BHARATIYA NIRDRESHAK DRAVYA
(INDIAN REFERENCE MATERIALS)

BND® ....
Ensuring the Quality for Aatmnirbhar Bharat
BND®

‘Quality Assurance of Products for Barrier Free Global Trades’
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Foreword

The National Physical Laboratory, India (NPLI), a constituent laboratory under Council of Scientific and Industrial Research (CSIR), was established on January 4, 1947. In 1956, the Legal Metrology Act entrusted NPLI to establish a measurement foundation of the country at par with international ones and to create and implement the programs needed for inclusive growth of the nation and the quality of life. In 1956, NPLI also became a permanent member of International Bureau of Weights and Measure (BIPM), France.

I am happy that the NPL is carrying out the original mandate of CSIR on maintenance of national physical standards and certified reference materials (under a trademark of Bharatiya Nirdeshak Dravya, BND). The availability of BND will ensure that quality of products made in India are of international standards.

Dr. Shekhar C. Mande
Director General,
Council for Science and Industrial Research
The international trade demands that the products are manufactured under quality systems with established measurement traceability to SI units through the National Metrology Institutes (NMI). In India, NPL provides the measurement traceability through the calibration of equipment using its national/primary standards and Bharatiya Nirdesha Dravya (BND®). BNDs are well-characterized using state-of-the-art measurement methods for the determination of chemical composition and/or physical properties. BNDs ensure the accuracy and reliability of measurements that are required for controlling the quality of products developed by industry, for new discoveries in science, innovation and technology, for monitoring the environment and for better health and safety of citizens in India. NPL has produced >70 BNDs in association with various Reference Material Producers in the country and looking forward to produce BNDs for all the requirements of India as well as for the world.

Dr. D K Aswal
Director
CSIR- National Physical Laboratory
CSIR-NPL has been one of the most important pillars in the Quality Infrastructure of the country. Its role as the NMI (National Measurement Institute), along with rules governing legal metrology, is well recognized. The initiative taken by CSIR-NPL, to strengthen the legal metrology as an important component of quality assurance through indigenously developed Indian Reference materials (RM) i.e. Bharatiya Nirdeshak Dravya is commendable. BNDs will play a crucial role in reducing the dependence of CRMs imported from foreign countries at much higher cost thus increasing cost of testing and calibration traceable to SI units ensuring the quality of products in every manufacturing & consumer sector by providing traceable measurements and enhancing quality of life of citizens through metrology. Through BND program, CSIR-NPL has put in motion the ecosystem of precise measurement which will provide credence to quality of Indian made products.

I am sure that this initiative will go a long way in promoting the concept of “Aatmnirbhar Bharat” as well as lend a resounding confidence to “Vocal for Local”.

We at QCI are committed to move forward hand-in-hand with this initiative of CSIR-NPL to make India a self-reliant nation where quality of products for our own market or the world market is never compromised. My best wishes for a bright and successful future of BND.

Ravi P Singh
Secretary General
Quality Council of India (QCI)
Certified reference materials (BNDs) are essential for quality assurance of life in terms of calibration, quality control, and method validation, assignment of values to other materials and to establish measurement traceability to SI units. On the occasion of World Metrology Day (WMD) celebration on 20th May 2020 CSIR-NPL has released the coffee table book on BND. It summarizes details of the BNDs developed by CSIR-NPL in association with Reference Materials Producers (RMPs).

As on today India imports CRMs worth more than Rs 10,000 crore. It is a primary responsibility of National Measurement Institute of India (NPL) to come forward towards import substitution and become Aatmanirbhar Bharat (self-reliant) in BND production. To cater the needs of Indian/global market, CSIR-NPL has started its mission mode program in association with Ministry of Commerce and Industry (MoC) with Line Ministry (S&T) for the indigenous production of BNDs. I am glad to say that CSIR-NPL has released so far 72 BNDs.

I wish to express my thanks to the Director NPL, MoC, QCI, RMPs, and members of the subcommittee on reference materials in this endeavour.

Dr. R P Pant
Head, BND
It’s an immense pleasure to write words about Bharatiya Nirdeshak Dravya (BND) program of CSIR-NPL which is an immediate response towards the clarion call of our Hon’ble Prime Minister Shri Narendra Modi towards making a self-reliant India. I deeply believe that NABL and NPL through their coordinated activities can achieve India’s 21 century dreams of becoming self-reliant in producing Certified Reference Materials (CRMs). Reference materials (RMs) and CRMs are widely used for the calibration of measuring apparatus, evaluation of measurement procedures, quality control of measurements and laboratories; also, play a crucial role in National and International standardizing activities.

Currently, India is majorly dependent on imported CRMs. A common national program i.e. BND for producing CRMs under the umbrella of National Measurement Institute (NMI) of India is a great initiative taken by National Physical Laboratory (NPL). This initiative by NPL will not only promote the CRMs produced in India but will also save precious foreign exchange, generate employment and boost our economy.

Best wishes for the success of this initiative.

N. Venkateswaran,
Chief Executive Officer
National Accreditation Board for testing and calibration Laboratories (NABL)
Release of Chemical BNDs by Hon’ble Dr. Harsh Vardhan, S&T Minister, Government of India; Dr. D. K. Aswal, Director, CSIR-NPL; Professor A. K. Grover, Research Council Chairman, CSIR- NPL & Former VC – Punjab University and other dignitaries.
On the occasion of Metrology day, release of 28 petroleum BNDs (bench-mark for BS VI fuels) by Hon’ble Dr. R. Chidambaram, former principal scientific advisor to Government of India; Dr. Shekhar S. Mande, DG- CSIR & Secretary- DSIR, Govt. of India; Dr. D. K. Aswal, Director, CSIR-NPL; Professor A. K. Grover, Research Council Chairman, CSIR- NPL & Former VC – Punjab University and other dignitaries.
Preamble

A rapid transition of India from developing state to developed state requires strengthening of its quality infrastructure and manufacturing, for which availability of indigenous standards and certified reference materials (CRMs) are pivotal.

