RS DATA SUPPORT

CROSS REFERENCE LIST

Stock No.	Manufacturer's Part No.
263-2479	HWAT-M + ETL+GTL66

Raychem

Instant hot water without re-circulation — economy and comfort



HWAT-Plus System
Hot water temperature maintenance

HWAT-Plus System Instant hot water without re-circulation — economy and comfort.

Hot water temperature maintenance

The principle
Instant hot water without waste and with energy efficiency is one of the basic requirements of modern hot water systems. With centralised schemes, this was only possible at great expense using the re-circulation approach. These older systems occupy a lot of space, are difficult to balance and have a high heat loss.

The HWAT-Plus system offers a simple, proven alternative, combining hot water comfort and economy. A self-regulating heating cable on the single hot water pipe compensates only for unavoidable heat loss and the water temperature is maintained.
The result — instant hot water everywhere.
The system equally complements localised and multi-point hot water schemes.

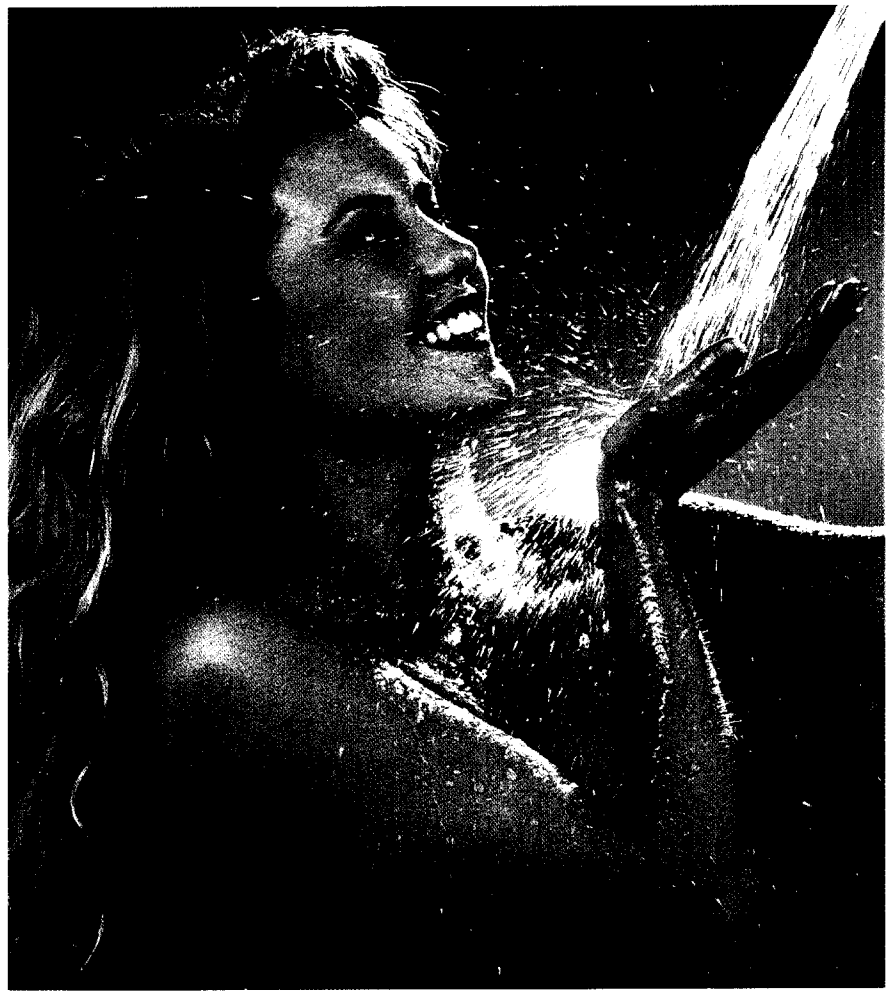


Photo Grohe

Instant hot water comfort.

Energy saving through modern technology
The heating cable automatically regulates its heat output according to the pipe temperature. This effect takes place in every centimetre throughout its entire length.
Where pipe temperatures rise, as fresh hot water flows in, the cable reduces its heat output along those sections.
Where pipe temperatures fall, because water is static, its heat output increases.
Only the right heat output is provided, essentially according to hot water demand, and with the return pipe and circulation pump gone the result is an energy efficient hot water system.

Targeted temperature control
The HWAT-Plus System now provides the extra option of additional hot water temperature control.
The HWAT-R cable, combined with the specially developed LS-20-01 control unit, now provides fully adjustable maintained temperatures in the range 50 to 60°C.
Further control can be achieved by linking the system to a BMS, or the QWT-04 timer, to provide targeted temperatures automatically, e.g. week-end shut-down or thermal disinfection of closed systems.
The HWAT-Plus System is the ideal solution when regular thermal disinfection is necessary — an important consideration in the fight against Legionella.

The intelligent HWAT-Plus System ensures safe hot water temperatures.

A reliable system for a wide variety of applications

The HWAT-Plus System is fully proven — in hospitals, schools, sport centres, hotels, prisons, apartment buildings, offices and single-family houses. It can be chosen with full confidence in its performance and long-term reliability.

In hotels the maintain temperature can be varied according to application and usage, e.g. kitchens, bedrooms, common areas, unoccupied floors.

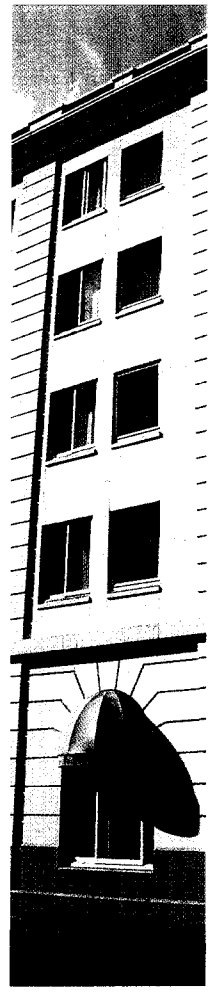
The hot water temperature can be set at any time (e.g. for regular thermal disinfection of a system at night in hospitals or convalescent homes).

