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## HEAT TRACING SOLUTIONS

TYPICAL DESIGN SOLUTIONS







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SST Energomontazh



# Introduction

This document contains typical design engineering layouts of heat tracing solutions for pipelines and tanks.

Information presented in this album is based on SST Group's extensive practical experience in heat tracing systems' design, installation and operation of such systems.

In each typical design there is a general arrangement, type of the heating element used and electric cable heating solutions for separate assembly units.

We also show recommended diagrams of power supply cabling and temperature sensors placement.

Particular importance is attributed to the construction of heat tracing systems in explosion-hazardous areas since SST Group has over 20 years of experience in design, manufacturing, installation and operation of such systems. SST Group manufactures explosion-proof equipment and all the necessary components with strict quality control procedures. All our products meet international standards and technical requirements.

This album will be helpful for design engineers of heat tracing systems and for those who are interested in implementing heat tracing systems for pipelines and tanks in general. The solutions presented here cover short and branched systems as well as long and ultra-long pipelines.

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## Electric heating of a water pipeline by self-regulating heating cables General specifications

### Location: Oil and gas condensate field, Kazakhstan

#### Heated object parameters

Type of the pipeline	water line
Area classification	safe
Location	above ground
Pipeline material	steel
Product	water
Ambient temperature, grad C	-25+30
Max. process temperatre of the product, grad C	+10
Required temperature to be maintained on the pipeline, grad C	+5
Steaming temperature, grad C	steaming not provided
Total length, m	376
Diameter Nominal, mm	150

#### Technical data of the "TEPLOMAG" electric heating system

Input powert supply of the control cabinet, V/Hz	3-380/50 TN-S
Supply voltage of the besting costions V	220
Supply voltage of the heating sections, v	220
Nominal power of the system, kW	11,2
Starting power of the system, kW	14,7
Temperature to be maintained, grad C	not less than +5
Thermal insulation material, thermal conductivity coefficient	mineral wool, 0,05 W/(m*grad C)
Thermal insulation thickness, mm	50

#### Thermotechnical calculation

Pipe No.	Diameter Nominal,	Length,	Thermal insulation thickness,	Therr	nal paramet	Thermal conducti- vity	Numb	per of a	access cs	ories,	Design heat loss,	Heating cable type	Heating cable output at the required	Num- ber of the	Heating cable consum-	ating Heating able power, isum- tion,	heating cable consumption per unit m			e unit,	Total heating cable	
				Required tempe- rature,	Tmaxen*,	Texp*,	coemcient,	valves	filters	flanges	supports	•		tempera- ture,	passes	ption,		valves	filters	flanges	supports	length,
	mm	m	mm	°C	°C	°C	W/(m*K)					W/m		W/m		m/m	W/m					m
B1	150	376	50	5	65	85	0,05	2	1	2	24	20,80	25HTP2-BT	25,73	1	1,00	25,73	2,10	2,10	0,60	0,50	395,50
			•												-	W	ith the safe	ty fact	tor 1,	05		416,00

#### Specification of basic units and equipment

Name	Designation	Quantity
Heating cable	25HTP2-BT	416 m
Connection box	PTB401	2 pcs
Connection box	PTB601	1 pcs
Thread-reinforced pressure hose		1 pcs
Device for heating secition entry under thermal insulation	LEK/U	1 pcs
Connection box	PTB1005	2 pcs
Control cabinet with the PT-240 thermostat	CC-TM-*-*	1 pcs
Temperature sensor	TST01	1 pcs
Connection box for temperature sensor connection	PTB404	1 pcs
Power coble	5×10 mm <sup>2</sup>	420 m
	5×6 mm <sup>2</sup>	115 m
Control cable	4×1 mm <sup>2</sup>	10 m

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The type of the required heating cable is determined by the temperature to be maintained (+5 °C), heat loss and steaming temperature

### Symbols:

Tmaxen\* - Maximum allowable exposure temperature of the cable, energized Texp\* - Maximum allowable exposure temperature of the cable, de-energized

<u>ets</u>

- sequence number of the cabinet in the project
- project number "Teplomag" system
- control cabinet







There must be also a protective cladding on the end surfaces of the supports, the joints are to be sealed.

Outside

mm

### Schematic circuit diagram The power supply part



#### NOTES

- The power wiring must be performed by solid installation wire 1x10 mm<sup>2</sup>. The Solid wire may be replaced by the stranded-core wire on condition of lugs/tips crimping on the wire ends.
   The power network laid from the Input Distribution Device must be in accordance with the TN-S system.
   The power cable ends must be connected in strict accordance with color marking.

- 4. Devices and apparatus must be marked according to the schematic diagram.
- Font 10. The method of marking by labels.
- 5. The control cabinet must be marked by the label "TEPLOMAG".
- 6. The phase terminals must be of grey color, zero termilals of blue color, PE terminals of yellow-green color
- 7. For the part list of the circuit refer to the sheet 6.

## Electric schematic diagram Control and signalling



Notes

- 1. Wiring of the control and signalling circuitry is to be performed by the stranded-core installation wire 1x0,75 mm<sup>2</sup>. The cable lugs/tips must be crimped on the wire ends.
- 2. The devices and instruments are to be marked according to the diagram.
- Font 10. The method of marking by labels.
- 3. For the temperature settings of the thermostat refer to the the control and signalling diagram. 4. The switch SA1, lamps HLG1, HLG2, HLR1 must be installed outside, on the cabinet's door.

5. The terminal A1 of the thermostat must be connected to the terminal blocks by the screened installation wire 3x0,12 mm<sup>2</sup>.

### Parts list

	Q-ty
	1
C50	1
C25	2
. F204C63 30 mA	1
	1
	1
	1
	1
	1
o +60)	1
	1
	1
0 V	2
/	1
	1
	1
	8

### Location: Oil field, Tumen region

Heated	object par	ameters
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Type of the pipeline	oil line
Area classification	explosion hazardous, В1-г
Location	above ground
Pipeline material	steel
Product	oil
Ambient temperature, grad C	-44+18
Max. process temperature of the product, grad C	+40
Макс. allowable temperature of the product, grad C	+60
<i>Required temperature to be maintained on the pipeline, grad C</i>	+20
Steaming temperature, grad C	180
Total length, m	89
Diameter Nominal, mm	200

#### Technical data of the "TEPLOMAG" electric heating system

Input powert supply of the control cabinet, V/Hz	3-380/50 TN-S
Supply voltage of the heating sections, V	220
Nominal power of the system, kW	4,8
Starting power of the system, kW	7,3
Temperature to be maintained, grad C	not less than +20
Thermal insulation material, thermal conductivity coefficient	mineral wool, 0,05  W/(m*grad C)
Thermal insulation thickness, mm	100

### Thermotechnical calculation

Pipe No.	Diamter Nominal,	Length,	Thermal insulation thickness,	Ther	mal parame	eters	Thermal conducti- vity	ac	Number accessorie		pcs	Design heat loss,	Heating tape type	Heating tape output at the required	e Num- e ber of the	Heating tape consum-	Heating power,	co	Heatir ns um uni	ig tape ption it, m	e per
				Required tempe- rature,	Tmaxen*,	Texp*,	coefficient of thermal insulation,	valves	filters	flanges	supports			tempera- ture,	tape passes	ption,		valves	filters	flanges	supports
	mm	m	mm	°C	°C	°C	W/(m*K)					W/m		W/m		m/m	W/m				
НЗ	200	89	100	20	120	190	0,05	3	0	2	12	35,90	45BTC2-BP	43,38	1	1,00	43,38	2,80	0,00	1,00	0,5
																N	With safety	factor	1,05		

#### Specification of basic units and equipment

	1				
Name	Designation	Quantity			
Heating tape	45BTC2-BP	111 m			
Connection box	PTB601	2 pcs			
Thread-reinforced pressure hose		1 pcs			
Device for heating section entry under thermal insulation	LEK/U	1 pcs			
Connection box	PTB1005	1 pcs			
Control cabinet with the PT-240 and PT-300 thermostats	CC-TM-*-*	1 pcs			
Temperature sensor	TST01	1 pcs			
Connection box for temperature sensor connection	PTB404	1 pcs			
Temperature sensor	TST04	1 pcs			
Connection box for temperature sensor connection	PTB403	1 pcs			
Rower cable	Armored power cable 5x6 mm <sup>2</sup>	200 m			
	Armored power cable 5x4 mm <sup>2</sup>	45 m			
Control coblo	Control cable 4x1 mm <sup>2</sup>	20 m			
	Armored control cable 5x1,5 mm <sup>2</sup>	200 m			

#### System of notation for control cabinets



The type of the required heating cable is determined by the temperature to be maintained, heat loss and steaming temperature

### Symbols:

Tmaxen\* – Maximum allowable exposure temperature of the cable, energized Texp\* – Maximum allowable exposure temperature of the cable, de-energized



sequence number of the cabinet in the project project number "Teplomag" system control cabinet

### Isometric drawing









Installation details of the temperature sensor and the conneciton box PTB403 on a pipeline (thermal insulation is conventionally not shown)

> The PT-300 blocks the heating turning ON when the tempearature of the pipe wall exceeds the maximum allowable temperature thus preventing the pipeline overheating.

