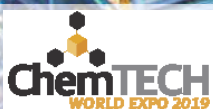


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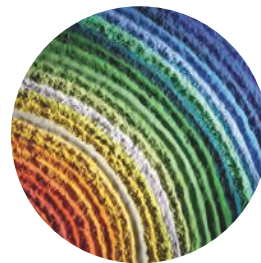


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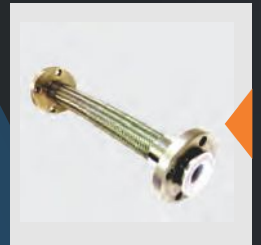


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New Mini Series Air Hoists from J D Neuhaus

Witten-Heven, Germany: J D Neuhaus, leading supplier of hoists and crane systems have been working in close collaboration with end users to develop the new Mini series of air hoists. This has resulted in an extraordinarily compact and innovative lifting device with an integrated NFC (Near Field Communication) sensor and service app that makes it truly unique in the industry. With various innovations incorporated in the concept, a multitude of improvements and new developments ensure maximum productivity, occupational safety and efficiency.

Special emphasis was placed on reducing the end-user's total cost of ownership (TCO) of the hoist. Reliable processes in the working sequence contribute to increased efficiency, achieved for 100% of the active operation time, by extending the service life significantly. Not only is the hoist optimised for outstanding overall efficiency, but the new Mini is also available around the clock (365/24/7). Unrivalled simple and fast maintenance further enhances efficiency, while also enhanced is highly sensitive, continuous control of hoisting and lowering speeds for which the Mini is known worldwide.

RespoKare Anti-Pollution Mask Launched in India

New Delhi India: Clean Air Store, a pioneering e-commerce portal providing innovative products and solutions to protect from both indoor and outdoor air pollution, today announced the launch of RespoKare, a reusable and highly effective anti-pollution mask. This is the only mask in the market that protects the wearer from both PM 2.5 particles and toxic gases like NO₂. The RespoKare mask also features a proprietary "Pollution Indicator" that indicates level of NO₂ gas that the wearer has been exposed to.

The RespoKare Anti-Pollution Mask is the first personal protection product with the capability to neutralize hazardous oxidizing gases in the air. Designed with built-in N98 and activated carbon filter, the mask comes with a 5-stage filtration mechanism which allows wearer to breathe cleaner air, while the two Filtration layers filter 98% PM_{2.5} particulates, its Active Respo Layer neutralizes > 90% toxic gases such as Nitrogen dioxide (NO₂) and Sulphur Dioxide (SO₂). The Unique design of "NO₂ Indicator System" allows easy identification of the level of NO₂ in air pollution, and also a mean to indicate the longevity of the mask when in contact with air pollutants. The proprietary pollution indicator changes colour gradually from natural off-white to dark brown depending on varying levels of exposure to toxic gases like NO₂ and SO₂. This allows the wearer to replace their mask based on the colour change.

Malvern Panalytical Introduces Epsilon 4

Almelo, the Netherlands: Malvern Panalytical presents Epsilon 4, the new high-performance benchtop analytical tool for the determination of the chemical composition of all kinds of material. Built on the experience and success of the proven Epsilon 3 range of XRF spectrometers, the Epsilon 4 is a multi-functional instrument opening new applications for industries such as mining, pharma or oils&fuels who are obliged to comply with international regulations and test methods. Combining the latest advances in excitation and detection technology with mature software and a smart design, the analytical performance of the new benchtop instrument approaches the one of more powerful and floor-standing spectrometers.

Due to its low infrastructural requirements, Epsilon 4 can be placed next to the production line anywhere in your process. Its high performance enables most applications to be operated at ambient conditions, reducing costs for helium or vacuum maintenance. The unique low-drift metal-ceramic X-ray tube, designed and manufactured by Malvern Panalytical, delivers compliant results for years without the need for costly re-calibration. The instrument can automatically process sample batches without the need for operator attention.

Epsilon 4 is a highly flexible tool available in a 10-Watt version for elemental analysis (F – Am) in areas from R&D through to process control. For even higher sample throughput or extended light-element capabilities and in more challenging environments a 15-Watt version is available, which can even analyze carbon, nitrogen and oxygen. "Epsilon 4 delivers the highest count rate in the market while little or no sample preparation is required to achieve very fast and reproducible results", says Simon Milner, product director at Malvern Panalytical. "It is the perfect analytical tool for any industry needing to comply with increasingly stringent test methods and norms. Trust our experienced staff to work with you on tailored solutions for your analytical challenges."