The national metrological institutes of advanced economies (e.g. USA, Germany, Japan France, UK, Korea, China) are having very strong program on reference material production whereas, the reference material development program in India is still in infancy.

Major industries in India depends on the other National Measurement Institutes (NMIs) for International System of Units (SI) traceable testing & calibration and CRMs resulting in depletion of foreign reserve.

Specifically, the CRMs are being procured at very high cost; India is exporting CRMs worth INR1000 Crore/annum approximately. This poses a dire need to take a step forward for indigenous development of CRMs which will contribute to save the import cost, enhance the export and thereby GDP of the country by many-folds, reinforcing the “Make in India” and “Self-reliance” pledge of Govt. of India.

CSIR-National Physical Laboratory has taken a lead for the production of Indian Reference Material registered trademark as Bharatiya Nirdeshak Dravya (BND) in association with ministry of commerce and industries for self-reliant India.
Bharatiya Nirdeshak Dravya (BND®)

Bharatiya Nirdeshak Dravyas (BNDs) i.e. Indian reference materials are CRMs developed by CSIR-NPL. BND activity at CSIR-NPL has recently been reinforced aiming to bring a paradigm shift in socio-economic fabric of the country through quality control assurance for export, import and domestic consumer products in every sector and versatile job creation.

The availability of BNDs is poised to enhance the national quality infrastructure and equip the quality regulatory bodies of almost all the ministries of Government of India.

CSIR-NPL is developing BNDs by its own and in collaboration with specific reference material producers (RMPs) following the stringent conditions of ISO17025 and ISO 17034 & 35.

**To date, 72 BNDs are available in the market with continuous effort to enhance the number. The developed BNDs are also being exported to different economies.**
Company Name: CSIR-National Physical Laboratory
Address: Dr K. S. Krishnan Marg
Email: headbnd@nplindia.org
Telephone: +91-11-45608373
Weblink: www.nplindia.in
Link to Order: http://www.nplindia.in/centre-calibration-testing-cfct
**PURPOSE:** BND® 2001, consists of an ‘Alumina powder’ (corundum structure), is an internal standard for intensity calibration of powder X-ray diffractometer (XRD).

**INDUSTRIAL DEMAND/MARKET:** XRD is one of the most widely used equipment for structural analysis of the materials and is required both in academia and industry. For quality and accurate data collection, routine calibration of XRD is required, indicating significant demand of reference materials i.e. BND 2001.

**POTENTIAL USERS:** Educational Institutions (All universities and Colleges), Mining Industries, Pharmaceutical Sector

**ANNUAL SALE:** 50-100 Units

**SOCIETAL IMPACT:** Availability of indigenously developed BND will indirectly contribute to the upliftment of the societal status.
PURPOSE: BND® 2004 is meant for the calibration of Fourier Transform Infrared (FTIR) Spectrometer which is being routinely used in chemical and pharmaceutical industry.

INDUSTRIAL DEMAND/MARKET: India is importing more than 5000 FTIR calibration standards per year.

POTENTIAL USERS: Chemical, analytical, pharmaceutical and biomedical industries, calibration and testing laboratories etc

NPL ANNUAL SALE: 100 Units

SOCIETAL IMPACT: Availability of indigenously developed BND will enhance the quality of products, export and
**PURPOSE:** BND® 2009 is a reference material for calibration of Magnification and Resolution of scanning electron microscopes (SEM and FESEM).

**INDUSTRIAL DEMAND/MARKET:**
More than 2500 units/ 2 years are being imported.

**POTENTIAL USERS:** Research institutes, National labs and universities, industries like Bruker, Zeiss, Hitachi, Pharmaceutical companies, Mitutoya Asia Pacific, Moserbaer, Jeol, NTMDT, Asylum Research, WITec, Vistec etc. need nanodimensional artefacts with traceability certificate.

**ANNUAL SALE:** 200 units

**SOCIETAL IMPACT:** Availability of indigenously developed BND will indirectly contribute to the upliftment of the societal status.
Company Name: National Council for Cement and Building Materials

Address: 34 Km Stone, Delhi-Mathura Road (NH-2), Ballabgarh – 121004, Haryana, India

Email: ncb.cqc@gmail.com, cqcb@ncbindia.com

Telephone: 0129-4192239, 4192305, 4192222

Weblink: www.ncbindia.com

Foreword

The cement industry today, rated as one of the best performing industries across various sectors is pivotal in realizing the dreams of a “New India” by supporting infrastructure development, real estate and many flagship schemes of the Indian Government like Housing for All, 100 Smart cities, World-class Cement Concrete Highways, Dedicated Freight Corridors.

National Council for Cement and Building Materials (NCB), a premier Research, Development and Innovation institution is equipped with multi-disciplinary expertise coupled with state-of-the-art testing and evaluation facilities. NCB is the premier body under the administrative control of Ministry of Commerce and Industry, Govt. of India, for technology development, transfer, continuing education and industrial services for cement and construction industries.