When steaming, the heating system must be de-energized.

The strap's lock



### Installation details of the heating seciton installation on a flange

### Installation details of the heating seciton installation on a valve

#### Spare length of the heating cable for various elements causing additional heat loss

Outside pipe diameter, mm	Flanges, m	Valves, strainers m	Pumps, m	Filters, etc., m	Supports of unknown design, m	
25	0,3	0,3	0,7	0,3	-	
32	0,3	0.4	0,8	0.4	-	
57	0.4	0,8	1,5	0,7		
76	0.4	0,9	1,8	0,7	0,7	
89	0,5	1,1	2,2	0.9		
108	0.6	1,4	2,9	1,1		
159	0,6	2,1	4.2	1,7		
219	219 1		5,5	2,3	0,8	
273	1	3,4	6,9	2,7		
325	1,3	4.1	8,1	3,3		
377	1,3	4.5	8,9	3,6	1.2	
426	1.3	5,1	10,2	4,1	1,2	
530	1,5	6,4	12,8	5,1		
630	1,5	7,7	15,3	6,2	1,5	
830	2,2	10,0	20,0	8,1	2	
1020	2,7	12,3	24,6	9,9	2,5	
1220	3.1	14,7	29,4	11,8	3	



### Installation details of the heating seciton installation on a support



NOTES

2. For in-service maintenance of valves, the heating cables must be installed on them in the form of a "reverse spiral".



1. For in-service maintenance of flange connections, it is required to leave enough spare length of the heating cable in the form of a loop mounted on the flange that ensures access to the flange seal.

## Schematic circuit diagram The power supply part



Notes.

- Notes.
   The power wiring must be performed by solid installation wire 1 x 4 mm<sup>2</sup>. The solid wire may be replaced by the stranded-core wire on condition of lugs/tips crimping on the wire ends.
   The power network laid from the Input Distribution Device must be in accordance with the TN-S system.
   The power cable ends must be connected in strict accordance with color marking.
   Devices and apparatus must be marked according to the schematic diagram. Font 10. The method of marking by labels.
   The control cabinet must be marked by the label "TEPLOMAG".
   The phase terminals must be of grey color, zero termilals of blue color, PE terminals of yellow-green color 7. For the part list of the circuit refer to the sheet 13.

## Electric schematic diagram Control and signalling



#### Notes.

- 1. Wiring of the control and signalling circuitry is to be performed by the stranded-core installation wire 1x0,75 mm<sup>2</sup>. The cable lugs/tips must be crimped on the wire ends.
- 2. The devices and instruments are to be marked according to the diagram.
- Font 10. The method of marking by labels.
- 3. For the temperature settings of the thermostat refer to the the control and signalling diagram.
- 4. The switch SA1, lamps HLG1, HLG2, HLR1 must be installed outside, on the cabinet's door.
- 5. The terminal A1 of the thermostat must be connected to the terminal blocks by the screened installation wire 3x0,12 mm<sup>2</sup>.

### Parts list

Name	Q-ty
	1
er, 3-pole S203C20	1
oreaker 4 mod. F204C25 30 mA	1
er S201C6	1
53-40	1
VAC (RELPOL)	2
	2
Г-240	1
01-0,3-П (-55 to +60)	1
	1
Г-300	1
04-2,0-∏ (+20 to +60)	1
-1500	1
rithout lamp	1
o HLG 220V	2
ILR 220V	1
blue	1
rth" STJZK219	1
	11

## Electric heating of a branched alkali pipeline by self-regulating heating cables

### General specifications

### Location: Oil refinery, Khabarovsk Territory

#### Heated object parameters

Type of the pipeline	alkali pipeline
Area classification	explosion hazardous, В1-г
Location	above ground
Pipeline material	steel
Product	alkali solution
Ambient temperature, grad C	-37+35
Max. process temperature of the pipeline, grad C	+60
Max. allowable temperature of the pipeline, grad C	+100
Required temperature to be maintained on the pipeline, grad C	+40
Steaming temperature, grad C	180
Total length, m	49
Diameter Nominal, mm	50, 100

### Technical data of the "TEPLOMAG" electric heating system

Input powert supply of the control cabinet, V/Hz	3-380/50 TN-S
Supply voltage of the heating sections, V	220
Nominal power of the system, kW	3,9
Starting power of the system, kW	6,3
Temperature to be maintained, grad C	not less than +40
Thermal insulation material, thermal conductivity	mineral wool,
coefficient	0,05 W/(m*grad C)
Thermal insulation thickness, mm	50

#### Thermotechnical calculation

Pipe No.	Diamter Nominal,	Length,	Thermal insulation thickness,	The Required tempe- rature,	rmal parame Tmaxen*,	ters Texp*,	Thermal conducti- vity coefficient of thermal insulation,	level gages	lumbe sd und	r of ac	relief valves	ries, p	supports	Design heat loss,	Heating cable type	Heating cable output at the required temperature,	Num- ber of the cable passes	Heating cable consum- ption,	Heating power,	level gages	sdwnd	able c unit	relief valves au un un	llanges	supports	Total heating cable length,
	mm	m	mm	°C	°C	°C	W/(m*K)							W/m		W/m		m/m	W/m							m
1	50	4	50	40	120	190	0,05	0	0	2	0	0	0	25,80	45BTC-BP	39,25	1	1,00	39,25	0,00	0,00	0,80	0,00	0,00	0,00	5,60
2	100	45	50	40	120	190	0,05	1	2	4	1	3	3	39,79	60BTC-BP	53,20	1	1,00	53,20	3,20	2,90	1,40	1,40	0,60	0,50	64,30
							·					•			·	`						With	safety	facto	r 1,05	74,00

#### Specification of basic units and equipment

Name	Designation	Quantity		
	45BTC-BP	6 m		
neating cable	60BTC-BP	68 m		
Connection box	PTB601	1 pcs		
Connection box	PTB401	3 pcs		
Thread-reinforced pressure hose		4 pcs		
Device for heating secition entry under thermal insulation	LEK/U	4 pcs		
Control cabinet with the PT-240 thermostat	CC-TM-*-*	1 pcs		
Temperature sensor	TST01	1 pcs		
Connection box for temperature sensor connection	PTB404	1 pcs		
Thermostat		1 pcs		
Power cable	Armored power cable 5x4 mm <sup>2</sup>	60 m		
Control cable	Control cable 4x1 mm <sup>2</sup>	20 m		
	Armored control cable 5x1,5 mm <sup>2</sup>	60 m		

The circuitry of the control cabinet is similar to that shown on the sheet 12. System of notation for control cabinets



The type of the required heating tape is determined by the temperature to be maintained, heat loss and steaming temperature, and possibility of the agressive alkali environment effect on the heating tape.

### Symbols:

Tmaxen\* – Maximum allowable exposure temperature of the cable, energized Texp\* – Maximum allowable exposure temperature of the cable, de-energized

sequence number of the cabinet in the project

- project number
- "Teplomag" system
- control cabinet



- (for pipelines)".
- of the products.
- the Electric Installation Code.

