

**LIQUID  
TEMPERATURE SENSOR type:  
HCT-01-01, -02  
HCT-02-01, -02  
HCT-03-01, -02  
HCT-04-01, -02  
HCT-05-01, -02**

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## 1. INTRODUCTION

### 1.1 SECURITY INSTRUCTIONS

#### 1.1.1 Application

Liquid temperature sensors, of different version shapes, as well as of the sizes are mainly designed for controlling of regulating valves – three-way; opening and closing valves.

Other applications should be consulted with manufacturer.

Manufacturer doesn't bear responsibility for any damages which result from using level switches in method not acct. to application. Risk is on user side.

Right using of level switches is make everything according to this document instructions.

#### 1.1.2. Definitions used in description

- **Operator** – person, who use product according to application (PN-EN 61010-1, July 2004),
- **Technical inspection** - person or group of people responsible for using and conservation of product, this person has to assure of well special training for OPERATORS (PN-EN 61010-1, July 2004),

#### 1.1.3. Allowed activities range



- **For operator** – valves using.
- **For technical inspections** – activities like for operator, mechanical and electrical assembly and activities connected with controlling.

#### 1.1.4 Instructions and warnings

Body damage and/or serious material damages might be formed if user doesn't keep of instructions and warnings. Servicing staff have to be instructed and acquaint with whole safety instructions and warnings.

For well and safe level switch's working there has to be assured right transport, storage, assembly, starting and conservation's instruction.

Main attentions of safety in mentioned operation and maintenance manual were marked as pictograms:

	<p style="text-align: center;"><b>This sign means: Pointer.</b></p> <p>„Pointer” indicates on action or any process important for well-working of product. Material damages might be formed if user doesn't keep of instructions.</p>
	<p style="text-align: center;"><b>This sign means: Warning.</b></p> <p>„Warning ” indicates on action or any process, which might be danger for staff or makes material damages if those aren't made correctly.</p>

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## 1.2 SUBJECT OF TECHNICAL PRODUCT DOCUMENTATION

The subject of this Technical Product Documentation is parameters, conditions and instructions connected with construction of valves, assembling, transport, storing and using of liquid temperature sensors.

## 1.3 APPLICATION, MARKINGS ACC. TO SWW AND PKWiU

### 1.3.1 Application

Liquid temperature sensors are designed for controlling of regulating valves – three-way; opening and closing valves.

Liquid temperature sensors HCT- connected with three-way regulating valve MED- forms the temperature regulator of direct continuous action - three-way mixing or distributing one HCT- + MED-

Liquid temperature sensors HCT- connected with opening regulating valve MEO- forms the temperature regulator of direct continuous action - opening HCT- + MEO-

Liquid temperature sensors HCT- connected with closing regulating valve MEZ- forms the temperature regulator of direct continuous action - closing HCT- + MEZ-

### 1.3.2. Marking acc. to SWW and PKWiU

Marking acc. to Polish Classification of Products and Services (PKWiU) : 26.51.65.0

