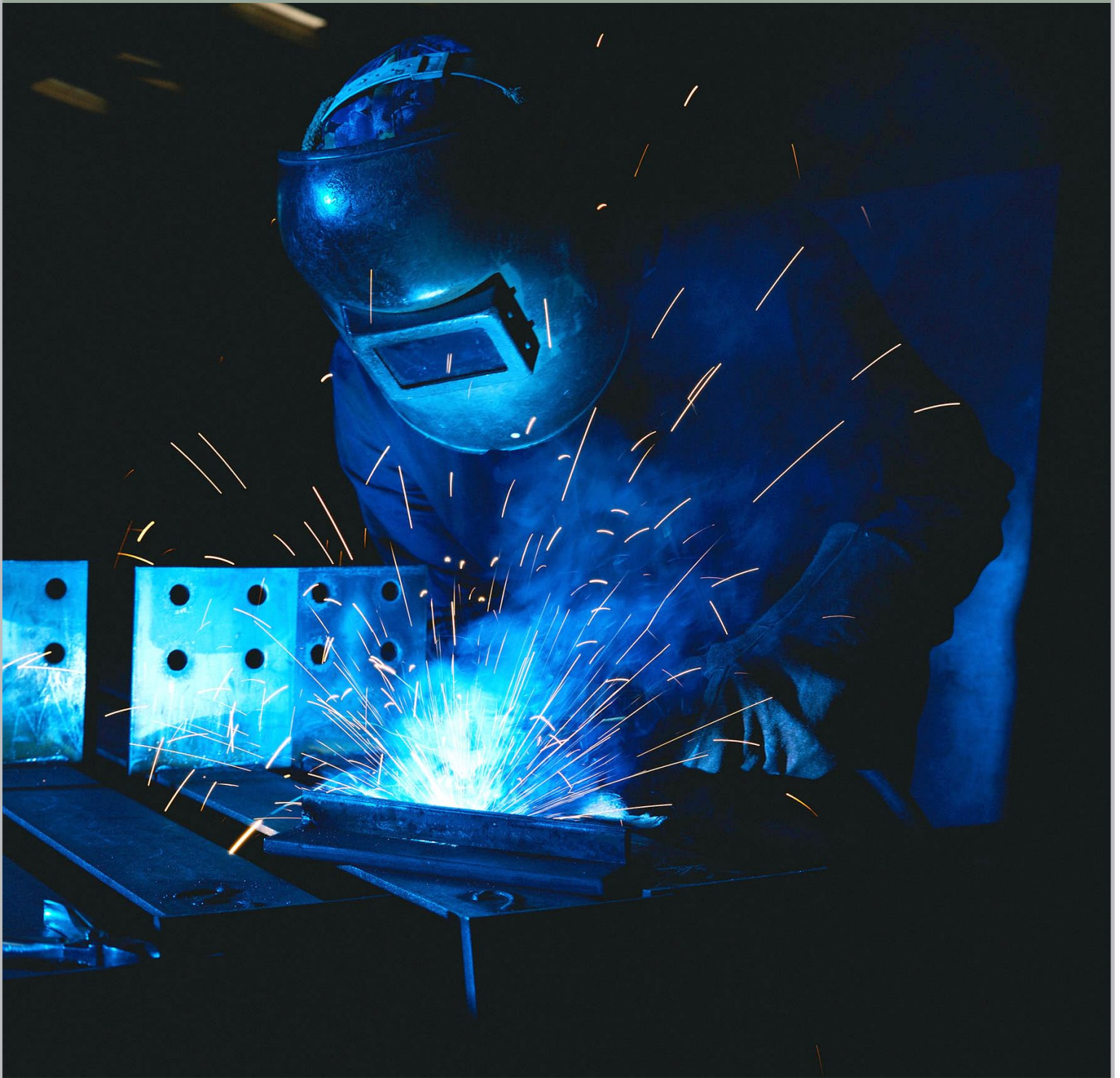


**CLEMEX** intelligent microscopy



## *Welding Analysis*

*Image Analysis Report #692*





## **Welding Analysis**

Joining metals together by welding goes back several millennia to the Bronze Age in Europe. Of course the means and the techniques have improved greatly over time especially during the 20th century starting with the appearance of stud welding in the 30s to electrogas welding and laser beam welding in the 60s. Welding is used in more and more industries, from the tallest skyscraper to the automotive industry, and in all cases the quality of the weld is paramount.

Typically, welding involves human judgment, more so than in any other machine operation. Consequently, quality control is of primary importance.

