

5.3 When wires not exceeding 6 mm in diameter are subjected to the twist test, number of twist in the twist test, condition of fracture and the twisted state shall conform to the requirements specified in Table 5.

Table 5

No. of twist	Diameter 2.00 mm Max	
	Diameter above 2.00 mm up to 3.50 mm	20 Min 15 Min 10 Min
Condition of fracture	Fracture should be at right angle to the axis of wire, free from cracks and other defects.	
Twisted state	There shall be no excessive lengthwise cracks, flaws and local twists.	

5.4 When wires of over 6 mm diameter are subjected to the bending test, surface of wires shall produce no harmful flaws as cracks etc.

5.5 When wires not exceeding 6 mm diameter are subjected to the coiling test, surface of wires shall produce no harmful flaws as cracks etc.

6. Test

6.1 Tension Test The test method shall conform to JIS Z 2241-Method of Tension Test for Metals and be carried out with the grip distance of the tester at approximately 100 mm for wires of less than 1.00 mm diameter, and approximately 200 mm for wires of over 1.00 mm diameter.

When it fractures at the point of the grip, the test shall be considered disqualified and the retest be made on another test piece taken.

6.2 Twist Test Grip firmly both ends of the test piece at a grip distance of 100 times the diameter of wire, and while keeping it just taut, twist one end of the grip until the wire fractures. Take note of number of twist, condition of fracture and twisted state. When the test is made with a grip distance other than 100 times the wire diameter, the value for 100 diameter grip distance shall be computed in direct proportion to the length.

6.3 Bending Test The test piece shall be bent to 90 deg. in different directions at two places therein, along the arc of 10 mm radius, for examination of the surface condition.

6.4 Coiling Test The test piece shall be coiled around the core of same diameter as the wires more than two times for examination of the surface condition.

Piano Wires*

1. Scope This specification covers standard requirements applicable to piano wires (hereinafter referred to as the "wires").

2. Classification

Wires are classified into the following three varieties:

Class	Notation	Applicable for
Piano wire, Class A	SWPA	Mainly for spring
Piano wire, Class B	SWPB	
Piano wire, Class V	SWPV	Valve spring

3. Manufacturing Method Wires shall be cold drawn from piano wire rods conforming to JIS G 3502-Piano Wire Rods, after subjecting it to the patenting treatment. Cu content in rod material for Class V, however, not to exceed 0.15 per cent.

4. Dimensions and Weight

4.1 The standard dimensions for wires are given in Table 1 with diameter range of 0.08~6.00 mm for Classes A, B and 2.0~5.0 mm for Class V.

Table 1

Unit: mm							
0.08	0.16	0.29	0.50	0.80	1.60	2.90	5.00
0.09	0.18	0.32	0.55	0.90	1.80	3.20	5.50
0.10	0.20	0.35	0.60	1.00	2.00	3.50	6.00
0.12	0.23	0.40	0.65	1.20	2.30	4.00	
0.14	0.26	0.45	0.70	1.40	2.60	4.50	

4.2 Tolerance on diameter and diametral deviation shall be as given in Table 2.

Table 2 Unit: mm

Diameter	Tolerance	Deviation
Not exceeding 0.18	±0.005	—
Above 0.18 to 0.45	±0.010	Not exceeding 0.010
Above 0.45 to 1.80	±0.015	Not exceeding 0.015
Above 1.80 to 3.20	±0.020	Not exceeding 0.020
Above 3.20	±0.030	Not exceeding 0.030

4.3 The standard weight of one coil of wires is as given in Table 3.

Table 3

Diameter mm	Minimum weight of one coil kg
Not exceeding 0.10	0.05
Above 0.10 to 0.20	0.20
Above 0.20 to 0.29	0.30
Above 0.29 to 0.45	0.50
Above 0.45 to 0.70	1.00
Above 0.70 to 1.00	3.00
Above 1.00 to 3.00	5.00
Above 3.00	10.00

Table 4

Diameter	Tensile strength kg/mm ²		
	Class A	Class B	Class V
0.08	295~325	325~355	—
0.09	290~320	320~350	—
0.10	285~315	315~345	—
0.12	280~310	310~340	—
0.14	275~305	305~335	—
0.16	270~300	300~330	—
0.18	265~295	295~325	—
0.20	260~290	290~315	—
0.23	255~285	285~310	—
0.26	250~280	280~305	—

