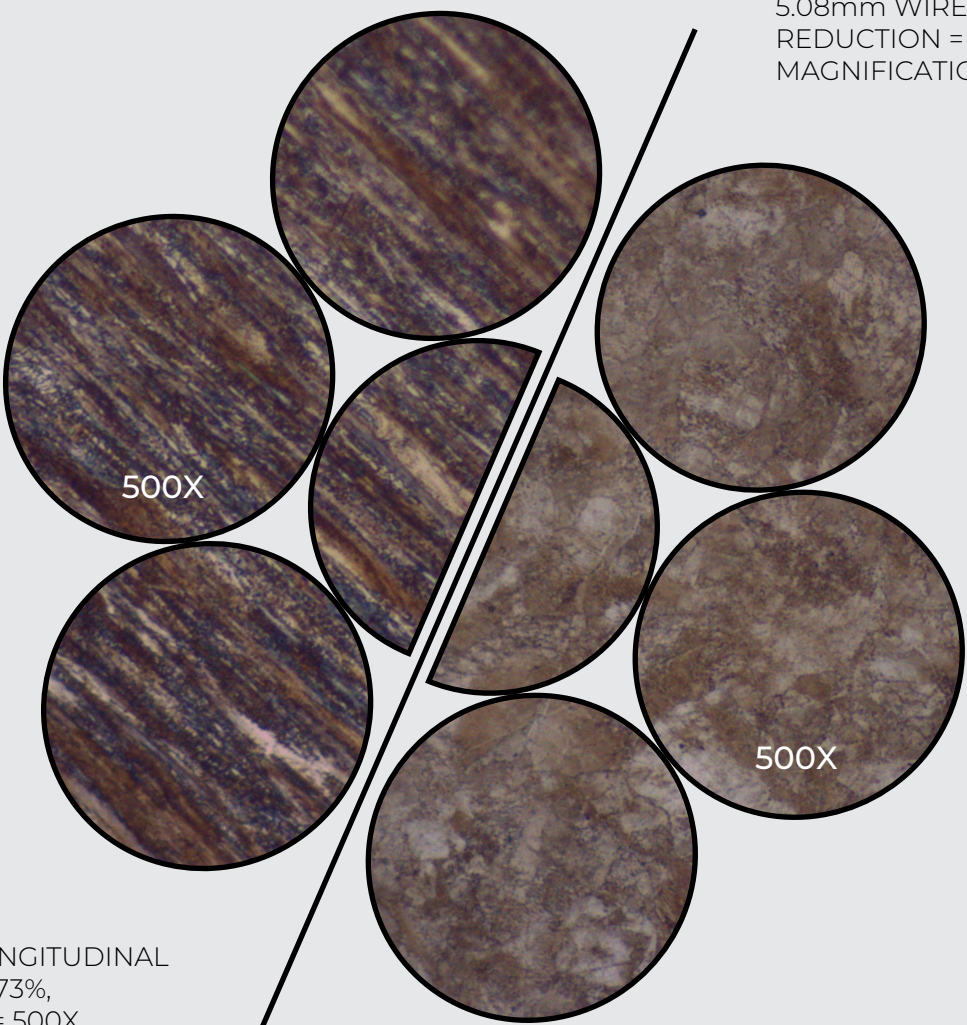


# QUALITY PLAN

As part of our commitment to quality, we have formulated a comprehensive quality plan in an effort to provide our customers with the assurance that they are receiving a top quality product.



