Environmental Product Declaration

AT-TS

TEMPERATURE SENSING THERMOSTAT

Chemelex RAYCHEM AT-TS Thermostats are electronic line or ambient sensing thermostats for self-regulating heating cables in pipe freeze protection or temperature maintenance applications.

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Chemelex is a global leader in electrical heat tracing products and services, mineral-insulated fire rated wiring, electrical floor heating systems, and fluid Leak detection systems. The company supports customers with products and services in industries ranging from commercial and residential construction, data centers, energy, industrial process heating and transportation. Its products are marketed globally under leading brands including Raychem, Tracer, NuHeat, and Pyrotenax.

Chemelex's Raychem brand is at the forefront of the heat tracing industry. Products include industrial process heating systems, pipe freeze protection, surface snow melting & de-icing, floor heating, and hot water temperature maintenance. Raychem's solutions are vital in sectors including energy, infrastructure, and commercial & residential building. Applications ensure accurate temperature maintenance for operational efficiency, enhanced safety and customer comfort.

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RAYCHEM AT-TS
Temperature sensing thermostat

According to ISO 14025 and EN 15804+A2

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	UL Solutions www.ul.com 333 Pfingsten Rd, Northbrook, IL 60062 www.spot.ul.com
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	UL Solutions General Program Instructions v.2.7 2022
MANUFACTURER NAME AND ADDRESS	Chemelex, 15375 Memorial Drive, Houston, TX 77079, United States
DECLARATION NUMBER	4791545949.101.1
DECLARED PRODUCT	AT-TS electronic thermostat
FUNCTIONAL UNIT	Control the ambient temperature set by the user in a defined temperature range of -5 to 15˚C in one zone, for pipe freeze protection applications, and for the reference service life of the product of 20 years.
REFERENCE PCR AND VERSION NUMBER	Core PCR: EN 15804:2012+A2:2019 PCR: PEP-PCR-ed4-EN-2021 09 06 PSR: PSR-0005-ed3-EN-2023 06 06
DESCRIPTION OF PRODUCT APPLICATION/USE	Electronic line or ambient sensing thermostats for self-regulating heating cables in pipe freeze protection or temperature maintenance applications.
PRODUCT RSL DESCRIPTION (IF APPL.)	20 years
MARKETS OF APPLICABILITY	Global
DATE OF ISSUE	April 21, 2025
PERIOD OF VALIDITY	5 Years
EPD TYPE	Product-specific
RANGE OF DATASET VARIABILITY	N/A
EPD SCOPE	Cradle-to-grave
YEAR(S) OF REPORTED PRIMARY DATA	2023
LCA SOFTWARE & VERSION NUMBER	LCA For Experts 10.8
LCI DATABASE(S) & VERSION NUMBER	Sphera MLC 2024.2
LCIA METHODOLOGY & VERSION NUMBER	EF 3.1 (as per EN 15804+A2)
The PCR review was conducted by:	PepEcoPassport PCR Review Panel contact@pep-ecopassport.org
This declaration was independently verified in accordance with ISO 14025: 2006. ☐ INTERNAL ☒ EXTERNAL	Cooper McCollum, UL Solutions
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	WAP Sustainability
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Peter Yeon, H.I.P. Pathway

LIMITATIONS

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

1. Product Definition and Information

1.1. Description of Company/Organization

Chemelex is a global leader in electric thermal and sensing solutions, protecting the world's critical processes, places and people. With over 50 years of innovation and a commitment to excellence, we develop solutions that ensure safety, reliability, and efficiency in diverse environments – from industrial plants and data centers to people's homes. Chemelex delivers future-ready technologies, advanced engineering capabilities and local expertise backed by global standards. Our offering includes a leading portfolio from our trusted brands: Raychem, Tracer, Nuheat and Pyrotenax.

1.2. Product Description

Figure 1: AT-TS Product Image

The reference product for the Chemelex RAYCHEM AT-TS thermostats is AT-TS-13. This product provides temperature control in safe area. The temperature set point can be checked through a window in the lid. LED´s are providing an indication when cables are energized (Heating ON) or when the temperature sensor is defect (sensor break or sensor short-circuit).

The temperature sensor has a length of 3 meter and can be shortened for ambient sensing operating. Direct connection of the heating cable is possible. Connection kits need to be ordered separately. The thermostat is available in 2 temperature ranges.

