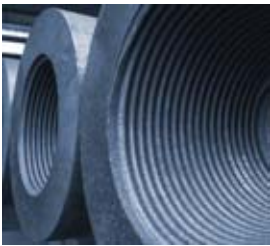


World Class
UHP
Graphite Electrodes



**Proven Choice Of
Top Steel Makers
Globally**



**HEG LIMITED
INDIA**





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Unit Locations

- ★ Graphite Electrodes
- Hydro Electric Power
- Textile
- Steel
- Co-Power Generation
- IT Enabled Services

Group Profile



The 500 million dollar LNJ Bhilwara Group is a diversified group with interests in **Graphite Electrodes, Textiles, Steel, Power Generation** and **IT Enabled Services**, headquartered in Noida (New Delhi) India.

In its over four-decade long existence, the LNJ Bhilwara Group has come to be identified with quality and technology. Six of the Group companies have been awarded ISO 9001:2000 certification for their exemplary quality standards. The fact that export earnings comprise over **forty percent** of the Group's turnover underlines its high quality standards.



About Us

H_{EG} Ltd, a premier company of this group, is today India's leading graphite electrode manufacturer. It has one of the largest integrated graphite electrode **plant in South Asia**, processing the sophisticated UHP (Ultra High Power) Electrodes with technology from SERS-a subsidiary of **Pechiney, France**.

No wonder the company exports over 80% of its production to more than 25 countries of the world.

The position the company enjoys today in India and abroad is largely due to its commitment to constant upgradation of the product quality to match international standards and the challenge to win and excel in all situations.



Executive Focus

Engineering a New Future

In 1990's we set our vision to be a vibrant globally acknowledged top league player in Graphite Electrodes & allied businesses with commitment to growth, innovation, quality & customer focus.

With focus on UHP grade electrode, we expanded our product range and established the same on some of the toughest furnaces at our customers. Today, we have years of experience supplying quality UHP grade electrodes all over the world.

The encouragement from our customers has led us to increase production capacity and become a significant global producer of quality UHP grade electrodes for EAF/LF application. Our ability to source the best raw material from sources worldwide and the strength of our human resources has been the key to our growth.

We now have upgraded technology using some of the equipment incorporating latest changes in manufacturing technology.

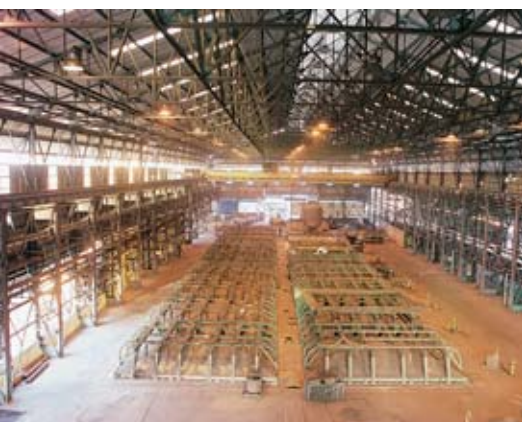
As a responsible graphite electrode manufacturer, we continue to invest in technology, development of new products and our human resources.

H_{EG}, an ISO 14001:1996 company, is fully aware of the ecological impact of its processes and actions can have and has put in place effective mechanisms to minimise any negative fallout. Also, the Company has carried out comprehensive afforestation programme in and around its facilities.

The Company's facility at Mandideep has been regarded one of the cleanest graphite electrode plant in the world when seen in the light of the material used and the products manufactured there. Moreover the Company has ensured compliance with all regulatory norms



H_{EG} Ltd. an **ISO-9001-2000** Company, has its Graphite Plant located at Mandideep near Bhopal (India). Set in a total area of 100 acres. HEG is one of the largest integrated graphite plant in South Asia.



