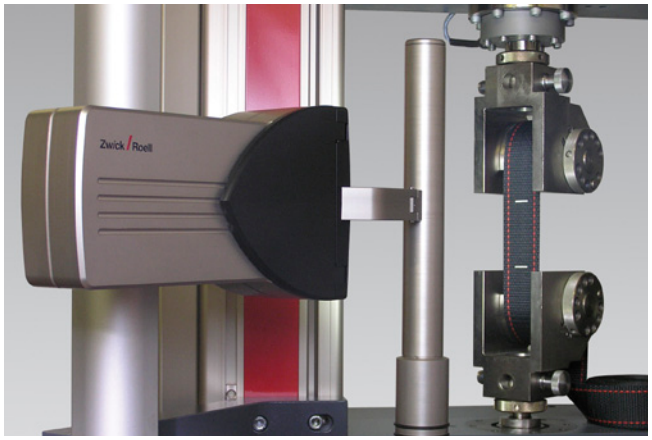
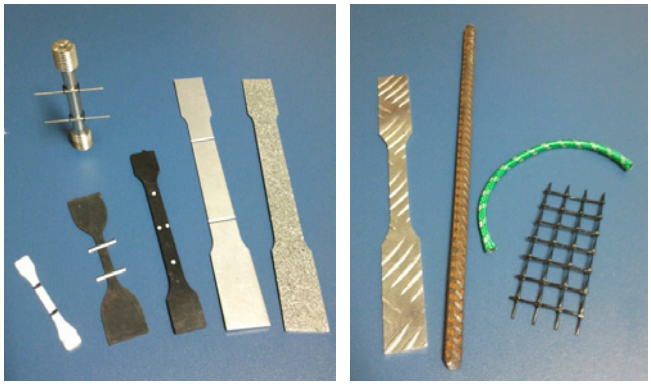
Zwick / Roell

Zwick
Materials Testing

Product Information
Marking methods for videoXtens





Marked specimens (on the left side) and specimens with patterns by surface texture (on the right side)

Application range
The videoXtens measures contactless and with high-resolution tensile, pressure and bending deformations on almost any type of material. Measurement of elongation is achieved by continuous determination of the distance between two or more markers.

These markers can either be manually or automatically applied lines, dots or patterns or with specimens with textured surfaces the texture itself. To measure reduction in width the contours of the sample can be also used in conjunction with back-light illumination.

The goal is to apply markers with the highest black / white contrast possible in order to achieve maximum accuracy and noise-free signals.

For this we have different marking methods and recommendations described in the following:
- Marking methods for ambient temperature
- Marking methods for applications in temperature chambers
- Marking methods for high temperature

Accessories for specimen marking	Item number
Marking templates for plastics specimens	**010406**
Marking templates for metal specimens	**010407**
Measurement marks to videoXtens	**353379**
Specimen marking spray to apply a pattern on the specimen	**057317**
Measurement marks for temperature range -40 °C...+250 °C	**077061**
Marking pen for temperature range -40 °C...+250 °C	**077062**

PI 888 2. 1214

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Marking methods for videoXtens

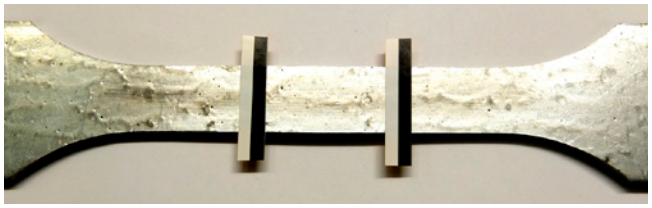
1 Marking methods for ambient temperature

1.1 Lines
Line markers deliver very good results especially for flat specimens. With these markers the number of measuring lines can easily be adjusted to fit to specimen width in order to achieve optimum resolution and accuracy.

Self adhesive lines
These self adhesive printed plastic strips are the most universal marking technique due to their defined black/white contrast and very good adhesion to most surfaces.

The strips can be easily detached from their carrier foil and attached in the required gauge length in a slight angle of 2-5°. This angle is required to improve accuracy. Marking templates are available to facilitate correct gauge lengths and angles.

With these markings the specimen has to be illuminated from the front (incident light).