(Cont'd)

Diameter	Tensile strength kg/mm ²		
	Class A	Class B	Class V
0.29	250~275	275~300	—
0.32	245~270	270~295	—
0.35	240~265	265~290	—
0.40	235~260	260~285	—
0.45	230~255	255~280	—
0.50	225~250	250~275	—
0.55	220~245	245~270	—
0.60	215~240	240~265	—
0.65	210~235	235~260	—
0.70	205~230	230~255	—
0.80	200~225	225~250	—
0.90	195~220	220~245	—
1.00	190~215	215~240	—
1.20	185~210	210~235	—
1.40	180~205	205~230	—
1.60	175~200	200~225	—
1.80	170~195	195~220	—
2.00	165~190	190~215	175~190
2.30	160~185	185~210	175~190
2.60	155~180	180~205	170~185
2.90	150~175	175~200	170~185
3.20	145~170	170~195	165~180
3.50	140~165	165~190	160~175
4.00	135~160	160~185	155~170
4.50	130~155	155~180	150~165
5.00	125~150	150~175	—
5.50	120~145	145~170	—
6.00	115~140	140~165	—

Remarks: For wires of intermediate diameter, take the value for nearest larger size.

5.3 Number of twist in twist test, condition of fracture and the manner of twisting shall conform to the requirement specified in Table 5.

Table 5

No. of twist	Classes A and B	Dia. not exceeding 2.6 mm	
		Dia. exceeding 2.6 mm	Not less than 25
Condition of fracture	Fracture should be right angle to the axis of wire, free from cracks and other defects.	Class V	Not less than 25
Manner of twist	Twist should be even throughout entire length without cracks and local twist. There shall be no excess spirality.		

5.4 When wires of over 1 mm diameter is subjected to corrosion test, it shall produce no harmful flaws and cracks etc.

5.5 When wires of Class V is subjected to decarburization test, there shall be no ferrite layer discernible. Further, the region 0.05 mm from the surface shall have the same carbon content as the core.

6. Test

6.1 **Tension Test** The test method shall conform to JIS Z 2241-Method of Tension Test for Metals, and carried out with the jaw distance of the tester at approximately 100 mm for wires of less than 1.00 mm diameter, and approximately 200 mm for wires of over 1.00 mm diameter.

When test piece fractures at the point of the grip, the test shall be considered disqualified and the retest be made on other test piece taken.

6.2 **Twist Test** Grip firmly, both ends of test piece at a grip distance of 100 times the diameter of wire, and while keeping the wire just taut, twist one end of the grip until the wire fractures. Take note of number of twist, condition of fracture and manner of twist. When the test is made with jaw distance other than 100 times the wire diameter, the value for 100 diameter grip distance shall be computed in direct proportion to the length.

6.3 **Corrosion Test** Test piece of suitable length free from residual stress, shall be immersed in boiling aqueous solution of hydrochloric acid, synthesized, conforming to JIS K 1310 (about 30 per cent by volume) and about 70 per cent of water for about five minutes for wires of less than 2.6 mm diameter, and about ten minutes for wires of over 2.6 mm diameter, and examine the condition of surface.

The test is not applicable to wires of less than 1 mm diameter.

6.4 **Decarburization Test** Polish the cross section of test piece and after corroding the surface, inspect by microscope of 100 times magnification, the condition of decarburization.

This test is only applicable to Class V wires.

Reference

The following items do not constitute a part of this specification, but given here only for the purpose of reference.

Coiling Test The wire is coiled not less than 10 times over a mandrill having 3~4 times the diameter of wire in close pitch, and stretched to the permanent length equal to 3~4 times the initial length of the coil, when there shall be found no excessive irregularities in pitch.

Fatigue Test Make the wire into a form of coil spring, and after heating it to the temperature of approximately 350°C and subject it to repeated compression test, when the spring must resist not less than 10⁷ compressions without fracture.

In this test, the mean stress (σ_m) is assumed to be 40 kg/mm², and stress amplitude (σ_a) 25 kg/mm² with Wahl correction coefficient for stress calculation.