Marking acc. to Systematic Products Specification (SWW) : -0919-200

## 1.4 CONSTRUCTION AND WORKING RULES

### 1.4.1. Construction of liquid temperature sensor – look at drawing no. 1:

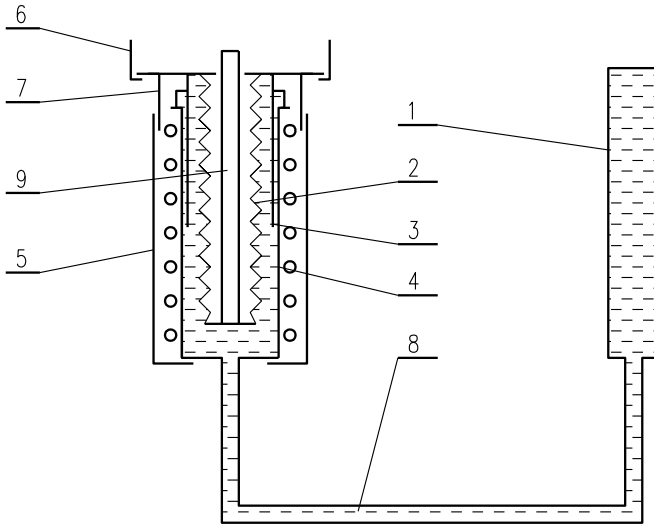
- Set of sensors at different figures and materials - 1
- Actuator bellows - 2
- Piston of the setter and fuse - 3
- Fuse spring - 4
- Regulating (adjusting) nut - 5
- Fixing nut - 6
- Sensor body - 7
- Capillary - 8
- Pusher - 9

### 1.4.2. Working rules

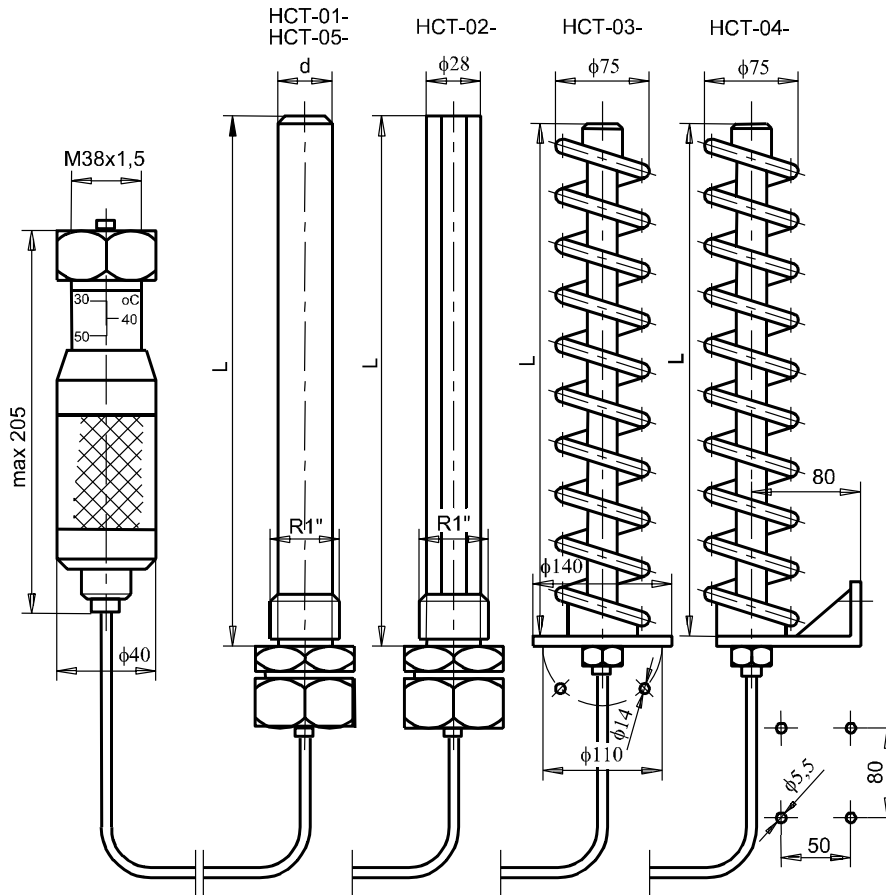
All the version shapes of the liquid temperature sensors are produced in three sizes. They are different from each other by the sensor assembly length.

The liquid temperature sensors operate on the liquid expansion principle - expansion of liquid contained in the sensor assembly.

Work necessary for shifting the actuator pusher is done by liquid contained in the sensor assembly, which depending on temperature near the sensor expands or shrinks itself in linear way. The liquid volume changes by means of capillary cause the actuator bellows movement. Setting of the set-point value is done by turning the regulating nut, causing increasing or decreasing of cell volume in the final control element. The fuse spring protects - in case of exceeding the maximum working pressure in the measuring system, that is, expansion cell increase (piston shifting) – against damaging of the measuring system.