Remarks:
- With highly polished/reflective surfaces like round stainless steel specimens, we recommend an optical filter on the lens in combination with the equivalent light. This eliminates or drastically reduces undesirable reflections from the specimen's surface.
- If this marking technique is used in conjunction with backlight illumination (e.g. for simultaneous measurement of axial strain and transverse strain), an optical filter on the lens in combination with the equivalent light are required.

Advantages of Zwick Roell self-adhesive dot markings: the adhesive dot markings we supply have been subjected to a large number of tests and as such have some important properties for testing use.

- They have low natural elasticity.
- They produce a defined black-white transition regardless of the color of the specimen.
- The adhesive sticks uniformly and very successfully to most materials.
- The adhesive has no demonstrable effect on the material.
- The dot markings are temperature and moisture-independent (-40°C to +250 °C).

Permanent/paint marker lines
Materials with smooth, monochrome surfaces can be also marked with permanent or paint markers.

Therefore dark surfaces require white markings, bright surfaces black markers.

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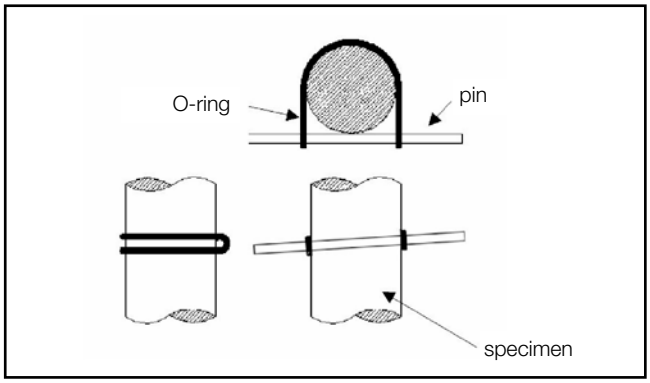
Remarks:
- Care has to be taken to draw the lines as straight as possible and bleeding to be avoided.
- Due to the solvent content of the ink/paint this technique might not be suitable for some materials (e.g. plastics) and has to be tested from case to case.
- With highly polished/reflective surfaces like round stainless steel specimens, we recommend an optical filter on the lens in combination with the equivalent light. This eliminates or drastically reduces undesirable reflections from the specimen's surface.
- If this marking technique is used in conjunction with backlight illumination (e.g. for simultaneous measurement of axial strain and transverse strain), an optical filter on the lens in combination with the equivalent light are required.

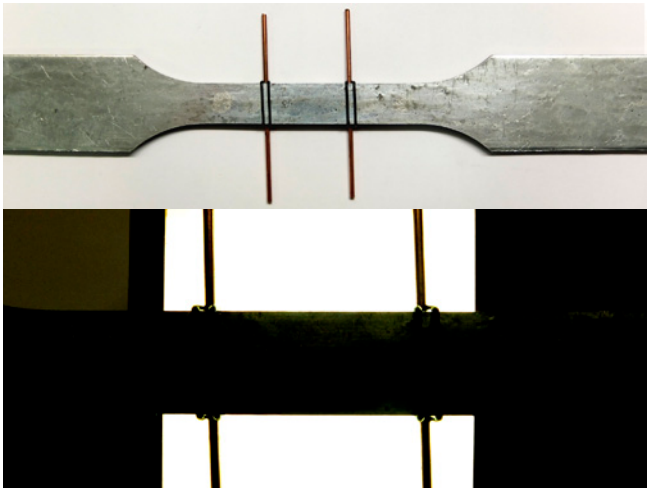
Pins with O-rings and backlight (diametrical measurement)

With this method metal pins are attached to the specimen by means of rubber „O-rings". The pins provide overhanging projections which can be selected as axial strain targets when using backlighting. This is done on the left- as well to the right-hand side of the specimen (diametrical measurement) which improves signal quality. A slight angle of the pins additionally enhances accuracy.

The pins and rubber rings are fitted as below



This technique is especially suitable for simultaneous measurement of axial strain and reduction in width/diameter of backlit flat and round specimens.



Remarks:
- If this marking technique is used in conjunction with incident light (e.g. for simultaneous measurement of axial strain) an optical filter on the lens in combination with the equivalent light are required.

