

## templine® – electrically heated hoses with system options

### Economical

Reduce your energy by up to 30 % in comparison with conventional systems

### Flexible

Extremely bendable in all directions (360°), torsionally resistant

### Optimum

Uniform and consistent heat distribution over the entire surface of the hose

### Ready for use

Fully assembled, with only one connection line

## templine® heated hose: it all began with an idea!

### How can high quality hoses be heated electrically using efficient and advanced technology?

Not an easy question, and initially it proved difficult even for an experienced developer and manufacturer of hoses. A heated hose system which really would meet the full range of demands of actual practice called for an entirely new technical approach.

The **templine®** patented heated hose system is the answer. The design of **templine®** is based on the concept of flexibly and reliably transferring fluid, granulated and gaseous media in a temperature-controlled environment between two fixed points.

The **templine®** design, consisting of a flexible hose (for transferring the required material), a new heating concept, thermal insulation and an outer casing, is very closely adapted to everyday operational needs, as well as those of system maintenance and upkeep:

- High mechanical resistive strength protects the material-transfer hose in the inner core against the effects of being trodden on, run over by vehicles, or friction wear of the outer casing due to the hose being dragged over rough ground.
- Uniform heating of the material being conveyed prevents it from becoming overheated and being destroyed.

The following paragraph outlines the new patent-protected technology of the **templine®** heated hose system:

A fabric braiding encompasses the surface of the material-transfer hose. The heating conductors are woven into this braiding in a helical fashion which means that, together with the fabric, they follow every movement of the hose and maintain permanent contact with it even under extreme bending or rotation. That guarantees the unhindered flow of heat produced in the conductors.

The **templine®** design is the result of the consistent application of the experience gained by users: 100 % heat transfer, 100 % reliability – and all this with up to 30 % energy saving thanks to a heating system with optimum degree of efficiency and highly effective thermal insulation.

Universal in concept. Individual in use and application.

**The **templine®** heated hose system by Masterflex.**





A **templine®** heated hose installed on an industrial robot

## The core competence of templine®



In automobile production, robots coat body parts with a fluid wax preservation coating



Industrial installations impose a whole range of demands on an electrically heated hose. These include, in particular, areas subject to the risk of explosion, high operating temperatures, and operational pressures of up to 475 bar

### Characteristics

Due to their specific properties, flexible heated hoses are designed for processes in which, as well as the conveyance of fluid, gaseous, or granulated media, extreme bending and torsion movements must be withstood without any damage over the long term.

In particular, torsion with large angles of rotation of up to a full 360°, and movement cycles and changes taking place within a few milliseconds, impose extreme demands on the selection of material used in the construction as well as on the structure and design. Extreme tensile forces, shear forces and pressures such as encountered by heated hoses on industrial robots provide a typical example.

### Other typical demands:

- Chemically resistant hoses for transferring materials
- Suitability of the material-transfer hose for conveying foodstuffs
- Pressure resistance up to 475 bar
- High operating temperatures of up to +300 °C
- Mechanically tough hose casings
- Range of operational voltages
- Installation under special environmental conditions, such as areas subject to the risk of explosion (chemicals)



## Areas of application

Basically, electrically heated pipes and hoses fulfil the same purpose. Where they differ, however, is flexibility. A hose connects two points with each other in a flexible manner, which means that the connection remains intact when one of the points, or even both, change position.

If this hose is equipped with an electrical heating system, media being transferred can be protected against frost, retain their temperature, or be heated up. This is particularly interesting for applications in the chemical or petrochemical industries, food production, or the manufacture of cosmetic products.