Drawing no.1. Construction of liquid temperature sensor type HCT (look at explanations point 1.4.1)



Drawing no.2. Versions of liquid temperature sensors type HCT (dimensions "L" and "d" look at table no. 1)

Table no. 1

Type	HCT-01-01	HCT-01-02	HCT-02-01	HCT-02-02	HCT-03-01	HCT-04-01	HCT-03-02	HCT-04-02	HCT-05-01	HCT-05-02
Dimension										
L	236	361	248	395	180	245	245	270	270	405
d	22	22	28	28	75	75	75	21,3	21,3	21,3

## 2. TECHNICAL DATA

Static characteristic of the sensor - proportional (P)

Linearity of the static characteristic -  $\pm 10\%$

Sensor dead zone -  $a_n \leq 2^\circ\text{C}$

Sensor hysteresis -  $a_h \leq 3^\circ\text{C}$

Nominal pressure - 4 MPa

Table no. 2

Sensor type	Set point value °C	Proportionality range mm/°C	Time constant		Overheating temperature °C	Sensor material	Remarks
			water s	air s			
HCT-01-01	-20 do +50 0 do +70 +30 do +100 +60 do +130	0,4	75	-	50	brass	
HCT-01-02		0,6			40		
HCT-02-01		0,4	20	-	50	brass	
HCT-02-02		0,6			40		
HCT-03-01		0,4	12	80	50	copper	
HCT-03-02		0,6			40		
HCT-04-01		0,4	80	-	50	copper	
HCT-04-02		0,6			40		
HCT-05-01		0,4	80	-	50	1H18N9T	
HCT-05-02		0,6			40		

Table no. 3

Liquid temperature sensor type	Proportionality range					
	$\phi 15$	$\phi 20$	$\phi 25$	$\phi 32$	$\phi 40$	$\phi 50$
MED-01-01-02 MEO-01-01-02 MEZ-01-01-02						
MED-02-01-02 MEO-02-01-02 MEZ-02-01-02						
MED-03-01-02 MEO-03-01-02 MEZ-03-01-02						
MED-04-01-02 MEO-04-01-02 MEZ-04-01-02						
MED-05-01-02 MEO-05-01-02 MEZ-05-01-02						
MED-06-01-02 MEO-06-01-02 MEZ-06-01-02						
HCT-01-01 HCT-02-01 HCT-03-01 HCT-04-01 HCT-05-01	7,5	10	12,5	15	15	24
HCT-01-02 HCT-02-02 HCT-03-02 HCT-04-02 HCT-05-02	5	6,5	8	9,5	9,5	15

### IMPORTANT:

The proportionality ranges marked with thick line (grey areas) are the standard values recommended for usage.

### 3. ORDERING METHOD AND EXAMPLE OF ORDERING

When selecting a sensor, one should observe:



- a) Which medium will have temperature regulated? - decision concerning the sensor version (sensor material);
  - b) Degree of temperature regulated - decision concerning the range of set quantity;
  - c) Layout of sensor installation place - decision concerning the sensor shape selection;
  - d) final decision concerning the sensor type selection, first of all, is based on the valve size.
- Combination – sensor size - the valve size – is the most frequently selected in such a way as to make the proportionality range from 7,5° to 15°C (see the table in the “Technical Data”)**

In order please determine:

(*) Liquid temperature sensors		HCT-	( )	- ( )	- ( )	- ( )
Sensor shape:						
- tube		-01				
- multi-tube		-02				
- spiral with flange		-03				
- spiral with hanger		-04				
- acid-proof steel tube		-05				
Proportionality range Xp:						
- Xp = 0.4 mm/°C		-01				
- Xp = 0.6 mm/°C		-02				
Capillary tube length:						
- 3m		-1				
- 6m		-2				
- 9m		-3				
- 12m		-4				
Setting range in °C:						
- 30...100		-1				
- 0...70		-2				
- 20...50		-3				
- 60...130		-4				

