सीएसआईआर
CSIR
भारत का नवाचार इंजन
The Innovation Engine of India

सी एस आई आर – राष्ट्रीय भौतिक प्रयोगशाला
CSIR-NATIONAL PHYSICAL LABORATORY
(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्)
(Council of Scientific and Industrial Research)
(राष्ट्रीय मापिकी संस्थान (एनएमआई), सदस्य बीआईपीएस एवं हस्ताक्षरकर्ता सीआईपीएम – एमआरए)
(National Metrology Institute (NMI), Member BIPM and Signatory CIPM - MRA)
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अंशांकन प्रमाण पत्र
CALIBRATION CERTIFICATE
FORCE PROVING INSTRUMENT

प्रमाण पत्र संख्या / Certificate No.

24050237/D1.05/C-140

दिनांक/ Date	अगले अंशांकन हेतु अनुशंसित तिथि Recommended date for next calibration	पृष्ठ / Page	पृष्ठों की संख्या / No. of Pa ges
12.07.2024	12.09.2026	1	2

1. Calibrated for: M/s. National Centre for Quality Calibration
4, Abhishree Corporate Park, Nr. Swagat Bunglow BRTS,
Iskcon-Ambli Road, Ambli, Ahmedabad – 380 058.

2. Description & identification of instrument

Customer's Ref. No.: Letter Dated: Nil
Type: Load Cell
Capacity: 10kN
Sl. No.: 14625
Make: NIL
Connector Type: 4 Pin
Digital Indicator Sl. No.: 14625
Manufacturer: Star Embedded Systems Pvt. l
Model No.: LED-SD1
Resolution: 1 Div
Cable length: 4.9 m.

Accessories: Self aligning Compression Pads.

3. Environmental conditions: **Temperature:** (23 ± 1)° C **Relative humidity**: (50 ± 10) %

4. Standards used with: 50 kN Dead Weight force machine
Associated uncertainty: ±0.009% (k=2)

5. Traceability of standard used: The standard used for calibration is traceable to the National Standard, which realize the units of quantities according to the International System of Units (SI).

6. Principle/Methodology of calibration and calibration procedure number: NPL Calibration procedure No.: Sub-Div.#D1.05/Doc.#3/CP#FT/F-02 broadly based on IS 4169-2014(ISO:376-2011).

No load output: The digital indicator was switched on for 30 minutes to warm up and stabilized for no load output before the start of calibration. The no load output was noted (before taring) and the calibration signal was noted.

Preloading: Before the application of the calibration forces, the instrument was preloaded thrice to its maximum capacity and kept at full load for about 90 seconds.

Calibration: The sequence of the applied calibration force in compression is given below:

At 0°: Two series of calibration forces in increasing values. At 120°and 240°positions: One series of calibration forces each in increasing values. Creep test is performed by calculating the difference in output i_{30} obtained at 30s and i_{300} obtained at 300s after the removal of the maximum calibration force and express this difference as percentage of maximum deflection.

The calibration was made by using Self-aligning compression pads provided along with the instrument to ensure axial application of the force.

Between each series, the instrument was rotated along its axis so as to occupy during the calibration three positions (0°, 120°& 240°) and the instrument was subjected to the full load once for about 90 seconds each time before starting in a new position.

Between the loadings, readings corresponding to no load after waiting at least 30 seconds for the return to zero were noted.

अंशांकनकर्ता: Calibrated by:
R.R.Meena

जाँचकर्ता: Checked by:
Dr. Rajesh Kumar

जारीकर्ता: Issued by:
Director's Nominee
डॉ० श्रीनिवास राव

प्रभारी वैज्ञानिक: Scientist-in-charge:
Dr. Rajesh Kumar

सी एस आई आर – राष्ट्रीय भौतिक प्रयोगशाला
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7. Results: Compression

The calibration data obtained is valid for the following digital indicator setting only					
Calibration Signal: NIL			No Load Output: 0 div		
	(Digital Indicator Reading in Div)				
Applied Force kN	Position 0° series 1	Position 0° series 2	Position 120° series 3	Position 240° series 4	Average 1,3,4
0	0	0	0	0	-----
0.5	9964	9965	9975	9958	9966
1.0	19940	19938	19947	19918	19935
2.0	39878	39875	39888	39848	39871
3.0	59814	59812	59820	59775	59803
4.0	79750	79748	79755	79700	79735
5.0	99675	99680	99685	99635	99665
6.0	119615	119620	119620	119575	119603
7.0	139555	139558	139552	139515	139541
8.0	159495	159500	159490	159455	159480
10.0	199380	199378	199375	199340	199365
0	8	9	2	1	---

Interpolation Equation: (Compression)

$F = -6.7050\times10^{-19}.X^3 + 1.3038\times10^{-13}.X^2 + 5.0160\times10^{-5}.X + 3.2037\times10^{-5}$

$X = 0.1060 . F^3 - 1.0339 . F^2 + 19936.3798 . F - 0.6408$

Where F = Force in kN

X = Indicator reading in Div

Classification: The force proving instrument is found to comply with the requirements of IS: 4169-2014 (ISO:376-2011) in respect of interpolated forces and classified as follows:

Class	Mode	From	To	Uncertainty of Measurement
Class 00	Compression	10.0 kN	5.0 kN	± 0.04%
Class 0.5	Compression	10.0 kN	2.0 kN	± 0.07%
Class 1	Compression	10.0 kN	0.5 kN	± 0.12%

The reported uncertainty is at coverage factor k=2 which corresponds to a coverage probability of approximately 95% for a normal distribution, considering the relative deviation of different components such as zero, resolution, repeatability, reproducibility, interpolation, creep and combining with the uncertainty of the applied force.

8. Date of calibration: 09-07-2024

9. Remarks: Nil

अंशांकनकर्ता:
Calibrated by:
R.R.Meena

जाँचकर्ता:
Checked by:
Dr. Rajesh Kumar

जारीकर्ता:
Issued by:
डॉ० श्रीनिवास राव
Dr. Srinivasa Rao

प्रभारी वैज्ञानिक:
Scientist-in-charge:
Dr. Rajesh Kumar