The major measure used for judging the quality of a weld is its strength and the strength of the material around it. The most common weld defects include: lack of fusion, lack or excess of penetration, porosity, inclusions, and cracking. Any of these defects are potentially disastrous, and quality control serves to identify the defect, find the cause, and remedy the situation quickly and efficiently.

There are several procedures for rating weld specimens, image analysis being one of them. Metallographic weld evaluation can help determine porosity or lack of fusion. On a micro scale, the examination of weld growth patterns, phase balance assessments or checking for non-metallic precipitates are used to determine the cause of a weakness.

The following report concerns the analysis of a fillet weld, a weld of approximately triangular cross section joining two surfaces at approximately right angles to each other. Important measurements made were the distance from the root of the fillet to the center of its face (or throat), the distance from the root of the joint to the junction between the exposed surface of the weld and the base metal (or leg), the angles and the root penetration. Measurements that could have been done with the same ease on similar samples are, among others: depth of HAZ (heat affected zone), area of HAZ, joint penetration, phase counting, etc.



## Sample Description

One image showing a fillet welding was submitted for analysis.

## Purpose of Analysis

To demonstrate that the Clemex Vision image analysis system can measure a sequence of specific characteristics on welded parts.

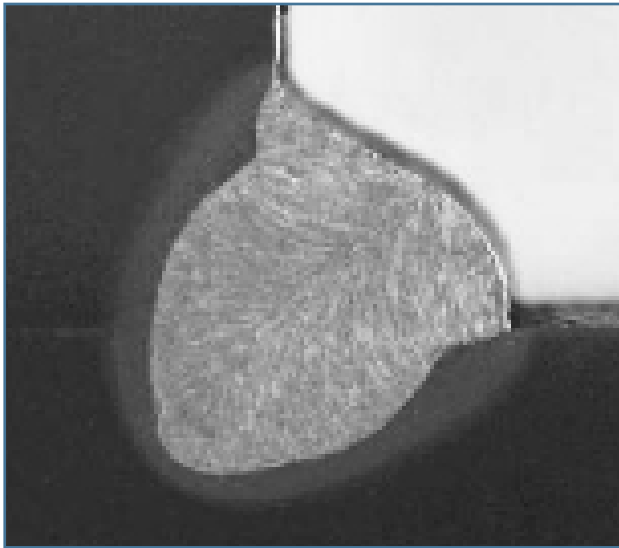


Figure 1: Part of the original image at 10x (6.43 microns/pixel).

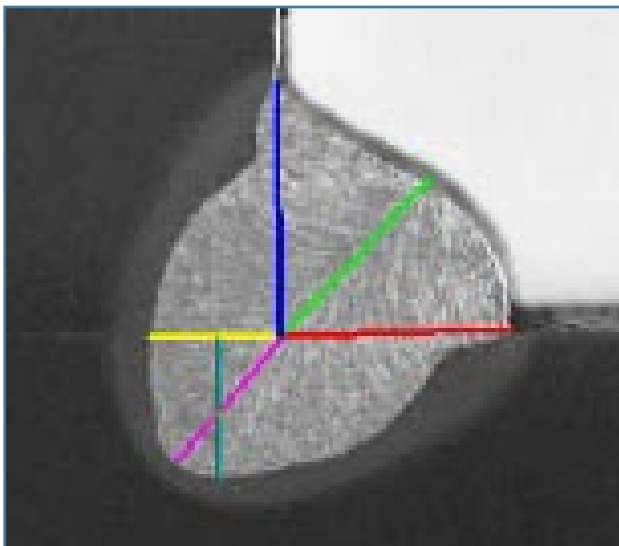


Figure 2: Six typically measured characteristics on welded parts.

## Procedure<sup>1</sup>

The system loads an image showing each characteristic that have to be measured with a short explanation for each of them into a viewer.

<sup>1</sup> Images taken during the procedure are available in appendix A

The viewer remaining available for consultation during the run, the system brings the good tool with the good color when it's the time for the operator to use it.

The magnifier tool was switched to on at 4x zoom. This tool zooms only the region surrounding the cursor allowing to increase the drawing precision while still seeing the whole sample. This is often more convenient than using the regular zoom which is applied on the whole image.

When all characteristics have been addressed, the system measures them

## Results<sup>2</sup>

The Length measurement was performed on each drawn feature while the angle is automatically added to the image at drawing time if desired. Automated statistics and graph were generated and would be cumulated if analyzing several images inside the same run. Final results could be printed directly from Clemex Vision and saved for further use. A customized report was built using the Report Generator module, to conform to industrial standards. Raw data is linked to their respective objects for validation purposes. Raw data could also be exported in Excel format.