Table 1: Products covered in the EPD

PRODUCT NUMBER	PRODUCT NAME	TEMPERATURE CONTROL RANGE
648945-000	AT-TS-14	0 – 120 °C
728129-000	AT-TS-13	-5 – 15 °C

1.3. Application

Chemelex RAYCHEM AT-TS Thermostats are electronic line or ambient sensing thermostats for self-regulating heating cables in pipe freeze protection or temperature maintenance applications.

1.4. Technical Requirements

The technical requirements are available on the Chemelex product page under engineering specifications: https://www.nvent.com/en-gb/raychem/products/ts-surface-sensing-thermostat-0

1.5. Properties of Declared Product as Delivered

The product is packaged in a cardboard box.

1.6. Material Composition

Table 2: Material composition, per unit

MATERIAL	Weight [%]
COPPER	15
STEEL	5
PLASTIC	42
ELECTRONICS	38
TOTAL	**100**

1.7. Manufacturing

The manufacturing process of the thermostat begins with the preparation of raw materials and components. The parts are then assembled and soldered onto printed circuit boards (PCBs). The assembled unit is then mounted into a protective housing and packaged for shipment to customers or distributors.

1.8. Packaging

The product packaging is made from recyclable materials.

The materials and components received from supplier for product manufacturing was also taken into account as per requirements from PSR section 3.1.5.1 (P.E.P. Association, 2023). An average packaging content of 5% of the reference input material has been considered and broken down as followed: 50% wood, 40% cardboard and 10% low-density polyethylene. This packaging is assumed to be disposed according to the European default scrap rates from Table 3 of the PSR in absence of specific data (P.E.P. Association, 2023).

1.9. Transportation

The units are assembled in Germany at the manufacturing site of the supplier, Karré Elektronik GmbH, and shipped from Germany to the Chemelex EU distribution center in Leuven by truck. From Leuven the units are shipped by truck or air to customers all over Europe and Asia.

1.10. Product Installation

Installation only requires the use of hand tools. No maintainance is required after installation.

1.11. Use

The AT-TS electronic thermostats operate on electricity during their use stage. The Table 3 below summarizes the power consumption and the average running time information for the product.

Table 3: Use stage details

	POWER CONSUMPTION (WATTS)	RUNNING TIME (HOURS/YEAR)
FULL OPERATION	1.8 W	480
STEADY STATE	1 W	8280

1.12. Reference Service Life

The reference service life (RSL) of the product is 20 years.

1.13. Reuse, Recycling, and Energy Recovery

The end-of-life disposal rates (recycling, energy recovery, and disposal) used in the study were based on EN 50639:2019 – Product category rules for life cycle assessments of electronic and electrical products and systems, Table G.4, and as shown in Table 4.

Table 4: End-of-life disposal rates

	MATERIAL RECOVERY RATE (%)	ENERGY RECOVERY RATE (%)	DISPOSAL RATE (%)
COPPER	60	0	40
ALUMINUM	70	0	30
STEEL	80	0	20
PLASTIC	20	40	40
ELECTRONICS	50	0	50
MINERALS AND OTHER ADDITIVES	0	0	100

1.14. Disposal

The thermostat must be disposed of as Waste Electrical and Electronic Equipment (WEEE directive) according to local regulations.

2. Life Cycle Assessment Background Information

2.1. Functional Unit

The functional unit is to "*control the ambient temperature set by the user in a defined temperature range of -5 to 15˚C in one zone, for pipe freeze protection applications, and for the reference service life of the product of 20 years*".

The associated reference flow is 1 unit of electronic thermostat.

2.2. System Boundary

This EPD is a Cradle-to-Grave study.

2.3. Estimates and Assumptions

All estimates and assumptions are within the requirements of ISO 14040/44 and EN 15804+A2. The primary data was collected as annual totals for electricity usage and production volume. The utility usage information was divided by the production to find a utility consumption per kilometer of cable produced.

2.4. Cut-off Criteria

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit.

2.5. Data Sources

Primary data were collected by facility personnel and from utility bills and was used for all manufacturing processes. Whenever available, supplier data was used for raw materials used in the production process. When primary data did not exist, secondary data for raw material production was utilized from Sphera Managed LCA Content Database 2024.2.

2.6. Data Quality

The geographical scope of the manufacturing portion of all life cycle modules is North America. All primary data were collected from the manufacturer. The geographic coverage of primary data is considered excellent. Time coverage of this data is considered excellent. Primary data provided by the manufacturer is specific to the technology used in manufacturing their product. It is site-specific and considered of good quality. Data necessary to model cradle-to-gate unit processes was sourced from Sphera Managed LCA Content LCI datasets.

