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JAPANESE INDUSTRIAL STANDARD

**Method of Fatigue Testing
for Spot Welded Joint**

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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Method of Fatigue Testing for Spot Welded Joint

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1. Scope

This Japanese Industrial Standard specifies the methods of the tensile shear fatigue test and the cruciform tension fatigue test for the metal sheets 0.5 mm or over up to and including 6.0 mm in thickness, to be conducted in the atmosphere at room temperature, with the ratio of the minimum load to the maximum load 0.2 or under, by the use of standard fatigue test pieces, hereinafter referred to as the "test pieces", which form single spot welded lap joints.

Remark: The units and numerical values given in { } in this Standard are based on the International System of Units (SI) and are appended for informative reference.

Further, the traditional units and numerical values accompanied by the SI units and converted values in { } shall be replaced by the units and the numerical values given in the Appendix on January 1, 1991.

2. Definitions

For the purposes of this Standard the following definitions apply. The other definitions shall be as specified in 2. of JIS Z 2273.

- (1) tensile shear fatigue test The fatigue test that is carried out by repeatedly applying the tensile load, hereinafter referred to as the "load", to the tensile shear fatigue test piece held by the fatigue testing machine.
- (2) cruciform tension fatigue test The fatigue test that is carried out by repeatedly applying the tensile load to the cruciform tensile fatigue test piece held by the fatigue testing machine.
- (3) repeated load (L) The load varying simply and periodically between the definite maximum and minimum values.
- (4) maximum load (L_{max}) The maximum algebraic value of the repeated load.
- (5) minimum load (L_{min}) The minimum algebraic value of the repeated load.
- (6) load range (ΔL) The algebraic difference between the maximum and the minimum loads of the repeated load.
- (7) load amplitude (L_n) One half of the algebraic difference between the maximum and the minimum loads of the repeated load.
- (8) mean load (L_m) One half of the algebraic sum of the maximum and the minimum loads of the repeated load.
- (9) minimum-maximum load ratio (R) The algebraic ratio of the minimum load to the maximum load.

Applicable Standards and Reference Standards: See page 10.

- (10) L-N curve The curve drawn by plotting the load range as ordinate and the number of load cycles before effecting a rupture (including the number of load cycles where the test is completed without failure) as abscissa. Also called the load range - number of load cycles curve.
- (11) fatigue limit The upper limit value of the load range up to which the test piece can endure an indefinite number of load cycles. However, since the test values obtained in the vicinity of the fatigue limit usually show a dispersion, the fatigue limit shall be obtained statistically.
- (12) fatigue strength The upper limit value of the load range up to which the test pieces can endure the designated number of load cycles.
- (13) weighin capacity The maximum load to be handled by the fatigue testing machine, hereinafter referred to as the "testing machine", under the same condition.
- (14) test plates Metal plates before spot-welded shaped like narrow paper tablets.
- (15) test pieces Spot welded test plates.

3. Types of Test

Types of fatigue test shall be two kinds of the tensile shear fatigue test and the cruciform tensile fatigue test.

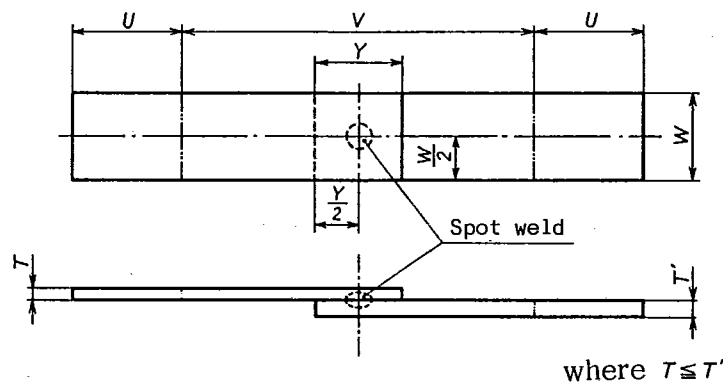
4. Test Plates and Test Pieces

4.1 Shapes and Dimensions

4.1.1 In the Case of Tensile Shear Fatigue Test Width (W), lap allowance (Y) and gripping distance (V) of test plates and test pieces used in the tensile shear fatigue test shall, as a rule, be as shown in Fig. 1. However, in the case of the combination of different plate thicknesses, the above measuring designations shall be on the basis of the shape and dimensions of the plate of the smaller nominal plate thickness (T or T').