## Equipment

Image Analysis System:	Clemex Vision PE or Vision Lite
Magnification:	10x
Illumination:	Reflected Light
Calibration:	6.42775510 microns/pixel

## Conclusion

Clemex Vision PE and Vision Lite can be used to produce a sequence of specific characteristic measurements. In the present case, it corresponds to standard welding measurements performed on a fillet weld but the same reasoning could be applied to other types of welding or to any type of parts requiring similar types of direct measurements, including angles, circle or arc radius, area and others.

The results can be expressed based on a specific standard using the Report Generator module. This also allows to obtain a passed/failed automatic decision based on predefined acceptance criterion. The final report being automatically saved (and or printed) the company keeps a record of what and how characteristics were measured with the corresponding results. Other important informations as the operator, the magnification, the calibration factor, the sample ID etc are recorded as well. The final report can be locked from writing if desired to prevent any possible subsequent modification.

<sup>2</sup> Complete results are available in appendix B.

## Image Analysis Step

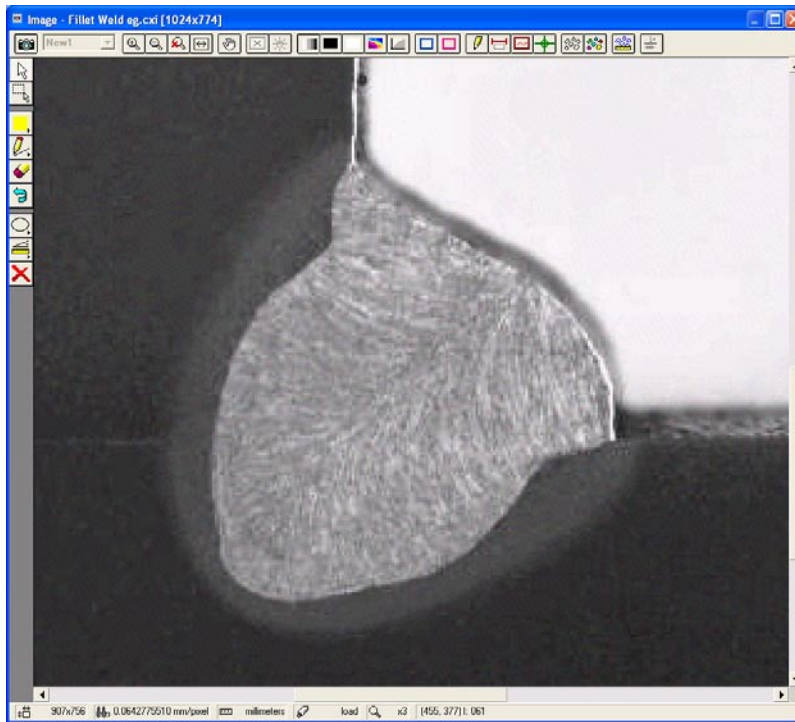


Image 1: Part of the original image as captured by the operator.

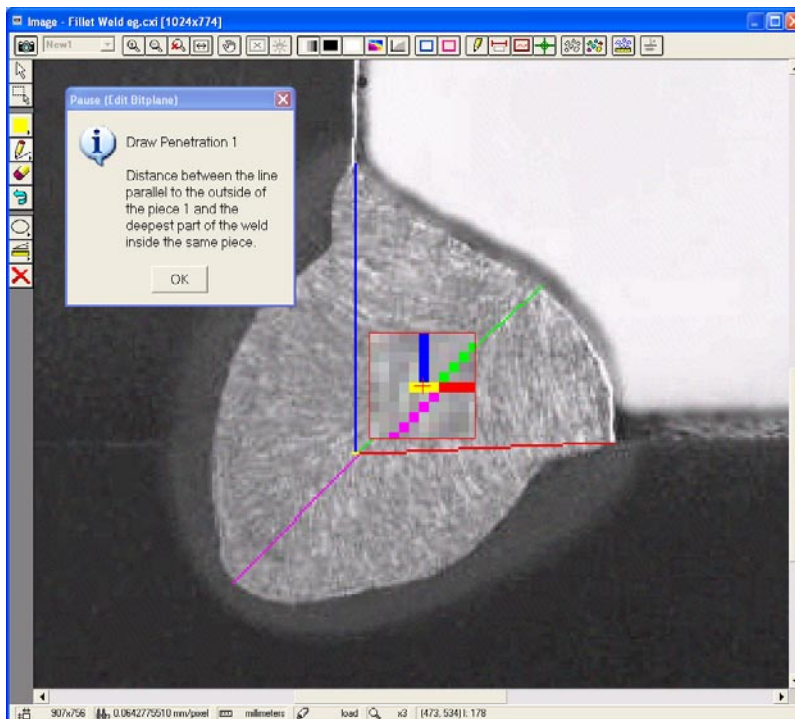


Image 2: In the run, the system temporarily makes a pause proposing a specific tool of a specific color to the user. An explanation of what to do appears in the Pause window even if a detailed example is available in a viewer. Here, the magnifier tool is used so the pointer surrounding is zoomed.

