TMV3 THERMOSTATIC MIXING VALVES

Engineered to a high specification, designed for safety and comfort

TMV 3 SCHEME

Reliance™ WATER CONTROLS

The Safety Valve Specialist

HOT WATER BURNS LIKE FIRE

is the key phrase in Reliance's campaign to raise the awareness of scalding injuries in the UK.

The striking image of a child about to climb into a steaming hot bath to get his toy is an all too realistic representation of real life situations that can and do happen, almost twice a day on average.

This image has been used extensively by the Children's Fire and Burn Trust, the TMVA (Thermostatic Mixing Valve Manufacturers Association) and by Reliance Water Controls in the UK to highlight the need for temperature control of hot water systems in homes, offices, hospitals, care homes, schools and other public buildings.

This guide to TMV3 thermostatic mixing valves has been put together to collate the wealth of technical information and expertise that Reliance Water Controls has gained in over 20 years of marketing thermostatic mixing valves in the UK.

About Reliance Water Controls

Reliance Water Controls began its operations in the UK market in 1986. Shortly after this, the first thermostatic mixing valve appeared on our shelves for sale. Now, over 20 years later, Reliance is a recognised market leader in the supply of thermostatic mixing valves. A founder member of the TMVA (Thermostatic Mixing Valve Manufacturers Association), Reliance was instrumental in the writing, promotion and technical support of the NHS model engineering specification D08 which is now a worldwide recognised benchmark standard for thermostatic mixing valves. Reliance has also worked with Buildcert (a division of WRc-NSF) to give industry input into the creation of the TMV2 and TMV3 schemes. Reliance actively supports the education of the public to the dangers of scalding and through working with organisations such as the CFBT (Children's Fire and Burn Trust), CAPT (Child Accident Prevention Trust), has helped to get scalding on the agenda for review in the building regulations in England and Wales for domestic housing. The company has also provided advice, support and technical expertise to the SBSA (Scottish Building Services Agency) when it was decided in 2006 to introduce legislation requiring the fitting of thermostatic mixing valves as standard in domestic properties in Scotland. In addition, Reliance is very active in the field of European standards: working on the committee charged with the revisions of BSEN1111 and 1287 (thermostatic mixing valves) and chairing the committee writing a new European standard for tempering valves, known as BSEN15092. Reliance is committed to raising the industry standards and maintaining them at a high level to ensure that thermostatic mixing valves are always fit for purpose and the public are protected from scalding injuries.

Reliance Worldwide

Reliance Worldwide is a global expert in the design and manufacture of advanced water controls and is one of the world's largest manufacturers of thermostatic mixing valves for sanitary use, with in excess of 1 million valves produced every year. In the last 20 years, Reliance Worldwide has designed and developed no fewer than 20 specialist valves for the UK market alone; these range from basic tempering valves like the Mastermixer range, to group showering valves like the Planar range, underfloor heating tempering valves for controlling low temperature heating circuits, as well as TMV2 approved valves for the domestic sector and TMV3 valves for the hospital and care home sectors. Reliance Worldwide is committed to the continuous improvement and development of its product range using its own extensive Research and Development department and by working with partner companies, both suppliers and customers, to make sure that it stays at the forefront of developing new and innovative products. Reliance is also dedicated to the continuous improvement of production techniques and quality control as per ISO 9001.2000; to ensure products meet the rigorous demands required by UK regulations, all of them are proven in the company's own in-house NATA approved test laboratory (one of only two labs outside WRc that is approved to test to TMV3/D08), as well as 100% tested on the automatic assembly lines.

The TMV3 Approval Process

In order for a manufacturer to get a valve approved to the D08 specification by Buildcert so that it can be marketed as a TMV3 scheme approved product, there is a very difficult approval process to go through. It starts with the application by the manufacturer in writing that they would like to submit the valve for testing to TMV3. All the relevant information is submitted at this time including material specifications, drawings, marketing information, instructions etc. Once Buildcert processes the application, they will then ask the company to submit samples of the valve in question for testing. Once the valve is on the test rig it is subjected to a battery of tests including but not limited to:

- Endurance testing of the thermal element
- Temperature overshoot on start up (the hot spike test)
- Temperature response on temperature adjustment
- Thermal shut off
- Temperature stability on changing pressures
- Temperature stability on changing inlet temperatures
- Temperature stability on reduced flow-rates.