**\* version with nominal pressure of liquid temperature sensor up to 6,3 MPa has to be agreed with manufacturer - Controlmatica ZAP-PNEFAL, +48 62 73 72 250**

**Example of order denotation:**

**Temperature sensor:** HCT -01 -01 - 1 - 1

Contents of marking: temperature sensor, tubular, brass, general purpose, setting range 30...100°C with capillary length 3 running metre, proportionality range 0,4 mm/°C.

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## 4. MAINTENANCE INSTRUCTION

### 4.1 ASSEMBLY INSTRUCTION

#### 4.1.1. Assembly conditions

Temperature sensors might be installed in closed rooms or protected before influence of atmospheric conditions like: rain, snow and others, and rooms, which are free of excessive quantity of aggressive chemical fumes.

Manufacturer fit out the sensor in connecting screwed ends, which are used for connect directly to connector pipe or indirect to sensor's shield, drawing no. HC3-0135-.

**Kinds of regulated medium** – for brass and copper sensors the liquids chemically non-aggressive, for the sensor made of 1H18N9T the liquids chemically aggressive in non-relation to this type of material..

**Working position** - arbitrary, vertical is recommended, sensor actuator is placed under the valve.

**Atmospheric requirements** – ambient temperature  $+5 \div +50^{\circ}\text{C}$ .

**Relative humidity**  $30 \div 80\%$ .

**Resistance to vibrations** – vibrations of frequency 25 Hz and amplitude not larger than 0.1 mm.



Sensor installation – the sensor should be immersed in the regulated medium along the whole length – examples of installation according to the enclosed drawings. The connectors fixing the sensors should be done according to the dimensions shown in the overall drawings.

Near the sensor installation place one should place the control thermometer, having the scale corresponding to the sensor range.

#### 4.1.2. Important factors for assembly of sensors:

##### **Ambient temperature effect:**

Liquid filling the actuator and capillary is the same liquid as the one expanding in the temperature sensor.

Changes in the temperature of capillary and actuator, having effect on the regulation course, and by means of this, it effects the deviation value between the set-point value and regulated quantity.

Temperature increase in the capillary and actuator has got the same effect as temperature increase in the sensor, that is why in result, actuator pusher shift value is higher than set-point value.

**With reference to the above, one should pay attention to that capillary will be protected against effect of variable temperatures, whose fluctuations exceed  $\Delta 3^{\circ}$ .**

##### **Correction of the set-point value in the sensor HCT-type**

With reference to that we have got different sizes of regulating valves (travel of closing component changes with valve size) and due to the ambient temperature effect at the installation place of capillary and actuator – one should correct the set-point value. The correcting of the set-point value is done each time during the start-up of new sensor acc. to the following procedure:

- prepare the regulator (controller) for normal operation conditions,
- set the required set-point value,
- read out the actual temperature value near the sensor (after a time necessary for temperature equalizing),
- define the closing component position (plug) in the valve and state of the fuse spring tension,



- e) if the set-point temperature corresponds to actual temperature and closing component is fully open or closed (depending on valve type) and the fuse spring is not tensioned, correction is unnecessary,
- f) if there are differences between the set-point and actual temperature, then one makes correction of the set-point by turning the setting nut, earlier loosened (the setting nut rotation does not protrude the pusher of sensor final control element), so as to set in the sensor scale the actual temperature,
- g) after regulation is finished, the setting nut should be protected against loose turning by a screw.