### Image Analysis Step

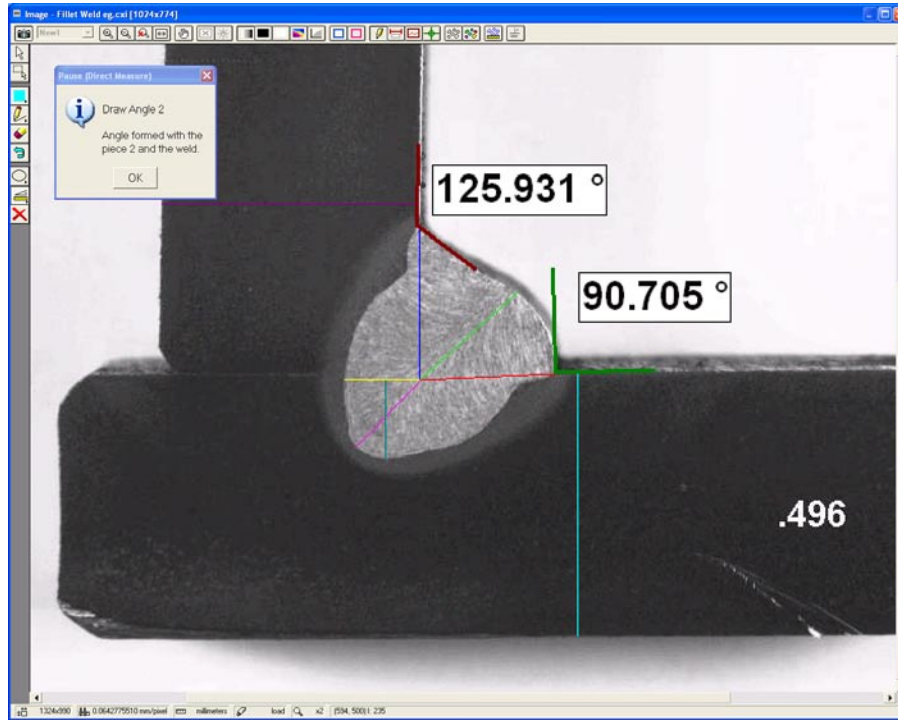


Image 3: The user is also prompted to draw the angles formed between the beams and the welding.

