PIPELINE
SYSTEMS & TECHNOLOGIES

Design, development, production,

supply of monolithic insulating joints,

corrosion protection equipment,

corrosion monitoring systems for steel pipelines,

onshore and offshore facilities

2019

PIPELINE SYSTEMS AND TECHNOLOGIES

Joint-stock company «Pipeline systems and technologies» introduces complete solutions for corrosion protection and corrosion monitoring of steel pipelines, structures, underwater and harbor facilities.

Our company was founded in 2006. Our production facilities are situated in Schelkovo, Moscow region.

Main activity:

- engineering services for corrosion protection
- development and production of the equipment
- complete supplies and site-assistance
- aftersales service

Produced equipment:

- insulating monolithic joints
- corrosion monitoring systems
- cathodic protection polarization cell
- test stations and resistance control units
- inducted current protection device
- reference electrodes
- anode grounding
- marker plates
- spark gaps control module

Equipment is exploitating at the sites of:

— PJSC «Gazprom»
— PJSC «Gazprom neft»
— PJSC «NK «Rosneft»
— PJSC «Transneft»
— PJSC «LukOil»
— JSC «Mosgaz»
— JSC «Mosoblgaz»
— and many others

Daughter companies:

LLC «PST Engineering» – is a developer and manufacturer of intelligent control systems of constructions that are based on distributed fiber optic sensing technologies.

«MetriCorr Aps» (Denmark) – is a designer and manufacturer of the hi-technology electronic equipment.

«PST Global» – is a company which presents JSC «Pipeline systems and technologies» interests abroad.

INSULATING MONOLITHIC JOINTS

Insulating monolithic joint is a permanent pipeline item which provides electrical disconnecting of the pipeline sections.

Insulating monolithic joints are installed:

- at the border of sections with pipelines electrochemical protection;
- at the border of the property plots, including disconnecting from the lateral pipeline;
- at the borders of pipeline sections with different types and quality of protective coatings, different systems of electrochemical protection or significant change of soil electrical resistivity, including between above-ground and underground areas;
- at the ends of coverage area of stray or telluric direct currents or alternating voltage;
- at the crossings lines of multi-line pipelines with water barriers;
- at the interface line of unprotected or grounded buried structures or equipment;
- in other places where electrical disconnecting of the pipeline is required.

Supply geography of the monolithic insulating joints produced by CJSC “Pipeline systems and technologies” covers all the territory of Russian Federation at such objects as:

- “Russia – Turkey”;
- “Yamal – Europe”;
- “Bovanenkovo – Ukhta”;
- “Sakhalin – Khabarovsk – Vladivostok”;
- “Power of Siberia”;
- “SRTO – Torzhok”;
- “Achimov field”;
- “Kovykta field”;
- “Chayanda field”;
- “North European Pipeline”;
- “South European Pipeline”;
- Varandey oil terminal;
- Ice-resistant oil platform LSP-1 of Yuri Korchagin deposit;
- Import, storage and regasifying LNG terminal in Kaliningrad region;
- Gasification program of Russian regions;
- and many others.

Installation of the insulating monolithic joint DN 1420 mm at the gas pipeline

Stress-strain analysis of the insulating monolithic joint

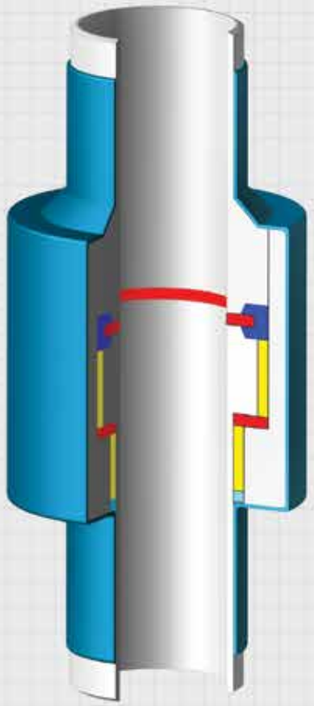
FEATURES AND ADVANTAGES

1 A welded monolithic construction has an enhanced capability to withstand mechanical loads and is convenient while installing and operating.

2 *Patented U-shaped double seal system has unique sealing and dielectric properties, and has a wide range of constructive and technological advantages as compared with O-ring seal systems:*

- *absence of explosive decompression effect;*
- *applicability under a high pressure (up to100 MPa);*
- *applicability at high mechanical loads (tension, compression, bending, torsion);*
- *possibility to manufacture large diameter joints (up to 3300 mm).*

U-shaped double seal system



3 Possibility of aboveground and underground installation.

4 Applicability in all the climatic zones including maximum operating temperature up to plus 250°C.

5 Factory outer coating (epoxy or polyurethane) provides an effective electrical and mechanical protection against external influences.

6 Nonconductive inner coating allows to avoid a bypass during the transportation of a conductive product.

7 All insulating monolithic joints pass the following set of tests:

- Non-destructive testing of welding seams;
- Strength test by trial internal hydraulic pressure;
- Leak test by internal pneumatic pressure;
- Electric strength test.

TECHNICAL DATA FOR STANDARD JOINTS

OPERATING PRESSURE – **UP TO 40 MPa**

OUTER DIAMETER OF A PIPELINE – **FROM 12 mm TO 1420 mm**

ELECTRICAL RESISTANCE IN THE AIR AT A VOLTAGE OF 1000 V DC – **MORE THAN 5 MOhm**

DIELECTRIC STRENGTH – **MORE THAN 5 kV**

OPERATING TEMPERATURE RANGE:

- CLIMATIC VERSION «Md» – **FROM -40°C TO +60°C**
- CLIMATIC VERSION «Cl» – **FROM -60°C TO +60°C**

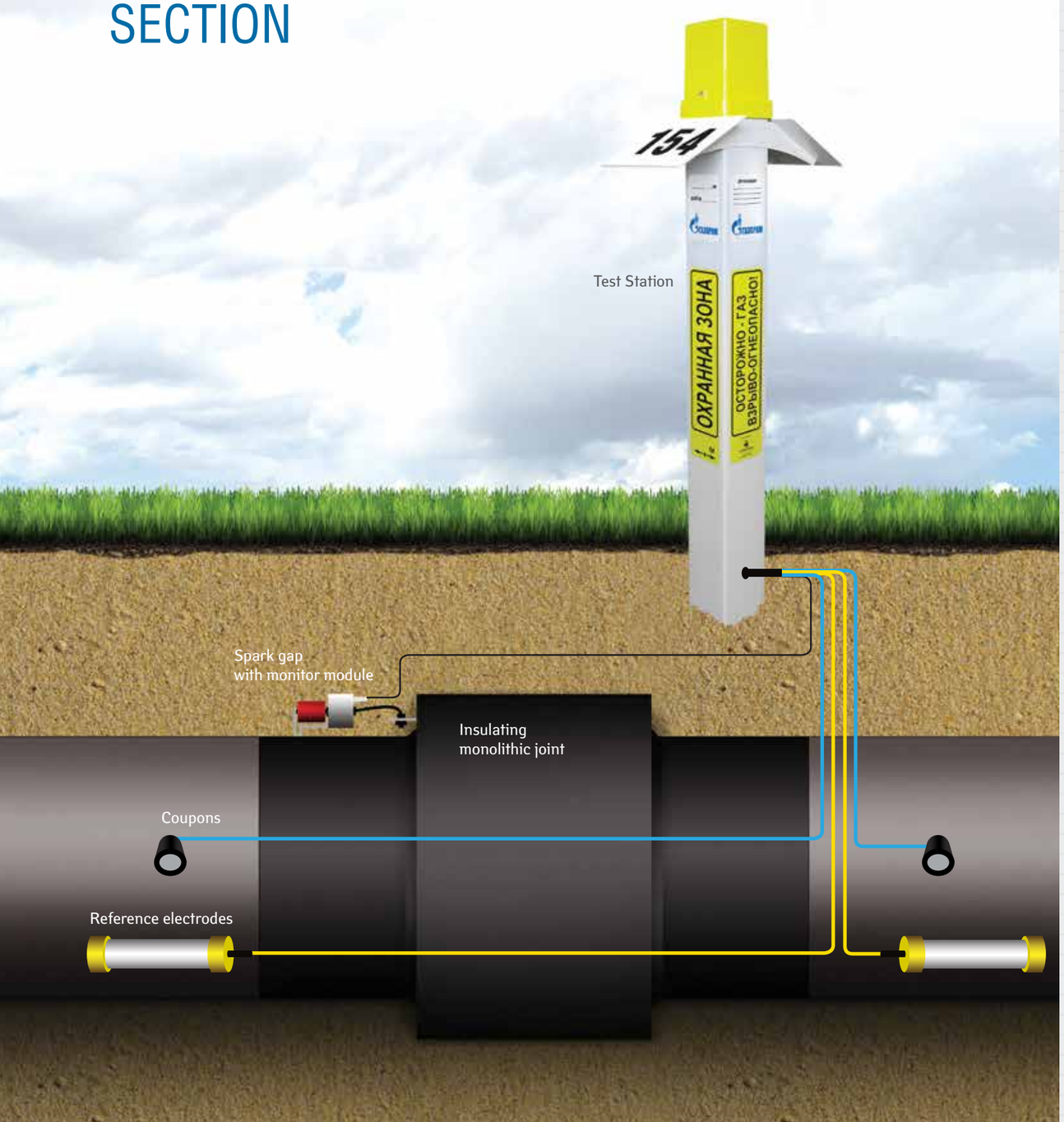
Tests for internal pressure combined action and torque

Tests for internal pressure combined action and torque

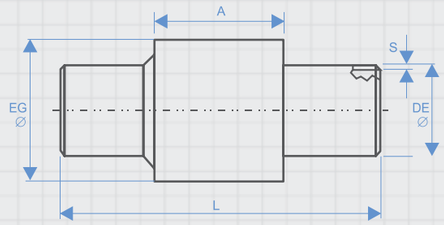
Shot peening before coating

Protective coat dielectric continuity test

ELECTRICAL DISCONNECTING OF THE PIPELINE SECTION



Overall dimensions and mass (main standard sizes)



An insulating monolithic joint's legend:
IMC-XX-YY-ZZ, where:

IMJ — insulating monolithic joint;

XX — outer diameter (DE) of joint pups and a pipeline, mm;

YY — joint operating pressure, MPa;

ZZ — climatic version (Md or Cl).

DE, mm	PN, MPa	S, mm	EG, mm	A, mm	L, mm	Mass, kg
32	1,6	4	66	55	250	1,6
	9,8	3,5	88	76	400	3
	16,0	5	88	130	600	7,3
57	1,6	4	88	62	500	5
	9,8	5	114	102	700	10
	12,0	5	120	112	700	12
	16,0	6	130	152	700	17
	25,0	6	175	214	750	39
89	1,6	4	126	62	500	7
	9,8	5	156	120	700	18
	12,0	5	160	122	700	20
	16,0	6	160	168	800	28
	25,0	8	192	186	800	43
108	1,6	6	150	72	500	12
	9,8	6	184	128	700	26
	12,0	6	186	132	700	28
	16,0	6	200	196	800	49
	25,0	9	230	200	800	61
114	1,6	6	154	76	500	15
	9,8	6	190	132	700	30
	12,0	7	195	150	800	35
	16,0	8	210	160	800	45
	25,0	8	290	260	800	122
159	1,6	6	216	96	600	24
	9,8	8	237	160	700	48
	12,0	8	248	170	800	56
	16,0	10	250	210	800	65
	25,0	14	270	284	1000	123
219	1,6	8	277	106	600	41
	9,8	10	297	180	800	81
	12,0	12	320	240	800	115
	16,0	16	330	234	1000	159
	25,0	18	428	324	1000	322
273	1,6	8	327	116	700	55
	9,8	10	364	220	800	120
	12,0	14	390	246	1000	180
	16,0	16	415	272	1000	251
	25,0	16	465	340	1000	376
325	1,6	8	381	154	700	74
	9,8	12	430	242	800	177
	12,0	16	460	254	1000	262
	16,0	20	480	296	1000	360
	25,0	22	520	368	1000	420

DE, mm	PN, MPa	S, mm	EG, mm	A, mm	L, mm	Mass, kg
426	1,6	10	530	250	900	270
	9,8	16	550	276	1000	344
	12,0	25	565	266	1000	405
	16,0	25	578	322	1000	515
	25,0	32	640	410	1500	1008
530	5,4	10	668	262	1200	390
	7,4	12	668	292	1200	450
	9,8	13	675	326	1200	515
	12,0	15	675	350	1200	540
	16,0	16	685	386	1200	637
	25,0	18	695	410	1200	710
630	5,4	12	782	326	1200	600
	7,4	14	782	346	1200	720
	9,8	16	782	366	1200	770
	12,0	19	784	398	1200	828
	16,0	20	792	410	1200	856
	25,0	22	792	442	1200	998
720	5,4	12	862	322	1300	665
	7,4	15	865	362	1300	795
	9,8	17	874	406	1300	936
	12,0	22	890	410	1300	1125
	16,0	24	967	466	1300	1480
	25,0	28	990	492	1300	1544
820	5,4	16	968	346	1500	975
	7,4	16	972	406	1500	1083
	9,8	20	984	446	1500	1330
	12,0	22	992	478	1500	1570
1020	5,4	15,2	1190	452	1600	1514
	7,4	18	1200	506	1600	1815
	9,8	24	1230	556	1600	2416
	12,0	30	1230	562	1600	2660
1220	5,4	16	1450	556	1800	2702
	7,4	21	1470	620	1800	3413
	9,8	29	1495	686	1800	4395
	12,0	30	1500	714	1800	4700
1420	5,4	23,2	1670	586	2000	4088
	7,4	25,8	1680	676	2000	4802
	9,8	32	1688	736	2000	5627
	12,0	37,9	1710	756	2000	7230

INSULATING MONOLITHIC JOINTS
of a special configuration

Application field

Steel pipelines for natural gas, gas condensate, oil and oil products transportation (including with high hydrogen sulfide content), water, steam and other gases and liquids.