1. The installation order is described in the Operating procedure "Installation. of electrical heating system TEPLOMAG using self-regulating heating tapes

2. The pipeline must be insulated by mineral wool having thermal conductivity not more than 0,05 W/(m\*°C) at 10 °C and density from 100 to 140 kg/m<sup>3</sup>, with the thickness of 50 mm for the pipe with DN = 100 mm and DN = 50 mm. 3. The minimum ambient temperature at the heating sections installation is -60 °C; (at that the recommended single bending radius is not less than 175 mm), at other equipment installation – according to the technical certificates

4. The installation works must be performed in accordance with the requirements of the design documentation, the installation operating procedure and



# Installation details



### Installation details of the heating seciton installation on a flange

### Installation details of the heating seciton installation on a valve

#### Spare length of the heating cable for various elements causing additional heat loss

Outside pipe diameter, mm	Flanges, m	Valves, strainers m	Pumps, m	Filters, etc., m	Supports of unknowr design, m			
25	0,3	0,3	0,3 0,7 0,3					
32	0,3	0.4	0,8	0.4	-			
57	0.4	0,8	1,5	0,7				
76	0.4	0,9	1,8	0,7	0,7			
89	89 0,5		2,2	0.9	1			
108	0.6	1,4	2,9	1,1				
159	0,6	2,1	4.2	1,7				
219	219 1		5,5	2,3	0,8			
273	273 1		6,9	2,7				
325	1,3	4.1	8,1	3,3				
377	1,3	4.5	8,9	3,6	1.2			
426	1.3	5,1	10,2	4,1	1,2			
530	1,5	6,4	12,8	5,1				
630	1,5	7,7	15,3	6,2	1,5			
830	2,2	10,0	20,0	8,1	2			
1020	2,7	12,3	24,6	9,9	2,5			
1220	3.1	14,7	29,4	11,8	3			

**Note:** The provided spare length is to be multiplied by the heating cable consumption ratio indicated in the thermotechnical calculation.

### Installation details of the heating seciton installation on a support



1. For in-service maintenance of flange connections, it is required to leave enough spare length of the heating tape in the form of a loop mounted on the flange that ensures access to the flange seal. 2. For in-service maintenance of valves, the heating tapes must be installed on them in the form of a "reverse spiral".



### Installation details of the heating seciton installation on a relief valve

Installation details of the heating seciton installation on a centrifugal pump

Installation details of the heating seciton installation on a level gage





### Location : Yakutsk city

#### Heated object parameters

Type of the pipeline	water pipeline
Area classification	safe
Location	underground (straight-way collector)
Pipeline material	steel
Product	water
Ambient temperature, grad C	-50+30
Max. process temperatre of the product, grad C	+10
Required temperature to be maintained on the pipeline, grad C	+5
Steaming temperature, grad C	steaming not provided
Total length, m	1300
Diameter Nominal, mm	100

### Technical data of the "TEPLOMAG" electric heating system

Input powert supply of the control cabinet, V/Hz	3-380/50 TN-S
Supply voltage of the heating sections, V	220
Nominal power of the system, kW	22,1
Starting power of the system, kW	43,4
Temperature to be maintained, grad C	not less than +5
Thermal insulation material, thermal conductivity coefficient	mineral wool, 0,05 W/(m*grad C)
Thermal insulation thickness, mm	100

#### Thermotechnical calculation

	Pipe No.	Diamter Nominal,	Length,	Thermal insulation thickness,	Therr Required tempe- rature,	nal parame Tmaxen*,	ters Texp*,	Thermal conducti- vity coefficient,	alves	per of p	access cs	sories,	Design heat loss,	Heating cable type	Heating cable output at the required temperature,	Num- ber of the cable passes	Heating cable consum- ption,	Heating power,	l const save	Heatin umptio	ng cabl on per n səbu	e unit,	Total heating cable length,
				1																			
	B4	100	1300	100	5	65	85	0,035	1	0	2	0	14,20	15HTP2-BT	15,98	1	1,00	15,98	1,40	0,00	0,90	0,00	1303,00
B4 100 1300 100 5 65 85 0,035 1 0 2 0 14,20 15HTP2-BT 15,98 1 1,00 15,98 1,40 0,00 0,90 0,00 1303,00																	١	With the safet	ty fact	or 1,0	5		1368,00

The circuitry of the control cabinet is similar to that shown on the sheet 12.

#### System of notation for control cabinets

C	C-TI	M-*	*_ *
_			ΓĽ

*The type of the required heating cable is determined by the temperature* to be maintained, heat loss and the Customer wishes to use self-regulating heating cable. In view of large length of the water main, it had been required to construct an overhead cable tray routing system for power cables routing.

### Symbols:

Tmaxen\* - Maximum allowable exposure temperature of the cable, energized Texp\* - Maximum allowable exposure temperature of the cable, de-energized

#### Specification of basic units and equipment

Name	Designation	Quantity		
Heating cable	15HTP2-BT	1368 m		
Connection box	PTB401	7 pcs		
Connection box	PTB1005	4 pcs		
Connection box	PTB1006	2 pcs		
Control cabinet with the PT-240 thermostat	CC-TM-*-*	1 pcs		
Temperature sensor	TST01	1 pcs		
Connection box for temperature sensor connection	PTB404	1 pcs		
	Power cable 4x35 mm <sup>2</sup>	2250 m		
	Power cable 4x25 mm <sup>2</sup>	1460 m		
Power cable	Power cable 4x16 mm <sup>2</sup>	430 m		
	Power cable 3x10 mm <sup>2</sup>	230 m		
	Power cable 3x4 mm <sup>2</sup>	60 m		
Control cable	Control cable 4x1,5 mm <sup>2</sup>	25 m		

sequence number of the cabinet in the project

project number
"Teplomag" system

- control cabinet



4. The installation works must be performed in accordance with the requirements of the design documentation, the installation operating procedure and the Electric Installation Code.

# Installation details of the PTB401 connection box on a pipeline for the case of two heating sections powering (thermal insulation is conventionally not shown)













### Installation details of the heating seciton installation on a valve

Outside pipe diameter, mm	Flanges, m	Valves, strainers m	Pumps, m	Filters, etc., m	Supports of unknown design, m		
25	0,3	0,3	0,7	0,3	-		
32	0,3	0.4	0,8	0.4	-		
57	0.4	0,8	1,5	0,7			
76	0.4	0,9	1,8	0,7	0,7		
89	0,5	1,1	2,2	0.9	1		
108	0.6	1,4	2,9	1,1			
159	159 0,6		4.2	1,7	0.0		
219	219 1		5,5	2,3	υ,δ		
273	1	3,4	6,9	2,7			
325	1,3	4.1	8,1	3,3			
377	1,3	4.5	8,9	3,6	1.2		
426	1.3	5,1	10,2	4,1	1,2		
530	530 1,5		12,8	5,1			
630	1,5	7,7	15,3	6,2	1,5		
830	2,2	10,0	20,0	8,1	2		
1020	2,7	12,3	24,6	9,9	2,5		
1220	3.1	14,7	29,4	11,8	3		

Spare length of the heating cable for various elements causing additional heat loss

**Note:** The provided spare length is to be multiplied by the heating cable consumption ratio indicated in the thermotechnical calculation.

Installation details of the heating seciton installation on a flange



NOTES on them in the form of a "reverse spiral".

For in-service maintenance of flange connections, it is required to leave enough spare length of the heating cable in the form of a loop mounted on the flange that ensures access to the flange seal.
 For in-service maintenance of valves, the heating cables must be installed

## General specifications

### Location : Oil field, Arkhangelsk Region

#### Heated object parameters

Type of the pipeline	fuel line
Area classification	explosion hazard zone, В1-г
Location	above ground
Pipeline material	steel
Product	diesel fuel
Ambient temperature, C deg.	-40+35
Max. process temperature of the product, C deg.	+40
Required temperature to be maintained on the pipeline, C deg.	+25
Steaming temperature, C deg.	steaming not provided
Length, m	1,000
Diameter Nominal, mm	150

#### Technical data of the "TEPLOMAG" electric heating system

Input powert supply of the control cabinet, V/Hz	3-380/50 TN-S
Supply voltage of the heating sections, V	3-380/50 IT
Nominal power of the system, kW	33.40
Starting power of the system, kW	61.15
Temperature to be maintained, C deg.	not less than +25
Thermal insulation material, thermal conductivity coefficient	mineral wool, 0.045 W / (m *C deg.)
Thermal insulation thickness, mm	80

