*भारतीय मानक* **IS 18724 : 2024**

***Indian Standard***

# ठोस जैव ईंधन — ईंधन विशिष्टताएँ और श्रेणियाँ — कृषि और जड़ी - बूटियों के अवशेषों से प्राप्त छर्रे

# Solid Biofuels — Fuel Specifications and Classes — Pellets from Agro and Herbaceous Residues

ICS 27.190; 75.160.40



भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

**June 2024** **Price Group 7**

Solid Mineral Fuels and Solid Biofuels Sectional Committee, PCD 07

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Solid Mineral Fuels and Solid Biofuels Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

Pellets from agro and herbaceous residues are manufactured from biomass originating from agriculture, herbaceous, fruit, and other renewable organic matter derived from trees, plants, crops, animal, municipal, agro-residue and agro-industrial waste or aquatic biomass, as well as blends or mixtures of woody and non-woody biomass.

These standard covers pellets for domestic and industrial use. Thermally treated biomass pellets (for example, torrefied pellets) are not included in this standard.

In general, agro and herbaceous residues have higher content of ash forming elements and produce ashes with lower melting temperature compared to most woody biomass. Different growing and soil conditions of the herbaceous or fruit biomass may influence the fuel ash composition. This may result in fouling, slagging and corrosion inside boilers. These problems are especially related to materials that have high content of potassium (K) and silicon (Si) and low content of calcium (Ca). The content of chlorine (Cl), phosphorus (P) and potassium (K) in the material may form chlorides and phosphates and other chemical compounds resulting in high hydrochloric acid emissions and chemically active ash causing corrosion. Special attention should be paid to the risk of corrosion in boilers and flue gas systems. Blending of agro and herbaceous residues with woody biomass can improve combustion characteristics.

Considerable assistance has been derived from ISO 17225-6 ‘Solid biofuels — Fuel specifications and classes Part 6: Graded non-woody pellets’ in development of this standard. Since, only agro residues and herbaceous residues are generally used non-woody biomass in India, the title, scope and the requirements have been modified when compared with ISO 17225-6. Terminology, few requirements, and sampling are same as mentioned in ISO 17225-6. Assistance has also been derived from report “Development of Standards and Guidelines for densified biomass products in Indian Context”, produced under Indo-German Technical operation project.

The composition of the Committee, responsible for the formulation of this standard is given in Annex C.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard*

# SOLID BIOFUELS — FUEL SPECIFICATIONS AND CLASSES — PELLETS FROM AGRO AND HERBACEOUS RESIDUES

## 1 SCOPE

This standard prescribes the fuel quality classes and specifications of pellets produced from agro and other herbaceous residues.

NOTES

1 Blends and mixtures include blends and mixtures from the main origin-based solid biofuel groups woody biomass, herbaceous biomass, fruit biomass and aquatic biomass. Blends are intentionally mixed biofuels, whereas mixtures are unintentionally mixed biofuels. The origin of the blend and mixture is to be described using ISO 17225-1 : 2021, Table 1. If solid biofuel blend or mixture contains chemically treated material, it shall be stated.

2 Thermally treated biomass pellets (for example, torrefied pellets) are not included in the scope of this standard.

## 2 REFERENCES

The standards listed in Annex A contain provisions, which through reference in the text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreement, based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards.

## 3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 18721 and in addition to, the following definitions shall apply.

**3.1 Additive** — Material which is intentionally introduced into the fuel feed stock to improve quality of fuel (for example, combustion properties), to reduce emissions or to make production more efficient.

NOTE — Trace amounts of grease or other lubricants that are introduced into the fuel processing stream as part of normal mill operations are not considered as additives.

**3.2 Biofuel Pellet —** Densified biofuel made with or without additives usually with a cylindrical form, random length typically 3 mm to 40 mm and diameter upto 25 mm and broken ends, produced by compressing biomass.

**3.3 Chemical Treatment** — Any treatment with chemicals other than air, water or heat.

NOTE — Examples of chemical treatment are listed in informative Annex C of ISO 17225-1.