Specifications

OPERATING PRESSURE – UP TO 100 MPa

OUTER DIAMETER OF A PIPELINE – FROM 12 mm TO 3300 mm

THE ELECTRICAL RESISTANCE IN AIR AT A VOLTAGE OF 1000 V DC – OVER 200 MOhm

DIELECTRIC STRENGTH – OVER 40 kV

MAXIMUM TEMPERATURE RANGE – UP TO + 250°C

Insulating monolithic joint of 128 inches (3251 mm) diameter for a water pipeline

Insulating monolithic joint of 88 inches (2235 mm) diameter for operating pressure of 9,8 MPa

Insulating monolithic joint with operating temperature of up to +250°C

Insulating monolithic joint for impulse lines with operating pressure of up to 40 MPa

INSULATING MONOLITHIC JOINTS
for gas distribution objects

OPERATING PRESSURE UP TO 1,6 MPa

CAN BE PROVIDED WITH BALL VALVE OR FLANGE CONNECTION

IMJ manufactured according to TS 3647-024-93719333-2016 have a GAZSERT conformity certificate in the system of voluntary certification for «Insulating connections (insulating monolithic joint) with operating pressure up to 1,6 MPa. Serial production".

Technical specifications

OPERATING PRESSURE – up to 1,6 MPa

OUTER DIAMETER OF A PIPELINE – from 12 mm (for the joints with ball valve)

THE ELECTRICAL RESISTANCE IN AIR AT A VOLTAGE OF 1000 V DC – over 5 MOhm

DIELECTRIC STRENGTH – over 3,5 kV

OPERATING TEMPERATURE RANGE:

— «Md» VERSION – from -40°C to + 60°C

— «Cl» VERSION – from -60°C to + 60°C

Insulating monolithic joint with operating pressure up to 1,6 MPa with ball valve

Insulating monolithic joint with operating pressure up to 1,6 MPa with a spark gap

Insulating monolithic joints with operating pressure up to 1,6 MPa

ADDITIONAL EQUIPMENT

Test Station

Application field

Designed to control operation of the insulating monolithic joint and efficiency evaluation of pipeline electrochemical protection. It is supplied with a resistance control unit and reference electrodes.

Spark gap

Application field

Serves as a safety device, which eliminates any breakdown of an insulator of insulating monolithic joint in case of surge overvoltage inside a pipeline. Explosion-proof.

Technical Specifications

Technical characteristic	Value
Lightning impulse current (10/350 μs)	100 kA
Charge	50 As
Specific energy	2500 kJ / Ohm
Nominal pulse breakdown voltage (1,2/50 μs)	1400 V
Nominal power-frequency withstand voltage	285 V
DC withstand voltage	350 V
Separation resistance at 175V DC	> 100 MOhm
Ambient temperature range	-60…+80 °C
Protection rating according to GOST14254	IP67

SGMM-HGS 100 Ex Spark gap Monitor Module

The spark gap monitor module (SGMM) is intended to assess the operation integrity and calculate the residual life of HGS100 Ex while in operation.

An underground part is a current sensor with an built-in connecting cable. A current sensor is intended for non-contacting registration of current impulses, which go through the spark gap while its operating.

An aboveground part of SGMM is a controller. It is intended to determine the impulse parameters (amplitude, width, charge, date and time) and to save data in a volatile store. Also the controller shows residual life of a spark gap or SGMM battery.

Technical data

Parameter name	Conditions	Value
Maximum permissible amplitude of current impulse, A	Impulse 8/20 μs	150000
	Impulse 10/350 μs	100000
Range of permissible relative amplitude measurement error, %, not more	if $I_A \geq 0,01^*$ Imax, Timp ≥ 16 μs, where Timp – duration of the current impulse by level $0,5^*I_A$	±15
Range of permissible relative width measurement error, %, not more		±15
Maximum permissible relative charge measurement error, %, not more		±15
Climatic version according to GOST 5150	Aboveground part	Md1, but with operating temperature limits: -40°C...+60°C
	Underground part	Md5 with operating temperature limits: -5°C…+35°C
Current sensor explosion-proof according to GOST R MEK 60079-18-2012	-	1 Ex mb II T6 Gb X
Protection rating of environmental impact and connecting with current-conductive parts	Current sensor case	IP68
	Controller case	IP40
Design life, years	Aboveground part	15
	Underground part	35
Maintenance intervals, years	-	1
Permissible cable length, not less, m	-	6

Insulating monolithic joint with spark gap

Spark gap

SGMM sensor on the spark gap

SGMM controller, installed inside a Test Station

CORROSION MONITORING SYSTEM CMS-PST

CMS-PST systems are hardware and software systems for corrosion monitoring of buried steel pipelines.

The systems allow to control with a given frequency the corrosion rate and at the same time the whole range of electrical parameters of the protected facility:

— AC and DC voltages on a pipeline and currents of the Coupon;

— polarisation potential;

— AC/ DC density;

— Current inside the pipeline (insulation quality control);

— Resistance to alternating current spreading.

The system measures:

— induced current protection device (ICPD) drained currents;

— currents of the resistance control unit (RCU), protection groups, grounding, drainage;

— rate of inside corrosion and erosion;

— resistance between a pipeline and a casing;

— parameters of analog and digital cathodic protection rectifiers.

CMS-PST systems include:

CMS-PST-MetriCorr®
CMS-PST-MetriCorr®-M
CMS-PST-MTC
CMS-PST-ICPD
CMS-PST-TS
CMS-PST-CCPS
CMS-PST-CPR
MCS-PST with special software

Production of CMS-PST in the electronic production center

Incoming control of the CMS measuring modules

CMS-PST-MetriCorr®

CORROSION RATE CONTROL

CMS-PST-MetriCorr® is a system for measuring the corrosion rate and at the same time a wide range of electrical parameters of the protected facility.

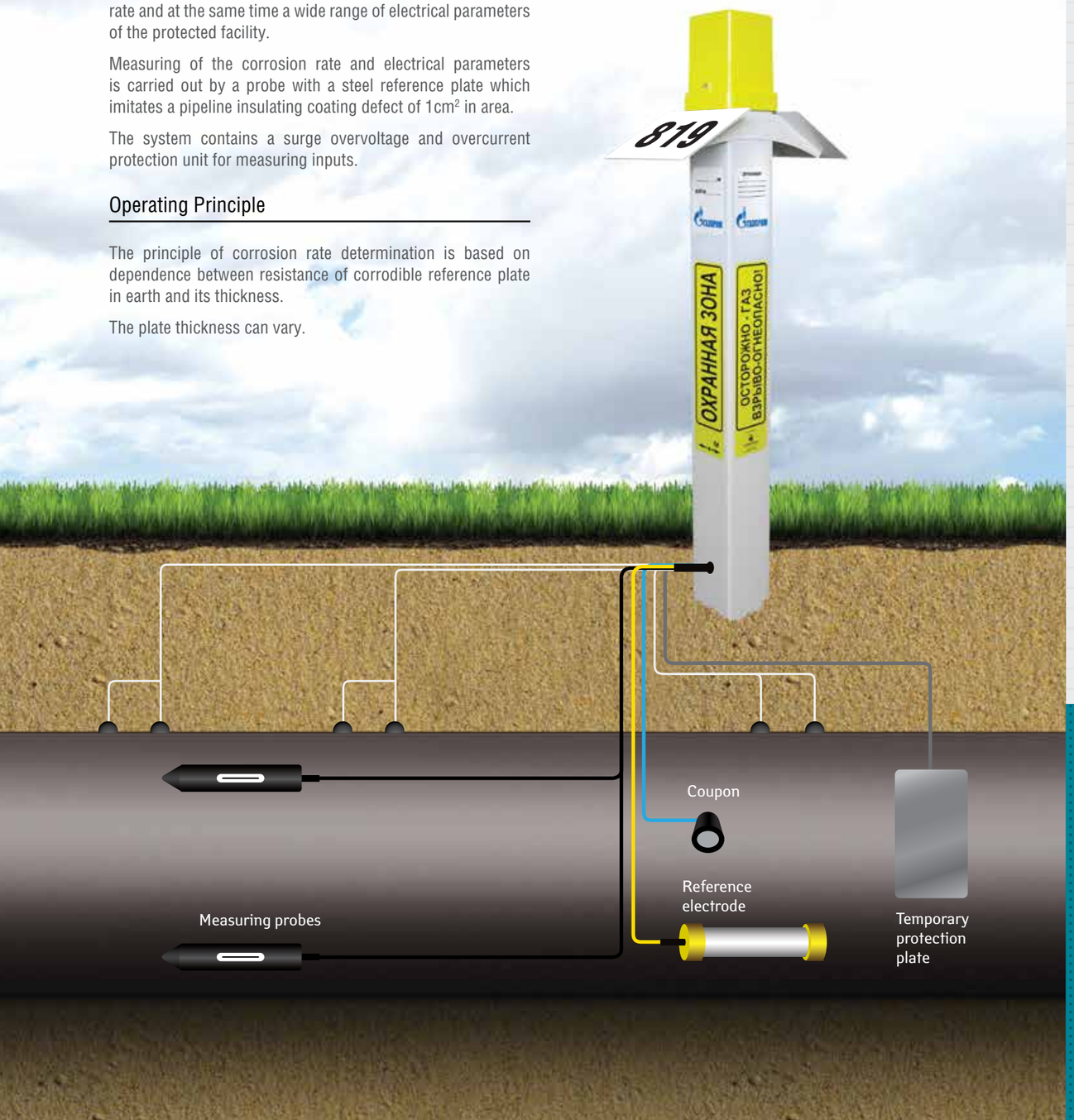
Measuring of the corrosion rate and electrical parameters is carried out by a probe with a steel reference plate which imitates a pipeline insulating coating defect of 1cm² in area.

The system contains a surge overvoltage and overcurrent protection unit for measuring inputs.

Operating Principle

The principle of corrosion rate determination is based on dependence between resistance of corrodible reference plate in earth and its thickness.

The plate thickness can vary.



Parameters monitored by the CMS-PST-MetriCorr®

Parameter	Value
Corrosion rate	0,001…50 mm/year
OFF potential of the structure	0…±3V
ON potential of the structure – reference electrode	0…±30V
AC voltage on the structure relative to the reference electrode	0…100V
AC «structure - coupon»	0…50mA
Current through the rheostatic resistance control unit (RCU), up to 2 channels	0…±50A
Voltage drop at current-measuring leads (for insulation-quality assessment)	0…1mV
Resistance between pipeline and casing	0…1kOhm

Measure probes and controllers for the CMS-PST-MetriCorr® corrosion monitoring system are manufactured by the technology of MetriCorr Aps, which has been a member of Pipeline Systems and Technologies CJSC Group of Companies since 2015.

MetriCorr Aps was founded in 2002 following many years of research in underground-steel-pipeline corrosion processes performed in close cooperation with European experts in the oil and gas industry. These studies covered dozens of large projects related to various aspects of corrosion diagnostics and prevention issues.

MetriCorr Aps today is one of the most credible companies in the world in research activities and development of integrated solutions for corrosion monitoring and risk assessment of industrial underground steel facilities. The company's managers are acknowledged experts in this area and hold official positions in NACE (North American National Association of Corrosion Engineers) and the European Committee for Standardization in corrosion protection.

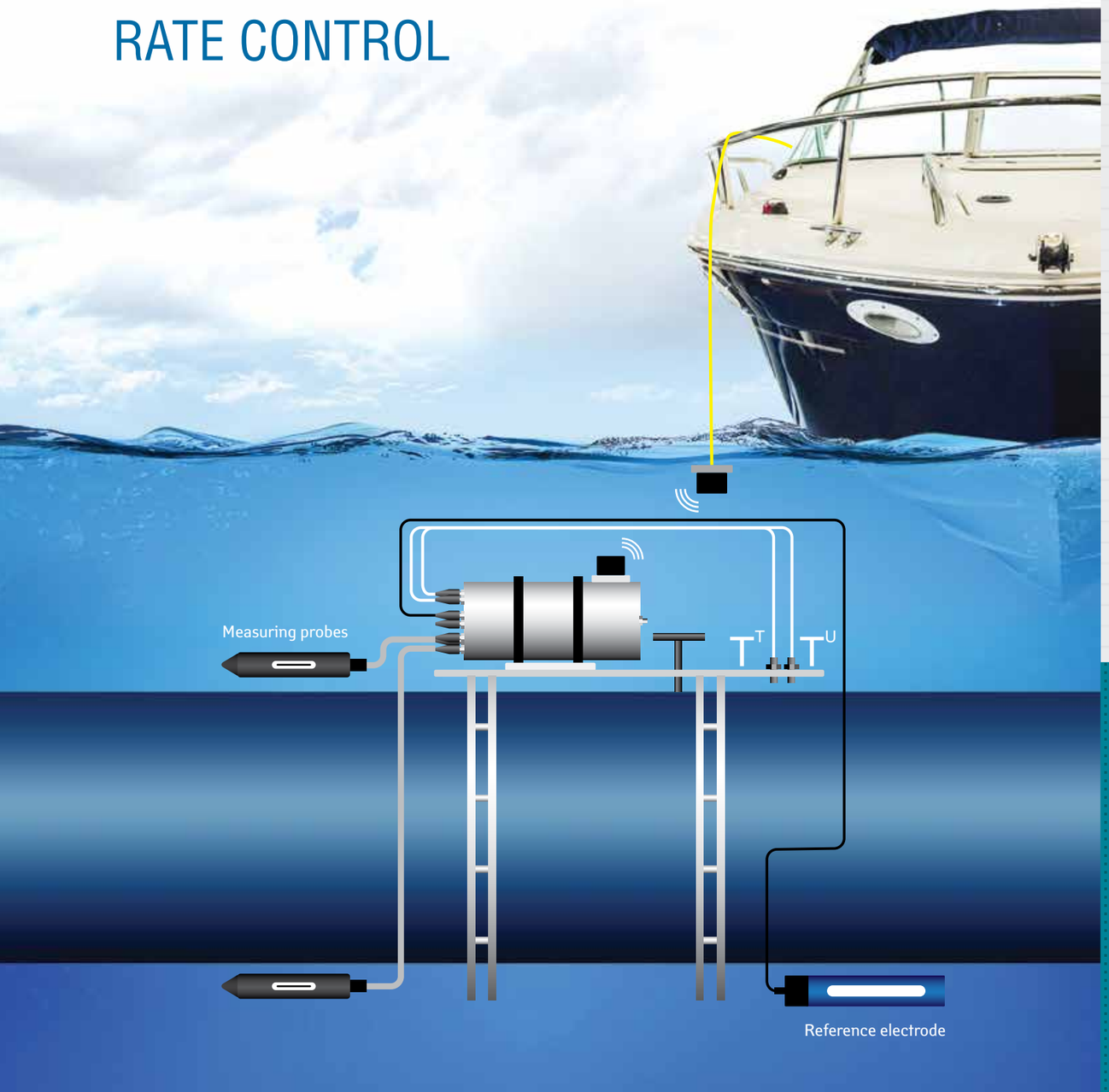
The key competence of MetriCorr Aps is development of corrosion-rate monitoring equipment and application-dependent analytical software, particularly, for integrated data acquisition and processing on corrosion processes associated with stray and induced alternating currents.