#### Thermotechnical calculation

Pipe number	Diameter Nominal,	Length,	Thermal insulation thickness,	Thern	nal paramet	ers	Coefficient of thermal insulation	Numl	ber of p	access cs	sories,	Design heat loss,	Heating cable type	Heating cable output at the required	Number of passes	Heating cable consump-	Heating power,	F consi	leatin umptio n	g cable on per u n	ınit,	Cable total length,
	mm	m	mm	Required tempera- ture, °C	Tmaxen*, °C	Texp*, °C	thermal conductivity, W/(m*K)	valves	filters	flanges	supports	W/m		temperature, W/m		tion rate, m/m	W/m	valves	filters	flanges	supports	m
T2	150	1,000	80	25	205	230	0.045	0	0	0	0	32.60	LLS	33.40	1	1.00	33.40	0.00	0.00	0.00 0	0.00	1,000.00
					-						•			· · · · ·	-		With safety	facto	or 1.05	5		1,050.00

#### Specification of basic units and equipment

		1	
Name	Designation	Quantity	
Heating cable	LLS	1,050m	
Feed box	PTB1007 15/1M	1pc.	
Termination	LLS-TK	4pcs	
Service box	PTB1007 1M/1M	1pc.	
Splice connector	LLS-SK	3pcs	
End box	PTB1007 1M/0	1pc.	
Control cabinet with PT-590 and PT-400 thermostats	CC-TM-*-*	1рс.	
Monitoring cabinet with TEMPORT	TMC	1pc.	
Temperature sensor	TST01	3pcs	
Connection box for connection of temperature sensor	PTB403	2pcs	
Temperature sensor	TC014	3pcs	
Power cable	Armored power cable 5x35mm <sup>2</sup>	50 m	
Control cable	Armored control cable 10x1,5mm <sup>2</sup>	225 m	
Control cable	Two-pair control cable 2x2x0,5mm <sup>2</sup>	225 m	

System of notation for control cabinets



Selection of heating cable and heating circuit is conditioned on the temperature to be maintained, the amount of heat loss, pipeline length. This solution does not require an accompanying power line.

### Symbols:

Tmaxen\* - Maximum allowable exposure temperature of the cable, energized Texp\* - Maximum allowable exposure temperature of the cable, de-energized

sequence number of the cabinet in the project – project number – "Teplomag" system – control cabinet

### Isometric drawing



- 3. The minimum ambient temperature during installation of heating sections is -25 °C; and during installation of other electrical equipment it is according to the products' technical certificates.
- 4. Perform installation work in accordance with the requirements of the design documentation, installation operating procedure and the Electric Installation Code.



### Installation details of feed, service, end boxes and terminations (for one pass of heating cable LLS)







	Q-ty
	1
ro +60)	1
io +125)	2
<i>monitoring cabinet)</i>	
	1
	3
)	
	2
	1
	3
	3
	1
	1
	1
	3

## Electric heating of a water pipeline 2.4 km long by a system based on skin-effect

General specifications

### Location: Oil-gas condensate field, the Republic of Komi

#### Heated object parameters

Type of the pipeline	water line
Class of explosion hazard zone	safe
Location	above ground
Pipeline material	steel
Product	water
Ambient temperature, C deg.	-46+19
Required temperature to be maintained on the pipeline, C deg.	not less than +5
Steaming temperature, C deg.	steaming not provided
Length, m	2,439
Diameter Nominal, mm	150
Type of pipes thermal insulation	preinsulated pipes

#### Technical data of the IRHS-15000 electric heating system

Section of induction-resistive conductor, mm <sup>2</sup>	10
Diameter of induction-resistive heater, mm	28x3
Maximum supply voltage of the system heating part, V	905
System maximum operating current, A	69
True power of the system per 1 m, W/m	21.0
Total power of the system per 1 m, V·A/m	25.6
Linear voltage drop per 1 m, V/m	0.37
Maximum operating power of the system (total), kV·A	62.5

#### Thermotechnical calculation

Pipe number	Diameter Nominal,	Pipe length,	Thermal insulation thickness,	Thermal Required temperature,	parameters Tmaxen*,	Texp*,	Coefficient of thermal insulation thermal conductivity,	Design heat loss,	Heating system	System power output at design temperature,	Number of passes	IRC*, IRH* consump tion rate,	Heating power,	IRC*, IRH* total length,
	mm	m	mm	°C	°C	°C	W/(m*°C)	W/m		W/m		m/m	W/m	m
6	150	2,439	90	5	40	80	0.035	15.70	IRHS-15000	21.00	1	1.00	21.00	2,439.00
										With	safety f	actor 1.05	,	2,560.00

#### Specification of basic units and equipment

Name	Designation	Quantity
Package transformer substation (PTS) with control cabinet with PT-580 thermostat	PTS-120/6/0,9-UHL1	1 pc.
Transformer in assembly with PTS	TMG-120/6/UHL1	1 pc.
Temperature sensor (installation cable L = 0.1 m)	TST01	1 pc.
Temperature sensor (installation cable L = 2 m)	TST01	4 pcs
Feed box	IRFB-2-28-010	1 pc.
Connection box	IRCB-2-28-010	39 pcs
End box	IREB-2-28-010	1 pc.
Induction-resistive conductor	IRC-2-10-001	2,560 m
Induction-resistive heater	IRH-28-3,0-002	2,560 m
Connection box	PTB403	2 pcs
Connection box	PTB404	1 pc.
Connection box with TEMPORT	PTB/TEMPORT	1 pc.
Control system bus	SST-Bus	100 m
Power cable	Armored power cable 3x35 mm <sup>2</sup> 1kV	
Coupling (induction-resistive heater connection)	BC.35x30.50.001	710 pcs
Holder block	CT.28x30.002	310 pcs
Safety insert (for induction-resistive heater)	CT.28x30.002	90 pcs
Induction-resistive heater pipe-bend	OTB.28.1000	30 pcs
Lock for fixing tape		5,120 pcs
Steel fixing tape		3,750 m
Connector	IRCn	40 pcs
Thermoconductive paste	Silarm 3	720 kg
Lute		27 kg
Aluminium self-adhesive mounting tape		1 roll

System of notation for package transformer substations (for skin-heating)



climatic version phase voltage on the side of load connection, kV line voltage at the entry, kV PTS power, kVA package transformer substation

Selection of this heating system is conditioned on the amount of heat loss, pipeline long length, a possibility to supply power only at the beginning of the pipeline.

### Symbols:

Tmaxen\* - Maximum operating temperature of the induction-resistive heater, energized Texp\* – Maximum allowable exposure temperature of the induction-resistive conductor, de-energized IRC\* - Induction-resistive conductor, IRH\* - Induction-resistive heater

### Principal drawing



- 1. Install power supply cables and control cables separately (on different trays of cable rack).
- Lay power supply from BLOCK-BOX 3 to power supply boxes IRFB with armored power cable 3x35mm<sup>2</sup> 1kV trademark.
- 3. Install air temperature sensor TS air of control system inside the terminal box. Mount the box outside BLOCK-BOX, in a place where penetration of direct sunlight and other flows of heat to the box is impossible (north side, shed, bottom).
- Install the control cable from control cabinet to the terminal box with temperature sensor TS air
- in a corrugated plastic tube as applicable. Fasten it with braces. Bring it in the box and control cabinet with use of sealing glands.
- 4. Install temperature sensors TS irh of control system on the IRH surface and connect them via terminal block of box of type PTB403 to control cable HCSC. Pull the cable to CC along the cable rack in a corrugated tube. Control cables maximum length should not exceed 100 m.
- Install the box on the water line in a place with easy access for installation and maintenance.
- 5. Install temperature sensors TS pl and TS irh of monitoring system on the water line surface and connect them via terminal block of box of type PTB403 to control cable MC.
- Install air temperature sensor TS air of monitoring system outside this same terminal box and connect it via terminal block of box of type PTB403 to control cable MC.
- Pull the cable to CC along the cable rack in a corrugated tube. Control cables maximum length should not exceed 100 m. Install the box on water line in a place with easy access for installation and maintenance.
- 6. The water line is mounted of ready-to-operate pipes and pipe-bends with induction-resistive heater (IRH) installed in them. During the water line installation it is required to provide the IRH location set in the drawing (on top) and an IRH misalignment on two adjoining water line pipes of 3 mm maximum in places of IRH connection by holder blocks and of 5 mm maximum in places of IRH connection by boxes IRCB.
- 7. In places of the water line turning and in places of gate valves installation use IRH pipe-bends. IRH connection (and IRH pipe-bends interconnection) must be made in places of the water line pipes joining by overlap welding with use of bushings. Ingress of metal splashes and oxide scale into the heater is not allowed. Seal IRH (IRCB joining pipes) junction points and couplings junction points with lute of type "BITUREL" according to instruction manual. After mounting the IRH connection fill space between IRH pipe and the water line pipe with thermoconductive paste to provide reliable heat transmission from IRH to the water line pipe.
- 8. To prevent damage of induction-resistive conductor (IRC) jacket when pulling it inside IRH, all of its internal junctions must not have sharp edges, fins, hard metal splashes, etc., the internal edge of IRH pipes butt-ends must be rounded up with a raduis of 1 mm.