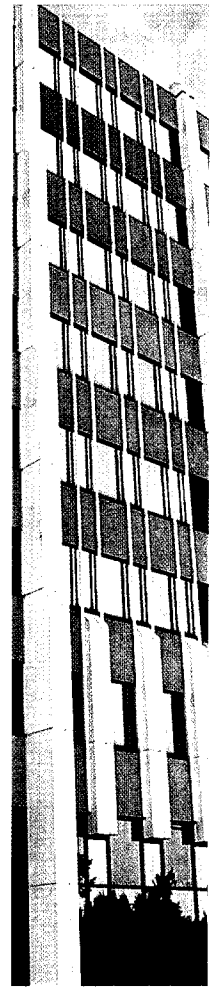


The comfort of instant hot water is no longer a luxury in single-family houses.



Instant hot water in every unit of an apartment building.





The HWAT-Plus System can be applied in most building types.

The complete system

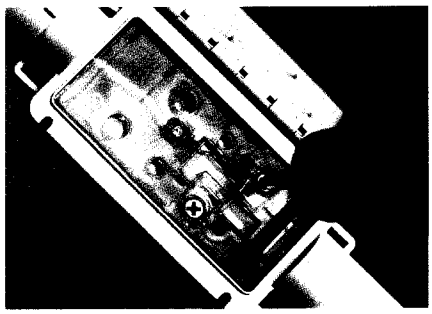
The HWAT cable is simply installed on the single hot water pipe underneath the insulation. The cable can be cut to length, spliced, tee-branched and terminated at the job site.

Power and branch connections are made with the user-friendly RayClic connection system.

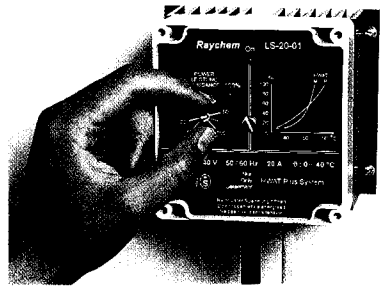
The required temperature can be set at any time on the control unit.



Space saving
The HWAT heating cables can easily be fixed on the hot water pipe underneath the thermal insulation.



Easily installed
Power and branch connections are made in a few minutes with RayClic devices.

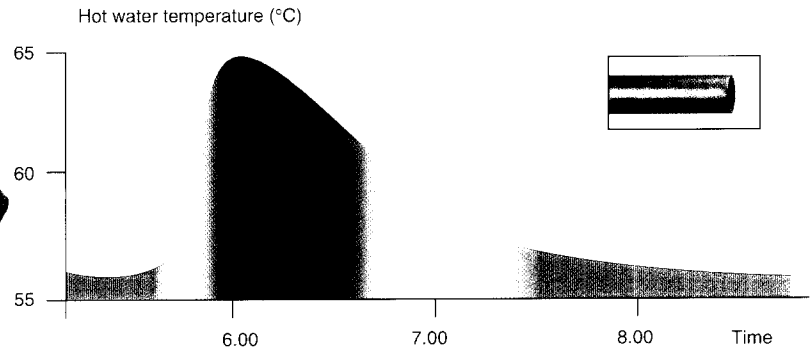


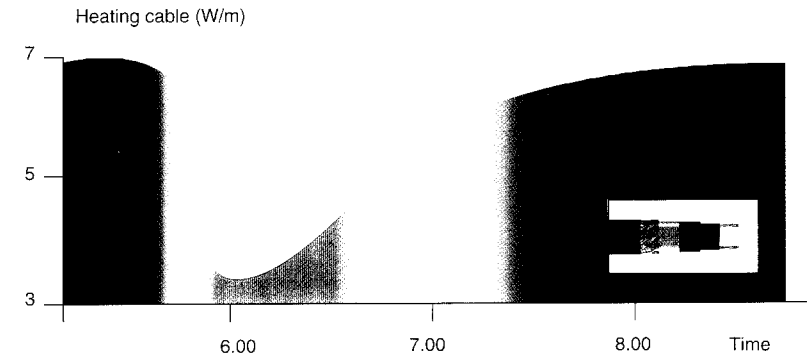
Targeted temperature control
The maintained hot water temperature can be set between 50 and 60° C by the LS-20-01 control unit with additional control by the BMS or QWT-timer.

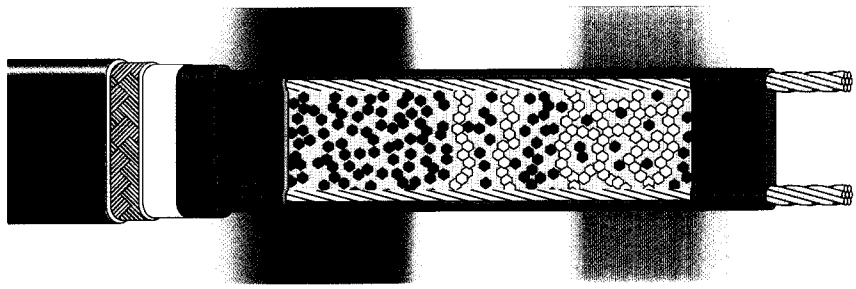
How it works

The HWAT cable adjusts its heat output automatically, based on self-regulation, to all local temperature conditions. When a hot water tap is turned on - at 6 o'clock in the illustration at right - hot water flows from the tank to the tap. The heating cable senses that water flow temperature is higher and activates the self-regulation process. Heat output drops. Energy consumption of the cable is reduced with every use of the tap.

When water stops flowing as taps are closed, the pipe begins to cool and cable heat output rises due to self-regulation. A situation of equilibrium is reached when heat output finally balances pipe heat losses; the maintain temperature in this illustration being 55°C.







One system, two versions

Raychem has defined a basic system for installations where a fixed temperature of 55°C will be sufficient and an advanced system for buildings where a flexible temperature setting is preferred. Choose the right version from the table below.