NCB’s areas of work span over the entire spectrum of cement manufacturing and usage – starting with geological exploration of raw materials through the processes, the machinery, the manufacturing aspects, energy and environmental considerations to the final utilization of materials in actual construction, condition monitoring & rehabilitation of buildings and structures. NCB started developing Certified Reference Materials (CRMs) since 1990. Since then 79 CRM’s have been developed for quality control.

It is a matter of great satisfaction that NCB has produced 12 nos. of Bharatiya Nirdeshak Dravya (BND) in collaboration with CSIR-National Physical Laboratory (NPL), Delhi. Moreover, 5 nos. of new CRMs are being in process for development as BND. The availability of SI traceable BND will bring boost to make in India programme and harmonize the quality infrastructure of the country.

Well equipped with vast experience and comprehensive knowledge about the industry trends and market needs, we are one among the best and I sincerely hope that our advance products and services will continue the make contribution in the growth of Indian economy.

Dr B N Mohapatra  
Director General
**SCOPE OF THE COMPANY:** Research, Technology Development and Transfer, Project Consultancy, Calibration, Testing, Quality Control, Continuing Education and Industrial Services in the field of Cement, Allied Building Materials and Constructions

**INDUSTRIAL DEMAND/MARKET:** Approximately **INR 4.0 Crore**

**POTENTIAL USERS:** Cement Plants, Building Materials & construction testing laboratory, R&D organizations, Government organization, Educational Institute/ Universities

**SOCIETAL IMPACT:** The societal impact is positive. The sale of respective BND in India and abroad results to saving in foreign exchange which led to growth of Indian economy.
# Cement and Cementitious Materials

<table>
<thead>
<tr>
<th>S. No.</th>
<th>BND No.</th>
<th>Material Description</th>
<th>Annual Sale (in Sets)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>5001</td>
<td>OPC –Blaine fineness</td>
<td>211</td>
</tr>
<tr>
<td>2.</td>
<td>5002</td>
<td>PPC-Blaine fineness</td>
<td>385</td>
</tr>
<tr>
<td>3.</td>
<td>5003</td>
<td>PSC –Blaine fineness</td>
<td>87</td>
</tr>
<tr>
<td>4.</td>
<td>5004</td>
<td>Fly ash –Blaine fineness</td>
<td>179</td>
</tr>
<tr>
<td>5.</td>
<td>5006</td>
<td>Composite cement</td>
<td>33</td>
</tr>
<tr>
<td>6.</td>
<td>5007</td>
<td>WPC-Blaine fineness</td>
<td>22</td>
</tr>
<tr>
<td>7.</td>
<td>5011</td>
<td>OPC higher fineness</td>
<td>134</td>
</tr>
<tr>
<td>8.</td>
<td>5021</td>
<td>OPC-Blaine Middle Fineness</td>
<td>143</td>
</tr>
<tr>
<td>9.</td>
<td>5051</td>
<td>OPC-Chemical</td>
<td>122</td>
</tr>
<tr>
<td>10.</td>
<td>5052</td>
<td>PPC-Chemical</td>
<td>75</td>
</tr>
<tr>
<td>11.</td>
<td>5054</td>
<td>Fly ash-Chemical</td>
<td>90</td>
</tr>
<tr>
<td>12.</td>
<td>5091</td>
<td>Coal-Chemical</td>
<td>03</td>
</tr>
</tbody>
</table>
**BND® 5001**

**ORDINARY PORTLAND CEMENT (OPC)**

**Blain Fineness**

**Purpose:** BND® 5001, has been developed for calibrating Blaine Air Permeability Apparatus, developing in-house secondary reference materials for routine control and evaluating proficiency of analysts.

Specific surface area (Blaine): 274 m²/kg ± 6.4 m²/kg

Specific Gravity: 3.16

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**BND® 5002**

**PORTLAND POZZOLANA CEMENT (PPC)**

**Blain Fineness**

**Purpose:** BND® 5002, has been developed for calibrating Blaine Air Permeability Apparatus, developing in-house secondary reference materials for routine control and evaluating proficiency of analysts.

Specific surface area (Blaine): 384 m²/kg ± 9.3 m²/kg

Specific Gravity: 2.85
**BND® 5003**
PORTLAND SLAG CEMENT (PSC)
Blain Fineness

**Purpose:** BND® 5003, has been developed for calibrating Blaine Air Permeability Apparatus, developing in-house secondary reference materials for routine control and evaluating proficiency of analysts
Specific surface area (Blaine): 330 m²/kg ± 9.3 m²/kg
Specific Gravity: 2.97

**BND® 5004**
FLY ASH
Blain Fineness

**Purpose:** BND® 5004, has been developed for calibrating Blaine Air Permeability Apparatus, developing in-house secondary reference materials for routine control and evaluating proficiency of analysts
Specific surface area (Blaine): 333 m²/kg ± 22.1 m²/kg
Specific Gravity: 2.23
**BND® 5006**

**COMPOSITE CEMENT**

**Blain Fineness**

**Purpose:** BND® 5006, has been developed for calibrating Blaine Air Permeability Apparatus, developing in-house secondary reference materials for routine control and evaluating proficiency of analysts. Specific surface area (Blaine): $372 \text{ m}^2 / \text{kg} \pm 9.3 \text{ m}^2 / \text{kg}$

Specific Gravity: 2.9

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**BND® 5007**

**WHITE PORTLAND CEMENT (WPC)**

**Blain Fineness**

**Purpose:** BND® 5007, has been developed for calibrating Blaine Air Permeability Apparatus, developing in-house secondary reference materials for routine control and evaluating proficiency of analysts. Specific surface area (Blaine): $382 \text{ m}^2 / \text{kg} \pm 8.4 \text{ m}^2 / \text{kg}$

Specific Gravity: 3.09
**BND® 5011**

**ORDINARY PORTLAND CEMENT (OPC)**

*Higher Blain Fineness*

**Purpose:** BND® 5011, has been developed for calibrating Blaine Air Permeability Apparatus, developing in-house secondary reference materials for routine control and evaluating proficiency of analysts.