The value W shall be within $\pm 2\%$ of values shown in Table. Where test plates and test pieces with shapes and dimensions outside this specification are used, values of their shapes and dimensions shall be stated clearly in accordance with the method described in 8.

Fig. 1. Shapes and Dimensions of Test Plate and Test Piece for Tensile Shear Fatigue Test and Gripping Distance



Unit: mm

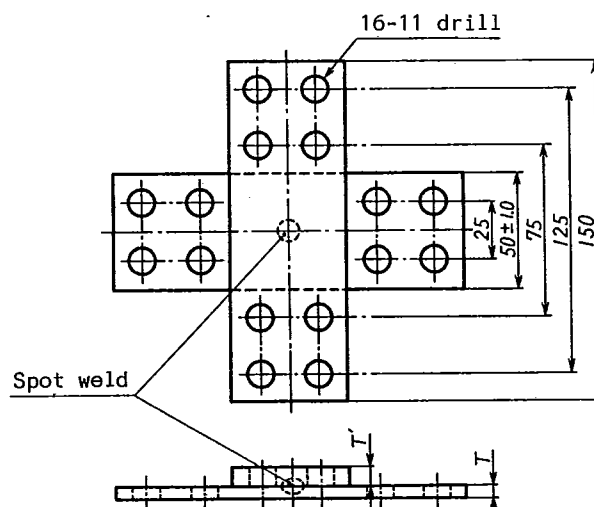
T or T'	W	Y	V
0.5 or over up to and incl. 1.6	40	40	160 min.
over 1.6 up to and incl. 3.2	50	50	200 min.
Over 3.2 up to and incl. 6.0	60	60	240 min.

Remark: It is desirable that gripping allowance(U) exceeds width W .

4.1.2 In the Case of Cruciform Tensile Fatigue Test Shapes and dimensions of the test plate and test piece for the cruciform tensile fatigue test shall be as shown in Fig. 2.

Fig. 2. Shapes and Dimensions of Test Plate and Test Piece for Cruciform Tension Fatigue Test

Unit: mm



4.2 Test Plates The test plates shall be as follows:

- (1) The test plates shall be in the condition as they are cut off with the shearing machine. However, in case of extremely large burrs caused by cutting off, they shall be removed by machining or other methods.
- (2) Care shall be taken not to cause distortion or bending in the test plate.

4.3 Preparation of Test Pieces The test pieces shall be prepared by the following procedures:

- (1) In spot-welding the specimen, use a suitable jig and make the center lines of plate width of the test plates coincide as far as possible in Fig. 1 and make them cross each other at right angles as closely as possible in Fig. 2. In both cases the spot weld shall be positioned as near the center point of the lap area as possible.
- (2) When a test piece for the tensile shear fatigue test is mounted on the testing machine, in order to prevent bending of the test piece, it is desirable to attach suitable appendant plates to the gripping areas of the test piece by means of spot welding and others. In this case the distance between the ends of appendant plates shall be of the value V shown in Table 1.
- (3) The test pieces shall be handled with sufficient care so that they will not be rusted or damaged after preparation.

5. Testing Machine

The testing machine shall be equipped with the following mechanism and performances:

- (1) It shall be capable of applying repeated loads to the portion between grips of the testing machine.
- (2) Grips of the testing machine shall hold the test piece or the jigs securely to prevent slips during testing. Moreover, the discrepancy between the center lines of the grips shall be sufficiently small.
- (3) It shall sufficiently withstand the maximum load used and maintain the accuracy prescribed in (8) for a long period.
- (4) Cracks developed on both surfaces of the test piece or their propagation shall be easily observed by a testing operator or with adequate equipment.
- (5) The testing machine of the constant load type shall be equipped with devices by means of which it is possible to establish and indicate or record either the mean load and the load range or load amplitude, or the maximum load and the minimum load.

It shall also be equipped with a device for indicating the number of load cycles.