2.7. Period under Review

The period under review is the full calendar year 2023.

2.8. Allocation

General principles of allocation were based on ISO 14040/44. To derive a per-unit value for manufacturing inputs such as electricity, thermal energy and water, allocation based on total production by mass was adopted. As a default, secondary Sphera Managed LCA datasets use a physical basis for allocation.

3. Life Cycle Assessment Scenarios

It is assumed that all raw materials are delivered to the manufacturing facility via truck and ship, based on global region. Distances were calculated using the supplier location and the location of manufacturing.

Table 5. Transport to the building site (A4)

NAME	UNIT	TRUCK	RAIL	SHIP	AIR
Vehicle type		Heavy Heavy-duty Diesel Truck / 53,333 lb payload – 8b	Rail transport cargo – Diesel, average train, gross tonne weight 1,000t/726t pay load capacity	Bulk commodity carrier, 1.000 to 250.000 dwt payload capacity, deep sea	Cargo plane, 65t payload
Fuel efficiency for full vehicle	l/100km	42	1.17E-05 kg / kg	15,134	1.75E-03 kg / lb
Capacity utilization (including empty runs, mass based	%	85	40	53	66
Transport distance	km	1.57E+03	-	-	4.98E+03
Gross density of products transported	kg/m^3	n/a			
Weight of products transported (if gross density not reported)	kg	9.30E-01			
Volume of products transported (if gross density not reported)	m^3	n/a			

Table 6. Installation into the building (A5)

NAME	VALUE	UNIT
Ancillary materials	0.00E+00	kg
Net freshwater consumption specified by water source and fate (amount evaporated, amount disposed to sewer)	0.00E+00	m^3
Other resources	0.00E+00	kg
Electricity consumption	0.00E+00	MJ
Other energy carriers	0.00E+00	MJ
Product loss per functional unit	0.00E+00	kg/unit
Waste materials at the construction site before waste processing, generated by product installation	2.70E-01	kg/kg
Output materials resulting from on-site waste processing (specified by route; e.g. for recycling, energy recovery and/or disposal)	0.00E+00	kg
Biogenic carbon contained in packaging	1.16E-01	kg C
Direct emissions to ambient air, soil and water	0.00E+00	kg
VOC content	0.00E+00	$\mu g/m^3$

Table 7. Reference Service Life

NAME	VALUE	UNIT
RSL	20	years
Declared product properties (at the gate) and finishes, etc.	As per EN 60730-1:2012	
Design application parameters (if instructed by the manufacturer), including references to the appropriate practices and application codes)	Temperature control of pipe freeze protection system	
An assumed quality of work, when installed in accordance with the manufacturer's instructions	100	%
Outdoor environment	As per EN 60730-1:2012	
Indoor environment	As per EN 60730-1:2012	
Use conditions	Winter period	
Maintenance	No replacements are necessary.	

Table 8. Operational energy use (B6)

NAME	VALUE	UNIT
Lifetime of cable	20	years
Power consumption over lifetime	6.58E+02	MJ/unit

Table 9. End of life (C1-C4)

NAME		VALUE	UNIT
Recovery (specified by type)	Reuse	0.00E+00	kg
	Recycling	2.53E-01	kg
	Landfill	2.96E-01	kg
	Incineration	1.12E-01	kg
	Incineration with energy recovery	0.00E+00	kg
Disposal (landfill)	Product or material for final deposition	2.96E-01	kg
Removals of biogenic carbon (excluding packaging)		0.00E+00	kg CO_2

Table 10. Reuse, recovery and/or recycling potentials (D), relevant scenario information

NAME	VALUE	UNIT
Net energy benefit from energy recovery from waste treatment declared as exported energy in C3 (R>0.6)	0.00E+00	MJ
Net energy benefit from thermal energy due to treatment of waste declared as exported energy in C4 (R<0.6)	1.20E+00	MJ
Net energy benefit from material flow declared in C3 for energy recovery	0.00E+00	MJ

4. Life Cycle Assessment Results

Table 11. Description of the system boundary modules

	PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
Cradle to Grave	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Modules B1-B5, B7 and C1 to be reported were all zero following the calculation, hence have not been included in the results tables for an easier reading experience.