Specific surface area (Blaine): 419 m²/kg ± 9.9 m²/kg
Specific Gravity: 3.15

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**BND® 5021**

**ORDINARY PORTLAND CEMENT (OPC)**

*Middle Blaine Fineness*

**Purpose:** BND® 5021, has been developed for calibrating Blaine Air Permeability Apparatus, developing in-house secondary reference materials for routine control and evaluating proficiency of analysts.

Specific surface area (Blaine): 337 m²/kg ± 12.9 m²/kg
Specific Gravity: 3.15
BND® 5051
ORDINARY PORTLAND CEMENT (OPC)
Chemical

**Purpose:** BND® 5051, has been developed for evaluating proficiency of analysts, evaluating/comparing various test methods and calibration of equipment for analyzing minor constituents, for analysis of Ordinary Portland Cement and material of similar matrix.

Chemical Parameters- LOI, SiO₂, Fe₂O₃, Al₂O₃, CaO, MgO, SO₃, IR, Na₂O, K₂O and Cl

BND® 5052
PORTLAND POZZOLANA CEMENT (PPC)
Chemical

**Purpose:** BND® 5052, has been developed for evaluating proficiency of analysts, evaluating/comparing various test methods and calibration of equipment for analyzing alkalis, for analysis of Portland Pozzolana Cement and material of similar matrix.

Chemical Parameters- LOI, MgO, SO₃, IR, Na₂O, K₂O and Cl
**Purpose:** BND® 5054, has been developed for evaluating proficiency of analysts, evaluating/comparing various test methods and calibration of equipment for analyzing alkalis for analysis of Fly ash.

Chemical Parameters- LOI, SiO$_2$, Fe$_2$O$_3$, Al$_2$O$_3$, CaO, MgO, Na$_2$O, K$_2$O, SO$_3$ and Cl

**Purpose:** BND® 5091, is intended to use as a primary standard for calibration of instruments and validation of method for the characterization of the measurand for the analysis of coal.

Chemical Parameters- Ash, Volatile Matter, Sulphur, Gross Calorific Value
Company/Institute Name: Aashvi Technology LLP.
Address: E-14, Madhavpura Market Shahibaug
City: Ahmedabad, Gujarat (India)
ZIP: 380004
Email: info@aashvitechnology.com
Telephone: +91- 9974145050
Weblink: https://aashvitechnology.com
For any business, utmost importance is customer satisfaction through quality product or quality services which not only boost the morale of organization but simultaneously create a quality consciousness within society. Quality direct impacts on health, environment and has knock-on effect on economy. To create quality infrastructure the Certified Reference Materials plays pivotal role.

Aashvi Technology LLP, Ahmedabad, producer of aQcrm, Indian Certified Reference Materials known as BND® (Bharatiya Nirdeshak Dravya) under the technology support and traceability establish to SI unit by CSIR-NPL (NMI of India). Aashvi Technology, producing BND to cater the need of various sector viz. Water, Food, Agriculture, Chemicals, Environmental, Pharmaceuticals. These efforts are developed to promote Made in India concept.

Mr Neeraj Kant Panday  
Director (Technical)
SCOPE OF THE COMPANY: Aashvi Technology LLP is producing Certified Reference Materials (CRMs) i.e. Bharatiya Nirdeshak Dravya (BND®) at its ISO 17034:2016; ISO/IEC 17025 accredited laboratory (accreditation body is QCI-NABL). The availability of indigenously developed BNDs will strengthen the statutory and regulatory bodies for uplifting the quality infrastructure of the country and thereby production of superior class commodities and products.

Aashvi Technology envisions to bring quality to the society and to make in India products which in turn will mark a positive impact for strong economy of the country. The availability of BNDs at lower cost and in timely manner will create an encouraging and sustainable atmosphere to strengthen quality culture of Indian industry.

BND® produced by ATL are very important and generic in nature, required by various industries for their routine quality control purposes.

INDUSTRIAL DEMAND/MARKET: ~ INR 40-45 Billion.

POTENTIAL USERS: Water, Food, Chemical, Pharmaceuticals, Agro-chemical Industries, commercial testing R &D Laboratories and Institutions

ANNUAL SALE: 40 Lakhs

SOCIETAL IMPACT: BNDs produced at Aashvi Technology are not only ensuring quality of products but improve healthcare system, education, technology improvement, protect environment and having a large economic and social impacts.
<table>
<thead>
<tr>
<th>Volumetric BNDs</th>
<th>Buffer Solution BNDs</th>
<th>Anions Standard Solution (1000 mg/kg)</th>
<th>Cation Standard Solution (1000 mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium Hydrogen Phthalate</td>
<td>pH 4.00</td>
<td>Bromate</td>
<td>Antimony</td>
</tr>
<tr>
<td>Sodium Chloride</td>
<td>pH 7.00</td>
<td>Nitrate</td>
<td>Aluminium</td>
</tr>
<tr>
<td>Potassium Dichromate</td>
<td>pH 9.00</td>
<td>Nitrite</td>
<td>Boron</td>
</tr>
<tr>
<td>Calcium Carbonate</td>
<td>pH 9.20</td>
<td>Sulphate</td>
<td>Cadmium</td>
</tr>
<tr>
<td>Sodium Carbonate</td>
<td></td>
<td>Fluoride</td>
<td>Copper</td>
</tr>
<tr>
<td>Ammonium Sulphate</td>
<td>Other BNDs</td>
<td></td>
<td>Lead</td>
</tr>
</tbody>
</table>

Conductivity 1.41 ms/cm
Total Dissolved solids (1000ppm)

Manganese
Nickel
Selenium
Potassium
Sodium
Silver
Zinc
**BND® 1003**  
*COPPER STANDARD SOLUTION*

**Purpose:** Primary calibration standard for the quantitative determination of copper, calibration of instruments and validation of method for the quantification/characterization of measurand.