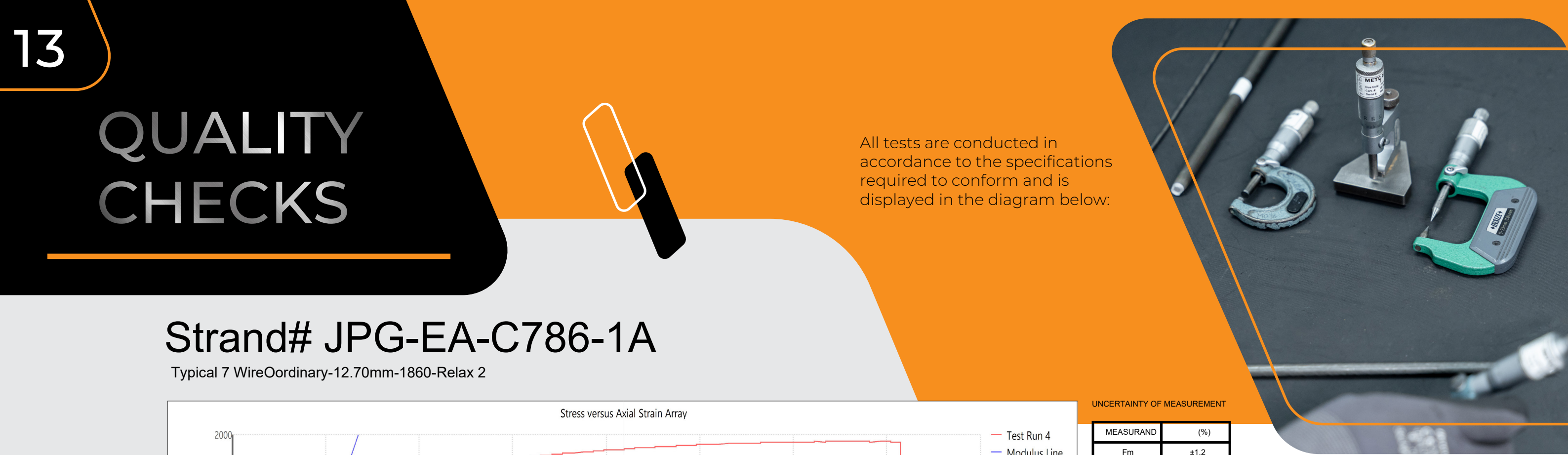
5.08mm WIRE TRANSVERSE  
REDUCTION = 84.73%,  
MAGNIFICATION = 500X

5.08mm WIRE LONGITUDINAL  
REDUCTION = 84.73%,  
MAGNIFICATION = 500X

# QUALITY SYSTEMS

Haggie Wire and Strand has a comprehensive quality management system which satisfies the requirements of ISO 9002. The operation goes through regular audits by both the local and international accrediting bodies.





