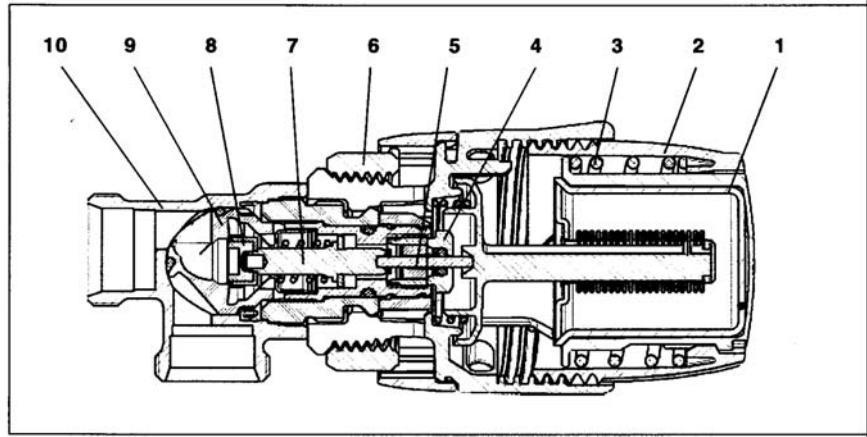


Fig.3. Cut-away of a Danfoss Randall RAS-C² radiator thermostat showing internal components

Wax reacts slower than gas. Gas is lighter and therefore reacts faster. The faster the reaction to change, the higher the energy saving. As a direct result the room will become more comfortable in a shorter time. The control action of TRVs is modulating, i.e. in response to room temperature changes it makes appropriate slight adjustments to the valve spindle position to increase or reduce the volume of heated water passing through the radiators. This achieves a closer temperature control band than the On/Off operating cycle of conventional room thermostats.

TEMPERATURE SETTING

The desired control temperature is easily set by rotating the setting dial (sensor head) until the appropriate comfort icon (number) coincides with the setting mark (see Fig. 4). Setting ranges vary with different manufacturers and types. Danfoss Randall types RAS-D² and RAS-C² have setting ranges of 8°C – 28°C plus a positive shut-off position (see Fig. 4). Note that the frost protection setting is at 8°C whilst 0 represents the positive-off position.

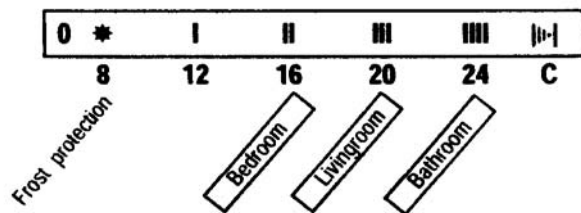


Fig.4. Setting icons (in box) for Danfoss Randall RAS-D² and RAS-C² radiator thermostats.

Frost Protection Setting

Using the frost protection setting while the heating system is on will maintain a temperature of 8°C in the room in which the radiator thermostat is installed, thus providing protection against freezing in that area with minimal fuel consumption. However, it should be recognised that this will not necessarily protect boilers situated in other rooms or outbuildings.

Positive-Off

The positive shut-off mechanical setting allows radiators to be removed for home decoration without any fear of the valve opening and possibly flooding the premises due to an unexpected drop in room temperature.

TYPES

Today's most popular radiator thermostats for fully pumped (2-pipe) domestic central heating systems are 15mm bi-directional, reversible, angle types with built-in (integral) sensors. These allow total installation flexibility, i.e. sensor mounted vertically or horizontally in either flow or return.

However, many alternative versions exist to suit other systems and situations where the fitting of this type is not appropriate. Different designs are available for virtually all requirements.

Valve Bodies. Valve body options exist in sizes from 3/8" to 1" BSP (Imperial) or 8, 10 and 15 mm (metric) for use in 2-pipe systems.

TRV valve bodies can be either *threaded* or provided with *compression fittings*. Some models are also available with *push-fit fittings* for plastic pipe. Special high capacity bodies are also available for 1-pipe systems.

Others, such as *presetting* versions and *special 'radiator' valves*, are also obtainable.

Bi-directional valve bodies are claimed to allow flow in both directions, removing any possibility of incorrect installation. Before these were introduced, valves fitted the wrong way round often caused system noise through water hammer. These older flow-dependent valves carried arrows on their castings indicating the correct flow direction to avoid the risk of water hammer.