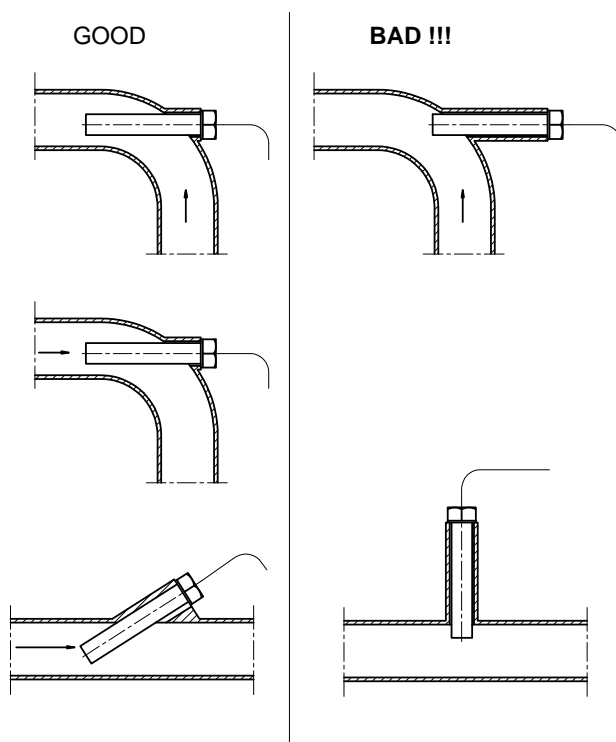
**Overheating fuse**



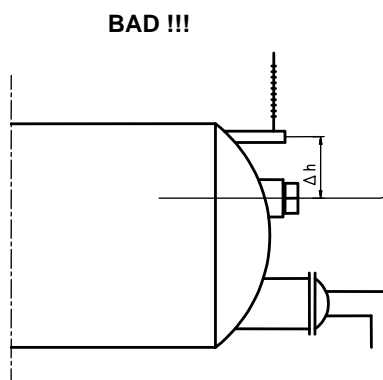
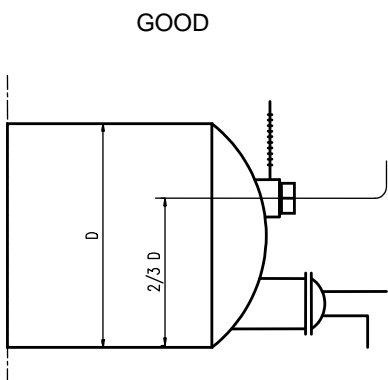
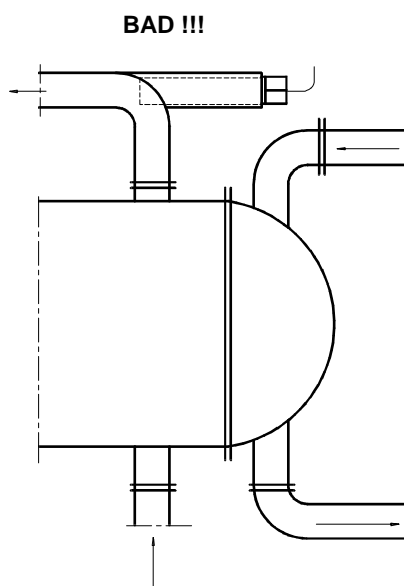
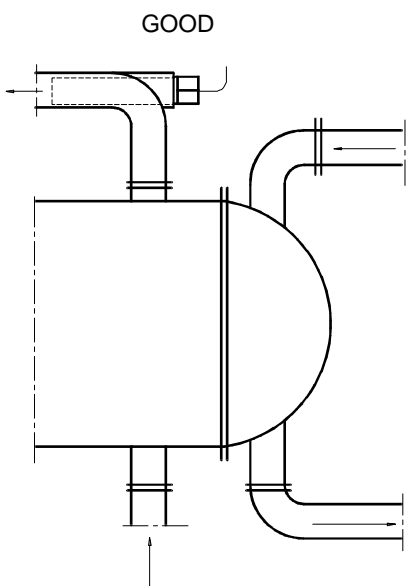
The temperature sensors HCT- have got the overheating fuse. It protects the HCT-sensor against damage in case of a large temperature increase in the neighbourhood of sensor. During the overheating there are significant loads of sensor element, with reference to that one should avoid continuous or more frequent operation of the overheating fuse.

