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Editorial Message

Dear Reader,

The continuously rising demand for energy in the face of its limited availability and increasing cost is making a clarion call to endusers to enhance their energy efficiency. Energy intensive industries have different rotating machines and equipment such as fans & pumps, grinding mills, kilns, crushers, conveyors, mine hoists, compressors, extruders, mixers, blower and these offer huge potential for energy saving.

AC Drive system plays a vital role in the operation of rotating machinery based equipment that not only reduces energy consumption but also offers speed control that can run the equipment at its optimum operating level. Today, industries are deploying AC Drive systems for enhancing energy efficiency and reduce wear & fear of mechanical equipment.

The AC Drive system consists of Motors, Inverters, Transformers, Filters, Cables and Auxiliaries. These have to be carefully integrated for a given application and requires in-depth knowledge of applications, customer needs and adherence to electrical and safety regulations.

Operating in this space for more than 30 years, C&A has accumulated enormous amount of experience in various industries and application know-how that enables us to provide optimum Drive solutions. This experience and positive feedback from the industry helps us to renew our commitment towards customer satisfaction. We have recently added yet another project to our list of success stories - the introduction of AC Drive system for Skip winch in Blast Furnace No. 3 at SAIL, Durgapur Steel Plant, which was traditionally dominated by the DC Drive system.

We are committed to helping our customers to optimize their energy usage, as is illustrated in the 'Customer Speak' section, a feedback from ACC, one of the largest cement manufacturers in India.

Finally, it gives me immense pleasure to share with you that L&T's Control & Automation business unit has been ranked Number 3 Systems Integrator in a global survey by Control Engineering, USA. Thank you for your support in helping us to achieve this position. Going forward, we seek your continued support in order to achieve the Number 1 position.

I am sure you will enjoy reading the articles in this edition.

Happy Reading !



Sandeep Bhat

Industry Trends

AC Drives – Driving the new applications

India's energy demand is expected to double by 2030. The Industry sector accounts for 40% of the country's total energy consumption. Introducing energy efficient processes and other energy saving measures can bring about considerable savings for the country. With energy accounting for 35-40 % of production cost of energy-intensive industries, the manufacturers stressing the need for energy efficiency, thus demand for electrical drives is on the rise.

Drives are widely used in manufacturing industries to regulate and control rotating equipment such as fans, conveyors, machine spindles, and pumps, which are used in production processes. AC drives are widely used in process industries to increase the efficiency of equipment. It controls the speed of electric motors according to the process needs, typically reduces energy consumption by 35-40%.

However, the bulk of the load of an energy intensive industry is driven by High Voltage / High Power AC motors. With the invent of High power transistor devices the current trend is to use Medium Voltage (MV) AC drives for such applications where the magnitude of savings in high

Energy intensive industries such as Metal, Cement and Power have started using MV Drives for controlling Medium Voltage Motors.

Some interesting applications.



Application : Long Conveyor in Material Handling

Long conveyors are extensively used in many industries like Mining, Cement, Ports and Power. Traditionally, slip ring motors or fluid couplings have

been used for long conveyors. Slip ring motors have high O&M cost due to which currently AC induction motors are preferred. Drive system is used for controlled start-up and load sharing in long conveyors.

New Approach

- Transport material over few Kms
- Reduce mechanical stress through controlled start-up and load sharing
- Control speed to match operation requirements

Benefits

- Longer mechanical life arising out of reduced mechanical stress through controlled acceleration/deceleration and load sharing
- Significantly reduced losses when compared to Fluid Coupling
- High reliability with multiple co-ordinated motors driving Long Conveyor



Application: Twin Motor Kiln in Cement

Traditionally Kiln Motors are driven by DC Drives due to its high starting torque, however DC Motors have high O&M cost and generate carbon dust. In

addition DC Drives also produce poor power factor and harmonics that are detrimental to the electrical system.

With the advent of MV Drive technology, the traditional DC Drives are getting replaced as AC MV drive to overcome all the above disadvantages of a DC system.

New Approach

- Reduce mechanical stress on Kiln system through twin motors instead of one.
- Replace the higher rating (>1000Hp) DC motors with two small AC motors which can meet same or higher Toque Requirement
- Use MV Drive to achieve load sharing between twin motors and speed control

Benefits

- Lesser stress on Electrical system through reduced in-rush current, improved power factor and lesser harmonics resulting in better asset utilization and longer life
- Reduced Power system components like Transformers, Breakers and HT Capacitors
- Reduced motor maintenance



Application: Pipeline in Oil & Gas

Cross country Pipelines are used to transport petroleum products from refineries to demand areas and crude oil from sources to inland refineries. To transport this

product over long distance from source to destination and to maintain desired flow, pumping stations are installed at strategic locations. Centrifugal pumps used at these locations offer great potential for energy saving, as the application always does not require 100% flow.