Type of building			
Examples	Single-family house Office	Appartment house Large office block	Hotel Hospital Nursing home
Typical hot water system	Localised	Centralised	Centralised
HWAT-Plus System	**Basic system**		**Advanced system**
Heating cable	**HWAT-M**	**HWAT-M**	**HWAT-R**
RayClic connection system	Yes	Yes	Yes
LS-20-01 temperature control unit	No	No	Yes
Variable temperature setting	No	No	Yes
Maintain temperature	55°C	55°C	50-60°C
Legionella thermal disinfection	No	No	Yes
Variable temperature for different parts of building	No	No	Yes
Connection to BMS system	No	No	Yes

The basic system has been designed for buildings where a constant maintain temperature of 55°C is required.

Typically it consists of the orange HWAT-M heating cable and the RayClic connection system.

The advanced, flexible system has been designed for buildings where a variable maintain temperature (50°-60°C) setting is preferred. This system is also recommended for hot water schemes which are to be thermally disinfected (e.g. Legionella) by periodically increasing the distribution pipework temperature to at least 65°C for one hour or more.
The system connects easily to a BMS system for fully automatic, targeted temperature control.

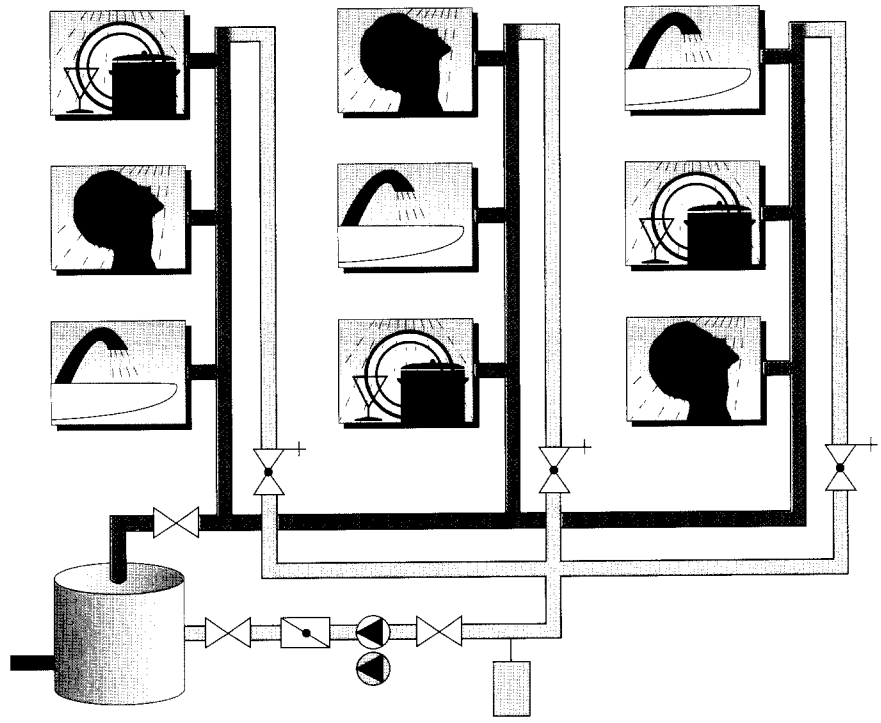
It consists of the red HWAT-R heating cable, the RayClic connection system and the LS-20-01 control unit.

Basic version:
HWAT-M + RayClic
Advanced version
HWAT-R + RayClic + LS-20-01

The logic of the change

Let's compare the re-circulation system...

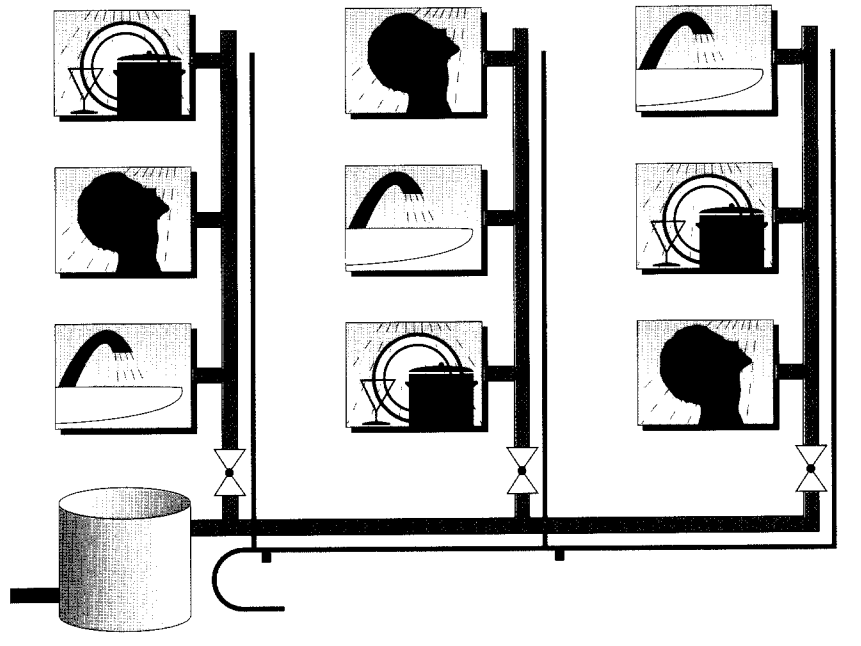
- additional return pipework, return insulation, re-circulation pumps, balancing valves, etc., and the labour to fit them all add extra installation costs.
- balancing of larger systems can be difficult, is labour intensive and adds extra costs.
- the mechanical pump is the weakest element in the system, and may lead to system breakdown.
- return pipe energy losses and constant circulation of storage temperature water result in higher operating cost.
- moving parts mean maintenance, resulting in even higher operating costs.
- installation of the two pipe system can be very difficult in some buildings due to space restrictions such as wall openings and small riser ducts.



The traditional re-circulation system.