- 9. Install connection (pull) boxes IRCB on pipelines in places of the water line pipes junction in accordance with INSTALLATION MANUAL OF IRCB OF ELECTRIC HEATING SYSTEM IRHS-15000. The distance between boxes in linear sections must be about 70 meters. The places of IRCB installation are shown schematically on the drawing. The places of IRCB installation are precised during installation, marked on the enclosure (on the nearest support) and recorded in the as built drawing.
- 10. Attach boxes IRCB to the water line pipe with use of steel fixing tape.
- 11. Boxes IRCB are connected to IRH by welding with use of bushings. Metal splashes, sharp edges and oxide scale are not allowed on the internal surface of IRCB and IRH.
- 12. Works on IRC pulling through in IRH must be performed at an ambient temperature of not lower than -30 deg. C.
- 13. IRC connection in boxes IRCB must be done with use of special connectors in accordance with connectors operation sheet.
- 14. After connectors installation the boxes covers must be tightly closed (all bolts tightened).
- 15. In the power supply box (IRFB) connect IRC to phase conductor of power supply cable, connect the cable neutral wire to IRH by bolting. Connect IRH to grounding conductor bus by means of welded connection.
- 16. The end box (IREB) is installed on the pipeline similarly to the connection box.
- 17. In the end boxes on the IRC there is installed high-voltage end sleeve and end piece by means of which IRC gets connected to IRH by bolting. End boxes (IREB) must be grounded.
- 18. After installation of IRH and boxes IRCB apply protective covering on their external surface (junctions). The operation is performed by customer along with pipeline painting. After it insulate thermally the point of joint and cover it with protective enclosure.
- 19. In the area of end box IREB installation mount thermal insulation and protective enclosure so as to provide access for end box maintenance during operation (removable access hole or sliding sleeve on protective enclosure).
- 20. After finishing installation works put marking "ELECTRIC HEATING" on the surface of protective enclosure in accordance with the requirements of the Electric Installation Code.
- 21. Perform installation work in accordance with the requirements of the design documentation, installation operating procedure and the Electric Installation Code.





To grounding loop

### Installation of temperature sensors of monitoring system



Canopy top on connection box is not shown for clarity

Installation of temperature sensors of control system



### Electric heating of single accessory units



## Electric heating of a horizontal tank by self-regulating heating cables

## General specifications

### Location : the South Shapkino field, the Republic of Komi

#### Heated object parameters

Type of tank	horizontal tank
Area classification	explosion hazard zone, B-1r
Location	above ground
Tank material	steel
Product	diesel fuel
Ambient temperature, C deg.	-46+30
Max. process temperature of the product, C deg.	+40
Required temperature to be maintained on the tank, C deg.	+10
Steaming temperature, C deg.	steaming not provided
Length, mm	4,300
Diameter, mm	2,800

#### Technical data of the "TEPLOMAG" electric heating system

Input powert supply of the control cabinet, V/Hz	3-380/50 TN-S
Supply voltage of the heating sections, V	220
Nominal power of the system, kW	1.8
Starting power of the system, kW	5.0
Temperature to be maintained, C deg.	not less than +10
Thermal insulation material, thermal conductivity coefficient	mineral wool, 0.05 W / (m*C deg.)
Thermal insulation thickness, mm	100

#### Thermotechnical calculation

Tank number	Diameter,	Length,	Thermal insulation	Therma	parameters		Coefficient of thermal insulation	Design H heat loss,	Heating cable type	Heating cable power output at design	Number of loops,	Laying pitch,	Heating power,	
			thickness,	Required temperature,	Tmaxen*,	Texp*,	thermal conductivity,			temperature,				
	mm	mm	mm	°C	°C	°C	W/(m*°C)	w		W/m	рс	mm	W	
T25	2,800	4,300	100	10	65	85	0.05	1,726.0	25HTP2-BP	23.75	8.00	268.00	1,733.80	
										With	safety facto	or 1.02		

#### Specification of basic units and equipment

Name	Designation	Quantity
Heating cable	25HTP2-BP	74.5m
Connection box	PTB401	1pc.
Control cabinet with PT-400 thermostat	CC-TM-*-*	1pc.
Temperature sensor	Pt100	2pcs
Connection box for connection of temperature sensors	PTB403	1рс.
Power cable	Armored power cable 5x4 mm <sup>2</sup>	50m
Control cable	Armored control cable 3x1,5 mm <sup>2</sup>	100m

The control cabinet circuit is carried out similarly to the circuit shown on sheet 12.

System of notation for control cabinets



Selection of heating cable is conditioned on the temperature to be maintained and the amount of heat loss

### Symbols:

Tmaxen\* - Maximum allowable exposure temperature of the heating cable, energized Texp\* - Maximum allowable exposure temperature of the heating cable, de-energized



- sequence number of the cabinet in the project
- project number
- "Teplomag" system
- control cabinet

### Principal drawing



- 3. The minimum ambient temperature during installation of heating sections is -40 °C (at that the recommended single bending radius must be 105 mm minimum); and during installation of other electrical equipment it is according to the products' technical certificates.
- 4. Perform installation work in accordance with the requirements of the design

documentation, installation operating procedure and the Electric Installation Code.





## Electric heating of a vertical tank by self-regulating heating cables General specifications

### Location: Cenomanian deposit of Beregovoye field, the Tumen Region

#### Heated object parameters

Type of tank	Upright tank
Area classification	safe
Location	above ground
Tank material	steel
Product	water
Ambient temperature, C deg.	-46+18
Required temperature to be maintained on the tank, C deg.	+10
Steaming temperature, C deg.	steaming not provided
Height, mm	9,070
Diameter, mm	8,530

#### Technical data of the "TEPLOMAG" electric heating system

Input powert supply of the control cabinet, V/Hz	3-380/50 TN-S
Supply voltage of the heating sections, V	220
Nominal power of the system, kW	14.4
Starting power of the system, kW	19.8
Temperature to be maintained, C deg.	not less than +10
Thermal insulation material, thermal conductivity coefficient	mineral wool, 0.05 W / (m*C deg.)
Thermal insulation thickness, mm	80