4.1 Life Cycle Impact Assessment Results

Table 12. EF 3.1 Impact Assessment Results, AT-TS-13, per unit

EF 3.1	A1 – A3	A4	A5	B6	C2	C3	C4	D
GWP_{total} [kg CO_2 eq]	5.62E+00	2.75E+00	2.58E-01	7.55E+01	4.84E-02	2.41E-01	7.12E-03	-8.44E-01
GWP_{fossil} [kg CO_2 eq]	5.96E+00	2.75E+00	1.87E-02	7.44E+01	4.75E-02	2.41E-01	7.11E-03	-8.44E-01
$GWP_{biogenic}$ [kg CO_2 eq]	-3.50E-01	2.84E-03	2.39E-01	1.04E+00	1.15E-04	1.24E-05	-2.34E-05	4.09E-03
$GWP_{land\ use}$ [kg CO_2 eq]	1.40E-02	1.69E-03	2.18E-04	1.46E-02	8.06E-04	4.40E-06	2.67E-05	-3.47E-03
ODP [kg CFC-11 eq]	5.88E-11	1.77E-13	1.39E-14	2.34E-09	7.07E-15	3.21E-14	2.24E-14	-1.41E-11
AP [kg SO_2 eq]	3.08E-02	1.13E-02	1.66E-04	1.17E-01	5.11E-04	1.69E-04	4.35E-05	-1.07E-02
$EP_{freshwater}$ [kg N eq]	3.34E-05	9.10E-07	6.33E-07	4.66E-04	2.05E-07	8.99E-09	1.90E-06	-1.75E-06
EP_{marine} [kg N eq]	4.99E-03	5.17E-03	9.80E-05	3.64E-02	2.58E-04	8.31E-05	1.03E-05	-6.80E-04
$EP_{terrestrial}$ [kg N eq]	5.28E-02	5.67E-02	8.61E-04	3.75E-01	2.84E-03	9.46E-04	1.10E-04	-7.01E-03
POCP [kg O_3 eq]	1.50E-02	1.45E-02	2.03E-04	8.76E-02	4.88E-04	2.13E-04	3.17E-05	-2.40E-03
$ADP_{element}$ [kg Sb-eq]	5.28E-04	7.28E-08	1.34E-09	1.57E-05	4.18E-09	3.57E-10	4.95E-10	-4.73E-04
ADP_{fossil} [MJ, LHV]	9.48E+01	3.61E+01	2.56E-01	1.04E+03	6.32E-01	8.24E-02	1.19E-01	-1.18E+01
WDP [m^3]	1.32E+00	5.62E-03	7.48E-04	2.41E+00	7.43E-04	3.00E-02	8.59E-04	-3.79E-01

Table 13. Resource Use Indicators, per unit

PARAMETER	A1 – A3	A4	A5	B6	C2	C3	C4	D
PERE [MJ]	3.17E+01	2.39E-01	2.35E-02	1.12E+03	5.44E-02	1.86E-02	1.75E-02	-4.74E+00
PERM [MJ]	3.59E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT [MJ]	3.20E+01	2.39E-01	2.35E-02	1.12E+03	5.44E-02	1.86E-02	1.75E-02	-4.74E+00
PENRE [MJ]	8.07E+01	3.61E+01	2.56E-01	1.04E+03	6.32E-01	8.24E-02	1.19E-01	-1.18E+01
PENRM [MJ]	1.41E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT [MJ]	9.48E+01	3.61E+01	2.56E-01	1.04E+03	6.32E-01	8.24E-02	1.19E-01	-1.18E+01
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m^3]	5.65E-02	2.92E-04	3.17E-05	3.53E-01	6.06E-05	7.05E-04	2.60E-05	-1.11E-02

Table 14. Output Flows and Waste Categories, per unit

PARAMETER	A1 – A3	A4	A5	B6	C2	C3	C4	D
HWD [kg]	9.50E-06	1.05E-09	2.24E-11	2.58E-06	2.42E-11	3.99E-11	2.88E-11	-1.10E-06
NHWD [kg]	4.49E-01	3.50E-03	6.22E-02	1.06E+00	1.03E-04	9.35E-03	2.95E-01	3.67E-01
RWD [kg]	3.32E-03	3.29E-05	1.42E-06	1.00E-01	1.15E-06	2.92E-06	1.62E-06	-6.67E-05
CRU [kg]	1.73E-02	0.00E+00	8.96E-02	0.00E+00	0.00E+00	2.53E-01	0.00E+00	0.00E+00
MFR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.63E-01
EEE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E+00

EET [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 15. Additional Indicators, per unit