**3.4 Non-woody Biomass** — Biomass originating from agriculture, herbaceous, fruit or aquatic biomass as well as blends or mixtures of woody and non-woody biomass.

**3.5 Non-woody Pellet** — Biofuel pellet (*see* **3.2**) made from non-woody biomass (*see* **3.4**).

## 4 REQUIREMENTS

**4.1** The material shall comply with the requirements of non-woody pellets given in Table 1 and Fig 1.

**4.2** In general, chemical treatment before harvesting of biomass does not need to be stated.

**4.2.1** However, the process of chemical treatment before harvesting need to be mentioned in the following cases:

a) If any operator in the fuel supply chain has reason to suspect serious contamination of the biomass;

b) The soil (for example, coal slag heaps) or if planting has been done specifically for the chemical sequestration; and

c) Biomass has been fertilized by sewage sludge (originating from wastewater treatment or chemical process).

In such cases, fuel analysis shall be done to identify chemical impurities such as halogenated organic compounds or heavy metals.

**4.2.2** In case of raw materials belonging to chemically treated herbaceous residue as per Table 1 of ISO 17225-1, the actual origin of the raw material shall be clearly reported.

**4.3** Further analysis may not be required, if data for chemical or physical properties is available.

**4.4** The amount of fines shall be reported before leaving the final point of loading for delivery to the end-user (*see* Table 1), to ensure that the end-user receives pellets with a low level of fines. While delivering pellets to the end-user, distributors should take appropriate measures to maintain this low level of fines.

**4.5** To ensure that pellets maintain their quality, the handling and storage (including the equipment) shall be appropriate at different stages of supply or delivery chain ending to the end-user storage.

NOTE — The fines requirements are included to ensure small-scale users, while operating their combustion plant/appliances are protected from handling and combustion issues.

## 5 PACKING AND MARKING

### 5.1 Packing

The material shall be as agreed between the purchaser and the supplier.

### 5.2 Marking

**5.2.1** When the material is packed in packages, packages shall be marked with the following:

a) Name of the feedstock material or blend or mixtures;
b) Name of manufacturer and his recognized trade-mark, if any;
c) Month and year of manufacture;
d) Net mass of the material;
e) Dimensions of the pellets;
f) Lot number; and
g) Any other statutory requirements.

**5.2.2** If pellets are available in general market for sale in addition to above information the following basic quality parameters shall be stated:

a) Gross calorific value;
b) Proximate analysis; and
c) Name and proportion (in percent) of the feedstock material or blend or mixtures used for preparation of the pellet.

**5.2.3** *BIS Certification Marking*

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the rules and regulations framed thereunder, and the products may be marked with the Standard Mark.

## 6 SAMPLING

The sampling and sample preparation shall be done as per ISO 18135 or ISO 21945 and IS 18640 respectively.

## 7 TEST METHODS

Tests shall be conducted according to the method of test referred in col (5) and col (6) of Table 1.

**Table 1 Requirements of Pellets Derived from Agro and Herbaceous Residues.**

(*Clauses* 1, 4.1, 4.2.2, 4.4 *and* 7, Annex B)

| Sl. No | Characteristic | Requirements | | Methods of Test, Ref to | |
|---|---|---|---|---|---|
| | | A | B | IS/ Annex | ISO |
| (1) | (2) | (3) | (4) | (5) | (6) |
| i) | Origin and source[1)] | Agro residues and other herbaceous biomass | | — | — |
| ii) | Diameter and length, mm | To be reported | | IS 17643 | — |
| iii) | Moisture, percent by mass, wet basis | ≤ 14 | | ≤ 14 | IS 17655 (Part 1)/ IS 17655 (Part 2) |

