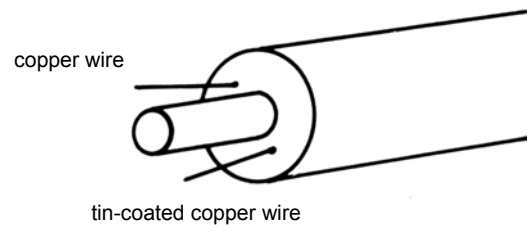


THE ALARM SYSTEM

The base of the system consists of two non-insulated copper alarm wires with section equal to 1.5 mm², located inside polyurethane foam parallel to the conduit pipe, offset in relation to one another by 180°, in 9 and 3 o'clock positions.

The system measures the resistance between the alarm wire and the conduit pipe. The alarm system is an impulse system.



The network is monitored by an LPS-2I fault detector for impulse systems. It is suitable for monitoring two sections of pre-insulated heating networks with alarm cable length equal to 2,000 meters per pipe. During the measurement cycle, the resistance of the polyurethane insulation and the resistance of the sensor loop are measured. Also, in each measurement cycle, calibration of the device is performed. The accuracy of measurements is not affected by changes in the ambient temperature or by disturbances caused by electric physical phenomena occurring in the conduit pipe. Measurement data is presented on an alphanumeric display as digital values and text messages. The illuminated field of the display consists of two 16-character lines. Each line is assigned to one measurement canal (one sensor loop).

Alarm systems of large networks may be built using the aforementioned fault sensor with an additional communications module for data transmission. This allows for sending information on the status of the heating network and the alarm circuit to the data collection system devices.

If it is necessary to install fault detectors in open spaces, they are placed in detached cabinets and connected with a 3-core YDYp cable with the alarm cables of the pipeline.

In the event of a failure, the detectors switches on an exterior signaling (sound- or light-emitting) device. The execution element is the relay; the contacts of the relay are connected with the exterior connection socket with the inscription "alarm."

The location of the faults is determined using an impulse fault locator. The advantage of a system where the location of faults is determined by measuring the reflection of an impulse is its precision.

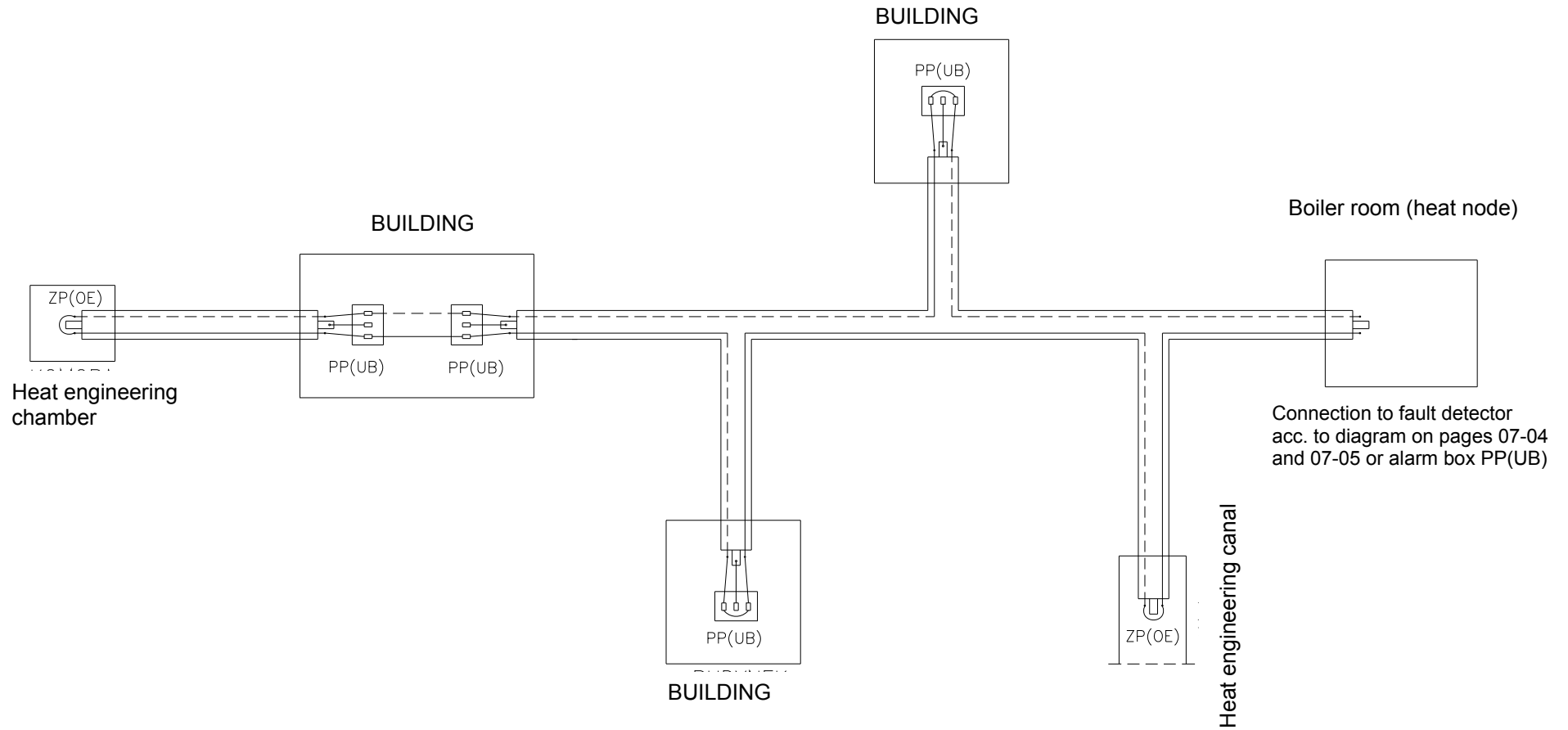
Location of faults may be determined by the STAR PIPE service crew.