Reidhammer Baking Furnace



Mixing in Green Shop



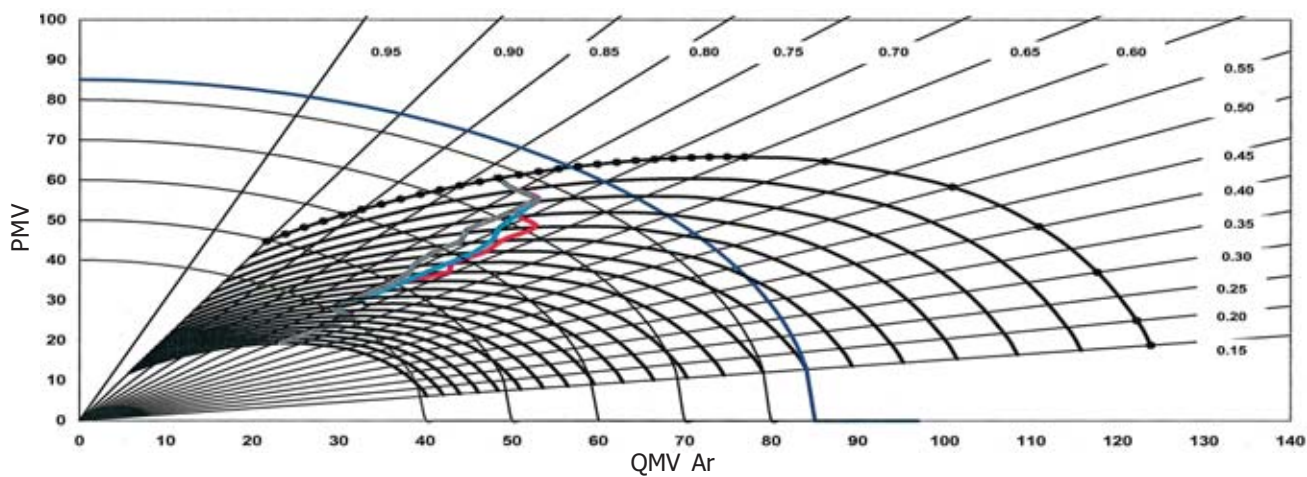
PLC Control Room

Application Assistance

Besides Technical Friendship with the Customers, HEG offers a complete Customized Package for Advanced Technical Support to their Customers. Few salient features of this activity are:

- **Advanced Metallurgical assistance for various Steel Applications.**
- **Suggestions for Cost effective Productivity enhancement.**
- **Structured Electrode Regulation Analysis.**

