MEASUREMENT SYSTEM FOR HIGH CURRENT SHUNTS DC CHARACTERIZATION AT CMI

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MEASUREMENT SET UP

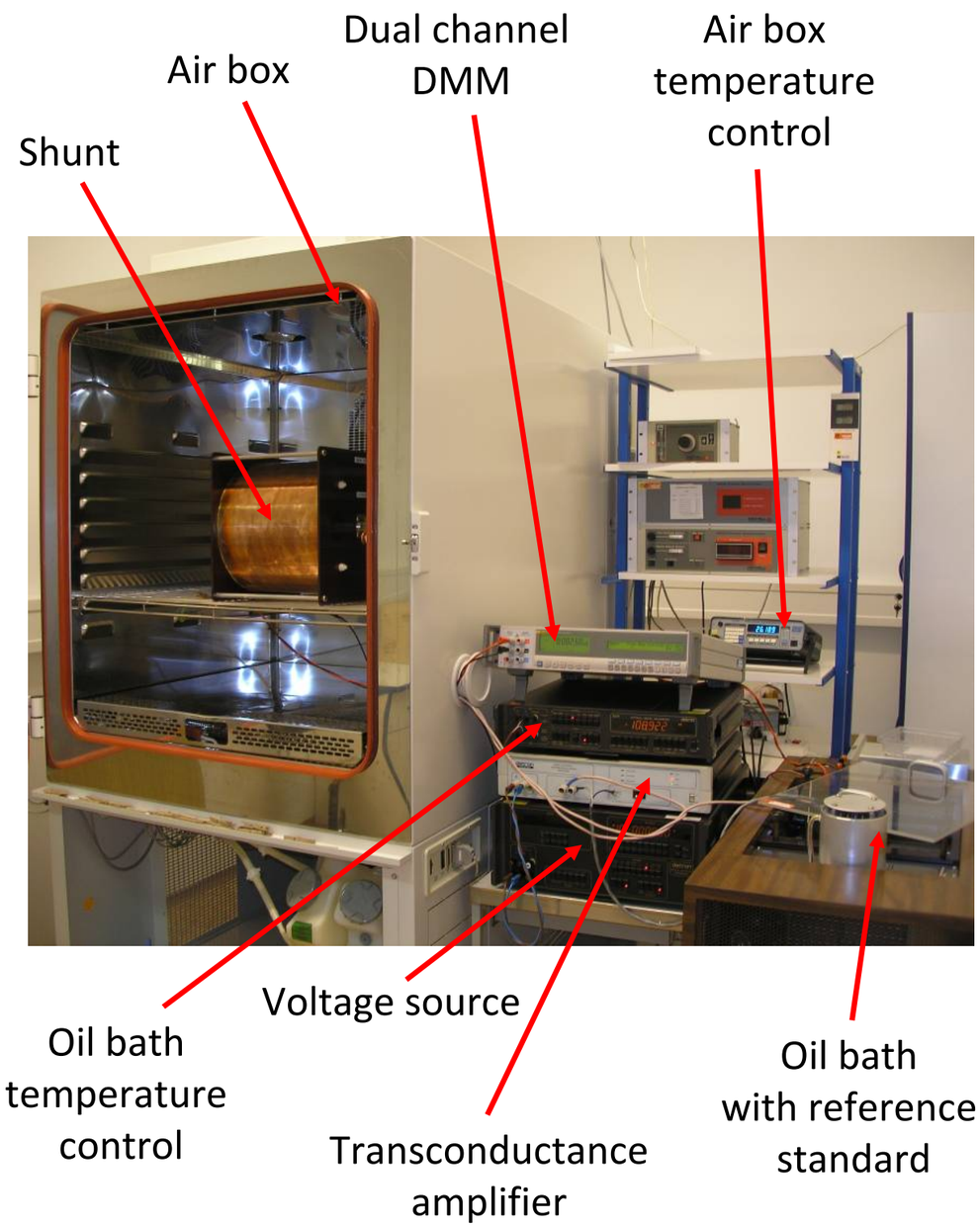
Method: **measurement of ratio of output voltages of the tested and the reference standard** by dual channel multimeter. Thus, the resistance of tested standard is calculated:

$$R_X = \frac{U_X}{U_E} \cdot R_E$$

Standards: oil filled and placed in the oil bath, traceability to QHS.