To assure correct determination of defect location, an as-built diagram of the alarm system must be made during the construction of the network; the diagram must include information on the lengths of all the wires integrated into the alarm circuit.

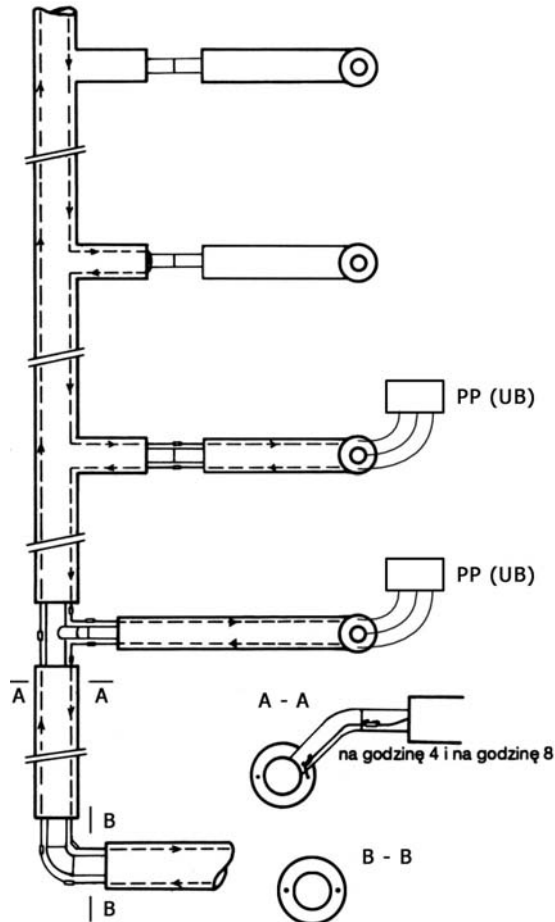
The minimum resistance of the polyurethane foam in pre-insulated STAR PIPE pipes should be equal to 500kΩ per 1000 m of the alarm cable (measured at 24V D.C. according to EN14419).

REMARK: our offer includes fault signaling devices of the 756 and 756-2 type and signaling devices of the ACN 2Z and ACN 4N type.

