



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

(विज्ञानिक तथा औद्योगिक अनुसंधान परिषद्)

(Council of Scientific and Industrial Research)

राष्ट्रीय मापिकी संस्थान (एनएमआई), सदस्य बीआईपीएम एवं हरताकरकर्ता सीआईपीएम - एमआरए  
(National Metrology Institute (NMI), Member BIPM and Signatory CIPM - MRA)

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

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

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अंशांकन प्रमाण पत्र  
TRUE COPY  
CALIBRATION CERTIFICATE  
FORCE PROVING INSTRUMENT

प्रमाण पत्र संख्या / Certificate No.

22021420 /D1.05/C-465

दिनांक/Date	अगले अंशांकन हेतु अनुशंसित तिथि Recommended date for the next calibration	पृष्ठ /Page	पृष्ठों की संख्या /No. of Page
01.03.2022	01.05.2024	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 - 380058.

Customer's Ref. No. & Dt.: Letter Dated Nil.

2. Description & identification  
of instrument:

Type: Load cell  
Capacity: 1 kN  
Sr. No: 14624

Digital indicator Sr. No.: 14624  
Manufacturer: Star Embedded Systems (P) I  
Resolutions: 1 div.  
Model: LED-SD1

Connector type: 4 pin  
Make : Star Embedded Systems (P) Ltd.  
Cable length = 6.18 mtr

Accessories: Self-aligning compression pads.

3. Environmental conditions:

4. Standards used with:

Associated uncertainty:

5. Traceability of standard used:

Temperature:  $(23 \pm 1)^\circ \text{C}$  Relative humidity:  $(50 \pm 10) \%$

1kN HMS force machine  
 $\pm 0.008\% (k=2)$

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

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

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  $0^\circ$ : Two series of calibration forces in increasing values. At  $120^\circ$  and  $240^\circ$  positions: One series of calibration forces each in increasing values. Creep test is performed by calculating the difference in output  $i_{30}$  obtained at 30 s at  $i_{300}$  obtained at 300 s after the removal of the maximum calibration force and express this difference as percentage 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 ( $0^\circ$ ,  $120^\circ$  &  $240^\circ$ ) and the instrument was subjected to the full load once for about 90 seconds each time before starting in 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:

SURYA

Gopal Jee  
GOPAL JEE

जांचकर्ता:

Checked by:

Dr. RAJESH KUMAR

जारीकर्ता:

Issued by:

प्रभारी वैज्ञानिक:

Scientist-in-charge:

NCC System Certificate No. 241/2

Dr.S.S.K.TITUS



डॉ. श्रीनिवास राव रांगम  
Dr. Srinivas Rao Rangam



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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: 25 div		
(Digital Indicator Reading in Div)					
Applied Force (N)	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	---
50	10083	10085	10091	10082	10085
100	20158	20161	20164	20145	20156
200	40255	40273	40284	40247	40262
300	60403	60429	60448	60386	60412
400	80559	80569	80608	80534	80567
500	100681	100703	100758	100655	100698
600	120827	120856	120925	120811	120854
700	140983	141009	141079	140941	141001
800	161164	161179	161228	161088	161160
1000	201462	201487	201539	201417	201473
0	10	16	8	11	---

### Interpolation Equation: (Compression)

$$F = 1.0344 \times 10^{-16} \cdot X^3 - 5.4728 \times 10^{-11} \cdot X^2 + 4.9709 \times 10^{-3} \cdot X - 0.1309$$

$$X = -1.7013 \times 10^{-7} \cdot F^3 + 4.4708 \times 10^{-4} \cdot F^2 + 201.1688 \cdot F + 26.3616$$

Where F = Force in N

X = Indicator reading in div.

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

Class	Mode	From	To	Uncertainty of Measurement
Class 0.5	Compression	1000 N	50 N	± 0.08%

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: 28.02.2022

### 9. Remarks: Nil.

अंशांकनकर्ता:

Calibrated by :

SURYA

Gopal Jee  
GOPAL JEE

जाँचकर्ता:

Checked by :

Dr. RAJESH KUMAR

जारीकर्ता:

Issued by:



डॉ. श्रीनिवास राव रांगम  
Dr. Subhakar Das

प्रभारी वैज्ञानिक:

Scientist-in-charge:

Dr.S.S.K.TITUS