Nom.value	Current level	Type	Producer
0,1 Ω	1A - 3A	1682	Tinsley
0,02 Ω	5A - 10A	1682	Tinsley
0,01 Ω	10A - 20A	RN I	Metra
0,001 Ω	30A - 100A	RN I	Metra

Set up for TC measurement



PC AND TC MEASUREMENTS

POWER COEFFICIENT MEASUREMENTS

The power coefficient is easily to calculate as:

$$PC_R = \Delta R / \Delta P$$

PCR measured and calculated **in current range of 50% - 100% of nominal current.**

Typical values of PCR

Foil shunts:

< ± 4 ppm, unc. < 3.1ppm

Cage shunts:

< ±1.5 ppm, unc. < 1.5 ppm

TEMPERATURE COEFFICIENT MEASUREMENTS

The temperature coefficient is easily to calculate as:

$$TC_R = \Delta R / \Delta T$$

TCR measured **in temperature range from 18 ℃ up to 28(30) ℃ at 1/10 of nominal current.**

Typical values of TCR

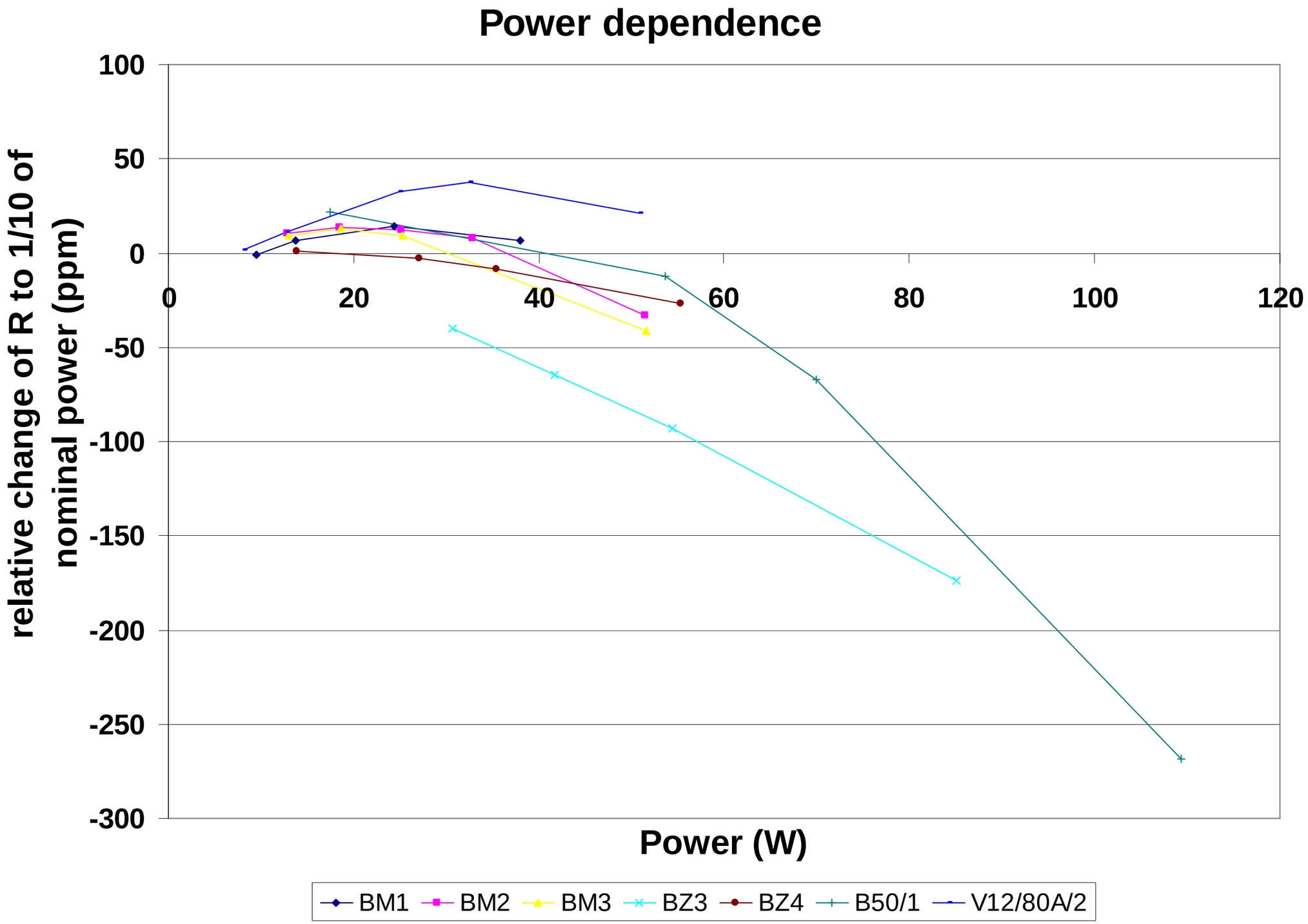
Foil shunts:

-2.8 +0.2 +8 ppm, unc. < 2.1ppm

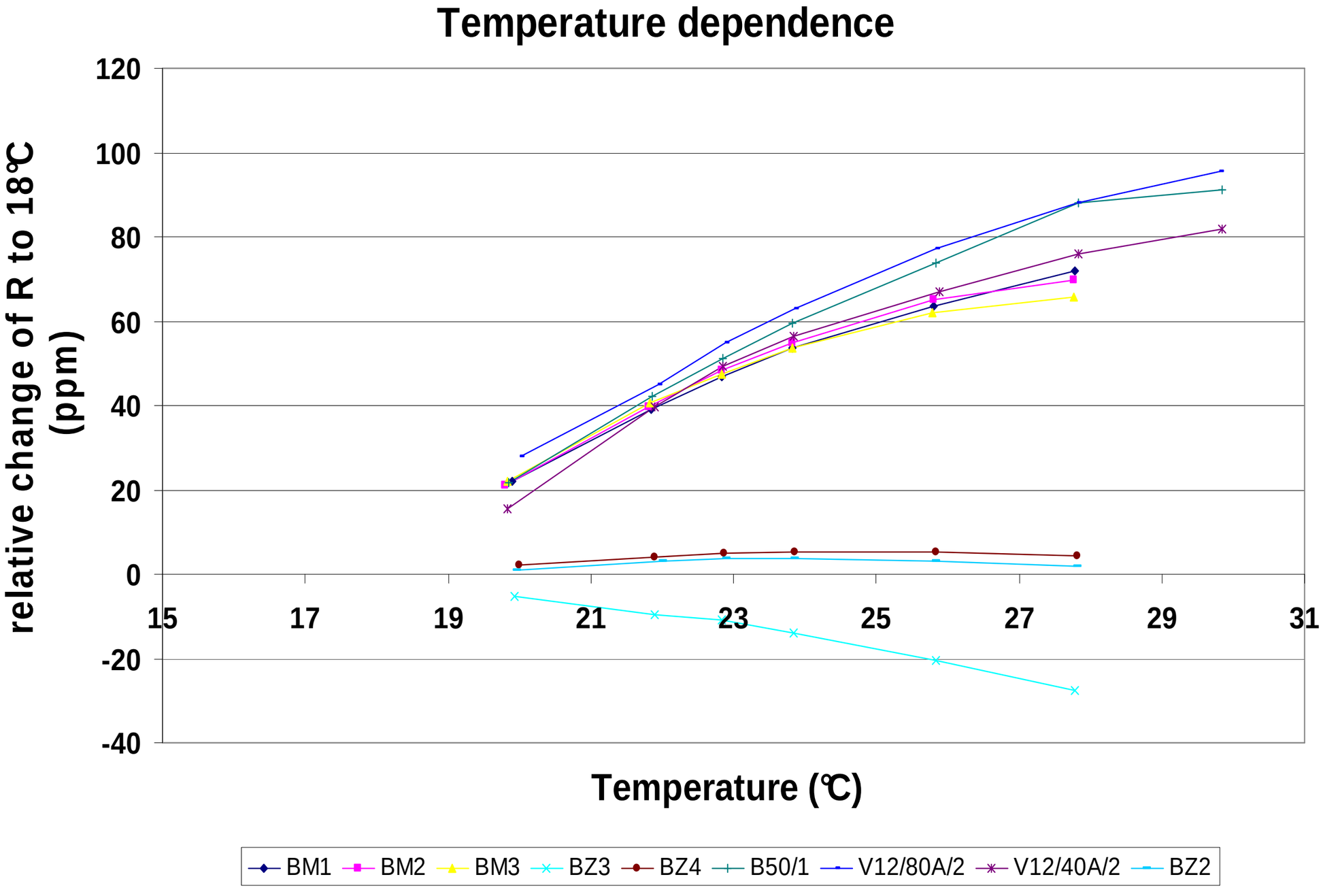
Cage shunts:

-0.8 +1.7 ppm, unc. < 1.7 ppm

FOIL SHUNTS RESULTS

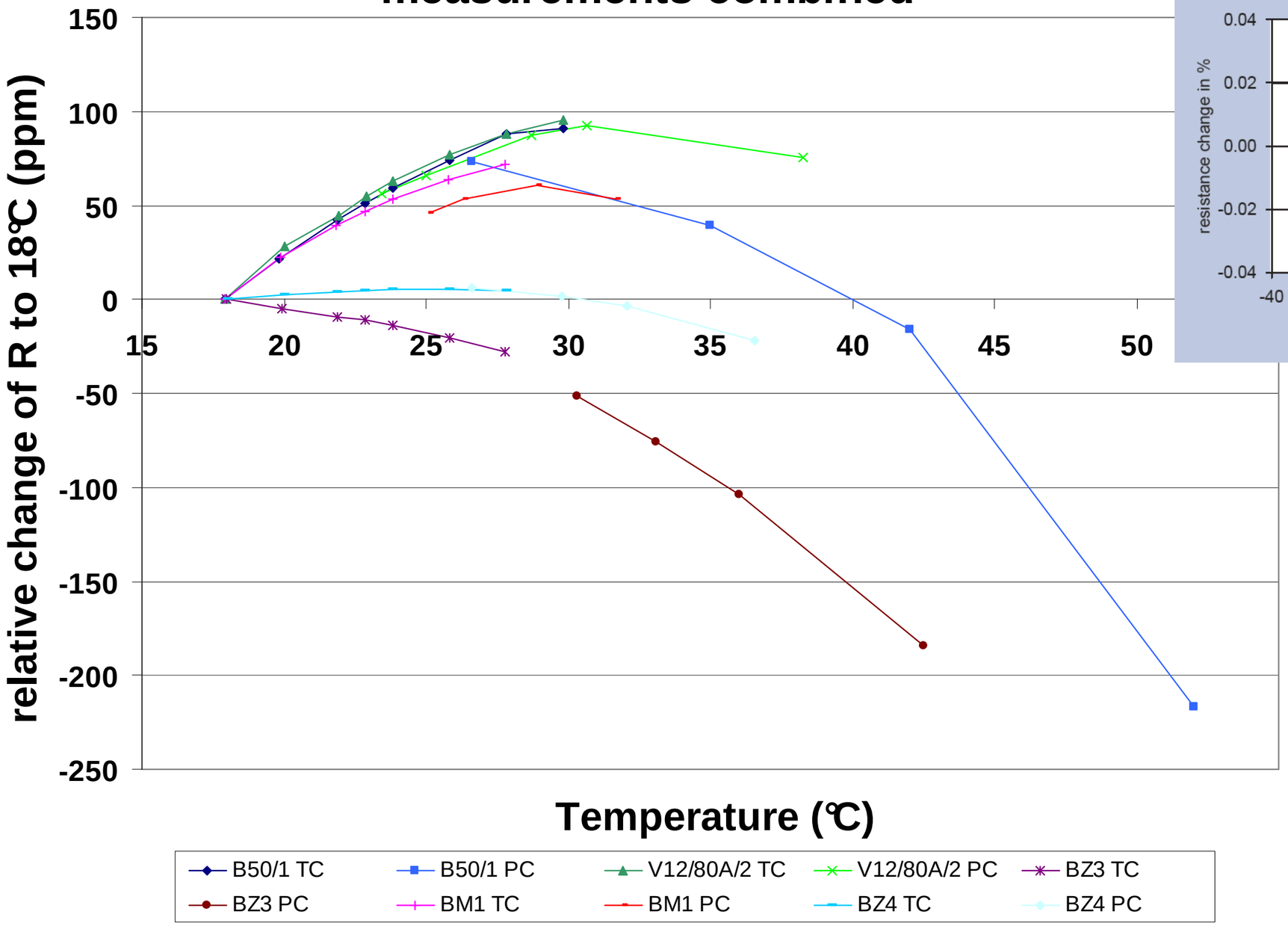


FOIL SHUNTS RESULTS

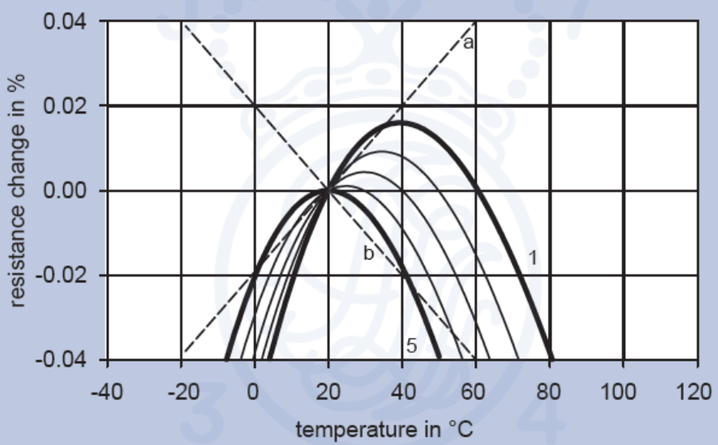


