

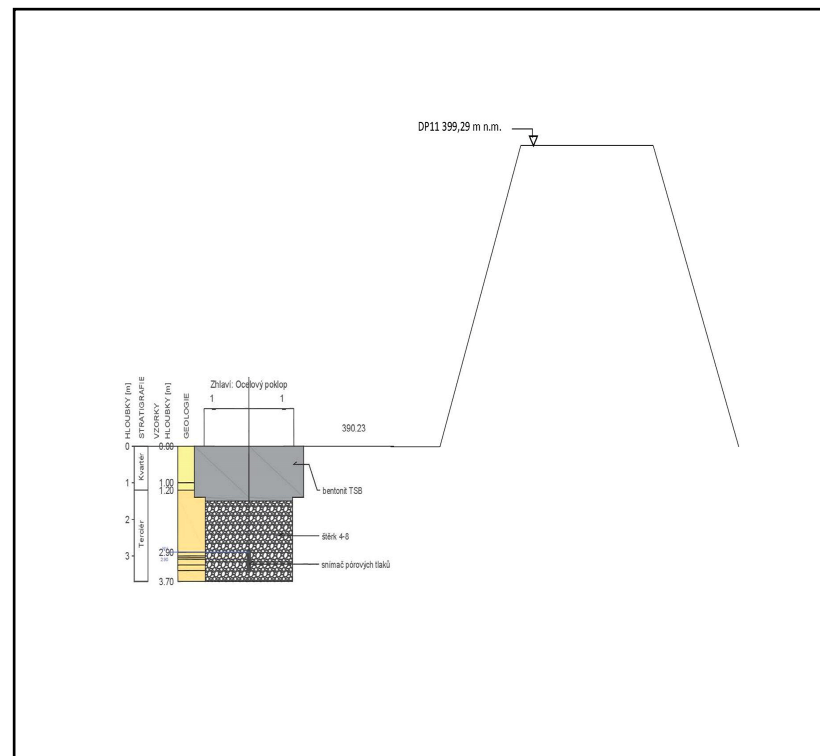
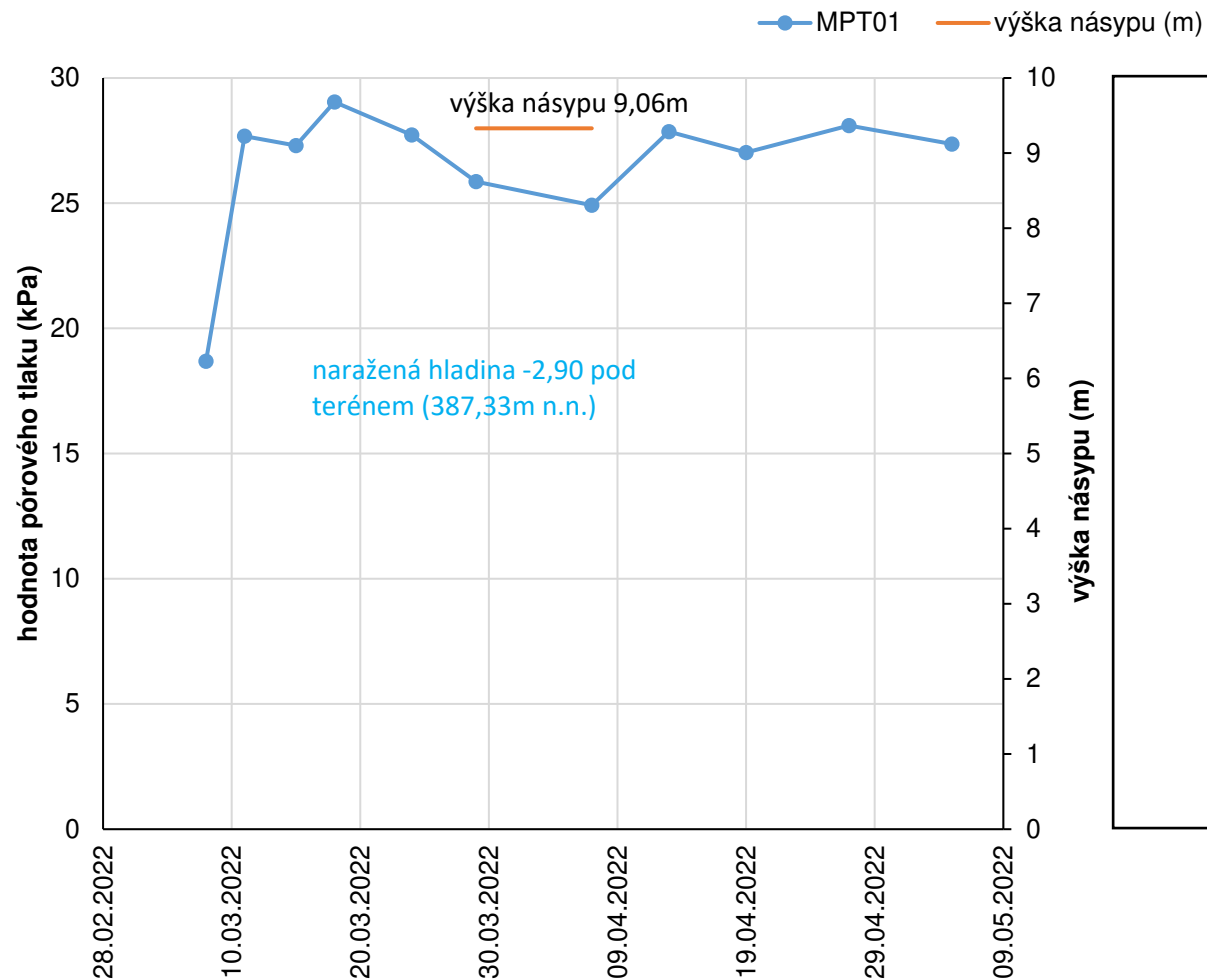
**INŽENÝRSKOGEOLOGICKÝ PRŮZKUM TRATI
V ÚSEKU KARLOVY VARY - CHODOV****PŘÍLOHA Č. 13****VÝSLEDKY MĚŘENÍ A KALIBRAČNÍ PROTOKOLY
SNÍMAČŮ PÓROVÉHO TLAKU**