#### Thermotechnical calculation

Diameter,	Length,	n, Thermal insulation Thermal parameters Coefficient of thermal insulation		Coefficient of thermal insulation	Design heat loss,	Heating cable type	Heating cable power output at	Number of loops,	Laying pitch,	Heating power,	Cable total			
		thickness,	Required temperature,	Tmaxen*,	Texp*,	conductivity,			design temperature,				length,	
mm	mm	mm	°C	°C	°C	W/(m*°C)	w		W/m	рс	mm	w	m	
8,530	9,070	80	10	65	85	0.05	13,956.00	33HTP2-BT	31.00	17.00	150.00	14,105.00	455.00	
-,										With	safety fact	or 1.02	464.00	
	Diameter, mm 8,530	Diameter,         Length,           mm         mm           8,530         9,070	Diameter,Length,Thermal insulation thickness,mmmm8,5309,07080	Diameter,Length,Thermal insulation thickness,Thermal Required temperature,mmmmmm°C8,5309,0708010	Diameter,Length,Thermal insulation thickness,Thermal required temperature,Thermal required temperature,mmmmmm°C°C8,5309,070801065	Diameter,Length,Thermal insulation thickness,Thermal Required temperature,Tmaxen*,Texp*,mmmmmm°C°C°C8,5309,07080106585	Diameter,Length,Thermal insulation thickness,Thermal neuronaThermal nameters,Coefficient of thermal insulation thermal conductivity,mmmmmm°C°C°C8,5309,070801065850.05	Diameter,Length,Thermal insulation thickness,Thermal required temperature,Tmaxen*,Coefficient of thermal insulation thermal conductivity,Design heat loss,mmmmmm°C°C°CW/(m*°C)W8,5309,070801065850.0513,956.00	Diameter,Length,Thermal insulation thickness,Thermal required temperature,Thermal rametersCoefficient of thermal conductivity,Design heat loss, thermal conductivity,Heating cable typemmmmmm°C°CW/(m*°C)W8,5309,070801065850.0513,956.0033HTP2-BT	Diameter,Length,Thermal insulation thickness,Thermal required temperature,Thermal required temperature,Coefficient of thermal insulation thermal conductivity,Design heat loss, thermal conductivity,Heating cable power output at design temperature,mmmmmm°C°C°CW/(m*°C)WW/m8,5309,070801065850.0513,956.0033HTP2-BT31.00	Diameter,Length,Thermal insulation thickness,Thermal insulation thickness,Thermal insulation thermal conductivity,Design heat loss, heat loss,Heating cable power output at design temperature,Number of loops, design temperature,mmmmmm°C°C°CW/m*°CWW/mPc8,5309,070801065850.0513,956.0033HTP2-BT31.0017.00With	Diameter,Length,Thermal insulation thickness,Thermal required temperature,TemmerCoefficient of thermal insulation thermal conductivity,Design heatloss,Heating cable power output at design temperature,Number of loops,Laying pitch,mmmmmm°C°C°V(m*°C)WImage: State of the	Diameter,Length,Thermal insulation thickness,Thermal required temperature,Thermal resultCoefficient of thermal insulation thermal conductivity,Heating cable pheat loss,Heating cable power output at design temperature,Number pheating pich,Laying pich,Heating power,mmmmmm°C°CW(m*°C)WImage: Second	

#### Specification of basic units and equipment

Name	Designation	Quantity		
Heating cable	33HTP2-BT	464 m		
Connection box	PTB402	3 pcs		
Connection box	PTB1005	1 pc.		
Control cabinet with PT-400 thermostat	ШУ-ТМ-*-*	1 pc.		
Temperature sensor	Pt100	1 pc.		
Connection box for connection of temperature sensor	PTB404	1 pc.		
Power cable	Power cable 5x6 mm <sup>2</sup>	50 m		
Power cable	Power cable 5x4 mm <sup>2</sup>	15 m		
Control cable	Control cable 3x1,5 mm <sup>2</sup>	55 m		

The control cabinet circuit is carried out similarly to the circuit shown on sheet 12. System of notation for control cabinets



Selection of heating cable is conditioned on the temperature to be maintained and the amount of heat loss

### Symbols:

Tmaxen\* - Maximum allowable exposure temperature of the heating cable, energized Texp\* – Maximum allowable exposure temperature of the heating cable, de-energized



sequence number of the cabinet in the project project number - "Teplomag" system

### Isometric drawing



*Connection box for connection of temperature sensor* 

3x1,5 mm<sup>2</sup>

Temperature sensor installed on tank, in a place that is most susceptible to overheating

NOTE

- 1. The installation order is described in the Operating procedure "Installation.
- 2. The tank must be insulated by mineral wool with a thermal conductivity of with a thickness of 80 mm.
- 3. The minimum ambient temperature during installation of heating sections is -40 °C (at that the recommended single bending radius must be according to the products' technical certificates.

![](_page_41_Figure_11.jpeg)

of electrical heating system TEPLOMAG using self-regulating heating cables". 0.05 W/(m\*°C) maximum at 10 °C, the material must have density from 100 to 140 kg/m<sup>3</sup>,

105 mm minimum); and during installation of other electrical equipment it is 4. Perform installation work in accordance with the requirements of the design

documentation, installation operating procedure and the Electric Installation Code.

![](_page_42_Figure_1.jpeg)

NOTE. 1. A deviation from design laying pitch of  $\pm 15$ mm is permitted.

![](_page_43_Figure_1.jpeg)

Installation details of steel welded mesh on tank

Assembly unit of meshes coupling and tension on tank

![](_page_43_Figure_4.jpeg)

Steel welded mesh

Steel installation wire

Metal tube

![](_page_43_Picture_10.jpeg)

## Electric heating of a mazout pipeline by medium-temperature series-resistance heating cables General specifications

### Location: Kirovsk town

#### Heated object parameters

Type of the pipeline	mazout line
Area classification	explosion hazard zone, B-1r
Location	above ground
Pipeline material	steel
Product	mazut
Ambient temperature, C deg.	-20+25
Required temperature to be maintained on the pipeline, C deg.	+70
Steaming temperature, C deg.	+150
Length, m	500
Diameter, mm	108

#### Technical data of the "TEPLOMAG" electric heating system

Input powert supply of the control cabinet, V/Hz	3-380/50 TN-S
Supply voltage of the heating sections, V	380
Nominal power of the system, kW	17.87
Starting power of the system, kW	21.51
Temperature to be maintained, C deg.	not less than +70
Thermal insulation material, thermal conductivity coefficient	polyurethane foam, 0.0375 W / (m *C deg.)
Thermal insulation thickness, mm	100

#### Thermotechnical calculation

Name of singling	Diameter,	Length,	Th	nermal paramet	ters, C	Design heat	Interconnection	Cable	Cable power	ower Number of Hea		Cable consumption rate per unit, m			Number of power	of Section starting	Section current (hot	Cold start	Hot power,	Section	Max. tempera-	Cable total
Name of pipeline	mm	m	Required	Min. ambient	Steaming tempera- ture	W/m	Interconnection	trademark	W/m	passes F	W/m	Valve	Flange	Support	supply points	current, A	condition), A	kW		m	ture, °C	m
mazout line	108	500	70	-20	150	25.10	Star	SNF-11R9	11.57	3	34.71	1.4	0.00	0.3	1	32.67	27.16	21.51	17.87	515	86.82	1,545
mazout line	108	500	70	-20	150	25,10	Star	SNF-11R9	11,57	3	34,71	1,4	0,00	0,3	1	32,67	27,16	21,51	17,87	515	86,82	1545
mazout line	108	450	70	-20	150	25,10	Star	SNF-17R4	9,88	3	29,63	1,4	0,00	0,3	1	25,41	20,86	16,72	13,73	464	83,90	1391
mazout line	108	535	70	-20	150	25,10	Star	SNF-11R9	10,19	3	30,57	1,4	0,00	0,3	1	30,54	25,59	20,10	16,84	551	84,43	1653
mazout line	108	470	70	-20	150	25,10	Star	SNF-17R4	9,10	3	27,29	1,4	0,00	0,3	1	34,76	20,07	22,88	13,21	484	82,62	1453
mazout line	108	470	70	-20	150	25,10	Star	SNF-17R4	9,10	3	27,29	1,4	0,00	0,3	1	34,76	20,07	22,88	13,21	484	82,62	1453

#### Specification of basic units and equipment

Name	Designation	Quantity		
Heating cable	SNF-11R9	1,545 m		
Installation cable ("cold lead")	SNF-02R9	бm		
Connection (feeding) box	PTB405	1 pc.		
Connection (end) box	PTB405	1 pc.		
Connector (heat.cable-heat.cable)		9 pcs		
Connector (heat.cable-instal.cable)		6 pcs		
Control cabinet with PT-400 thermostat	CC-TM-*-*	1рс.		
Temperature sensor	Pt100	3 pcs		
Connection box for connection of temperature sensor	PTB403	1 pc.		
Power cable	Armored power cable 5x6 mm <sup>2</sup>	100 m		
Control cable	Armored control cable 10x1,5 mm <sup>2</sup>	100 m		

The control cabinet circuit is carried out similarly to the circuit shown on sheet 12.

System of notation for control cabinets

![](_page_44_Figure_12.jpeg)

Selection of heating cable is conditioned on the Customer's desire to minimize the number of power supply points and on the temperature parameters of the heated object

sequence number of the cabinet in the project project number "Teplomag" system control cabinet

### Isometric drawing

![](_page_45_Figure_1.jpeg)

- according to the products' technical certificates.
- documentation, installation operating procedure and the Electric Installation Code.