SIMPLIFIED ALARM SYSTEM DIAGRAM



CONNECTION DIAGRAMS



If alarm cables are not used in branches, pre-insulated T-connections with alarm cables only in the main pipes (purchased components) can be supplied if requested.

If alarm cables are used only in the main pipes, alarm cables in the branches of the T-connection are connected and pressed into the foam so as to prevent their connection with the conduit pipe (ZP (OE) type connection). The connection is made by putting a copper connector on the wires and then soldering it with tin.

If the alarm system is used in the whole pipeline system and a fault detector is not installed on a given end of the pipeline, then alarm cables are connected at the end of the entrance pipe or elbow to a terminal block (PP (UB) type of connection). The free side of the foam is covered with a heat-shrinking ending.

If a pipeline which includes an alarm system uses folded T-connections, the alarm wires must be connected so that they constitute an uninterrupted circuit at all times. If the assembly elbow is directly adjacent to the main pipe, alarm wires are connected according to the diagram, and a fault detector is not installed on a given end of the pipeline, the connection at the end of the pipe or an entrance elbow is made the way described above. Alarm cables on the assembly elbow are placed in the 4 and 8 o'clock positions.

Alarm cables in folded elbows are connected as shown on the diagram, in the 3 and 9 o'clock positions.

REMARK: The fault detector is connected in accordance with the diagrams shown on pages 07-4.

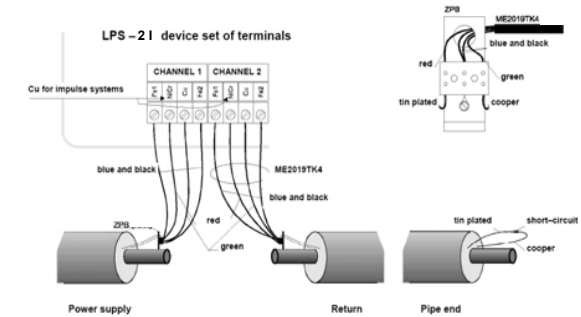
LPS-2I FAULT DETECTOR

Technical data:

1. The number of monitored sections of the heating network (canals) 2
2. Max. length of monitored alarm cables (per canal) 2,000 m
3. Method of presenting information display 2x16 characters
LED diode with inscription "FAILURE"
4. Scope of resistance measurement of polyurethane insulation .0.2kΩ÷200MΩ
 - Accuracy of measurement of resistance of polyurethane insulation: ±5% of read value ±3 digits
 - measurement range 0,2kΩ÷100MΩ
 - measurement range 100MΩ÷200MΩ ±10% of read value ±5 digits
5. Scope of measurement of resistance of alarm loop 0÷70Ω
6. Scope of measurements of the length of the heating network section 0-2,000 m
7. Measurement ranges distinguished by illumination of LED diode with inscription FAILURE
 - Range of values of resistance of leaks 0,1kΩ ÷1MΩ
 - Range of values of resistance of direct short-circuit of the alarm loop wire with the conduit pipe 1Ω ÷ 0,45 MΩ
 - Maximum value of resistance of the alarm loop for message L>Lmax <100 kΩ
 - Minimum value of resistance of the alarm loop for the Break message ≥100 kΩ
8. Meaning and content of symbols and text messages
 - Symbols of measurement canals (sections of heating network) 1;2
 - Value of resistance of insulation PUR > starting from 150 MΩ Dry
 - Symbol of the length of the heating network section L
 - Symbol of short-circuit of the sensor loop cable with the conduit pipe C
 - Symbols of resistance units Ω, kΩ, MΩ
 - No connection of the device with the conduit pipe Connect pipe
 - Exceeding of the measurement range for the measurement of length of the heating network section L>Lmax
 - Electric break in the sensor loop Break
9. Method of sending information to the data collection system:
 - status of contacts (closed/open) of the ALARM connection;
 - module of digital data transmission LPS-RS;
 - radio data transmission module, LPS-GSM.
10. Supply voltage: 230V 50Hz
11. Operating temperature range: 0 ÷ 50°C
12. Tightness class of the casing IP65.
13. Dimensions of the device 210x200x120



Connection diagram



Characteristics of the work environment:

The device is intended for work in closed premises. The meter works correctly when the ambient temperature is 5°C to +50°C; relative humidity may not exceed 80%. During storage of the device, the ambient temperature may be within the range of -40°C to +70°C.