Název zakázky:	Karlovy Vary - Chodov, násep, IGP		
Číslo zakázky:	2022 - 050	Objednatel:	Správa železnic, státní organizace
Datum:	05/2022	Zpracoval:	RNDr. Václav Hájek
Počet stran:	6	Schválil:	Mgr. Filip Dudík

MĚŘENÍ VÝVOJE PÓROVÝCH TLAKŮ

Název zakázky:	Karlovy Vary - Chodov		
Číslo zakázky:	2022-050	Staničení (km):	187.010
Umístění:	levá strana násypu		
Typ snímačů:	Sisgeo PK45S35000		

Datum instalace:	08.03.2022		
	MPT01	0	-
Čísla snímačů:	P211262	0	-
Hloubka (m):	3.5	0.0	-





CALIBRATION REPORT

N. 2107199

Serial Number: P211262

Product Code: OPK45S35000

Model: HD PIEZOMETER 350 kPa

Type: Vibrating Wire + NTC

Calibration Date: 20/07/2021 13:44

Job Number: 21-00757

Project Code:

Cable (m): 40

Test Conditions

Temperature: 21 ± 0.5 °C

Humidity: 32 ± 10%

Barometric Pressure: 997 ± 5 hPa

Calibration Method

Calibration is made by direct comparison method using a calibration bench.

Calibration is made at SISGEO laboratory. SISGEO S.r.l. is a Certified UNI EN ISO 9001 Company.

Calibration procedures: IST 10/01*; IST 10/04*; IST 10/06*; IST 10/13*; IST 10/28* (*: in accordance to the instruments model)

Calibration is made according to inclinometric, displacement, load and pressure conventions reported in standard for calibration equipment.