 The pipeline must be insulated by polyurethane foam with a thermal conductivity of 0.0375 W/(m\*°C) maximum at 10 °C, with a thickness of 100 mm for pipes with D=108 mm.
 The minimum ambient temperature during installation of heating sections is -50 °C; and during installation of other electrical equipment it is 3. Perform installation work in accordance with the requirements of the design

![](_page_46_Figure_1.jpeg)

### Installation details of the connection (feedind) box PTB405 on a pipeline

### Installation details of the connection (end) box PTB405 on a pipeline

## Installation drawing and electric heating of single accessory units

![](_page_47_Figure_1.jpeg)

### Temperature sensors installation

Installation details of the heating section on a valve A loop is made by each pass of the heating section

![](_page_47_Figure_4.jpeg)

![](_page_47_Picture_7.jpeg)

## Electric heating of a bitumen pipeline by series-resistance heating cables with mineral insulation

General specifications

### Location: the Orenburg Region

neuteu object purumeters						
Type of the pipeline	bitumen line					
Area classification	explosion hazard zone, B-1r					
Location	above ground					
Pipeline material	steel					
Product	bitumen					
Ambient temperature, C deg.	-43+42					
Required temperature to be maintained on the pipeline, C deg.	+180					
Max. process temperature of the product, C deg.	+220					
Steaming temperature, C deg.	steaming not provided					
Length, m	10.45					
Diameter Nominal, mm	80					

#### Heated object parameters

#### Technical data of the "TEPLOMAG" electric heating system

Input powert supply of the control cabinet, V/Hz	3-380/50 TN-S
Supply voltage of the heating sections, V	220
Nominal power of the system, kW	2.2
Starting power of the system, kW	2.23
Temperature to be maintained, C deg.	not less than +180
Thermal insulation material, thermal conductivity coefficient	mineral wool, 0.066 W / (m*C deg.)
Thermal insulation thickness, mm	80

Name of pipeline	Diameter Nominal, mm		ength, m thickness, mm	Thermal parameters, C			Design boot	Heating cable			Heating Supp	Gummhr	Section	Section operating	Section	Section "bot"	Max.	Contion	
		Length, m		Required	Min. ambient	Max. temp. in effect	loss, W/m	Interconnec- tion	Trademark	Power output, W/m	Number of passes	power, W/m	voltage, V	current, A/phase	current (hot condition), A/phase	starting power, kW	power, kW	tempera- ture, °C	length, m
Bitumen line	80	10.45	80	180	-43	220	120.6	loop	MIC CuNi 0630	65.3	2	130.6	220	11.4	10.1	2.23	2.20	377	34.18
CH 2.1	89	5,60	80	180	-43	220	120,6	loop	MIC ST 2500	61,4	2	122,8	220	5,6	4,9	1,10	1,08	321	17,6
CH 3.1	89	12,29	80	180	-43	220	120,6	loop	MIC CuNi 0630	65,3	2	130,6	220	11,4	10,1	2,23	2,20	377	34,18
CH 4.1	89	10,85	80	180	-43	220	120,6	loop	MIC CuNi 0630	65,3	2	130,6	220	11,4	10,1	2,23	2,20	377	34,18
CH 5.1	89	6,15	80	180	-43	220	120,6	loop	MIC CuNi 1600	62,1	2	124,2	220	6,2	7	1,40	1,37	361	22
CH 6.1	89	15,65	80	180	-43	220	120,6	loop	MIC CuNi 0400	62,1	2	124,2	220	14	12,4	2,80	2,73	361	44
CH 7.1	89	7,30	80	180	-43	220	120,6	loop	MIC ST 2500	61,4	2	122,8	220	5,6	4,9	1,23	1,08	321	17,6
CH 8.1	108	11,70	80	180	-31	220	128,7	loop	MIC CuNi 0630	66,0	2	132,0	220	11,5	10,3	2,30	2,24	343	34
CH 9.1	89	12,61	80	180	-43	220	120,6	loop	MIC ST 0400	70,6	2	141,2	220	15	13,2	2,80	3,30	353	41
CH 10.1	89	7,10	80	180	-43	220	120,6	loop	MIC ST 4000	62,6	2	125,2	220	4,5	3,9	0,90	0,86	325	13,78
CH 11.1	159	7,40	80	180	-31	220	167,7	loop	MIC CuNi 0630	85,8	2	171,6	220	13,1	11,6	2,60	2,56	348	29,8
CH 12.1	159	2,70	80	180	-31	220	167,7	loop	MIC ST 2500	84,1	2	168,2	220	6,6	5,7	1,30	1,26	406	15

#### Thermotechnical calculation

#### Specification of basic units and equipment

Name	Designation	Quantity
Heating cable	MIC CuNi 0630	34.2 m
Connection box	PTB406	1 pc.
Control cabinet with PT-400 thermostat	CC-TM-*-*	1 pc.
Temperature sensor	TC1288/2/Pt100	2 pcs
Connection box for connection of temperature sensor	РТВ404-1Б/0/ДР	1 pc.
Power cable	Armored power cable 3x4 mm <sup>2</sup>	100 m
Control cable	Armored control cable 7x1 mm <sup>2</sup>	100 m

#### The control cabinet circuit is carried out similarly to the circuit shown on sheet 12.

System of notation for control cabinets

![](_page_48_Figure_13.jpeg)

Selection of heating cable is conditioned on the temperature to be maintained and the product maximum process temperature

sequence number of the cabinet in the project

- project number - "Teplomag" system control cabinet

### Isometric drawing

![](_page_49_Figure_1.jpeg)

### Installation details of the connection box PTB406 on a pipeline

![](_page_50_Figure_3.jpeg)

### Temperature sensors installation

### Installation details of the heating section installation on a valve

Installation details of the heating section installation on a flange coupling

![](_page_51_Figure_3.jpeg)

![](_page_51_Figure_4.jpeg)

![](_page_52_Picture_0.jpeg)

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### Heat tracing systems

Please fill out and send us this questionnaire containing the parameters required to design the electric heating system. We will respond with a detailed quote.

![](_page_52_Picture_4.jpeg)

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### QUESTIONNAIRE

Q	UESTION	NAIRE								
		Company								
1	Customer*	Name Surname								
		Name								
2	Site object*	Available design documentation for heated object Yes No								
_	-	Installer								
		Responsible representative Phone								
	Туре	Thermotechnical stage (TTS) Automation (ACS - automated control systems)								
3	of design	<ul> <li>(installation drawings and cabinets one-line diagrams)</li> <li>(a possibility of centralized control and data transfer to the higher level)</li> <li>Flectrotechnical stage (FTS)</li> <li>Thermal insulation (TI)</li> </ul>								
	works*	(electric networks laying diagrams, cable record)								
Δ	Purpose of	Freeze protection Anti-condensate heating								
<u> </u>	the system	Temperature maintenance Heating-up Time of heating hours Initial temperature °C								
		°C, Required pipe temperature*								
		C, Minimum ambient temperature								
		°C, Maximum ambient temperature								
5	Temperature	C, Standard process-oriented temperature* (Product temperature under standard operational conditions)								
5	conditions	°C, Maximum process-oriented temperature*								
		°C, Maximum allowed product temperature*								
		(The product highest temperature having no adverse effect on the product properties)								
		C, Minimum activation temperature* (The lowest temperature, which enables activation of the heating system)								
6	Steaming*	°C, Maximum steam temperature in case an object steaming is stipulated								
7	Environment	Normal (water, household wastewater)								
•	Pineline	Open air Undeground Depth m Soil								
Ø	location*	Indoors								
9	Cabling	C External C Internal								
40	Heat inculation	Mineral wool Preinsulated pipes								
10	type*	☐ Foamed rubber								
11	Heat insulation									
	installation Zone									
12	classification	Safe Explosion hazardous								
13	Pipe	Carbon steel Stainless steel								
	material*	Plastic   Other, heat conductivity coefficient   W/m•°C								
		Pipeline 1 2 3 4 5								
		Pipeline diameter								
		Heat insulation thickness, mm								
		Pipe length, m								
14	Parameters	Quantity of valves, pcs								
	of pipeline"	Quantity of flanges, pcs								
		Quantity of pipe supports, pcs								
		Pumped product								
		Product density, kg/m <sup>3</sup>								
		Product heat capacity, J/(kg • °C)								
1 E	Further									
15	information	Date*								
* R	equired field (mar	indatory for completion).								