| Sl. No | Characteristic | Requirements | | Methods of Test, Ref to | |
|---|---|---|---|---|---|
| | | A | B | IS/ Annex | ISO |
| (1) | (2) | (3) | (4) | (5) | (6) |
| iv) | Ash, percent by mass, dry | ≤ 15 | | ≤ 15 | IS 17653 |
| v) | Mechanical durability[2)], percent mass | ≥ 95 | | ≥ 95 | IS 18557 (Part 1) |
| vi) | Fines, percent mass | ≤ 5 | | ≤ 5 | IS 17656 |
| vii) | Additives[3)], percent mass | Type and amount to be reported. | | — | — |
| viii) | Gross calorific value, kcal/kg | A1: ≥ 2 800 to < 3 000<br>A2: ≥ 3 000 | B1: ≥ 2 800 to < 3 000<br>B2: ≥ 3 000 | IS 17654 | — |
| ix) | Particle size, mm | a) Pass through 2 mm mesh size, percent, *Min* = 75<br>b) Pass through 3 mm mesh size, percent = 100 | — | B | — |
| x) | Bulk density, kg/m$^3$ | To be reported | | IS 17642 | |
| xi) | Nitrogen, percent mass in dry | To be reported | | IS 17832 | — |
| xii) | Sulphur, percent mass in dry | To be reported | | IS 17833 | — |
| xiii) | Chlorine, percent mass in dry | To be reported | | IS 17833 | |
| xiv) | Arsenic (As), mg/kg dry | To be reported | | — | ISO 16968 |
| xv) | Cadmium (Cd), mg/kg dry | To be reported | | — | ISO 16968 |
| xvi) | Chromium (Cr), mg/kg dry | To be reported | | — | ISO 16968 |
| xvii) | Copper (Cu), mg/kg dry | To be reported | | — | ISO 16968 |
| xviii) | Lead (Pb), mg/kg dry | To be reported | | — | ISO 16968 |
| xix) | Mercury (Hg), mg/kg dry | To be reported | | — | ISO 16968 |
| xx) | Nickel (Ni), mg/kg dry | To be reported | | — | ISO 16968 |

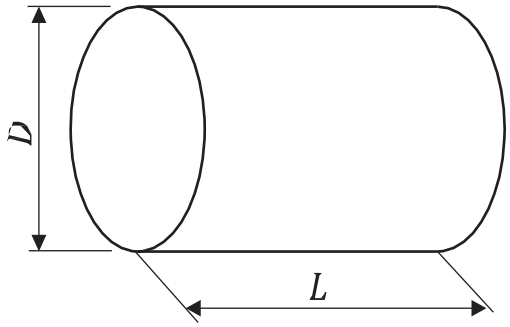
| Sl. No | Characteristic | Requirements | | Methods of Test, Ref to | |
|---|---|---|---|---|---|
| | | A | B | IS/ Annex | ISO |
| (1) | (2) | (3) | (4) | (5) | (6) |
| xxi) | Zinc (Zn), mg/kg dry | To be reported | | — | ISO 16968 |

NOTES

**1** Name and proportion (in percent) of the feedstock material or blend and mixtures used for preparation of the pellet shall be reported. Saw dust and other permitted woody biomass may be used in the blend to achieve the desired quality.

**2** At final point of loading in bulk transport (at the time of loading) and in small (up to 20 kg) and big bags (at time of packing).

**3** Type and amount of additive(s) to aid production, delivery or combustion (for example, pressing aids, slagging inhibitors or any other additives like starch, corn flour, potato flour, vegetable oil, and lignin) shall be reported.




All dimensions are in mm

FIG. 1 DIMENSIONS OF PELLETS

where

$D$ = diameter; and

$L$ = length.

## ANNEX A

(*Clause* 2)