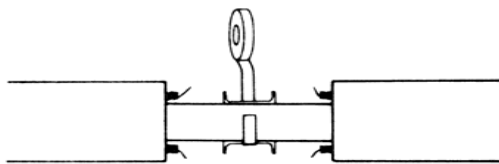
If the measuring device has been stored at less than +5°C, then before it is energized it should be for 3 hours in conditions corresponding to the actual working conditions.

The device may not be operated in premises with high dust levels or with atmosphere containing explosive gasses or corrosive gasses.

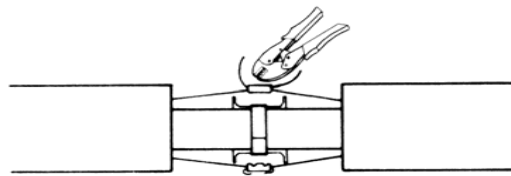
The parameters tolerances shown in the technical data are achieved after 30 min. of work of the meter in technical conditions which are suitable for it.

DETECTOR CONNECTION ACCESSORIES:

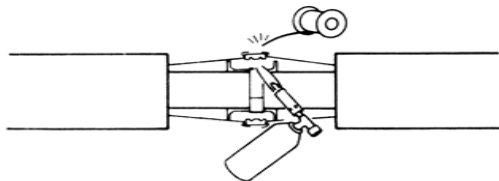
- Connection ZPB – 2 pieces
- Wire ME2019 TK4 – 2 x 3 m

ASSEMBLY OF ALARM WIRES

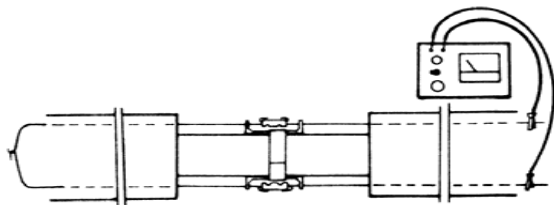
Before the assembly starts, the conduit pipe must be dry and clean. The supports are placed on the alarm cable lines in the 3 and 9 o'clock positions and fixed with a tape (wrapped three times around).



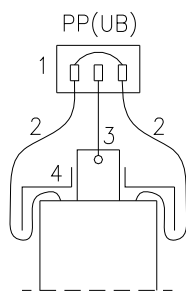
The spirally wound alarm wires must be straightened and cleaned with a soft cloth to remove grease, paint, etc. Then the wires must be put through a copper connector as shown in the drawing below. The wires must be bent. The connector must be squeezed on the wires with pliers a few times at the distance of 5 m from each end. The extraneous parts of the wires must be cut off.



The copper connector must be soldered with tin.

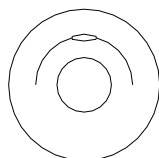
**Control measurement**

- After the ohm-meter switch is set in the “ Ω ” position, one must check if there is no break in the alarm wire circuit. The maximum resistance is 1 Ω per 100 m of the wire.
- Each time during the assembly one must check if the alarm wires do not touch the conduit pipe. This can be done with a meter with the switch set in the “V-M Ω ” position.

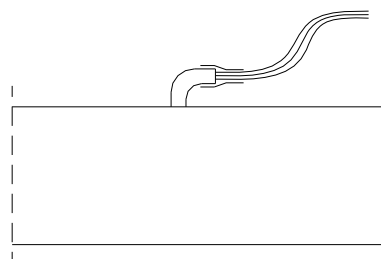
CONNECTIONS OF ALARM WIRE LEADS**Leads of alarm wires – type PP (UB)**

Application: ending an alarm system in buildings without connecting a fault detector (with a fault detector connected in accordance with the diagrams shown on pages 07-4 and 07-5)

1. Terminal box PP (UB)
2. Insulated alarm wire 1.5 mm²
3. 8 mm screw with a nut to connect the grounding wire
4. Heat-shrinking end