Copper Standard Solution: 988 mg/kg ± 6 mg/kg

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**BND® 1004**  
*NICKEL STANDARD SOLUTION*

**Purpose:** Primary calibration standard for the quantitative determination of nickel, calibration of instruments and validation of method for the quantification/characterization of measurand.

Nickel Standard Solution: 979 mg/kg ± 5 mg/kg
**BND® 1005**  
**pH BUFFER SOLUTION 4.00**

**Purpose:** Calibration standard for calibration of pH instruments and validation of method for determination of the pH value.

pH Buffer Solution: 4.01 ± 0.03

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**BND® 1006**  
**pH BUFFER SOLUTION 7.00**

**Purpose:** Calibration standard for calibration of pH instruments and validation of method for determination of the pH value.

pH Buffer Solution: 7.00 ± 0.03
**BND® 1007**

**pH BUFFER SOLUTION 9.00**

**Purpose:** Calibration standard for calibration of pH instruments and validation of method for determination of the pH value.

pH Buffer Solution: 9.05 ± 0.05

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**BND® 1010**

**LEAD STANDARD SOLUTION**

**Purpose:** Primary calibration standard for the quantitative determination of lead, calibration of instruments and validation of method for the quantification/characterization of measurand.

Lead Standard Solution: 981 mg/kg ± 6 mg/kg
**BND® 1011**  
**ARSENIC STANDARD SOLUTION**

**Purpose:** Primary Calibration standard for quantitative determination of Arsenic calibration of instrument and validation of method for the quantification/characterization of the measurand.

Arsenic Standard Solution: 988 mg/kg ± 5 mg/kg

**BND® 1012**  
**MERCURY STANDARD SOLUTION**

**Purpose:** Primary calibration standard for the quantitative determination of Mercury, calibration of instruments and validation of method for the quantification/characterization of the measurand.

Mercury Standard Solution: 936 mg/kg ± 5 mg/kg
**BND® 1013**

**CADMIUM STANDARD SOLUTION**

**Purpose:** Primary Calibration standard for quantitative determination of Cadmium calibration of instrument and validation of method for the quantification/characterization of the measurand.

Cadmium Standard Solution: 979 mg/kg ± 6 mg/kg

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**BND® 1015**

**ZINC STANDARD SOLUTION**

**Purpose:** Primary Calibration standard for quantitative determination of Zinc calibration of instrument and validation of method for the quantification/characterization of the measurand.

Zinc Standard Solution: 982 mg/kg ± 6 mg/kg
**BND® 1016**

**POTASSIUM HYDROGEN PHTHALATE**

**Purpose:** Primary titrimetric standard for the standardization of volumetric standard solutions and validation of standard methods.

Potassium Hydrogen Phthalate: 100.00 ± 0.22 (w/w %)

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**BND® 1017**

**POTASSIUM DICHROMATE**

**Purpose:** Primary titrimetric standard for the standardization of volumetric standard solutions and validation of standard methods.

Potassium Dichromate: (99.92 ± 0.21) %
**BND® 1018**

**SODIUM CHLORIDE**

**Purpose:** Primary standard for the standardization of titrimetric and volumetric standard solutions for the validation of standard methods.

Sodium Chloride: 99.94 ± 0.27 (w/w %)

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**BND® 1019**

**IRON STANDARD SOLUTION**

**Purpose:** Primary Calibration standard for quantitative determination of Iron calibration of instrument and validation of method for the quantification/characterization of the measurand.

Iron standard solution: 983 mg/kg ± 7 mg/kg
**Purpose:** Gravimetric standard for the validation of standard methods and calibration

Total Dissolve Solids: 997 mg/kg ± 7 mg/kg

**Purpose:** Primary titrimetric standard for the standardization of volumetric standard solutions and validation of standard methods

Sodium Carbonate: 99.98 ± 0.19 (w/w %)
Purpose: Primary titrimetric standard for the standardization of volumetric standard solutions and validation of standard methods

Calcium Carbonate: 100.00 ± 0.20 (w/w %)
Company/Institute Name: Hindustan Petroleum Co. Ltd.
Address: Visakha new white oil terminal, Port connectivity road, opposite INS Dega
City: Visakhapatnam
ZIP: 530014
Email: hpcrm@hpcl.in
Telephone: 0891-2826906
Weblink: www.hindustanpetroleum.com
Foreword

HPCL and CSIR-National Physical Laboratory (National Measurement Institute of India) created history when the 28 numbers of Petroleum BNDs, the National Traceability standards for petroleum products certification, developed jointly by HPCL & CSIR – NPL were released on the historical occasion of World Metrology Day-20th May 2019(26 Nos) & CSIR Foundation day – 27.09.2019 (2 Nos). These BNDs will provide traceability for all vital parameters of Petroleum products testing and certification comprising of 15 physical properties, 02 Physicochemical Properties and 11 Chemical Properties including BND for sulfur content measurement at lower concentrations.