PARAMETER	A1 – A3	A4	A5	B6	C2	C3	C4	D
PM [disease incidence]	3.64E-07	5.09E-08	1.62E-09	9.16E-07	5.00E-09	6.51E-10	4.79E-10	-8.68E-08
IRP [kBq U235 eq]	3.47E-01	4.30E-03	2.11E-04	1.06E+01	1.67E-04	4.36E-04	2.18E-04	-6.40E-03
ETP [CTUe]	4.20E+01	2.69E+01	2.25E-01	3.87E+02	4.69E-01	3.92E-02	1.60E-01	-7.36E+00
HTCE [CTUh]	2.61E-09	4.85E-10	4.06E-12	2.22E-08	9.56E-12	2.03E-12	2.71E-12	-5.21E-10
HTnCE [CTUh}	8.97E-08	1.55E-08	3.11E-10	3.05E-07	4.26E-10	1.70E-10	6.63E-11	-1.31E-08
LU [Pt]	5.71E+01	7.13E-01	8.94E-02	7.31E+02	3.11E-01	1.91E-02	2.02E-02	-7.58E+00

5. LCA Interpretation

The use stage (B6) contributes to the majority of impacts across the life cycle stages, and across all indicators, except for ADP - elements, as shown in Figure 2. This is due to the energy required to operate the thermostat during its lifetime. The manufacturing stage is the largest contributor to the abiotic depletion potential – elements, due to the raw materials required for producing the thermostat.

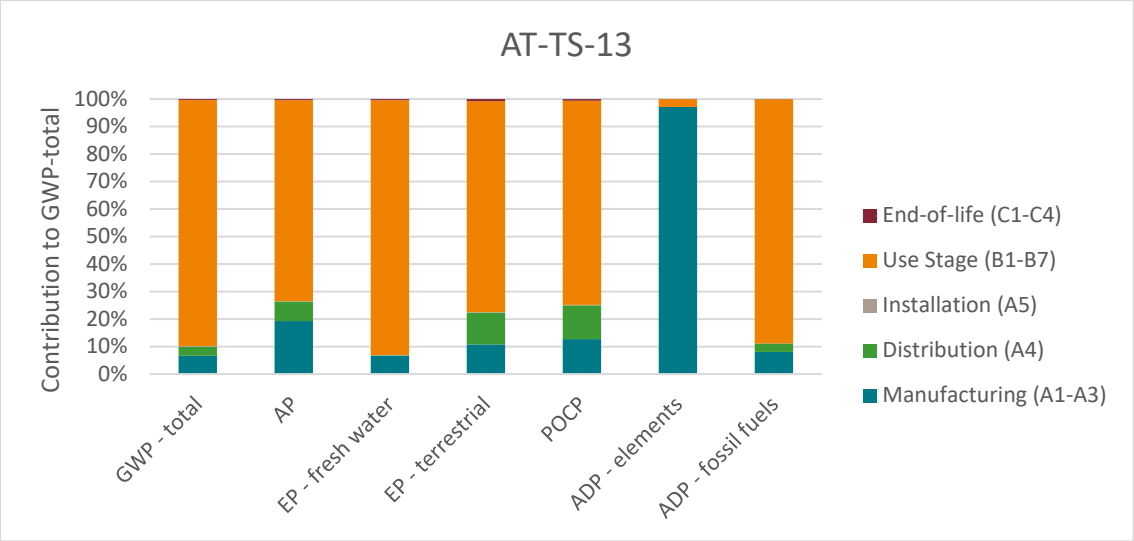

Figure 2: LCA Results for AT-TS-13, by life cycle stage

6. Additional Environmental Information

6.1 Environment and Health During Installation

Further information about the product installation can be found on the Chemelex RAYCHEM website product page: https://www.nvent.com/en-gb/raychem/products/ts-surface-sensing-thermostat-0

6.2 Environmental Activities and Certifications

The manufacturing site holds the following certifications:

- EN ISO 9001 quality management certified - since 2002
- EN ISO 14001:2005 Environmental Management Systems certified
- IPC-A-610 Acceptability of Electronics Assemblies Endorsement Program
- IPC-7711B/-7721 Repair and Modification of Printed Boards and Electronic Assemblies
- IPC-J-STD-001 Requirements for Soldered Electrical and Electronic Assemblies
- DIN EN ISO / IEC80079-34 Explosive atmospheres: Application of quality management systems for Ex Product manufacture

6.3 Further Information

Further information about the product can be found on the Chemelex RAYCHEM website product page: https://www.nvent.com/en-gb/raychem/products/ts-surface-sensing-thermostat-0.

7. References

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