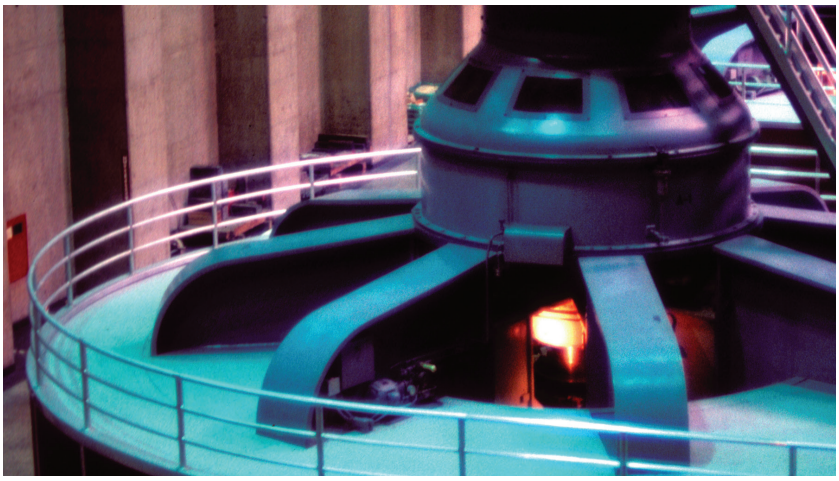
MINERAL INSULATED (MI) SERIES HEATING SYSTEMS

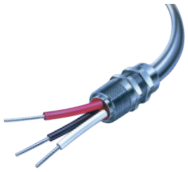


INNOVATION

Industries worldwide have been benefiting from the unique high-performance capabilities of Raychem MI heating cables for over 75 years. Over the past decade nVent customers have been able to take advantage of a range of innovative developments that have further enhanced the flexibility, reliability and cost-effectiveness of these industry-leading systems.

Alloy 825 sheathed MI heating cables exceed by far the corrosion resistance of standard materials and are most suitable for heat-tracing applications. The introduction of dual conductor heating cables offers economic advantages in particular for shorter circuits, as it requires only half of the length of the heating cable.

Factory terminated Heating units (Brazed or Laser welded) give customers the assurance of the highest integrity and reliability in their heating systems even at highest temperatures and wattages.



2003/04

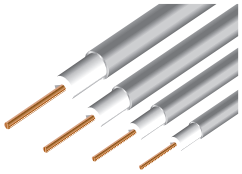
Introduction of **Alloy 825** sheath material and dual conductor elements

2015

IECEx approvals for entire range

2005

Introduction of **laser welding capabilities**

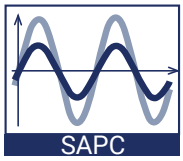


2016

Extension of resistance range for **Alloy 825 cables**

2014

PYROTENAX products rebranded to **RAYCHEM**



2017

Introduction of formalized **Smart Adaptive Power Control** for MI and Improved brazed capabilities

The installation of MI heating units requires adequate training and sufficient experience. In particular for hazardous area applications, factory termination of the MI heating units is strongly recommended. Our Tracer team is widely regarded as the premier provider of industrial turnkey heat-tracing solutions. With our full suite of services, from front-end engineering and installation to maintenance and operation services, we are capable of handling heat-tracing projects of any size and scope.

INTRODUCTION

Raychem MI heating systems provide the optimum solution when power outputs and/or temperatures exceed the limits of any polymeric heating cables.

Operating to voltages up to 600 V

Temperature maintenance up to 600°C

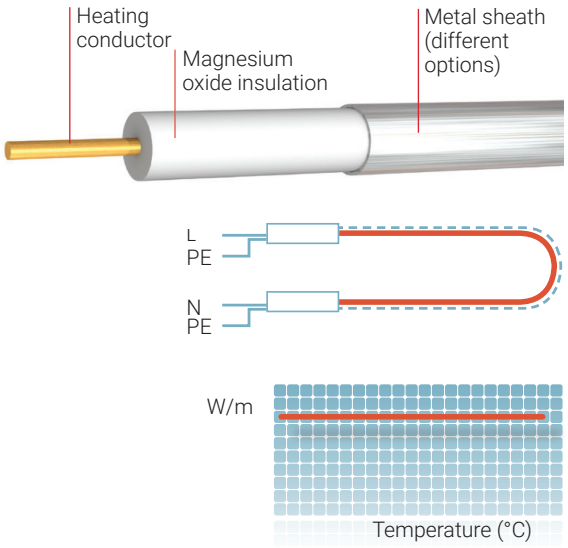
Exposure temperatures up to 1000°C

Circuit lengths up to several kilometres

CONSTRUCTION

Raychem MI heating cables consist of one (single core) or two (dual core) conductors embedded in a highly dielectric magnesium oxide insulation surrounded by a seamless metal sheath. The cables are terminated at the extremities with a non-heating section and seal.