AkzoNobel brings the latest digital color technology to yacht coatings customers

Amsterdam, Netherlands: Customers using AkzoNobel's yacht coatings can now take advantage of a new digital tool which offers a wide selection of colors from its industry-leading Awlgrip product range.

Building on the existing International and AkzoNobel color pallets, the new MIXIT tool includes more than 18,000 colors and is larger than any existing offering on the yacht market. Its newly developed cloud interface also means that users have quick and easy access globally.

The system played a key role in developing the custom-made colors for all the competing teams in the current edition of the Volvo Ocean Race. As the official Boatyard supplier, AkzoNobel coated all the boats in the fleet, while a mixing tool is also traveling around the world to help the shore teams carry out repairs and maintenance at each of the stopovers.

In addition, a new Awlcraft SE product line for yacht owners has been introduced. The basecoat provides a variety of color options - such as solid, metallic and pearl effects - as seen on team AkzoNobel's own race boat. The new solution also decreases the time needed to respond to customer requirements

"This new color offer and digital customer support package will enable us to supply the majority of color requests much faster than before," explained Hans Slegtenhorst, Global Segment Manager for AkzoNobel's Pro and Superyacht business. "By offering such a large database of colors, we will continue to outperform the competition and guarantee premium customer service, thereby standing out as the front-runner in the industry."

AkzoNobel has been developing industry-leading digital color techniques and technologies for yacht customers since the 1990s, and is continuously reinventing for the future. The MIXIT tool is the latest example of the company's innovation strategy moving towards more digital solutions, allowing AkzoNobel to cater for the industry's increased need for greater accuracy and efficiency in color matching.

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Haldor Topsoe and JITRI found joint R&D company

Copenhagen, Denmark: Haldor Topsoe, a world leader in catalysis and surface science, has signed a shareholder agreement with Jiangsu Industrial Technology Research Institute (JITRI) and Xiangcheng Suzhou District for a joint R&D company in the Jiangsu Province of China. Based on Topsoe's world-leading insight into the industrial application of catalytic technologies and surface science, the company will focus on the fast commercialization of new technologies and services, with special attention to the needs of customers in China and the Jiangsu Province.

The joint R&D company's first project will be to develop more cost-effective NCA batteries (lithium nickel cobalt aluminum oxide) for use in electric cars. China is the largest and fastest growing market for electric cars. The company will also offer Chinese customers fast and efficient testing within hydroprocessing and emissions management (catalytic filtration) in a convenient location.

Topsoe invests mainly technology and knowhow in return for a 60% ownership share of the company, which is expected to reach 30-40 employees over five years. JITRI and Xiangcheng Suzhou District own the remaining shares and will invest 80 million RMB over a five-year period.

VDMA and Silicon Software host the next International Vision Standards Meeting

Mannheim, Germany: From 14 to 18 May, about 150 technical experts from all over the world will meet at the VDMA in Frankfurt, Germany, to work on standards for machine vision and discuss new standardisation initiatives for the future. Hosting organisation is Silicon Software, in cooperation with VDMA Machine Vision.

"Standards are the turbocharger of growth for our industry. Standards were one of the reasons for the boom of the machine vision industry over the last years and continue to be the key for further success," says Klaus-Henning Noffz, CEO of Silicon Software and member of the board of VDMA Machine Vision. Components and systems with standardised interfaces are accelerating the market availability and development of new applications and solutions. "Due to the importance of standardisation, we look forward to hosting the next IVSM in May 2018!", adds Reinhard Heister, in charge of vision standardisation topics at the VDMA.

UAIL Appoints Thyssenkrupp Industrial Solutions for Alumina Refinery Expansion Project

Mumbai, India: Utkal Alumina International Limited (UAIL) has appointed thyssenkrupp Industrial Solutions (India) to render engineering, procurement, construction management services for their proposed integrated alumina refinery expansion project at Rayagada in Odisha, India. The refinery is located near the company's captive mines and captive power plant.