13

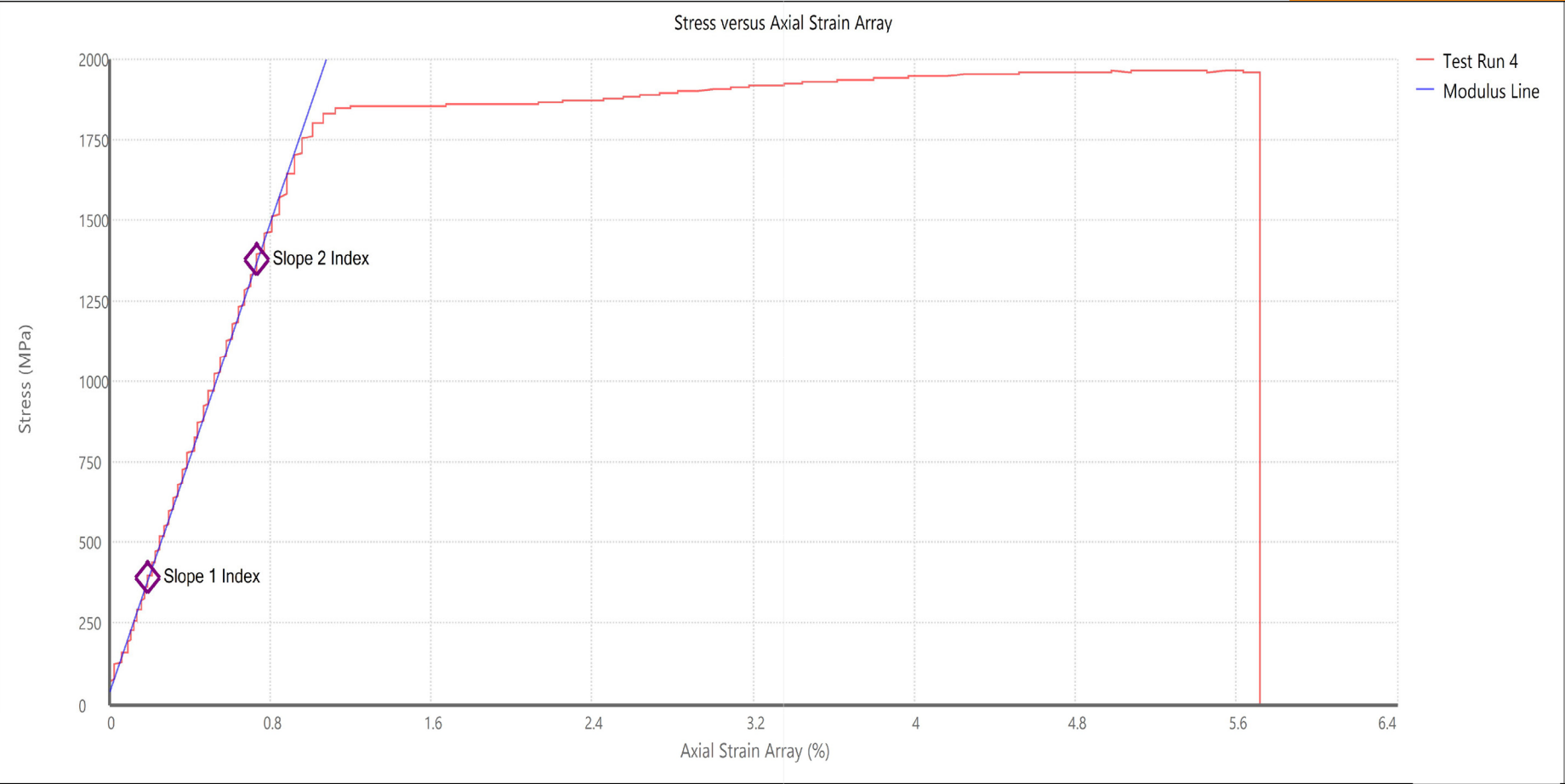
QUALITY  
CHECKS



All tests are conducted in accordance to the specifications required to conform and is displayed in the diagram below:

Strand# JPG-EA-C786-1A

Typical 7 Wire Ordinary-12.70mm-1860-Relax 2



UNCERTAINTY OF MEASUREMENT

MEASURAND	(%)
Fm	±1.2
Rt1	±1.2
Rp0.2	±1.3
E	±1.2
At	±2.3
SO	±0.2
CONFIDENCE LEVEL	95%
COVERAGE FACTOR	2

All critical measures are reported as follows:

- Modulus of Elasticity (Young's Modulus) – E 0.1% and 0.2% Proof Load – Rp0.1 & Rp0.2
- Load at 1% Extension – F (1%)
- Ultimate Tensile Strength – Fm
- Maximum Breaking Load or Stress – Rm
- Total Elongation at Fracture – At
- Elongation at maximum load – Agt
- Ductility – reported as Total Elongation at Fracture At

Test no	Pack #	Bno mm	Fm kN	F(1%) kN	Rp0.1 kN	Rp0.2 kN	E GPa	At %	Agt %	So mm <sup>2</sup>	Mass kg	Cast #	C %	Mn %	Si %	S %	P %	N %
4	JPG-EA-C786-1A	12.70 mm	191.3	171.5	178.6	180.2	190.4	5.72	5.27	97.52	2924	233226	0.830	0.670	0.590	0.012	0.007	0.010

Bno	Strand diameter	%At	Percentage elongation at	%C	Percentage carbon content
Fm	Breaking load in kN	%Agt	maximun load	%Mn	Percentage manganese content
F (1%)	Load In kN at 1 % extension	So	Percentage elongation	%Si	Percentage silicon content
Rp <sub>0.1</sub>	Load at 0.1 % Stress		at breaking load Cross	%S	Percentage sulphur content
Rp <sub>0.2</sub>	Load at 0.1 % Stress		sectional area	&P	Percentage phosphorus content
E	Modulus of Elasticity			%N	Percentage nitrogen content



# SPECIALISED TESTING

## Relaxation Properties

Haggie Wire and Strand is routinely tested in a temperature controlled modern state of the art automated stress relaxation laboratory. Typical relaxation values of our strand products after 1000 hours at an initial load of 70% of minimum breaking load are 1.0 to 1.5%. Both ASTM and BS specify 2.5% maximum for low relaxation strand. Results for an initial load of 80% of minimum breaking load are typically between 2.0 – 2.5%. The maximum permissible is 3.5%.