HPCL, a Maharatna CPSE, is playing significant role in meeting the energy demands of the nation. HPCL have a Quality Control dept in Marketing which monitors the quality of Petroleum products during the receipt, storage and distribution. QC dept of HPCL is pioneer in producing CRMs in India in the field of petroleum sector under “Make in India” initiative. CSIR National Physical Laboratory is the National Measurement Institute of India by act of Parliament and custodian of the fundamental units of measurement. “Accurate and precise measurements are essential to drive the growth engines of Indian Science & Industry”. Developing India’s measurement standards that are internationally accepted and disseminating the measurement capabilities is essential for progress. The need becomes all the more obvious in case of petroleum product used by various stakeholders including common man.

This initiative of HPCL has received Prestigious Quality Council of India- DL Shah National Quality Award in Platinum Category in year 2019. These BNDs were also launched on COMAR (Côde d’Indexation des MAteriaux de Référence), an international agency based in Germany which assist users in finding the Certified Reference Materials they need and thereby giving global reach for the BNDs. This initiative will not only save vital foreign exchange thru import substitution for CRMs rather will also ensure maintaining highest standard quality ecosystem for petroleum products. This initiative will be a milestone in ensuring “Self-Reliant India “and makes “Local Vocal “as per the clarion call given by Hon’ble Prime Minister.

C Madhusudan
Chief General Manager
Quality Control, HPCL
**BND® 7001**

**SULPHUR IN DIESEL**

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of total sulfur in diesel or materials of similar matrix.

Sulphur in Diesel: $2.5 \pm 0.75 \text{ mg/kg}$

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**BND® 7002**

**SULPHUR IN DIESEL**

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of total sulfur in diesel or materials of similar matrix.

Sulphur in Diesel: $5 \pm 1.5 \text{ mg/kg}$
**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of total sulfur in diesel or materials of similar matrix.

Sulphur in Diesel: \(10.0 \pm 1.5\) mg/kg

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of total sulfur in gasoline or materials of similar matrix.

Sulphur in Gasoline: \(25.0 \pm 2.5\) mg/kg
**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of total sulfur in gasoline or materials of similar matrix.

Sulphur in Gasoline: 50.0 ± 2.5 mg/kg
**BND® 7007  
SULPHUR IN KEROSINE**

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of total sulfur in kerosene or materials of similar matrix.

Sulphur in Kerosene: 1000 ± 20 mg/kg

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**BND® 7008  
DENSITY PETROLEUM OIL**

**Purpose:** Primary Standard for equipment performance check or calibration as per the standard test procedure.

Density: 824.9 ± 3.2 kg/m³
**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of Kinematic Viscosity.

Kinematic Viscosity at 40 °C: 2.917 ± 0.02 cSt

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of Kinematic Viscosity.

Kinematic Viscosity at 50 °C: 170.2 ± 0.6 cSt
**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of Kinematic Viscosity.

Kinematic Viscosity at 100 °C: 10.64 ± 0.04 cSt

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of Kinematic Viscosity.

Kinematic Viscosity at (-)20 °C: 3.171± 0.022 cSt
**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of Freezing Point.

Freezing Point: -57.5 ± 1.5°C

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of Flash Point (Abel).

Flash Point (Abel): 40.5 ± 1.5 °C
**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of Flash Point (PMCC).

Flash point PMCC: 74.5 ± 3.5 °C

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of Flash Point (COC).

Flash point COC: 212 ± 15 °C
**BND® 7017**  
**SMOKE POINT PETROLEUM**

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of total Smoke point of Petroleum Oils and materials of similar matrix like ATF matrix

Smoke Point: 23 ± 2 mm

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**BND® 7018**  
**DISTILLATION STANDARD-Group 2 PETROLEUM**

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of Distillation properties of Petroleum Oils or oils of similar matrix

Distillation Standard-Group 2: Range 34.3 to 193.4 °C
**BND® 7019**

**DISTILLATION STANDARD-Group 4 PETROLEUM**

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of Distillation properties of Petroleum Oils or oils of similar matrix.

Distillation Standard-Group 4: Range 182.2 to 362.8 °C

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**BND® 7020**

**POUR POINT PETROLEUM**

**Purpose:** Use for the evaluation of test methods Pour Point of Petroleum Oils or oils of similar matrix.

Pour Point: -6.0 ± 3.0°C
**BND® 7021**

**COLOUR SAYBOLT PETROLEUM**

**Purpose:** Calibration of instruments, evaluation of test methods and performance verification of equipment used in the determination of Saybolt Colour.

Colour Saybolt: 24± 1 Saybolt Colour units

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**BND® 7022**

**COLOUR ASTM MINERAL OIL**

**Purpose:** Use for the evaluation of test methods, performance verification of equipment used in the determination of Colour ASTM

Colour ASTM: 4 ± 1 ASTM Colour units
**BND® 7023**
*TOTAL BASE NUMBER MINERAL OIL*

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of total base number in Mineral oil / Mineral oil matrix matching material.

Total Base Number: Mass Fraction: $9.22 \pm 0.27$ mg KOH/g

**BND® 7024**
*TOTAL ACID NUMBER MINERAL OIL*

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of total acid number in Mineral oil / Mineral oil matrix matching material.