Danfoss Revolver. Unfortunately, even the new specially designed bi-directional valves produced by numerous manufacturers have been found to occasionally give rise to system noise. Danfoss intensive research found that it was physically impossible to produce a bi-directional valve of this type that would eliminate noise every time under every set of conditions.

The answer was to produce the patented Danfoss Revolver (flow selection) mechanism that enables the flow direction through the valve to be completely reversed just by removing the sensor head and rotating a flow selection ring through 180°. This means that, in whatever direction the valve is installed, any noise problems encountered can be easily and quickly overcome without having to drain down and reinstall. The Revolver mechanism is now fitted as standard in most popular Danfoss domestic radiator valves.

Sensors. Built-in (integral) sensors can be secured to valve bodies by Allen screws, screw collars or snap-lock mechanisms.



*Fig.5. Danfoss sensors for domestic radiator thermostats
(RAS-D2 sensor in white and chrome)*

For installations where integral sensors are not practical, remote sensors or remote adjusters are readily available. These sealed units connect to the valve-operating unit by a length of thin capillary tubing.

There are also advanced electronic programmable sensors that provide additional control flexibility by enabling temperature setting changes to occur at desired pre-set times.

INSTALLATION

Most installers will not need advice on installation techniques. An easy plumbing job for the valve body, plus ensuring the sensor head is fixed correctly, is all that it takes. No wiring is necessary. Detailed instructions that accompany each product should be observed.

However, care is required with valve positioning and sensor mounting.

To monitor air temperatures that represent the room as a whole, the best installation position is with the sensor mounted horizontally away from the hot valve body and pipes. Mounting the sensor vertically above the hot valve is likely to prevent the room attaining the desired temperature.

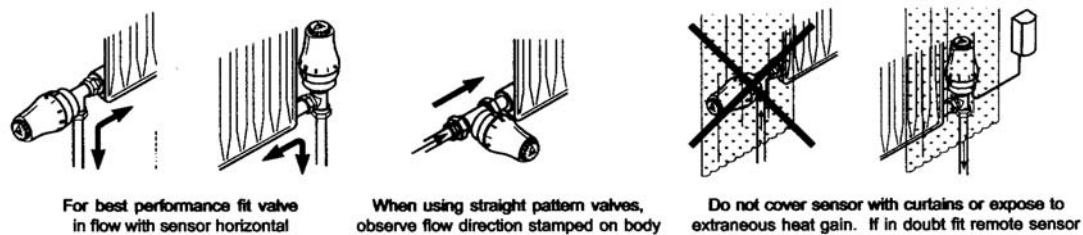


Fig.6. Mounting positions for radiator thermostats

If sensors must be mounted vertically, due to space limitations or for other reasons, the valves are best fitted at the return where valve temperatures are lower.

Also, sensors positioned behind curtains or furnishings, or in tight corners alongside hot pipes, will not allow satisfactory control. In these situations it is best to use remote sensors/adjusters.

Where an automatic by-pass valve is installed in a heating system, radiator thermostats may be fitted to all radiators. Many boiler manufacturers specify by-passes and minimum flow rates through the boiler heat exchanger to maintain peak system efficiency, irrespective of load. Latest Building Regulations, Part L1, insist on the use of automatic by-pass valves in such installations; a by-pass alone or a manual by-pass valve is not considered adequate. Automatic by-pass valves, opening only when system flow/pressure conditions dictate, improve system efficiency and reduce the risk of flow noise.

The old method of leaving one radiator uncontrolled is wasteful and should be avoided if possible.

In all domestic heating systems, including those controlled predominantly by radiator thermostats, an overriding room thermostat should be provided to meet the Building Regulations requirement for boiler interlock circuitry that prevents wasteful boiler 'dry' cycling.

COMMERCIAL PRODUCTS

Danfoss Randall also provides the extensive and well proven RA2000 range of radiator thermostats designed to cope with the accidental abuse and deliberate misuse frequently encountered in commercial and public premises. Full details of this range are given on this website, www.danfoss-randall.co.uk.

TECHNICAL LITERATURE AND DATA SHEETS

Detailed information on all Danfoss Randall products is available on request. In most cases, literature and instructions can be quickly downloaded from this website.