The expansion project envisages increasing the refinery's total processing capacity by 0.5 MMTPA to 2.0 MMTPA from its existing 1.5 MMTPA. Bauxite, the raw material for the process, is being sourced from UAIL's mines in Odisha. The alumina from the complex is proposed to be used in Hindalco's aluminium smelters at various locations for the production of aluminium products. The project was won by the company in a global bidding process.

thyssenkrupp will provide Engineering, Technical Procurement Services, Planning, Project Management Services and Supervision Services pertaining to the alumina refinery. The award of the project vindicates the company's emerging position as the engineering partner of choice in the metallurgical segment, having completed the 1.5 MMTPA refinery for UAIL in 2014. The company is also currently implementing other alumina refinery projects in India, in addition to key caustic Soda jobs for leading metallurgy companies setting up projects as part of their product integration plans.

UAIL is a fully owned company of Hindalco, which forms part of the Aditya Birla Group. Hindalco has extensive global operations in aluminium and copper. The company is a flagship organisation in the Aditya Birla Group, which is one of India's largest corporate houses.

KSB Pumps bags Order worth Rs. 4130 Mio to supply Primary Coolant Pumps to NPCIL

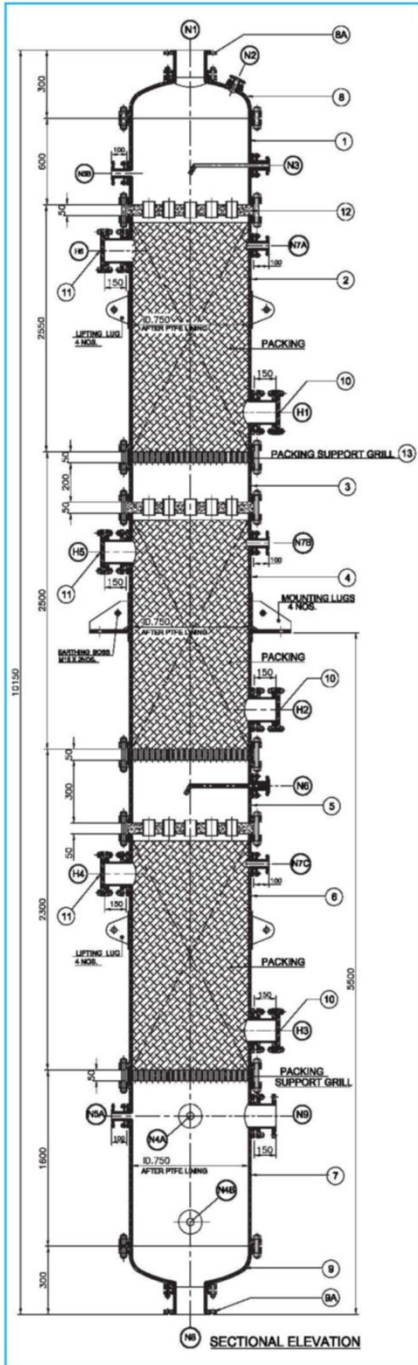
Pune, India: Make in India is a major national program driven by the Government of India under the able stewardship of the Honourable Prime Minister Shri Narendra Modi. It is designed to facilitate investment, foster innovation, enhance skill development, protect intellectual property and build best in class manufacturing infrastructure in our country. The primary objective of this initiative is to attract investments from across the globe and strengthen India's manufacturing sector.

With the Indian Government's ambitious growth plans in the energy sector, and the aim to raise contribution in indigenous manufacturing under "Make in India" initiative, M/s Nuclear Power Corporation of India (NPCIL) awarded an order worth Rs. 4130 Mio to KSB Pumps Limited for supply of 8 nos. Primary Coolant Pumps - RSR 400/2 with related accessories. These pumps will be installed at NPCIL's Gorakhpur Anu Vidyut Pariyojana 1 & 2 project Haryana.

With the completion of initial technical as well as commercial formalities; manufacturing of these pumps will commence at the "Energy Pumps Division" of KSB. Delivery of these pumps is expected to begin from June 2021 with a target to complete the order by March 2023.

KSB has been the pioneer in indigenizing Vertical Canister Pumps and Boiler feed Pumps for Super Critical Power Plants ... some of which have already been supplied; or are at the dispatch stage! NPCIL has embarked on an ambitious program of 12 PHWR projects of 700 MW at various locations including the 2 at Gorakhpur in Haryana; and we at KSB in India have taken up the challenge of indigenizing the Primary Coolant Pumps. For the Gorakhpur and future projects of NPCIL, we are now geared up to supply the PCs made 100 % locally; following receipt of this order! Likewise, the Main Feed Water Pumps for the new projects, if ordered on us, shall also be made by us indigenously.

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Integrated Engineering, Operations and Asset Management are Vital for Chemical Industries

This article discusses improving return on chemicals assets using integrated engineering, operations, maintenance and compliance management.

Chemical industries are diverse in terms of products and processes, and the nature and state of the assets. In the developed world, assets are on average older, intrinsically less reliable and efficient, but in these regions companies have the highest skilled personnel and most advanced methods in place to compensate for it. The regular economic cycles in petrochemicals and polymers have been replaced by irregular, more regional economic ups and downs, with high amplitude. The high growth in developing Asia is slowing down significantly. The oil and gas boom in North America has created growth in the chemical industry in the region in the recent years. The recent drop in oil price has created economic relief for chemical producers globally but demand may suffer because of the economic slowdown. The best strategy for the future is likely one of high flexibility and adaptability to react to global and regional market fluctuations, product innovations, feedstock costs and regulations.

Necessary Steps

A first step is to reduce the cost of assets throughout their lifecycle. This includes effective engineering, leading to more flexibility and lower cost designs that can be operational more quickly. Engineering and design costs can be reduced by making information transparent across disciplines, regions, offices and sites and easier to reuse. Sharing and transparency must be extended across the enterprise borders to engineering, procurement and construction firms (EPC's), subcontractors, to achieve tighter collaboration. Collaboration during design and construction has significantly increased during the past years, and as contractors provide more and more services for plants in operation too, it is expected that the importance of efficient cross-enterprise collaboration will further increase. Compliance of processes and equipment

can be efficiently handled when requirement engineering is electronically linked to qualification processes. Information should also be reused across engineering, operations and maintenance within the corporation, and by their subcontractors. As all stakeholders work on the same asset, they should all work off the same asset information to coordinate and optimize their plans and actions. This concept is referred to as integrated engineering or integrated operations.

In a second stage, these efficient processes can be applied to more productive and flexible process designs using intensification, modularization, and mobile processing units.

Accurate asset information requires a state-of-the-art application and data repository that must be complemented by processes for keeping asset information up-to-date. People must be trained and motivated to use them. When these key success factors are in place, operations and maintenance can be optimized, to sustain a compliant and reliable asset at the lowest cost and with the lowest inventory of spare parts. This includes modern asset management strategies, such as predictive maintenance and condition monitoring, and the simultaneous optimization of asset capabilities and production requirements.

Companies that have pioneered these new practices, report increased engineering productivity, improved handover, accelerated operational readiness, reduction of regulatory compliance cost, reduced maintenance costs and improved reliability.

Asset Management Challenges

The chemical industry is very diverse and, depending on the region, features various characteristics. We can broadly distinguish the following categories:

- Aging, commodity producing assets. These are most likely to be found in advanced economies, and need to be operated and maintained at the lowest operating cost possible. At the same time, they need to operate reliably, safely and be compliant with regulations. Asset information is at risk of being dispersed on paper and in various systems.
- Recent assets for commodity products using classical, mostly continuous process technologies. These assets are mostly found in growing economies, for example in South-East Asia, but also in the USA. Asset information is more likely to be available in electronic format. Reliability, safety and compliance are likely to be satisfactory, but need to be maintained.
- Assets for specialty chemicals, specialty polymers, agrochemicals, food and pharmaceutical ingredients, mostly using traditional batch processing. The products have a high innovative content, and plants are regularly adapted and reengineered, or have been recently constructed. In these cases, it is likely that electronic asset information is available. Regulatory compliance is an increasing cost factor.
- Assets using modular and/or intensified process technology for chemicals or polymers. Existing plants are built for research and process development purposes. The first commercial modular plants are coming on-stream. Asset information is available in electronic form.
- From an engineering and asset information management perspective, a number of challenges can be distinguished:
- In plants under construction by engineering procurement and construction firms (EPC's), owner-operators (OO's) require a tighter collaboration than before. Being responsible for the plant's performance and regulatory compliance at startup, they

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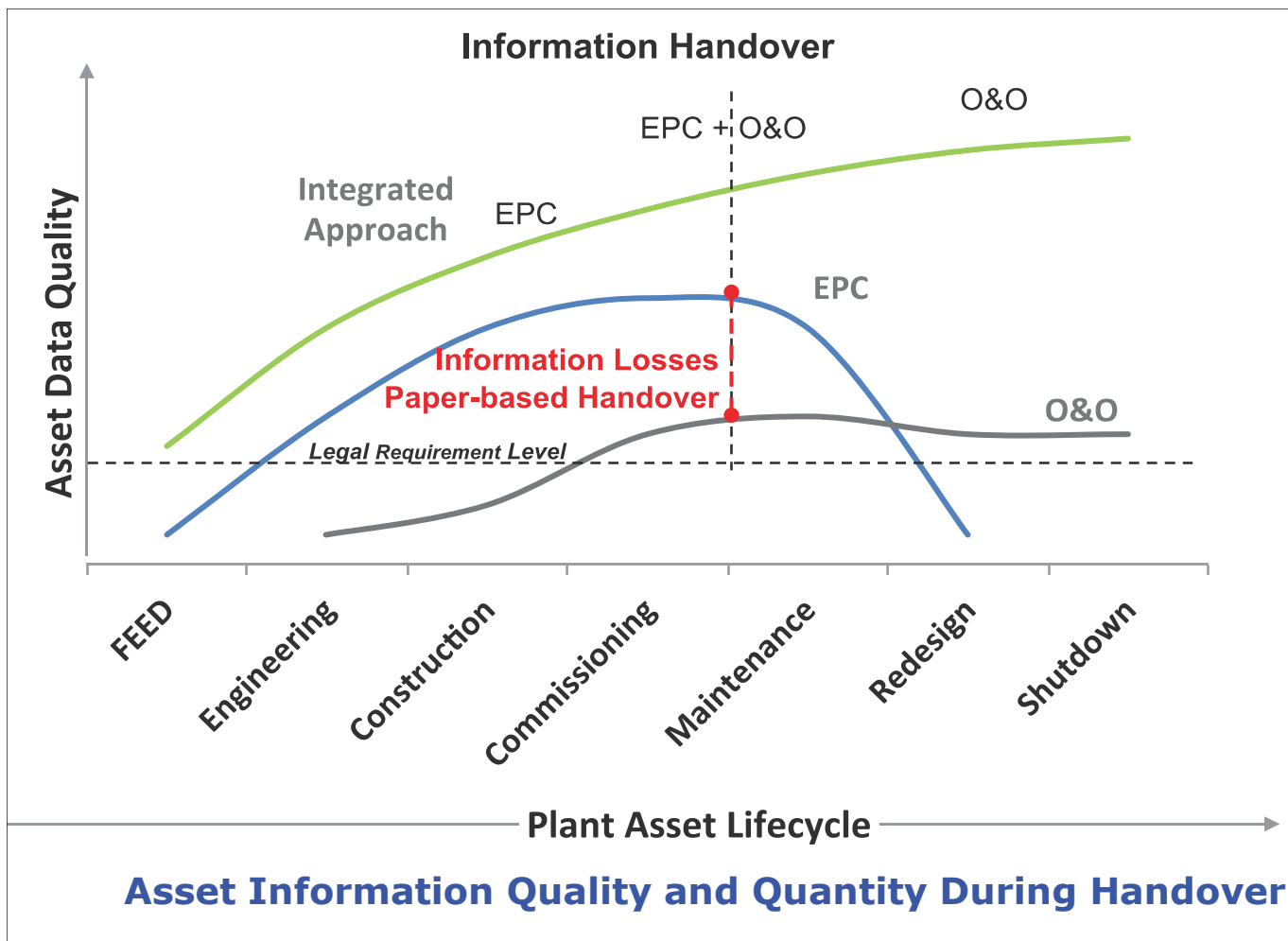
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require design reviews in electronic form as well as the tracking of construction and commissioning progress against electronic documents. More and more qualification processes use electronic design and requirement documentation, with electronic sign-offs.