For better performance, VFD based solutions are being adopted because of their ability to control flow efficiently and optimize energy use.

New Approach

- Improve operational efficiency with MV VFD as compared to earlier LV VFD based solution with Step-down & Step-up Transformers preceding & following the VFD popularly called Hi-Lo-Hi solution
- Co-ordinated drive operation to control multiple pumps with Single VFD controlling flow
- Ability to perform synchronous changeover to Mains and back to Inverter mode

Benefits of the MV Drive System

- Reduction in Source Transformer rating due to elimination of full voltage start when compared to DOL star
- Reduction in number of Power components when compared to Hi-Lo-Hi solution
- Extended Equipment Life, Reduced Maintenance & Easy retrofit due to the near sinusoidal waveform & soft-start
- Efficient Process Control to meet the varying flow requirement



Application: Blast Furnace in Steel plant

Traditionally Fans and Pumps in a Steel plant were driven directly on mains voltage and process fluid flow was controlled by Dampers. These include different

types of fans like Combustion Air fan, De-dusting fan and a variety of pumps. Process efficiency is largely governed by the extent of speed control of Fans and Pumps, which can better addressed by VFDs.

New Approach

- Variable Torque Load
- Eliminate Damper based flow control
- Precise flow control as per process requirement

Benefits

- Energy savings at reduced Fan/Pump speed
- Minimised vibration levels as compared to Damper control
- Enhanced Asset life by minimizing wear and tear on all drivetrain components

The technology development has led to the networking features in drives, it is more open to networking with the plant DCS on various networking protocols, configuration and troubleshooting on network is possible. VFDs are now fully function driven, able to compensate for load changes, more intelligent to understand the frequency conversion for speed with high precision, easy to form a closed-loop control and component health monitoring. Also the power handling capacity is changing from AC-DC-AC to AC-AC without storage device in between, this improves the reliability and performance of drives.

Facing challenges from different application areas, the variable speed drive are constantly upgrading and developing into applicationspecific algorithm, feature rich, easy to operate, versatile, fully function driven software programs. High torque and 4 quadrant applications are being handled by AC drives more intelligently with the advent of software and built-in application algorithm. This gives flexibility to user for easily configuring the drive for his application without much complexity.

Conclusion:

Due to technological advancements in semiconductor devices such as insulated gate bipolar transistors (IGBTs), MV drives are increasingly used in Petrochemical, Mining, Steel and Metal, Transportation industries, among others, to conserve electrical energy, increase productivity and improve product quality. Going forward, AC Drives would replace the use of DC Drive system and contactors in motor control centres. Also, the high power high voltage drives will replace the use of inefficient damper and valve control system. This will give reliability of operation coupled with energy saving.



VFD solutions from L&T-C&A

At L&T-C&A, we know what works best for your process. We understand the electrical challenges such as transformer-filter's requirements, distance between equipment, cabling, control strategy and the effects of speed control. We help customer from conceptual design to sizing, selection and implementation of Drives system which is key to the success of any project.

With a complete range of high powered AC drives from 220V to 11,000V (0.75kW to 12 MW), we set new standards in efficiency for your process. We are constantly updating our solution to provide you with better quality and highly efficient Drive systems that work incredibly even in the most critical applications.

LnTAC-400 - High Performance Vector Drive

The LnTAC-400 is the premium vector drive with integrated latest vector control technology for induction motors. It provides great operation reliability, environmental benefits and energy savings as well as many other user oriented operational features that make it a first class choice. It runs synchronous motors like IP and SP motors with high vector control and also offers sensor less control with synchronous motors and achieves more powerful starting torque at zero speed with an IPM Motor.

Features

- Closed or open loop vector control for outstanding regulation, torque production, and position control capability
- Advanced Auto-Tuning function optimizes performance by compensating for changes in motor temperature
- Available with pre programmed algorithm for various applications

LnTAC[™]-690 - High Performance AC Drive

Finest range of high powered AC drives, operating from 500V to 690V, are designed for industrial application, and especially for application in process industries such as Metals & Mining, Water, Pulp & Paper, Cement, Power, Chemicals and Oil & Gas industries. These Drives offer a wide power range from 160kW to 5MW. Flexible programmability makes the drive adaptable to various applications in all industries.