... with the HWAT-Plus hot water maintenance system

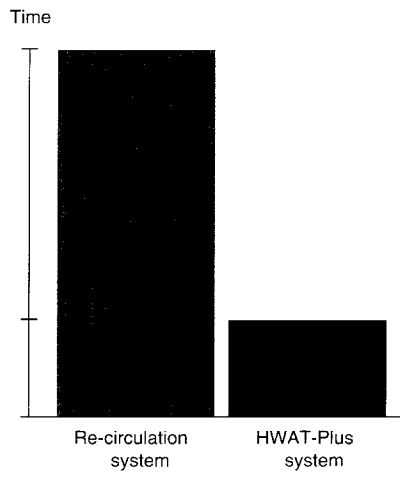
- only a single hot water pipe is needed - there is no need for the return pipe system and circulation pump.
- investment costs are constant: 1 metre of pipe requires 1 metre of HWAT heating cable, regardless of the pipe diameter.
- installation of the heating cable is very fast and the system needs very few components.
- single pipe systems are naturally balanced.
- with no moving parts the system is maintenance-free.
- with one less pipe, heat loss is lower.
- the HWAT-Plus system can be switched on or off, section by section, e.g. in a hotel, staged occupation of offices, very large residences, etc.
- with the advanced system, the maintain temperature can be set in the range 50 to 60°C.
- further control can be achieved by interfacing with the BMS or QWT-04 timer, e.g. weekend shut-down, thermal disinfection.



The modern HWAT-Plus system - less space - more economical to run - maintenance-free.

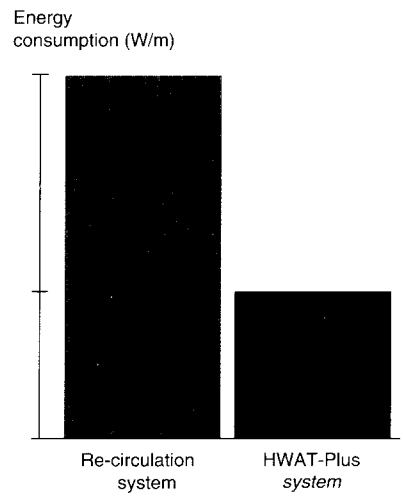
Because economy is convincing

Installation time reduced



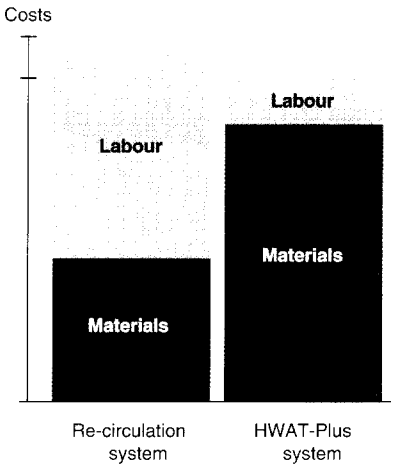
The HWAT-Plus System saves up to 85% of installation time.

Energy savings



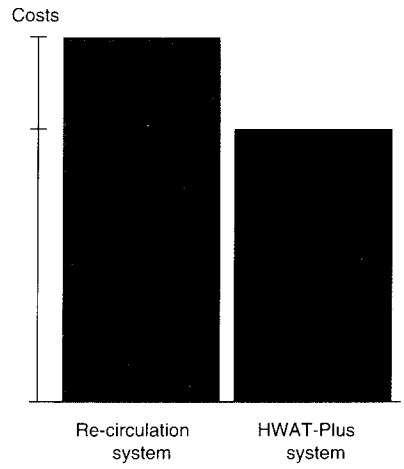
The HWAT-Plus System can give an average energy saving of 50 to 60%.*

Investment costs down



The HWAT-Plus System can save 5 to 20% in investment costs.

Operating costs down



The HWAT-Plus System can save 25% or more in operating costs.*

* *The results shown are based on comparative studies. Raychem will be glad to provide you with the original data.*

Installation and operation costs of the hot water system are lowered by the HWAT-Plus System.

The reliable system

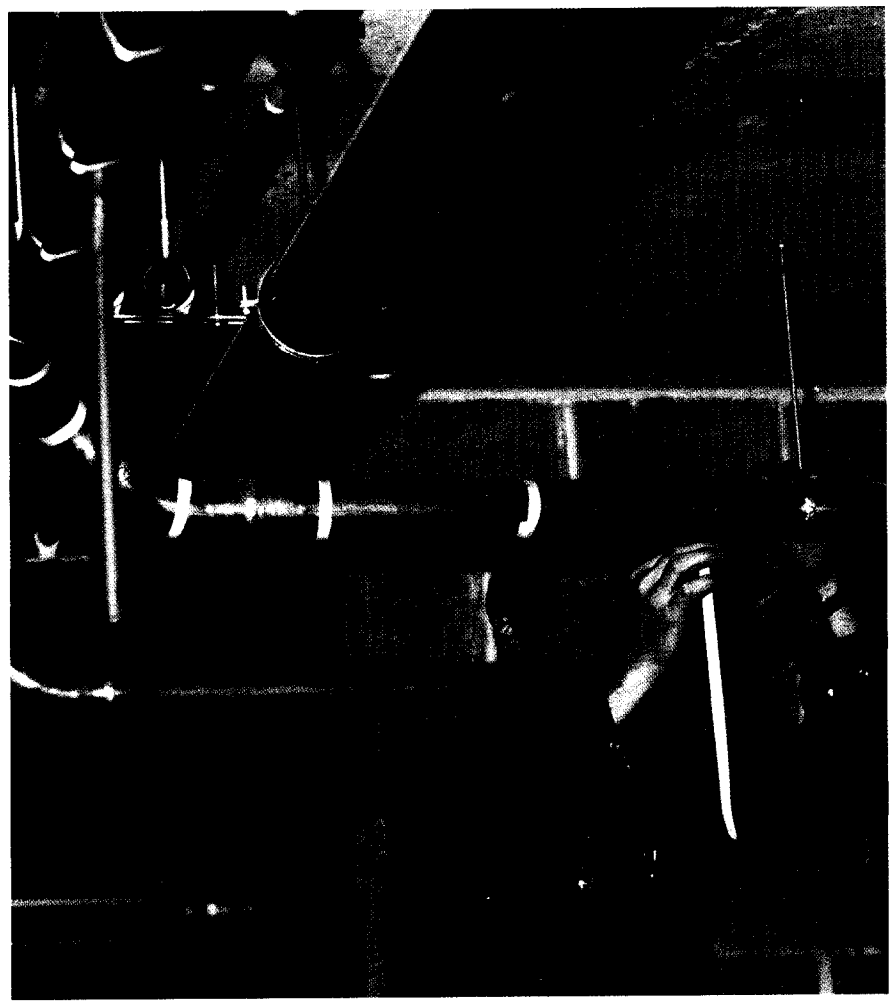
Experience pays off
Raychem has been the world leader in self-regulating heating cable technology and manufacture for over 25 years. Over 125 million metres of cable have been installed worldwide, proof of reliability and economy.

