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.
Areas of application

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

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

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

The core competence of templine®
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**Structure of the heated hose**

The design structure and its variants

The illustration shows the new design concept of the templine® heated hose in comparison with conventional versions.

**Braiding / carrier braid**
- with embedded heating conductors

**Heating conductors:**
- PTFE insulated (medium up to 200 °C)
- Fabric-insulated (medium up to 300 °C)

**Casing:**
- Polyamide braiding
- KEVLAR® braiding
- PUR spiral hose
- HYPALON® spiral hose
- etc.

**Thermal insulation:**
- Closed-cell insulation hose
- Silicone-free thermal fleece

The templine® heated hose provides technical solutions to meet real, practical expectations.

**Material-transfer hose:**
- PTFE smooth hose (single/double/multiple pressure-reinforced up to max. 475 bar)
- Metal hose
- Vacuum-resistant hose, up to 20 mbar

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.

**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

**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

Here is a direct comparison of heated hose systems:
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

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

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 foodstuffs (standard inner hose)

**PTFE hose with pressure reinforcement**
Inner diameters: DN 4 – DN 25
Pressure resistance: 172–23 bar
Suitable for contact with foodstuffs

**PTFE hose with double pressure reinforcement**
Inner diameters: DN 4 – DN 25
Pressure resistance: 371-155 bar
Suitable for contact with foodstuffs

**Metal hose with vacuum resistance**
Inner diameters: DN6 – DN50
Pressure resistance: 75-25 bar
Vacuum-resistant

**Good flexibility**

**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

**PTFE hose with triple pressure reinforcement**
Inner diameters: DN 4 – DN 25
Pressure resistance: 371-155 bar
Suitable for contact with foodstuffs

**PTFE hose with pressure reinforcement**
Inner diameters: DN 6 – DN 50
Pressure resistance: 172-23 bar
Suitable for contact with foodstuffs

**Good flexibility**

**Pressure**
PTFE hose
Inner diameters: DN 4 – DN 50
Pressure resistance: 22-3 bar
Suitable for contact with foodstuffs

PTFE hose with pressure reinforcement
Inner diameters: DN 4 – DN 25
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PTFE hose with double pressure reinforcement
Inner diameters: DN 4 – DN 25
Pressure resistance: 371-155 bar
Suitable for contact with foodstuffs

Metal hose with vacuum resistance
Inner diameters: DN6 – DN50
Pressure resistance: 75-25 bar
Vacuum-resistant

Good flexibility
Materials

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-NiAl [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®-B**

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®-R**

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 choose 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.

Fax: +49 209-97077-33  Tel.: +49 209 97077-0  sales@masterflex.de

Project checklist

Company:
Street:
City & Country:
Contact:
Job Function:

Application details (enter cross or details where applicable)

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inner/medium transfer hose material: PA PTFE metal hose silicone-free
thermal insulation material: silicone foam thermal fleece glass fabric
hole fitting material: steel stainless steel stainless steel quality
format: 24° cone/union nut 24° inner cone/outer thread: 60° inner cone/union nut: surface-sealing/union nut: surface-sealing/outer 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: