

QAA-021-A
Operating Manual for
Heat Tracing Systems ELK-MI-...

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Heat Tracing System ELK-MI-****

Application

The Heat Tracing System ELK-MI-**** is suitable for industrial use on piping, vessels, instrumentation and related equipment in non-classified (ordinary) areas, in wet areas and in areas where combustible gases or dust may be present, including Class I Div 2 and Class II Div 1 environments (for details please see the attached type plate).

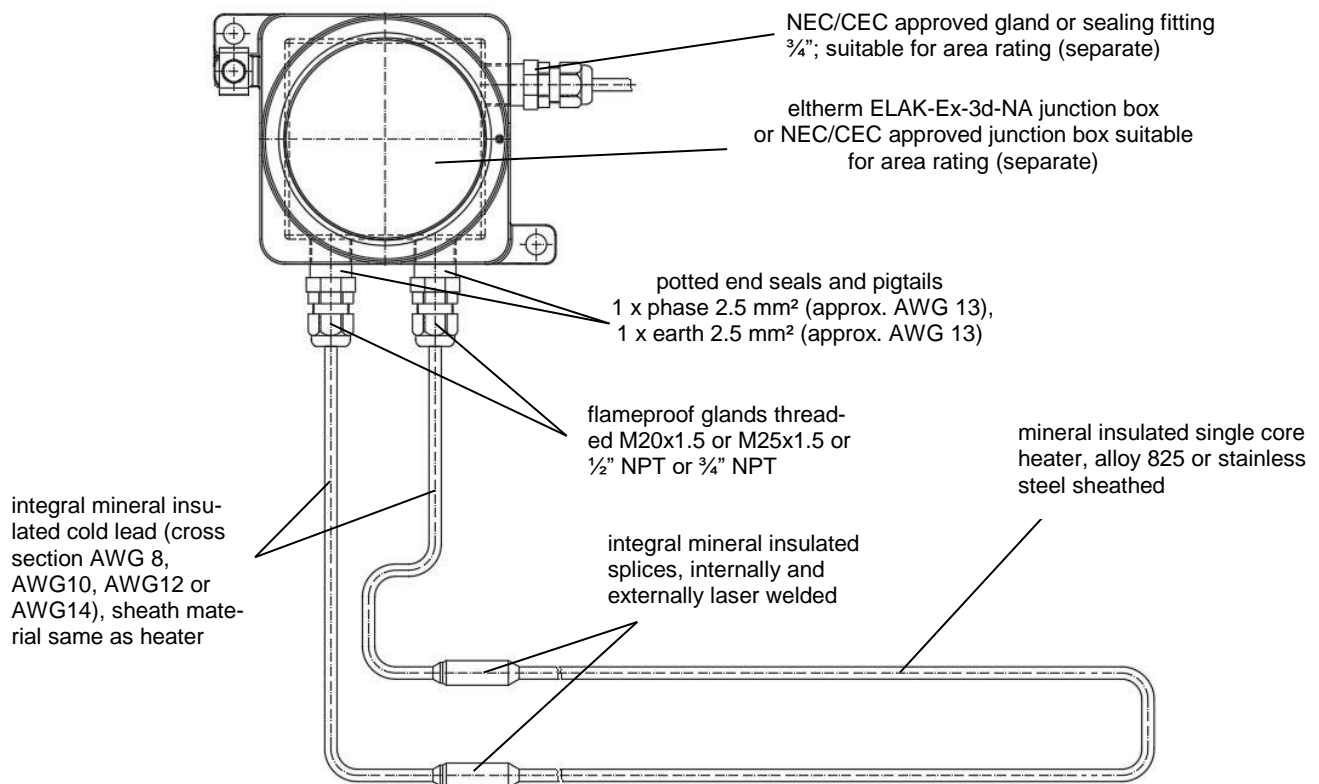
The system is based on series and twin heaters and is to be operated in controlled or stabilized design as per IEC/IEEE 60079-30-1 (former IEEE 515) or CSA 22.2 130. All electrical connections must be made to a suitable junction box approved for use in the above listed areas.

Furthermore, the heat tracing installation must meet the requirements of the National Electric Code or the Canadian Electrical Code.

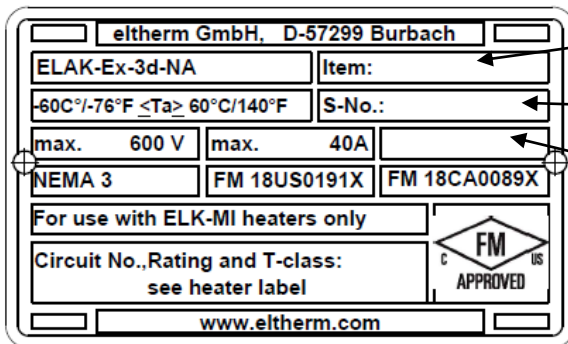
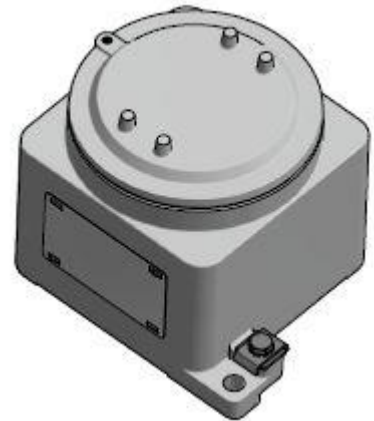
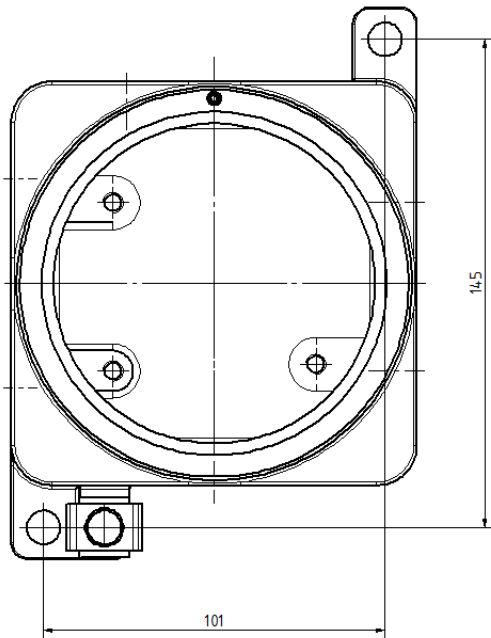
System Components

The Heat Tracing System ELK-MI-**** comes prefabricated and ready for installation. The Single Core Heating System ELK-MI-**** comprises the following components:

- 1 (each) Mineral insulated single core trace heater as per tables 1 and 3 (integral)
- 2 (each) Laser welded splices (integral)
- 2 (each) Mineral insulated cold leads (integral)
- 2 (each) Potted end seals with pigtails (integral)
- 2 (each) Glands (integral)
- 1 flameproof enclosure ELAK-Ex-3d-NA (optional)



eltherm ELAK-Ex-3d-NA
 junction box



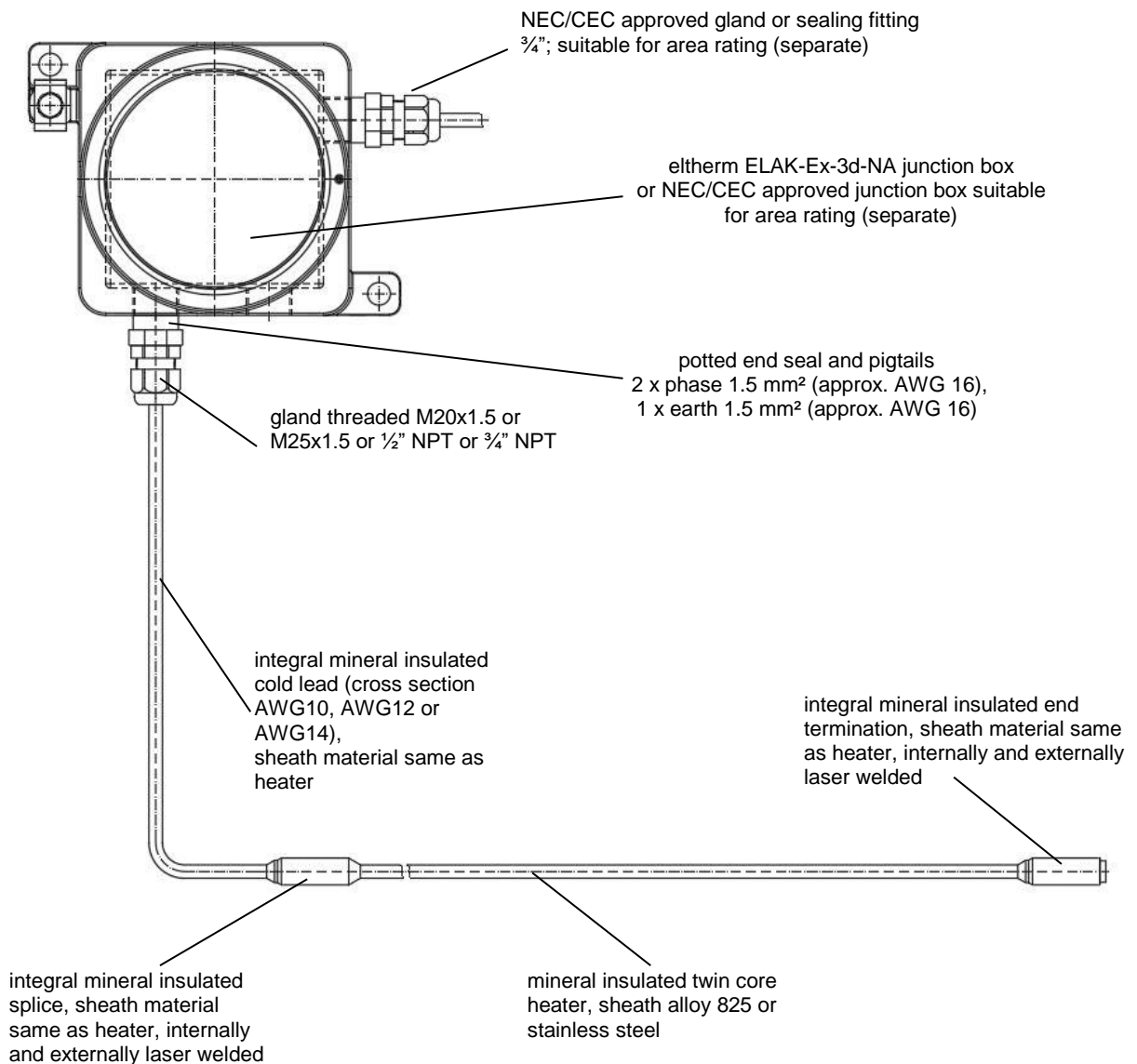
item number

serial number

heater threads

The Two Conductor Heating Systems comprise the following components:

- 1 (each) Mineral insulated two conductor trace heater as per tables 2 and (integral)
- 1 (each) Laser welded splice (integral)
- 1 (each) Mineral insulated cold lead (integral)
- 1 (each) Potted end seal with pigtails (integral)
- 1 (each) Gland (integral)
- 1 (each) Laser welded end termination (integral)
- 1 flameproof enclosure ELAK-Ex-3d-NA (optional)



Technical Data AY825

Sheath material	Alloy 825
Gland material	stainless steel 1.4404 (AISI 316L)
Min. bend radius	6 x cable diameter (see table 2 for details)
Max. voltage	600V or 300V; refer to type plate
Max. exposure temp.	700°C / 1292°F (MI cable and integral splice); 80°C / 176°F (potted end seals)
Max. operating temp.	refer to type plate
Min. installation temp.	-60°C / -76°F
Min. start up temp.	-60°C / -76°F

Available resistances AY825

	No.	Resistance Ω / ft	Outer diameter approx. inch	Bend radius inch
Heater:	1	2.000	0,170	1.02
	2	1.600	0,170	1.02
	3	1.301	0,170	1.02
	4	1.000	0,170	1.02
	5	0.850	0,170	1.02
	6	2,300	0,170	1.02
	7	0.701	0,170	1.02
	8	0.381	0,170	1.02
	9	0.298	0,170	1.02
	10	0.250	0,170	1.02
	11	0.201	0.173	1.03
	12	0.170	0.181	1.09
	13	0.149	0.170	1.02
	14	0.100	0.170	1.02
	15	0.079	0.170	1.02
	16	0.070	0.170	1.02
	17	0.061	0.170	1.02
	18	0.039	0.173	1.04
	19	0.030	0.185	1.11
	20	0.021	0.200	1.20
	21	0.010	0.170	1.02
	22	0,006	0.181	1.09
	23	0.004	0.188	1.13
Cold:	24	AWG 14	0.208	1.25
	25	AWG 12	0.224	1.34
	26	AWG 10	0.251	1.50
	27	AWG 8	0.283	1.70

Table 1: available resistances and bend radii Single, alloy 825 sheathed

Available resistances AY825-T

	No.	Resistance Ω / ft	300V AC Outer diameter approx. inch	300V AC Bend radius inch	600V AC Outer diameter approx. inch	600V AC Bend radius inch
Heater:	1	11.000	0.161	0.97	0.220	1.32
	2	9.000	0.161	0.97	0.224	1.34
	3	7.500	0.161	0.97	-	-
	4	6.000	0.161	0.97	0.228	1.37
	5	5.000	0.161	0.97	-	-
	6	4.000	0.161	0.97	0.240	1.44
	7	3.200	0.161	0.97	-	-
	8	2.700	0.161	0.97	-	-
	9	2.500	0.161	0.97	-	-
	10	2.000	0.161	0.97	-	-
	11	1.990	-	-	0.255	1.53
	12	1.700	0.161	0.97	-	-
	13	1.400	0.161	0.97	-	-
	14	3,280	0.165	0.99	0.255	1.53
	15	2,300	0.181	1.09	0.263	1.58
	16	1,640	0.189	1.13	0.279	1.67
	17	0,980	0.169	1.01	0.300	1.80
	18	0,820	0.169	1.01	-	-
	19	0,660	0.170	1.02	0.255	1.53
	20	0,490	0.173	1.04	0.263	1.58
	21	0,330	0.189	1.13	0.279	1.67
	22	0,230	0.205	1.23	0.295	1.77
	23	0,160	0.224	1.34	0.311	1.86
	24	0,130	-	-	0.326	1.96
	25	0,098	-	-	0.346	2.08
	26	0,066	-	-	0.271	1.63
	27	0,052	-	-	0.279	1.67
	28	0,043	-	-	0.291	1.75
	29	0,033	-	-	0.299	1.79
Cold:	30	AWG 14	0.279	1.67	-	-
	31	AWG 12	0.315	1.89	-	-
	32	AWG 14	-	-	0.350	2.10
	33	AWG 12	-	-	0.381	2.29
	34	AWG 10	-	-	0.433	2.60

Table 2: available resistances and bend radii Twin, alloy 825 sheathed

Technical Data VA

Sheath material stainless steel 1.4541 (AISI 321)
 Gland material stainless steel 1.4404 (AISI 316L)
 Min. bend radius 6 x cable diameter (see table 2 for details)
 Max. voltage 500V or 400V; refer to type plate
 Max. exposure temp. 700°C / 1292°F (MI cable and integral splice);
 80°C / 176°F (potted end seals)
 Max. operating temp. refer to type plate
 Min. installation temp. -60°C / -76°F
 Min. start up temp. -60°C / -76°F

Available resistances VA and VA-T

	No.	Resistance Ω / m	Outer diameter approx. mm	Bend radius mm
VA:	1	10,000	3,20	19
	2	6,300	3,20	19
	3	5,200	3,50	21
	4	4,000	3,20	19
	5	3,300	3,50	21
	6	2,500	3,60	22
	7	1,600	3,80	23
	8	1,000	4,10	25
	9	0,630	4,50	27
	10	0,400	5,00	30
	11	0,250	5,60	34
	12	0,160	6,50	39
Cold:	13	0,007	5,70	34
VA-T:	1	36,000	3,70	22
	2	24,600	4,00	24
	3	19,680	3,80	23
	4	13,120	4,40	26
	5	9,840	5,10	31
	6	6,600	5,00	30
	7	4,600	5,30	32
	8	3,200	4,00	24
	9	2,460	5,00	30
	10	1,600	4,70	28
	11	1,000	4,40	26
	12	0,750	5,10	37
	13	0,330	6,70	40
	Cold:	14	0,022	7,50

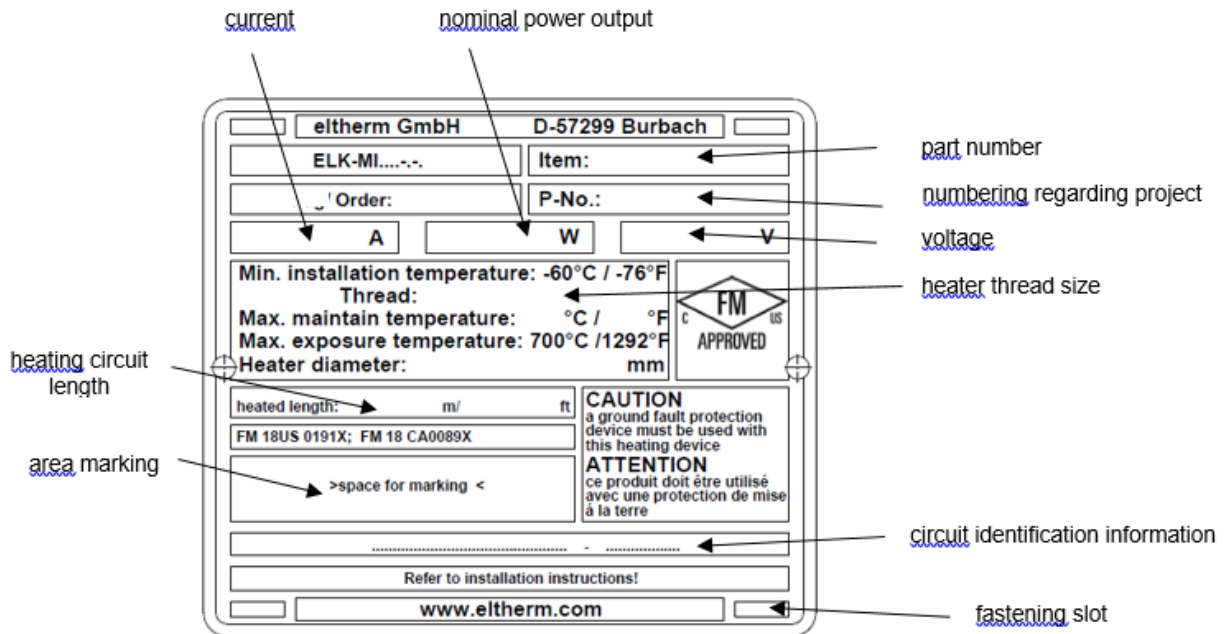
Table 3: available resistances and bend radii Single and Twin, stainless steel sheathed

Usage Rating

ELK-MI-**** is rated “-WS” and hence suitable for outdoor and wet applications.

Marking

Trace heaters ELK-MI-**** are marked as follows:



Rating	T-Class (to be chosen from the listed values as per actual heater design)	EPL
Class I Div 2 Group A, B, C, D	T1 / T2 / T2A / T2B / T2C / T2D / T3 / T3A / T3B / T3C / T4 / T4A / T5 / T6	n.a.
Class II Div 1 Group E, F	T3B / T3C / T4 / T4A / T5 / T6	n.a.
Class II Div 1 Group G	T3 / T3A / T3B / T3C / T4 / T4A / T5 / T6	n.a.
Class III Div 1	T3 / T3A / T3B / T3C / T4 / T4A / T5 / T6	n.a.
Class I Zone 1 AEx d e IIC	T1 / T2 / T3 / T4 / T5 / T6	n.a.
Class I Zone 1 Ex d e IIC	T1 / T2 / T3 / T4 / T5 / T6	Gb

Table 3: possible markings

Restrictions on Permissible Thickness and Material of Thermal Insulation

Insulation materials need to withstand at least the expected cable sheath temperatures, otherwise no restrictions

Location of Temperature Sensors

1. Temperature controllers

Temperature sensors may be used either as ambient sensing devices or attached directly to the equipment/device that is to be heated.

In case of ambient sensing, place the sensor in the coldest expected spot of the area where the heated equipment is located. This is typically a shaded place (e.g. on the northern side of buildings) on low ground. However, ambient sensing is recommended only for frost protection applications and when the permissible temperature band of the equipment to be heated and its contents is considerably wide (approx. 50K / 122°F). Please consult the eltherm project department if further assistance is required.

In cases where sensors are directly attached to the heated equipment/device, two different applications need to be considered:

a) heated pipes

Place the sensor on the anticipated coldest section of the pipe (underneath the thermal insulation, direct contact to the heated surface). Avoid direct contact between sensor and heating cable. Branched piping systems may require more than one heating circuit (with a sensor each) or implementation of the “dead leg” technique depending on the flow pattern of the piping system. If help is required, please consult the eltherm project department for further assistance.

b) heated vessels

Place the heating on surfaces that always have contact to the contents of the vessel (typically the bottom of the vessel and/or lower section). Then place the temperature sensor in the heated area (underneath the thermal insulation, direct contact to the heated surface). Avoid direct contact between sensor and heating cable. Large vessels may require more than one heating circuit, especially when they need to be heated up at various filling levels. If help is required, please consult the eltherm project department for further assistance.

Be aware of the fact that temperature sensors mounted on the surface of the heated equipment never provide readings of the exact temperatures of the medium inside the device that is being heated. Therefore, temperature settings may need to be determined empirically when exact temperatures are crucial for the process.

2. Temperature limiters

The use of temperature limiters is recommended to prevent excessive temperatures in case of a failure of the temperature control. For controlled design of heating circuits in Hazardous Areas, a temperature limiter is mandatory. Temperature limiter sensors are to be installed in the same way as controller sensors, however the anticipated hottest area of the heated equipment needs to be chosen as sensor location. Avoid direct contact between sensor and heating cable. A temperature offset between the equipment and heating cable sheath is reflected in the maximum maintain temperature stated on the heating circuit label. Unless otherwise noted, the limiter set point should be 5K above the actual maintain temperature. Please consult the eltherm project department if further assistance is required.

Summary of Conditions of Safe Use as per Type Approval Certificate

1. Power Connections shall only be made using eltherm ELAK-Ex-3d Junction Box or NRTL listed Junction Box with minimum Approval rating compatible for the connection of the heating cable.
2. Minimum installation temperature is -60°C / -76°F.
3. Maximum exposure temperature is 700°C / 1292°F for the MI cable and integral splice and 80°C / 176°F for the potted end seals.
4. A ground fault protection device must be used with this heating device.
5. The ELK-MI-**** trace heating cables and integral splices shall have a minimum and maximum operating temperature range of -60°C / -76°F to +700°C 1292°F. The potted end seals shall have a minimum and maximum operating temperature range of -60°C / -76°F to +80°C / 176°F.
6. The maximum surface temperature in or on the ELK-MI-**** Trace Heating System is limited to the maximum allowed values by means of controlled design or stabilized design in accordance with IEEE 515 or CSA C22.2 No. 130.

For Stabilized Design -

The design information from eltherm GmbH and the calculation tool "eltherm designer version 2.0" shall be such that they ensure temperature stabilization at lower values than the specified maximum surface temperature class selected, T1 to T6 or the auto-ignition temperature of the specific gas for Class I, or T200°C to T85°C or the auto-ignition temperature of the specific dust or fiber for Class II, Group E & F or T165°C to T85°C or the auto-ignition temperature of the specific dust or fiber for Class II, Group G & Class III.

For Controlled design -

The device applied as a temperature limiter for the controlled temperature design shall comply with the types of protections that are suitably rated for compatibility with the heating cable system.

7. The design information shall be retained as a record of system documentation for each controlled design system for as long as the system is in use. The set point in the system documentation shall be checked during commissioning of the system.

Installation of the Heat Tracing System ELK-MI-****

Application

ELK-MI-**** trace heaters are suitable for industrial use on piping, vessels, instrumentation and related equipment in non-classified (ordinary) areas and in areas where combustible gases or dust may be present. The heaters are supplied with integral cold leads and glands ready for installation. For use in corrosive environment, consideration of the material properties (see section “Technical Data” above) and the specific application conditions is recommended.

1. Receipt of Goods

After receipt of goods, check the heating cable and all supplied accessories and compare with the data on the delivery note to ensure that the correct material was supplied.

Verify the integrity of the electrical insulation as described under “6. Test and Commissioning”. If the heating cable is to be stored for installation at a later date, it is recommended that the exposed wires are sealed against possible ingress of water.

The type plate is attached to one of the cold leads and carries the information listed above under section “Marking”:

2. Storage

The goods have to be stored in a dry environment at an ambient temperature of -60 ... +60°C (-76°F...+140°F). If a dry storage is impossible, the exposed wires are to be sealed against possible ingress of water. This is also necessary if a heating circuit cannot be finished at the end of a shift.

3. Length of Heating Circuit

The heating circuits are designed (or approved) by eltherm. For shortening or elongation, please contact eltherm. In case a circuit consists of a number of individual heater lengths which are designed to be connected in series, make sure that the voltage applied corresponds with the voltage suitable for the individual length (as per attached label).

4. Protective Measures

- unless otherwise stated, mineral-insulated trace heaters have to be operated with controller and limiter. In hazardous areas, operation of the heater in controlled design or stabilized design as defined in IEEE 515 / CSA 22.2 130 is required
- suitable location of the temperature sensors will avoid overheating of medium and trace heater.
- a RCD with a tripping level of max. 30 mA above the inherent leakage current level needs to be provided for each heating circuit.
- the metallic sheath of the trace heater has to be connected to potential earth.
- prior to installation work or maintenance, the relevant heaters need to be disconnected from power supply. If required, heated surfaces need to cool down to become accessible.
- all work has to be carried out in compliance with all effective codes and regulations

5. Heater Installation

- installation is to be done by personnel that has been trained for installation of trace heaters
- remove any sharp objects from the surface to be heated
- clean and degrease the surface
- mark the tracing distance on the surface.
- attach pins to the surface to be heated and fit mesh via push-on discs. Alternatively, attach pre-punched stainless steel band to the surface with spacing of approx. 300 mm / 1'.
- uncoil heater carefully to avoid twisting. Do not pull at an angle
- to be observed when bending heaters:
 keep bends away from joints at least 30 mm / 1.2". Do not subject joint and adjacent heater parts to mechanical stress (torsion, pull, deformation)
 keep bends away from potted end seals at least 50 mm / 2"
 do not bend at radii smaller than the minimum bend radius (6 x heater diameter)
 do not bend same areas repeatedly due to the risk of fatigue
- for trace heaters with bilateral supply: Arrange cable-entry and -exit next to each other.
- install heater, use tie wire or lugs to hold it in place at distances of 150 – 400 mm / 0.5' – 1.3'. If the heater is installed by means of tension strip, make sure to allow for sufficient slip of the heater in order to avoid fatigue fracture due to thermal expansion
- keep at least 25 mm / 1" distance between heaters

- take care that the heater is not twisted, that the heating elements do not touch nor cross, as it might otherwise lead to local overheating and destruction of the heating elements. In Hazardous Areas, the certificate of approval will be void.
- the joints between cold lead and heating cable should be placed directly on the heated surface
- heater and cold lead next to both sides of the joints are to be suitably fixed to eliminate possible stress from the joint.
- attach heater to pumps, valves and other components in such way that those components are accessible for maintenance or exchange without major mechanical stress for the heater
- the max. operating temperature of the heated device as defined by the plant owner as well as the maximum heating cable temperatures as given on the label must not be exceeded. This may be achieved by use of an appropriate temperature control.
- the heater should be fully covered (the entire length) with metal foil in order to prevent insulation material from slipping between the cable and surface to be heated.
- make sure that the trace heater has good contact to the heated surface along the complete length (including the connection to the supply lead); this may be achieved by covering the heating cable with metal foil. In case of gaps, fill those with thermally conductive and temperature resistant materials.
- if thermal insulation with metallic cladding is used, provide an insulation entry kit to protect the cold end against wear
- insert the potted end seals into a suitable junction box via threaded M20x1.5 , M25x1.5 , ½" NPT or ¾" NPT holes and fit the cable glands. Then pull back the potted end seal until it rests in the rear of the cable gland. Tighten the gland nut. Attention: the compression ring beneath the gland nut can be used one time only. Connect wire ends to terminals.
- power connection shall only be made using eltherm ELAK-Ex-3d junction box or an NRTL listed junction box with minimum approval rating compatible for the connection of the trace heater.
 Hazardous Areas: the connection needs to be made either outside the Hazardous Area or to a junction box which is approved according to a standardized type of protection
- the potted end seals must not be exposed to temperatures > 80°C (176°F).
- upon completion of the installation, the heating circuit needs to be marked by fitting an appropriate label to the associated junction box or to the heating cable close to the junction box. The label shall be weatherproof and bear relevant information of all used components
- identification: electrically heated parts have to be identified in reasonable distances with warning labels "Electrical Heating" on the thermal insulation (approx. 5 m / 15' distance between each label on pipelines or at least 1 warning label per pipe-branch respectively).

6. Test and Commissioning

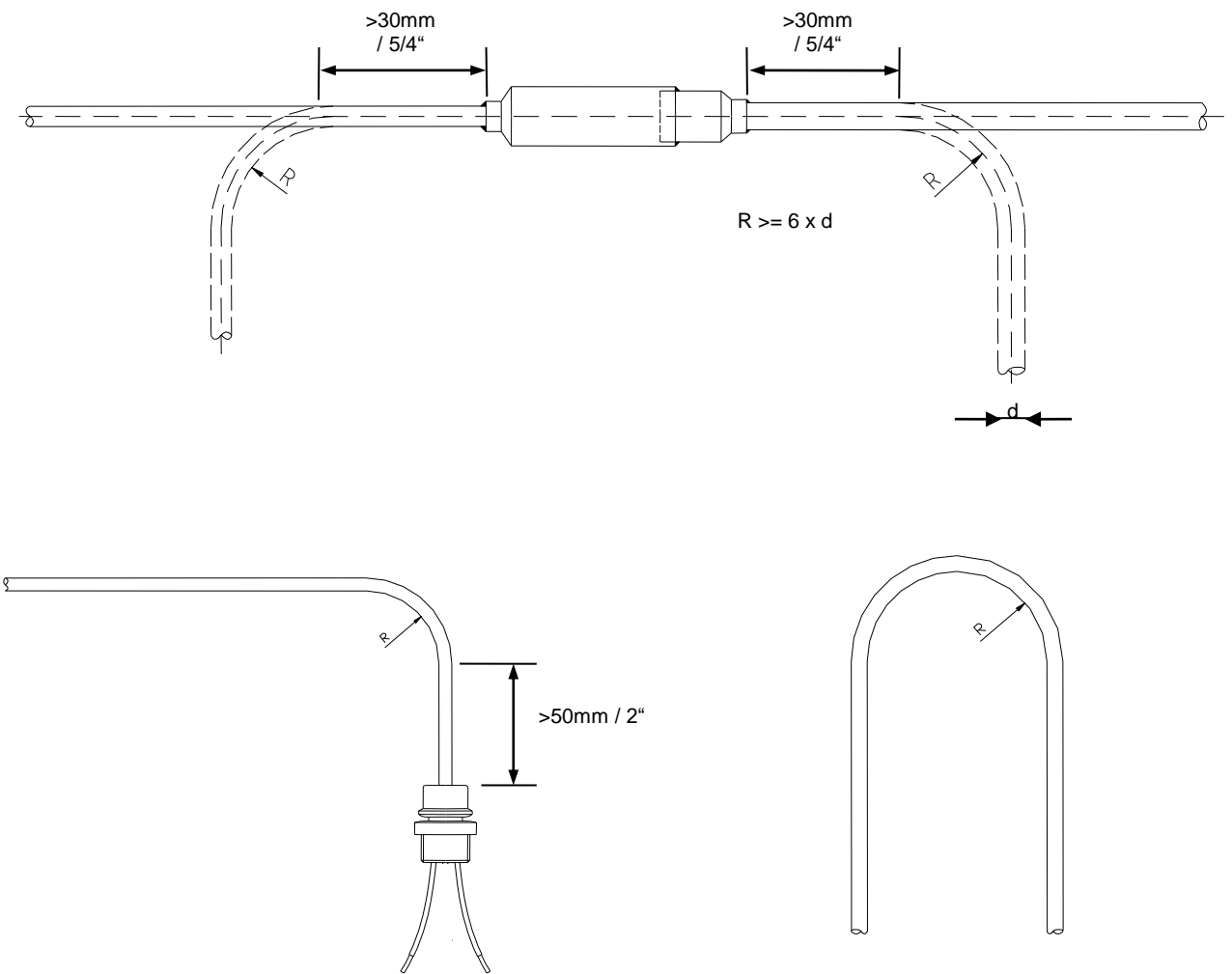
After completion of a heating circuit and prior to the installation of the thermal insulation, the following steps shall be taken:

- perform visual inspection of the heating cable for possible mechanical damage or improper installation.
- perform insulation resistance test
 - the insulation resistance of each heating circuit is to be measured between each single bus wire / twin bus wire and the protective braid or screen. The measured values are to be recorded.
 - test voltage: min 500 VDC, max. 1000 VDC.
 - regardless of heating circuit length, the insulation resistance must not be lower than 20 MOhm (the measured values are to be noted and recorded). In case of a lower insulation resistance, the source of defect has to be determined and eliminated.
- check the operation of the heating circuit (only in connection with the required temperature controller and/or limiter)
- in case of damage, replace trace heater immediately.
- repeat the tests after the thermal insulation has been applied. The insulation resistance must not now be lower than 5 MOhm.

7. Operation and Maintenance

- follow local codes and regulations for the use of electrical heating cables
- the permissible operating specifications stated in the data sheets (i.e. voltage, amperage, exposure temp., operating temp., IP rating) are to be followed accordingly
- the permissible temperatures provided in section “Technical Data” and on the type plate must not be exceeded
- the maximum operating temperature given on the type plate must not be exceeded
- the use of temperature controllers may be desired (e.g. to conserve energy) or required (e.g. to maintain accurate temperature control, hazardous area applications etc.). Contact eltherm project department for assistance.
- Trace heaters ELK-MI-**** are generally maintenance free. However, it is recommended that the heating cables be checked by qualified personnel in regular intervals for damage and insulation resistance.
- disconnect any power supply to the heating system prior to opening of any controllers, junction boxes and terminations. Access is only permitted when heating system is de-energized.
- protect installed heating cable against damage which may occur during repair work on heated components
- after completion of the repair, the heating circuit will once again need to be tested as shown in paragraph 6 “Test and Commissioning”.
- damaged heating circuits shall not be operated. This is the case when:
 - heater or attached leads show damage or deformation
 - the circuit is electrically defective (open circuit, high leakage current)
 - after thermal or mechanical overstress
 - after failure of temperature controls
 - after damage to the workpiece to which the heater is installed
- readings of ohmic resistance and insulation resistance are to be taken from cold heaters only
- check temperature control units and control devices annually by trained workers or authorized personnel.

Installation of Trace Heater





MONTAGEANLEITUNG / INSTALLATION INSTRUCTIONS
für mineralisoliertes Heizkabel / for MI Heating cable

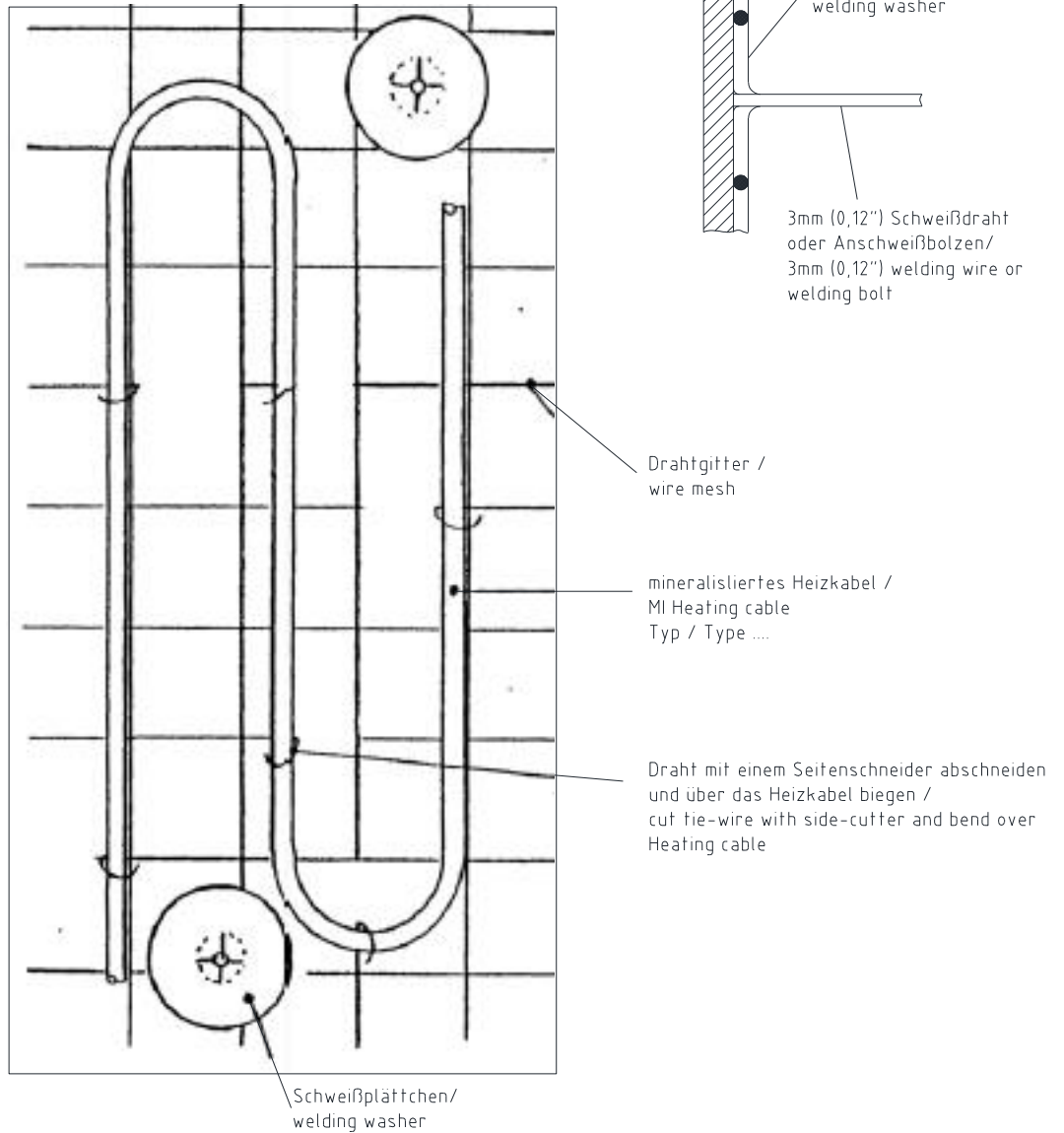
3mm (0,12") Schweißdraht
oder Anschweißbolzen/
3mm (0,12") welding wire or
welding bolt

Nach der Heizkabelmontage die gesamte Fläche mit einer selbstklebenden Alufolie oder anderer Alufolie 100%-ig abdecken / 100% covered with Aluminium foil after installing Heating cable.

DRAHTKÖRBE / wire comb
für Ventile, Hähne, Pumpen und andere Einbauten /
for valves, drain valves, pumps and other components

P.O.S.		Stück		Werkstoff/DIN		Maße/Zeichn.-Nr./Art.-Nr.	
DIN ISO 2768 T1 C				Verlegeschema		MI-Heizkabel mit Gitter	
DIN ISO 2768 T2 L				eltherm		TBL 1.008Q221.01	
Normart		Abw.		Name		TBL	
6 ± 0,3				Datei		%	
30 ± 0,5				Inter		%	
300 ± 0,8				Gez.		23.07.2006	
120 ± 0,1				Esp.		23.07.2006	
1000 ± 0,2				JSt			
1000 ± 0,3				FFREI			
eltherm				Elektrowärmetechnik			
EMT-Helms-Strak 8-10				Forman DIN AS			
57239 Bursach				Druck Nr.			

MONTAGEANLEITUNG / INSTALLATION INSTRUCTIONS
für mineralisierte Heizkabel / for MI Heating cable

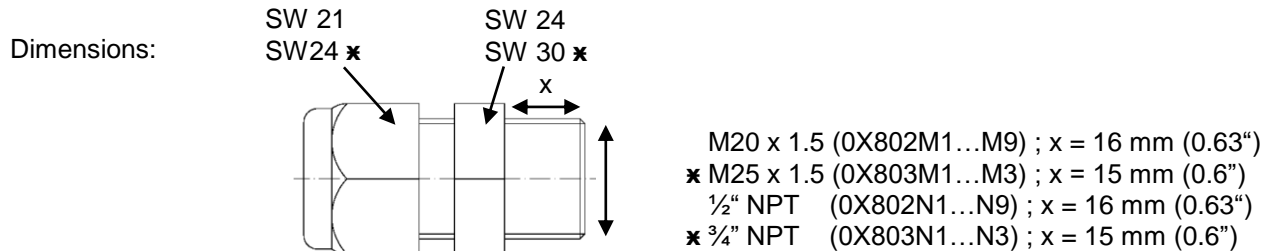


Nach der Heizkabelmontage die gesamte Fläche mit einer selbstklebenden
Alufolie (oder anderer Alufolie 100%-ig abdecken.)
100% covered with Aluminium foil after installing Heating cable.

Installation of gland

Design and Technical Data

The Ex-Gland MICL consists of double nipple, nut and compression ring. All parts that are accessible from outside are constructed of stainless steel. The glands with metric thread contain an additional O-ring.



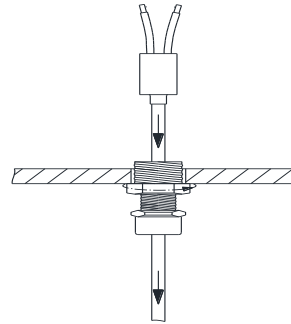
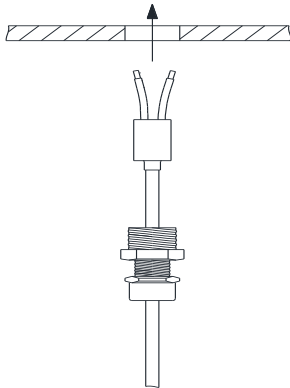
torques: double nipple – enclosure 20 Nm (15 ft lb)
 nut 30 Nm (22 ft lb)

IP Rating: IP 64, Nema 3

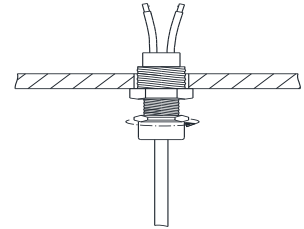
Installation

- before installation, check conditions of thread in junction box (clean, undamaged). Required thread: see marking on gland. Threads in enclosure wall need to comply with the local requirements
- check Ex-Gland for integrity. The nut should be loosely in place in order not to deform the compression ring.
- install double nipple in box wall by using an appropriate wrench (size 24/size 30). If the box wall is uneven, an additional seal shall be placed between intermediate gland and box wall. Tighten double nipple (torque 20 Nm/15 ft lb).
- insert heating cable as shown below:

insert cable end into junction box



fasten double nipple into thread
 (20 Nm / 14.75 ft lb), pull cable
 back until end pot rests in
 gland



tighten nut (30 Nm / 22 ft lb),
 prevent double nipple from
 turning

4. Operation and Maintenance

The compression ring is to be used one time only.

After proper installation, the Ex-Gland can in principle be operated maintenance-free. However, it is recommended to check the Ex-Gland and the inserted heating cable in suitable intervals for integrity and proper fit. If required, the Ex-Glands are to be tightened again. Damaged Ex-Glands cannot be exchanged separately. Please consult the eltherm project department if assistance is required in this regard.