- In recently constructed plants, the asset information built up during engineering and construction is traditionally handed over on paper, and is often incomplete or outdated at the moment of transfer. NIST estimates that the cost of information losses during handover to be 1.8 percent of capital expenditure. There is a huge opportunity to improve the process by making it electronic, and make sure the information is reused.
- In existing plants, when engineering or maintenance troubleshoot an operational issue or need to start a modified project, they first spend time – sometimes weeks or months – to find out the actual status and performance of equipment and piping,

the available or missing spare parts, etc., before starting their actual work. Further time is lost in ordering missing parts or equipment, increased time to repair, and multiplying travel times. In other cases wrong or excess parts are available, which increase working capital without benefit. Incomplete, inaccessible, and inaccurate asset information therefore leads to a longer project duration, longer “mean time to repair” (MTTR), higher operational and capital expenditure than necessary. Compliance costs increase, or compliance becomes impossible as accurate information cannot be produced at any point in time. NIST estimates the cost of information losses in the operate-maintain phases of the asset to 2.4 percent of the capital expenditure cost, higher than the cost of losses during handover.

- Chemical plants are usually part of large industrial complexes, where plants, and

utilities and storage facilities are distributed over the premises. It is a real challenge to keep track of the asset state, as operations, maintenance and contractors work independently on the same assets.

These challenges imply that it is not a trivial task to obtain a complete, accurate and up-to-date virtual image of distributed assets, easily and rapidly accessible to office and field workers throughout a vast geographical area.

The different types of assets have partly different regulatory obligations, but for all of them regulatory pressure is increasing and will continue to increase in the future. The spirit of these regulations tends to evolve from describing the means for protection into a responsibility of the owner-operator to be able to demonstrate performance-based quantitative risk management.

Whether asset information is built up

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during engineering and construction, or by operations and maintenance of an existing installation, in the end there is always an installation in operation that undergoes maintenance activities and engineering projects related for reasons of improvement, troubleshooting or debottlenecking.

As a result, two or more organizational entities work on the same assets, using – ideally – the same asset information: engineering to design changes and improvements; operations and maintenance for day-to-day activities and long term asset management. To streamline the collaboration between those entities, the concept of “integrated engineering” was created.

The “Integrated Engineering” Concept

In 2005, Dr. Thomas Tauchnitz published a vision for “integrated engineering” (Tauchnitz, 2005), based on three basic principles: “[...] every information is generated and maintained at only one location, existing knowledge is reused where possible, and the software tools stay interfaced while the production plant is in operation.” He sketched the workflow as starting with process design followed by the transfer of the resulting

process information to an engineering software tool, common to all engineering disciplines involved in front-end and detail engineering. To increase engineering efficiency, he proposed to implement modular engineering – using standardized, generic engineering modules comprising all functions built and maintained within the common tool.

Many plants apply a wide variety of control systems. To further increase engineering efficiency, control engineering should be done at a generic level, enabling reuse of designs. The designs can be used to configure systems, and compile the generic designs within different DCS brands.

The next step is the transfer of the engineering information to operations and maintenance and keeping it up to date with the goal to transform “as-built” information into “as-maintained” information to ensure accuracy and save time.

Therefore, “integrated engineering” incorporates different disciplines during design and build stages, and also integrates engineering, operations, maintenance and automation during operate and maintain stages of the installation life cycle.

Finally, the vision includes the implementation of standardized processes across the extended enterprise, reducing the number of systems and interfaces, and organizing centralized maintenance and support and promoting company-wide knowledge management.

In the case of maintenance and improvement projects related to automation and instrumentation, seamless, bi-directional integration with automation systems simplifies the changes to the automation systems significantly, by enabling the configuration of the control system directly from the design in the engineering tool. Vice versa, when a control system configuration is changed in the field, the control system would automatically update the application with the actual control system configuration. The NAMUR standard NE 150 enables doing this in a standardized manner.

Collaboration between internal or external engineering departments and maintenance (and/or operations) may occur during these projects or changes. It is of utmost importance that the stakeholders work off the same, up-to-date asset and engineering data. This has important benefits for engineering and modernization projects by simplifying the work, unloading personnel, while guaranteeing accurate and up-to-date asset information. It creates even more benefits by saving engineering work when the same changes need to be applied to several sites. Many standards are available for this complex domain. ISO 15926 is the most well-known, standardizing the equipment specification. ■

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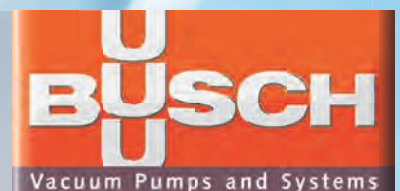
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Effective Risk Mitigation Strategies for Projects

The most common risks for projects are improper execution strategy, contractor selection, permitting, vendor selection and design changes. The article will address common risks encountered in projects and effective strategies to mitigate these risks. Examples will be provided for these common pitfalls

A modern day project manager has to always juggle between the 4 key project objectives of safety, quality, cost and schedule. To manage these objectives one of the key tools is risk management.