Features

- Modular flexible design
- Starting from Basic & Expandable I/O configuration, up to 5 slots (A, B, C, D and E) available for easy configuration
- Supports induction motors and permanent magnet motors in open and closed loop control modes

Super Energy Saving Medium-Voltage AC Drive

Medium Voltage AC Drives are used in applications ranging from small fans and pumps to the large Mill drives and compressors. With recent advancements in IGBT devices, VFD technology can now address Medium Voltage and therefore directly operate Medium Voltage motors resulting in larger magnitude of energy saving & reduction of electrical assets like Transformers and associated switchgear.

L&T-C&A, a leading solution provider of Medium Voltage Drives, can help successfull implemention of Drive solution for a wide range of applications in various industry segments like Cement, Metals, Mining & Minerals, Power, Water, Oil & Gas and Chemicals.

Features

- Compact design that produces a very competitive footprint across the entire power range
- Using the Smart Harmonics[™] Technology ensures very low THD, without the need for additional filters
- Unique output stage, multilevel output providing a very clean output wave form to the motor, without the need for additional filters or reactors. This is best suitable for retrofit use with existing non inverter duty motors.

Slip Power Recovery System (SPRS)

L&T-C&A continues to dominate for over three decades in this area. SPRS is used to control speed of Slip ring motors. With new technology available, we bring *Q***vertor** SPRS with IGBT based Inverter & Active Front End (AFE) which overcomes the legacy problem of poor power factor, while providing energy saving. GVerter SPRS is now available for speed control of Slip ring motors upto 5 MW.

Features

- Feedback at Unity power factor and meeting IEEE 519
- High efficiency
- Speed holding accuracy 0.5%
- Designed for upto 40% voltage dip for 2 secs
- Designed for upto 50 Deg C Ambient





Introduction of AC motors and Drive for SKIP operation

About Customer:

Steel Authority of India (SAIL), established in 1954, is India's largest state–owned steel producer. It manufactures and sells a wide variety of steel products such as hot and cold rolled sheets and coils, galvanized sheets, electrical sheets, structural, railway products, plates, bars and rods, stainless steel and other alloy steels.

Need

The skip winch charging system is a critical mechanism for blast furnaces. Skips are designed for transportation of burden materials from the skip pit via the blast-furnace throat to the reception hopper of the charging device. SAIL has around 24 blast furnaces below 4000 m3, equipped with skip winches for charging the burden into the furnace. The skips of the blast furnace, travel upwards - 85 meters from skipping pit to reach the discharging point. The velocity and rate of acceleration of skips need to be varied at different points as the inclination of the skip bridge rail track is not uniform throughout the length. In the skip, 98% of travel period is pulled up by motoring action and is decelerated by regenerative action at creeping speed to discharging position.

For the last six decades, skip winches of the blast furnaces are driven by DC motors and DC drives in spite of many deficiencies. SAIL, DSP decided to upgrade its Skip Winch system due to nonavailability of spares for DC motors and support, as well as to meet its stringent quality norms, power quality and energy conservation goal.

The main objectives in introduction of AC motors and Drives for SKIP operation were:

- To overcome non-availability of DC Motors a constraint as most reputed motor manufacturers have stopped production of DC motors.
- Continuous development in AC drive technology over the years has resulted in performance of AC motors getting superior day by day. AC drive technology is replacing the DC drive system worldwide in almost all areas of application.
- To have a system with less maintenance, which is a drawback of DC motors
- To have improved power factor and less harmonics.

For the above reasons, SAIL decided to switch to AC Drives based system and awarded the project to L&T Electrical & Automation's Control & Automation (C&A) business unit, which is a leading solutions provider.



The scope of work included design, engineering, manufacturing, testing, supply, erection and commissioning of the AC motors with dual redundant regenerative AC drives and dedicated programmable logic controller (PLC) system along with required communication cables, field devices and HVAC system for skip winch of BF No. 3.

Solution

The blast furnace No.3 has a useful volume of 1400m3 cubic. The skip cars are used to feed burden materials from the top, which require high starting torque, steep acceleration and regenerative braking. C&A took the challenge of migrating the existing DC Drive based System to AC Drive, despite there being no reference of AC Drive being deployed in Blast Furnace Skip Winch application in India and only 3 references available globally. The major challenges included selection of suitable AC motors to match velocity and the acceleration diagram for same or better throughput, availability of sufficient mechanical motor ratings to select appropriate motors that would help to achieve high starting torque and equivalent response to the DC motor being used.