As the above list shows, TMV3 is very comprehensive in its performance testing, and necessarily so for a valve that is really a safety valve.

The TMV3 Scheme and NHS Model Engineering Specification D08

In 1996 the UK market for thermostatic mixing valves was very similar to the rest of Europe and North America: regulations and standards were either non-existent or hopelessly full of holes. At about that time, the Department of Health realised that the issues of scalding within NHS properties was a serious threat to the health and safety of both patients and staff, and that the tempering valves being fitted then in an attempt to protect the people under their care were woefully inadequate for the task. Part of the problem was that the tempering valves used at the time were mainly of continental or North American design and they could not cope with the vagaries of UK supply conditions such as low pressure from gravity fed systems or having a mixed pressure system, ie high pressure mains cold and low pressure gravity hot water. Another far bigger problem was that the UK standard at the time, BS1415 part 2, was a self certification standard so anyone could claim compliance; the standard was also very weak in terms of how much of the functionality of the valve was tested and virtually everything was done at low, equal pressures. To address this problem the NHS Estates enlisted the help of WRc and industry, including Reliance Water Controls, to discuss what could be done to make sure that the thermostatic mixing valves fitted in hospitals and nursing homes were (a) of suitable quality and built in an ISO 9001 accredited facility, (b) were capable of functioning under extreme supply conditions that were and are still common in the UK, (c) were identifiable and traceable after installation, and most importantly (d) were independently third party tested by an approved test house and not self certified.

From these initial discussions the 1997 NHS model engineering specification D08, which forms the basis for the testing requirements of the TMV3 scheme, was born. The key to why the D08 specification has worked so well is in the fact that it was written together by the UK regulators, test houses, industry and NHS Estates who understand that the unique qualities found in UK plumbing systems create challenges that are different from anywhere else in the world. In response to this, the specification was written to cover performance at both high and low pressures, and with mixed high and low pressures and to cover a multitude of other requirements never before considered, such as thermal shut down on hot or cold supply failure (ie the failsafe test), testing for hot spikes, testing for temperature control at equal and unequal pressures, testing for temperature stability under changing inlet temperatures as well as many others. In the years since the D08 was first written it has had some updates, but it has proven its validity and quality as the core of the specification has remained largely unchanged from the 1997 version and it has become a benchmark for many countries upon which to base their own national standards for thermostatic mixing valves.

Buildcert and the TMV3 Scheme

The TMV3 scheme is the third party valve accreditation scheme which is administered by Buildcert (a division of WRc-NSF). This scheme has been set up to independently test that valves submitted are suitable for use in high risk applications within the UK; the performance requirements tested are based on the NHS D08 healthcare specification, but many other factors are also considered. An applying company must also prove they comply with ISO 9001 or a suitable equivalent quality control system, the valves are checked for correct marking so they can be identified in the field, packaging and instructions are checked to make sure they comply with guidelines issued by Buildcert. If the TMV3 scheme's technical assessment panel are convinced that all the performance and non performance related requirements have been met then they will issue a certificate granting a five year period of approval for the thermostatic mixing valve. The valve will also be added to a list of approved products which is kept on the Buildcert website and is updated regularly. During this five year period of approval Buildcert will carry out 2 audit tests, usually after 18 months and again after 36 months. This involves Buildcert removing valves from a company's stock and subjecting the items to specific tests to ensure that the production valves, as well as the valves originally submitted for testing, comply with the requirements of the TMV3 scheme. This level of third party compliance testing is unheard of in the rest of the world and helps to ensure that the UK is at the forefront of hot water safety and the development of thermostatic mixing valve technology.