Project risks are internal and external and as with any type of risks the key to their management is early identification and effective mitigation.

In this digital age, with so many tools available to the project management team to manage risks, it is seen that in spite of the best laid plans, projects go off track and fail in achieving one or more of their key objectives.

Below we shall examine some key pitfalls in projects where risks are missed out and could lead to possible project derailment.

Stakeholder Identification/Engagement

One of the prime reasons for projects going off track is inadequate involvement of key stakeholders. A classic case is to bring in the Production manager into the project close to commissioning. Very often production in charge has a very different outlook compared to the design team and can lead to last minute changes in the plant.

All the key stakeholders need to be identified right at the start of the project and their roles defined very clearly. Involve production engineers as well as Site HSE in early model reviews to avoid last minute changes.

Another pitfall is to give too much or the wrong category of information to

stakeholders. A common example is to feed the project steering committee with too much technical details. The role of the Steering committee is to guide the project team in key decisions on costs and schedule and not to provide technical solutions to issues. With too much technical information, the key project cost issues might get drowned in data or some member of the steering committee might start interfering in technical details for which they are not responsible for. Both situations can have damaging effect on the project.

Contracting Strategy

Contracting strategies can make or break a project. A lot of companies go with a one strategy fit all approach. But unfortunately there is nothing like a perfect contracting strategy. Below are just broad guidelines on selection of a appropriate contracting strategy

EPC Lumpsum: Go in for a lumpsum EPC contract only if the scope of the project is well defined and contractors are available who have experience in similar plants. Going in for a Lumpsum contract for a new Process or a plant which has a lot of specialised equipment can be a recipe for disaster.

EPC Reimbursable: This strategy can be very effective where the project owner has little or no regional experience where the project is being set up. The risks associated with less knowledge of local conditions can be mitigated to a large extent by passing them on to a good local contractor.

EPCm model: Probably the safest contracting strategy. But EPCM model can easily lead to large cost escalation as the EPCM contractor has very little stake in the project. Also this model can easily turn out to be a sparring game between the Engineering and Construction contractors.

It is essential that each project be assessed on specific requirements and then the contracting strategy be finalised very early in the project.

Vendor Selection

The general attitude towards vendors is that there is a prequalified approved vendor list so it is just a matter of following the approved list for the project. Since all the vendors are prequalified, no risk is foreseen for vendors. But this is far from reality. Even vendors with whom clients are working for decades can be the source of major risk to the project.

The first check required is whether the key vendors have adequate spare capacity at present to handle the load posed by the project. In absence of this it is possible that the vendor will supply the items required but with substantially longer delivery times.

For critical suppliers, it is worthwhile to do a financial due diligence especially if the client has not worked with the vendors for a substantial period of time. There are multiple cases globally where the vendor collapsed financially in the middle of the execution phase and disrupted the project as the order had to be diverted to alternate vendors. This risk is especially high for Single Source vendors.

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Permitting

Getting local permits brings in the uncertainty associated with dealing with a variety of Government authorities. Delays in obtaining permits can not only jeopardise the project schedule but sometimes even bring about design changes which would throw the project cost out of bounds.

Many of times some of the requirements of local authorities are unwritten. So the best solution to handle this is to have a Engineering contractor well versed with preparing and submitting statutory approval drawings. In addition it is advisable to submit the approval drawings quite early in the project.

It is worthwhile to submit revised drawings when the final versions are available so that major modifications especially to the building layouts due to authority feedback is avoided.

Design Change

Design changes in a project are inevitable and these are normally covered in the project estimates as design creep allowances. But the design changes if not properly managed can easily go beyond the creep allowance and bloat up the project cost.

A few simple steps can easily ensure that design changes are minimised.

Focus on getting major design reviews done pretty early in the project. These include HAZOP, SIL Assessment and Constructability reviews. These reviews can bring in maximum changes in the design leading to cost increases. But for carrying out the reviews early, it has to be planned that all the deliverables required for these reviews be completed early. Ideally these reviews (at least HAZOP and preliminary constructability review) should be completed before the sign off of the FEL3 (Front End Loading) package.