## Bond Strength & Transmission Length

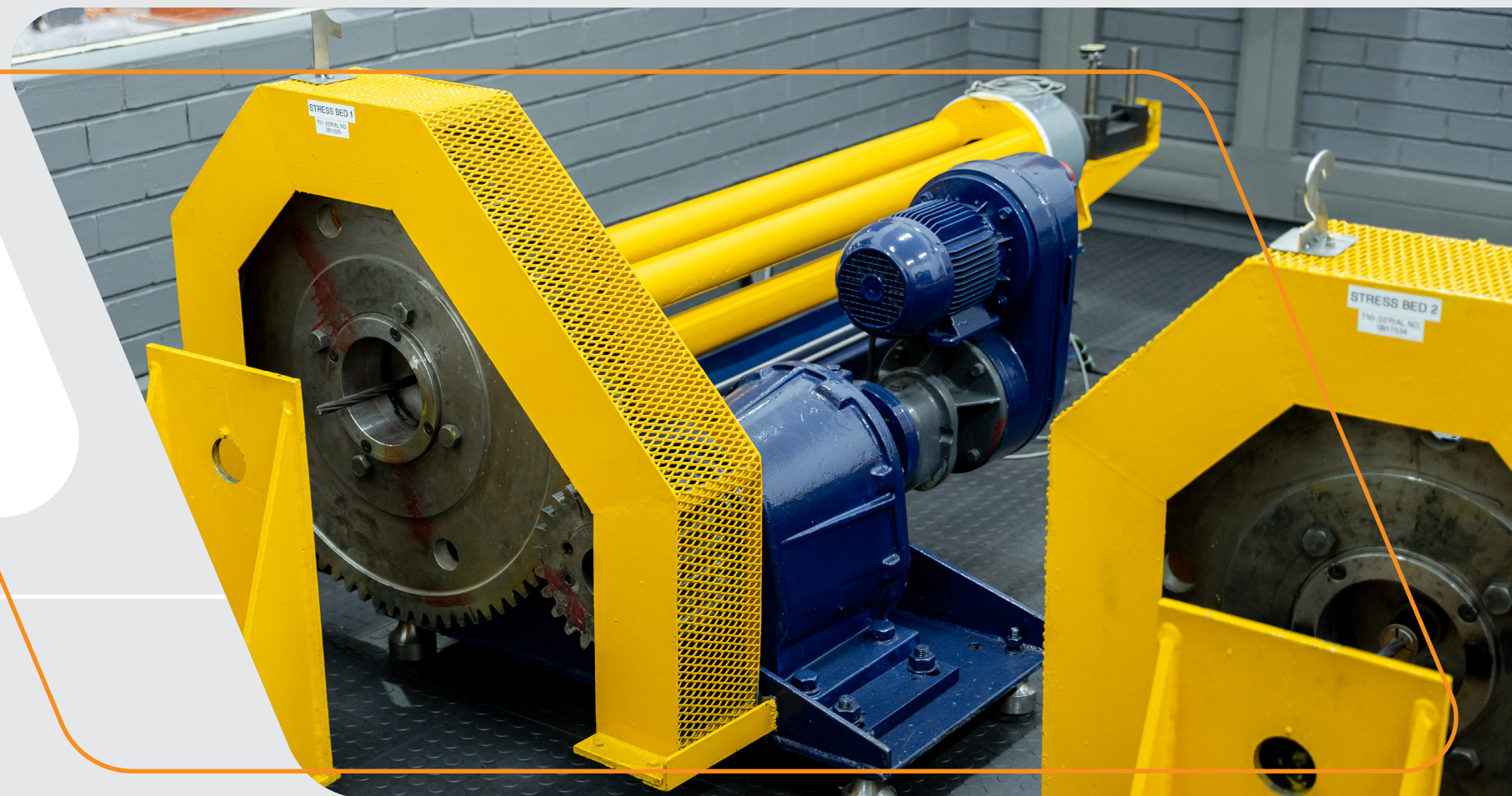
Through the years our PC wire and strand has been tested for bond strength and transmission length by various independent bodies. Regular bond strength tests are conducted internally as well.

## Stress Corrosion Resistance

Haggie Wire and Strand is tested in a purpose built laboratory for conformance to the FIP test, now incorporated into the latest draft version of EURONORM 10138. Both products easily pass the minimum requirements of the test.

## Fatigue Endurance

Haggie Wire and Strand has been tested by two independent laboratories for conformance to the tension – tension fatigue test requirements of BS, EURONORM, and other standard bodies, including the PTI for stay cables. The requirements is for the strand to endure 2 million cycles at specified maximum loads of up to 70% of the actual breaking force, with specified load ranges. The product's tendons pass easily, with results in excess of 5 million cycles being recorded.



## Cryogenic Properties

For use in the prestressing of concrete vessels for liquid gas, or other applications where very low temperatures are experienced, Haggie Wire and Strand regularly tests its PC strand cryogenic properties. Typically the tensile strength of strand increases by about 12% at 165oC, while elongation is reduced from approximately 5.5% to 3.7%. Relaxation losses are minimal below – 100oC. Young's Modulus is slightly increased.

