L&T Earthmover News

Vol. 18, No. 4 October-December 2006

3000th L&T-Komatsu PC200-6 Hydraulic Excavator

The 3000th L&T-Komatsu PC200-6 hydraulic excavator rolled out of L&T Komatsu Ltd., Bangalore on October 30, 2006.

L&T-Komatsu PC200-6 is the most popular Hydraulic Excavator in the 20-tonne class in the Indian market. Its high performance, reliability and aesthetics are unmatched by other excavators in its class.

The keys of 3000th excavator were handed over to one of the long-standing customers Mr. B. Seenaiah. Over the years, M/s. B. Seenaiah & Company and its joint venture units have purchased a large fleet of construction equipment from L&T and Komatsu.

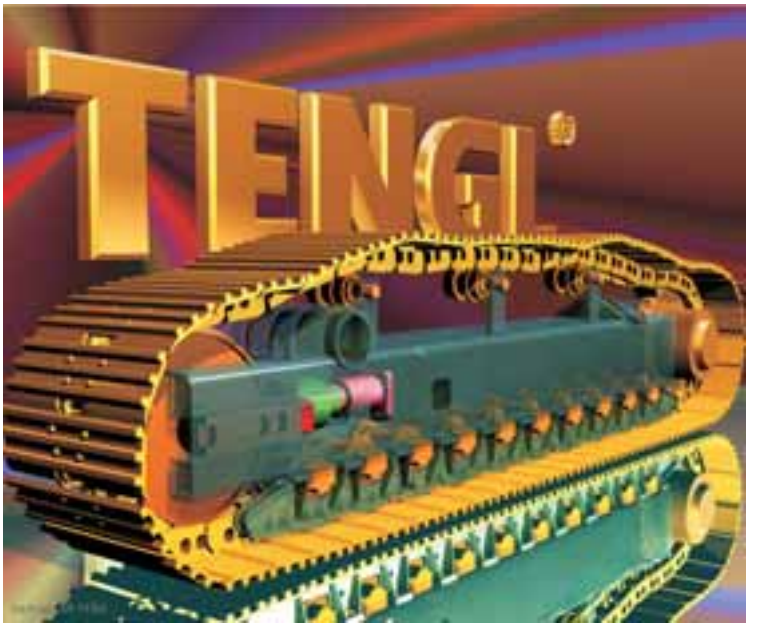
Mr. S. Raghavan, Executive Vice-President – Construction Equipment Business Sector, handing over a silver plaque to Mr. B Seenaiah.

Mr. B. Seenaiah (fifth from right in the front row) flanked by officials from L&T-Komatsu Limited and L&T's Construction & Mining Equipment Business Unit.

L&T-Komatsu PC200-6 Hydraulic Excavator was introduced in the Indian market in January 1999. The 1000th machine rolled out in 60 months after the launch and the 2000th, 20 months later. Bettering the performance, L&T-Komatsu Limited and L&T's Construction & Mining Equipment Business Unit rolled out the 3000th machine 13 months later.

Induction hardening of Undercarriage components

Undercarriage is the chassis member for any crawler type machine. Typical examples of crawler type machines are Hydraulic Excavator, Dozer, Blast Hole Drill, Crusher & Screener, Paving machine etc. The application of the machine dictates the strength requirements of the undercarriage. The application could range from excavation to drilling, mining, forestry etc. Due to the underfoot conditions as well as the application, the undercarriage is subjected to various loads such as tensile, impact, fatigue etc. Hence, the selection of proper material along with the proper heat treatment process is equally important as the structural design of the components of the undercarriage.



TENGL* undercarriage is designed and engineered as a system, with specific attention to critical factors such as material quality, surface hardness, hardened depth, and precise dimensional tolerances. The result is not just a collection of components, but a system that matches and balances wear life between components. That means there are no components that will wear out early or need continuous attention. It also means an OEM's customer can plan undercarriage service and maintenance well in advance to reduce the impact on their operations.

The strength of the components is achieved by body hardening or volume hardening and the wear properties are achieved by induction hardening. TENGL has the state-of-the-art heat treatment equipment for both of the above processes, which guarantee a good mix of strength and wear properties of the components of the undercarriage. The hardness levels are matched for mating components like the Track Link and the Roller, Track Link and Idler, Track Link and Upper Roller, Sprocket and Bush etc. to achieve optimal wear properties. Moreover, the heat treatment equipment has robust inbuilt process controls, which guarantee consistency in meeting the requirements of the mechanical properties, thus resulting in trouble-free performance of the components over the full life of the undercarriage.