Circle Diagram

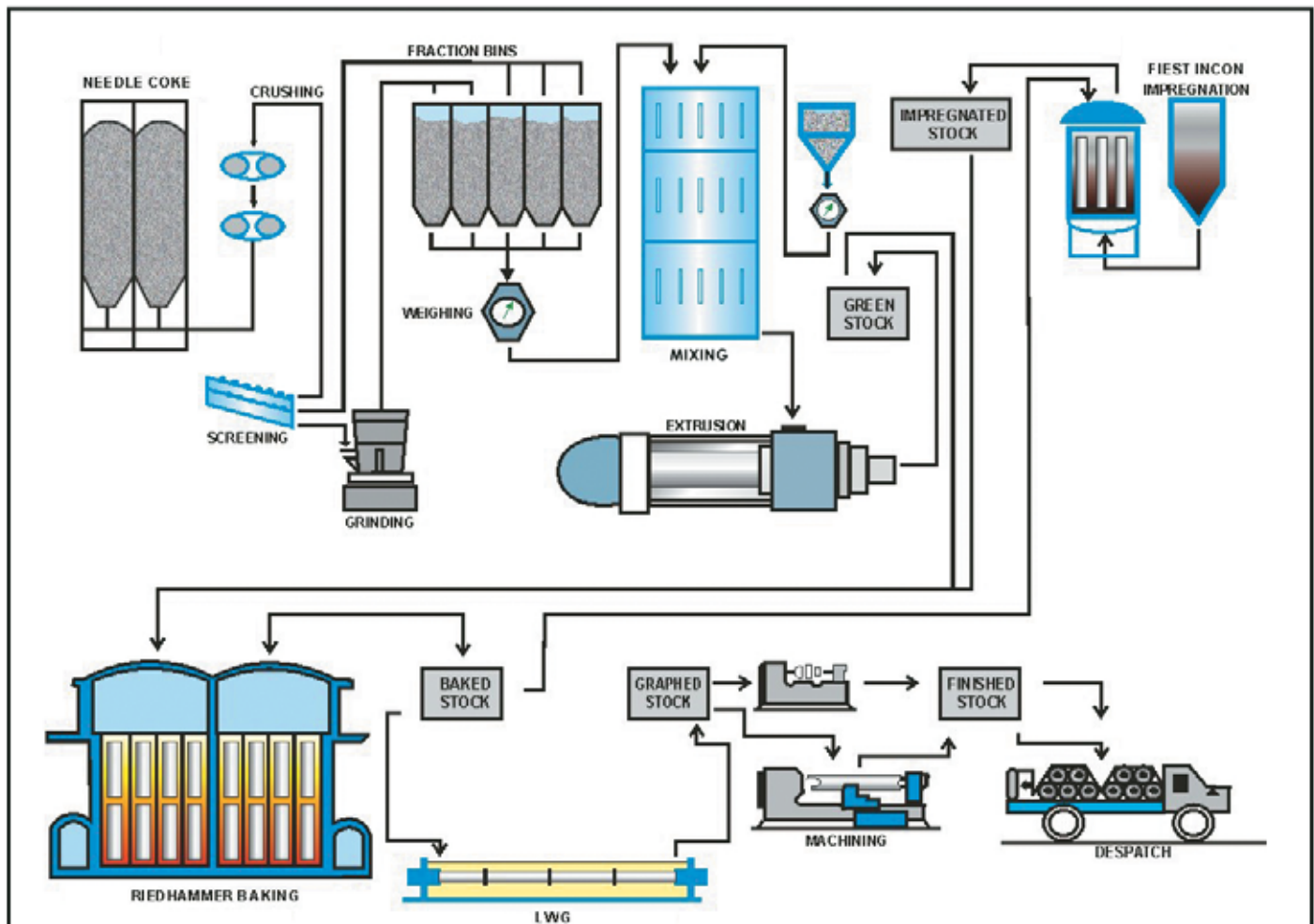


Process

- Needle coke is crushed, screened and mixed with pitch in controlled proportion and extruded to make green electrodes.
- Green electrodes are then baked slowly by heating up to 800°C to coke the pitch and remove the volatile matter.
- UHP electrodes are then impregnated with special pitch to increase the density and strength. They are then baked again to coke the pitch.
- Baked electrodes are then heated up to 2800-3000°C in lengthwise electric resistance furnaces to convert carbon to graphite.

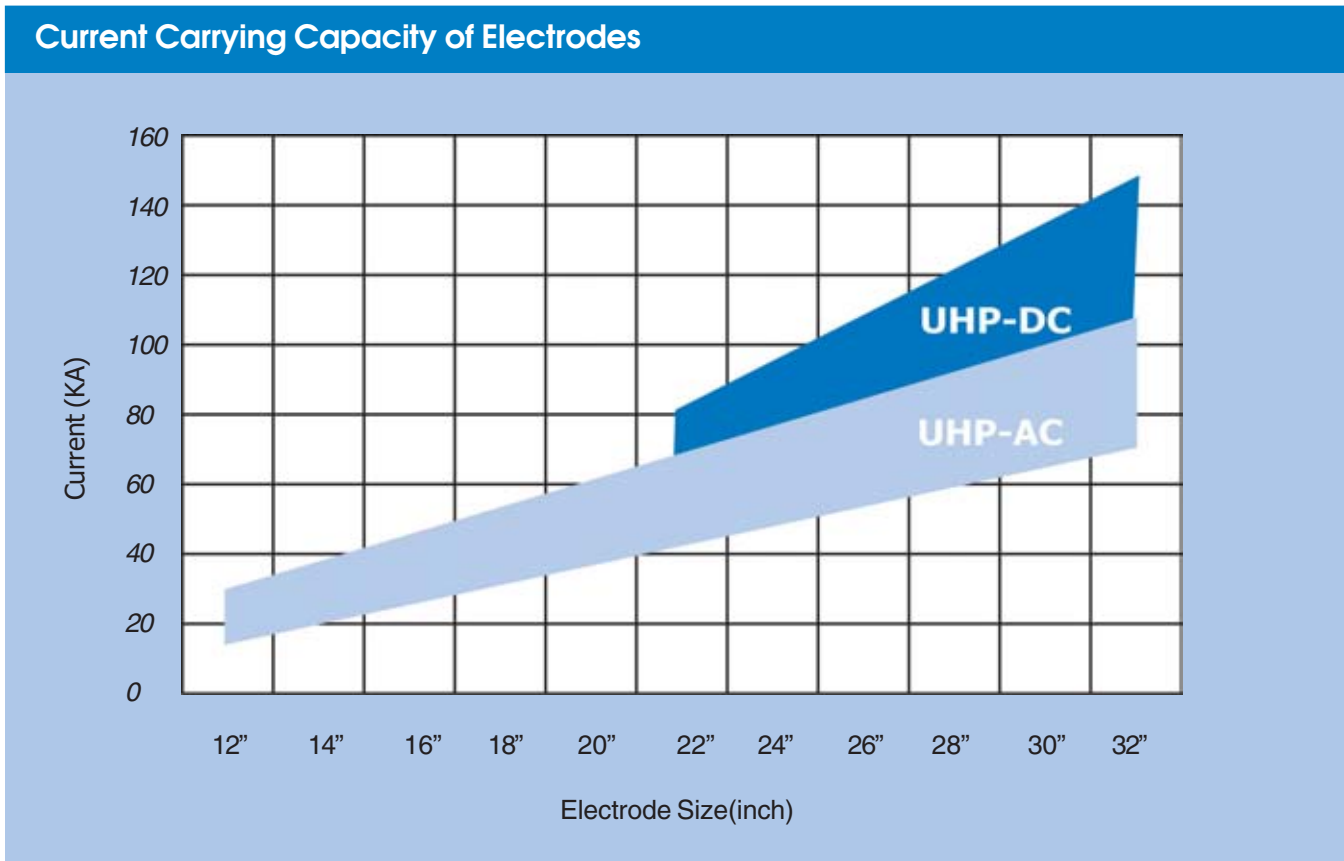
After stringent quality tests the graphitized electrodes are machined in required diameter and matching end sockets to accept threaded nipples.

