

CERTIFICATE OF CALIBRATION

ISSUED BY:

SERCAL MATERIALS TESTING MACHINES SERVICES LTD
UKAS ACCREDITED CALIBRATION LABORATORY

CERTIFICATE NUMBER: 53700

DATE OF ISSUE: 01 October 2019



0375

SERCAL MTMS LTD.

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Sercal Materials Testing Machines Services Ltd.
Southern Avenue, Leominster,
Herefordshire, HR6 0QH.
Tel: +44 (0) 1527 514015 Fax: +44 (0) 1527 514016
E-mail: enquiries@sercalcalibrations.co.uk

Approved Signatories
J. Swann
Dr N. Wrigley

Issued To: Strainstall Ltd.
Address: 9-10 Mariners Way, Somerton Industrial Estate, Cowes, Isle of Wight PO31 8PD
Machine Description: Universal Testing Machine **Serial Number:** 27667
Manufacturer / Type: Denison T42B3 **Force Capacity:** 500kN
Display System 1: Single range digital display
Display System 2: Analogue scale with 4 ranges
Force Transducer: 5kN Load Cell **Serial Number:** 27667
Associated Equipment: Strainstall Tracker 200 Digital Display Unit **Serial Number:** 04110101

Date of Calibration: 25 September 2019 **Ambient Temperature:** 21.3°C
Sercal Quote Reference: Q190722R **Location:** Test & Calibration Room
Previous certificate number: 51974 Issued: 03 October 2018

Method:

The testing machine identified above has been calibrated in accordance with the requirements of **BS EN ISO 7500-1:2018** over the ranges given below for increasing forces only. The calibration was performed using force proving devices and / or masses which meet the requirements of BS EN ISO 7500-1 and equipment which is calibrated in accordance with BS EN ISO 376:2011. The machine complied with the requirements of the standard for the following ranges and classifications with regard to the relative error, repeatability, resolution and zero return to which table 2 of the standard refers:

| Range | Mode | Display | Status | Classification of range(s) to minimum force |
|-------|-------------|-----------|----------|---|
| 500kN | Tension | Display 1 | As found | 500kN Class 1 down to 5kN |
| 500kN | Compression | Display 1 | As found | 500kN Class 1 down to 5kN |
| 500kN | Tension | Display 2 | As found | 500kN Class 1 down to 100kN |
| 250kN | Tension | Display 2 | As found | 250kN Class 1 down to 50kN |
| 100kN | Tension | Display 2 | As found | 100kN Class 1 down to 20kN |
| 50kN | Tension | Display 2 | As found | 50kN Class 1 down to 10kN |
| 500kN | Compression | Display 2 | As found | 500kN Class 1 down to 100kN |
| 250kN | Compression | Display 2 | As found | 250kN Class 1 down to 50kN |
| 100kN | Compression | Display 2 | As found | 100kN Class 1 down to 20kN |
| 50kN | Compression | Display 2 | As found | 50kN Class 1 down to 10kN |

Detailed tabulated results are shown on the following pages.

Calibrated by: Jim Swann

Certified by:

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The following traceable force proving equipment was used for the calibration:

| Description | Capacity | Class | Serial Number | Certificate Number | Date Calibrated |
|----------------------|----------|-------|---------------|--------------------|-------------------|
| Nobel DC Ratio meter | - | - | 3035 | 0478/2016120145-5 | 27 February 2017 |
| Load Cell | 50kN | 0.5 | 40929 | 0157/1909030 | 17 September 2019 |
| Load Cell | 500kN | 0.5 | 600/5U | 2018110043-1 | 03 June 2019 |

With reference to clause 6 of BS EN ISO 7500-1 the proving equipment used has been calibrated to BS EN ISO 376 and the class of the proving device(s) was equal to or exceeded the class to which the machine has been verified.

The expiry date of the certificates of calibration for the elastic proving devices used is 26 months and for masses 5 years from the dates given above.

Where masses are used, the value for gravity (g) used to calculate the forces exerted by the masses was 9.815m/s^2

When using elastic proving devices the constant indicated force method was used to effect the verification. When masses are used the constant true force method was used to effect the verification. Three verification runs were made on each range

The Interval between verifications, clause 9 of the standards refers.

The time between verifications depends upon the type of testing machine, the standard of maintenance and the amount of use. Unless otherwise specified it is recommended that the verification be carried out at intervals not exceeding 12 months. The machine shall in any case be verified if it is moved to a new location necessitating dismantling or if it is subject to major repair or adjustment.

The Sercal Calibration Laboratory is accredited by UKAS to BS EN ISO 17025 (General requirements for the competence of testing and calibration laboratories) to perform the calibration which is reported on this certificate.

Prior to verification the machine was inspected for good working order and was found to satisfy the guidelines given in section 5 of BS EN ISO 7500-1

The calculation of the accuracy and repeatability errors and the classification of the testing machines performance was made in accordance with the method specified in BS EN ISO 7500-1:2018

In the result tables which follow a negative relative error indicates that the machine indicator lags the true applied force. Where there are adjacent results at the same force increment, these are at the overlap point from the two proving devices used.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

The uncertainty stated above refer to values obtained during calibration and make no allowances for factors such as long term drift, temperature and alignment effects, the influences of these factors should be taken into account by the user.