Traceability is through first line standards, validated by certificates of calibration

Pressure Control Module 154: GE Druck, CM1, COFRAC N. 14199607-1

Multimeter 171: Keysight Technologies, 3458A, LAT 046 365165

Universal counter 185: TTI, TF930, LAT 019 57780

- The measurement results reported in this Calibration Report were obtained following the calibration procedures and the reference standard written above. They relate only to the calibrated item and they are valid only for the time and conditions of calibration, unless otherwise specified.

- The measurements uncertainties (U) stated in this document have been determined according to the ISO/IEC Guide 98 and to EA-4/02. Usually they have been estimated as expanded uncertainty obtained multiplying the standard uncertainty by the coverage k factor corresponding to a confidence level of about 95%. Usually the k factor is 2.

- MPE: Maximum Permissible Error

RESULTS

Temperature Linear Factor: $kT = -0.1329781 \text{ [kPa/}^\circ\text{C]}$

Reading thermically compensated: $P_{tc} = R_{cl} + \Delta T \cdot kT \text{ [kPa]}; P_{tc} = R_{cp} + \Delta T \cdot kT \text{ [kPa]}$

Linear Sensitivity Factors: (1) **A=** $-1.1984E-01 \text{ [kPa/digit]}$ **B=** $1.0288E+03 \text{ [kPa]}$

Maximum Linear Error + U: (2) 0.2757 [%FS]

MPE Lin. = 0.4 [%FS]

Final Linear Reading: (3) $R_{cl} = A \cdot R_{meas} + B \text{ [kPa]}$

Polynomial Sensitivity Factors: (4) **A=** $-5.6029E-11 \text{ [kPa/digit}^3\text{]}$ **B=** $8.1952E-07 \text{ [kPa/digit}^2\text{]}$ **C=** $-1.2289E-01 \text{ [kPa/digit]}$ **D=** $1.0296E+03 \text{ [kPa]}$

Maximum Polynomial Error + U: (2) 0.1718 [%FS]

MPE Pol. = 0.25 [%FS]

Final Polynomial Readings: (5) $R_{cp} = A \cdot R_{meas}^3 + B \cdot R_{meas}^2 + C \cdot R_{meas} + D \text{ [kPa]}$

CRITERIA $|\text{Max Lin. Err.}| + U < |\text{MPE Lin.}|$

$|\text{Max Pol. Err.}| + U < |\text{MPE Pol.}|$

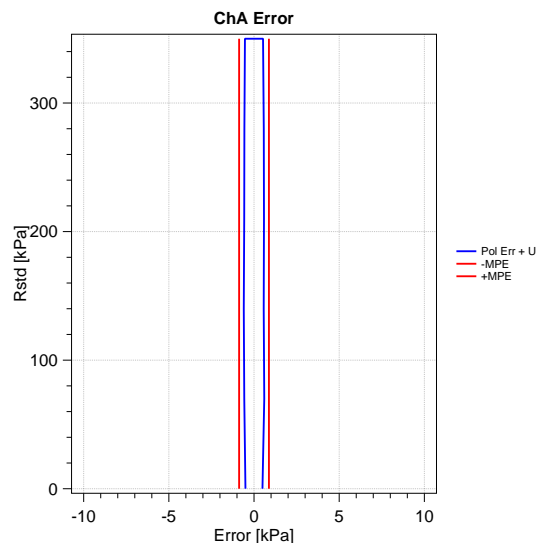
COMPLIANT

To the Datasheet

Issue Date: 20.07.2021

CQE: *Mario Bruni*

Ch. A				
Rstd ⁽⁶⁾ [kPa]	Rmeas ⁽⁷⁾ [digit]	U [kPa]	Rcl ⁽³⁾ [kPa]	Rcp ⁽⁵⁾ [kPa]
0	8580.356	0.41258	0.5522701	0.09085856
70	8000.72	0.4284275	70.01373	70.144
140	7418.476	0.4442979	139.7877	140.1571
210	6834.267	0.4601889	209.7972	210.1152
280	6248.039	0.4760983	280.0486	280.0894
350	5660.666	0.4920245	350.4372	350.0412
350	5661.326	0.4920245	350.3581	349.9626
280	6249.6	0.4760983	279.8615	279.9033
210	6836.271	0.4601889	209.557	209.8757
140	7420.82	0.4442979	139.5068	139.8758
70	8003.346	0.4284275	69.69904	69.82747
0	8581.789	0.41258	0.3805446	-0.08282125