Production Flow Chart



Specifications

Ultra High Power



Specific conditions such as mechanical requirement, tap to tap time, oxygen blowing etc., should also be considered. The choice of most suitable grade can only be the result of discussion with our engineer.

Typical Characteristics-UHP-Grade

| SPECIFICATIONS | UNIT | ELECTRODE DIA | | | UHP (DC) 600mm to 800mm 24" to 32" | Matching Nipples |
|---|--------------------------------|---------------------------------|---------------------------------|---------------------------------|---|---------------------|
| | | 300mm to 400mm 12" to 16" | 450mm to 600mm 18" to 24" | 650mm to 700mm 26" to 28" | | |
| APPARENT DENSITY | GMS/CC | 1.66 TO 1.76 | 1.66 TO 1.76 | 1.66 TO 1.76 | 1.68-1.76 | 1.73-1.85 |
| COEFFICIENT OF THERMAL EXPANSION 20° C-100° C | 10 ⁻⁶ /° C | 0.2 TO 0.55 | 0.2 TO 0.55 | 0.2 TO 0.55 | 0.2 TO 0.55 | 0.1-0.5 |
| FLEXURAL STRENGTH | N/mm ² Lbs/SQ IN | 9 TO 14 1305 TO 2030 | 9 TO 14 1305 TO 2030 | 7 TO 13 1015 TO 1885 | 8 TO 13 1160 TO 1885 | 22-30 3190-4350 |
| SPECIFIC ELECTRICAL RESISTIVITY | MICRO OHM METER | 4.5 TO 6.0 | 4.5 TO 5.5 | 4.5 TO 5.2 | 4.5-5.2 | 3.6-4.5 |
| | MICRO OHM INCH | 177 TO 236 | 177 TO 216 | 177 TO 204 | 177 TO 204 | 142-177 |

Note :The values given in this catalogue are for purpose of information only and do not constitute any contractual obligation.

Standard Size & Weights of Electrodes

The weights indicated are approximate and calculated using average dimensions and densities.