In this edition, let us understand the complete science of induction hardening along with its application in heat treatment of undercarriage components.

Theory of induction heating

General principles:

If an electrical conductor is carrying an alternating current, it will be surrounded by lines of magnetic flux as shown in fig.1

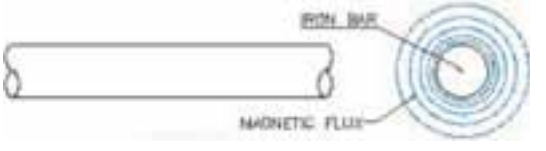


Fig. 1

If the conductor is wound into the form of a helical coil, fig. 2, the lines of magnetic flux will surround the coil in the manner indicated in fig.3

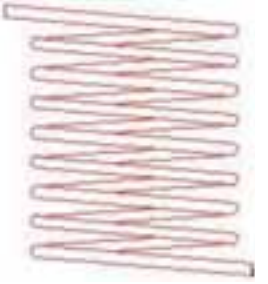


Fig 2

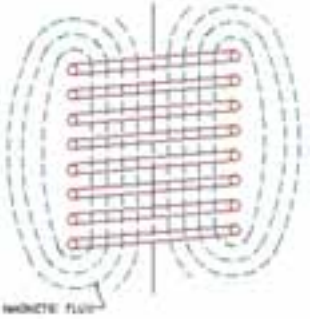


Fig 3

Because of the tendency of the current in the inductor to follow the shortest possible path, there will be a concentration of current on the inside turns of the coil, resulting in the magnetic field being appreciable stronger inside the coil than adjacent to the outside of the turns.

*Tractor Engineers Limited (TENGL) is a subsidiary of Larsen & Toubro Limited.

If an iron bar is now placed inside the coil as shown in fig. 4, the lines of flux will cut into the surface of the iron and, by the laws of electro-magnetic induction, will produce current in the iron bar.

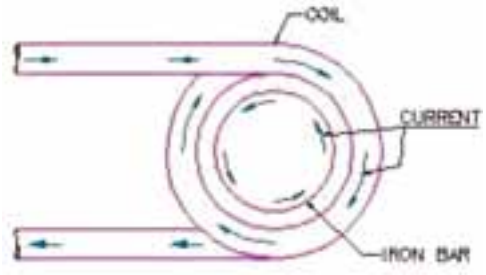


Fig. 4

A peculiarity of high frequency current is that it concentrates in the outer layer of the conductor (skin effect). As the frequency increases, the depth of the layer carrying the induced current decreases.

The induced current which circulates in the surface layer of steel bar on workpiece is opposed by the electrical resistance of the material, and the energy which is used to overcome this resistance is manifest in the form of heat. In this respect, the heating is similar to normal resistance heating (I^2R).

What is induction hardening?

Induction hardening is a form of heat treatment in which a metal part is heated inductively and then quenched. The quenched metal undergoes a martensitic transformation.

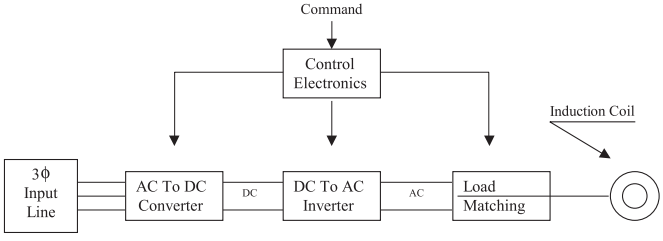
Induction hardening is used to selectively harden areas of a part or assembly without affecting the properties of the part as a whole.

The principal metallurgical advantages that may be obtained by induction hardening include increased wear resistance and improved fatigue strength. Induction hardening process results in the formation of residual compressive stresses on the surface. These compressive stresses counteract the external applied tensile stress; resulting in excellent endurance limit. The compression stress in the surface may cause higher hardness values as normally achieved with the given material and also provide some protection against cracks caused by scratches.

Moreover, induction hardening as a process is stable, consistent, clean, and efficient. Induction hardening process can also be easily automated.

Principles of power supply:

Induction heating power supplies are frequency changers which converts the available utility line frequency power to the desired single-phase power at the frequency required by the induction heat-treating process. Although often referred to as converters, inverters, or oscillators, they are generally a combination of these devices. The converter portion of the power supply converts the line frequency AC input to DC and the inverter or oscillator portion changes the DC to single phase AC of the required heating frequency.



Basic Block Diagram of Induction Heat Treat Power Supply

Different power supply types and models are produced to optimally meet the heating requirements of a nearly endless variety of induction heating applications. The specific heat treating application will dictate the frequency, power level and other inductor parameters including coil voltage, current and power factor.