### Some examples of typical applications for electrically heated hose systems:

#### Robots in the motor industry



Heating capacity: 100-180 W/m for maintaining temperature when applying special adhesive / preservation coating. Temperature of medium: +60°C to +140°C

#### Processing of waxes



Wax-conveying hoses, heating capacity 60-120 W/m. Heating with minimized tolerances to guarantee extremely uniform consistency

#### Beverage production



Flexible connection by heated hoses between tank and production installations. Maintaining temperature and compensating for vibrations along the conveyance path

#### Shaping/adhesive bonding of plastics



CNC-controlled injection moulding machine. Temperature-controlling the plastic and adhesive in the heated hose during manufacture of housing parts (PA, TPE, EVA). Temperature of medium: +90°C to +180°C

#### Plastics processing



Co-extruding plastics. Conveying fluid plastic granules to the extrusion mould in heated hoses. Optionally: Temperature-monitored extrusion head with integrated sensor in the mould head. Heating capacity: 60-140 W/m

#### Fire-extinguishing water distribution system



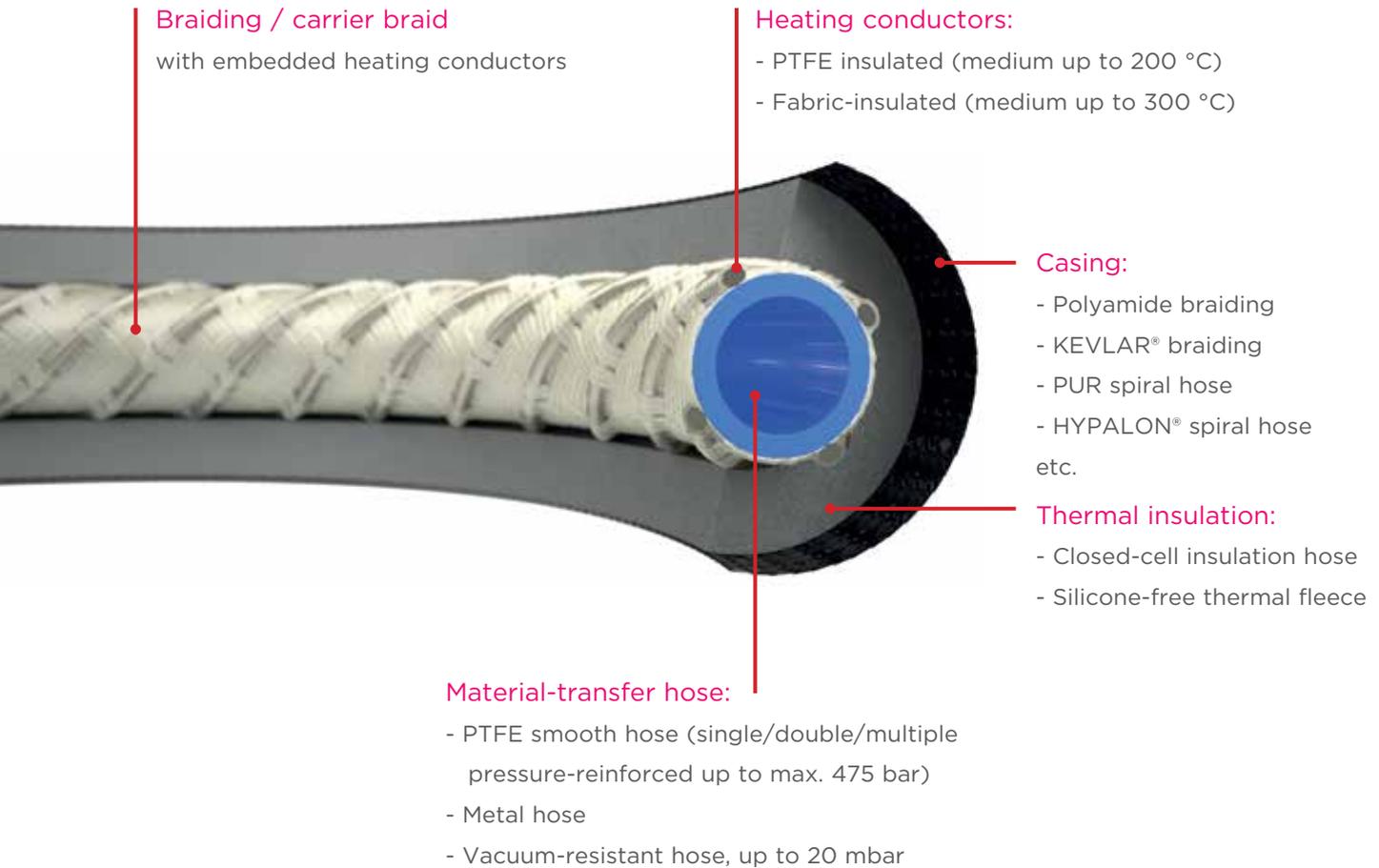
Heated hose (nominal diameter 50) for connecting storage tank and extinguishing water distribution system. Function: Protection against freezing (+ 5°C) outdoors. Material-transfer hose made of polyethylene