| NOMINAL DIMENSIONS | | AVERAGE WEIGHT (Preset Electrode) | |
|--------------------|----------|-----------------------------------|------|
| Dia. x Length | | Ultra High Power (UHP) | |
| INCH | MM | Lbs | Kg |
| 12x72 | 300x1800 | 509 | 231 |
| 14x72 | 350x1800 | 676 | 314 |
| 14x84 | 350x2100 | 787 | 363 |
| 16x72 | 400x1800 | 906 | 418 |
| 16x84 | 400x2100 | 1050 | 483 |
| 16x96 | 400x2400 | 1200 | 550 |
| 18x72 | 450x1800 | 1118 | 525 |
| 18x84 | 450x2100 | 1360 | 615 |
| 18x96 | 450x2400 | 1545 | 700 |
| 20x72 | 500x1800 | 1415 | 660 |
| 20x84 | 500x2100 | 1602 | 750 |
| 20x96 | 500x2400 | 1925 | 870 |
| 20x110 | 500x2700 | 2167 | 985 |
| 22x72 | 550x1800 | 1683 | 800 |
| 22x84 | 550x2100 | 1991 | 925 |
| 22x96 | 550x2400 | 2321 | 1050 |
| 22x110 | 550x2700 | 2607 | 1185 |
| 24x72 | 600x1800 | 2013 | 950 |
| 24x84 | 600x2100 | 2365 | 1100 |
| 24x96 | 600x2400 | 2750 | 1250 |
| 24x110 | 600x2700 | 3080 | 1400 |
| 26x110 | 650x2700 | 3630 | 1650 |
| 28x110 | 700x2700 | 4270 | 1940 |
| 30x110 | 750x2700 | 4732 | 2200 |
| 32x110 | 800x2700 | 5456 | 2510 |



Electrode

Dimensions

The machined dimension of our products are in accordance with recommendations made by the International Electro-thermic Commission. Nevertheless, because of the very strict machining tolerances which have been adopted in our production process we recommend the use of our electrodes with our nipples, which are carefully matched to ensure the best performance. Likewise our products are matched according to their physical properties. However, our electrodes and nipples are interchangeable with those of other suppliers.

Dimensional Tolerances

Our electrodes are usually offered with tapered nipples, 4 or 3 threads per inch, to the internationally accepted tolerances as per **NEMA/IEC-239(1987)/IS-9050 (1979)** specifications.



Product Testing

DIMENSIONAL TOLERANCES

| NOMINAL DIAMETER | | ACTUAL DIAMETER | | | |
|------------------|-----|-----------------|-----|---------|-----|
| | | Minimum | | Maximum | |
| INCH | MM | INCH | MM | INCH | MM |
| 12 | 300 | 11.89 | 302 | 12.09 | 307 |
| 14 | 350 | 13.86 | 352 | 14.05 | 357 |
| 16 | 400 | 15.87 | 403 | 16.06 | 408 |
| 18 | 450 | 17.87 | 454 | 18.11 | 460 |
| 20 | 500 | 19.88 | 505 | 20.12 | 511 |
| 22 | 550 | 21.89 | 556 | 22.12 | 562 |
| 24 | 600 | 23.90 | 607 | 24.13 | 613 |
| 26 | 650 | 25.87 | 657 | 26.10 | 663 |
| 28 | 700 | 27.87 | 708 | 28.11 | 714 |
| 30 | 750 | 29.87 | 759 | 30.12 | 765 |
| 32 | 800 | 31.88 | 810 | 32.12 | 816 |

Any specific requirement on dimensions can be offered

| NOMINAL LENGTH | | ACTUAL LENGTH | | | | MINIMUM LENGTH FOR AN ELECTRODE | |
|----------------|------|---------------|------|---------|------|---------------------------------|------|
| | | MINIMUM | | MAXIMUM | | | |
| INCH | MM | INCH | MM | INCH | MM | INCH | MM |
| 60 | 1500 | 56 | 1400 | 61 | 1550 | 48 | 1225 |
| 72 | 1800 | 67 | 1700 | 75 | 1905 | 60 | 1525 |
| 84 | 2100 | 78 | 1975 | 87 | 2210 | 72 | 1825 |
| 96 | 2400 | 90 | 2275 | 99 | 2515 | 84 | 2125 |
| 110 | 2700 | 100 | 2550 | 114 | 2895 | 94 | 2400 |

Each shipment may comprise upto 15% of short length electrodes

Dimensions

Nipples are tapered and generally have 4 threads per inch. However, if required, they can be made with 3 threads per inch but only with electrodes of 300 mm (12") diameter and above. These are shown in following tables:



Nipple Chain

| DIMENSION OF ELECTRODES WITH 4 TPI NIPPLES | | | | | | | | | | |
|--|-----|--------|-----|--------------------------|--------|--------|----------------------------|--------|--------|--------|
| ELECTRODES | | | | NIPPLES 4 THREADS / INCH | | | | | | |
| NOMINAL DIA | | DEPTH | | IEC DESIG- NATION | LENGTH | | MAXIMUM DIA AVERAGE WEIGHT | | | |
| INCH | MM | INCH | MM | | INCH | MM | INCH | MM | lb | kg |
| 12 | 300 | 4.370 | 111 | 177T4N | 8.5 | 216.0 | 7.000 | 177.80 | 15.50 | 7.00 |
| 14 | 350 | 5.118 | 130 | 203T4N | 10.0 | 254.0 | 8.000 | 203.20 | 24.25 | 11.00 |
| 16 | 400 | 6.102 | 155 | 222T4N | 12.0 | 304.8 | 8.750 | 222.25 | 34.20 | 15.50 |
| 16L | 400 | 7.125 | 181 | 222T4L | 14.0 | 355.6 | 8.750 | 222.25 | 38.60 | 17.50 |
| 18 | 450 | 6.102 | 155 | 241T4N | 12.0 | 304.8 | 9.500 | 241.30 | 40.80 | 18.50 |
| 18L | 450 | 7.125 | 181 | 241T4L | 14.0 | 355.6 | 9.500 | 241.30 | 46.30 | 21.00 |
| 20 | 500 | 7.125 | 181 | 269T4N | 14.0 | 355.6 | 10.625 | 269.88 | 60.60 | 27.50 |
| 20L | 500 | 9.173 | 233 | 269T4L | 18.0 | 457.2 | 10.625 | 269.88 | 71.69 | 32.50 |
| 22 | 550 | 7.125 | 181 | 298T4N | 14.0 | 355.6 | 11.750 | 298.45 | 74.95 | 34.00 |
| 22L | 550 | 9.173 | 233 | 298T4L | 18.0 | 457.2 | 11.750 | 298.45 | 92.60 | 42.00 |
| 24 | 600 | 7.125 | 181 | 317T4N | 14.0 | 355.6 | 12.500 | 317.50 | 28.20 | 40.00 |
| 24L | 600 | 9.173 | 233 | 317T4L | 18.0 | 457.2 | 12.500 | 317.50 | 108.00 | 49.00 |
| 26 | 650 | 9.173 | 233 | 355T4N | 18.0 | 457.2 | 14.000 | 355.60 | 141.0 | 64.00 |
| 26L | 650 | 11.187 | 284 | 355T4L | 22.0 | 558.8 | 14.000 | 355.60 | 154.30 | 70.00 |
| 28 | 700 | 11.187 | 284 | 374T4L | 22.0 | 558.8 | 14.750 | 374.65 | 180.70 | 82.00 |
| 30 | 750 | 12.163 | 309 | 406T4L | 24.0 | 609.60 | 16.000 | 406.40 | 231.35 | 105.00 |
| 32 | 800 | 12.755 | 324 | 431T4L | 25.0 | 635.0 | 17.000 | 431.80 | 275.00 | 125.00 |

Dimensions

| DIMENSION OF ELECTRODES WITH 3 TPI NIPPLES | | | | | | | | | | |
|--|-----|-------|-----|--------------------------|--------|--------|-------------|--------|----------------|-------|
| ELECTRODES | | | | NIPPLES 3 THREADS / INCH | | | | | | |
| NOMINAL DIA | | DEPTH | | IEC DESIGNATION | LENGTH | | MAXIMUM DIA | | AVERAGE WEIGHT | |
| INCH | MM | INCH | MM | | INCH | MM | INCH | MM | lb | kg |
| 12 | 300 | 5.354 | 136 | 177T3N | 10.667 | 271.00 | 6.975 | 177.17 | 17.60 | 8.00 |
| 14 | 350 | 6.023 | 153 | 215T3N | 12.000 | 304.80 | 8.500 | 215.90 | 32.00 | 14.50 |
| 14 Long | 350 | 7.125 | 181 | 215T3L | 14.000 | 355.60 | 8.500 | 215.90 | 38.50 | 17.50 |
| 16 | 400 | 6.023 | 153 | 215T3N | 12.000 | 304.80 | 8.500 | 215.90 | 32.00 | 14.50 |
| 16 | 400 | 6.692 | 170 | 241T3N | 13.333 | 338.70 | 9.500 | 241.30 | 44.00 | 20.00 |
| 16 Long | 400 | 7.125 | 181 | 241T3L | 14.000 | 355.60 | 9.500 | 241.30 | 46.30 | 21.00 |
| 18 | 450 | 6.692 | 170 | 241T3N | 13.333 | 338.70 | 9.500 | 241.30 | 44.00 | 20.00 |
| 18 | 450 | 7.126 | 181 | 273T3N | 14.000 | 355.60 | 10.750 | 273.05 | 61.70 | 28.00 |
| 18 Long | 450 | 9.173 | 233 | 273T3L | 18.000 | 457.20 | 10.750 | 273.05 | 71.60 | 32.50 |
| 20 | 500 | 7.126 | 181 | 273T3N | 14.000 | 355.60 | 10.750 | 273.05 | 61.70 | 28.00 |
| 20 Long | 500 | 9.173 | 233 | 273T3L | 18.000 | 457.20 | 10.750 | 273.05 | 71.60 | 32.50 |
| 22 | 550 | 7.362 | 187 | 298T3N | 14.660 | 372.40 | 11.750 | 298.45 | 77.00 | 35.00 |
| 22Long | 550 | 9.173 | 233 | 298T3L | 18.000 | 457.20 | 11.750 | 298.45 | 94.80 | 43.00 |