The Conflict: Legionella or Burns?

Not much of a choice, but this conflict is at the heart of every plumbing system. Water heated and stored at sufficiently high temperatures to control and kill bacteria such as legionella can cause severe scalding injuries in a matter of seconds but water that is heated and stored at safe non-scalding temperatures provides the ideal medium and temperatures for bacteria growth.

Legionnaire's Disease

Legionnaire's Disease comes from a naturally occurring organism that can be found in low levels in the water supply. It is a bacterial disease that may cause pneumonia, and is contracted from small droplets of water that are contaminated with legionella bacteria and which have become suspended in the air. The time from infection to start of the illness (the incubation period) is between two and ten days and the disease can be particularly deadly to the very young or old, especially if infirm.

Aerosol droplets that allow transmission of legionella are found in: whirlpool spas, showers, cooling towers, taps with sprays etc. Legionella can grow in any water system that is not properly maintained.

The effect of temperature on legionella

Temperature Range	Effect On Legionella
70-80°C	Disinfection range
66°C	Legionella will die in 2 minutes
60°C	Legionella will die in 32 minutes
55°C	Legionella will die in 5-6 hours
50-55°C	Legionella can survive but do not multiply
20-50°C	Legionella growth range
Below 20°C	Legionella can survive but are dormant

Elimination of legionella from a system

Methods to eliminate legionella include chlorination: more than 10mg injection of chlorine per water litre in the sanitary installation. This method of treatment is used when a system is cleaned prior to commissioning. It has real disadvantages if a system is being used.

Another option is to use heat treatment, ie running water above 70°C for 30 minutes in the whole sanitary system. This can also have serious drawbacks if no temperature control is used on the outlets.

If temperature control down to a completely safe level is exercised at the water heater, ie turning the cylinder down to a non-scalding temperature so that all the stored water is below 50°C, the following will occur:

- The system will not comply with building regulations
- Water usage will increase as users run taps for longer periods, in the hope of getting hot water
- Users will not get a hot bath unless the water heater is close to the bath because of the temperature loss from the pipework between the water heater and the point of use
- Washing up becomes a problem as lukewarm water will not shift grease

Building regulations state that the circulation of hot water must be at temperatures sufficiently high to stop the legionella that naturally occurs in the water supply from multiplying to a level that will cause health problems to susceptible people. In the UK building regulations stipulate that hot water should be stored at no less than 60°C and circulated at no less than 55°C to prevent the growth of legionella.

The Burns Issue

Every year 570 people are admitted to UK hospitals suffering from severe and debilitating scald injuries. In addition, 23 people are killed every year by being immersed in hot water by mistake by a carer or nurse or by falling in to a bath and not being able to get out quickly enough. These are sobering statistics when you consider that the burns suffered by scald victims are every bit as painful and destructive as those suffered by victims of fires or explosions.

Raising awareness of scalding prevention: Mary Creagh MP with Reliance's Grant Phipps and Eric Winter at a 'Hot Water Burns Like Fire' campaign event.

A common scenario is a parent filling a bath for a toddler: as is common in the UK the hot tap is turned on first and then the temperature is adjusted by adding cold afterwards, suddenly the doorbell rings, the phone goes or the parent is distracted by another child and leaves the bathroom for a few seconds, the child reaches in to grab his/her favourite toy and falls headfirst into the 60°C uncontrolled hot water. The child will probably raise the alarm and the parent may have the child out of the water in a matter of seconds, but unfortunately even then it is far too late: hot water at this temperature will result in virtually instantaneous third degree burns to all parts of the body that it comes in contact with.

Almost 90% of the 570 people who suffer serious scalds each year, which require hospitalisation, are children.