## LIST OF REFERRED STANDARDS

| *IS No./Other standards* | *Title* |
|---|---|
| IS 17642 : 2021/ ISO 17828 : 2015 | Solid biofuels — Determination of bulk density |
| IS 17643 : 2021/ ISO 17829 : 2015 | Solid biofuels — Determination of length and diameter of pellets |
| IS 17653 : 2021/ ISO 18122 : 2015 | Solid biofuels — Determination of ash content |
| IS 17654 : 2021/ ISO 18125 : 2017 | Solid biofuels — Determination of calorific value |
| IS 17655 (Part 1) : 2021/ ISO 18134-1 : 2015 | Solid biofuels — Determination of moisture content — Oven dry method: Part 1 Total moisture — Reference method |
| IS 17655 (Part 2) : 2021/ ISO 18134-2 : 2017 | Solid biofuels — Determination of moisture content — Oven dry method: Part 2 Total moisture — Simplified method |
| IS 17656 : 2021/ ISO 18846 : 2016 | Solid biofuels — Determination of fines content in samples of pellets |
| IS 17832 : 2022/ ISO 16948 : 2015 | Solid biofuels — Determination of total content of carbon, hydrogen and nitrogen |
| IS 17833 : 2022/ ISO 16994 : 2016 | Solid biofuels — Determination of total content of sulfur and chlorine |
| IS 18557 (Part 1) : 2024/ ISO 17831-1 : 2015 | Solid biofuels — Determination of mechanical durability of pellets and briquettes: Part 1 Pellets |
| IS 18640 : 2024 | Solid biofuels — Sample preparation |
| IS 18721 : 2024 | Solid biofuels — Vocabulary |
| ISO 16968 : 2015 | Solid biofuels — Determination of minor elements |
| ISO 17225-1 : 2021 | Solid biofuels — Fuel specifications and classes : Part 1 General requirements |
| ISO 18135 : 2017 | Solid biofuels — Sampling |
| ISO 21945 : 2020 | Solid biofuels — Simplified sampling method for small scale applications |

## ANNEX B

[Table 1 *and* Sl No. (ix)]

## DETERMINATION OF PARTICLE SIZE

### B-1 SIEVE ANALYSIS

Sample of non-torrefied biomass pellets will be tested for particle size distribution after pulverizing 50 g crushed pellets sample in a lab pulverizer for 1.5 min or any fixed time period as found suitable by testing laboratory incharge and measuring the passing proportion of the pulverized sample by sieving it through 2 mm and 3 mm mesh size sieve.

**ANNEX C**

(*Foreword*)

**COMMITTEE COMPOSITION**

Solid Mineral Fuels and Solid Biofuels Sectional Committee, PCD 07

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|---|---|
| CSIR - Central Institute for Mining and Fuel Research, Dhanbad | PROF ARVIND KUMAR MISHRA (***Chairperson***) |
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| Coal India Limited, Kolkata | SHRI SUBHASIS SAHU |
| CSIR - Central Institute for Mining and Fuel Research, Dhanbad | DR ASHOK KUMAR SINGH<br>DR SUJAN SAHA (*Alternate*) |
| CSIR - Institute of Minerals and Materials Technology, Bhubaneswar | DR SUDDHASATWA BASU<br>DR D. S. RAO (*Alternate* I)<br>DR MANISH KUMAR (*Alternate* II) |
| CSIR - National Metallurgical Laboratory, Jamshedpur | DR SANCHITA CHAKRAVARTY<br>SHRIMATI RUPA DAS BISWAS (*Alternate*) |
| Geological Survey of India, Kolkata | DR SUDIP BHATTACHARYYA |
| Hindalco Industries Limited, Ranchi | SHRI MIRAJUL HAQUE<br>DR RAHUL MITRA (*Alternate*) |
| Indian Council of Agricultural Research, New Delhi | DR PANNA LAL SINGH |
| Indian Institute of Technology (ISM), Dhanbad | DR S. BHATTACHARYA |
| Indian Metals and Ferro Alloys Limited, Bhubaneswar | SHRI DINESH KUMAR MOHANTY (*Alternate*) |
| Mahanadi Coal Field Limited, Burla | SHRI RAVIKESH KUMAR RAJU<br>SHRI NEERAJ KALLA (*Alternate*) |