**Leads of alarm wires – type ZP (OE)**



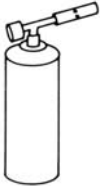


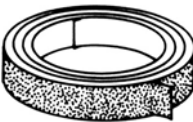


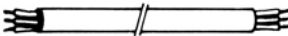

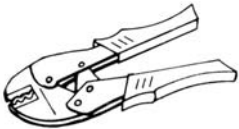
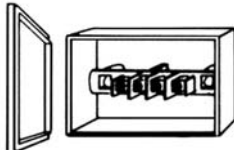

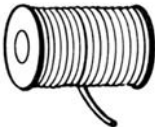
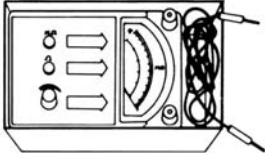
Application: closing a circuit in a pre-insulated pipe, for example in a T-connection on a branch which will be installed in pipes without an alarm system, or on the end of pipes under a heat-shrinking end

**Leads of alarm wires – type ZS**

Application: leads of alarm wires into field cabinets

To be used if the length of the network is greater than the measurement range of the fault detector
Done by STAR PIPE service crews

ACCESSORIES TO THE ALARM SYSTEM

 <p>Ø1,5 mm² copper wire</p>  <p>Ø 1,5 mm² insulated copper wire</p>	 <p>Gasburner with cylinder</p>	 <p>2-canal fault detector LPS-21</p>
 <p>Copper muff Ø 4 x 10 mm</p>	 <p>Grinding paper</p>	<p>DETECTOR CONNECTION ACCESSORIES</p>
 <p>Wire bridges 90 x 20 x 20 mm</p>		
 <p>Paper tape 25 mm x 20 m</p>	 <p>3-lead cable 3 x 1,5 mm² YDYp</p>	 <p>ZPB connector for fault detector</p>
 <p>Crimping tool</p>	 <p>Connection box PP(UB)</p>	 <p>ME2019 TK4 cable for fault detector</p>
 <p>Solder 60% 2 mm with flux</p>	 <p>Megohm-meter + megger</p>	

RESISTIVE ALARM SYSTEM

(optional)

The basic components of the system are two alarm wires:

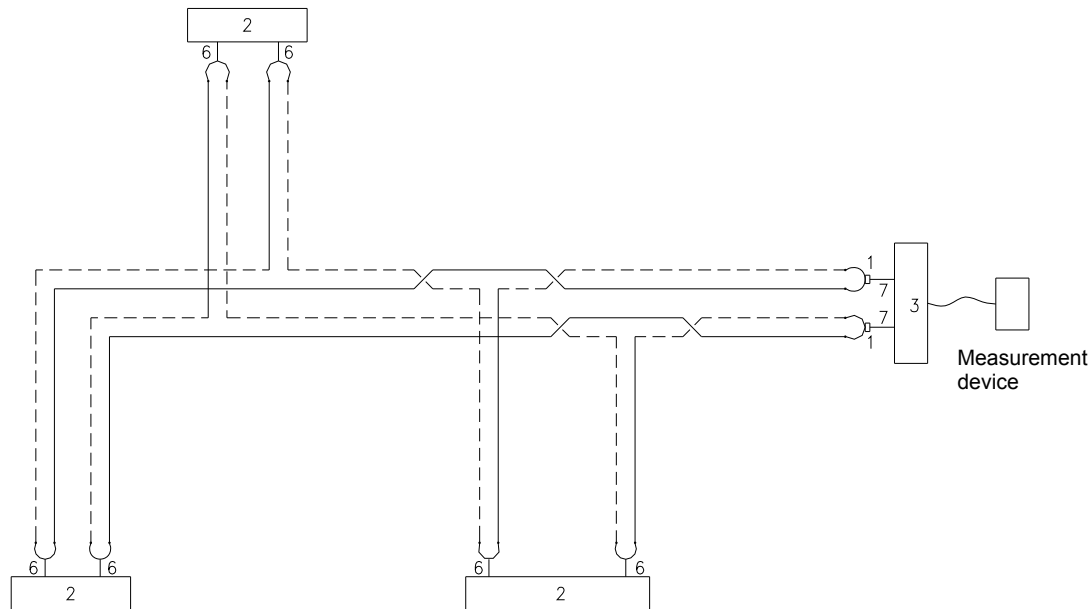
- sensor wire NiCr 80% - Ni, 20% - Cr, 0.5 mm thick, constant resistance 5.7 Ω/m. The wire is in red teflon insulation with a perforation every 15 mm;
- copper return wire, 0.8 mm thick, constant resistance 0.036 Ω/m. The wire is in green teflon insulation.