Measuring probe

Installation of CMS-PST-MetriCorr®

CMS-PST-MetriCorr®-M

UNDERWATER CORROSION RATE CONTROL



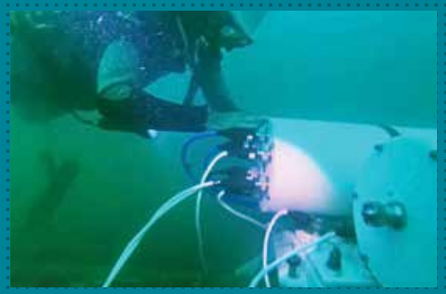
The CMS-PST-MetriCorr®-M corrosion monitoring system (co-development with «Gazprom VNIIGAZ» LLC and «KATOD» CJSC) is designed for remote monitoring of corrosion parameters on the underwater steel pipelines via wireless communication channels (hydroacoustic and GSM).

An underwater controller reads the monitored parameters from sensors, probes, and electrodes connected thereto to save them in the non-volatile memory according to a preset measurement schedule. After that, according to a preset data-transmission schedule, the underwater controller transmits accumulated data via hydroacoustic modems to a controller located aboard ship or on a buoy. Then, this controller relays the received data via a GSM channel to a MCS-PST monitoring and control server.

Basic technical characteristics of the CMS-PST-MetriCorr®-M

Parameter	Value
Corrosion rate, 2 channels	0,001…50mm/year
OFF potential of the structure	0…±3V
ON potential of the structure relative to the reference electrode	0…±30V
AC voltage on the structure relative to the reference electrode	0…100V
AC «structure - coupon»	0…50 mA
Local protector's current, up to 2 channels	0…±1A
Self-contained operation period of the underwater controller	up to 5 years

Startup and commissioning
at the Dzhubga–Lazarevskoye–Sochi gas line



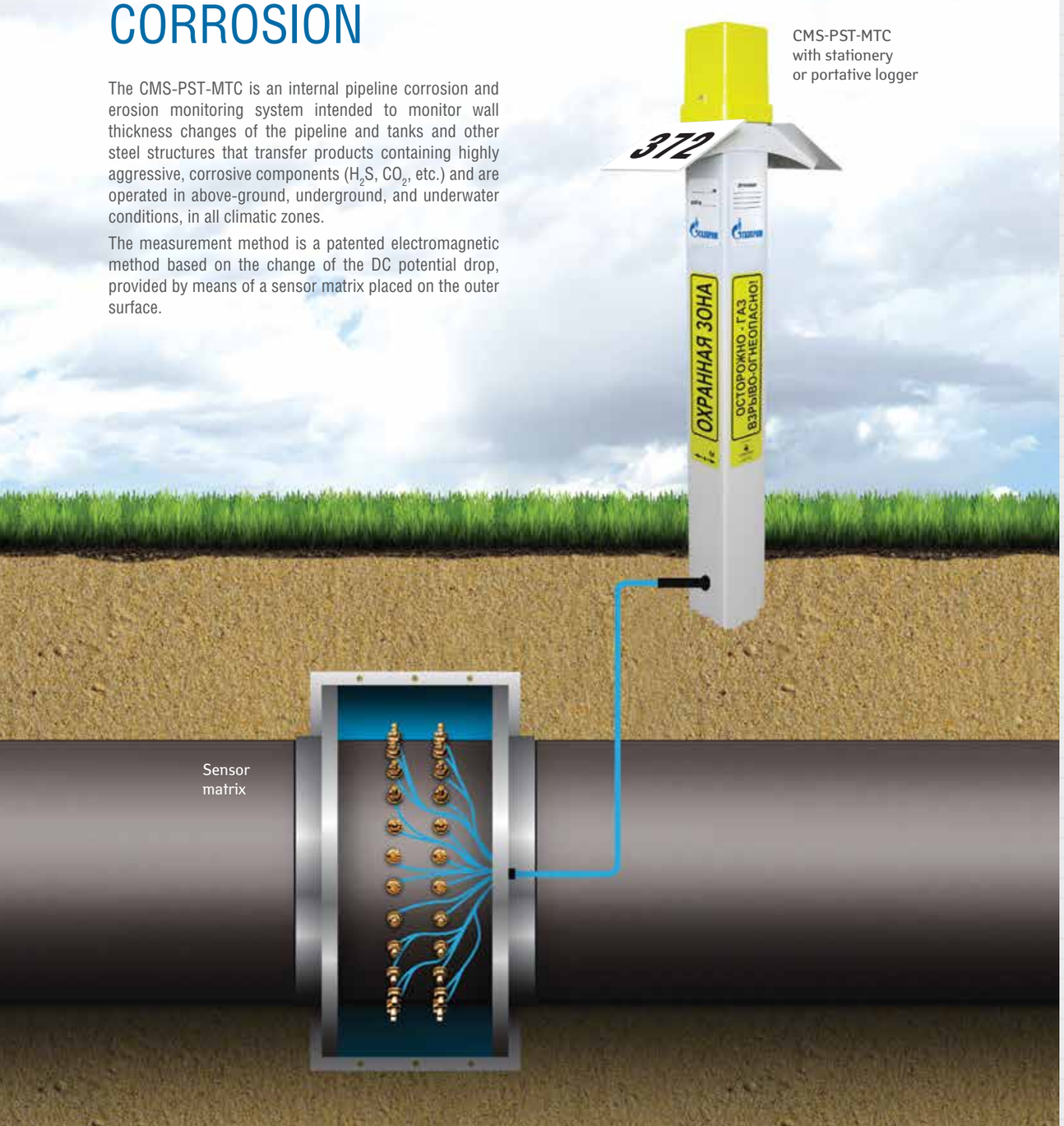
CMS-PST-MetriCorr®-M general view

CMS-PST-MTC

MONITORING OF INTERNAL CORROSION

The CMS-PST-MTC is an internal pipeline corrosion and erosion monitoring system intended to monitor wall thickness changes of the pipeline and tanks and other steel structures that transfer products containing highly aggressive, corrosive components (H_2S, CO_2, etc.) and are operated in above-ground, underground, and underwater conditions, in all climatic zones.

The measurement method is a patented electromagnetic method based on the change of the DC potential drop, provided by means of a sensor matrix placed on the outer surface.



The system consists of 5 basic components:

- Sensor matrix;
- Sensor matrix controller;
- Stationery (or portative) logger completed with:
  - Power supply,
  - Data transmission device;
- Clamp terminal;
- Software.

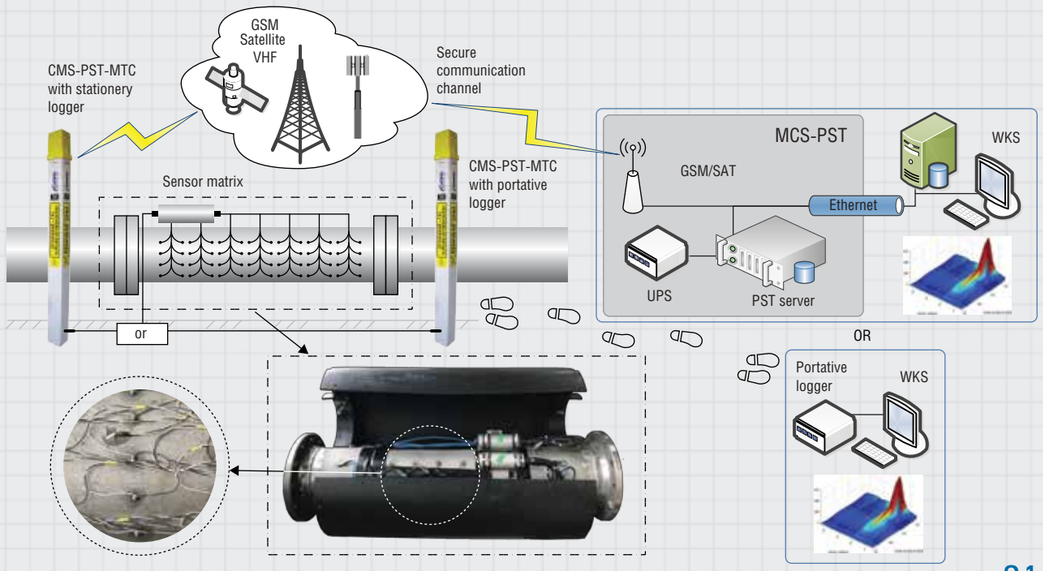
The system's power supply source can be batteries, rechargeable batteries, solar cells, and other AC sources.

Alternative power sources such as solar panels, wind generators or fuel cells can be used. The frequency of data collection is determined by the Customer and local conditions.

Installation of the sensor matrix should be carried out, as a rule, in the factory. The finished product (joint) can be installed at the Object, by means of flange connection or welding. In some cases, it is possible to install the sensor matrix in the field conditions, providing the special design solutions aimed to ensure the matrix installation possibility and to guarantee the quality of the anti-corrosive coating application and protective case installation, confirmed by the manufacturer.

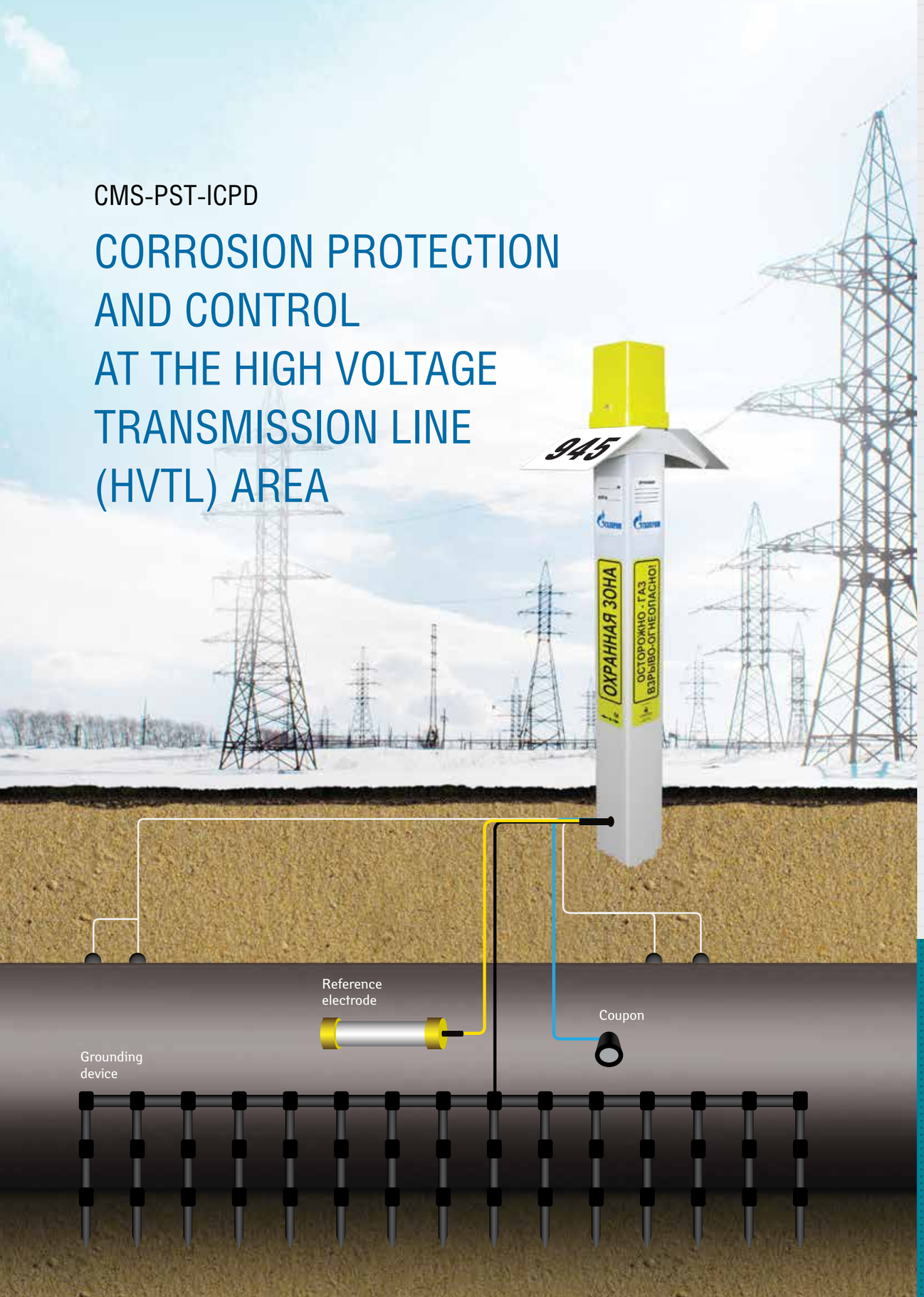
Main technical characteristics of PCM-PST-MTC

Parameter	Value
CMS-PST-MTC resolution, % of rated thickness	0,1
Operating temperature range while using a stationary logger	from -40°C to +85°C
Operating temperature range while using a portable logger	from -20°C to +70°C
Operating temperature range of the sensor matrix controller	from -40°C to +65°C
Thickness of the measured surface, mm	from 4 mm to 40 mm
Matrix shape	Specified by design company. Concentration of the sensor matrix pins depends on the wall thickness of the controlled object.
Standard (maximum) quantity of pins per one matrix of the CMS-PST-MTC	28 (224) pairs
Communication channels	— Manual data extraction — Wire RS-485 — GSM/GPRS — Satellite — Fibre-optic



CMS-PST-ICPD

CORROSION PROTECTION AND CONTROL AT THE HIGH VOLTAGE TRANSMISSION LINE (HVTL) AREA



The CMS-PST-ICPD is a corrosion monitoring system consisting of a drainage unit for direct and alternating currents induced to the pipeline, which is equipped with a controller and a data transmission channel. The direct current is drained at the condition that the pipeline voltage exceeds the given range.