In addition, another challenge was to install AC motors in place of DC Motors in available space with minimum modification to the existing civil foundation. Also SAIL-DSP team wanted to retain the existing DC Drive system, in the event of an AC Drive system not performing as expected so that they can switch to the old system.

In line with customer's requirement, C&A supplied active front end, 4 quadrant, AC drives with suitably derated induction motors, associated automation system to protect customer's existing investment in hardware and software to the maximum extent possible.

Sizing of new AC motors was critical since the angle of Skip Bridge was modified from 520 to 540, travel distance exceeded by seven meters and filling capacity of skip was enhanced. The C&A team along with SAIL-DSP studied the existing system and recorded the existing loading pattern of skipping due to the absence of sufficient mechanical data. The recorded data was extrapolated to its worst case loading pattern, which helped to finalize AC Motor ratings by evaluating rope drum/torque requirements for different burdens. The AC drives were selected to match the overload/acceleration torque requirement of the motors. The DC motors were removed including its mounting plates and new mounting plates were provided for AC motors keeping the foundations unchanged.

The performance of the new AC motors and AC drives were found satisfactory as these were able to meet the process requirements keeping entire operation and control philosophy, safety interlocks and protections intact, in line with the existing arrangement.

With the help of a new system, the burden charging capacity of skips increased by 30%. Travel time of skips from skip pits to discharging point reduced from 55 sec to 50 sec. With introduction of bell–less charging system in combination with skip charging system with new drives, an increase from 1900 TPD to 2000+ TPD of Hot metal production in Blast furnace no.3 was achieved. The end user is fully relieved from spares planning and day to day maintenance related issues arising in the case of DC motors.

⁶⁶L&T-C&A's strength in the field of design, engineering, project management and implementation of Integrated (drives and motors) system brings sustainable benefit to SAIL-DSP operations. ⁹⁹ - S.C. Prasad, CET

The engineers of CET, DSP & C&A jointly as a team and made sincere efforts to ensure that project was successfully commissioned. The project was successfully implemented for the first time in any Indian Blast furnace and fourth Blast furnace in the world.

Benefits

- 1) Significant improvement in production
- 2) Improved dynamic response and better speed regulation
- 3) Improved power factor and power quality
- 4) Energy efficiency
- 5) Minimised spare requirements
- 6) Reduced down time and maintenance time.

Conclusion:

Skip charging system in small capacity blast furnaces is expected to continue for next 20-25 years. Hence it is recommended to replace the DC drives by energy efficient AC drives technology not only to get the above benefits but to ensure that furnaces do not face any crisis in future.



VFD System configuration



Quality Commitment & Certification

We make no compromise when it comes to quality, safety and reliability. By adopting world class quality standards, we set benchmarks for solutions that we provide in the areas of electrical and automation. The key to our success and growth in this competitive market place, is our focus on quality systems since inception Way back - on January 10, 1996, we obtained ISO 9001 certification, which is valid till date since we go in for periodic recertification.

Towards environment friendliness through efficient waste management, energy & resource optimization and meeting all applicable regulatory requirements, our Quality Systems received ISO 14001:2004 certification on October 14, 2008, which have been maintained till date.

To support continuous improvement in the area of Occupational Health and Safety, we are OHSAS 18001:2007 certified since October 15, 2008. We are committed to developing and maintaining a 'Zero Harm Culture' for employees, contractors, and customers.

We joined the league of select few Indian companies by achieving ISO 27001:2005 - the highest certification standard in Information Security from the International Standards Organisation (ISO) on June 12, 2008.

To quote our General Manager and Head - Control & Automation -Mr. Sandeep Bhat, "Our various quality certifications bear testimony to our commitment to the highest quality standards".

In today's environment where Information Security is of major concern, the ISO 27001 certification is a reinforcement of our commitment to providing our customers with a secure environment to manage their outsourcing requirements. C&A achieves this with a quality system that deploys information security processes systematically and consistently throughout the organization.



C&A received a Certificate of Compliance for Functional Safety Management (FSM) System from TUV India - a premier leading international Quality Certification & Inspection organization committed to the certification of organizational competence, business processes, systems and products.