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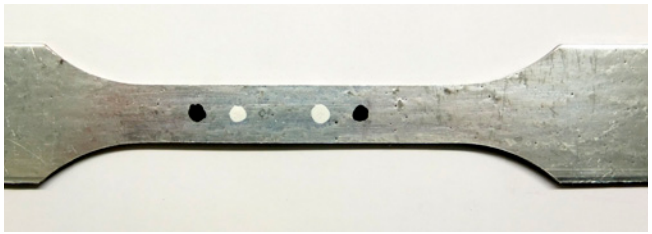
Marking methods for videoXtens

1.2 Dots
As an alternative to lines specimens can also be marked with dots. Dots are advantageous with high to very high strains due to the way their positions are calculated. For 2D dot matrix measurements this method is mandatory.

Permanent/paint marker dots
Materials with smooth, monochrome surfaces can be marked with permanent or paint markers.

Therefore dark surfaces require white markings, bright surfaces black markers.

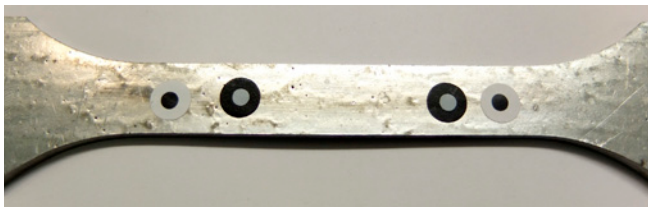
Since manually drawn dots are not always round and their contours can be quite ragged, this method is not recommended for high resolution measurements (e.g. determination of tensile modulus according to ISO 527).



Remarks:
- Care has to be taken to avoid bleeding of the ink/ paint.
- Due to the solvent content of the paint this technique might not be suitable for some materials (e.g. plastics) and has to be tested from case to case.
- With highly polished/reflective surfaces like round stainless steel specimens, we recommend an optical filter on the lens in combination with the equivalent light. This eliminates or drastically reduces undesirable reflections from the specimen's surface.
- If this marking technique is used in conjunction with backlight illumination (e.g. for simultaneous measurement of axial strain and transverse strain) an optical filter on the lens in combination with the equivalent light are required.

Self adhesive dots
Due to their defined black/white transition these black dots on white adhesive plastic foil or white dots on black foil can used on surfaces regardless of their colour.

Even with high elongations these dots will not change shape and will therefore provide highly accurate breaking strain results.



Remarks:
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- If this marking technique is used in conjunction with backlight illumination (e.g. for simultaneous measurement of axial strain and transverse strain), an optical filter on the lens in combination with the equivalent light are required.

Advantages of Zwick Roell self-adhesive dot markings: the adhesive dot markings we supply have been subjected to a large number of tests and as such have some important properties for testing use.

- They have low natural elasticity.
- They produce a defined black-white transition regardless of the color of the specimen.
- The adhesive sticks uniformly and very successfully to most materials.
- The adhesive has no demonstrable effect on the material.
- The dot markings are temperature and moisture-independent (-40°C to +250 °C).

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1.3 Patterns
By means of complex image processing algorithms it is possible to use surface patterns rich in contrast as markings.

These patterns can either be sprayed-on or the texture of the surface itself, if present and contrast-rich. One example is deformed reinforcement steel.

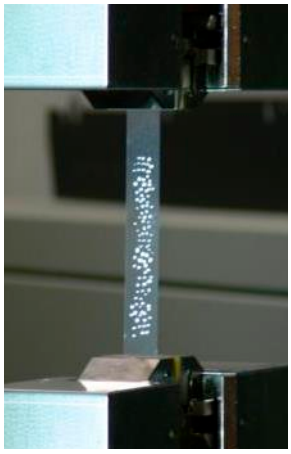
One of the advantages of this method is that initial gauge lengths can be set arbitrarily and together with the Test Re-Run-Option they can be positioned to different locations during post-processing.

Remarks:
- This method can't be used with simultaneous incident light (for axial strain) and backlight (for transverse strain measurements by means oft he specimen's contours)

Spray-on patterns
If the specimen's surface does not show a contrast-rich texture, a patterns can be sprayed on e.g. by means of glitterspray.