Parameters monitored by the CMS-PST-ICPD

Parameter	Value
Drained AC	0…40 A
OFF potential of the structure	0…±3V
«Structure–reference electrode» ON potential	0…±30V
AC voltage «Structure–reference electrode»	0…100V
AC «Structure–coupon»	0…50mA

The system allows to monitor:

— drained direct and alternating currents;

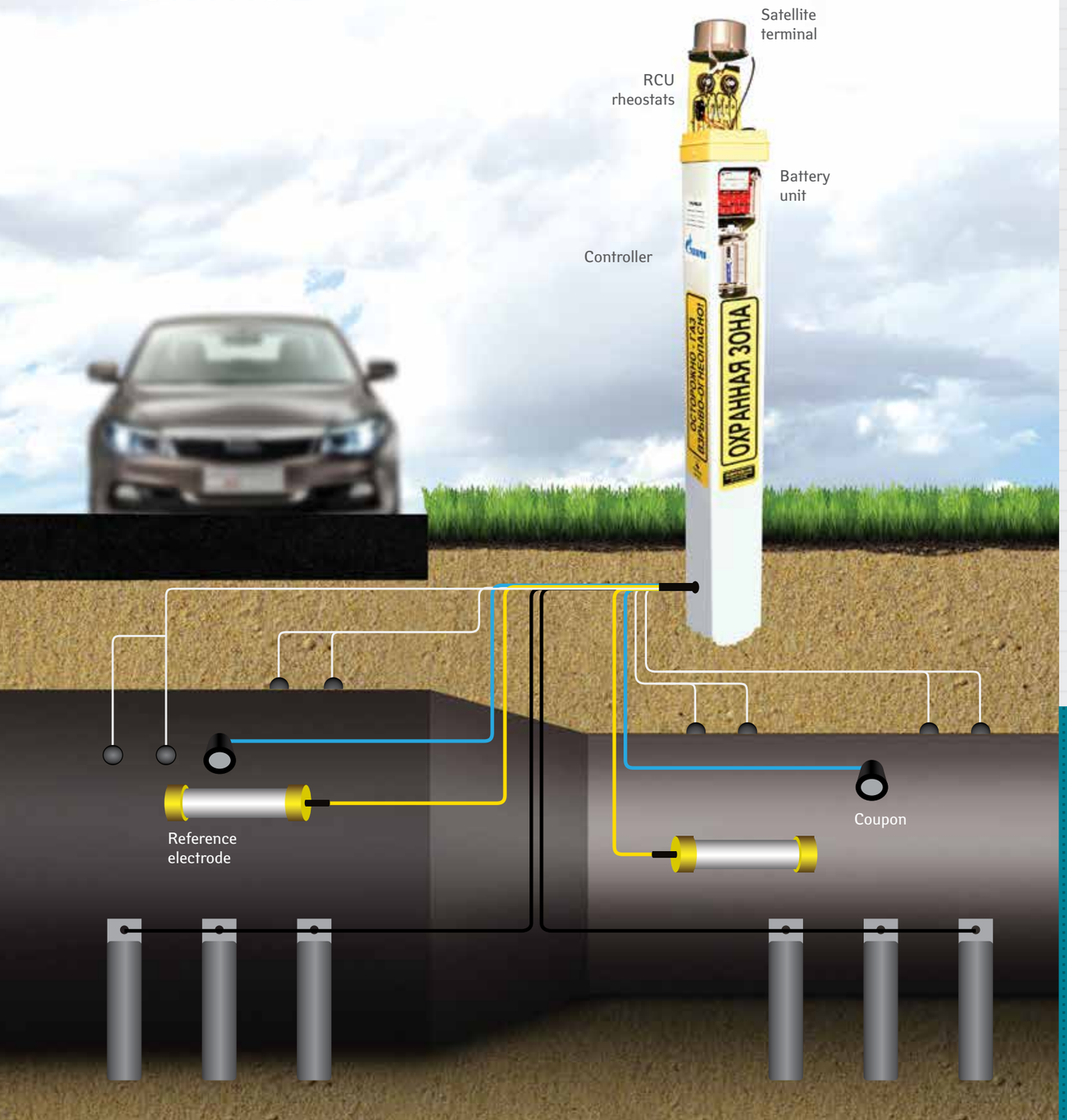
— corrosion situation parameters at the installation place.

Electrochemical protection parameters are measured with a steel coupon of 1cm^2 surface area.

CMS-PST-ICPD installed at the South Stream

CMS-PST-TS

REMOTE CONTROL



The CMS-PST-TS is a corrosion monitoring system ensuring monitoring of electrochemical protection parameters at test stations located in different areas of hazard corrosion zones and structural elements of the protected object.

The system allows to monitor corrosion parameters where at the same time up to 4 reference electrodes are installed with coupons:

— earth, drainage, and protector-group currents (up to 12 current-measuring channels);

— insulation quality (voltage drop at current-measuring leads);

— «pipeline – casing» resistance;

The system can contain a rheostat resistance control unit RCU (up to 2 channels, up to 14A).

Parameters monitored by the CMS-PST-TS

Parameter	Value
OFF potential of the structure	0…±3V
«Structure–reference electrode» ON potential	0…±30V
«Structure–reference electrode» AC voltage	0…100V
AC «Structure–coupon»	0…50mA
Current through the RCU (up to 2 channels)	0…±25A
Voltage drop at current-measuring leads	0…1mV
Drainage/ground/etc. current (up to 12 channels)	0…+25 (50, 100) A
Pipeline–casing resistance	0…1kOhm

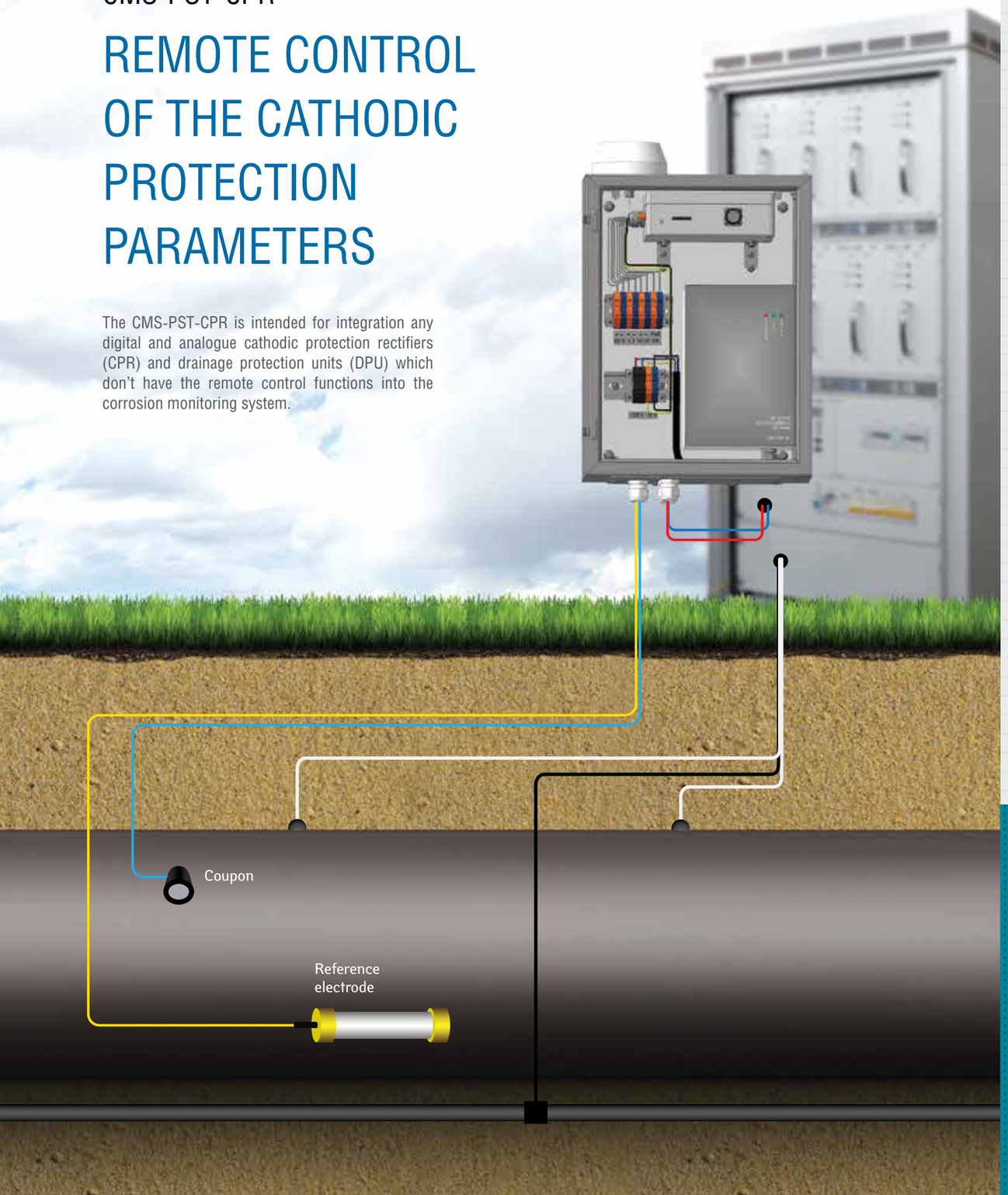
CMS-PST-TS for upstream

Compact version of the CMS controller for installation into the TS post

CMS-PST-CPR

REMOTE CONTROL OF THE CATHODIC PROTECTION PARAMETERS

The CMS-PST-CPR is intended for integration any digital and analogue cathodic protection rectifiers (CPR) and drainage protection units (DPU) which don't have the remote control functions into the corrosion monitoring system.



CMS-PST-CPR functions

When working with analogue CPRs:

— Measuring analogue signals of internal and external CPR circuits;

— Receiving and processing discrete signals from sensors;

— Transmitting the alarm messages in case of the sensor actuating and exceeding the monitored parameters out of the given range.

When working with digital CPRs:

— Receiving data via RS-485 serial interface;

— Transmitting data via wireless communication channels;

— Transmitting the alarm messages in case of the sensor actuating and exceeding the monitored parameters out of the given range.

In addition to CPR monitoring and control, the system allows to monitor cathodic protection parameters at installation location remotely.

Characteristics of measuring channels

Parameter	Value
CPR output voltage («pipe-DPU rail» voltage)	0…100 V
CPR output current (75 mV shunt voltage drop)	50/100 A
Drainage protection device current	+ 500 A
CPR input voltage	0…300 V
CPR current power supply	0…25 A
OFF potential of the structure	+3 V
Total potential "Structure–reference electrode up to 4 channels"	+30 V
AC voltage "structure – reference electrode"	0…100 V
AC "structure – coupon"	0…50 mA
Additional measuring channels of the ON potential	up to 3

Calibration of CMS-PST-CPR

CMS-PST-CPR

Functional Features of CMS-PST Systems

1 The systems can have data transmitting channels as follow:


Satellite


GSM/GPRS


Fiber optic


RS-485 wire interface


Manual extraction of accumulated data

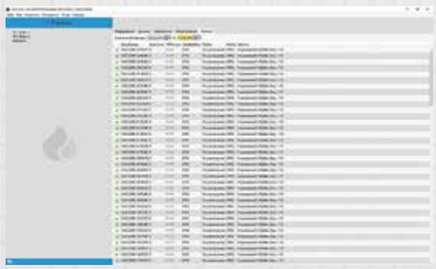
2 System controllers can be powered either by batteries of various capacities (3 to 6 years of self-contained operation) or any AC voltage sources.

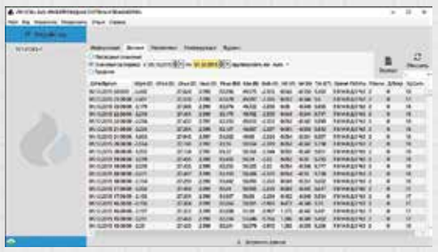
3 System controllers have circuits of input protection against surge overvoltage (1100V/150ms) and overcurrent (20kA/20μs).

4 The system elements monitor the corrosion rate and electrochemical protection parameters with a set frequency along the entire length of the protected facility and transmit data to a monitoring and control server MCS-PST and then to higher-level systems (system of corrosion protection control and management (SCPCM) and information and control system (ICS).

Data analysis and presentation

Data visualization, table, graph, and report generation are carried out with the front-end software of the monitoring and control server MCS-PST.





The software allows to compare corrosion rate data and the whole range of corrosion parameters on the one axis.

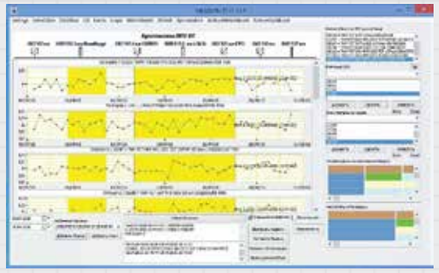
THE «GUARD» SOFTWARE

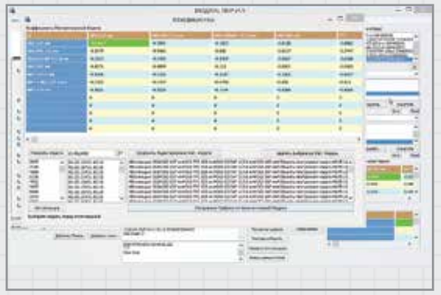
This software expands the basic function of monitoring and control server MCS-PST in the CMS-PST corrosion monitoring systems and solves the following principal tasks:

— To determine optimal current and possible CPR operating modes, including those on a «what if» basis, depending on various contingencies related to staff's actions (setting of knowingly incorrect or unachievable values, etc.) or external factors (failure, power loss, etc.);
— To identify a possibility of CPR disabling or output-parameter optimization;
— To calculate protection parameters at disabled CPRs;
— To calculate optimal protection parameters— to determine protective potentials on gas line sections according to CPR operating modes;
— To trace slow (seasonal) changes in the pipe-earth system's characteristics;
— To identify dependences of protective potentials on CPR operating modes on a gas pipeline or a site;
— To identify dependences of the OFF potential (protection criterion) on the protective potential at each point according to CPR operating modes;
— To assess dependences of the external factors' aggregate effect on corrosion;
— To monitor (with automatic tendency detection) changes in the «pipe-earth» system's characteristics. To adapt a «pipe-earth» system model according to performance data;
— To perform cause-and-effect and logical-and-probabilistic simulations in order to plan maintenance and repair activities, depending on the technical condition of pipeline sections;
— To predict the condition of pipeline sections and CPR equipment for maintenance and repair activities;
— To support supervisory decision-making and to control such decisions.

