Bulletin
122-A

Tinius Olsen

MODUL - r

Drawability Testing System

The Modul-r is the most efficient and economical 'Go/No-Go' testing method available for determining if given batch of sheet steel is suitable for a deep-drawing application

If you can't assess the drawability of your sheet steel, you can't be certain that your steel will perform properly when deep-drawn in a particular application. Without the proper drawability characteristics, it could fracture in the die or create excessive "ears" that could ruin an entire production run. At the same time, you can't afford to hold up production while obtaining that quality control assurance…..conventional testing takes time.

The Modul-r testing system helps cut potential material and production losses because you can accurately assess the drawability and earing characteristics of any carbon or other magnetic sheet steel in 5 minutes or less….compared to the three, plus, hours conventional testing methods can take. Additionally, the Modul-r can be used by personnel with little or no technical background.

The Modul-r is compact and light enough to make it truly transportable anywhere in the plant and only requires a tabletop as a test surface. The unit isn't susceptible to the normal floor vibrations of stamping or steel-producing environments so can be kept close to the pressing operations, eliminating the downtime normally associated with coordinating testing operations between plant locations. Any production variable changes can be handled with a minimum of downtime and material loss.

Operation is extremely simple. First, the operator prepares three test strips from a sample sheet about150 mm square; after marking the rolling direction of the sheet, three narrow test strips are blanked, or sheared, at 0°, 45° and 90° to this direction. For optimum ease, all three test strips can be produced simultaneously with the punch press described later.

Testing involves simply inserting a steel strip into the test slot and depressing the 'TEST' button for a few seconds while the resonant frequency appears on the display. The operator records the reading on a worksheet and repeats the test for the remaining two strips.

The relationship between r and Young's modulus allows us to readily determine the drawing and earing tendencies of the sample. Taking the resonant frequency and using the data handbook and worksheet format we provide, the operator performs a short series of indicated calculations to generate the necessary information.

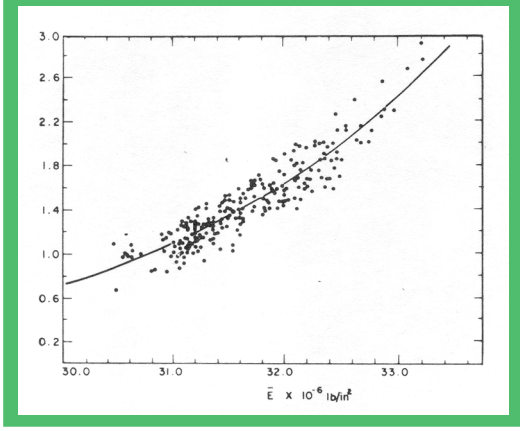
The Modul-r system punch press is recommended for punching out samples in the required configuration. This easy to use unit will simultaneously punch out all three required samples in one smooth stroke and consists of an electric pump, piston and cylinder, and all necessary dies.

Preparing samples is easy too. Mark the rolling direction along the center line of a 6 x 6in square sample from the sheet and insert the sample in the press. The piston lowers and punches out three clean test strips from the sample: one parallel to the rolling direction (0°), one 45° to the rolling direction, and one at 90° to the rolling direction.

Two sizes of punch press are available, as are two models of Modul r – see attached chart for sample thickness limitations for each system.

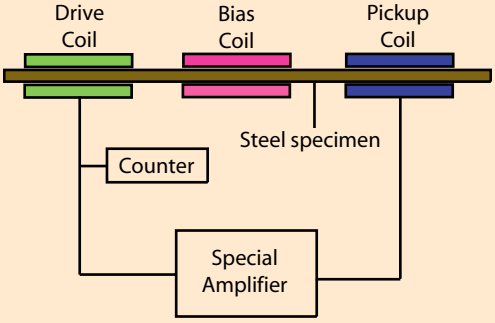
Many years ago, engineers at US Steel's Monroeville Research Center studied the correlation between the average plastic strain ratio, and the average Young's Modulus of a sample of steel. They observed that the higher the plastic strain ratio (r or r_m) of a steel, the higher the drawability. They also discovered that Young's moduli could easily be determined by using a resonant frequency technique, which led to their development of the Modul-r now produced by Tinius Olsen.

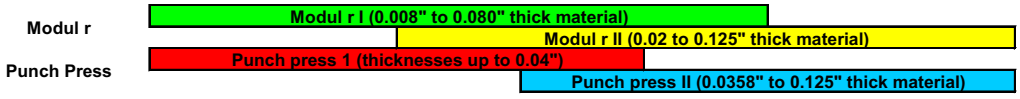
For most commercially produced low carbon steel sheets, the plastic strain ratio ® varies with the test direction relative to the rolling direction. This variation is called the planar anisotropy, which correlates with the tendency of the sheet to form "ears" upon drawing.



The Modul-r employs a simple feedback system (called a magnetostrictive oscillator) consisting of a measuring head, an amplifier and an electronic counter. The measuring head consists of three coils that form the sample chamber. When the sample is inserted and the TEST button depressed, an alternating field is created by the current passing through the coil network, producing cyclical longitudinal expansion and contraction in the sample through a process called magnetostriction.

These vibrations match the characteristic velocity of sound for that particular sample, or resonant frequency. This frequency Is displayed within seconds and is also used to control the oscillator circuit, stabilizing the output to a high degree of accuracy.





Specifications subject to change without notice

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