FOIL SHUNTS RESULTS

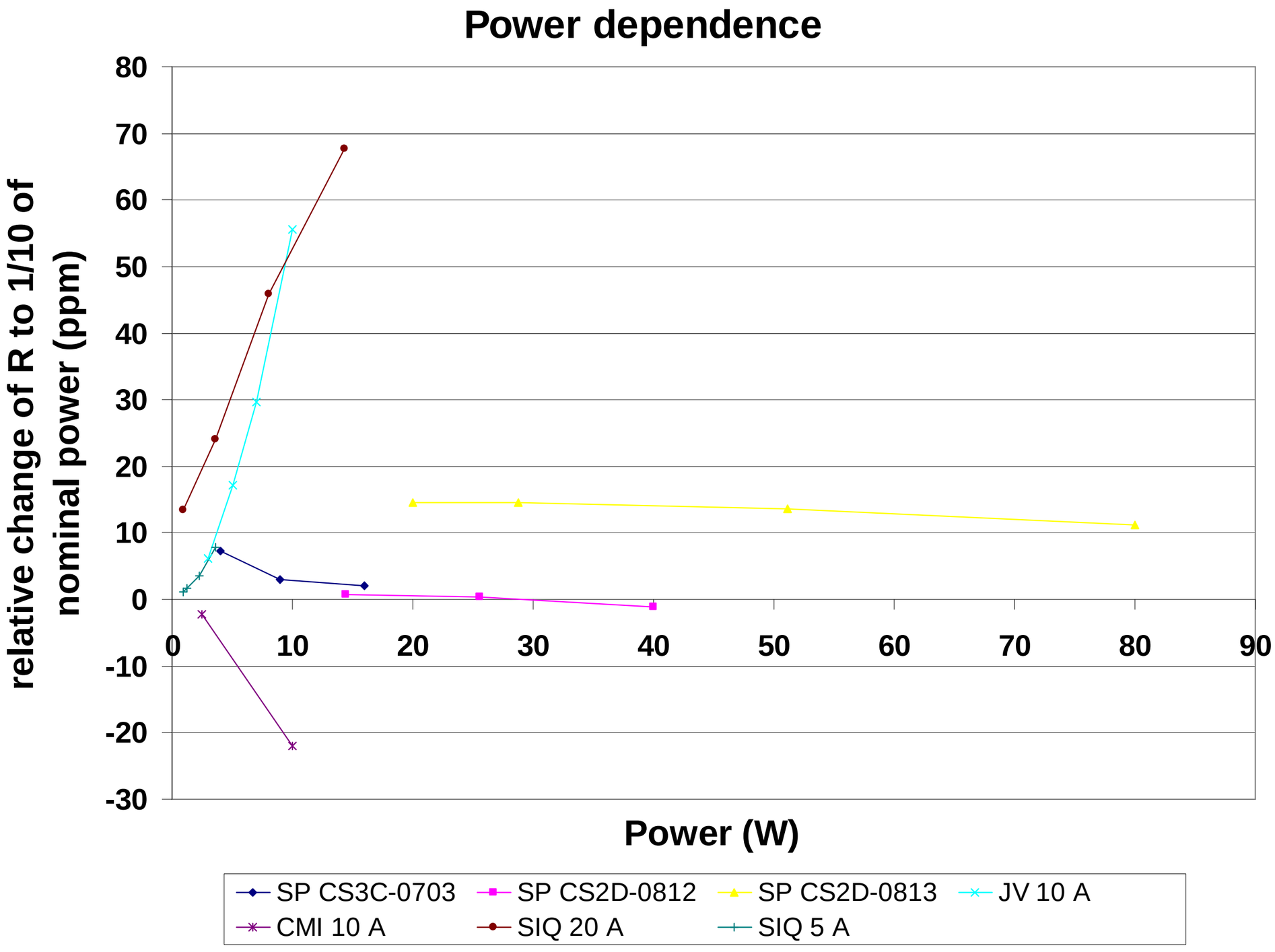
Temperature dependence of foil shunts TC and PC measurements combined



