

# Standard Pieces for the Spark Test

## Machine Materials and the Spark Test

A spark test provides an easy and quick method to identify the type of steel based on the spark generated from the steel when being pressed onto a grinder. The method of the spark test was standardized by JIS in 1966 and has since been widely used with high reliability. For the quality control of machine parts, choosing the right machine material is of primary importance. To this end, the JIS-defined spark test for steel is the most suitable because it helps identify the type of steel for the onsite management of steel types and enhances knowledge of steel materials. (Standard pieces for the spark test are also available as standard pieces for simplified emission spectrometry.) The fields for spark test application range widely, including material control, machine designing and processing, heat treatment and material tests.

### Standard Pieces for the Spark Test

These sets of standard pieces for the spark test are compliant with the JIS G0566:1980 Method of the spark test for steels. They include Group K, a selection of frequently used JIS steel types for educational applications and general onsite material control, and Groups F, G and H, which are grouped according to their specialized applications. All of them are standardized pieces that have been chemically analyzed with great strictness. With the JIS spark test, you 1) compare the grinder spark from a test piece against those from the standard pieces to find any difference, and 2) by referring to a table of chemical constituents of the standard pieces, 3) identify the steel type and chemical constituents of the test piece in qualitative and quantitative manners. Using the standard pieces not only makes the judgment of test results easier, faster and more accurate, but also makes it more objective by eliminating too much dependence on the subjective viewpoint of the test operator.

### Purposes of the Spark Test

1) Detecting abnormal materials mixed in; 2) Confirming if a decarburized or carburized layer exists; 3) Identifying the elements contained and estimating their amounts; 4) Estimating the type of steel; and 5) Estimating the amount of constituents before precision analysis (which enables 100% inspection). In addition, the spark test is available for judging oxidation resistance at a high temperature, detecting traces of nitriding or quenching, and many other purposes.

### Features of the Spark Test

Compared with precision analysis methods, such as chemical and spectrometric analyses, the spark test only provides a rough estimate for the amount of chemical constituents. However, it has the following advantages: 1) Spark test results are not subject to the shape, roughness and/or heat-treated structure of the test piece; 2) Nondestructive 100% inspection is possible (except for end products); and 3) The spark test requires less installation cost, time and labor. It is recommended to use the spark test for suitable applications where these advantages are exploited effectively.

### Test Conditions

1) Grinder requirements: 36 or 46 in grindstone's grain size, P or Q degree of bond and 20 m/s or more in circumferential speed. 2) The force for pressing the piece onto the grinder should be applied so that the spark lines generated by 0.2% C steel become 500 mm in length. 3) The spark lines should flow horizontally and be observed by looking at them from behind their origin or from their side. 4) The spark test should be conducted in a darkroom, in principle, without receiving direct rays of light. If this is impossible, any assistive device may be used. 5) The spark test should be conducted under the same conditions and using the same apparatuses. 6) For example, the use of the "Standard Spark Test Booth" is recommended to get highly reliable results.

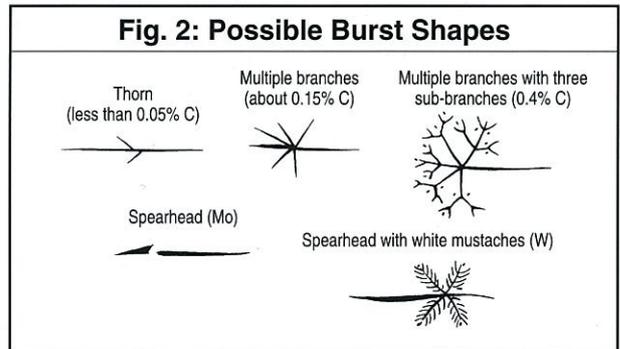
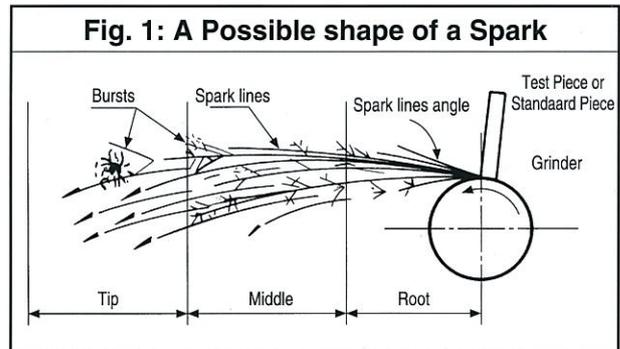
### Judgment of Test Results

Observe the three sections—the root, middle and tip—of a spark as shown in Fig. 1, and identify the type of the tested steel piece based on the results of observation with attention to the following (for details, see the relevant JIS standards). 1) Angle, color, brightness, thickness and length of the spark lines; whether the lines have bursts; and how the lines wind around the grinder stone. 2) Color and shape of the bursts (whether they represent carbon steel or alloy steel); whether the bursts have pollens and what pollens, if any. 3) What responses you feel when the spark is generated.

