



सी एस आई आर - राष्ट्रीय भौतिक प्रयोगशाला
CSIR-NATIONAL PHYSICAL LABORATORY

(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्)

(Council of Scientific and Industrial Research)

(राष्ट्रीय मेट्रिकी संस्थान (एनएमआई), रातुरम मीट्रोलॉजी एंड इन्स्ट्रुमेंट्स रीसेचरिन्स - एगारारु)

(National Metrology Institute (NMI), Member BIPM and Signatory CIPM - MRA)

डॉ. के. एस. कृष्णान् मार्ग, नई दिल्ली-110012, भारत

Dr. K. S. Krishnan Marg, New Delhi-110012 INDIA

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अंशांकन प्रमाण पत्र

CALIBRATION CERTIFICATE

FORCE PROVING INSTRUMENT

प्रमाण पत्र संख्या / Certificate No.

24050209/D1.05/C-093

दिनांक/ Date	अगले अंशांकन हेतु अनुशंसित तिथि Recommended date for next calibration	पृष्ठ / Page	पृष्ठों की संख्या / No. of Pages
12.06.2024	12.08.2026	1	2

1. Calibrated for:

M/s. National Centre for Quality Calibration
4, Abhishree Corporate Park, Nr. Swagat Bunglow BRTS,
Iskon-Ambli Road, Ambli,
Ahmedabad-380058 (Gujarat).
Customer's Ref. No.: Letter Dated: Nil

2. Description & identification
of instrument

Type: Load Cell
Capacity: 3000 kN
Sr. No: 14626
Manufacturer: Star Embedded Systems
Connector Type: 4 Pin
Accessories: Self-aligning compression pads.

Digital Indicator Sr. No.: 14626
Manufacturer: Star Embedded Systems
Resolution: 1 div
Model: LED-SD1
Cable length: 11.65 m

3. Environmental conditions:

Temperature: (23 ± 1)° C Relative humidity: (50 ± 10) %

4. Standards used with
Associated uncertainty

3MN force machine
±0.05% (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 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 and thrice the changed mode.

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

अंशांकनकर्ता:

Calibrated by:

Surya

Gopal Jee

Gopal Jee

जाँचकर्ता:

Checked by:

Dr. RAJESH KUMAR

जारीकर्ता:

Issued by:



डॉ० श्रीनिवास राव रागम
Dr. Srinivasa Rao Ragam

प्रभारी वैज्ञानिक:

Scientist-in-charge:

Dr. RAJESH KUMAR



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(राष्ट्रीय मापकी संस्थान (एनएमआई), सदस्य भीआईपीएस एवं हस्ताक्षरकर्ता सीआईपीएम - एसआरए)
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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: 28 div		
(Indicator Reading in kN)					
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
100	6679	6684	6685	6681	6682
300	20056	20061	20055	20052	20054
600	40105	40109	40101	40098	40101
900	60144	60150	60138	60133	60138
1200	80176	80182	80165	80169	80170
1500	100195	100202	100182	100186	100188
1800	120213	120221	120200	120204	120206
2100	140202	140213	140194	140204	140200
2400	160212	160226	160203	160201	160205
3000	200198	200232	200209	200195	200201
0	12	16	15	16	---

Interpolation Equation: (Compression)

$$F = -4.0613 \times 10^{-16} \cdot x^3 + 2.5868 \times 10^{-10} \cdot x^2 + 1.4949 \times 10^{-2} \cdot x + 0.1161$$

$$x = 8.1013 \times 10^{-9} \cdot F^3 - 7.7080 \times 10^{-5} \cdot F^2 + 66.8942 \cdot F - 7.7370$$

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 1	Compression	3000 kN	100 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, repeatability, reproducibility, resolution, creep, interpolation and combining with the uncertainty of the applied force.

8. Date of calibration: 11.06.2024

9. Remarks: Nil

अंशांकनकर्ता:
Calibrated by:
Surya

Gopal Jee

जाँचकर्ता:
Checked by:
Dr. RAJESH KUMAR

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