Other groups considered to be at high risk are the elderly and disabled. While children are normally scalded because they do not identify or understand the risk, the elderly and disabled are more likely to be injured or killed as a result of not being physically able to remove themselves from the scalding situation when they find themselves in danger. A typical scenario is a carer or nurse filling a bath of hot water and leaving the person to get in by themselves; quite often the bather will sit on the side of the bath and swing their legs over and into the water. At 60 degrees an adult will suffer third degree burns after less than six seconds of immersion, with an elderly person this time is likely to be even less due to the more sensitive nature and reduced thickness of their skin. Regardless of skin sensitivity, however, it is clear that anyone who is even marginally impeded in their movements is going to suffer a serious scald injury at such temperatures.

90% of all people who are killed each year by scalding are the elderly aged 65 and over.

Temperature versus exposure time

The severity of a burn will be affected by the temperature and the time of exposure to hot water:

Type of Burn	Time of exposure in minutes and seconds							
Temp	45°C	50°C	55°C	60°C	65°C	70°C	75°C	80°C
Adult 3rd	>60 m (e)	300 s	28 s	5.4 s	2.0 s	1.0 s	0.7 s	0.6 s (e)
Adult 2nd	>60 m (e)	165 s	15 s	2.8 s	1.0 s	0.5 s	0.36 s	0.3 s (e)
Child 3rd	50 m (e)	105 s	8 s	1.5 s	0.52 s	0.27 s	0.18 s	0.1 s (e)
Child 2nd	30 m (e)	45 s	3.2 s	0.7 s	0.27 s	0.14 s	<0.1 s	<0.1 s (e)

(e) = estimated

The table has been taken from a 1993 ASSE paper. There are a number of different published figures used to indicate the effect of temperature and time on the severity of the resultant burn. All figures used must be taken as indicators only as from the difference in published figures it is clear that the results will vary from person to person.

Legionella or Burns? The Solution

As indicated in the time versus temperature chart, water below 50°C can be considered 'safe' as even for a child to receive a second degree burn would take 45 seconds, however water stored below 50°C creates a breeding ground for legionella bacteria to breed.

The best solution to both problems is to fit a thermostatic mixing valve at the point of use, ie local to the taps. This will allow the hot water to be stored at a sufficiently high temperature in the water heater to prevent bacteria growth but the TMV will mix cold water and hot together and discharge it out of the tap at a controlled and stable temperature, typically 38-44°C in a hospital or nursing home, to prevent scalding the end user.

TMV Selector Chart

Environment	Appliance	Is a TMV :			Valve type?	Reference documents
		Required by legislation or authoritative guidance?	Recommended by legislation or authoritative guidance?	Suggested best practice?		
Private dwelling	Bath Basin Shower			Yes Yes Yes	TMV2 TMV2 TMV2	
Housing association dwelling	Bath Basin Shower		Yes	 Yes Yes	TMV2 TMV2 TMV2	Housing Corp Standard (1.2.1.33a)
Housing association dwelling for the elderly	Bath Basin Shower	Yes Yes Yes			TMV2 TMV2 TMV2	Housing Corp Standard (1.2.1.58 and 1.2.1.59)
Hotel	Bath Basin Shower			Yes Yes Yes	TMV2 TMV2 TMV2	Guidance to the Water Regulations (G18.5)
NHS nursing home	Bath Basin Shower		Yes Yes Yes		TMV3 TMV3 TMV3	NHS Health Guidance Note, Care Standards Act 2000, Care Homes Regulation 2001, D08
Private nursing home	Bath Basin Shower		Yes Yes Yes		TMV3 TMV3 TMV3	Guidance to the Water Regulations (G18.6), Care Standards Act 2000, Care Homes Regulations 2001, HSE Care Homes Guidance
Young persons' care home	Bath Basin Shower	Yes Yes Yes			TMV3 TMV3 TMV3	DoH National Minimum Standards Children's homes Regulations, Care Standards Act 2000, Care Homes Regulations 2001, HSE Care Homes Guidance
Schools, including nursery	Basin Shower Bath	 Yes Yes, but 43°C max	Yes		TMV2 TMV2 TMV2	Building Bulletin 87, 2nd edition, The School Premises Regulations/ National minimum care Standards Section 25.8
Schools for the severely disabled including nursery	Basin Shower Bath	 Yes Yes, but 43°C max	Yes		TMV3 TMV3 TMV3	Building Bulletin 87 2nd edition, The School Premises Regulations, if residential, Care Standards Act
NHS hospital	Bath Basin Shower	Yes Yes Yes			TMV3 TMV3 TMV3	NHS Health Guidance Note, D08
Private hospital	Bath Basin Shower		Yes Yes Yes		TMV3 TMV3 TMV3	Guidance to the Water Regulations (G18.6)