LEGEND

(1): Linear factors obtained by means of linear formula according to the least squares method.
 (2): The errors shows related to residual error on the calibration step applying linear/polynomial correction + Uncertainty.
 (3): Values calculated using linear correction.
 (4): Polynomial factors obtained by means of linear multiply regression formula.
 (5): Values calculated using polynomial correction.
 (6): Reference readings.
 (7): Instruments readings.

NOTES:

a) % F.S. error is calculated on whole range.
 b) Resulting error depends on the effects of linearity and hysteresis.
 c) The errors reported into the charts are the results of the sum of each step error and the related measure uncertainty.

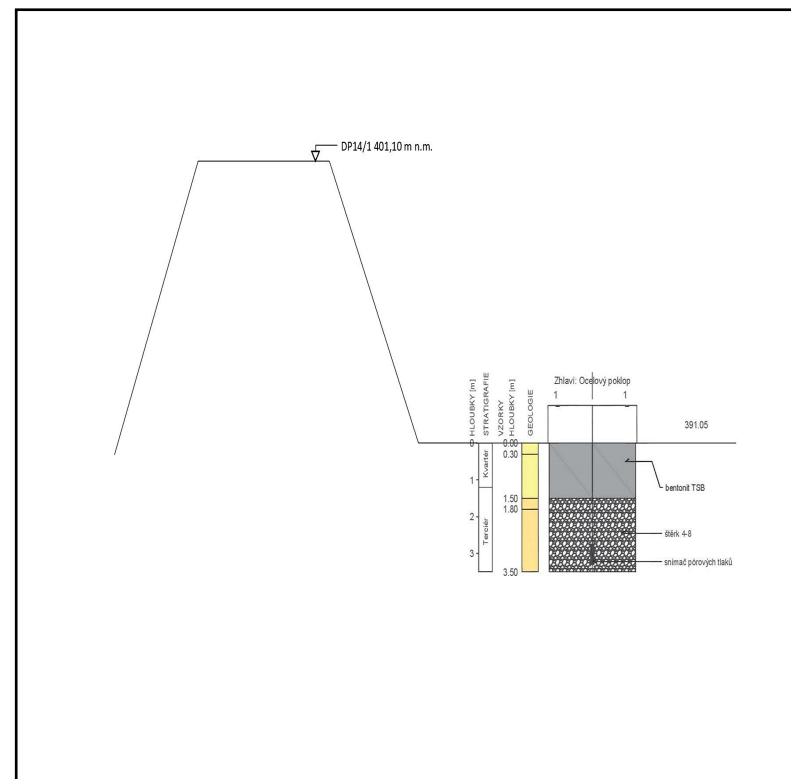
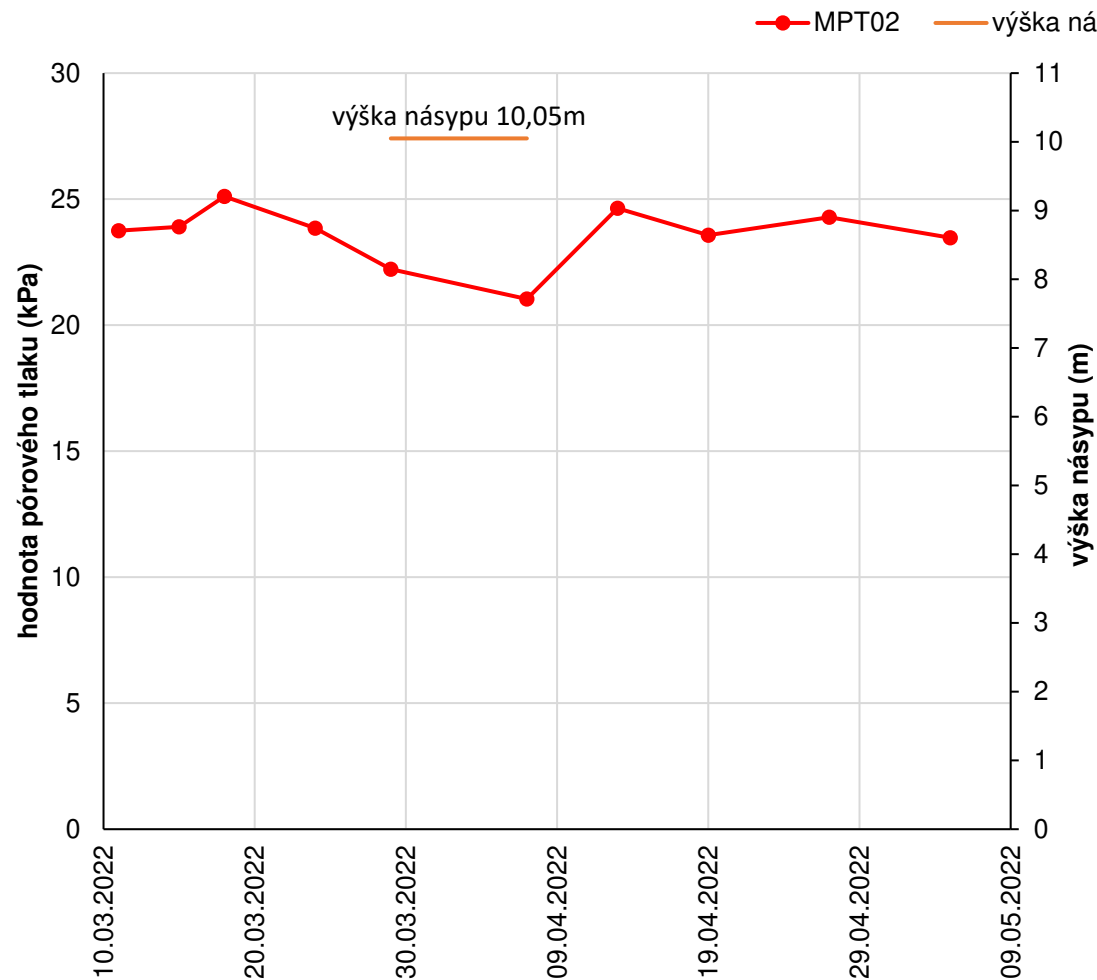
digit = Hz²/1000