| *Organization* | *Representative(s)* |
|---|---|
| Ministry of Coal, New Delhi | SHRI ANINDYA SINHA |
| Ministry of Environment Forest and Climate Change, New Delhi | SHRI N. SUBRAHMANYAM |
| Ministry of New and Renewable Energy, New Delhi | SHRI HIREN CHANDRA BORAH<br>SHRI VIKRAM DHAKA (*Alternate*) |
| National Council for Cement and Building Materials, Faridabad | SHRI ANKUR MITTAL<br>SHRI GAURAV BHATNAGAR (*Alternate*) |
| NLC India Limited, Chennai | SHRI R. SHANMUGASUNDARAM<br>SHRI G. THIRUMURUGAN (*Alternate*) |
| National Test House, Kolkata | SHRI S. K. LAHA<br>SHRI RATUL BEZBARUAH (*Alternate*) |
| Northern Coalfields Limited, Singrauli | SHRI SATISH JHA |
| Steel Authority Of India Limited (SAIL), Research & Development Centre for Iron & Steel, Ranchi | SHRI K. K. MANJHI<br>SHRI B. CHAKRABORTY (*Alternate*) |
| Tata Power Limited, Mumbai | SHRI PRAVASH SINHA |
| Tata Steel Limited, Kolkata | SHRI B. K. SINGH<br>SHRI H. N. PRASAD (*Alternate*) |
| The Energy and Resources Institute, New Delhi | SHRI SUNIL DHINGRA<br>SHRI N. K. RAM (*Alternate*) |
| The Singareni Collieries Company Limited, Kothagudem | SHRI SYED HABEEB HUSSAIN |
| BIS Directorate General | SHRIMATI MEENAL PASSI , SCIENTIST 'F'/SENIOR DIRECTOR AND HEAD (PETROLEUM COAL AND RELATED PRODUCTS) [REPRESENTING SENIOR DIRECTOR (*Ex-officio*)] |

*Member Secretary*
MS. ADITI CHOUDHARY
SCIENTIST 'B'/ASSISTANT DIRECTOR
(PETROLEUM, COAL AND RELATED PRODUCTS), BIS

Solid Biofuels Subcommittee, PCD 7 : 6

| *Organization* | *Representative(s)* |
|---|---|
| CSIR - Central Institute for Mining and Fuel Research, Dhanbad | DR R. E. MASTO (***Convenor***) |
| Abellon Cleanenergy Limited, Ahmedabad | SHRI PANKAJ PATEL<br>DR BEENA PATEL (*Alternate*) |
| Central Electricity Authority, New Delhi | SHRI JITESH SHRIVAS<br>SHRI MD. ZUHAIB (*Alternate*) |
| Central Power Research Institute, Bengaluru | SHRI PRAFULCHANDRA R. DONGRE |

| *Organization* | *Representative(s)* |
|---|---|
| CSIR - Central Institute for Mining and Fuel Research, Dhanbad | DR S. G. SAHU (*Alternate* I)<br>DR PINAKI SARKAR (*Alternate* II) |
| CSIR - Central Mechanical Engineering Research Institute, Durgapur | DR KRISHENDU KUNDU |
| CSIR - Institute of Minerals and Materials Technology, Bhubaneswar | DR SUDDHASATWA BASU<br>DR D. S. RAO (*Alternate* I)<br>DR MANISH KUMAR (*Alternate* II) |
| CSIR - Indian Institute of Petroleum, Dehradun | DR Y. SUDHAKAR REDDY<br>DR GANESH NAIK (*Alternate*) |
| Defence Research Development Organization, Ministry of Defence, New Delhi | DR PRAKASH |
| EID - Parry India Limited, Chennai | SHRIMATI SIVARANI. J<br>SHRI K. SENTHIL ENIYAN, (*Alternate*) |
| ICAR - Central Institute of Agricultural Engineering, Bhopal | DR VINOD K. BHARGAVA<br>DR SANDIP GANGIL (*Alternate*) |
| Indian Institute of Engineering Science and Technology, Shibpur | DR SUDIP GHOSH |
| Jadavpur University, Kolkata | PROF SUDIPTA D. E |
| Kalpa Taru Power Transmission Limited, Biomass Power Plant, Padampur | SHRI HITESH GOYAL |
| Maharana Pratap University of Agricultural and Technology, Udaipur | DR SUDHIR JAIN<br>DR N. L. PANWAR (*Alternate*) |
| Ministry of New and Renewable Energy, New Delhi | SHRI HIREN CHANDRA BORAH<br>SHRI VIKRAM DHAKA (*Alternate*) |
| NTPC Limited, New Delhi | SHRI PIYUSH SRIVASTAVA |
| Orient Green Power Company Limited, Chennai | DR R. KULOTHUNGAN<br>SHRI S. SUDARSAN (*Alternate*) |
| Punjab Agricultural University, Ludhiana | DR SARBJIT SINGH SOOCH |
| Sardar Patel Institute of Technology, Petroleum, Coal and Related Products Department, Vadodara | DR MADHURI NARRA |
| Steel Authority of India Limited (SAIL), Research & Development Centre for Iron & Steel, Ranchi | SHRIMATI NEETA CHAKRAVARTY<br>DR B. K. SAHOO (*Alternate*) |
| The Energy and Resources Institute, New Delhi | DR ASHVINI KUMAR<br>SHRI N. K. RAM (*Alternate* I)<br>VARUN GROVER (*Alternate* II) |
| IN PERSONAL CAPACITY (*B-178, Aakriti Garden, Nehru Nagar, Bhopal - 462003*) | DR ANIL KUMAR DUBEY |
| IN PERSONAL CAPACITY (*Prachi Apartment, Bl A, Fl 4 A , 127 Ho Chi Min Sarani. Behala, Near Bidya Bharati School,Kolkata - 700 008*) | SHRI ASHIM KUMAR BHATTACHARYA |