The chart of typical induction heat treatment applications as function of frequency and required power is shown in fig. 5 below:

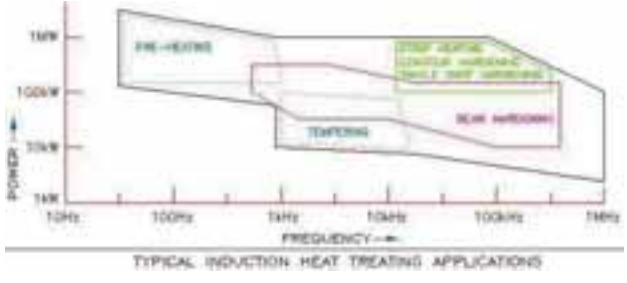


Fig. 5

Frequency is a very important parameter in induction heat treatment because it has the primary control over the depth of current penetration and, therefore, the depth and shape of the resulting heat pattern.

Evolution of HF Power Sources:

Prior to 1970, most audio frequency and radio frequency induction heating processes were with motor generator sets and vacuum tube oscillators. In the late 1960s, relatively fast switching thyristors (SCRs) with current ratings of up to 300 amperes, became available.

These devices made it technically and economically possible to provide solid-state audio frequency induction

heating power. This development has led to a gradual extinction of the motor generator set in this industry.

A similar revolution has recently taken place in both the audio and radio frequency ranges. In the mid 1980s, new power components were developed that were suitable for use in new generation of induction heating power supplies. These components included power semiconductors, capacitors, and transformers. Power transistors called Metal Oxide Silicon (MOS), Field Effect Transistor (FET) and Insulated Gate Bi-Polar Transistor (IGBT) became available with high power handling capabilities, fast switching speed and low losses at prices that soon made their use cost competitive with vacuum tube SCR technology.

About Motor Generator:

Motor generator unit consists of a high-frequency generator driven by a motor. Induction motors, which may be mounted integrally with generator or separately on a common base, are used with 1,3 and 10 Kc generators. The integrally mounted units can be either vertical or horizontal. The motors for generators of these frequencies may be of either the induction or synchronous type. Units using a synchronous motor are mounted horizontally and separately from the generator.

About Vacuum Tube Unit:

Electronic tube unit consists of a power supply section and an oscillator section. The power section provides high voltage for the oscillator tube after rectification to a pulsating direct current, usually by mercury – vapor tubes. The oscillator and a tank circuit consisting of a matched inductor coil and capacitor comprise the oscillator section.

The oscillator tube controls the amount of electrical energy delivered to the tank circuit from which the energy is removed by the coupled load. A small and proportionate amount of power in the tank circuit is fed back into the grid of the oscillator tube to control the current that is delivered to the tube, and it in turn controls the amount of electrical energy entering the tank circuit. The frequency developed in the converter is determined by the inductance of the tank coil and the capacitor, which form a parallel tuned circuit. A load-matching network electrically coupled to the tank circuit is used to transmit tank circuit energy to the work.

About IGBT:

In the IGBT, two transistor technologies are combined to obtain: 1. High Voltage 2. High Current, 3. Fast Switching Speeds.

Bipolar transistors capable of handling relatively high voltage and high current have been available for about 30 plus years but are slow switching and require relatively high power control signals. Small low power MOS FET transistors with very fast switching speeds and low power control requirements have also been around for many years. Put the two technologies together with the MOS FET (Insulated Gate Technology) on the control end and the Bipolar on the power handling end, you have the best of both in the IGBT.

Application of Induction Hardening Process in Undercarriage Manufacturing

As indicated earlier, Earthmoving equipment demands a good mix of wear and fatigue strength from undercarriage components.

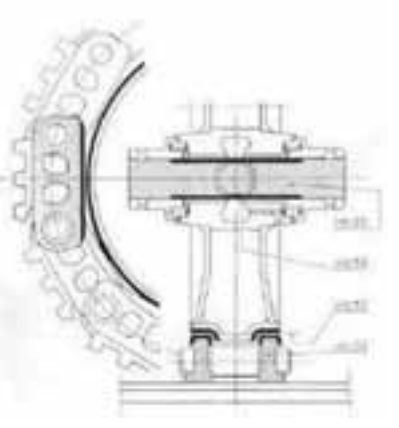
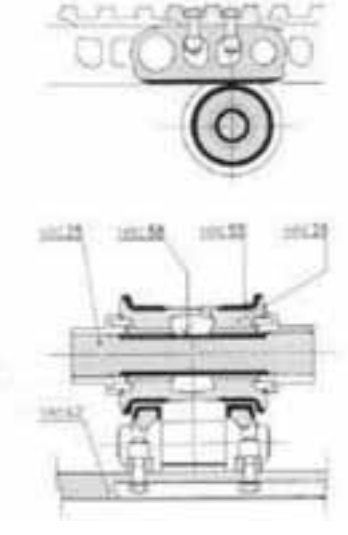