Quality and durability
Arrhenius life projections during long term product qualification show useful lifetimes in excess of 40 years.*

Thermal stability testing during production** and quality control ensures that stringent performance requirements are met.

High standards
The HWAT-Plus system was developed to comply with the latest Codes of Practice for minimising the risk of Legionnaires' disease. HWAT-Plus meets the requirements of the Health and Safety Executive document H.S.(G) 70, CIBSE TM13 and the NHS Technical Memorandum 2040.
The approach has been included and discussed in each of these documents.

* *As reported in Building Serv. Eng. Res. Technol. 14(2) 77-79 (1993)*
** *Refer to our QA manual and product specifications*



***Ease of installation** - the cable is directly traced to the pipework and the system has very few components*

The flexible system

The HWAT-Plus system is suitable for new construction and refurbishment, to replace the re-circulation system or to complement the use of localised hot water heaters.

Building extension
If an existing building is extended, the new part of the building can be connected to the hot water system using the HWAT-Plus approach. Installation is simple, quick and economical, with no effect on the hot water balance in existing parts of the building.

Localised water heaters
The HWAT-Plus system can be used on run-outs from localised water heaters to provide instant hot water, e.g. where dead legs are too long, or where spray taps are in use.

Economy tariff water heaters
Off peak storage systems can be complemented by the HWAT-Plus approach. Instant hot water not only brings comfort but maximises the use of the hot water generated overnight at low cost.

Pre-fabricated modules
The HWAT-Plus system can be easily integrated into pre-fabricated cloakroom or bathroom modules due to its minimal space requirements.

Partial repair
If the total system cannot be replaced due to cost considerations, the existing hot water pipes can be equipped with the HWAT-Plus system.

Water metering
The HWAT-Plus system takes hot water all the way to the tap, minimising water wastage.

Refurbishment
HWAT-Plus in refurbishment offers many benefits.
The single pipe approach is ideal where minimum space is available, and use of the HWAT-R cable with minimum insulation brings further space savings.
The system can be installed and made operational section by section, and is simple to extend.

A high quality system — for new construction and refurbishment.

The simplicity of the system is convincing

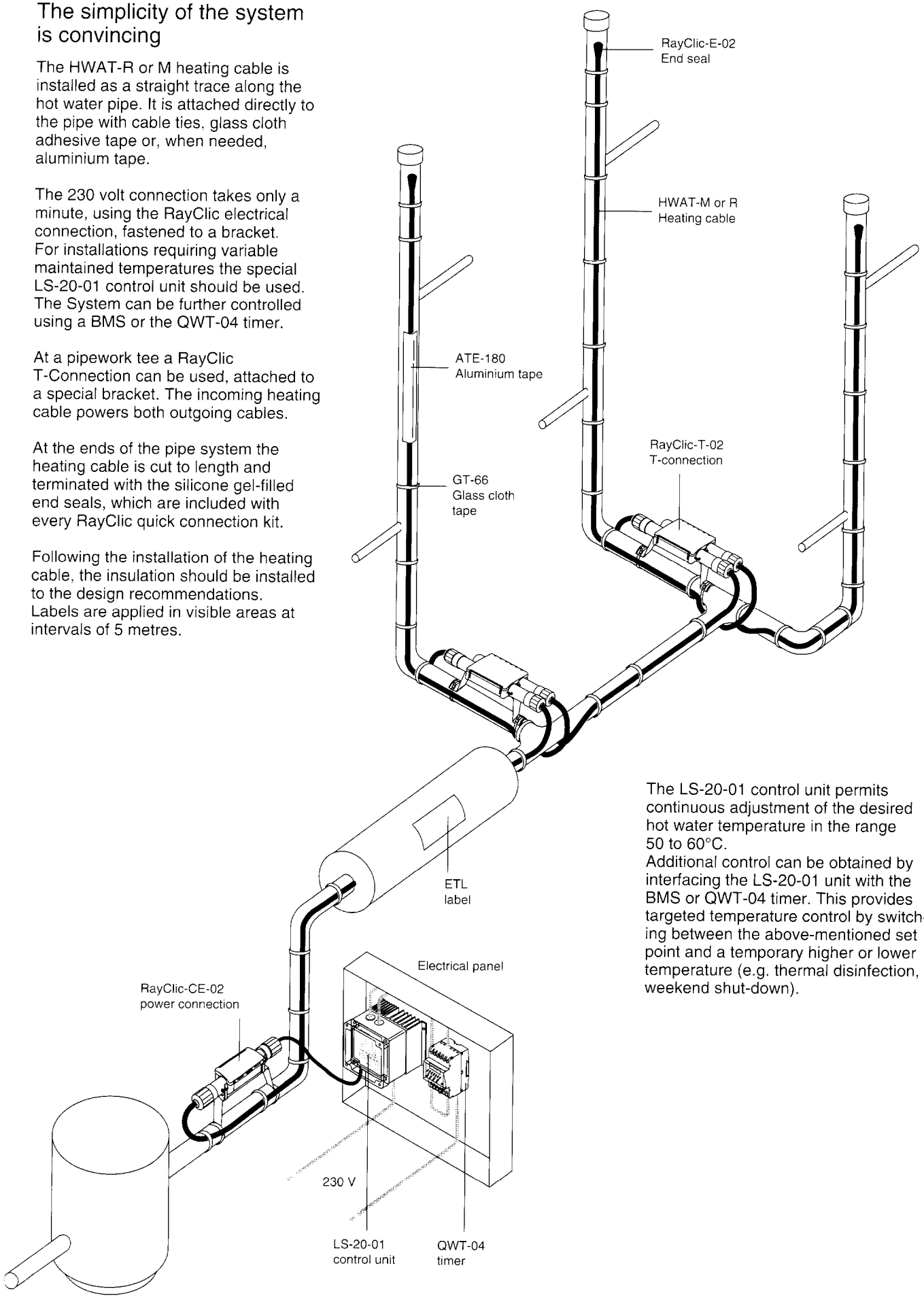
The HWAT-R or M heating cable is installed as a straight trace along the hot water pipe. It is attached directly to the pipe with cable ties, glass cloth adhesive tape or, when needed, aluminium tape.