Panel for formulation of this Standard

| *Organization* | *Representative(s)* |
|---|---|
| CSIR - Central Institute for Mining And Fuel Research, Dhanbad | DR R. E. MASTO (***Convener***) |
| Abellon Cleanenergy Limited, Ahmedabad | DR BEENA PATEL |
| Biofuel circle Private Limited, Pune | SHRI SUHAS BAXI |
| Central Power Research Institute, Bengaluru (also Member of National Mission on use of biomass in Thermal Power Plants) | SHRI PRAFULCHANDRA R. DONGRE |
| CSIR - Central Mechanical Engineering Research Institute, Durgapur (Center of Excellence for Farm Machinery) | DR PRADEEP RAJAN |
| CSIR- Indian Institute of Petroleum, Dehradun | DR THALLADA BHASKAR |
| Indian Institute of Engineering Science And Technology, Shibpur | DR. SUDIP GHOSH |
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| NTPC Limited, New Delhi | SHRI AMIT KULSHESTRA |
| Punjab Renewable Energy Systems Private Limited, Mumbai | LT COL MONISH AHUJA |
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| Tata Steel Limited, Jamshedpur | DR SACHCHIT KUMAR MAJHI |
| In Personal Capacity (*B-178, Aakriti Garden, Nehru Nagar, Bhopal - 462003*) | DR ANIL KUMAR DUBEY |

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

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**BUREAU OF INDIAN STANDARDS**

**Headquarters:**

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
*Telephones*: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

| **Regional Offices:** | | *Telephones* |
|---|---|---|
| Central | : 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002 | 2323 7617 |
| Eastern | : 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091 | 2367 0012<br>2320 9474 |
| Northern | : Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019 | 265 9930 |
| Southern | : C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113 | 2254 1442<br>2254 1216 |
| Western | : Manakalya, 4th Floor, NTH Complex (W Sector), F-10, MIDC, Andheri (East), Mumbai 400093 | 283 25838 |

**Branches** : AHMEDABAD, BENGALURU, BHOPAL, BHUBANESHWAR, CHANDIGARH, CHENNAI, COIMBATORE, DEHRADUN, DELHI, FARIDABAD, GHAZIABAD, GUWAHATI, HARYNA, HUBLI, HYDERABAD, JAIPUR, JAMMU & KASHMIR, JAMSHEDPUR, KOCHI, KOLKATA, LUCKNOW, MADURAI, MUMBAI, NAGPUR, NOIDA, PARWANOO, PATNA, PUNE, RAIPUR, RAJKOT, SURAT, VIJAYAWADA.

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