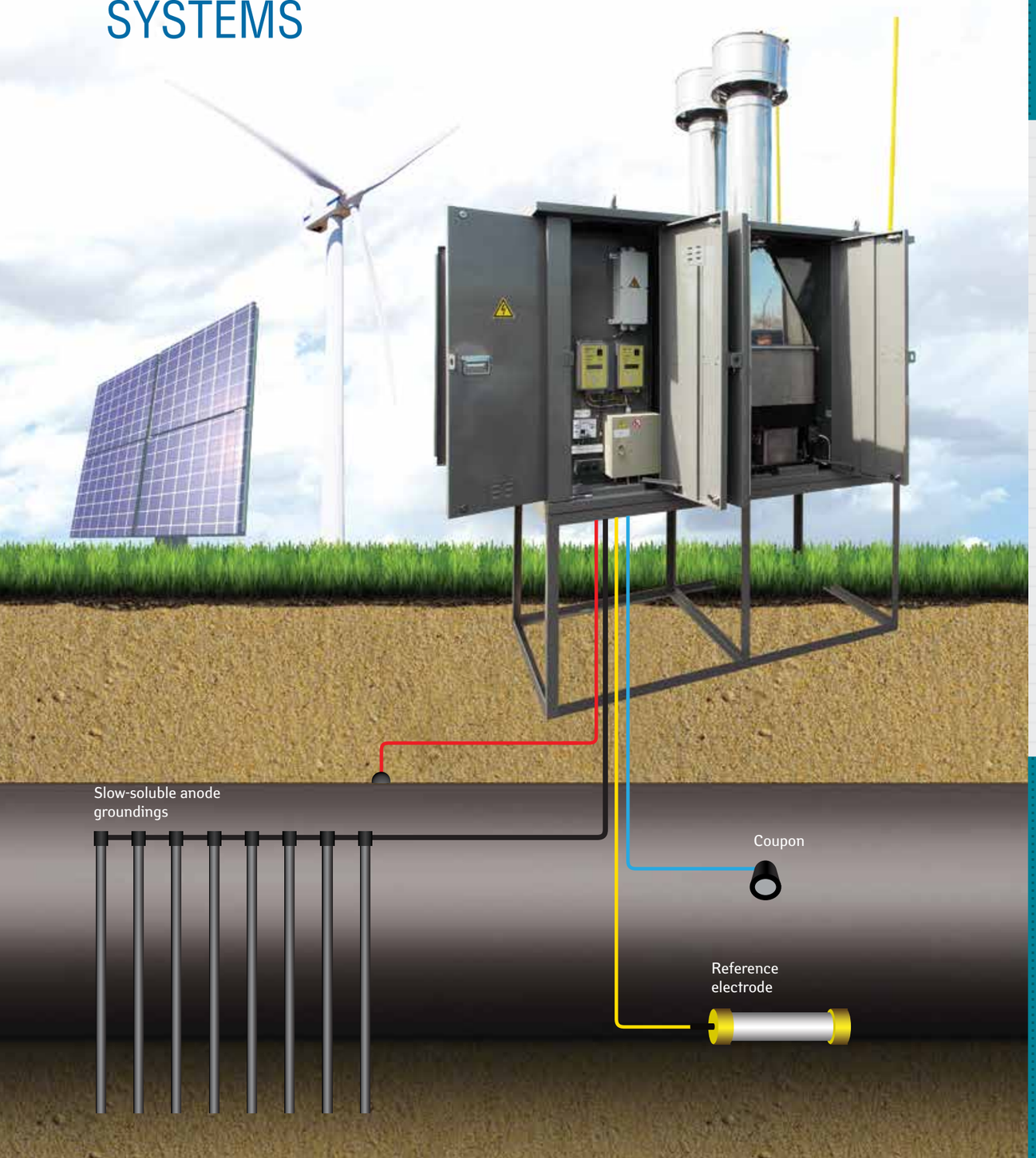
In terms of data visualization and report form generation, the «GUARD» software ensures:

— Display of a process flow diagram with marked monitoring points, control objects, and parameters to be measured; graphs of current and expected values; time history trends; and points of limit values;
— Three-dimensional distribution of protective potential on areal facilities (multithread pipelines, compressor sites, and gas-reservoir sites);
— Joint data presentation on the time axis and/ or the pipeline axis for different database sections, in order to compare results of various measurement methods;
— Graphic display of equipment and corrosion protection devices on mnemonic diagrams according to Gazprom STO 2-1.13-317-2009
— Generation of report forms.





CATHODIC PROTECTION SYSTEMS



COMPLETE CORROSION PROTECTION

AND MONITORING OF BURIED, UNDERWATER AND HARBOR STRUCTURES

A reliable and durable rectifier is a basic functional element of any cathodic protection system. Since the necessity in high output power of cathodic protection rectifiers is increasingly reduced by improving the quality of protective coatings and their application technology, CJSC «Pipeline systems and technologies» has developed and proposes compact cathodic protection stations (CCPS) – small-sized cathodic protection rectifiers (SCPR) with lower power consumption, precise adjustment of output parameters and high efficiency.

CCPS-PST (SCPR-PST) may be manufactured and supplied as an element of a complete corrosion protection and monitoring system for buried, onshore and offshore facilities (provided with justifying calculations of parameters, technical, information and operational support) in combination with other items of CJSC «Pipeline systems and technologies» such as AG-PST, CMS-PST, RE-PST, IMJ-PST etc.

This equipment may be used as:

- main cathodic protection unit for a pipeline;
- local protection for facilities in areas of hazard corrosion zones (HCZ) and poorly protected areas of extended facilities (main pipelines);
- protection of process areas (control and distribution units (CDU), compressor stations (CS), valve blocks, etc.).

In addition to manufacture and supply of equipment, CJSC «Pipeline systems and technologies» provides a package of engineering services by making justifying calculations for solutions and complete sets of cathodic protection systems for buried, underwater and harbor structures.

CCPS powered by solar panel and wind turbines

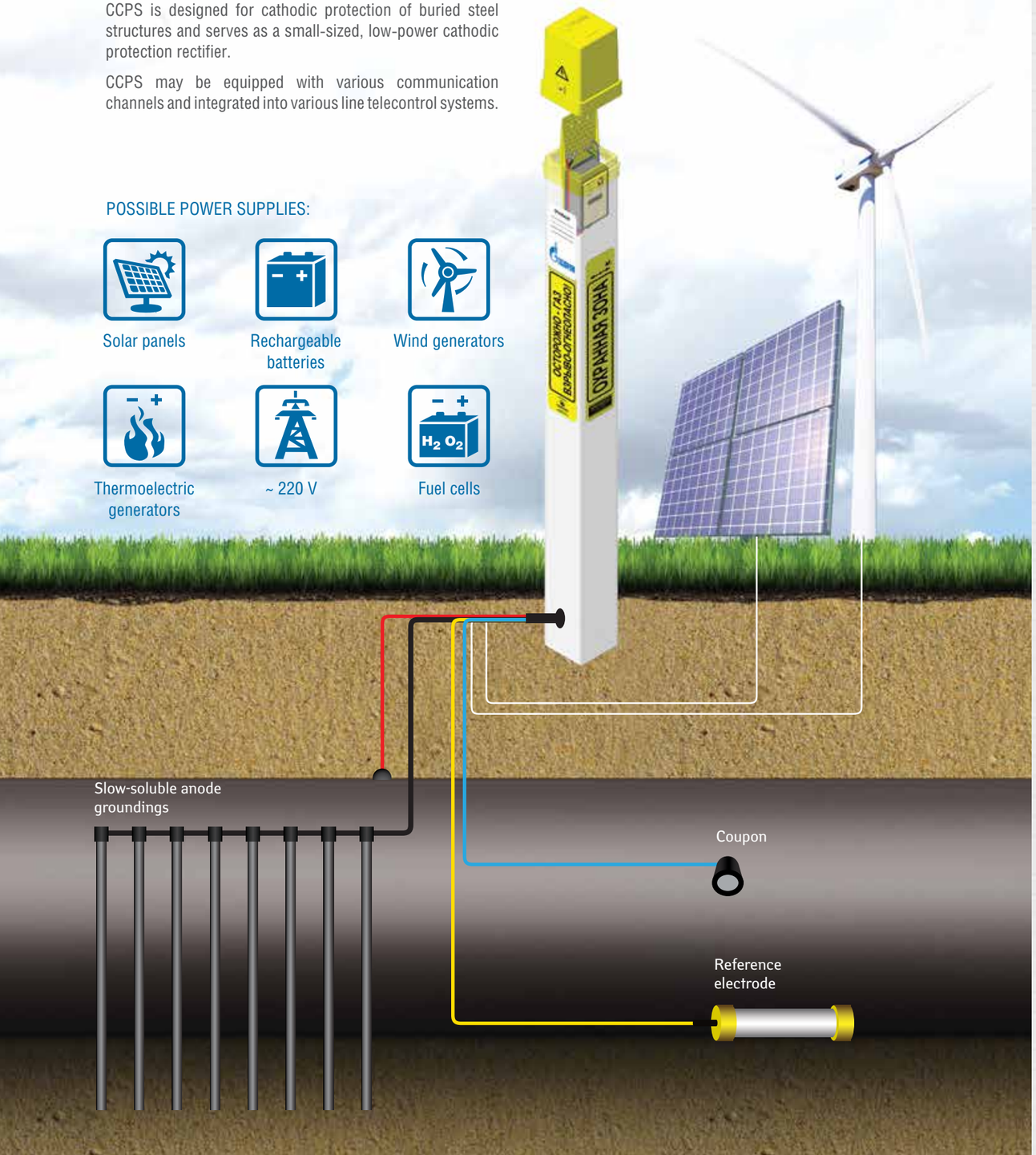
CCPS powered by thermoelectric generator

COMPACT CATHODIC PROTECTION

CCPS is designed for cathodic protection of buried steel structures and serves as a small-sized, low-power cathodic protection rectifier.

CCPS may be equipped with various communication channels and integrated into various line telecontrol systems.

POSSIBLE POWER SUPPLIES:



COMPACT CATHODIC PROTECTION STATION (CCPS)

Functional capabilities

- Measurement and transmission of additional parameters:
  — running time meter
- Integrated GSM modem and RS-485 interface
- Data archive for up to 80,000 snapshots
- Scope of supply includes surge protection devices (protection against lightning and electrostatic discharges, etc.) for input and output circuits
- Double overload and short-circuit protection for a nonspecified period of time (hardware and software)
- Protection against unauthorized control of operation modes, tuning and adjustment
- Automatic information transfer in case of abnormal situations and falling of any parameters beyond the setting limits
- Remote monitoring and operation modes control by means of special software

STABILIZATION MODES:

— output current;
— output voltage;
— ON potential;
— OFF potential.

CCPS specifications

Parameter	Value
Output parameters:	
— voltage	48 V
— power	50 / 300 W
— current	5 / 10 A
— U / I setting increment	0.01 V / 0.01 A
Minimum output current	10 mA
Input voltage	20...60 V
Efficiency, more than	85%
Operating temperature range	-45...+45 °C
Cabinet protection rating	IP65
Weight	2,4 kg
Dimensions	255x146x83 mm

CATHODIC PROTECTION SYSTEM FOR UNDERWATER AND HARBOR STRUCTURES

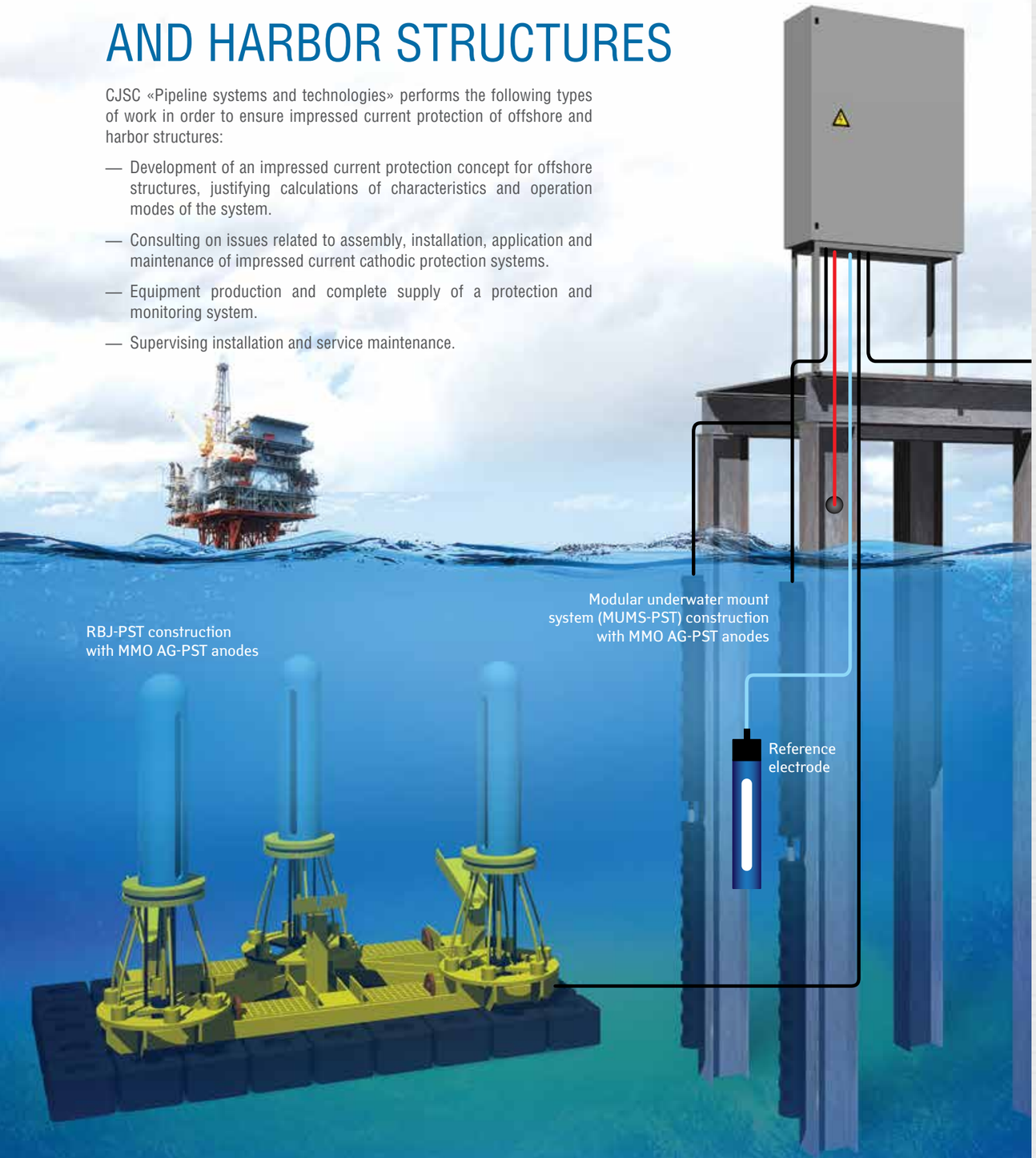
CJSC «Pipeline systems and technologies» performs the following types of work in order to ensure impressed current protection of offshore and harbor structures:

— Development of an impressed current protection concept for offshore structures, justifying calculations of characteristics and operation modes of the system.