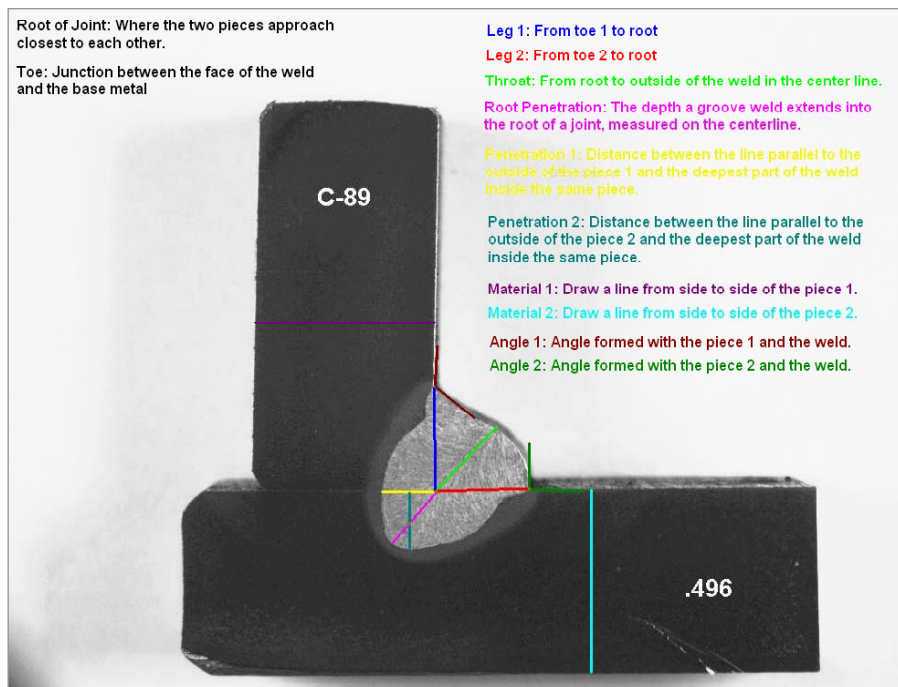
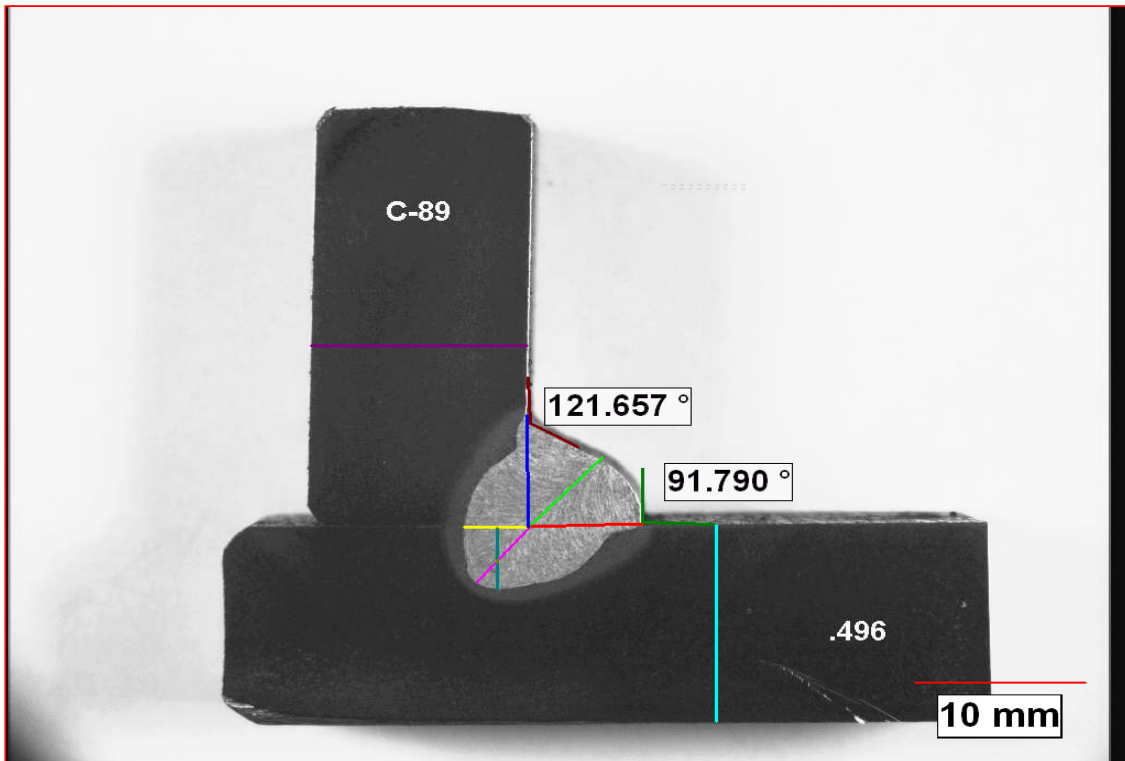












Image 4: Example of what to do as available in the viewer window during the run.

## Soldering Analysis Results

<b>Date:</b>	2006 11 06	<b>Magnification:</b>	10x
<b>Company:</b>	Clemex	<b>Calibration:</b>	64.2776 $\mu\text{m}/\text{pixel}$
<b>Department:</b>	Laboratory	<b>Units:</b>	millimeters
<b>User Name:</b>	Myriam Savard (sign...)	<b># Fields:</b>	1
<b>Sample ID:</b>	S 04		

Figure 1: Typical field of view.



	Measured	Specification	Passed or Failed
 Leg 1:	7.39	8.00	Pass
 Leg 2:	6.68	8.00	Pass
 Throat:	6.24	6.00	Failed
 Root Penetration:	4.71	5.00	Pass
 Penetration 1:	3.86	4.00	Pass
 Penetration 2:	4.05	13.00	Pass
 Material 1:	12.66	14.00	Pass
 Material 2:	12.92	15.00	Pass
 Angle 1:	121.66	115.00	Pass
 Angle 2:	91.79	115.00	Failed



# CLEMEX

[www.clemex.com](http://www.clemex.com)

Printed in Canada

11-06

Some images may not be representative of the exact product.  
Clemex Vision, Clemex Vision Lite, Clemex Captiva, Clemex R'Kive Explorer,  
Clemex CMT and Clemex CIR are trademarks of Clemex Technologies Inc.  
All other products mentioned are trademarks of their respective companies  
© 1990-2006 Clemex Technologies Inc. All rights reserved. Rev.11/06