Table no. 2 gives the permissible overheating temperatures.

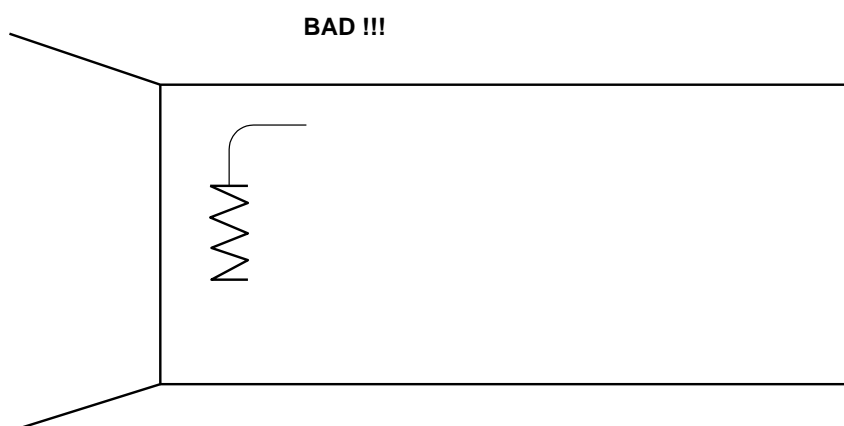
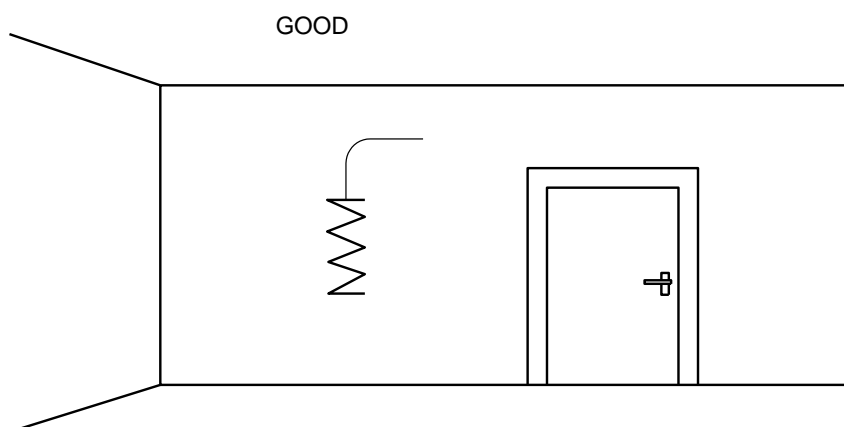
4.1.3. Examples of building temperature sensor



**The temperature sensor must be totally touched by controlled liquid.**



The place of temperature sensor installation close to the hot water heaters should be located on 2/3 of the heater height, that is, on the same height as the control thermometer



**When regulating the room temperatures, temperature sensor cannot be exposed to the extreme ambient effects but it must record the average temperature of the given room. The device mustn't be installed in the corners, close to the radiators and near the doors and windows.**

**Co-operation of HCT sensor with the MERTIK Company's valves**

The HCT type sensors can control the valves produced by the MERTIK Company. Condition of cooperation of these devices is using the manual setting element.

- The manual setting element no. HC3-0030 is used for the MERTIK Company's valves, the diameter of whose does not exceed  $\phi$  40.
- The manual setting element no. HC3-0148 is applied for the MERTIK Company's valves, the diameter of whose is larger than  $\phi$  40.