WIRING: Red = VW; Black = VW; White = Thermistor; Green = Thermistor; Shield = Ground

MĚŘENÍ VÝVOJE PÓROVÝCH TLAKŮ

Název zakázky:	Karlovy Vary - Chodov			
Číslo zakázky:	2022-050		Staničení (km):	186.700
Umístění:	pravá strana násypu			
Typ snímačů:	Sisgeo PK45S35000			

Datum instalace:	11.03.2022		
	0	MPT02	-
Čísla snímačů:	0	P211263	-
Hloubka (m):	0.0	3.3	-





CALIBRATION REPORT

N. 2107200

Serial Number: P211263

Product Code: OPK45S35000

Model: HD PIEZOMETER 350 kPa

Type: Vibrating Wire + NTC

Calibration Date: 20/07/2021 13:44

Job Number: 21-00757

Project Code:

Cable (m): 40

Test Conditions

Temperature: 21 ± 0.5 °C

Humidity: 32 ± 10%

Barometric Pressure: 997 ± 5 hPa

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Multimeter 171: Keysight Technologies, 3458A, LAT 046 365165

Universal counter 185: TTI, TF930, LAT 019 57780

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- The measurements uncertainties (U) stated in this document have been determined according to the ISO/IEC Guide 98 and to EA-4/02. Usually they have been estimated as expanded uncertainty obtained multiplying the standard uncertainty by the coverage k factor corresponding to a confidence level of about 95%. Usually the k factor is 2.