The wires form a measurement loop with maximum length equal to 1,000 m (the length of the sensor wire) which allows monitoring a 1,000 m long pipe section. In order to determine the location of moist or damaged insulation, one conducts measurements with an appropriate measurement device where a certain measurement voltage is applied between the sensor wire in the thermal insulation and the pipe. In the beginning of the sensor loop, between the sensor wire and the pipe, the partial voltage (U_1) to the location of the leak is measured. However, the measured partial voltage is not displayed in volts, but as a percentage of the total voltage (U) and, consequently, it is the result of the location test. The location of the damaged area is determined on the basis of the total length of the measurement loop ($x\% = U_1/U = L_1/L$). The length of the copper return wire is regarded in the calculations as zero.

name	description
portable failure locator LP10S	- can be used to determine the location of a moist area in the heating network
portable insulation testing device LH20S	- allows for precise tracking of changes in moisture of polyurethane insulation during the use of the network - indicates defects of the resistance alarm system
stationary network monitor MSP-1	- can be used for automatic and continuous monitoring of four sections of a heating network - shows the results of measurements of polyurethane insulation moisture, insulation resistance, heating network length, distance between the measurement station and the location of the failure - can store the changing measured values as well as the conditions and the events, together with the date and time of their occurrence
stationary detector LPS-2	- can be used for monitoring the technical condition of two sections of a heating network - indication of three conditions (GOOD, HAZARD, FAILURE) - total length of monitored network $\leq 1,000$ m
stationary device LPS-2R1	- can be used for monitoring two sections of a heating network with an alarm system - during measurement cycles, the device measures the moisture level of the polyurethane insulation, the resistance of the insulation, the length of the heating network, the distance between the measurement station and the location of the leak, or a short-circuit between the sensor wire and the conduit pipe
stationary device MHL 200	- can be used for monitoring two sections of a heating network with an alarm system - allows for cooperation with a central unit of the data collection system using the alarm system wires for sending information - during measurement cycles, the device measures the moisture level of the polyurethane insulation, the resistance of the insulation, the length of the heating network, the distance between the measurement station and the location of the leak, or a short-circuit between the sensor wire and the conduit pipe

List of control and measurement devices in the resistance system:

ALARM SYSTEM DIAGRAM (RESISTIVE SYSTEM)



In order to connect the alarm wires of a branch with alarm wires of the main pipeline, the pipe section of the branch must be assembled so that the sensor wire (red) in the branch, as seen from the side of the main pipeline, is on the right side. The sensor wire must be connected to the part of the sensor circuit of the main pipeline which leads to the right. The return wire of the branch (green) must be connected with the part of the sensor circuit (red) of the main pipeline which leads to the left. The green wire in the main pipeline of the branch must not be cut.

Elements of the system:

No.	name	quantity
1	connector ZPB	in the place of installation of a control instrument or a measurement box - 1 pcs on the end of each pipe wire, when DN>400 – 2 pcs
2	terminal box PPA	1 ea, on the end of a pipe pair, when DN>400 – 2 pcs
3	measurement box PPM	1 ea, on the end of a pipe pair, when DN>400 – 2 pcs
4	terminal sleeve BS-QU	2 pcs, on the joint
5	heat-shrinking coat BS-SRA	2 pcs, on the joint
6	two-core wire ME2019K2	~3 m on each loop closure
7	four-core wire ME2019TK4	~ 3 m on the measurement point