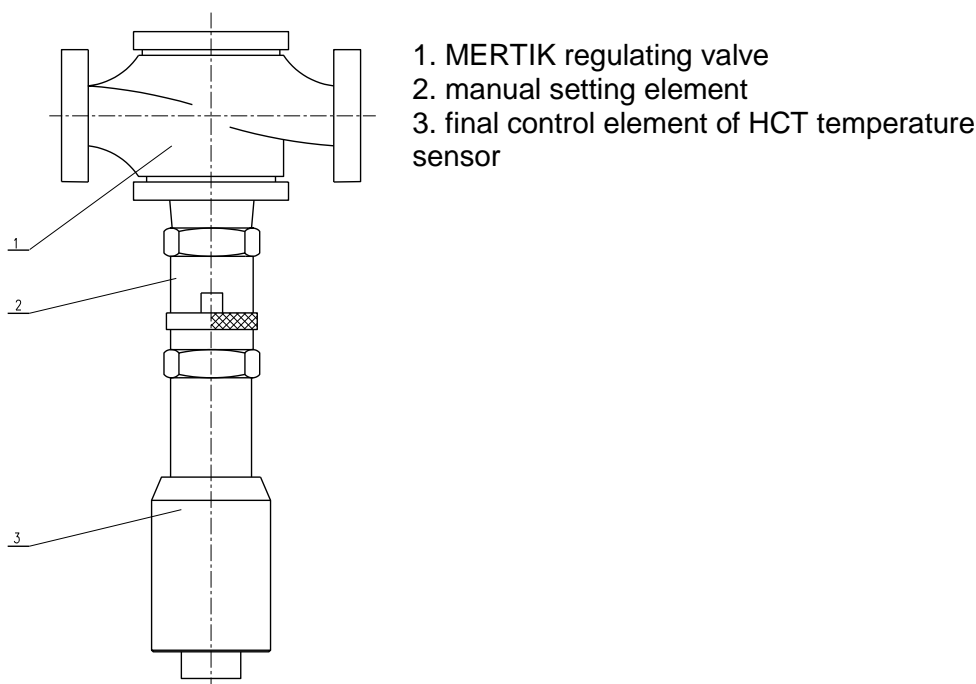
The way of assembling the HCT sensor, manual setting element and valve produced by MERTIK Company is shown in the below drawing:

After mounting the manual setting element, one must set the scale, that is, determine the positions of arrows on the manual setting element scale.

- We close the „MERTIK” valve by means of the manual valve control handwheel.
- The arrow on the setting element scale must be shifted to the setting element indicator position, then it will mean that the valve is closed.
- The second arrow on the setting element scale is be shifted to the position corresponding to valve opening.

**ATTENTION:**

**The adjustment of the setting element scale is to be done after correction of the set-point value for HCT- sensor on the basis of point 4.1.2.**



1. MERTIK regulating valve
2. manual setting element
3. final control element of HCT temperature sensor

Drawing no. 6. HCT sensor with MERTIK valve

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## 4.2 STARTING AND SERVICE INSTRUCTION

### 4.2.1 Preparing products for starting

After installing the sensor in accordance with the above conditions, one should set the required temperature in the sensor scale. Wait until the moment of fixing of the regulated medium temperature (acc. to the control thermometer indications). In case when this temperature will be different from the required temperature, one should change the setting by turning the setting nut – towards increasing values on the scale, when temperature is too low. Towards decreasing values on the scale, when temperature is too high. After start-up and achieving of the required sensor temperature, the sensor does not require further service.

### 4.2.2 Maintenance instruction

After building, connection with valves and setting required temperature the temperature sensor will not require further maintenance.

## 4.3 CONSERVATION INSTRUCTION



Liquid temperature sensor has to be check very carefully once a year and user has pay attention on technical condition of parts, which are endangered on liquid or live other parts working on sensor.  
After conservation the temperature sensor has to be assembled.

## 4.4. INDUSTRIAL SAFETY INSTRUCTION



Workers who make assembly of liquid temperature sensors on objects should have general knowledge of safety instruction and this document (IOM).