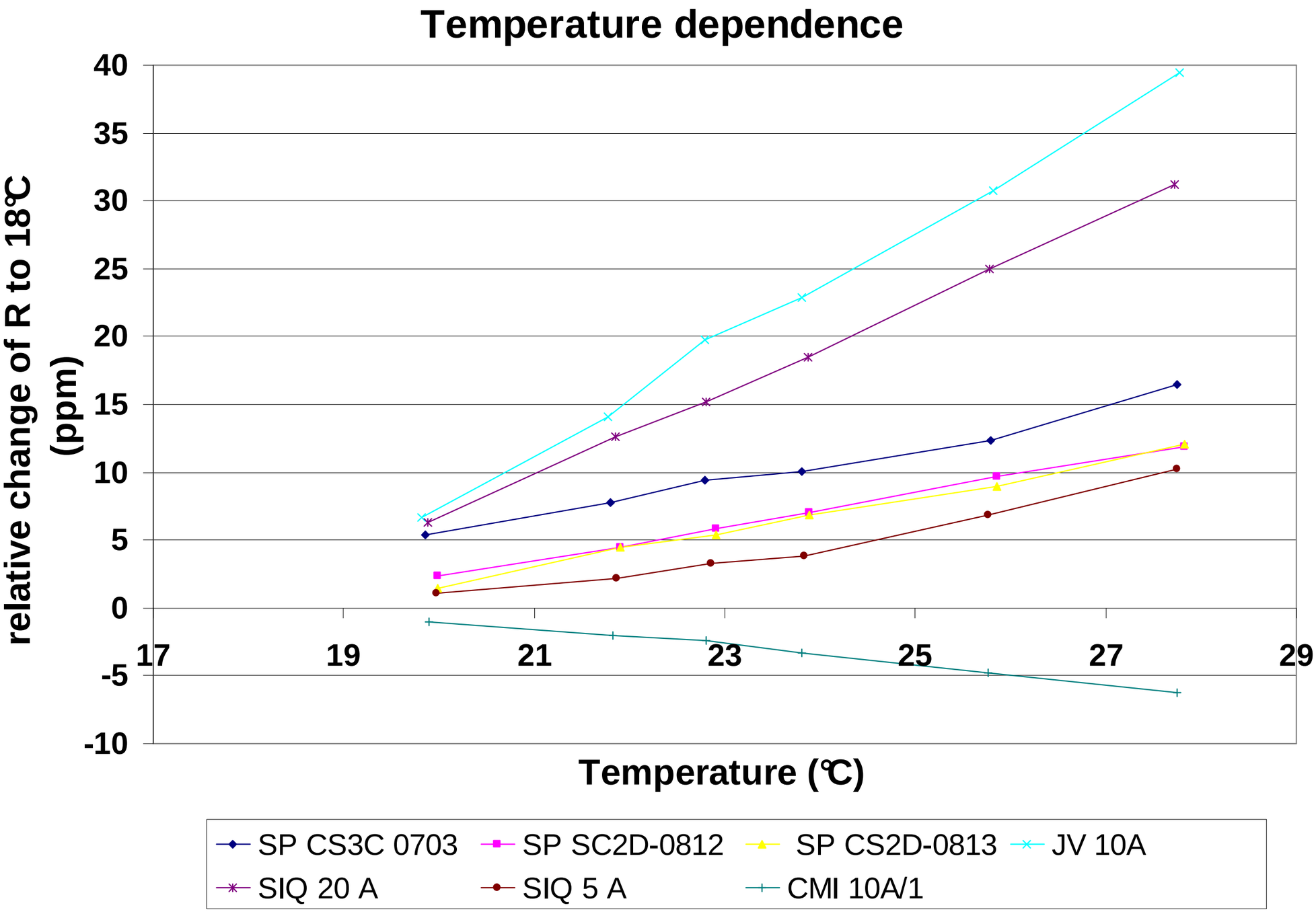
Producer's specs



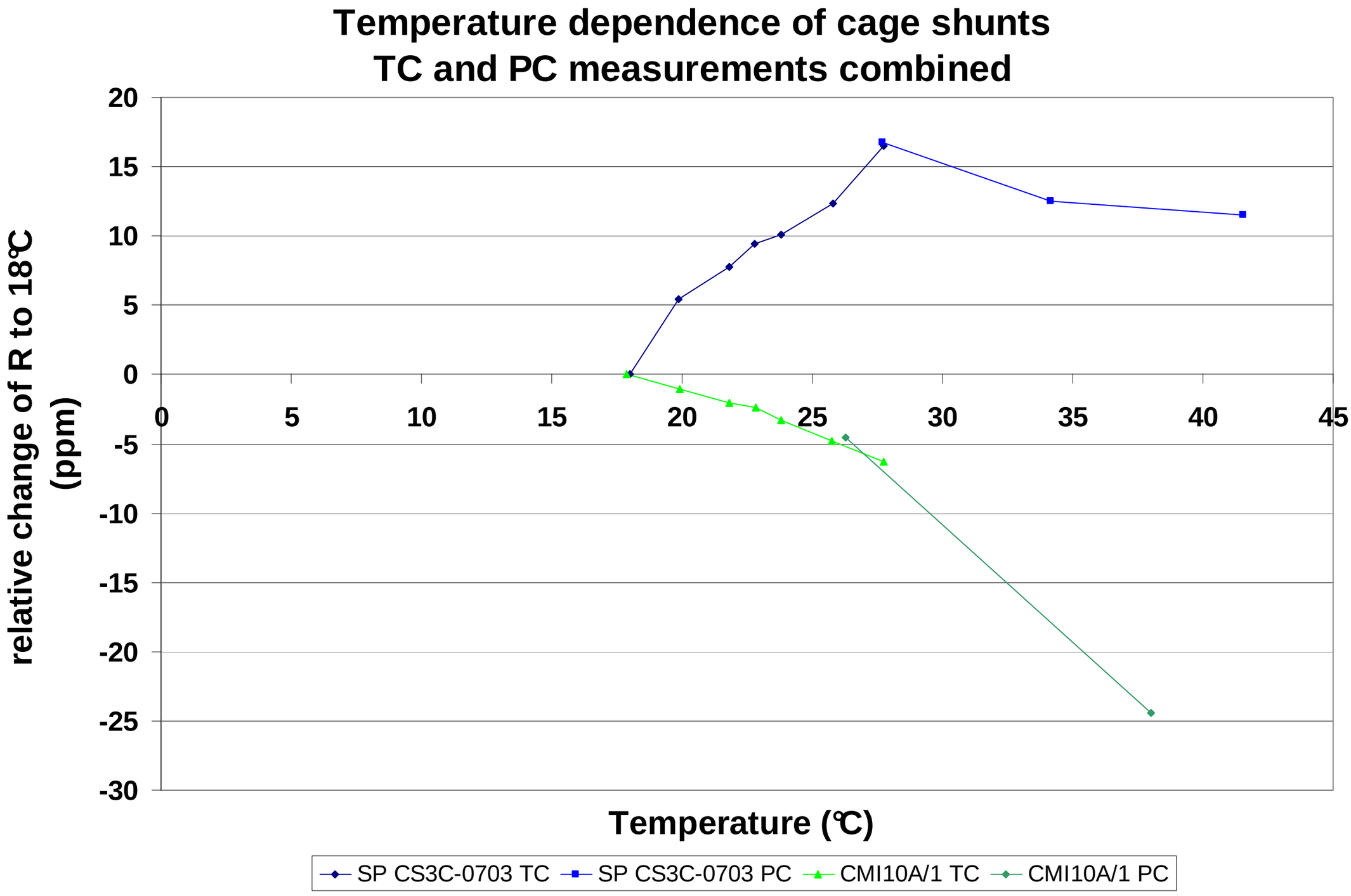
CAGE SHUNTS RESULTS



CAGE SHUNTS RESULTS



CAGE SHUNTS RESULTS



CALCULATED TC AND PC OF SHUNTS

Origin	Serial No.	Nominal I (A)	Nominal R (mΩ)	Shunt type	I (A)	temp. range (°C)	TC (ppm/°C)	Unc. (ppm/k)	current range (A)	PC (ppm/W)	Unc. (ppm/W)
SIQ	SIQ07023	5	150	cage	0,5	18°C...28°C	1,1	0,7	2,5A...5A	2,5	1,2
CMI	CMI/10A/1	10	100	cage	1	18°C...28°C	-0,8	0,33	5A...10A	-1,5	1,2
JV	-	10	90	cage	1	18°C...28°C	4,0	0,9	5A...10A	5,7	1,2
BEV	BZ1	15	42	foil	-	-	-	-	5A...15A	-28,3	1,2