Standard and long nipples

The nipples for 300 mm (12") diameter and above sizes electrodes are supplied with a system designed to prevent unscrewing unless a specific request to the contrary is made by the customer. We recommend the use of long nipples which help to achieve a reduction in the number of collar breaks. For changing from 4 threads per inch to 3 threads per inch or from standard to long nipples, we deliver special transfer nipples. Electrodes can be supplied with or without preset nipples.

Our electrodes are delivered on wooden rafters strapped with steel bands, the threads and faces being protected by end caps in order to minimise the risk of damage to the threads and end faces. The tables shown indicate, for standard grade electrodes, number of pieces per pallet. Each shipment may contain upto 15% of short length electrodes.



Packing Details Of Electrodes

| Electrode Size in Inches | | Crate Size Inch LxWxH | No. of Crates per Container | No. of Electrode per crate | No. of Electrode per Container | Net weight per Container |
|-----------------------------|--------|-----------------------------|-----------------------------------|----------------------------------|--------------------------------------|--------------------------------|
| Dia | Length | | | | | |
| 12 | 72 | 81.1x38.1x28.9 | 15 | 6 | 90 | 19.5 |
| 14 | 72 | 81.5x44x18.11 | 22 | 3 | 66 | 20 |
| 16 | 72 | 83.6x50.2x20.3 | 12 | 3 | 50 | 20 |
| | | 83.6x34.2x20.3 | 7 | 2 | | |
| 16 | 84 | 96.4x50.2x20.3 | 8 | 3 | 40 | 19 |
| | | 96.4x34.2x20.3 | 8 | 2 | | |
| 16 | 96 | 106.3x50.2x20.3 | 7 | 3 | 37 | 20.1 |
| | | 106.3x34.2x20.3 | 8 | 2 | | |
| 18 | 72 | 86.6x37.8x22.2 | 20 | 2 | 40 | 20.1 |
| 18 | 84 | 98.4x37.8x22.2 | 16 | 2 | 32 | 19.8 |
| 18 | 96 | 108.3x37.8x22.2 | 15 | 2 | 30 | 20.5 |
| 20 | 72 | 86.6x42.5x24.2 | 15 | 2 | 30 | 19.2 |
| 20 | 84 | 98.4x42.5x24.2 | 12 | 2 | 24 | 17.5 |
| 20 | 96 | 108.3x42.5x24.2 | 11 | 2 | 22 | 19.1 |
| 22 | 84 | 98.4x46x25.6 | 11 | 2 | 22 | 19.8 |
| 22 | 96 | 108.3x46x25.6 | 10 | 2 | 20 | 20.5 |
| 22 | 110 | 122x46x25.6 | 6 | 2 | 12 | 14.3 |
| 24 | 84 | 98.4x50.2x28.5 | 8 | 2 | 16 | 17 |
| 24 | 96 | 108.3x50.2x28.5 | 8 | 2 | 16 | 20 |
| 24 | 110 | 122x50.2x28.5 | 4 | 2 | 8 | 11.2 |
| 26 | 110 | 122x54.3x30.7 | 4 | 2 | 8 | 13.2 |
| 28 | 110 | 122x58.2x32.7 | 3 | 2 | 6 | 11.6 |
| 30 | 110 | 122x62.2x34.7 | 2 | 2 | 4 | 8.9 |
| 32 | 110 | 122x66.2x36.9 | 2 | 2 | 4 | 10.2 |