The 230 volt connection takes only a minute, using the RayClic electrical connection, fastened to a bracket. For installations requiring variable maintained temperatures the special LS-20-01 control unit should be used. The System can be further controlled using a BMS or the QWT-04 timer.

At a pipework tee a RayClic T-Connection can be used, attached to a special bracket. The incoming heating cable powers both outgoing cables.

At the ends of the pipe system the heating cable is cut to length and terminated with the silicone gel-filled end seals, which are included with every RayClic quick connection kit.

Following the installation of the heating cable, the insulation should be installed to the design recommendations. Labels are applied in visible areas at intervals of 5 metres.



The LS-20-01 control unit permits continuous adjustment of the desired hot water temperature in the range 50 to 60°C.
Additional control can be obtained by interfacing the LS-20-01 unit with the BMS or QWT-04 timer. This provides targeted temperature control by switching between the above-mentioned set point and a temporary higher or lower temperature (e.g. thermal disinfection, weekend shut-down).

1. Heating cable selection and insulation schedule

Please consult the table below to choose the correct HWAT cable and corresponding insulation schedule. The table assumes an ambient temperature of 18°C, the use of copper or galvanised steel pipes and an insulation Kfactor of 0.037 W/m°C.

Maintain temperature	Pipe size (mm)	15	22	28	35	42	54
	Insulation thickness (mm)	20	20	25	30	40	50
55°C	HWAT cable	M	M	M	M	M	M
50-60°C[1]	HWAT cable	R	R	R	R	R	R

Basic system

- For maintain temperature at 55°C
- HWAT-M cable (orange outer jacket)

Advanced system

- For variable maintain temperature in the range 50 to 60°C
- For thermal disinfection[2]
- HWAT-R (red outer jacket) with LS-20-01 control unit.

Insulation

The above table is based on a Kfactor of 0.037 W/m°C calculated at 10°C. Insulation must be complete throughout, of correct thickness and dry in order for the pipes to be maintained at the correct temperature.

Other design parameters

Please contact Raychem where different design conditions occur, e.g. larger pipes, other insulation materials or thicknesses, different ambient temperatures, different pipe materials e.g. plastic pipes.

[1] *Use of the LS-20-01 control unit, with the HWAT-R cable, permits variable temperatures in the range 50 to 60°C.*

[2] *Thermal disinfection can be achieved via the BMS or QWT-04 by raising the temperature to at least 65°C (100% LS-20-01 set point) for one hour or more.*

2. Heating cable length

The heating cable is always installed straight, i.e. not spiralled.

Total length of pipe to be traced
+ approximately 0.3 m per connection
+ approximately 1.0 m per T-connection or splice
+ 1.2 m per four way connection
+ any additional amount required for heat sinks such as pipe supports, uninsulated wall-feedthroughs, etc.

= Heating cable length

A good first approximation of the required cable length is the pipe length plus 10%.

3. Electrical protection

Maximum circuit length at 230 V and for 12°C start-up temperatures.

MCBs to BS EN 60898 Type C or D, or equivalent	HWAT-M	HWAT-R
10 A	40 m	50 m
16 A	80 m	80 m
20 A	100 m	100 m

Where the heating cable length is greater than the above, multiple power points will be needed.

Minimum circuit length for HWAT-R when used in combination with the LS-20-01 control unit is 15 m.

Earth leakage protection.
Raychem insists on the use of a 30 mA residual current device to provide maximum safety and protection.

4. Number of heating circuits

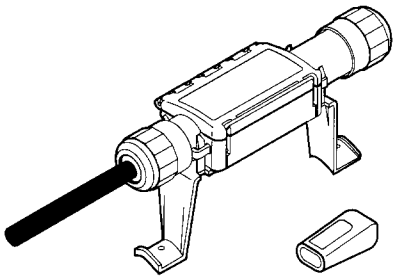
$$\text{Minimum number of circuits} = \frac{\text{heating cable length}}{\text{max. circuit length}}$$

5. Components and accessories

The HWAT-Plus system comes with a complete line of components and accessories. All electrical components and accessories comply with the relevant safety standards.

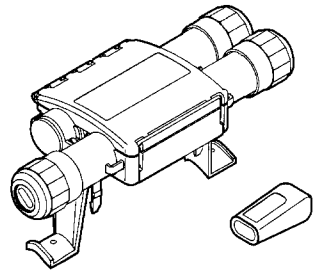
The RayClic connection System

Power connection and end seal	RayClic-CE-02
T-connection and end seal	RayClic-T-02
Powered T-connection and end seals	RayClic-PT-02
In-line splice	RayClic-S-02
Powered splice and end seals	RayClic-PS-02
Four way connection and end seals	RayClic-X-02



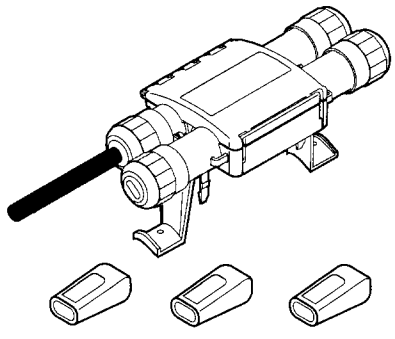
RayClic-CE-02

Power connection with integral 1.5 m 3-core cable plus a gel-filled end seal and a support bracket.