Fig. 6

Induction Hardness and depth are matched for Link & Idler to achieve optimal levels of wear life. Similarly, Roller/Idler Shaft is having a hard case and tough core for unique blend of wear resistance and beam strength.

Induction hardened pattern of Roller, Link for long and matched wear life. Fig. 7



Photograph below shows the induction hardening process for Track Links and Roller Rims.

Induction Hardening of Track Link Pair

Induction hardened pattern of Sprocket and Bush are matched for extended wear life.

Likewise, pin is induction hardened to achieve beam strength, as shown in Fig. 8

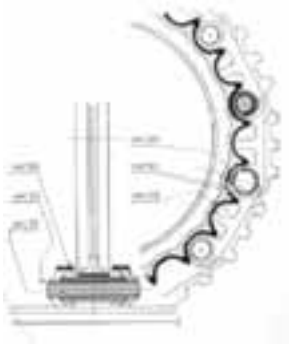


Fig. 8

Induction hardening of Roller Rim

Induction hardening of Track Pin

As explained earlier, Induction hardening process lends itself suitable for achievement of the above properties.

TENGL has kept pace with the latest advancements in technology in Induction hardening process and Heating sources. Introduction of IGBT type heating source is one of the breakthroughs in the above endeavor.

For more information contact on email: vk-tng@tengl.ltindia.com, rvc-tng@tengl.ltindia.com

'Mines Safety Week' at India Cements Limited, Vishnupuram, Andhra Pradesh

The 22nd Mines Safety Week-2006 was organized by India Cements Limited (ICL) at Vishnupuram from 4th to 12th November, 2006. This safety week was attended by 36 other Cement manufacturing companies who participated in the programme that took place on the last day of the exhibition viz., on November 12, 2006. On the concluding session of this safety week, ICL invited L&T for an exhibition at this venue.

Based on the invitation, L&T Product Support Department put up an outdoor stall in the premises of India Cements Limited, Vishnupuram Works.

Responses from customers were overwhelming. L&T's stall was visited by many distinguished officials like Mr. P.L. Subramanian, President (Tech & Mfg.), ICL and Mr. Raja Rao, Vice-President, ICL. Mr. S.J. Sibal, DDGMS, South Zone, Hyderabad also visited our stall.

Mr. P.L. Subramanian, President (Tech. & Mfg.) of India Cement with L&T Team

Mr. S.J. Sibal, Dy. Director General of Mines Safety, Southern Zone, Hyderabad going through our product catalogues

IMME 2006

The 8th International Mining and Machinery Exhibition 'IMME 2006' was organized by the Confederation of Indian Industry (CII), in association with Ministry of Coal & Mines, Government of India, at Central Park, Salt Lake, Kolkata between 22nd and 25th November 2006.

Construction & Mining Equipment Business Unit of Larsen & Toubro Limited and Komatsu Asia & Pacific Pte Ltd., jointly put up an impressive outdoor stall and displayed 2 large mining machines viz., Komatsu HD785-5 Dump Truck and PC1250SP-7 Hydraulic Excavator. The closed stall had a photographic display of all the machines marketed by L&T. Genuine parts were showcased alongwith the product support capabilities of L&T. The unique stall design was conceptualized and designed by L&T for providing maximum visibility of the stall as well as the machines, besides providing space for free movement of the visitors inside the stall and around the machines. The response from the large number of visitors from the mining sector as well as the construction & earthmoving sectors, throughout the exhibition, was very encouraging.

View of outdoor stall

Mr. P.S. Bhattacharyya (second from right), Chairman, Coal India Ltd. discussing with Mr. S.K. Mittra, Vice-President, Construction & Mining Equipment Business Unit, L&T.

Mrs. & Mr. Govind Atwal (fifth and sixth from left) along with L&T and Komatsu officials during their visit to our stall.