	Company
1 Customer*	Name
Customer	
	Phone E-mail
	Name
•	
2 Site object*	Available design documentation for heated object
	Installer
	Responsible representative Phone
Type	Thermotechnical stage (TTS)
5 of design	(Instantation drawings and cabinets offerine diagrams) (a possibility of certicalized control and data draisier to the ingrite rever)
WOIKS	(electric networks laying diagrams, cable record) (electric networks laying diagrams, cable record)
<b>4</b> Purpose of	Freeze protection Anti-condensate heating
the system*	Temperature maintenance Heating-up Time of heating hours Initial temperature °C
	C, Required vessel temperature*
	°C, Minimum ambient temperature
	°C, Maximum ambient temperature
- Tomporaturo	°C, Standard process temperature*
5 conditions	(Product temperature under standard operational conditions)
conditions	C, Maximum process temperature*
	C Maximum allowed product temperature*
	(The product highest temperature having no adverse effect on the product properties)
	°C, Minimum activation temperature*
	(The lowest temperature, which enables activation of the heating system)
6 Steaming	°C Maximum steam temperature in case an object steaming is provided
Usteaming	
Object	Open air On the soil
7 location*	
0	External Distance to heating control point m
8 Cabling*	Internal Distance to nower supply point m
• Heat insulation	Mineral wool (mats) Thickness mm
9 <sub>type*</sub>	Others, heat-conductivity factor
7	
10 classification	Safe Explosion hazardous (zone classification)
classification	
11 Vessel	Carbon steel Stainless steel
II material*	Plastic Other, heat conductivity coefficient W/m·°C
	Horizontal Vertical Fullness coefficient
	Diameter mm Height mm Walls thickness mm
12 Parameters	Fittings and hatches:
of the vessel*	Type of cover: Flat Cover height m
	Conic
	Name*
12 Parameters	Density kg/m <sup>3</sup>
of the product	Viscosity kg/m·s at a temperature °C
	Heat capacity J/kg•°C
	Discharge m <sup>3</sup> /h Continuous Cyclic
A A Further	
14 information	Date*
*	

\* Required field (mandatory for completion).

### Heating of tanks

Please fill out and send us this questionnaire containing the parameters required to design the electric heating system. We will respond with a detailed quote.

![](_page_53_Picture_0.jpeg)

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# Trace heating with the IRHS-15000 skin-effect system

Please fill out and send us this questionnaire containing the parameters required to design the electric heating system. We will respond with a detailed quote.

![](_page_53_Picture_4.jpeg)

		Company							
1	Customer*	Name	Surname						
		Phone	E-mail						
		Name							
		Location*							
2	Site object*								
4	Site object	Available design documentation for heat	ad object Ves No						
		Installer							
		Responsible representative	Phone						
3	Type of design works*	<ul> <li>Thermotechnical stage (TTS) (installation drawings and package transformer substation (PTS) diagrams)</li> <li>Electrotechnical stage (ETS) (Installation drawings and package transformer)</li> <li>Automation (ACS – automated control systems) (a possibility of centralized control and data transfer to the higher level)</li> <li>Thermal insulation (TI)</li> </ul>							
		(electric networks laying diagrams, cable	record) (equipment thermal insulation drawings, list of equipment to be installed)						
4	Purpose	Freeze protection	Anti-condensate heating						
-	of system	Temperature maintenance	Heating-up Time of heating hours Initial temperature °C						
		°C, Required pipeline tempe	rature*						
		Minimum ambient temperature minus	°C. maximum ambient temperature						
		°C Standard process temper							
5	Temperature	(Product temperature under	standard operational conditions)						
v	conditions	°C, Maximum process temper (The highest temperature the	:rature* e vessel may occasionally attain)						
		°C, Maximum allowed produ	ict temperature*						
		(The product highest temper	ature having no adverse effect on the product properties)						
		(The lowest temperature, wh	ich enables activation of the heating system)						
		Open air							
		Subsea							
6	Pipeline	Buried Laving dep	th m Soil						
	location*	With pipeline	a laving depth of over 0.7m from the soil surface.						
		specify the av	verage temperature of the coldest month °C						
7	Heat insulation installation*	In plant conditions	nsite						
•	Heat insulation	Mineral wool Fo	bamed polyurethane						
8	type*	Foamed rubber	ther, heat conductivity coefficient W/m•°C						
	<u> </u>								
9	Supply points								
	-	From both ends Distance	e from power supply point to the beginning of heated area* m						
10	Zone classification	Safe	Explosion hazardous (area classification)						
11	Pipe	Carbon steel	Stainless steel						
	material*	Plastic	Other, heat conductivity coefficient W/m·°C						
		Pipeline	1 2 3 4 5						
		Pipeline name							
		Pipe outer diameter, mm							
		Pipe wall thickness, mm							
12	Parameters	Heat insulation thickness, mm							
14	of pipelines*	Pipe length m							
		Number of valves pos							
		Number of flanges, per							
		Number of nanges, pcs							
		Number of pipe supports, pcs							
42	Further	More detailed further information can be	entered in the Attachment						
13	information		Date*						
		·							

GC SST GROUP

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### ATTACHMENT TO THE QUESTIONNAIRE

		Date*
15	Further information	
14	System's power supply parameters*	Diesel generator     Supply voltage     V       Power line     Frequency     Hz       Others     Number of phases
13	Protection type	Relay module         Electronic module
12	Transformer type	Oil filled Dry
11	Energy accounting	Yes         Others:
10	Earthing	Horizontal Others: Others:
9	Telemetry	Signaling     Monitoring       Control     Others:
8	Remote control	Yes           No         Others:
7	Ventilation system	Natural draft     Air conditioner       Forced draft     Others:
6	Fire fighting system	Indication     Automatic       Fire extinguisher     Others:
5	Installation	On soll On supports
4	Supply lead	Aerial Others
3	PTS design	Kiosk type without heat insulation and heating Kiosk type with heat insulation and heating
		Responsible representative Phone
2	Site object*	Available design documentation for heated pipeline Ves No
		Name
1	Customer*	Name         Surname           Phone         E-mail
	Customer*	Company Surrame

\* Required field (mandatory for completion).

Please make sure to fill in the Attachment!

\* Required field (mandatory for completion).

# Trace heating with the IRHS-15000 skin-effect system

Please fill out and send us this questionnaire containing the parameters required to design the electric heating system. We will respond with a detailed quote.

![](_page_54_Picture_0.jpeg)

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# Low voltage electrical switchboards

Please fill out and send us this questionnaire containing the parameters required to design the electric heating system. We will respond with a detailed quote.

## QUESTIONNAIRE

	Company
1 Customer*	Name Surname
	Phone E-mail
	Phone
	NKU name (purpose in brief)
	Diagram sequence number (for typified product)
	Farthquake intensity as per MSK-64
	Seismic safety group according to GOST 30546.1-98
	Minimum ambient temperature minus $\bigcirc$ °C, maximum ambient temperature $\bigcirc$ °C
	Protection rating IP Climatic version according to GOST 15150-69
	Power cables lead From top From bottom
	Power cables cross section mm <sup>2</sup>
2 General	Cobles lead from lead
uala	
	Cables cross section from load
	Number of phases Supply voltage V Frequency Hz
	Power supply category
	Earth system
	Version by installation method On-floor Hinged Built-in
	Dimensions of body, mm
	Version of front door
	Version of back door
	Equipment element base   Hager   ABB   SE   Legrand   ETI   Others
	Rated power output of load, maximum kW Starting current, maximum A
3 Control	Equipment type None Temperature controllers PLC
J control	Data transfer protocol   Data transfer interface
	Fiscal metering device Ves No
	Input amperemeter O Yes O No
Auxiliary	Input voltmeter Ves No
4 equipment	Ventilation system O Yes O No
	Cabinet lighting system $\widecheck$ Yes $\bigcirc$ No
	Cabinet heater O Yes O No
E Further	
<b>D</b> information	
	Date*

![](_page_54_Picture_6.jpeg)

\* Required field (mandatory for completion).

![](_page_55_Picture_0.jpeg)

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