— Consulting on issues related to assembly, installation, application and maintenance of impressed current cathodic protection systems.

— Equipment production and complete supply of a protection and monitoring system.

— Supervising installation and service maintenance.



Impressed current cathodic protection system may be nominally divided into several components:

1 Power supply unit to polarize metal surfaces of the protected facility

CJSC «Pipeline systems and technologies» manufactures both small-sized cathodic protection rectifiers (CCPS-PST) to ensure local protection of a facility and multi-mode power supplies (MPS-PST) with high output power designed to power anode groundings located far from the protected facility.

2 Low soluble anode groundings

with coating made of mixed metal oxides. Groundings may be installed either far from the protected structure, or directly on it (supports, piles), or in any other design position with the help of special mount systems.

3 Corrosion monitoring system

Corrosion monitoring system (CMS-PST) intended to operate in corrosive marine environment.

4 High-quality and durable primary control elements

Corrosion rate probes and reference electrodes.

TEST STATIONS

Test stations are intended to control and regulate the electrochemical protection parameters and to identify the pipelines routes.

THE CONSTRUCTION ADVANTAGES:

1. Increased resistance to impact of the environment climatic factors
2. Modern and aesthetic appearance
3. Free access to the contact clamps of a terminal block
4. Easy installation of cables and additional equipment: reference electrodes, corrosion rate indicators, etc.)
5. Installation of the equipment inside the post (resistance control unit, controllers, etc.)
6. Additional maintenance to preserve the appearance is not required
7. Low weight (for test stations with PVC posts)

BASIC TECHNICAL SPECIFICATIONS

QUANTITY OF MEASURING AND POWER TERMINALS — UP TO 44

CROSS-SECTION OF CONNECTED WIRES:

— MEASURING WIRES: 1,5…6,0 mm^2

— POWER WIRES: 6,0…35 mm^2

IP RATING ACCORDING TO GOST 14254 – IP34

TEMPERATURE RANGE: FROM – 60°C TO + 60°C

Test stations are manufactured in accordance with the two technical specifications:

— TS 3435-002-93719333-2009 on a circular cross-section post of 108 mm made of metal or 110 mm made of PVC;

— TS 3435-008-93719333-2012 on a square cross-section post 200 mm made of PVC;

— Test stations produced according to the TBPSh.421453.028 TS

Test stations produced according to the
TS 3435-002-93719333-2009

Test station

A test station is a terminal block fixed on a post. Additionally completed with a distance mark, which allows to check visually a pipeline route from the air.

Post

A post may be made of PVC or metal. The applied materials are intended for outdoors operation in all climatic zones. The post is equipped with an anchor device which prevents test station from free taking out.

Terminal block

A terminal block is made of polycarbonate and intended for applying up to 18 terminal clamps. The terminal clamps are made of stainless steel or brass. To exclude an illegal access, the terminal block has a cap with a locking device.

Marking and warning (informational) inscriptions

Marking and warning (informational) inscriptions are made on a self-stick film by thermal transfer printing method. To increase the UV radiation resistance of marking signs and labels, an outside lamination with a special protective film is applied. The resistance period of marking and inscriptions is at least 15 years.

Test station legend

TS-PST-XX-XX-XX/YY-X-Fx XX-RCU XX/YY-K

1 2 3 4 5 6 7 8

where:

1 – name / trademark of a test station

2 – quantity of measuring terminals

3 – quantity of the power terminals

4 – XX – above-ground level of a the terminal block lower edge, m / YY – post burial depth, m

5 – X – material of a test station post:

- P – polyvinyl chloride (PVC) post
- F – fiberglass
- M – metal post

6 – electric circuit diagram number in accordance with TS-3435-002-93719333-2009 (it is not specified if cables and other accessories are not ordered,). In case of order with a special electrical connections diagram “SP” must be specified instead of “FxXX” and the diagram should be enclosed as a separate document. In case of applying a VBbShv type armored cable, the diagram number is completed with the “Ar” abbreviation (in other cases – not specified).

7 – RCU – resistance control unit (rheostat) (not specified, if absent):

- XX – number of RCU channels
- YY – RCU channel nominal current, A

8 – distance mark presence (not specified, if absent).

Upon request, test stations are equipped with additional accessories for electrochemical protection of pipelines (reference electrodes, coupons, corrosion rate indicators, etc.).

Test station at the South Stream

TS terminal block with circuit post

Terminal block cap with locking device

Test stations produced according to the
TS 3435-008-93719333-2012

Test station

A test station s a 200x200 mm square-cross section post and a terminal block, fixed on it. Additionally equipped with a distance mark, which allows to visually control a pipeline route from the air.

Post

A post is made of PVC. The applied materials are intended for outdoors operation in all climatic zones. The post is equipped with an anchor device which prevents test station from free taking out.

Terminal block

A terminal block is made of polycarbonate and intended for applying up to 44 terminal clamps for one panel. Installation of two terminal panels are allowed. The terminal clamps are made of stainless steel or brass. To exclude an illegal access, the terminal block has a cap with a locking device.

Marking and warning (informational) inscriptions

Marking and warning (informational) inscriptions are made on a self-stick film by thermal transfer printing method. To increase the UV radiation resistance of marking signs and labels, an outside lamination with a special protective film is applied. The resistance period of marking and inscriptions is at least 15 years.

Production of Test Stations for oil industry (sector)

Locking device

Test station legend

TS-PST-X-X/Y-X-SchYY-RCU N/M-K-REX-MX

1 2 3 4 5 6 7 8 9

where:

1 – product name and manufacturer;

2 – quantity of terminals (measuring and power);

3 – TS size:

— «1,8 / 0,7» – the height of above-ground part is 1.8 m, burial depth – 0,7 m,
— «1,8 / 1,2» – the height of above-ground part is 1.8 m, burial depth – 1,2 m;

4 – color of the terminal block cap:

— «Yell» – yellow,
— «R» – red,
— «Bl» – blue,
— «Gr» – green;

5 – «Sch» and «YY» symbols are electric circuit diagram No in accordance with TS-3435-008-93719333-2012 (it is not specified if cables and other accessories are not ordered). In case of applying a VBbShv type armored cable, the diagram number is completed with the "Ar" abbreviation (in other cases – not specified). In case of request a special electrical connections diagram "SP" must be specified instead of "SchYY" and the diagram should be enclosed as a separate document.

6 – RCU(R) – resistance control unit (rheostat) (not specified, if absent):

— N – quantity of RCU channels,
— M – nominal current of RCU channel, A;

7 – K – distance mark (not specified, if absent);

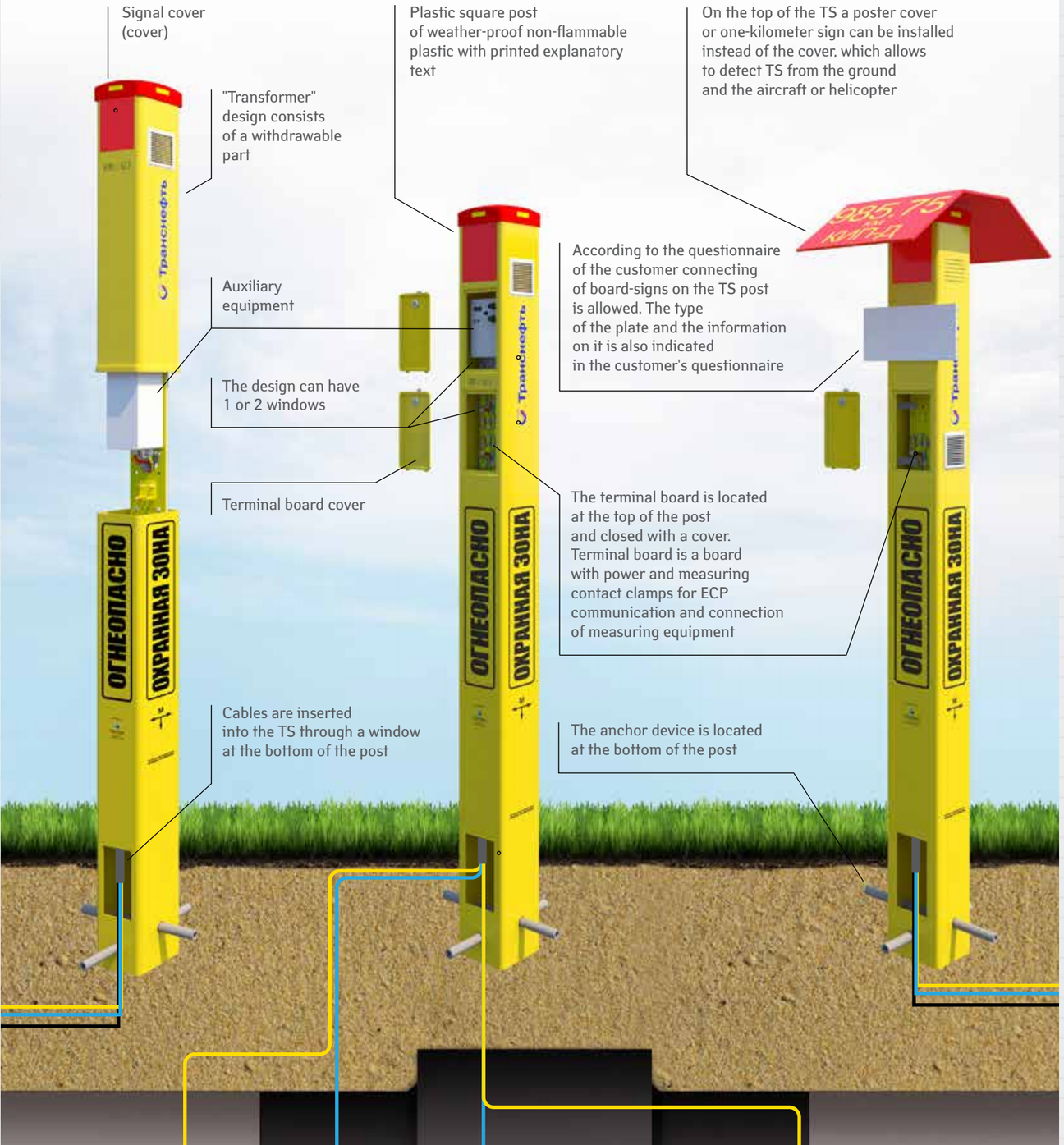
8 – «REX» – set of electrodes consisting of a reference electrode and coupon, where the symbol «X» is the quantity of sets in the scheme;

9 – «MX» – set of marker plates, where the symbol «X» is the outer diameter of a pipe, mm (not specified, if absent).

Test Station at the 318th kilometer of The Power of Siberia

Test stations produced according to the

TBPSH.421453.028 TS



Test station

The test station consists of a 200 mm square post with explanatory text, a terminal board with contact clamps, a cover (for process pipelines and tanks), a poster cover/one-kilometer sign (for the infrastructure of the main pipelines) and anchor device. Optionally, board-sign can be installed on the TS.

Posts

Posts are made of polyvinyl chloride (PVC) based polymer material in two versions.

01 type TS post consists of a solid-drawn section with terminal board hatches, installation opening, auxiliary equipment, closed with covers.

02 type TS post consists of 2 half-posts of a solid-drawn section connected with a lifting and sliding mechanism. The lifting and sliding mechanism of the post is made of corrosion-resistant metal to ensure trouble-free operation throughout the service life of the TS.

The materials used in the posts are specially designed for outdoor use in all climatic zones. Posts are equipped with anchor devices preventing free removal of the Test station from the ground.

Terminal block

Depending on the purpose and conditions of use, TS is equipped with the appropriate quantity of power and measuring contact clamps.

The terminal board is made of glass fiber plastic. Contact clamps of TS terminal board are made of non-ferrous metals (brass).

The post design eliminates the access of unauthorized persons to the terminal board, installation opening, and additional equipment. Hatches covers are equipped with a lock made of corrosion-resistant metal, with a universal key.

Marking and warning (explanatory) text

Explanatory text is made by full-color printing, using ultraviolet radiation (fading) resistant inks, that provide image resistance to climatic factors for at least 10 years from the start of operation with a warranty period of 5 years minimum.

All explanatory texts of TS are factory applied.

Test station legend

TS-PST-X-X-X(X)-X-X-X where:

1 2 3 4 5 6 7 8 9

1 – Letter designation «TS»

2 – Manufacturer CJSC «Pipeline systems and technologies»

3 – TS post type (P01, P02)

4 – Quantity of measuring terminals

5 – Quantity of power terminals

6 – Color of power terminals:
- — R-red;
- — B-blue.