Reference documents:
Housing Corp Standard Housing Corporation, Scheme Development Standards, 5th Edition, Housing Corporation 2003.
D08 Model engineering specifications D 08 Thermostatic mixing valves (healthcare premises), NHS Estates, 1997.
Building Bulletin 87 2nd edition School Building and Design Unit Department for Education and Skills. Building Bulletin 87 2nd edition, Guidelines for environmental design in schools. DfES 2003, London.
Guidance to the Water Regulations Department for Environment, Food & Rural Affairs, *Water Supply (Water Fittings) Regulations 1999, Guidance Document relating to Schedule 1: Fluid Categories and*
Schedule 2: Requirements For Water Fittings. DEFRA 1999, London.
DoH National Minimum Standards Children's homes Regulations Department of Health, National Minimum Standards, Children's homes Regulations
National minimum care Standards Section 25.8
NHS Health Guidance Note National Health Service Guidance note, Safe hot water and surface temperatures
HSE Care Homes Guidance Health and Safety Executive, Health and Safety in care homes, HSG 220, HSE 2001.
Care Standards Act 2000
Care Homes Regulations 2001
Children's Home Regulations 2001

Reliance TMV3 Approved Valves

Heatguard® DC3

The Reliance Heatguard DC3 is a high performance TMV3 approved thermostatic mixing valve, fully approved by Buildcert to the NHS D08 specification for thermostatic mixing valves in healthcare premises. The Heatguard DC3 provides precise and stable temperature control and protects the user from thermal shock if either the hot or cold supplies fail. It can be used for virtually any application in premises such as nursing homes, hospitals, sheltered housing, nursery schools or anywhere else accessed by people considered to be at high risk of scalding by hot water. Two versions of the Heatguard DC3 are available: 15mm or 22mm connection. Both valves come with single check valves fitted to the inlets to prevent crossflow and disc type stainless steel strainers fitted in front of the check cartridges to protect them from damage by system contamination. A 4in1 valve accessory pack is also available: this has specially constructed inlet fittings incorporating isolation, filtration and a test point for temperature and pressure. The valve is TMV3 approved for use with washbasins, showers and for high pressure bathfill applications.

- **Fully approved by Buildcert under the TMV3 scheme to the D08 specification**
- **Rapid thermostatic failsafe on either cold or hot supply failure protects the user from extreme temperature dangers**
- **Unique, purpose-built temperature adjuster tool prevents unauthorised tampering**
- **Provides extreme mixed water temperature stability under changing supply conditions**

Product Range

HEAT 170 001 – 15mm Heatguard DC3

HEAT 170 020 – 22mm Heatguard DC3

Typical Installations

Accessories

SKIT 170 001 – 15mm 4in1 fittings pack (2 valves per pack)

SKIT 170 005 – 22mm 4in1 fittings pack (2 valves per pack)

SKIT 170 010 – 22mm to 15mm reducing set

Materials

Body	Gunmetal
Seals	Nitrile
Spring	Stainless steel
Piston	Polysulphone
Fittings	DZR brass
Strainers	Stainless steel

Specifications

Factory temperature setting	38°C
Temperature setting range	38-46°C
Temperature, hot supply (55°C-60°C is recommended)	52-90°C
Temperature, cold supply	5-20°C
Minimum hot to mix differential temperature	10°C
Temperature stability	± 2°C
Maximum static pressure	16 bar
Working pressure range, dynamic	0.1-5.0 bar
Maximum pressure loss ratio	10:1
Minimum flow rate	4 lpm
Flow rate @ 1bar pressure loss	21 lpm