# Structure of the heated hose

## The design structure and its variants

The illustration shows the new design concept of the **templine**<sup>®</sup> heated hose in comparison with conventional versions.

The **templine**<sup>®</sup> heated hose provides technical solutions to meet real, practical expectations.



Section and cross-section of a **templine**<sup>®</sup> heated hose

The special way in which the heating conductors are processed into the hose braiding optimizes the heat transfer. This means that, even with severe bending or torsional movement, contact between the heating conductors and the surface of the hose will be ensured at all times, and prevents overheating (also referred to as “hot spots”). Damage to the heating

system itself due to excessive temperatures is also excluded, because the heating system can emit the heat constantly to the medium being transferred. As this type of hose heating works without any sources of ignition or hot spots, **templine®** provides operational safety and reliability even in areas subject to the risk of explosion.

Here is a direct comparison of heated hose systems:



Conventional heated hose:

Parallel heating strips as heat conveyors



templine® heated hose:

Heating conductors as “heated hose”

### Other major features of the templine® heated hose system:

- Highly effective foam thermal insulation means up to 30 % energy saving
- Extremely flexible hose structure, resistant to bending and torsion (proved by tests by independent institutes in Germany, approximately 1,000,000 test cycles)
- Temperature of the medium can be monitored within very narrow tolerances, thanks to the uniform heat distribution along the hose
- Choice of ageing-resistant materials guarantees long service life
- Optional: Fitted with integrated temperature controller/temperature limiter
- Optional: Anti-static/friction wear-resistant casing
- Operational voltages range between 6 V and 400 V in single-phase and three-phase mains operation

## Technical Data

### Basic data:

Hose design:	single material-transfer hose/interchangeable inner hose
Inner diameter:	DN 4 to DN 50
Pressure resistance:	Depending on the rated width, up to 500 bar possible, other values upon request (guide values at +20 °C)
Connection housing:	Hard shell/silicone cap/EPDM cap (silicone-free format)
Thermal insulation:	Silicone foam/thermal nonwoven fleece
Protection class:	I (protective earthing)
Protection mode:	IP 65
Nominal voltage range:	Up to 500 V
Nominal power:	Up to 200 W/m (higher values on request)
Heated hose lengths:	Up to 100 m (DN 4), up to 50 m (DN 50)
VDE certification:	File reference 5012550-4510-0001
Relevant standards:	DIN EN 62395-1 (VDE 0721-52):2007-05 EN 62395-1:2007-05 DIN EN 60730-1 (VDE 0631 part 1) DIN EN 60730-2-9 (VDE 631 parts 2-9):2011-07 EN 60730-2-9:2010

## Selection of hose components

The structure of **templine®** heated hose systems takes full account of the operational conditions within an installation or a process. The systems are individually planned by Masterflex.

Individual components can be selected from a range of different design formats, made up of the material-transfer hose and the outer casing. Another factor is the choice of an operating concept:

### templine®-A

Heated hose system for connection to an external temperature controller and an external energy supply

### templine®-R

Heated hose system with integrated temperature controller in the connection housing

### templine®-B

Heated hose system with integrated temperature controller/ limiter in the connection housing



templine®-A



templine®-R



templine®-B

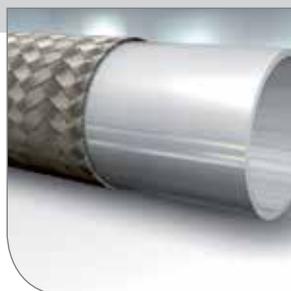
## Material-transfer internal hose

Pressure values at +20 °C rated reference temperature. Beware influence of temperature on pressure resistance!