C&A has implemented standards and procedures in line with FSM as defined

under IEC 61511 – a technical standard which sets out practices in the engineering of systems for ensuring the safety of an industrial process. Ten of its engineers have been certified by TUV India as internal auditors for FSM (IEC 61511-1) and four engineers have cleared the prestigious Functional Safety Professional certificate exams conducted by TUV SUD.

Considering that compliance with international safety standards is becoming increasingly important for industries, the certification will equip C&A to execute complex Safety Instrumented System (SIS) projects and address potential opportunities.

Recent Awards

Our Unnati building based at Mahape, Navi Mumbai has been awarded Leadership Energy and Environmental Design (LEED) Gold certification by the U.S. Green Building Council in December, 2013. LEED is the world's preeminent certification programme for the design, construction and operation of high-performance green buildings. LEED Certification encourages energy efficient, water conserving buildings that use sustainable or green resources.

In August 2014, a survey conducted by Control Engineering - a reputed, US-based journal ranked us as the Number 3 System Integrator in the world. The survey covered the top 100 Global System Integrator Giants for 2014 among companies listed in the Control Engineering Automation Integrator Guide.

L&T-C&A ranks 3rd globally ...

According to the Control Engineering 2014 System Integrator Giants report





		2013			YEAR
RANK	FIRM NAME	RANK	LOCATION	WEB ADDRESS	FOUNDED
1	M+W Automation	1	Greenville, SC, U.S.	www.mwgroup.net	2001
2	Wood Group Mustang	2	Houston, TX, U.S.	www.mustangeng.com	1987
3	Larsen & Toubro	-	Navi Mumbai, Maharashtra, India	www.larsentoubro.com	1938
4	Maverick Technologies	3	Columbia, IL, U.S.	www.mavtechglobal.com	1999
5	Prime Controls L.P.	4	Lewisville, TX, U.S.	www.prime-controls.com	1991
6	RedViking	-	Plymouth, MI, U.S.	www.redviking.com	1983
7	Mangan Inc.	6	Long Beach, CA, U.S.	www.manganinc.com	1991
8	Optimation Technology Inc.	5	Rush, NY, U.S.	www.optimation.us	1985
9	Leidos Engineering LLC	-	Oklahoma City, OK, U.S.	www.leidos.com	1909
10	Autopro Automation Consultants	-	Grande Prairie, AB, Canada	www.autopro.ca	1990
11	Cimation	-	Houston, TX, U.S.	www.cimation.com	2009
12	ProLeIT AG	-	Herzogenaurach, Bavaria, Germany	www.proleit.com	1986





L&T-C&A was selected by ACC Limited (ACC) to implement VFDs for its various Cement Plants. We spoke to Mr. Tapendu Datta, Head - Energy Conservation & Renewable Energy & Projects to capture his experience of role of VFDs as well as working with the C&A team.

Please describe your company's business activities and your involvement in the Cement market.

ACC Limited (ACC) is India's largest cement manufacturer, having a countywide network of 17 modern cement plants, more than 50 Ready mix concrete plants, sales offices, dealers and retailers. Presently we produce 30 million tonne of cement and are likely to increase to around 35 million tonne capacity by 2015. During the > 75 years of our existence, we have been a pioneer and trend-setter in cement manufacture and sustainable development.

Why did you decide to implement VFD Systems?

In today's climate of increasing energy costs, any technology which helps plant to utilise energy more efficiently is being adopted. Installation of VFDs is one of the levers adopted by ACC for improving efficiency across our cement plants and captive power plants for meeting our sustainability goals. Besides, it would also help ACC plants to excel in PAT. We are also pursuing other energy reduction projects on Fans, compressors and pumps, which have similar investments and returns like VFDs.

What benefits you seek from VFD system implemented?

Based on our experience, we have observed that use of variable frequency drives not only helps to reduce energy by eliminating the damper or GRR losses, but also helps in precise control of the process parameters. However Cement manufacturing is a continuous 24 X 7 process and any interruption on account of tripping due to VFD has an adverse effect on the savings in absolute terms. Hence the reliability of the drive is of prime importance.

What is your experience of working with L&T-C&A?

L&T-C&A is one of the VFD suppliers across ACC plants. Mostly the orders released on L&T have been executed within the contractual time frame. In recent past also, L&T-C&A executed a project for supply of LV VFDs & in spite of tight delivery schedule, L&T could complete the supply in time. L&T-C&A has assisted our plants in up keep of the equipment, whenever called for.



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