7 – Additional equipment:
- — RCU-resistance control unit;
- — DRU-diode resistive unit;
- — PTU – ECP parameters transmission unit;
- — CCD – current control device EP;
- — ICPD-Inducted current protection device against induced currents;
- — FI – TS fixation instrumentation in weak soils;
- — 0 – no additional equipment.

8 – Kind of covers:
- — C-cover (signal cover);
- — PC – poster cover;
- — KS-one-kilometer sign.

9 – K – distance mark (not specified, if absent);

10 – Climatic category according to GOST 15150

Esistance control unit

RESISTANCE CONTROL UNIT (RHEOSTAT) RCU (R)

RCU(R) are designed to provide resistance control of parallel, converging, or intersecting underground steel structures and utilities by regulating the ECP parameters.

RCU(R) are used as a part of Test Stations produced according to the TS 3435-002-93719333-2009, TS 3435-008-93719333-2012, TBPSh.421453.028 TS and as a separate unit.

RCU (R) may be additionally equipped with CMS-PST for remote monitoring, storage and transfer of the corrosion protection parameters of buried steel construction.

RCU (R) are recommended to apply at the linear part of the main pipelines and at industrial sites:

— at pipeline crossings;

— at the pipelines crossings with armored signal cables;

— at electrical insulating joints;

— at other sections of pipelines, in accordance with the requirements of GOST R 51164, GOST 9.602 and reference documentation of organizations operating underground pipelines.

— others

RCU(R) are manufactured in two versions:

— in a metal electrical cabinet;

— inside the TS post.

Power rheostats situated in the RCUs (R) allow to adjust the channel resistance smoothly without using electrical ¬jumpers and disconnecting the cathodic protection rectifier. Built-in shunt allows to determine the channel current rate with help of a millivoltmeter.

RCU (R) design in a metal electrical cabinet consists of the following:

— electric cabinet;
— terminal block;
— diodes;
— rheostats;
— instrument shunts.

RCU (R) design in the terminal cabinet has the following characteristics:

Maximum current	Adjustment range of the rheostat electrical resistance
1 A	0 ... 30.0 Ohm
2 A	0 ... 30.0 Ohm
10 A	0 ... 0.5 Ohm
15 A	0 ... 0.5 Ohm
25 A	0 ... 0.25 Ohm
30 A	0 ... 0.25 Ohm

The quantity of independent control channels is set by the Client in the purchase order data sheet.

RCU (R) design on the terminal board consists of the following:

— TS terminal block;
— diodes;
— rheostats;
— instrument shunts;
— radiator;
— CMS-PST block (as an option).

RCU (R) design on the terminal block has the following characteristics:

Maximum current	Rheostat electrical resistance regulation band	Quantity of independent control channels
1 A	0 ... 30.0 Ohm	1 … 4
10 A	0 ... 0.5 Ohm	1 … 4
15 A	0 ... 0.5 Ohm	1 … 4
25 A	0 ... 0.25 Ohm	1
30 A	0 ... 0.25 Ohm	1

Cables installation on a terminal board

Test station with RCU(R) for upstream

Terminal board with a single-channel RCU-10A

Four-channel RCU-14A

ELECTRONIC RESISTANCE CONTROL UNIT (ERCU)

ERCU Application field — Corrosion Protection Systems of Metal Structures

ERCUs are used in combined cathodic protection systems and depending on the version, may ensure simultaneous protection of several buried metal structures from one cathodic protection rectifier by distributing output current among protected structures and setting optimal protection current or potential for each protected structure separately.

The ERCU does not contain any built-in power supplies. The unit is powered by the potential difference between the protected structures.

The ERCU supports the following operation modes:

— current stabilization mode;
— potential difference stabilization mode.

Test station legend

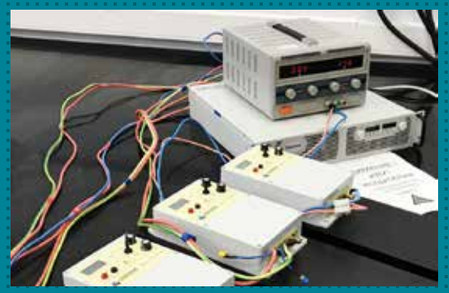
ERCU-PST-XX-XX-U2 where:

1 2 3 4 5

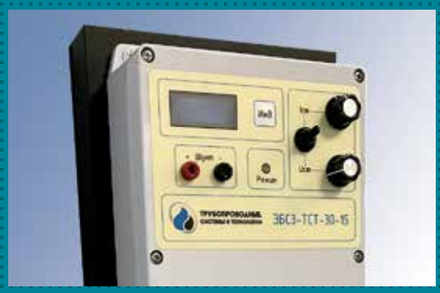
1 – product name;
2 – manufacturer name;
3 – nominal current;
4 – nominal potential difference;
5 – climatic version (U2).

An example of the ordered ERCU-PST with the nominal output current of 30A and the nominal potential difference of 15V: ERCU-PST-30-15-U2 TU.

Electrical testing of the digital CPR



Control panel of electronic RCU



Technical characteristics	Value
Maximum power dissipation, W	150
Stabilized current range, A	0,5…30 1
Maximum current within 10 minutes, A	32 2
Minimum potential difference in the current stabilization mode, V	0,1 3
Maximum potential difference in the current stabilization mode, V	15 4
Maximum stabilization error of the set current, %	2,5 5
Stabilized potential difference range, V	0,5…12
Maximum stabilization error of the set potential difference, %	2,5
Minimum potential difference for operation of the built-in indicator, V	0,4
Surge protection response voltage, V	16
Maximum voltage and current indication error, %	5
Overheating protection response temperature, °C	+ 70 6
Maximum reverse voltage, V	100
Maximum reverse current, A	
Climate version as per GOST 15150, in this case:	U2
— operating temperature range, °C	- 45… + 60 7
— relative air humidity at 25 °C, %	up to 98
— atmospheric pressure, kPa	from 84,0 to 106,7
— operation in the following types of atmosphere	I и II
Minimum transportation and storage temperature, °C	- 50
Housing dimensions (without the radiator), mm, max.	255x146x83
Dimensions (with the radiator8 and control elements), mm, max.	600x170x110
Weight, kg, max.	4

In case the potential difference at the ERCU terminals is at least 250 mV, the radiator temperature does not exceed 70° C, and the power dissipation does not exceed 150 W.

In case the potential difference at the ERCU terminals is at least 270 mV, the radiator temperature does not exceed 70° C, and the power dissipation does not exceed 150 W.

With the specified potential difference value at the ERCU terminals, the current adjustment is possible up to 2 A; with the voltage of 0.15 V, up to 10 A; and with the voltage ranging from 0.25 V to 15 V, up to 30 A.

In case the radiator temperature does not exceed 70° C, and the power dissipation does not exceed 150 W.

In the range of the potential difference at the ERCU terminals from 0.25 V to 15 V, and absence of protection operation impact.

The radiator temperature is controlled in immediate vicinity of load-bearing elements. Peripheral areas of the radiator may have lower temperature.

As the ambient temperature increases, the maximum possible current and the maximum possible power dissipation of the ERCU will automatically lower to values at which the radiator temperature does not exceed 70 °C.

The ERCU radiator may have different dimensions depending on the operating conditions, upon request and agreement with the Customer.

INDUCTED CURRENT PROTECTION DEVICE

OF AC IMPACT

Electrical transmission line (HVTL) has a hazardous impact on a steel pipe, located nearby:

— if a pipeline goes in parallel with HVTL;
— at intersection areas of pipelines and HVTL;
— at convergence and removal areas of pipelines and HVTL.

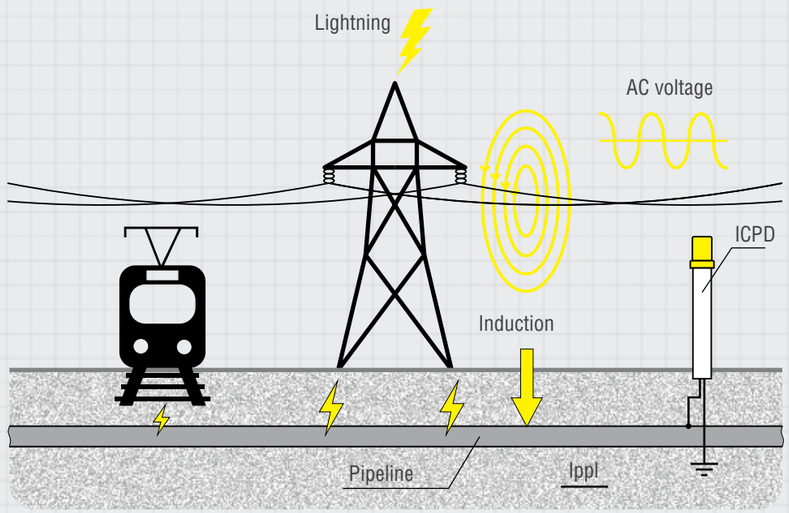
A hazardous impact of a high-voltage power line on a pipeline is expressed as follow:

1 As a result of HVTL AC electromagnetic field, the induced electrical voltages and currents occur in the pipeline which can lead to:
— threat to the workers safety;
— electrolytic corrosion from AC;
— damage of electrical equipment connected to the pipeline.

2 In case of HVTL damage the pipeline may be directly under voltage of several thousand volts.

3 HVTL are potentially dangerous in terms of atmospheric overvoltage (lightning) which requires the use of appropriate pipeline protection devices (lightning protection).

To reduce the impact of electrical transmission line a device for AC pipeline protection (ICPD) is used.



Inducted current protection device is a part of pipeline cathodic protection system (CP) against corrosion and performs the following functions:

— drains the AC induced by HVTL through grounding device;

— prevents the CP potential leakage;

— allows to measure drained AC through the built-in ICPD transformer;

— equipped with lightning protection device.

CONSTRUCTION DESCRIPTION

The ICPD consists of a post, an AC draining unit, a terminal block and a grounding device.

1 POST may be made of PVC or metal by the Client's request. The post is equipped with an anchor device, which prevents a test station from free taking out the soil.

2 AC / DC DRAINING UNIT contains the following devices:

— a condenser unit for AC draining to the grounding device;

— a protection device of atmosphere overvoltage (lightning protection) – a spark gap;

— an electric transformer for drained AC measurement with 100:1 transformation ratio;

— a frequency filter (a standard version with 1100 Hz frequency); to prevent AC leakage of a fixed frequency when using the electrometric equipment at the pipeline.

3 GROUNDING DEVICE may consist of horizontal ground conductors, vertical ground conductors or their combination. Horizontal and vertical ground conductors represented by sections of stainless steel or zinc plated steel connected to each other. Quantity of ground conductors and its sections number are defined by a pipeline system project.

As an option, ICPDs are produced with possibility to drain AC.

Horizontal and vertical grounding universal connection

ICPD unit modification for installation into the TS square-cross section

Technical data:

GENERAL:	
Operating temperature limits: — "Md" climatic version — "Cl" climatic version	 from – 40°C to + 60°C from – 60°C to + 60°C
Maximum DC leakage current, if U_{max}= 3,5 V [=], IL [=], mA	≤ 1
AC DRAINED UNIT:	
Nominal drained current 50 Hz, IA [~], A (depending on ICPD version)	40 or 80
Maximum drained current during 1 sec/50Hz, I_{max} [~], A	400
GROUNDING DEVICE:	
Grounding conductor's cross-section, mm^2	35
Length of a vertical ground conductor section (rod), m	1,5
Diameter of a vertical ground conductor (rod), mm	16
Length of a horizontal ground conductor section (strip), m	2,0
Width of a horizontal ground conductor (strip), mm	40
Thickness of a horizontal ground conductor (strip), mm	4

CJSC «Pipeline systems and technologies» provides engineering assistance by performing special calculations at the stage of designing the ICPD installation locations in HVTL areas by performing special calculations.

Initial data required for calculations:

— description of a pipeline under the current impact;

— description of HVTL affecting the pipeline;

— physiographic (climatic) features of the construction area.

Based on the provided initial data, the HVTL impact on the pipeline is estimated, and installation places for ICPD with appropriate configurations are selected.

Calculation and research results may be presented in the form of a technical report and recommendations for cathodic protection arrangement in places where designed pipelines approach/cross HVTL.

REFERENCE ELECTRODES

Reference electrode (RE) is an electrode with a stable and reproducible potential, which can be used to measure other electrochemical potentials. Stationary reference electrodes are used to monitor and control the level of cathodic protection.

Stationary reference electrodes — STELTH — are designed for buried application and operation in fresh and salt water. Reference electrodes are also characterized by stable operation in tight soil, sand, flooded and seasonally flood-prone ground; they keep a wide range of operating temperatures (-18...+85 °C) and remain functional after freezing (up to -40 °C).

CJSC «Pipeline systems and technologies» has a wide range of stationary electrodes, both single- and multi-purpose, which allow guaranteeing fail-safe operation for a long period of time, in case the application conditions are observed.

ADVANTAGES AND FEATURES OF RE-PST-STELTH-P40

PRODUCTION TESTS OF EACH REFERENCE ELECTRODE, BASED ON 8 PARAMETERS.

100% ELECTROLYTE SOLID CHEMICAL STATE FORM (WITHOUT INACTIVE OR INERT COMPONENTS)

The presence of a solid-state electrolyte is required to achieve a 30 years' service period.

HYDROGEN SULFIDE SENSOR (A PART OF A REFERENCE ELECTRODE)

Provides an opportunity to evaluate the influence of hydrogen on the reference electrode and its surrounding conditions under

MOISTURE RETENTION MEMBRANE

It prevents the failure of the RE due to pH high values.

CHLORIDE ION TRAP

One of the main reasons for the reference electrodes fault is chloride contamination. Copper sulfate electrodes have a membrane, which traps the chloride ions. Also, an ion trapping technology implemented in the chemical composition of the electrolyte, which joins these ions to prevent their impact on copper sulfate.

HYDROGEN SULFIDE ION TRAP

Sulfides have a destructive effect on the reference electrodes. Ceramic sensor zone at all STELTH reference electrodes contains a special composition of the trap to neutralize these ions.

LARGE COPPER ELECTRODE SURFACE AREA (12.5 CM^2)

Allows to reach high operating stability of the reference electrode and prolong its service life.