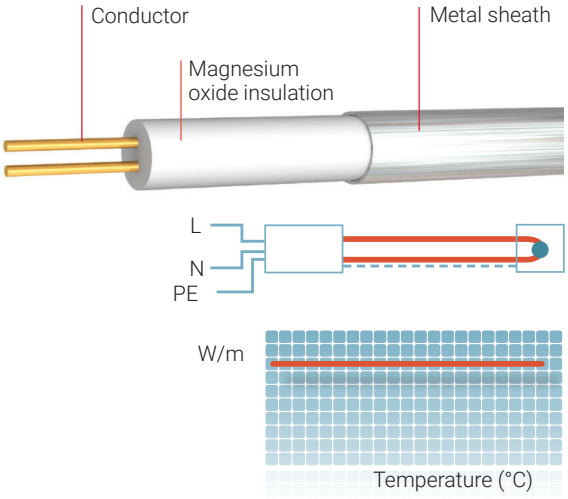
Heating elements are manufactured by brazing the heating cable with a cold lead, either on-site or at the factory.



HOW IT WORKS

Heat is generated in the conductor(s) through the principle of Ohmic resistance heating (Joule effect). A variety of central conductor materials is used, depending on the specific resistance requirements.

Power output and temperatures of a MI series heating system depend on the specific application. Design parameters including type/resistance used, circuit length, applied voltage and electrical configuration directly influence the performance of the heating system. Design and product selection has to be carried out by qualified personnel using appropriate software. Any change to these parameters can be critical and require a revalidation of the design.



BENEFITS

Large variety of sheath materials and resistances

The extended range of sheath materials ensures that you will find the product which will fit your particular applications perfectly considering temperature withstand capabilities, desired power output as well as corrosion resistance. The wide range of resistances will allow you to design the right heating circuit based on your pipe length or equipment dimensions.

Adaptable to all specific applications

Different available constructions and termination styles allow for a wide range of applications: from small instrument lines exposed to very high temperatures to long transfer lines or even specific equipment shapes. High power output provides the solution for melting or vaporizing processes.

Factory terminated elements for enhanced reliability (OPTIONAL WITH LASER WELDING)

Factory-terminated and fully tested units guarantee a consistently high level of quality, providing significant saving on installation time and eliminating risk of rework in the field.

The stainless steel (HSQ), Inconel 600 (HIQ) and Alloy 825 (HAx) heating cables can be delivered with:

- Brazed joints and/or end caps
- Laser welded joints and/or end caps.

We recommend the use of brazed joints and/or end caps if the load or exposure temperatures keep element temperatures below 550°C. For higher element temperatures, laser welded connections are the most suited connection technology.

When brazed connections are used, we recommend the use of Alloy 825 cold leads, regardless of the sheath material of the heating cable, to obtain maximum corrosion resistance on the exposed parts.

This option is also possible with laser welded joints if the exposure temperatures or element temperatures allow for it. (Alloy 825 should not be used at temperatures between 650°C and 750°C)

For use in hazardous areas, MI heating units need to be assembled by nVent or an authorized installer.

APPLICATIONS

Typical applications for mineral insulated cables require either high power, high maintain temperatures or resistance to high exposure temperatures.

Refining crude distillation	(Petro-) chemical	Power generation	General
Hydrocracking	Phtalic anhydride	High-pressure feedwater	Condensation prevention in filters
Coking	Benzene/Styrene	Blowdown lines	Phase changes (melting,vaporizing)
Wax	Polypropylene	Instrument lines	Salts
Sulphur	Polyethylene	Stream lines	Reactors
Asphalt	Chlorine/Glycol	De-aerator lines	Nuclear industry
Bitumen	Acrylic & adipic acids	High-pressure condensate	
Heavy residue	Dimethyl terephthalate		
Gas condensate prevention	Synthetic fiber components		

CHARACTERISTICS OF RAYCHEM MI CABLES

Due to their particular construction, based on a resistive heating element and metallic sheath material, the design of an application and selection of a relevant heating cable follows some specific rules:

- Evaluation of corrosive agents potentially existing in the environment in order to check compatibility of heating cable outer sheath (see table 1).
- Estimation of maximum sheath temperature and maximum output based on cable family and methodology of fabricating elements, brazing or laser welding (see table 2).
- Determination of the actual output power based on applied voltage, length and resistance of heating elements.

The cables are terminated at the extremities with a non-heating section and seal, a so called 'cold lead'. The connections and seals are critical factors for safe and reliable operation. Although on-site terminations are possible, they can only be executed by personnel experienced and trained in brazing techniques. Raychem MI heating systems can be supplied as factory-terminated and tested units to guarantee a consistently high level of quality. (see Figure 1).

Stainless steel, Inconel 600 and Alloy 825 heating cables can be delivered with either brazed joints and/or end caps or laser welded joints and/or end caps. We recommend the use of brazed joints and/or end caps if the load or exposure temperatures keep element temperatures below 550°C. For higher element temperatures, laser welded connections are the most suited
connection technology.

Heating cables with Alloy 825 sheath are also available in a dual conductor version, which offers a significant technical advantage when space is limited or when high resistances are required, such as for high temperature instrumentation lines or short branches. They also significantly reduce installation times, as only half of the length of the heating cable is required (see Figure 2).

Our unique design software TraceCalc Pro provide support for simplifying the design and selection process.

MI heating unit type B (single conductor)

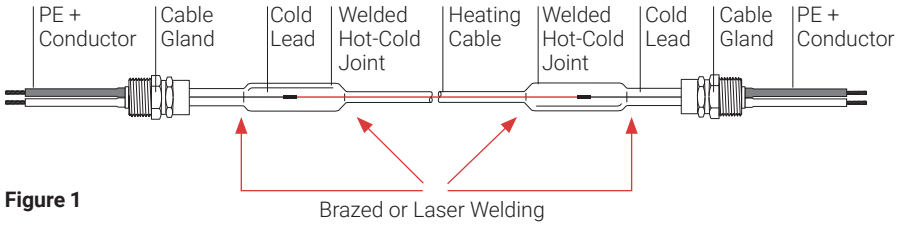


Figure 1

MI heating unit type D (dual conductor)

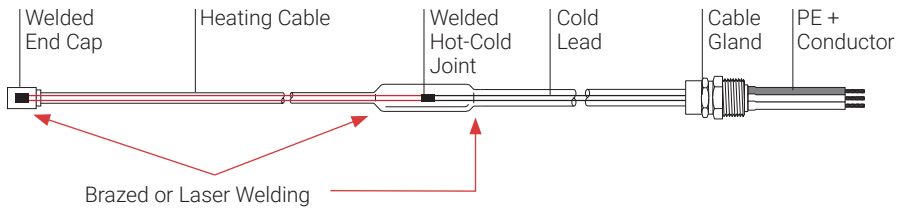


Figure 2

This table gives an indication of the corrosion resistance of the available sheath materials against different corrosive agents.

Table 1

MI heating cable type	Sulphuric acid	Hydrochloric acid	Hydrofluoric acid	Phosphoric acid	Nitric acid	Organic acids	Alkalis	Salts	Sea water	Chlorides
HCC	NR	NR	A	A	NR	A	A	X	NR	X
HCCH	GE	GE	A	A	A	NR	A	A	A	A
HDC/HDF	NR	X	X	X	X	X	X	X	GE	GE
HSQ	NR	NR	NR	NR	X	GE	A	A	NR	NR
HIQ	X	X	A	X	X	GE	GE	GE	A	GE
HAx	GE	GE	GE	GE	GE	GE	GE	GE	GE	GE

GE Good to excellent **A** Acceptable **X** Check for specific data **NR** Not recommended

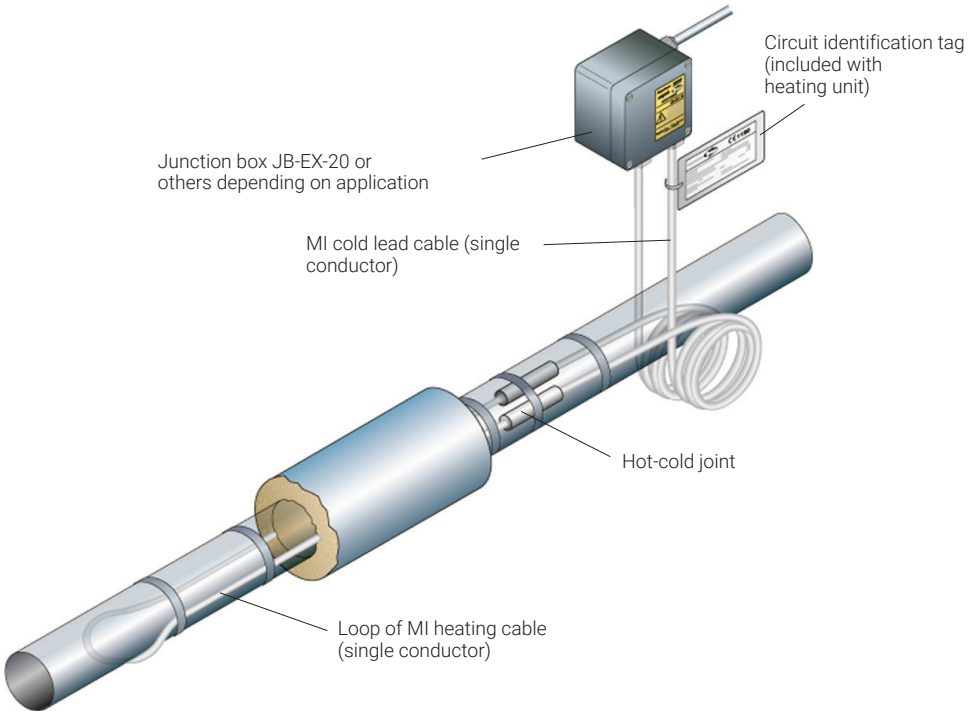
Table 2

MI heating cable reference	Sheath material	Max. sheath temperature	Max. typical (1) power output
HCC (*)	Copper (*optional additional sheath "H" for HDEP)	200°C (limited to 80°C with HDPE)	50 W/m
HDC/HDF	Cupro-Nickel (70/30)	400°C	70 W/m
HSQ	Stainless Steel 321	450°C (ATEX) / 550°C (Ordinary) (700°C with laser welded joints)	150 W/m
HIQ	Inconel 600	450°C (ATEX) / 550°C (Ordinary) (700°C with laser welded joints)	300 W/m
HAx	Alloy 825	550°C (700°C with laser welded joints)	270 W/m

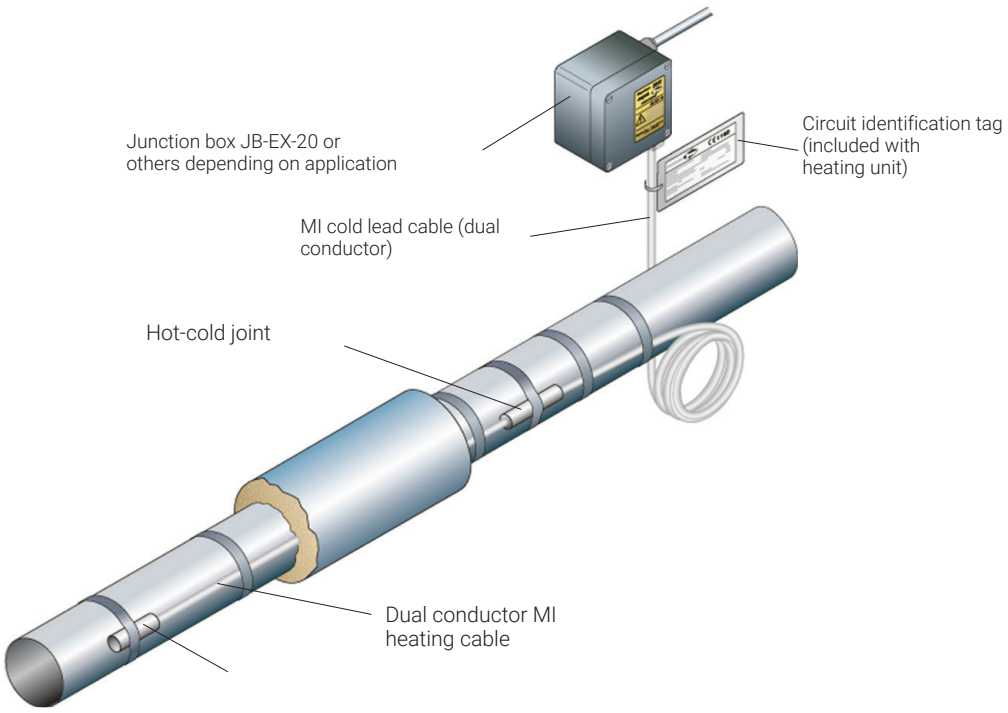
(*)Corrosion resistance data is dependent on temperature and concentration.
(1) Typical value, allowed max. power output dependent on the application. Consult nVent for more information.

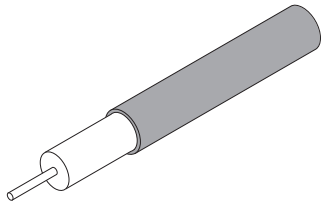
TYPICAL CONFIGURATION FOR RAYCHEM MI HEATING CABLE SYSTEMS

SYSTEMS WITH SINGLE CONDUCTOR



SYSTEMS WITH DUAL CONDUCTOR



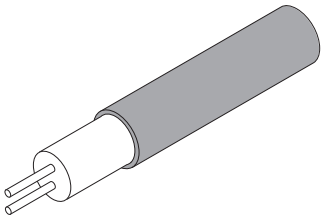


HCH/HCC

Copper sheathed MI cable approved for use in hazardous areas (gas and dust environments). The maximum exposure temperature s is 200°C and the typical maximum load is 50 W/m*. Copper cables are also available with an over-sheath in HDPE (max. 80°C) or FEP (max. 200°C) for enhanced corrosion protection.

HDF/HDC

Cupro-nickel (70/30) sheathed MI cable approved for use in hazardous areas (gas and dust environments). The maximum exposure temperature is 400°C and the typical maximum load is 70 W/m*.



HSQ

Stainless steel (321) sheathed Mineral Series (MI) heating cable approved for use in hazardous areas (gas and dust environments). The maximum exposure temperature is dependent on the technology used for the hot-cold joint assembly. Silver solder joints allow for exposure temperatures up to 450°C (ATEX) / 550°C (Ordinary) while laser welded joints can withstand 700°C.
The typical maximum load is 150 W/m*.

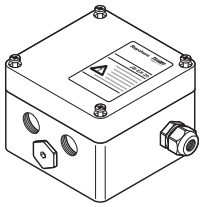
HAx

Alloy 825 sheathed MI cable approved for use in hazardous areas (gas and dust environments) are available in both single and dual conductor versions. Dual conductor heating cables are available for voltage ratings of 300 Vac (HAx2M) and 600 Vac (HAx2N). The maximum exposure temperature is dependent on the technology used for the hot-cold joint (and end cap) assembly.
Silver solder joints (and end caps) allow for exposure temperature up to 550°C while laser welded joints (and end caps) can withstand 700°C. The typical maximum load for single conductor cables is 210 W/m while dual conductors can be powered up to 270 W/m*.

HIQ

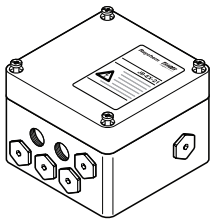
Inconel 600 sheathed MI cable approved for use in hazardous areas (gas and dust environments). The maximum exposure temperature is dependent on the technology used for the hot-cold joint assembly. Silver solder joints allow for exposure temperature up to 450°C (ATEX) / 550°C (Ordinary) while laser welded joints can withstand 700°C. The typical maximum load is 300 W/m*.

* Typical power output dependent on the application and cable construction. Higher power outputs and/or higher exposure temperatures are possible. Contact nVent for more information.



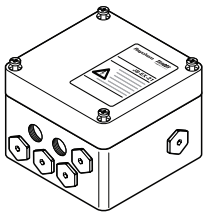
JB-EX-20 (-EP)

Junction box, 3 x M20 entries and 1 x M25 with gland, approved for use in hazardous areas.
Typical use as powerbox for PI/MI heating cables. Also available with earth plate (reference JB-EX-20-EP).



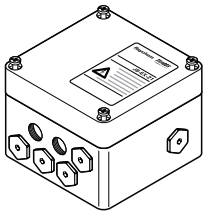
JB-EX-21

Junction box, 6 x M20 and 1 x M32 entries for use in hazardous areas. Power cable gland (M32) must be purchased separately.
Typical use as power-, splice- and end-box for 3-phase systems with PI/MI heating cables.



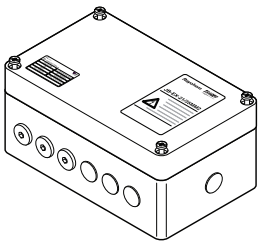
JB-EX-21/35MM2

High load junction box, 6 x M20 and 1 x M40 entries, approved for use in hazardous areas. Power cable gland (M40) must be purchased separately.
Typical use as power-, splice- and end-box for 3-phase systems with PI/MI heating cables.



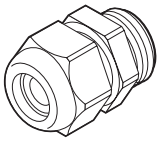
JB-EX-21/35MM2

High load junction box, 6 x M20 and 1 x M40 entries, approved for use in hazardous areas. Power cable gland (M40) must be purchased separately.
Typical use as power-, splice- and end-box for 3-phase systems with PI/MI heating cables.



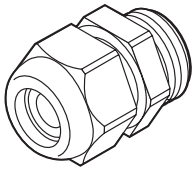
JB-EX-32/35MM2

High load junction box, 3 x M32 and 1 x M40 entries, approved for use in hazardous areas. Power cable gland (M40) must be purchased separately.
Typical use as power-, splice- and end-box for 3-phase systems with MI heating cables, in particular for dual conductor heating elements.



GL-45-M32

Cable gland Ex e (M32), polyamide, for use with power cables with a diameter range of 12 - 21 mm.

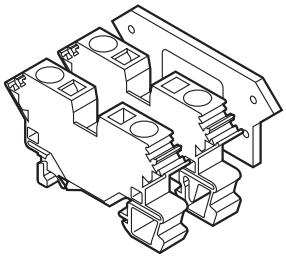


GL-51-M40

Cable gland Ex e (M40), polyamide, for use with power cables with a diameter range of 17 - 28 mm.

HWA-PLUG-M20-EXE-PLASTIC

Stopping plug Ex e (M20), polyamide, spare part for various junction boxes.



HWA-WAGO-PHASE

Phase/neutral terminal (Ex e), spare part for various junction boxes, max. 10 mm^2 solid/stranded.

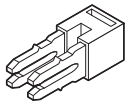
HWA-WAGO-EARTH

Earth terminal (Ex e), spare part for various junction boxes, max. 10 mm^2 solid/stranded.

HWA-WAGO-ENDPLATE

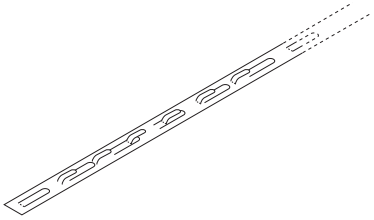
End plate for terminals HWA-WAGO-..., 10 mm^2 terminals, spare part.

HWA-WAGO-JUMPER



Jumper to bridge terminals HWA-WAGO-..., 10 mm^2 terminals, spare part.

FIXING/INSTALLATION MATERIALS



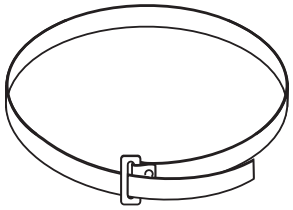
HARD-SPACER-SS-25MM-25M

Pre-punched strap in stainless steel, which controls spacing distances when heating cables are attached to surfaces of bigger pipes and vessels. Punch interval: 25 mm.

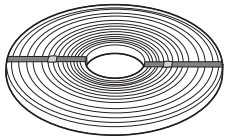
Available Pipe Straps

Stainless steel pipe straps for holding MI cable onto pipe. Tighten with pliers.

Allow one strap per 30 cm of pipe



Part No.	Pipe Diameter	Packing Qty
PB 125	to 1 ¼" (32 mm)	50 pc
PB 300	1 ½" to 3" (38 - 75 mm)	35 pc
PB 600	3 ½" to 6" (89 - 150 mm)	25 pc
PB 1000	6" to 10" (150 - 250 mm)	1 pc
PB 1200	to 12" (300 mm)	1pc
PB 2400	to 24" (600 mm)	1pc
PB 3600	to 36" (900 mm)	1pc

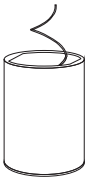


SNLS

Plain stainless steel banding/strip for holding MI cables in place on pipes. 30 m roll. Secured with buckles.