Fig. 2 shows some possible burst shapes.

### Comparison against a Standard Piece

If it is difficult to determine the type of steel from the results of the aforementioned observation, it would be helpful to compare the spark test result of the tested steel piece against that of a standard piece.



## Standard Spark Test Booth

Under the guidance of the MS Committee (Japan Society for Material Technology Education)



### Specifications of the Equipment

	Type 1 (for educational purposes)
Dimensions	1.2m(W)×0.5m(D)×1.5m(H)
Weight	Approx. 100kg(movable)
Grinder	100V 200V 50Hz 3,000rpm 60Hz 3,600rpm
Grindstone	150mm dia.×16mm JIS R6210 A.36.P.V
Ventilator	100V
Price	¥480,000

### Features of the Equipment

- 1) Ensures an accurate spark test in compliance with JIS G0566.
- 2) Regardless of ambient brightness, the equipment ensures a test conducted in a dark field of view, enabling an accurate observation of the sparks generated.
- 3) The conditions for generating a spark, including a grinder or grindstone (36 or 46 in grain size, P degree of bond and 20 m/s or more in circumferential speed), are standardized.
2. The equipment makes the test free from wind influences, while providing appropriate ventilation to ensure a comfortable testing environment.
3. The equipment allows the operator in a comfortable position to conduct the test, with a field of view that is bright enough to conduct the test. Brightness at a constant intensity ensures less fatigue and higher safety.
4. The equipment eliminates the need for using a darkroom and ensures a safe and accurate spark test. For this reason, it is desirable for educational purposes as well as onsite applications at factories.
5. The equipment remarkably improves the factory environment in terms of fire prevention, disaster prevention and environmental friendliness.

For identifying the features of machine materials

# Standard Piece Sets of JIS Steel Materials

Standard Pieces for the Spark Test

JIS G0566-1980 compliant



Pure iron(0.01 C)

Group K for Educational Applications

SCM415(0.15C, 1Cr, 0.2Mo)

## Standard Piece Sets for the Spark Test

### Group for Educational Applications(15Pieces)

Group K		
Steel Type	JIS Symbol	Chemical Components(%)
Pure iron	SUY	0.02C
Carbon steel for machine structural use	S10C	0.1C
	S20C	0.2C
	S45C	0.45C
	SK105	1.05C
Carbon tool steel	SKS2	1.05C, 0.8Cr, 1W
	SKD11	1.5C, 12Cr, 1Mo, 0.4V
	SKD61	0.37C, 1Si, 5Cr, 1Mo, 1V
	SKH55	0.9C, 6W, 5Mo, 4Cr, 2V, 5Co
High-speed tool steel	SUJ2	1C, 1.5Cr
High-carbon chrome bearing steel	SCM440	0.4C, 1Cr, 0.2Mo
	SCM415	0.15C, 1Cr, 0.2Mo
Alloy steel for machine structural use	SUS420J2	0.35C, 13Cr
	SUS304	0.06C, 19Cr, 10Ni
Spring steel	SUP6	0.6C, 1.7Si, 0.9Mn

### Group for Specialized Applications(15Pieces Each)

Carbon Steel Group F		Tool Steel Group G		Structural and Special Steel Group H	
Pure iron	SUY	Alloy tool steel		Alloy steel for machine structural use	SNC631
Carbon steel for machine structural use	S10C	for cutting tool	SKS2		SNC415
	S15C	for cold mold tool	SKS3		SNCM447
	S20C	for impact-resistant tool	SKS4		SNCM420
	S30C	for cold mold tool	SKS93		SCr440
	S35C		SKD11		SCr420
	S40C	for hot mold tool	SKD4		SCM440
	S45C		SKD61		SCM415
	S50C		SKT4		
	S55C				
	S55C				
Carbon tool steel	SK85	High-speed tool steel		Stainless steel	
	SK105	for cutting general materials	SKH2	Martensitic	SUS410
Carburized	S10C	for cutting difficult-to-cut materials	SKH4		SUS420J2
	SWRCH10R			Ferritic	SUS430
Rimmed steel		for general cutting of tough materials	SKH51	Austenitic	SUS304
Gray iron	FC30	for high-speed cutting of tough materials	SKH55		SUS316
			SKH57	Heat-resisting steel	SUH3
		High-carbon chrome bearing steel	SUJ2	Spring steel	SUP6
		Quenching	SKS3		



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