LARGE SENSITIVE SURFACE AREA (170 CM^2)

Allows to obtain a high sensitivity, to reduce the voltage drop across the resistance between the reference electrode and its environment.

REUSE IS ALLOWED

All the reference electrodes provide the possibility of commissioning, decommissioning, and then reuse in any time sequence during the product life, following the correct procedures for dismantling, storage and installation.

FREEZING UP TO – 40°C IS ALLOWED.

HIGH STABILITY IN DESERT AND FLOODED SOILS.

CAN BE COMPLETED WITH CABLE BY THE CLIENT'S REQUEST

RE-PST-STELTH-P40 - T - XYZ - L - CS

1 2 3 4 5

where:
1 – RE name/trade mark;
2 – type of reference electrode:
— «Cu» – copper-copper sulfate RE;
— «Ag» –silver-silver chloride RE;
— «Zn» – zinc-zinc sulfate RE,

3 – model No, according to the table;
4 – measuring cable length, m;
5 – «CS» – presence of the coupon (not specified, if absent):
— «C» – coupon;
— «S» – operating surface area, cm².

Example of RE designation: «Reference electrode RE-PST-STELTH-P4-Cu-007-6-C1»

RE Types and application conditions:

Model No	Application Conditions	Type (electrolyte and core materials)
002	For regular and highly saturated soil with chloride content no more 0,1%	Cu
004	For regular and highly saturated soil with any chloride content	Ag*
006	For regular and highly saturated soil with chloride content no more 0,1%	Zn
007	For regular and dry soil with chloride content no more 0,1%	Cu
008	For regular and dry soil with any chloride content	Ag*
008C	For regular and dry soil with any chloride content, hydrocarbon-proof	Ag*
009	For regular and dry soil with chloride content no more 0,1%	Zn
019	For concrete, dry soils and soils with periodic and seasonal moisture saturation with chloride content no more 0,1%	Cu
020	For concrete, dry soils and soils with any level of moisture saturation and chloride content	Ag*
021	For concrete, dry soils and soils with periodic and seasonal moisture saturation with chloride content no more 0,1%	Zn
038	Applied for installation to a depth up to 600 m into the environment with any chloride content (crush-proof and weighted case).	Ag*

*By the type of silver-silver chloride (Ag-AgCl) with stabilizing components

Copper-copper sulfate reference electrodes RE-PST-STELTH-P40-Cu-007

Sensitive surface area	Not less 170 cm²
Copper bar surface area	Not less 12,5 cm²
Average size of sensitive area voids	17 µcm
Stability on 3 mcA load	5 mV
Operating temperature limits	- 18…+ 85 °C
Storage temperature limits	- 40…+ 85 °C
Overall dimension, length/ diameter	18 cm / 4 cm
Minimum projected service life	30 years

Copper-copper sulfate reference electrodes RE-PST-STELTH-P40-Cu-002

Sensitive surface area	Not less 7 cm²
Copper bar surface area	Not less 12,5 cm²
Average size of sensitive area voids	17 µcm
Stability on 3 mcA load	5 mV
Operating temperature limits	- 18…+ 85 °C
Storage temperature limits	- 40…+ 85 °C
Overall dimension, length/ diameter	21 cm / 3,5 cm
Minimum projected service life	30 years

Coupon (basic supply)

Operating surface area – 1 cm²

Cable lenght – 7 m

Electrode material – pipe steel

Control parameters (CMS-PST systems):

— OFF potential

— AC «structure – Coupon»

— AC / DC Density

— AC spreading resistance

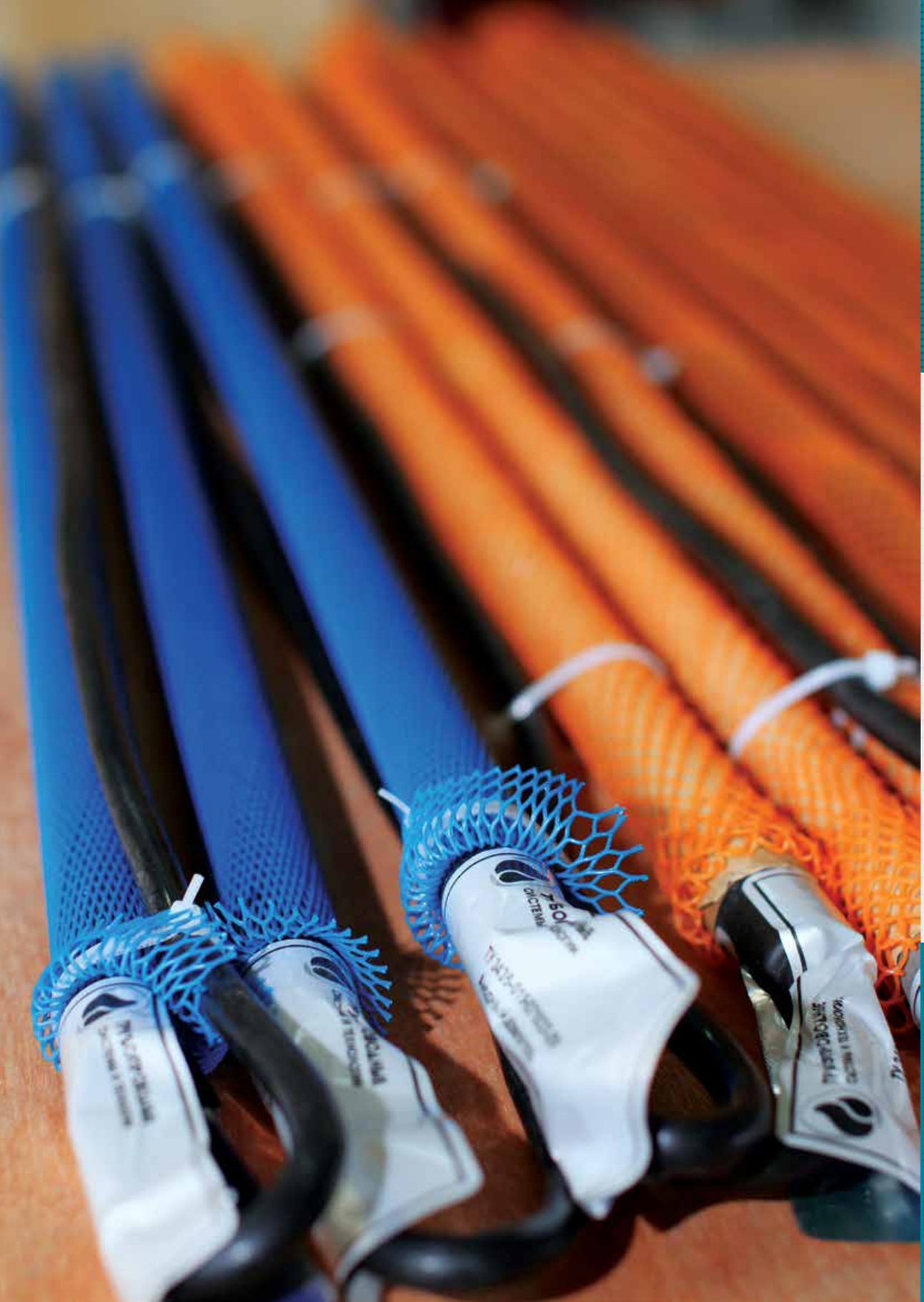
*A cable with any length and coupon with surface 6,25 cm² are available for order

Reference electrode STELTH

Installation of the reference electrode

Reference electrode with coupon

Coupon with 1 cm² surface



ANODE GROUNDINGS AG-PST

Anode groundings AG-PST are electrodes or a chain of electrodes to be used as grounding elements in cathodic protection units to protect metal structures operated in different aggressive soils and underwater.

Low soluble coatings applied to the surface of anode grounding electrodes have a certain composition and, depending on application conditions, are subdivided into the following types:

type 1: MMO coating for soil and fresh water

type 2: MMO coating for seawater

type 3: metallized coating

type 4: MMO coating for fresh water and seawater, modified

AG-PST are environmentally friendly, low soluble and do not contaminate aquatic and process environment with dissolution products.

AG-PST may be used as:

— surface anode groundings with vertical and horizontal position of electrodes;

— deep-ground anode groundings located in casing columns;

— underwater anode groundings (for both: sea and fresh water).

AG-PST in a protective dielectric case

Low soluble anode groundings

CJSC «Pipeline systems and technologies» manufactures 2 types of anode groundings (based on the form of an electrode base):

tubular;

tubular of a special purpose.

Standard dimensions of the functional part of a tubular electrode:

Electrode type	Length, mm, not less	Diameter, mm, not less	Wall thickness, mm, not less	Surface area of 1 m electrode, m²	Electrode weight without cable, kg
1	1200	19	1	0,0596	1,1
2	500	25	1	0,0785	0,9
3	1500	25	1	0,0785	1,6
4	1200	32	1	0,101	1,5

Standard dimensions of the functional part of a special purpose tubular electrode:

Electrode type	Length, mm, not less	Diameter, mm, not less	Wall thickness, mm, not less	Surface area of 1 m electrode, m²	Electrode weight without cable, kg
1	1220	32	0,9	0,101	1,5
2	600	32	0,9	0,101	0,8

Current density and coating application conditions

Electrode type	Coating type	Rated current density, A/m²	Maximum current density, A/m²	Application conditions
Tubular electrode	Type 1	65	80	Sand, soil, fresh water
	Type 2	400	480	Seawater
	Type 3	65 (for soil and fresh water) 400 (for seawater)	80 (for soil and fresh water) 480 (for seawater)	Sand, soil, seawater, fresh water
Tubular electrode of a Special purpose	Type 4	65 (for fresh water) 400 (for seawater)	80 (for fresh water) 480 (for seawater)	Seawater, fresh water

The lifetime of AG-PST is 30 years.

The coating dissolution rate at the nominal current density is 0,01 g/A-year. Anode groundings AG-PST are manufactured according to the TS 3435-019-93719333-2016 and TBPSh.685543.027 TS.

Type designation:

AG-PST - X - X - X - X - X - X
1 2 3 4 5 6 7

where:

1 – name of the anode grounding (assigned by the manufacturer);

2 – type of the anode grounding electrode design:
— tubular electrode — 3;
— tubular electrode of a special purpose — 4.

3 – coating type on the AG surface:
— low soluble coating of type 1 — 1;
— low soluble coating of type 2 — 2;
— low soluble coating of type 3 — 3;
— low soluble coating of type 4 — 4.

4 – AG-PST diameter type;

5 – Cable length, m;

6 – Cable cross-section, mm²;

7 – Number of working grounding electrodes connected in series, pcs:
— when ordering AG-PST consisting of a single electrode — 1.

Designation example:
Anode grounding AG-PST-3-2-3-5-10-1 according to the TU 3435-019-93719333-2016 is a 1500x25 mm tubular anode grounding with low soluble coating of type 2,5 m main cable, 10 mm² cross section, a single electrode.

Linear anode groundings LAG-PST

An linear anode grounding LAG-PST is a current-conducting cable surrounded by a functional wire electrode coated with mixed metal oxides (Type 1), which is packed into low-mesh coke and designed to be used as a grounding element in cathodic corrosion protection units to protect buried metal structures.

LAG-PST may be applied in any soil, including high-ohmic. LAG-PST may be laid into the same trench with the protected structure, which simplify the installation process.

LAG-PST is used to protect:
— underground parts of tanks;
— pipelines;
— industrial sites.

Main characteristics of linear anode groundings LAG-PST:

Parameter	Value
Current carrying capacity, mA/running meter	50; 150; 300
Outer diameter, mm, no more.	38
Cross-section of a current-conducting cable, mm²	16
Minimum bend radius	500
Grounding length, m	against order
Weight, kg/m	1,5
Service life, years, not less.	30

Deep anode earthing devices

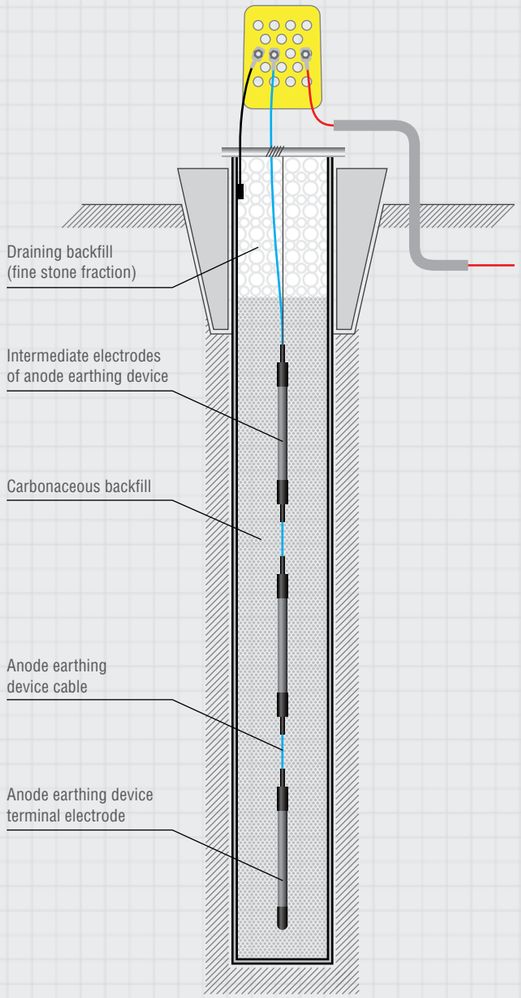
Deep anode earthing devices with a functional coating of mixed metal oxides can be used for installation in closed or open wells. These anode earthing devices can be used when replacing other types which have depleted their potential such as deep anode earthing devices made of magnetite, wire grounding earthing devices or scrap metal.

Deep anode earthing devices are several series-connected tubular electrodes, their quantity and dimensions are determined by the order. The connection of the electrodes is performed by an intermediate cable with a contact node, which is located inside the tubular electrode. The internal cavity of the tubular electrode is reliably protected from the external influence of the corrosive environment. The distance between the electrodes in the standard version is 1 m, but it can be changed according to the order.

A prerequisite for the use of deep anode earthing devices is the use of coke-mineral activator to fill the anode space in the well.

Installation in closed wells

Organization of wells and installation of deep anode earthing devices is carried out in accordance with the project.



MMO Anodes