

DISCUSSION

A. K. Schmieder¹—This comparison was proposed by H. R. Voorhees and sponsored by the American Society for Testing and Materials. The specimen material was Type 304 stainless steel, billet 6C804-T3, from the ASTM stock called E139, Standard Unmachined Specimens for Calibrating Creep Testing Machines. The furnished blank was quartered by two longitudinal cuts. From each quarter a threaded specimen was machined with a reduced portion 0.253 in. in diameter and 1.25 in. in length.

The same creep machine was used to test all four specimens. The machine ordinarily is used with a power drive on the lower draw bar to level the lever. A switch on the lever actuates the motor whenever the lever leaves the horizontal position. The loading weights at the end of the 16:1 lever move 0.58 in./s when the motor is energized continuously; however, in normal testing, the motor is energized for a period much less than 1 s during each leveling operation. Two specimens were tested with the machine in its ordinary condition. An events recorder was used to mark a record whenever a leveling operation occurred.

For tests on the remaining two specimens the machine was modified in two ways. First, the motor was disconnected and a hand crank substituted. With this hand crank the loading weights were moved to the upper limit of their travel whenever the lower limit was approached owing to extension of the specimen. During manual leveling the crank was turned at approximately 1 rps, resulting in a velocity of the loading weights of 0.02 in./s.

Before the tests the machine was calibrated with a proving ring at the force used for these tests in order to establish the permissible range of motion of the loading weights. It was found that for a 4-in. range of downward motion of the weights the force varied smoothly from 100.8 to 99.3 percent of the nominal force (loading weight times 16). The second machine modification was made to reduce this variation. A weight of 4 lb was attached to the lever so that its center of gravity was 7.6 in. directly above the support fulcum with the loading weights at midrange. After this modification the variation in force during 4 in. of motion of the loading weights was less than 0.1 percent from the nominal value.

To measure the shock loading due to automatic leveling a wire resistance strain gage was attached to a specimen similar to those rupture tested.

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The gaged specimen was loaded at room temperature to the same stress as the rupture specimens. After loading, strain was recorded on an instrument with a linear response to 40 cps. Whether or not the leveling motor was operating, a vibratory strain was recorded whenever the specimen was loaded. The rough sawtooth record showed about 3 peaks per second when the motor was not running and about 1.5 peaks per second when the weights were being raised. The corresponding stress amplitudes were 1 and 1.5 percent of the applied stress. The first peak after the motor was started was of about the same height as later peaks, indicating that no measurable shock loading occurred owing to starting of the leveling motor.

The heating and loading procedure for the four rupture specimens was the same as that recommended when using specimens from the same source for machine calibrations, that is,

1. Hold overnight at 1325 F.
2. Raise to 1350 F and hold 1 h before loading.
3. Load to 13,500 psi.

The test results are

Specimen Number	Rupture Time, h	Elongation, ^a %	Reduction in Area, %	Number of Times Level Relevelled
1.....	107.9	44.0	46.0	2 (manual)
2.....	116.0	44.3	45.0	2 (manual)
3.....	109.0	47.6	42.0	143 (automatic)
4.....	113.7	43.0	45.0	127 (automatic)

^a Change in overall length divided by length of reduced portion between fillet tangent points.

These values show no significant difference in the results due to type of lever leveling.

H. R. Voorhees (author's closure)—Mr. Schmieder's tests provide a valuable addition to this study, particularly so because the steel tested and the procedures followed were intended to be identical. His results, like ours, show the effect of variation in type of beam leveling to be smaller than the scatter between some pairs of tests with the same beam leveling practice.

Perhaps of more interest is the fact that all of Mr. Schmieder's rupture times exceeded the longest time obtained in our four tests; his rupture times averaged to a value roughly 1.2 times as great as our average. This finding clearly reinforces the conclusion that other factors are more critical to test results than the type of beam leveling applied.