Graphite Lifting Plug



Torque Wrench

RECOMMENDED JOINT TORQUE

| ELECTRODE Size in Inches | TORQUE SPECIFICATIONS | |
|-----------------------------|-----------------------|--------|
| | KG-M | FT-LBS |
| 12 | 65 | 470 |
| 14 | 90 | 650 |
| 16 | 112 | 810 |
| 18 | 150 | 1085 |
| 20 | 255 | 1850 |
| 22 | 350 | 2530 |
| 24 | 400 | 2895 |
| 26 | 500 | 3620 |
| 28 | 600 | 4340 |
| 30 | 750 | 5425 |
| 32 | 800 | 5785 |

Care, Handling and Joint Making

Always keep the end caps in place to prevent electrode threads from getting dirty.

- Use a lifting plug when lifting and transferring electrodes
- Before addition, clean electrode threads and sockets with compressed air.
- Tighten the electrode with proper torque as per the specifications given in the table.

If excessive torque is applied, transversal stresses increase which results in lowering of thermal shock resistance of the joint and thus increases the risk of crack generation. We recommend above mentioned tightening torque, bearing in mind the properties of our electrodes.



HEG LIMITED

FURNACE QUESTIONNAIRE

| | | |
|----------------------------------|---------------------------|--|
| Date | | ELECTRODE SIZE |
| Company | | Electrode Dia. tolerance |
| | | Electrode length tolerance |
| Country | | Standard Used IEC/NEMA |
| Type of steel produced | | Nipple Size (Dia.X Length) |
| | | Nipple Preset Yes/No |
| Nipple type | With / Without Pitch Plug | Nipple TPI |
| Furnace Details | | |
| Furnace Make | | Furnace Type EAF/LF |
| No. of furnaces | | Nominal Capacity(MT) |
| Pitch Circle Dia. (mm) | | Heat Size (MT) |
| Shell Dia. (mm) | | Electrode quality used HP/UHP |
| Transformer | | Scrap/Raw Material |
| Capacity (MVA) | | Heavy melting scrap % |
| Highest tap Voltage | | Shredded scrap % |
| Rated current (KA) | | DRI/HBI % |
| Melt Aids | | Others % |
| Max Power input (MW) | | % |
| Kwh/ton of steel | | Electrode Joining |
| No. of Burners | | Electrode Joining process On / Off furnace |
| CO jets | | Joining Device Ring/Wrench/Robot |
| Oxygen (NM ³ /T) | | Torque applied (kg.M) |
| Burner fuel (NM ³ /T) | | Operational Parameters |
| Carbon Addition (Kg/T) | | Arcing Time (min.) |
| Regulation | | Melting time (min.) |
| Mechanical | Hydraulic/Winch Motor | Refining time (min.) |
| Electrical | Digital / Analog | Tap to Tap time (min.) |
| Electrode Performance | | No. of Heats/day |
| Consumption (Kg/T of st.) | | Tapping Temp(° C) |
| Breakages / month, if any | | Current Electrode suppliers |



Global Presence

World Class UHP Graphite Electrodes - Proven Choice of top steel makers globally

Global Acceptance



HEG has been regularly exporting since 1985 and today **exports more than 80% of its production**. HEG has been winning the country's **top export award (CAPEXIL)** for several years.

Proud to be Indian
Privileged to be Global



LNJ Bhilwara Group



HEG LIMITED

Corporate & Marketing Office :

Bhilwara Towers, A-12, Sector-I, Noida-201301, NCR-Delhi (India)

Ph: +91-120-2541810 Fax : +91-120-2531648, 2531745

Website : www.heg ltd.com

E-mail : export@heg ltd.com

Graphite Plant:

Mandideep (Near Bhopal),

District-Raisen (MP), Pin-462046, (India)

Ph: (Mandideep) +91-7480-233524 (3 Lines)

Fax : +91-7480-33522/23

E-mail : services@hegmdp.com