- MPE: Maximum Permissible Error

RESULTS

Temperature Linear Factor: $kT = 0.1811776 \text{ [kPa/°C]}$

Reading thermically compensated: $P_{tc} = R_{cl} + \Delta T \cdot kT \text{ [kPa]}; P_{tc} = R_{cp} + \Delta T \cdot kT \text{ [kPa]}$

Linear Sensitivity Factors: (1) **A=** $-1.2642E-01 \text{ [kPa/digit]}$ **B=** $1.1670E+03 \text{ [kPa]}$

Maximum Linear Error + U: (2) 0.2546 [%FS]

MPE Lin. = 0.4 [%FS]

Final Linear Reading: (3) $R_{cl} = A \cdot R_{meas} + B \text{ [kPa]}$

Polynomial Sensitivity Factors: (4) **A=** $-2.0568E-11 \text{ [kPa/digit}^3]$ **B=** $1.6129E-07 \text{ [kPa/digit}^2]$ **C=** $-1.2512E-01 \text{ [kPa/digit]}$ **D=** $1.1571E+03 \text{ [kPa]}$

Maximum Polynomial Error + U: (2) 0.2012 [%FS]

MPE Pol. = 0.25 [%FS]

Final Polynomial Readings: (5) $R_{cp} = A \cdot R_{meas}^3 + B \cdot R_{meas}^2 + C \cdot R_{meas} + D \text{ [kPa]}$

CRITERIA $|\text{Max Lin. Err.}| + U < |\text{MPE Lin.}|$

$|\text{Max Pol. Err.}| + U < |\text{MPE Pol.}|$

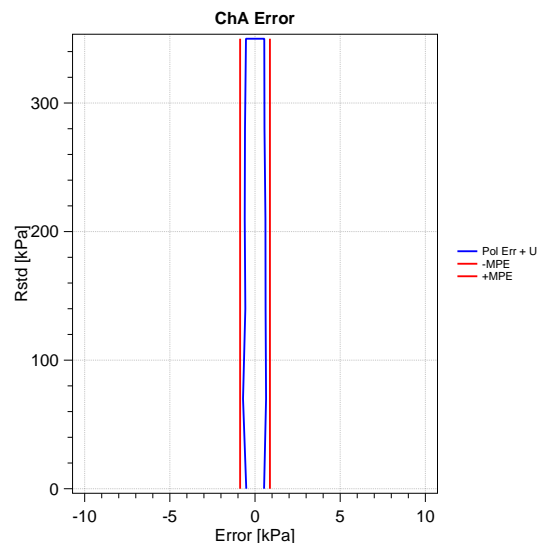
COMPLIANT

To the Datasheet

Issue Date: 20.07.2021

CQE: *Mario Bruni*

Ch. A				
Rstd ⁽⁶⁾ [kPa]	Rmeas ⁽⁷⁾ [digit]	U [kPa]	Rcl ⁽³⁾ [kPa]	Rcp ⁽⁵⁾ [kPa]
0	9227.372	0.4135219	0.4401513	0.1007807
70	8675.597	0.4293345	70.19468	70.27474
140	8124.592	0.4451726	139.8519	140.1235
210	7570.601	0.4610334	209.8865	210.1427
280	7015.517	0.4769147	280.0594	280.1117
350	6459.44	0.4928145	350.3578	350.0381
350	6460.146	0.4928145	350.2685	349.9495
280	7017.029	0.4769147	279.8682	279.9214
210	7572.923	0.4610334	209.593	209.8496
140	8126.948	0.4451726	139.554	139.8253
70	8679.49	0.4293345	69.70253	69.78046
0	9229.088	0.4135219	0.2232173	-0.1178346



LEGEND

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- (3): Values calculated using linear correction.
- (4): Polynomial factors obtained by means of linear multiply regression formula.
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digit = Hz²/1000

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