## 5. STORAGE AND TRANSPORT TERMS

The sensors should be stored on shelves, in rooms free from chemical vapours.

Air temperature in the room should vary from +5 ÷ +50°C.

Air relative humidity should be 30 ÷ 80 %.

Dustiness isn't acceptable.

After 6 months storage the sensors have to be checked by made:

- Visual inspection,
- Checking painting and galvanic covers,
- Checking of full complete the unit.

All the external elements - steel zinc-coated elements – should be covered with thin layer of technical vaseline (petroleum jelly).

The sensors type HCT-01, -02, -05 should be packed in cardboard box, made acc. to drawing no. EZ1-2832. The sensors type HCT-03, -04 should be packed in cardboard box, made acc. to drawing no. HC2-0134.

Sensors should be transported without shocks and strokes higher up 6+/- 0,5mm at frequency vibrations 2Hz.

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## 6. SETS DELIVERY

The complete shipment of liquid temperature sensor includes:

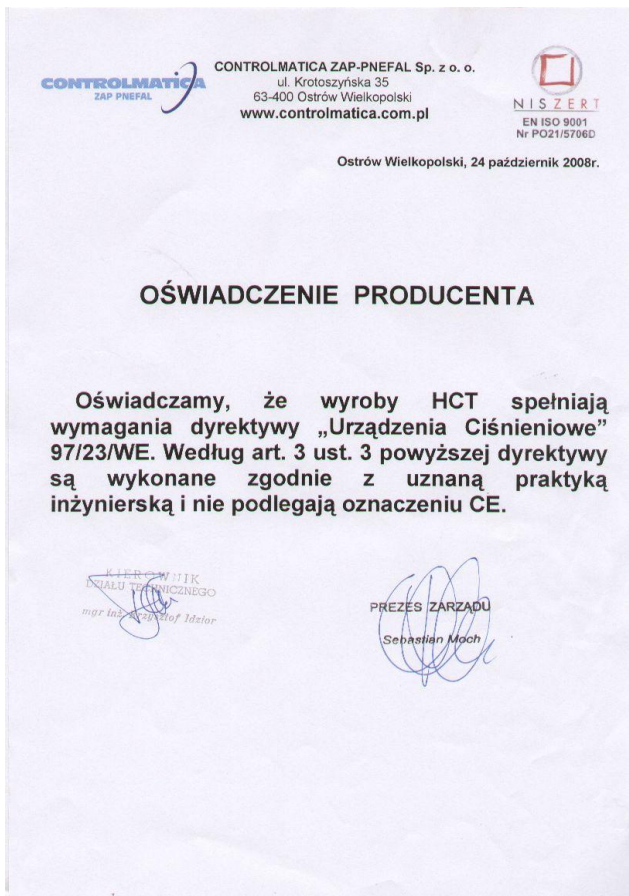
- Technical Product Documentation,
- Compatibility Declaration ,
- Guarantee Card,

## 7. GUARANTY TERMS

Guaranty terms are determined in guarantee card of Manufacturer – Controlmatica ZAP-PN EFAL Sp. z o.o., Ostrów Wlkp., Poland – guarantee card is added to the each piece of liquid temperature sensor.

**ATTENTION: The right of introducing design changes in the product, without deteriorating of its operation parameters, is reserved.**

## 8. DECLARATION



*The original is made in Polish language*

*Ostrow Wielkopolski, October 24<sup>th</sup>, 2008*

### **PRODUCER'S DECLARATION**

***We declare that the products type HCT-meet the requirements of the Directive „Pressure-type Equipment” no. 97/23/WE.***

***In accordance with art. 3, section 3 of the above mentioned Directive, these goods are made with acknowledged engineering practice and are not subject to the CE marking.***

*/-/ Krzysztof Idzior  
Manager of Technical  
Department*

*/-/ Sebastian Moch  
President of the  
Board of Directors*

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