4.4.13. VIBRATION TRANSDUCER WITH BUILT-IN ELECTRONICS WITH C TEMPERATURE COMPENSATION AND SELF-TESTING

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General purpose piezoelectric vibration transducers used in majority of diagnostic and monitoring systems can operate in a wide temperature range from –60 … –40 to 150 … 200ºC. But in the case of deviation of temperature from the norm an axial sensitivity and capacitance have an essential variation. Typical temperature dependence of sensitivity and capacitance of general purpose vibration transducers with piezoelectric element (type PZT5) are shown in Figure 1 [1]. As is obvious from this Figure the variation of sensitivity and capacitance can reach 20 … 30%. It has a negative influence on a measurement error.

It is ineffective to use materials with low temperature dependence (quartz monocrystal and bismuthic segnetoceramic PZ46 [2], PZ45 [3]) for manufacturing of sensing element of general purpose vibration transducer because they have bounded piezoproperties which don't allow to provide an acceptable axial sensitivity.

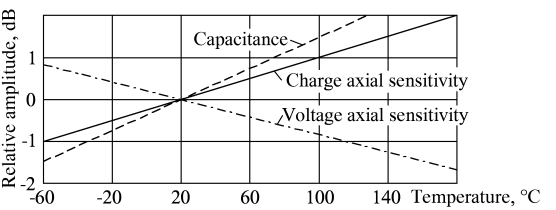

Fig. 1. Deviation of axial sensitivity and capacitance vs. temperature

Table 1 contains specifications of general purpose vibration transducers with built-in electronics with temperature compensation of axial sensitivity 8752A50 (Kistler) [4] and 625B01 (PCB) [5]. As a comparison Table 1 also contains specifications of vibration transducers AP35-02 and AP36-02 (LLC GlobalTest) [1]. Appearance of vibration transducers is shown in Fig. 2. The vibration transducers AP35-02 and AP36-02 have an identical housing.

The sensitivity variation of vibration transducer 625B01 versus temperature is shown in Figure 3 [5]. As is obvious from the Figure the vibration transducer 625B01 does not provide temperature compensation in the low temperature region. This fact restricts using of this vibration transducer. Typical axial sensitivity deviation of vibration transducers AP35-02 and AP36-02 versus temperature is shown in Figure 4. Results from this dependence that these vibration transducers have temperature compensation within all temperature range.

Fig. 2. Appearance of 8752A50, 625B01, AP35-02, AP36-02

Table 1. Specifications

Parameter	Unit	8752A50	625B01	AP35-02	AP36-02[3]
Axial sensitivity (± 10%)	mV/g	100	100	100	100
Amplitude range	g	± 50	± 50	± 50	± 25
Temperature range	°C	–54…+120	+2…+121	–40…+125	–40…+125
Influence coefficient of ambient temperature within +20 … +125°C on axial sensitivity	% /°C	–0.03	0.04	0.04	0.04
Influence coefficient of ambient temperature within +20 … –40°C on axial sensitivity	% /°C	–0.03	–	–0.04	–0.04
Frequency range (ripple ±1 dB)	Hz	0.5…5 000	37…7 500	1..8 000	1…8 000
Output resistance	Ω			<500	<500
Power: – voltage – current	 V mA	 20…30 2…20	 20…30 2…20	 18…30 2…20	 10…15 <4
Test signal duration	c	–	–	5…10	5...10
Amplitude range of test signal with frequency 160±2 Hz	mV	_	–	±(25…50)	±(25…50)

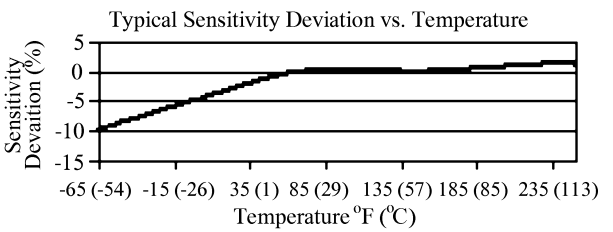

Fig. 3. Sensitivity deviation of 625B01 vs. temperature

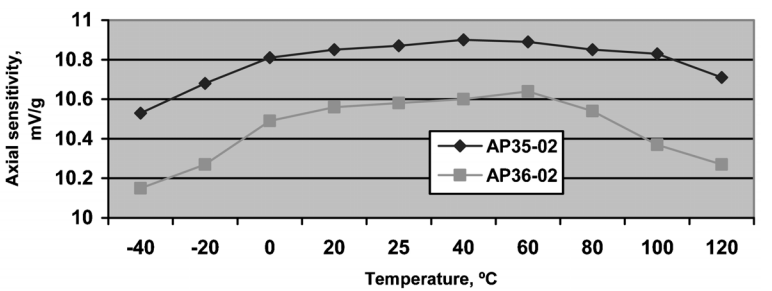

Fig. 4. Typical axial sensitivity deviation of AP35-02 and AP36-02 vs. temperature

Vibration transducers AP35-02 and AP36-02 have an operation check by means of power connection of test signal. The operation check is urgent for stationary diagnostic and monitoring systems because it increases reliability of continuous running. Note should be taken that the property of AP36-02 is availability of lower voltage and current (10 ... 15 V and <4 mA).

References:

1. **LLC GlobalTest** catalogue 2009.
2. **OST 11 0444–87.** Piezoelectric materials. Technical requirements.
3. Ferroperm catalogue. Piezoceramics. High Quality Components Materials for electronic industry, Denmark.
4. **Kistler** catalogue (www.kistler.ru).
5. **PCB catalogue** (www.pcb-group.ru.