SNLK

Stainless steel buckles for use with metal banding strip type SNLS.

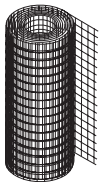


RMI-TW

Tie wire for fastening steel heating cables on pipes. Especially suitable for irregular shaped objects such as pumps, valves, flanges. Supplied in 50 m reels.
Do not use with copper or cupro nickel sheathed heating cables; use straps wherever possible.

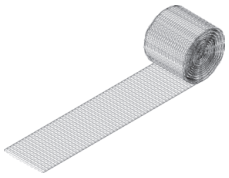
ALLOWANCES FOR TIE WIRE AND BANDING ON PIPES.

Pipe Size (mm)	25	40	50	100	150	200	250	300	350	400	450	500	600	750	900	1200
Required length (m) per m of pipe	0.8	1.1	1.2	1.6	2.1	2.8	3.5	4.2	4.6	5.2	5.9	6.5	7.9	9.8	11.8	15.7



FT-19/FT-20

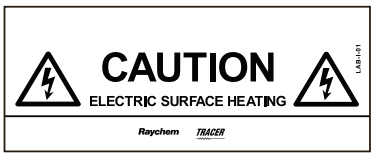
Zinc-plated metal mesh (FT-19) or stainless steel metal mesh (FT-20) for holding MI heating cables in place on pipes, tanks or other equipment.
Supplied in 25 m rolls (approx. width 1 m).



HWA-MESH-SS-50MM-10M

Stainless steel mesh for fixing heating cables on valves, pumps or other odd-shaped surfaces. This mesh provides optimum contact and heat transfer between heating cables and heated equipment and can be used for exposure temperatures of up to 400°C, width: 50 mm, rolls of 10 m.

WARNING LABELS



LAB-I-01

Self adhesive warning label: For proper marking of electrical trace heating systems. One label per 5 m of traced pipe.
Attach to outside of thermal insulation on both sides of pipe and also at equipment such as valves, pumps requiring periodic maintenance.

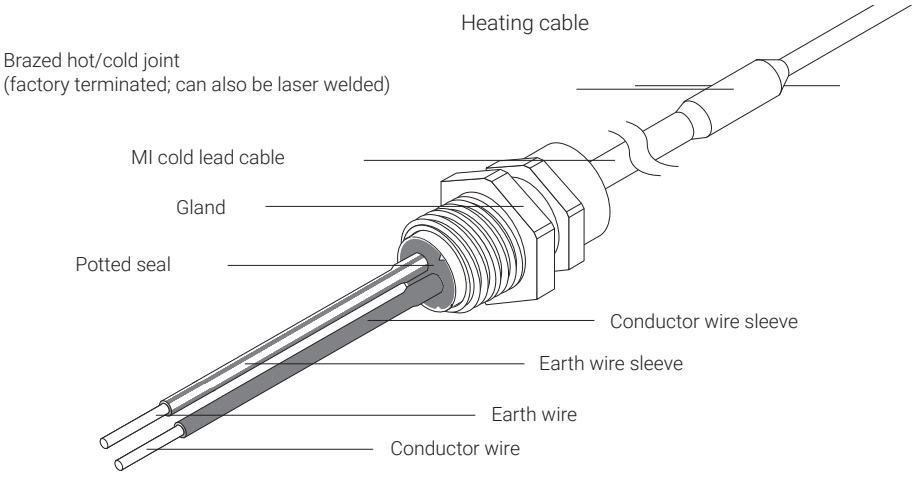
TEMPERATURE CONTROLS

See control and monitoring product range (p.)

The termination of MI heating units requires adequate training and sufficient experience. In particular for hazardous area applications, factory termination of the MI heating units is strongly recommended.

For possible combinations and detailed order information of glands, seals, joints and other accessories also refer to datasheet for **MI Termination Accessories** (reference DOC-606), or contact nVent.

TYPICAL TERMINATION OF MI HEATING CABLE



PRE-TERMINATED MI DOUBLE COLD ENDS

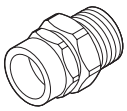
To facilitate occasional on-site termination and eventual repairs, nVent offers Pre-terminated MI double Cold Ends (PCE).

The standard PCEs consist of 4m of cold lead cable of the appropriate type which ends are pre-terminated with a factory seal, gland assembly and insulated flexible tails. The use of Pre-terminated Cold Ends (PCE) significantly increases the reliability of field-termination and repairs of cold leads since they are fully factory tested and assembled in a controlled manufacturing environment.