Standards

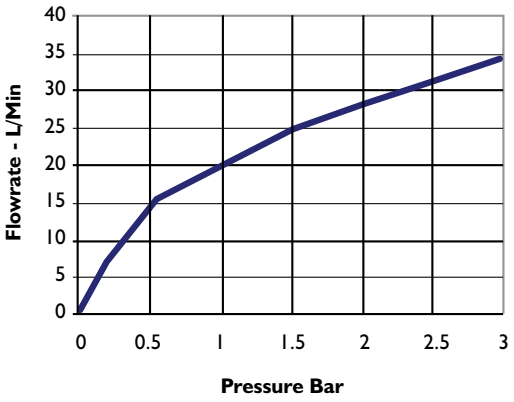
Complies with BS7942, NHS MES D08

Approvals

WRAS Approved

TMV3 Approved

Flowrate graph



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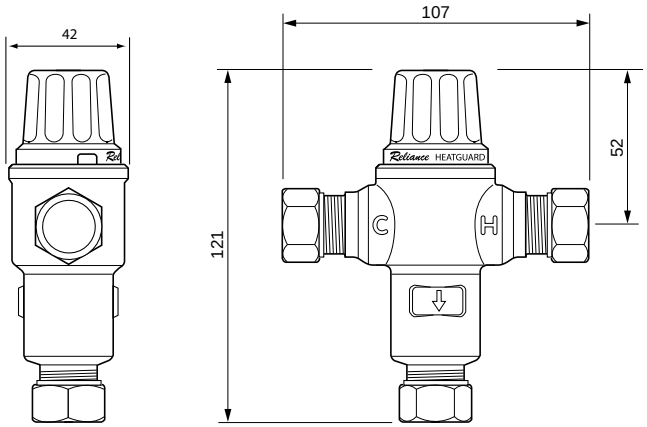
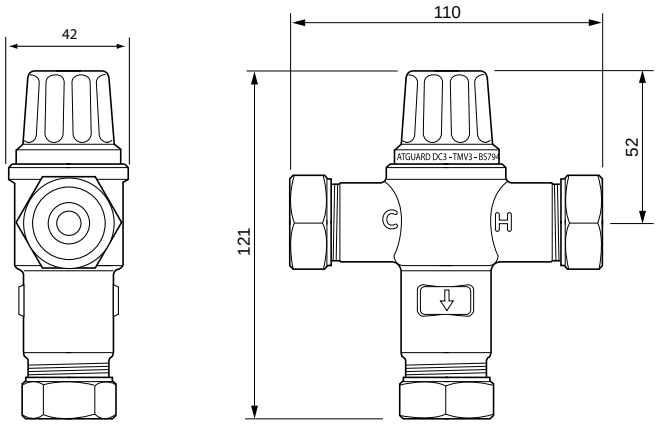


HEAT 170 001-15mm Heatguard DC3



HEAT 170 020-22mm Heatguard DC3

Promix 22-2

The Promix 22-2 is the ideal way to supply a bath with temperature controlled hot water in a healthcare environment. The Promix 22-2 is a type 3 thermostatic mixing valve approved by Buildcert to meet the performance criteria of the NHS D08 Specification for thermostatic mixing valves in healthcare premises.

The Promix 22-2 has been specifically designed to provide high flow rates at low pressures and so is ideal and TMV3 approved for bathfill applications in high risk environments. The Promix 22-2 can provide stable temperature management at high and low pressures regardless of the fluctuations in the incoming hot and cold water supplies and can work on unbalanced systems, up to a maximum pressure differential of 10:1. The Promix 22-2 uses a one-piece thermostatic cartridge which can be removed and replaced very quickly and easily, reducing downtime and rationalising and simplifying the stocking of spare components.

