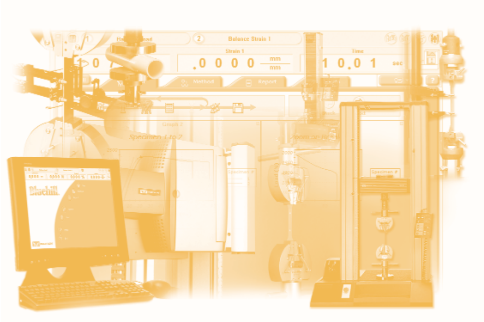

R&N Testing Using a Video Extensometer - Steel Specimens

Application Report

Introduction

Sheet metal testing applications require calculations such as yield strength, yield point elongation, ultimate tensile strength, plastic strain ratio ('r' value) and the strain hardening exponent ('n' value). These calculations place a high physical demand on traditional contacting extensometers for measuring axial and transverse strain to allow for enough travel to test the specimens through break but small enough gage lengths to ensure high accuracy in measurements. Further, relevant ASTM and ISO testing standards have accuracy requirements that must be achieved.

Video extensometry is not frequently used in these applications, as most in the metals industry have used traditional contacting extensometers and trust the reliability of the results. Developments in the technology of extensometry offer metals testing customers other options, such as the Instron Advanced Video Extensometer (AVE). Not only would this solution allow for simultaneous collection of axial and transverse strain data and reduce the maintenance required for wear and tear on knife-edges, it may also increase productivity and simplify testing. The purpose of this testing was to demonstrate the accuracy and reliability of the Instron AVE for testing steel specimens.

Test Configuration

Frame: 5582
Load cell: 10 kN
Grips: 50 kN wedge grips with serrated faces
Software: Bluehill®
Extensometer: AVE with 200 mm Field of View (FOV) lens
Test speed: 0.125 in/min until 0.05 of an inch was reached and then the speed changed to 1.00 in/min

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Figure 1:
Test configuration for steel specimens tested with the AVE. Specimen is marked with four white dots to measure axial and transverse strain simultaneously.

Results

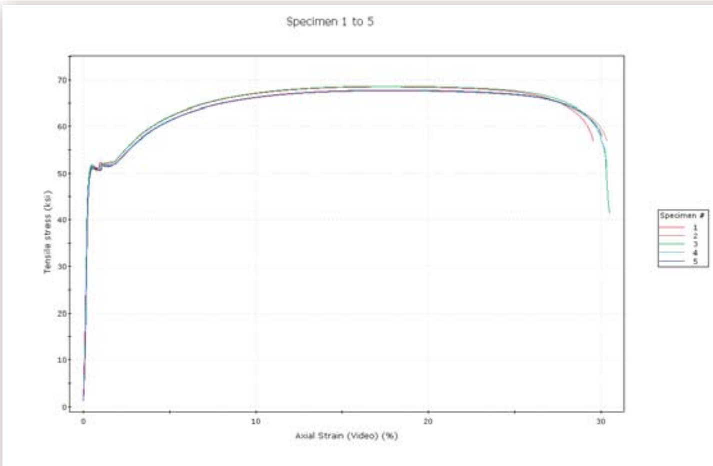

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Figure 2:
Axial strain (%) vs. tensile stress (ksi) for five steel specimens tested to failure.

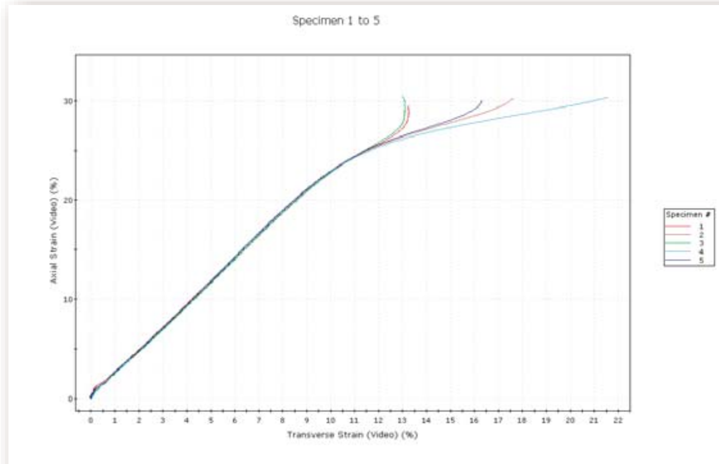

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Figure 3:
Transverse strain (%) vs. axial strain (%) for five steel specimens tested to failure.

Specimen #	Yield Stress at 0.2% Offset (ksi)	Max Tensile Stress (ksi)	Axial Strain at Break (%)	R-Value (at 17% Strain)	N-Value (at 10% to 20% Strain)	Load at 0.2% Offset Yield (lbf)	Max Load (lbf)	Width (in)
1	51.31	68.54	29.52	0.895	0.166	995.70	1329.94	0.504
2	51.00	67.63	30.30	0.917	0.167	1004.48	1331.88	0.505
3	51.62	68.65	30.43	0.920	0.166	1005.64	1337.36	0.506
4	51.26	67.73	30.32	0.889	0.167	1005.59	1328.66	0.503
5	51.12	67.80	30.02	0.903	0.169	996.80	1322.11	0.500
Max	51.62	68.65	30.43	0.920	0.169	1005.64	1337.36	0.506
Mean	51.26	68.07	30.12	0.905	0.167	1001.64	1329.99	0.504
Min	51.00	67.63	29.52	0.889	0.166	995.70	1322.11	0.500

▲
Table 1:
Results for five steel specimens tested to failure.

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