Mr. J.P. Nayak, President (Operations), L&T, handing over the miniature model of Komatsu HD785 Dump Truck to Mr. U.K. Upadhaya, Managing Director, EMTA Group, in the presence of Mr.T. Kayata (fourth from right), President (Overseas Marketing, Construction & Mining Equipment Marketing Division), Komatsu. Also seen in the photograph are (right to left) Mr. Davinder Singh, Mr. H. Miyazaki and Mr. S. Ueno of Komatsu Asia & Pacific Pte Ltd., and Mr. S.K. Mittra of L&T.

Demo of Komatsu PC1250 Hydraulic Excavator. Komatsu Dump Truck Model HD785 which was displayed is also seen.

Mr. V. Prabhakar Reddy at the controls of HD785 Dump Truck

Miniature model of Komatsu India Pvt. Ltd., Chennai Plant which was displayed at the exhibition.

View of Scania stall

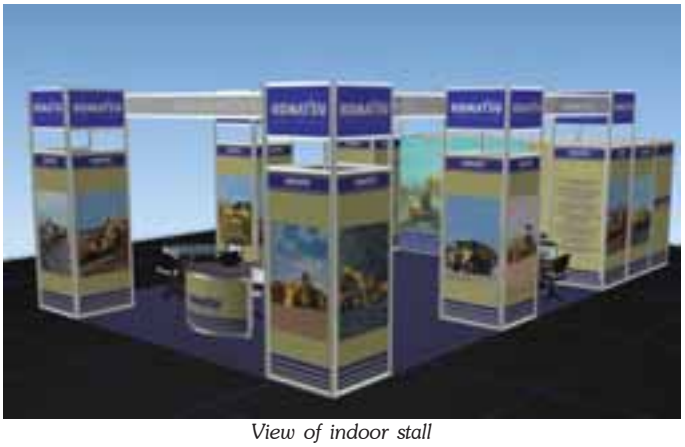
International Coal Congress & EXPO 2006

The Institution of Engineers (India) under the aegis of World Mining Congress organized the International Coal Congress and EXPO from 11th to 13th December 2006 at New Delhi. The event was held at hotel 'The Ashok'.

The event was supported by the Ministry of Coal, Ministry of Power, Ministry of Mines and Steel. The congress was inaugurated by Dr. M.S. Ahluwalia, Deputy Chairman, Planning Commission and was presided over by Dr. Dasari Narayan Rao, Union Minister of State for Coal.

Komatsu participated in the exhibition by putting up a photographic display of mining machines.

Dr. Dasari Narayan Rao, Union Minister of State for Coal visiting Komatsu stall



View of indoor stall

Kolhapur Meet

Earthmoving Machinery Owners' Association organized its 4th Annual General Meeting on 23rd July, 2006 at Hotel Vrushali in Kolhapur. This event was attended by about 150 contractors operating in Kolhapur and Sangli area. L&T team along with the local dealer M/s. Aryan Earthmovers put up a stall during the event.

Mr. Mohit Kondaskar, Territory Executive-Pune, made a product presentation on the occasion.

Customer Training Programme at Gorakhpur & Shikhohabad

The CEB Team from L&T, Lucknow and U.P. Dealer M/s. Chintamani Enserve Pvt Ltd jointly organized Customer Training Programme on Highway Project Machines (O&M) at Gorakhpur and Shikhohabad. The participants from customers like Progressive Constructions Ltd., B. Seenaiah & Co., Vijay Expressway Engrs Ltd., and Oriental Infrastructurals, took part in the three day schedule at each location. During the programme,

participants were briefed about Komatsu Road Construction machines working in Golden quadrilateral projects with emphasis on operation & maintenance of machines, spare parts management and the advantages of using genuine parts. The entire programme was lively and interactive, thanks to the active participation of those present, who evinced keen interest to expand knowledge level on Komatsu products.

Printed by Sri Sudhindra Offset Process, No. 97-98, D.T. Street, 8th Cross, Malleswaram, Bangalore-3. Phone : 23368339, 23364798 Email: sri_sudhindra@vsnl.com
Edited by S.K. Mittra for Construction & Mining Equipment Business Unit, Larsen & Toubro Limited, Bangalore. The views expressed in this magazine are not necessarily those of the management of Larsen & Toubro Limited. The contents of this magazine should not be reproduced without the written permission of the Editor. For further information please contact: Larsen & Toubro Limited, 10/1, Palace Road, First Floor, Lakshminarayan Complex, Bangalore 560 052. Telephone: 080-22256982/3/4, Fax: 080-22250309. Email: cms@pro.ltindia.com Not for sale – only for circulation among the customers of L&T's Construction & Mining Equipment Business Unit.

Associate Editor: C.K. Sathish • Editorial Co-ordinator: S. Shetty, L&T, Bangalore