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CALIBRATION CERTIFICATE

PPT GROUP UK LTD (SLINFOLD)
t/a MECMESIN LTD
NEWTON HOUSE
SPRING COPSE BUSINESS PARK
STANE ST, SLINFOLD
HORSHAM
RH13 0SZ

Certificate No: 2510022
Issue Date: 17 October 2025

Calibration Date: 15 October 2025
Technician: L Shenton

Description: A 5000 N tension and compression strain gauged load cell, used with an associated digital indicator, both manufactured by Interface.

Identification: 551530 (TM0300) on load cell.
J10601 (TM0302) on indicator.
CT-177-10 on cable.

Basis of Calibration: BS EN ISO 376:2011
Increasing Forces Only

Calibration Location: Element Sheffield (address shown in header)

Classification: The force proving instrument satisfies the requirement of BS EN ISO 376:2011 for the following classification range:-

Compression	**Class 0.5 ,**	**5000 N down to 200 N**
	Class 1.0 ,	**5000 N down to 100 N**
Tension,	**Class 0.5 ,**	**5000 N down to 200 N**
	Class 1.0 ,	**5000 N down to 100 N**

Signed for and on behalf of Element Sheffield:

R Moore

Senior Force Calibration Technician

UKAS CALIBRATION
0157

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.
The certificate and results within, relates only to the item calibrated as shown on the first page of the certificate.

When Element is making statements of conformity a simple acceptance rule has been applied.
Uncertainty budgets have been determined and are available on request.

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Method:

The calibration was made in the laboratory's No. 4 & No. 5 Force Standard Machines in terms of the SI unit of force, the newton (N). The uncertainty of the forces applied during the calibration is ± 1 part in 5 000 (±0.02%).

An overload test as specified in Clause B.1 of Annex B of BS EN ISO 376:2011 was carried out prior to the calibration.

A creep test as specified in Clause 7.4.4 of BS EN ISO 376:2011 was performed for between 30 and 300 seconds at maximum load after the final pre-load, the results of which were within the classification parameters stated in Clause 8.2.5 table 2 of BS EN ISO 376:2011.

Two tests were made in compression followed by two tests in tension. Two further tests were then made in compression followed by two further tests in tension. The forces were applied to the device in compression through a soft pad, provided by Element, placed centrally on the domed upper loading boss. In tension the forces were applied to the device through adaptors, also provided by Element.

Measurements:

1. The bearing pad test, Clause B.2 of Annex B of BS EN ISO 376:2011, was carried out during a previous calibration dated November 2017, certificate serial no. 1711064. The force proving instrument satisfies the requirements of the bearing pad test for the following classification range(s):-

Class 0.5	5000 N down to 200 N
Class 1.0	5000 N down to 100 N

2. The temperature during the calibration tests varied between 19.7°C and 19.9°C.

3. Before calibration commenced the device was zeroed using the Tare button. The no-load readings for compression and tension are shown in the table below. The results on the following pages have been adjusted using a linear progression between the initial and final zero values based on these zero readings.

	Compression				Tension			
	Run 1	Run 2	Run 3	Run 4	Run 1	Run 2	Run 3	Run 4
Initial Zero	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final Zero	0.1	0.1	0.0	0.1	-0.1	0.0	0.0	-0.2

4. The forces applied and the resulting deflections are given in Tables 1 and 2: no correction for temperature has been applied to the results.

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5. For calibration in the compression mode in increasing forces, the estimate of the mean deflection was calculated as the mean of the tests 1, 3 and 4.

6. The procedure above was repeated for the calibration in the tension mode.

   For each mode of application of force, the coefficients of a third degree equation relating the estimate of the mean deflection as a function of the applied calibration force were calculated by the method of least squares. The differences between the mean value of deflection with rotation for each force and the computed value of deflection given by the equation were used to determine the relative interpolation error. The coefficients of a third degree equation relating a given applied force to the estimate of the mean deflection were also calculated.

Notes:

1. Clause 8.3.2 of BS EN ISO 376:2011 states that the maximum period of validity of the calibration of a force proving instrument shall not exceed 26 months. The force proving instrument shall be recalibrated if it sustains an overload which exceeds the maximum force by 12%.
2. Clause 9 of BS EN ISO 376:2011 states that the force proving instrument shall be loaded in accordance with the conditions under which it was calibrated. Precautions shall be taken to prevent it from being subject to forces greater than the maximum force to which it is classified.
3. If given or calculated forces are required to be in terms of one of the technical units of force, then the following conversion factors may be used:

Required unit of force	Factor by which the force in newtons must be multiplied
kilogram-force (kgf)	101.972×10^{-3}
pound-force (lbf)	224.809×10^{-3}
ton-force (tonf)	100.361×10^{-6}

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Results Table 1 : Compression