### PTFE hose

Inner diameters: DN 4 - DN 50  
Pressure resistance: 22-3 bar  
Suitable for contact with food-stuffs (standard inner hose)



### PTFE hose with pressure reinforcement

Inner diameters: DN4 - DN25  
Pressure resistance: 264-80 bar  
Suitable for contact with food-stuffs



### PTFE hose with double pressure reinforcement

Inner diameters: DN 4 - DN 25  
Pressure resistance: 371-155 bar  
Suitable for contact with food-stuffs



**PTFE hose with triple pressure reinforcement**

Inner diameters: DN 4 - DN 25  
 Pressure resistance: 371-155 bar  
 Suitable for contact with food-stuffs  
 Good flexibility



**PTFE hose with pressure reinforcement**

Inner diameters: DN 6 - DN 50  
 Pressure resistance: 172-23 bar  
 Suitable for contact with food-stuffs  
 High flexibility



**Metal hose with vacuum resistance**

Inner diameters: DN6 - DN50  
 Pressure resistance: 75-25 bar  
 Vacuum-resistant  
 Good flexibility

## Hose connections (fittings)

for connecting the **templine®** hose system. Optionally available in steel or stainless steel



**Standard connection**

With 24° outer cone and union nut, with metric internal thread



**Hose connection with flat seal**

Union nut, with metric / BSP / NPT internal thread



**Pipe connection**

For connecting the heated hose by clamping ring and union nut



**Hose connection with external thread**

Flat sealing or with internal cone (24°, 60°, 74°), with metric / BSP / NPT thread



**Special connector**

Type: KAMLOCK. Illustration is of female/male format

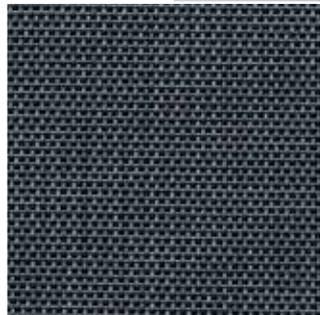


## Casing

There are a wide range of casings available to protect the **templine®** heated hose against mechanical influences:

### Polyamide fabric

Wear-resistant, UV-stable, flexible, black, up to +80 °C (standard)



### Polyamide (KEVLAR®) fabric

Extremely wear-resistant, resistant to high temperatures up to +250 °C



### PUR L-EL spiral hose

Mechanically tough, UV-resistant, crush-resistant & recoverable, up to +125 °C



### HYPALON® spiral hose

Extremely wear-resistant, resistant to temperature up to +175 °C



## Limiting/controlling temperature

In order to monitor flowing media in electrically heated hose systems, whatever the operating mode - protection against freezing, maintaining of constant temperature, or temperature increase - the use of an electronic control system is always recommended. An important factor in this situation is matching the controlling behaviour to the heat

being transferred by the electrical heating system. Both systems **templine®-R** and **templine®-B** offer the possibility of direct integration of controllers or controller/limiters into the heated hose connection. This has the advantages of saving space, offering precision, requiring no maintenance, and being VDE-tested and approved.



**templine®-R** Electronic temperature controller, PI control characteristic, system deviation +/- 1K. Sensor input: PT100, two/three conductor technology. Switching capacity: 1360 VA/ 6A. Nominal voltage: 230 V AC (standard)



**templine®-B** Electronic temperature controller with integrated temperature limiter (safety temperature limiter). PI control characteristic, system deviation +/- 1K. Sensor input: PT100, two/three conductor technology. Switching capacity: 1360 VA/ 6A.

### Technical data for **templine®-R** and **templine®-B**:

- Reference value for temperature controller adjustable in the range of 0 °C to +250 °C. Temperature limit value selectable in the range of 0 °C to +250 °C.
- Rated voltages (optional): 12 V =, 24 V =, 48 V =, 62 V =, 115 V -
- Casing protection mode: IP 65, protection class II
- EMC compatibility in accordance with EN61326
- Signal lights for nominal voltage, operation of heating, and sensor break/short-circuit

## Variants at a glance

Three different designs allow **templine®** heated hose systems to be selected corresponding to the mode of operation occurring within the process.