- **Fully approved by Buildcert under the TMV3 Scheme to the D08 specification for high and low pressure bathfill applications**
- **Single piece cartridge allows easy maintenance and replacement**
- **Provides extreme stability of mixed water temperature even under varying supply conditions**
- **Ensures rapid and positive shut-off of mixed flow on cold or hot supply failure**
- **High flow design suitable for rapid bath fill at low pressure**
- **Designed to handle dynamic pressure imbalances of up to 10:1**
- **Polished chrome finish for ease of cleaning**

Product Range

PROM 022 007-22mm Promix 22-2

Typical Installation

Materials

Body	DZR brass, chrome plated
Internal components	DZR brass
Seals	Nitrile elastomer
Spring & strainers	Stainless steel
Piston	DZR brass, PTFE coated
Fittings	DZR brass

Standards

Complies with BS7942, NHS MES D08

Approvals

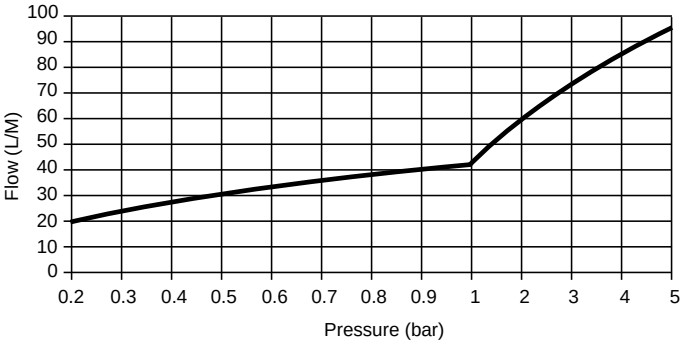
WRAS Approved

TMV3 Approved

Specifications

Factory temperature setting	44°C
Temperature setting range	38-46°C
Temperature, hot supply (55°C-60°C is recommended)	52-90°C
Temperature, cold supply	5-20°C
Minimum hot to mix differential temperature	10°C
Temperature stability	± 2°C
Maximum static pressure	16 bar
Working pressure range, dynamic	0.1-5.0 bar
Maximum pressure loss ratio	10:1
Minimum flow rate	4 lpm
Flow rate @ 1 bar pressure loss	42.5 l/min

Flowrate Graph



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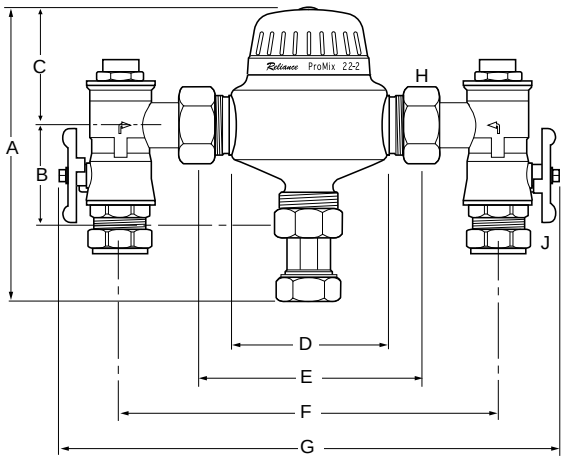

	A	B	C	D ref Ø	E	F	G	H	J
22 (22mm)	162	62	67	86	128	212	288	1"BSP	22mm

All dimensions are in mm unless stated

TMV3/ D08 Field Testing Requirements

To comply with current NHS guidelines the Heatguard® TMV3 valve should be tested against the original performance results 6-8 weeks after installation. If the temperatures have remained set to within 2°C and the failsafe function is operating correctly, then a six monthly cycle of performance testing can be implemented.

Performance checks that should be carried out at routine maintenance times are:

1. Check the set temperature using a hand-held digital thermometer.
2. Carry out the cold and hot fail-safe shut off tests.

TMV3 THERMOSTATIC MIXING VALVES

THORNE & DERRICK UK

Tel: +44 (0)191 490 1547
Fax: +44 (0)191 477 5371
Email: northernsales@thorneandderrick.co.uk
Website: www.heattracing.co.uk
www.thorneanderrick.co.uk