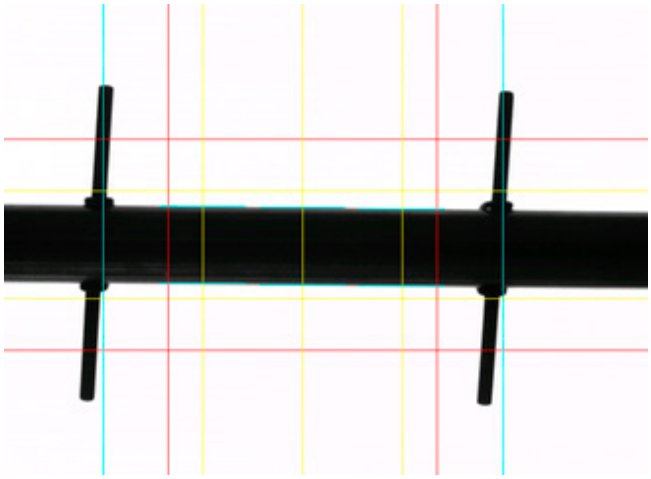
Surface texture
If a specimen provides a contrast-rich surface texture, e.g. deformed rebars, textiles etc, strain can be measured directly without additional markings.

Manually applied pattern / stippled pattern
For high-extension materials in particular, the manual application of a stippled pattern applied with a paint-stick or marker-pen has proved effective. Even if the pattern changes during the test, the self-learning software algorithm can track the positions of the pattern up to specimen break.



1.4 Contours in backlight
The backlit contours of a specimen are especially suitable for transverse strain measurements. This is very important for results measurements that require measurements of reduction in width across the entire width of the specimen (e.g. r-values)

To achieve this a light-panel is mounted behind the specimen, whose contours will then appear as white/black and black/white transitions in the camera image. The videoXtens uses these transitions as markers to measure the width of the specimen.



Remark:
- If this marking technique is used in conjunction with incident light (e.g. for simultaneous measurement of axial strain) an optical filter on the lens in combination with the equivalent light are required.

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Matrix test results / marking methods in ambient temperature

		Self adhesive lines	Permanent / paint-marker lines	Pins with O-rings and backlight	Permanent / paint-marker dots	Self adhesive dots	Spray-on patterns	Surface texture	Backlit contours
Flat specimens									
Tensile module		++		+		•	•	+	
Compression module		++		+		•	•	+	
Bending module		++				•	•	+	++
Yield strains		++	•	+	•	•	•	+	
Stress at x% strain		++	•	+	•	•	•	+	
Strain at tensile strength		++	•	+	•	•	•	+	
Breaking strain		++	•	+	•	•	•	+	
Transverse strain (incl. r-value)	axial	++	•	+	•	•	•	+	
Transverse strain (incl. r-value)	transverse	+	•		•	•	•	•	++
n-value		++	•	+	•	•			
Round specimens									
Tensile module		+		++		•	•	+	
Compression module		+		++		•	•	+	
Bending module									++
Yield strains		+	•	++	•	•	•	+	
Stress at x% strain		+	•	++	•	•	•	+	
Strain at tensile strength		+	•	++	•	•	•	+	
Breaking strain		+	•	++	•	•	•	+	
Transverse strain (incl. r-value)	axial	+	•	++	•	•	•	+	
Transverse strain (incl. r-value)	transverse								++
n-value		+	•	++	•	•			

++ very suitable / recommended
+ well-suited
• suitable

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Marking methods for videoXtens

2 Marking methods for temperature chamber applications

The same fields of application and remarks hold true for temperature chamber applications as well. However only the following methods have been approved and if a method suitable for ambient temperature is not listed below, it should not be applied in temperature chambers.

2.1 Lines

Self adhesive lines
The self adhesive lines mentioned before are also available in a version to be used in a temperature range between -70°C and + 250°C.

The strips can be easily detached from their carrier foil and attached in the required gauge length in a slight angle of 2-5°. This angle is required to improve accuracy. Marking templates are available to facilitate correct gauge lengths and angles.

With these markings the specimen hast o be illuminated from the front (incident light).