Total Acid Number: Mass Fraction: $1.64 \pm 0.12$ mg KOH/g
**BND® 7025**

**FIA-AROMATIC, OLEFINS, SATURATES Petroleum**

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of Aromatic, Olefins and Saturates content in Petroleum Oils or oils of similar matrix.

FIA-Aromatics, Olefins, Saturates:
- Aromatics: $17.0 \pm 1.2$ (%, v/v)
- Olefins: $0.9 \pm 0.1$ (%, v/v)
- Saturates: $82.1 \pm 1.2$ (%, v/v)

**BND® 7026**

**SULFUR IN GASOLINE**

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of total sulfur in Gasoline or materials of similar matrix.

Sulfur in Gasoline: $2.5 \text{ mg/kg} \pm 0.75 \text{ mg/kg}$
**BND® 7027  SULFUR IN GASOLINE**

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of total sulfur in Gasoline or materials of similar matrix.

Sulfur in Gasoline: 5.0 ± 1.5 mg/kg

**BND® 7028  SULFUR IN GASOLINE**

**Purpose:** Calibration of instruments and the evaluation of test methods used in the determination of total sulfur in Gasoline or materials of similar matrix.

Sulfur in Gasoline: 10.0 ± 1.5 mg/kg
**Company/Institute Name:** Global PT Provider Private Limited

**Address:** F-89/22, Okhla Industrial Area, Phase-I

**City:** NEW DELHI,

**ZIP:** 110020

**Email:** umesh@globalptprovider.com

**Telephone:** 011-40722200

**Weblink:** www.globalptprovider.com
Our Hardness blocks are certified through our ISO 17043 accredited Inter-laboratory certification program which is dedicated to the production and development of the highest quality certified reference materials (CRMs). A key feature of this program is the traceability of CRM to the National Physical Laboratory.

Global PT hardness test blocks set the standard for the industry and are made from the highest quality material to insure the most uniform and repeatable test blocks available. A comprehensive variety of scales and hardness test blocks are available to meet the wide ranges and hardness scales associated with Rockwell, Brinell and Vickers.

Umesh Gupta
Chief Executive Officer
**SCOPE OF THE COMPANY/ INSTITUTE**

Chemical Composition
Hardness Blocks (Rockwell, Vickers, Micro Vickers, Brinell)
Tensile Properties

**INDUSTRIAL DEMAND/MARKET:** 10 thousand Hardness Blocks in a year catering Automobile, Aerospace Industry, Commercial Metallurgical Laboratories etc.

**POTENTIAL USERS:** These blocks will serve Automobile, Metallurgical Testing Lab, Steel Manufacturing, Railway, Defence and Aerospace industry. We are also committed to help the whole Indian industry suffering with traceability issues from long time and launch more Indian reference materials which will effectively reduce the cost of Indian laboratories.

**ANNUAL SALE:** Projected Annual Sale is 20 Lakhs for first year and 1 crore next year

**SOCIETAL IMPACT:** This will reduce the import of at least 1.5 Crores in first year and 5 crores in next year
**BND® 2201**

**ROCKWELL HARDNESS**

**Purpose:** Rockwell Hardness reference blocks are used for periodic check or verification of hardness testing machines.

Rockwell Hardness (C Scale): 44.33±0.83

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**BND® 2202**

**ROCKWELL HARDNESS**

**Purpose:** Rockwell Hardness reference blocks are used for periodic check or verification of hardness testing machines.

Rockwell Hardness (C Scale): 61.04±0.77
Purpose: Vickers Hardness reference blocks are used for periodic check or verification of hardness testing machines.