### templine®-A

The basic format for direct connection of the heated hose to an external energy supply and an external temperature control. Temperature sensor leads and energy leads are run separately in the connection cable, and colour-coded. With this variant, as well as the use of a PT100 sensor in our two-conductor or three-conductor technology, the application of thermocouples (NiCr-NiAi [Type K] or Fe-CuNi [Type J]) and NI100, NI120, or PT1000 is optional. Final terminations such as connection housings are made of impact-resistant fibre-reinforced plastic.



Connection fittings are adapted individually depending on the application.



### templine®-R

Heated hose with integrated temperature controller in the connection housing. A clear-view cover with window allows the reference value setting and signal lights to be easily seen, and the energy supply is ensured by means of a flexible connection line.

Temperature sensors: PT100. Connection housing and final termination of the hose system are made of impact-resistant fibre-reinforced plastic.

### templine®-B

Heated hose with integrated temperature controller and safety temperature limiter in the connection housing. A clear-view cover with window allows the reference value setting and signal lights to be easily seen, and the energy supply is ensured by means of a flexible connection line.

Temperature sensors: PT100 (controller), PT100 (limiter). Connection housing and final termination of the hose system are made of impact-resistant fibre-reinforced plastic.



## Special designs for special requirements

The heated hose system also offers variants for larger rated widths (32 to 65 mm) and special operating conditions. As the inner diameter of the inner hose increases, so too does the mechanical stress on the hose components inside the **templine®** system. Specifically, in the course of bending and torsional stress, tensile and compressive forces are incurred and, depending on the bending and torsional loading, these forces can lead to accelerated ageing of the heated hose. In many cases, transferring materials in this way requires high pressure resistance values along with high flexibility. And when heated hoses with large dimensions are being used such as, for example, when bitumen processing in machines for roadway repairs, even external influences come into play.

These hoses are subjected to high vibrations, increased wear of the outer casing due to friction rubbing against surfaces, or stress loading from being trodden on during operation.

Masterflex has paid special attention to these particular applications in the further development of the **templine®** heated hose system. And the result is the heavy-duty series of **templine®** heated hose systems, for rated widths between 32 and 65 mm.

### Features of these formats:

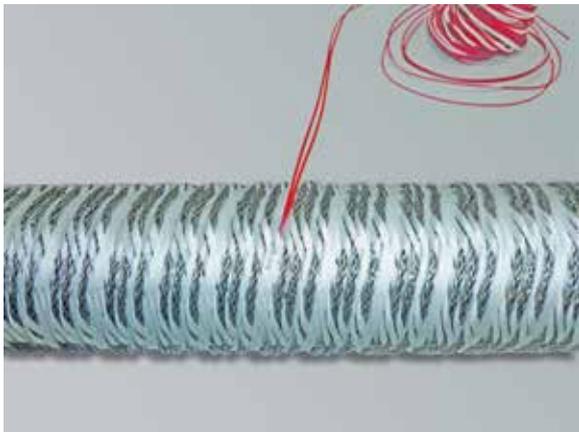
- Tough, pressure-reinforced and vacuum-resistant medium hoses, in part with single/multiple steel wire braiding
- Multi-layer thermal insulation formed from closed-cell wear-resistant silicone foam with low thermal conductivity coefficient ( $\lambda < 0,025 \text{ W/mK}$ )
- Intermediate layers made of high-quality fabric to increase flexibility
- Ageing-resistant and wear-resistant casing (ARAMID/KEVLAR® fabric, spiral hose with Teflon® textile fabric, steel/stainless steel braiding)
- Connection cap and end cap optionally made of fibre-reinforced impact-resistant plastic, and, optionally, designed as silicone or EPDM soft cap.