Permanent/Paint marker lines
Materials with smooth, monochrome surfac-es can be also marked with permanent or paint markers.

Therefore dark surfaces require white markings, bright surfaces black markers.

Following two paint markers have been tested and approved for use in temperature chambers:

Temperature range:
Edding 780 white: -40°C to max. 800°C
Edding 780 black: -40°C to max. 400°C

Pins with O-rings and backlight
With this method metal pins are attached to the specimen by means of rubber „O-rings“. The pins provide overhanging projections which can be selected as axial strain targets when using backlighting. This is done on the left- as well to the right-hand side of the specimen (diametrical measurement) which improves signal quality. A slight angle additionally enhances accuracy.

The supplied O-rings can be used in temper-atures ranging from -40°C and +250°C.

2.2 Dots
As an alternative to lines gauge lengths can also be marked with dots. For 2D dotmatrix measurements this method is mandatory.

Permanent/paint marker dots
Materials with smooth, monochrome surfaces can be marked with permanent or paint markers.

Therefore dark surfaces require white markings, bright surfaces black markers

The same temperature range as for permanent / paint marker lines.

2.3 Patterns
By means of complex image processing algorithms it is possible to use surface patterns rich in contrast as markings.

These patterns can either be sprayed-on or the texture of the surface itself, if present and contrast-rich. One example is deformed reinforcement steel.

Surface texture
If a specimen provides a contrast-rich surface texture, e.g. deformed rebars, textiles etc, strain can be measured directly without additional markings.

This method has no limits for tests under temperature, only the behaviour of the specimen itself can be a limit.

Manually applied pattern / stippled pattern
For high-extension materials in particular, the manual application of a stippled pattern applied with a paint-stick or marker-pen has proved effective. Even if the pattern changes during the test, the self-learning software algorithm can track the positions of the pattern up to specimen break.

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Marking methods for videoXtens

Matrix test results / marking methods in temperature chambers

		Self adhesive lines	Permanent / paint-marker lines	Pins with O-rings and backlight	Permanent / paint-marker dots	Surface texture	Backlit contours
Flat specimens							
Tensile module		++		+		+	
Compression module		++		+		+	
Bending module		++				+	++
Yield strains		++	•	+	•	+	
Stress at x% strain		++	•	+	•	+	
Strain at tensile strength		++	•	+	•	+	
Breaking strain		++	•	+	•	+	
Transverse strain (incl. r-value)	axial	++	•	+	•	+	
Transverse strain (incl. r-value)	transverse	+	•		•	•	++
n-value		++	•	+	•		
Round specimens							
Tensile module		+		++		•	
Compression module		+		++		•	
Bending module							++
Yield strains		+	•	++	•	•	
Stress at x% strain		+	•	++	•	•	
Strain at tensile strength		+	•	++	•	•	
Breaking strain		+	•	++	•	•	
Transverse strain (incl. r-value)	axial	+	•	++	•	•	
Transverse strain (incl. r-value)	transverse						++
n-value		+	•	++	•		

++ very suitable / recommended
+ well-suited
• suitable

All data at ambient temperature.

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Marking methods for videoXtens

3 Marking methods for high temperature

There are only very few materials that can be used for marking in high temperatures of 1000°C and above and still provide suitable contrast for measurements with the videoXtens.

The material of choice is aluminium oxide which has a melting point of 2072°C and in combination with special lighting provides outstanding contrast.

In addition in order to prevent signal noise caused by thermal convection between camera and furnace it is recommended to enclose the optical axis by means of a HT-tunnel.

Remarks:
- In high temperatures furnace and specimen itself will start to radiate in the infrad red spectrum. Therefore green monochrome incident light in combination with a green pass-filter for the lens have to be employed.
- The markers are sprayed-on using a template and can therefore be used on almost any surface.
- Care has to be taken when handling the specimen after applying the markers as they are sensitive to the touch.

Aluminium oxide powder
Fine aluminum oxide powder (Al2O3) is sus-pensed in a solvent (e.g. water or ethanol) and brushed on or sprayed on with an air-brush. That way flat as well as round specimens can easily be marked.

These markers can then be traced with the videoXtens for elongation measurements.