A PCE with a single conductor cable includes two terminations, sufficient for the termination of an MI heating unit type B. A PCE with dual conductor cable includes two terminations, sufficient for the termination of two MI heating unit type D or for one MI heating unit type E.

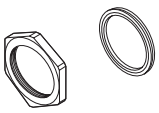
Any ingress of moisture is minimized, if the PCE is cut (typically in the middle) just before the connection to a heating cable. Unused ends can be sealed for storage using wax or other appropriate sealing methods. More details on the available types can be found in MI Termination Accessories (reference DOC-606).

GLANDS, SEALS, JOINTS, FERRULES



RGM

Metric brass glands are standard.



RLM20

M20 brass lock nuts for securing glands

RLM25

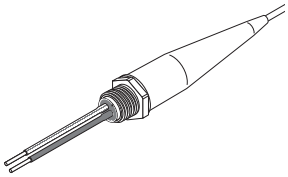
M25 brass lock nuts for securing glands.

SATP20

Fibre washers for glands, M20

SATP25

Fibre washers for glands, M25

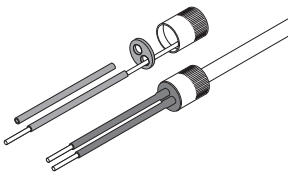


RHG20

M20 gland shrouds for enhanced gland protection

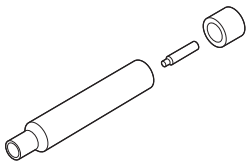
RHG25

M25 gland shrouds for enhanced gland protection



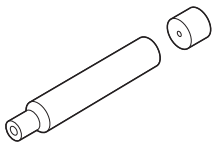
RPAL/RPSL

Hazardous and ordinary area seals are supplied with 300 mm tails including earth tail.



SJK..

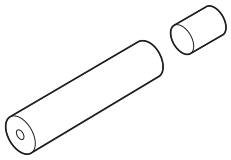
Joint types SJK are made of brass, types SJKAS are made of stainless steel.



SJK..-PILOT-...

Universal hot/cold or hot/hot joint for brazed connection of MI heating cables and/or cold leads. Universal joints have two pilot holes (one for the joint body and one for the joint bush) that must be drilled to match the exact diameter of the heating cable and/or cold lead during the termination operation or field repair. Joint types SJK are made of brass, types SJKAS are made of stainless steel.

The preferred solution to join two heating cables includes a short section of cold lead joined between the two MI heating cables with two hot/cold joints.



SPOT-PILOT

End cap for the termination of dual conductor MI heating cables. The end caps have a pilot hole that must be drilled to match the exact diameter of the heating cable during the termination operation. End cap types SPOT are made of brass, types SPOTAS are made of stainless steel.

SJK...F

Ferrules (copper) for reliable connection of MI conductors in hot/cold joints.

FABRICATION CONSUMABLES

SABAG13

Silver solder for brazed joints, use for conductor.

SABAG14

Silver solder for brazed joints, use for joint body.

SABF

Brazing flux (250g).

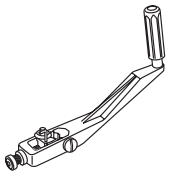
SMP-300

Magnesium oxide powder (250g).

RMX

Grey potting compound.

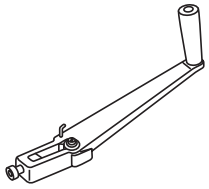
TOOLS



ZSU

Large stripping tool – all cable sizes, spare blades ZSUB.

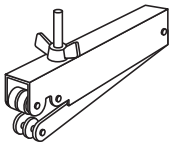
For Copper and Cupro-Nickel cables.



ZSUS

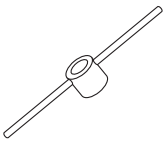
Small stripping tool – cable ø < 9 mm, spare blades ZSUSB.

For Copper and Cupro-Nickel cables.



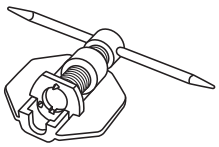
ZR

Ringing tool for cable ø < 9 mm.



ZPM20, ZPM25

Potting tool, ensures quick and accurate screwing on of the brass pot and is used in conjunction with the appropriate RGM cable gland (M20 or M25).



ZDC20, ZDC25

Crimping tool for 20 and 25 mm seals.

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