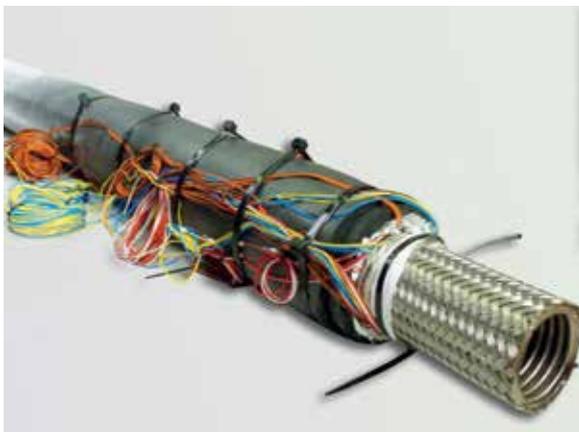
Vehicle for making roadway surfaces:

**templine®** heated hoses for transferring the bitumen (+220 °C)

## Construction design examples



Surface-covering **templine®** heating system, hose inner diameter: 50 mm.  
Temperature deviation along the hose: <2K



Large number of measuring points in the **templine®** heated hose. Temperature maintained with only minor deviations from the reference temperature value.  
Inside: metal hose.

The Masterflex range offers external temperature controllers and temperature limiters for all **templine®** heated hose systems. These devices offer the possibility, regardless of where the heated hose is being used, for one or more installations to be monitored. The connection lines of **templine®** heated hoses and the connections to the energy supply for temperature sensors on the temperature controller can be fitted at the production plant with industrial plugs and sockets. These make installation on site easier and increase operational safety and reliability even more. Available to choice are, for example, connection systems from the manufacturers Harting, AMP, Phoenix, and Walther.



Digital temperature controller with multi-segment display, sensor connection capacity for PT100, PT1000, thermocouples, and NI100/120. Switching capacity up to 3600 VA/230 V AC. Protection mode: IP 54.

Electrically heated hoses from the templine® product range are individual solutions, and the calculations behind them are derived from the data from the user. Please complete this form as fully as possible, since this will enable us to prepare the best possible product solution to suit you.

# Project checklist

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 Contact: \_\_\_\_\_ Mobile: \_\_\_\_\_  
 Job Function: \_\_\_\_\_ Email: \_\_\_\_\_

## Application details (enter cross or details where applicable)

Hose inner diameter in mm: 4  6  8  10  12  14  16  20  25   
 32  38  40  50  other: \_\_\_\_\_ mm

Hose length (m): \_\_\_\_\_ Number of hoses: \_\_\_\_\_ Pressure (bar): \_\_\_\_\_ Vacuum (mm Water Column): \_\_\_\_\_

Application: Antifreeze protection  Temperature maintenance  Temperature raising

Temp./target media temp. (°C) \_\_\_\_\_ Entry temp. (°C): \_\_\_\_\_ critical media temp. (°C): \_\_\_\_\_

Type of medium: granular/dust  gaseous  liquid  ID: \_\_\_\_\_

Environment: indoors  outdoors  wind (>2ms/s)  humidity/fog

Location: rural/urban: \_\_\_\_\_

External influences: none  sun radiation  sustained use in the cold

Nominal/operational voltage (V): \_\_\_\_\_ power desired (specified) \_\_\_\_\_ Watt

System set-up: external control  with temp. controller  with temp. limiter   
 (templine®-A) (templine®-R) (templine®-B)

## Hose fittings:

inner/medium transfer hose material PA  PTFE  metal hose  silicone-free

thermal insulation material silicone foam  thermal fleece  glass fabric

hose fitting material steel  stainless steel  stainless steel quality

format 24° cone/union nut metric thread  BSP thread

24° inner cone/outer thread: metric thread  BSP thread

60° inner cone/union nut: metric thread  BSP thread

surface-sealing/union nut: metric thread  BSP thread

surface-sealing/outer thread: metric thread  BSP thread

Divergent fitting types: \_\_\_\_\_

*In the case of two different fittings, please define the side of the connection line!*

Interchangeable inner hose: yes  no

Protective casing braiding: PA braiding  PUR spiral hose  polyamide (KEVLAR®) braiding   
 stainless steel braiding  glass-fibre braiding  silicone   
 HYPALON® helical hose

Mechanical stress: yes  no  description: \_\_\_\_\_

Type of installation: rigid installation  open installation  movable installation

Approvals/certificates: \_\_\_\_\_

Supplementary remarks notes:

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