Test Number	1	2	5	6	Unbiased estimate of mean	Expanded Uncertainty N	Expanded Uncertainty %
Orientation	0°	0°	120°	240°			
Force (N)	Deflection (N)					±	
100	-100.0	-100.0	-100.1	-100.0	-100.0	0.10784	0.108%
200	-200.0	-200.0	-200.1	-200.0	-200.0	0.12570	0.063%
500	-500.0	-500.0	-500.0	-499.7	-499.9	0.24368	0.049%
1000	-999.8	-999.8	-999.9	-999.5	-999.8	0.33857	0.034%
1500	-1499.7	-1499.6	-1499.8	-1499.4	-1499.7	0.43649	0.029%
2000	-1999.4	-1999.4	-1999.7	-1999.0	-1999.4	0.59205	0.030%
2500	-2499.2	-2499.2	-2499.6	-2498.5	-2499.1	0.88629	0.035%
3000	-2999.0	-2998.9	-2999.4	-2998.3	-2998.9	0.95218	0.032%
3500	-3498.6	-3498.6	-3499.2	-3498.3	-3498.7	1.00364	0.029%
4000	-3998.3	-3998.3	-3998.4	-3997.7	-3998.1	1.00213	0.025%
4500	-4497.9	-4497.9	-4498.2	-4496.7	-4497.6	1.39667	0.031%
5000	-4997.5	-4997.5	-4998.1	-4996.5	-4997.4	1.46486	0.029%

Maximum Relative Uncertainty = 0.11%

Coefficients

For a given applied force F (in N), the expected deflection D (in N) OR For a given deflection D (in N), the applied force F (in N) is calculated from the following:

$D=B_0+B_1F+B_2F^2+B_3F^3$ $F=A_0+A_1D+A_2D^2+A_3D^3$

where:

$B_0 =$ -5.22989E-02 $A_0 =$ -5.23133E-02
$B_1 =$ -9.99800E-01 $A_1 =$ -1.00020E+00
$B_2 =$ 5.93176E-08 $A_2 =$ 5.93342E-08
$B_3 =$ 2.27919E-12 $A_3 =$ -2.29457E-12

If the expanded uncertainty is required for forces other than above it can be calculated from the following:

$U_{exp}=(C_0+C_1F+C_2F^2)x2$

where:

$C_0 =$ 0.00000E+00
$C_1 =$ 1.34801E-04
$C_2 =$ 4.22144E-10

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Results Table 2 : Tension

Test Number	3	4	7	8	Unbiased estimate of mean	Expanded Uncertainty N	Expanded Uncertainty %
Orientation	0°	0°	120°	240°			
Force (N)	Deflection (N)					±	
100	100.0	100.0	100.0	100.0	100.0	0.12756	0.128%
200	200.0	200.0	200.0	200.0	200.0	0.13056	0.065%
500	499.9	500.0	499.9	499.8	499.9	0.28892	0.058%
1000	999.9	999.8	999.7	1000.7	1000.1	0.65034	0.065%
1500	1499.8	1499.7	1499.5	1500.3	1499.9	0.75673	0.050%
2000	1999.7	1999.5	2000.7	2000.9	2000.4	1.08750	0.054%
2500	2499.7	2499.8	2500.0	2500.4	2500.0	0.81563	0.033%
3000	2999.8	2999.9	3000.9	3000.4	3000.4	1.04698	0.035%
3500	3499.8	3499.9	3500.5	3500.1	3500.1	0.94855	0.027%
4000	3999.8	4000.0	4000.4	4000.0	4000.0	1.07529	0.027%
4500	4500.0	4500.2	4500.3	4500.1	4500.1	1.11057	0.025%
5000	5000.0	5000.2	5000.3	5000.0	5000.1	1.22807	0.025%

Maximum Relative Uncertainty = 0.13%

Coefficients

For a given applied force F (in N), the expected deflection D (in N) OR For a given deflection D (in N), the applied force F (in N) is calculated from the following:

$D=B_0+B_1F+B_2F^2+B_3F^3$ $F=A_0+A_1D+A_2D^2+A_3D^3$

where:

$B_0 =$ -5.93227E-02 $A_0 =$ 5.93143E-02
$B_1 =$ 1.00012E+00 $A_1 =$ 9.99884E-01
$B_2 =$ -7.36670E-10 $A_2 =$ 6.86753E-10
$B_3 =$ -3.56890E-12 $A_3 =$ 3.57554E-12

If the expanded uncertainty is required for forces other than above it can be calculated from the following:

$U_{exp}=(C_0+C_1F+C_2F^2)x2$

where:

$C_0 =$ 0.00000E+00
$C_1 =$ 2.40375E-04
$C_2 =$ -2.81200E-08

End of Certificate

UKAS CALIBRATION 0157

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