Vickers Hardness (5 kgf/49.03N Load): 735.6±13.9
<table>
<thead>
<tr>
<th>S. No</th>
<th>BND® Number</th>
<th>Name of Material</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>BND 2005-P</td>
<td>Si/Pt nanorods</td>
<td>Magnification calibration Standard for TEM/SEM</td>
</tr>
<tr>
<td>2.</td>
<td>BND 1001-P</td>
<td>Aqueous Fluoride Standard Solution</td>
<td>Primary calibration standard for quantitative determination of fluoride</td>
</tr>
<tr>
<td>3.</td>
<td>BND 1002-P</td>
<td>Aqueous Copper Standard Solution</td>
<td>Primary calibration standard for quantitative determination of copper</td>
</tr>
<tr>
<td>4.</td>
<td>BND 2002-P</td>
<td>Alpha Quartz (SiO2)</td>
<td>Powder X-ray diffraction reference</td>
</tr>
<tr>
<td>5.</td>
<td>BND 2003-P</td>
<td>Mullite (Al₆Si₂O₁₃)</td>
<td>Powder X-ray diffraction reference</td>
</tr>
<tr>
<td>6.</td>
<td>BND 2006-P</td>
<td>Gold on Copper Grid</td>
<td>Magnification calibration Standard for TEM</td>
</tr>
<tr>
<td>7.</td>
<td>BND 3001-P</td>
<td>Contaminants in Rice Flour Standards</td>
<td>Toxic elements in Rice Flour for calibration of equipment</td>
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<td>8.</td>
<td>BND 2901-P</td>
<td>Gold Nano-Particle (15nm particle size)</td>
<td>Particle size standard</td>
</tr>
<tr>
<td>9.</td>
<td>BND 2007-P</td>
<td>Opto mMicro Ruler</td>
<td>Ruler Au/Ti on Si/SiO₂ substrate to calibrate optical microscopes, stereoscopes, scale rulers etc</td>
</tr>
<tr>
<td>10.</td>
<td>BND 2008-P</td>
<td>TransMicro Ruler</td>
<td>Ruler Au/Ti on ITO substrate to calibrate optical microscopes, stereoscopes, scale rulers etc</td>
</tr>
<tr>
<td>11.</td>
<td>BND 2010-P</td>
<td>Nano Squ &amp; Gaps</td>
<td>Nanosquares (Pt or W) and Nanogaps fabricated on carbon coated TEM grid to calibrate SEM and FESEM</td>
</tr>
<tr>
<td>12.</td>
<td>BND 2011-P</td>
<td>SEM Res Test Sample</td>
<td>Au nano islands on carbon tape or Si/SiO₂ substrate for magnification and resolution test of SEM</td>
</tr>
<tr>
<td>13.</td>
<td>BND 2012-P</td>
<td>Body/Tissue equivalent liquid 900MHz</td>
<td>The body/ tissue equivalent liquids are useful for SAR value assessments for various wireless devices and further estimation of their impact on humans. ACh liquid behaves at par with human body electric properties</td>
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<td>like permittivity, loss and conductivity at said frequency.</td>
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<td>14.</td>
<td>BND 2013-P</td>
<td>Body/Tissue equivalent liquid 1800MHz</td>
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<td>The body/ tissue equivalent liquids are useful for SAR value assessments for various wireless devices and further estimation of their impact on humans. ACH liquid behaves at par with human body electric properties like permittivity, loss and conductivity at said frequency.</td>
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<td>15.</td>
<td>BND 2014-P</td>
<td>Body/Tissue equivalent liquid 2100MHz</td>
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<td></td>
<td>The body/ tissue equivalent liquids are useful for SAR value assessments for various wireless devices and further estimation of their impact on humans. ACH liquid behaves at par with human body electric properties like permittivity, loss and conductivity at said frequency.</td>
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<td>16.</td>
<td>BND 2015-P</td>
<td>Body/Tissue equivalent liquid 2300MHz</td>
<td>The body/ tissue equivalent liquids are useful for SAR value assessments for various wireless devices and further estimation of their impact on humans. Each liquid behaves at par with human body electric properties like permittivity, loss and conductivity at said frequency.</td>
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<td>17.</td>
<td>BND 2016-P</td>
<td>Body/Tissue equivalent liquid 2450MHz</td>
<td>The body/ tissue equivalent liquids are useful for SAR value assessments for various wireless devices and further estimation of their impact on humans. Each liquid behaves at par with human body electric properties like permittivity, loss and conductivity at said frequency.</td>
</tr>
<tr>
<td>18.</td>
<td>BND 2017-P</td>
<td>Body/Tissue equivalent liquid 5800MHz</td>
<td>The body/ tissue equivalent liquids are useful for SAR value assessments for various wireless devices and further estimation of their impact on humans. Each liquid behaves at par with human body electric properties</td>
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<td>No.</td>
<td>Code</td>
<td>Description</td>
<td>Details</td>
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<tr>
<td>19.</td>
<td>BND 2018-P</td>
<td>Polystyrene</td>
<td>For GPC instrument calibration to defined the polymers in tern Mw, PDI etc</td>
</tr>
<tr>
<td>20.</td>
<td>BND 2019-P</td>
<td>Silicon Dioxide Film Thickness Standard</td>
<td>Calibration of Optical instruments such as single wavelength and spectroscopic ellipsometers and reflectometers for thickness</td>
</tr>
<tr>
<td>21.</td>
<td>BND 2020-P</td>
<td>Holmium Oxide Glass (Film) wavelength standard</td>
<td>Calibration of spectrophotometers</td>
</tr>
<tr>
<td>22.</td>
<td>BND 2021-P</td>
<td>Potassium Dichromate Solution</td>
<td>Calibration of absorbance scale in UV/Vis spectrophotometer</td>
</tr>
<tr>
<td>23.</td>
<td>BND 2022-P</td>
<td>Holmium oxide solution</td>
<td>Reference material for validating the wavelength scale of UV/Vis spectrophotometer</td>
</tr>
<tr>
<td>24.</td>
<td>BND 2902-P</td>
<td>ZnO nanoparticles (4-6 nm size, monodispersed solution)</td>
<td>Particle size calibration for electron microscopy</td>
</tr>
<tr>
<td>25.</td>
<td>BND 2903-P</td>
<td>Silica Nanoparticles (300 nm size) powder</td>
<td>Calibration of PM 2.5 and PM 10</td>
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<tr>
<td>No.</td>
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<td>26.</td>
<td>BND 2023-P</td>
<td>Cyclohexane</td>
<td>Wave number calibrator for Raman Spectrometer</td>
</tr>
<tr>
<td>27.</td>
<td>BND 3001-P</td>
<td>Honey</td>
<td>Carbohydrate contain in Honey</td>
</tr>
<tr>
<td>28.</td>
<td>BND 2024-P</td>
<td>Silicon Powder</td>
<td>XRD line position and shape</td>
</tr>
<tr>
<td>29.</td>
<td>BND 2025-P</td>
<td>LaB₆ Powder</td>
<td>XRD line shape and Intensity</td>
</tr>
</tbody>
</table>

**P- Provisional. (Temporarily BND number were allotted until the release)**
The comparable measurement i.e. “once measured or tested, globally accepted”, strengthen the quality life of the consumers and enhance the socio-economic fabric of the societies through unhindered trade.

The availability of indigenous BNDs in the country is poised to reinforce and realise National Mission on “Make in India” and “Self-Reliance”.

Compiled by: Dr S.P. Singh, Dr Pallavi Kushwaha, Dr Sandeep Singh
BND Management Section, CSIR-NPL