BEV	BZ2	20	27	foil	2	18°C...28°C	0,20	0,48	10A...20A	-11,9	1,2
SIQ	SIQ07025	20	35	cage	2	18°C...28°C	3,2	0,7	10A...20A	4,1	1,0
SP	CS3C-0703	20	40	cage	2	18°C...28°C	1,67	0,33	10A...20A	-0,25	0,82
BEV	V16/20A/3	20	20	foil	-	-	-	-	10A...20A	-1,4	3,1
BEV	V12/40A/2	40	9,5	foil	5	18°C...30°C	6,8	1,1	20A...40A	0,51	1,7
SP	CS2D-0812	50	16	cage	5	18°C...28°C	1,22	0,83	30A...50A	-0,07	0,51
BEV	BM1	50	15	foil	5	18°C...28°C	7,4	1,3	25A...50A	1,0	1,0
BEV	V12/80A/2	80	5	foil	10	18°C...30°C	8,0	2,1	40A...80A	1,48	0,68
BEV	B50/1	100	10	foil	10	18°C...30°C	7,7	1,0	50A...100A	-3,97	0,21
BEV	BZ3	100	8,5	foil	10	18°C...28°C	-2,8	1,5	50A...100A	-2,23	0,16
BEV	BZ4	100	5,5	foil	10	18°C...28°C	0,5	0,5	50A...100A	-0,68	0,90
SP	CS2D-0813	100	8	cage	10	18°C...28°C	1,2	1,7	50A...100A	-0,06	0,20
BEV	BM2	100	5	foil	10	18°C...28°C	7,3	1,5	50A...100A	-1,1	1,0
BEV	BM3	100	5	foil	10	18°C...28°C	6,8	1,5	50A...100A	-1,3	1,0

CONCLUSION AND ACKOWLEDGEMENT

CONCLUSIONS

Most significant influences of measurements (except of working standard calibration): temperature influence on air cooled shunts and/or standard deviation of measured voltages ratio.
Future work focus on measuring of temperature dependence of Vishays resistors.

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