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Results:

| Range 1 500kN Tension Display 1 | | | Shunt Cal 89.13kN | Range 2 500kN Compression Display 1 | | | |
|---------------------------------|----------------|----------------------|-------------------------------------|-------------------------------------|----------------------|--|-------------------------------------|
| These results are: | | | As found - no adjustments were made | These results are: | | | As found - no adjustments were made |
| Nominal Force | Relative Error | Expanded Uncertainty | Nominal Force | Relative Error | Expanded Uncertainty | | |
| kN | % | % | kN | % | % | | |
| 5.00 | 0.35 | 0.29 | 5.00 | 0.38 | 0.31 | | |
| 10.00 | 0.21 | 0.27 | 10.00 | 0.22 | 0.27 | | |
| 25.00 | 0.09 | 0.27 | 25.00 | 0.08 | 0.27 | | |
| 25.00 | 0.11 | 0.28 | 25.00 | 0.09 | 0.28 | | |
| 50.00 | 0.07 | 0.27 | 50.00 | 0.06 | 0.27 | | |
| 75.00 | -0.02 | 0.27 | 75.00 | 0.00 | 0.27 | | |
| 100.00 | -0.09 | 0.27 | 100.00 | -0.05 | 0.27 | | |
| 200.00 | -0.20 | 0.27 | 200.00 | -0.17 | 0.27 | | |
| 300.00 | -0.32 | 0.27 | 300.00 | -0.29 | 0.27 | | |
| 400.00 | -0.53 | 0.27 | 400.00 | -0.49 | 0.27 | | |
| 500.00 | -0.61 | 0.27 | 500.00 | -0.59 | 0.27 | | |

| Range 3 500kN Tension Display 2 | | | Range 4 250kN Tension Display 2 | | |
|---------------------------------|----------------|----------------------|---------------------------------|----------------|----------------------|
| These results are: | | | These results are: | | |
| Nominal Force | Relative Error | Expanded Uncertainty | Nominal Force | Relative Error | Expanded Uncertainty |
| kN | % | % | kN | % | % |
| 100.0 | -0.09 | 0.30 | 50.0 | 0.04 | 0.29 |
| 200.0 | -0.16 | 0.27 | 100.0 | -0.03 | 0.28 |
| 300.0 | -0.34 | 0.27 | 150.0 | -0.29 | 0.27 |
| 400.0 | -0.55 | 0.27 | 200.0 | -0.39 | 0.27 |
| 500.0 | -0.68 | 0.27 | 250.0 | -0.61 | 0.27 |

| Range 5 100kN Tension Display 2 | | | Range 6 50kN Tension Display 2 | | |
|---------------------------------|----------------|----------------------|--------------------------------|----------------|----------------------|
| These results are: | | | These results are: | | |
| Nominal Force | Relative Error | Expanded Uncertainty | Nominal Force | Relative Error | Expanded Uncertainty |
| kN | % | % | kN | % | % |
| 20.00 | 0.11 | 0.31 | 10.00 | -0.08 | 0.31 |
| 40.00 | -0.21 | 0.28 | 20.00 | -0.26 | 0.30 |
| 60.00 | -0.39 | 0.28 | 30.00 | -0.35 | 0.28 |
| 80.00 | -0.51 | 0.29 | 40.00 | -0.51 | 0.28 |
| 100.00 | -0.71 | 0.28 | 50.00 | -0.69 | 0.27 |

In the result table(s) above a negative relative error indicates that the machine indicator lags the true applied force.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

The uncertainty stated above refer to values obtained during calibration and make no allowances for factors such as long term drift, temperature and alignment effects, the influences of these factors should be taken into account by the user.

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Results Continued:

| Range 7 500kN Compression Display 2 | | | Range 8 250kN Compression Display 2 | | |
|-------------------------------------|----------------|-------------------------------------|-------------------------------------|----------------|-------------------------------------|
| These results are: | | As found - no adjustments were made | These results are: | | As found - no adjustments were made |
| Nominal Force | Relative Error | Expanded Uncertainty | Nominal Force | Relative Error | Expanded Uncertainty |
| kN | % | % | kN | % | % |
| 100.0 | -0.06 | 0.29 | 50.0 | 0.11 | 0.30 |
| 200.0 | -0.18 | 0.28 | 100.0 | -0.03 | 0.28 |
| 300.0 | -0.35 | 0.27 | 150.0 | -0.27 | 0.27 |
| 400.0 | -0.51 | 0.27 | 200.0 | -0.37 | 0.27 |
| 500.0 | -0.66 | 0.27 | 250.0 | -0.57 | 0.27 |

| Range 9 100kN Compression Display 2 | | | Range 10 50kN Compression Display 2 | | |
|-------------------------------------|----------------|-------------------------------------|-------------------------------------|----------------|-------------------------------------|
| These results are: | | As found - no adjustments were made | These results are: | | As found - no adjustments were made |
| Nominal Force | Relative Error | Expanded Uncertainty | Nominal Force | Relative Error | Expanded Uncertainty |
| kN | % | % | kN | % | % |
| 20.00 | 0.09 | 0.30 | 10.00 | -0.06 | 0.31 |
| 40.00 | -0.17 | 0.28 | 20.00 | -0.28 | 0.28 |
| 60.00 | -0.36 | 0.27 | 30.00 | -0.28 | 0.28 |
| 80.00 | -0.49 | 0.27 | 40.00 | -0.47 | 0.27 |
| 100.00 | -0.72 | 0.27 | 50.00 | -0.61 | 0.27 |

In the result table(s) above a negative relative error indicates that the machine indicator lags the true applied force.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

The uncertainty stated above refer to values obtained during calibration and make no allowances for factors such as long term drift, temperature and alignment effects, the influences of these factors should be taken into account by the user.