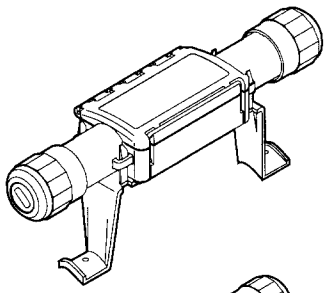
RayClic-T-02

T-connection plus a gel-filled end seal and a support bracket.



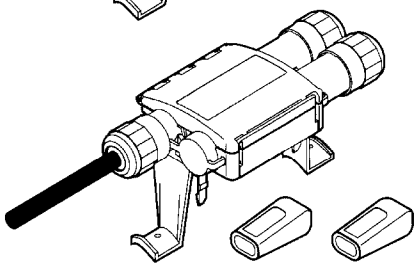
RayClic-PT-02

Powered T-connection, 3 connections with integral 1.5 m cable, 3 gel-filled end seals and a support bracket.



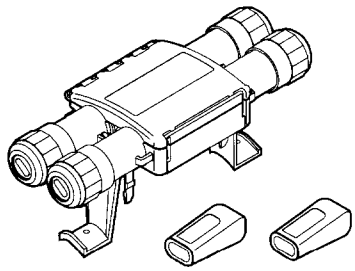
RayClic-S-02

Splice for joining two lengths of heating cable and a support bracket.



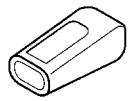
RayClic-PS-02

Powered splice, 2 connections with integral 1.5 m cable, 2 gel-filled end seals and a support bracket.



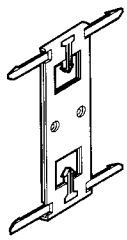
RayClic-X-02

Four way connection plus 2 gel-filled end seals.



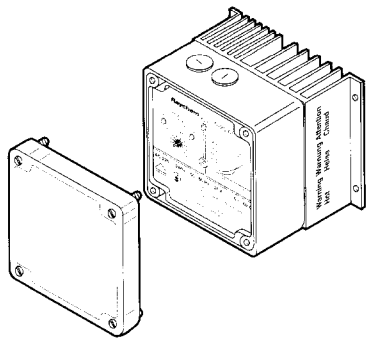
RayClic-E-02

Spare gel-filled end seal.



RayClic-SB-02

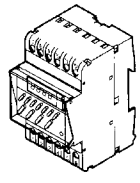
Optional wall-mounted support bracket.



LS-20-01

Power output control unit for HWAT-R with BMS interface and potential-free cut-off switch. It is used for permanent individual temperature settings between 50 and 60°C. Maximum circuit length per LS-20-01 unit is 100 metres.
The control unit can be switched on and off by means of the QWT-04 timer or BMS (0% power, set point power, 100% power).

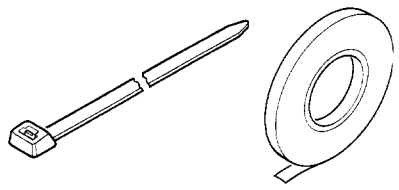
Dimensions: 120 x 122 x 110 mm



QWT-04

Pre-programmed, two channel electronic timer (one for 0% override; one for 100% override) with 7-day programming and battery back-up. Usually, only one timer is required per installation (one timer for upto twenty LS-20-01 control units).
The QWT-04 timer is not needed if the HWAT-Plus system is controlled using BMS.

Dimensions: 54 x 58 x 88 mm



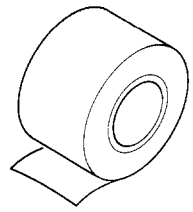
KBL-370/GT-66

Cable tie/glass cloth tape to fix heating cables onto pipes at 30 cm intervals.

KBL-370: 1 package (50 pieces) per 15 metres of pipe.

GT-66: one roll of glass cloth tape is required for the following pipe lengths:

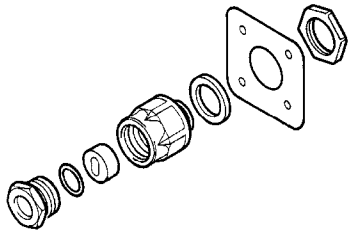
Pipe size (mm)	15	22	28	35	42	54	67
Pipe length (m)	29	19	18	13	13	10	8



ATE-180

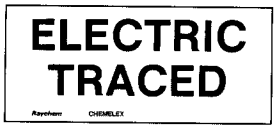
Aluminium adhesive tape to fix heating cable onto the pipes. Used on stainless steel and plastic pipes.
The heating cable should be covered along its entire length.

1 roll for approximately 50 m pipe.



IEK-16-05

Insulation entry kit to insert heating cable through metal cladding of insulation material, consisting of metal fasteners, gland, locknut, sealing washer and grommet.



ETL

Electric traced label.
"Electric traced" labels should be installed onto the outside of the thermal insulation surface, at visible 5 m intervals.

6. Supply voltage

The supply voltage lead to the heating circuits must be laid according to the local standards, codes and regulations.

The diameter is determined by the nominal current and the maximum permissible voltage drop.

MCBs to BS EN 60898 Type C or D, or equivalent	Min. power cable diameter (mm^2)	Max. power cable length (m) HWAT-M	HWAT-R
10 A	3 x 1.5	200	80
16 A	3 x 1.5	100	50
20 A	3 x 2.5	130	70

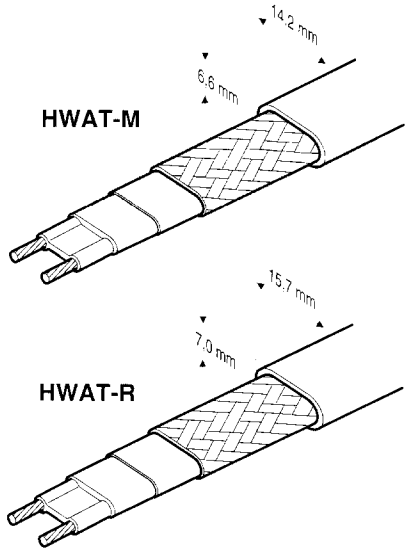
7. LS-20-01 setting

The LS-20-01 control unit must be adjusted to select the desired maintain temperature as shown.
The settings assume a system design and ambient conditions as shown in the table in section 1 of this guide.
The number of control units should correspond to the number of heating cable circuits.

Desired temperature	Approximate setting LS-20-01
50°C	36%
55°C	50%
60°C	65%
65°C	100%

8. BMS	Interface to the BMS is possible with the LS-20-01 control unit. The power output from the HWAT-R cable can be automatically adjusted from the BMS (0% power, set point power, 100% power). The result is even better management of hot water temperatures. Operating costs can be even further reduced by switching to 0% power output automatically during periods of non-occupation, e.g. a hotel in quiet seasons, a school during holidays or an office over the weekend.	Thermal disinfection of the distribution pipework is possible by automatically switching to 100% power output, i.e. raising the temperature to at least 65°C for one hour or more at the weekend. A typical system may set the LS-20-01 control unit at 50% to achieve a maintain temperature of 55°C, with automatic switch off (0% power) and automatic thermal disinfection at 100% power as needed. The electronic timer QWT-04 can be similarly used where the building does not have a BMS.
9. Legionnaires' disease	Three main documents provide guidance in design to minimise the risk of Legionnaires' diseases from engineering services, namely the Health and Safety Executive document HS(G) 70, CIBSE TM13, NHS Estates TM 2040. The HWAT-Plus system complies with each of the above codes of practice and the approach is actually discussed in some detail within each of them.	The HSE document also recommends, in certain circumstances, that the hot water services be cleaned and disinfected. Thermal disinfection of the distribution pipework is recommended by raising its temperature to 60°C or more for at least one hour. Such an approach is now possible by use of the HWAT-R cable and the LS-20-01 control unit. This can be achieved manually, by the use of the QWT-04 electronic timer or by the BMS.
10. Installation	The HWAT-Plus system must be installed strictly according to our installation instruction documents. In general the heating cable is cut to length on site and applied as a straight trace on a lower quadrant of the pipe. The flexibility of the cable and its flat construction means installation is quick and easy.	The heating cable can be spliced, T-branched, cross-branched and terminated to the power supply with our simple, user-friendly RayClic connection system. The electrical system should be planned and installed strictly according to the design guide, local standards, codes and regulations. A test result should be made.
11. Pipe materials	HWAT cables can be installed on all pipe materials including copper, galvanised steel, carbon steel and plastic.	
12. Insulation	Insulation must be of the correct type and correct thickness, and must be dry and complete throughout in order for the pipes to be maintained at the correct temperatures.	

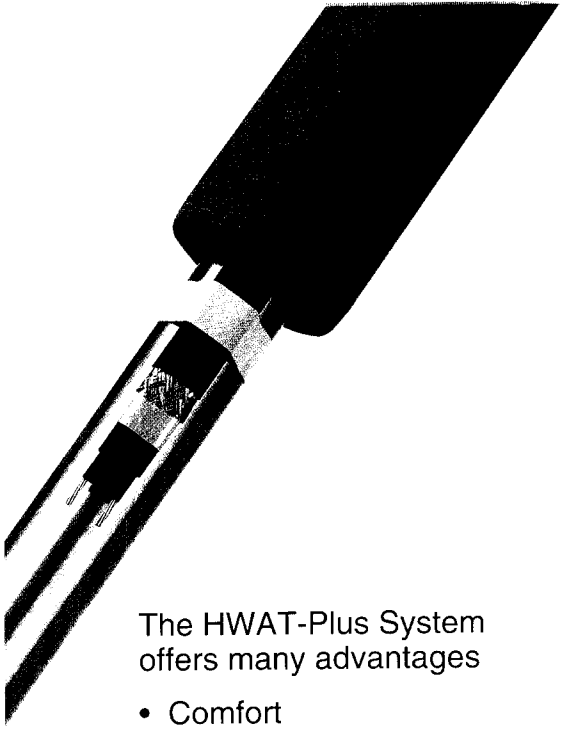
Technical data



	HWAT-M	HWAT-R
Supply voltage	230V +10% -6%	230V +10% -6%
Typical maintained temperature[1]	55°C	50-60°C
Power output[2]	8.9 W/m (at 55°C)	12.5 W/m (at 60°C)
Circuit breaker rating	20A max.	20A max.
Maximum circuit length	100 m	100 m
Minimum bend radius	10 mm	10 mm
Minimum installation temperature	5°C	5°C
Continuous withstand temperature	65°C	80°C
Colour of outer jacket	Orange	Red
Maximum thickness	6.6 mm	7.0 mm
Maximum width	14.2 mm	15.7 mm
Weight	0.12 kg/m	0.14 kg/m

[1] *Due to different pipe dimensions and other possible influences, the programmed temperature may deviate slightly upwards or downwards.*

[2] *The heating cable power output is the guaranteed minimum power at a given temperature on insulated pipes. In variable temperature systems the power output to maintain or reach the set point temperature is governed by the LS-20-01 control unit as shown in step 7 on page 13.*



The HWAT-Plus System
offers many advantages

- Comfort
- Reliability
- Variable temperature control
- Automatic control by BMS
- Modern technology
- Naturally balanced
- Energy savings
- Reduced operating costs
- Maintenance free
- Space savings
- Fast, simple design
- Quick, easy installation

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