The rest is up to rigorous project control that every change after the design signoff is properly recorded and measured. While this does not minimise the changes but at least keeps track of the variations and genuine scope changes can be identified.

Managing Risk Register

Project risks are identified at the start of the project through a risk workshop and recorded in the project risk register. But many a times the risk register is not updated on a regular basis and the risks though clearly identified at the start of the project actually start affecting the project just because no one bothered to monitor them. In such a case the entire project risk assessment exercise is futile.

It is one of the key responsibilities of the project management team to manage risks to the project and ensure minimum monthly reviews of the risk register are done.

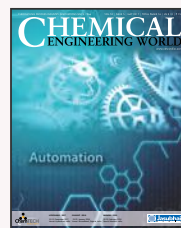
Last but not the least remember that Risks are never eliminated, they are always mitigated. Manage risks effectively and meet the project goals of safety, quality, costs and schedule. ■

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Modularization of Onshore Plants

Modularization is a plant design concept that is fast gaining acceptance across the construction industry as a means to reduce cost, improve quality and speed up construction. This article attempts to discuss the various factors that serve as drivers for modularization techniques, as well as the pros and cons of the concept.

What is a Modular Plant?

Simply put, a modular plant consists of a skid on which the various plant components such as equipment, piping, structures, supports, insulation, distribution boards, control consoles, fire alarm panels, cable trays and cabling and even light fittings are all mounted. Each module is thus a fully contained process unit and could represent an entire plant, or part of a plant. This skid is then transported to the project site and installed at the location with minimal effort.

Drivers behind the Modularization Concept

The traditional approach to design and construction of a plant involves in-situ construction of the facilities using locally-sourced labor, resources and material. However, in specific cases, EPC companies nowadays are increasingly going for modularization.

The factors that influence the decision to go in for modularization are as follows:

- Remote site locations: Remote site locations throw up a variety of challenges, especially in terms of availability of skilled labor, and the transport of materials to the job site. This is where the biggest advantage of module-based construction lies. A modular plant can be constructed in an altogether different location, far away from the job site, and then be transported to the site.
- Hostile weather conditions: Vagaries of weather, such as extreme hot and cold conditions, pose a threat to productivity, worker safety and associated parameters such as quality. In such cases various parts of the plant could be modularized and fabricated at a location where more favourable conditions for construction exist, leaving only the bare minimum

work and module interfaces to be carried out at site.

- High field construction costs: Construction cost can form a major component of the overall project cost, especially if labor costs are high. It would therefore help reduce the project cost if field work is minimized and most of the work is modularized. The module could be fabricated in regions such as Asia or Eastern Europe where labor is relatively cost-efficient.
- Crashed schedules: With modularization of a plant, work can go on in parallel on different modules. Even multi-storied structures can be handled in this manner. This can help in improving schedules as opposed to the linear construction sequence of stick-built designs.
- Where repeatability or duplication is possible: Companies are already exploring the options of breaking up a large capacity plant into smaller modules of lower capacities. Thus an in-situ conventional natural gas liquefaction plant with a capacity of 2.5 million metric tons per year (MMtpy) could be broken into 10 typical modules, each of 0.25 MMtpy capacity, shaving off an entire 12 months from the construction schedule.
- Where reusability is a factor: In a bid to be competitive in an already crowded market, companies are looking to reduce costs all the time. Modules designed to be reused across locations can greatly reduce capital investments.

Modularization as a concept has been used widely in the offshore industry, but is now making its way into the onshore industry for the reasons stated above.

At the same time, some projects may not lend themselves to modularization.

If the project site is in a location where infrastructure is good and skilled labor is abundantly available, there may be no point in using modularization.

It is to be noted however that while modularization can complement in-situ site work, it cannot totally replace it. Certain activities such as site grading, civil foundation work, large equipment erection and interfacing between the modules can only be performed on site.

Planning and Execution:

While a modularization strategy seems to offer all the solutions to typical in-situ construction problems, it is important that it is thoroughly planned out during the early and detailing phases of the project, and engineered efficiently.

A few important points to be considered are:

- Evaluation of the strategy: While modularization can have major cost and schedule benefits, it could lead to complexities if not evaluated properly. The plant must be of a nature such that parts of it can be modularized. The added design and coordination costs along with the transportation costs must be carefully estimated. The modes of transportation that are likely to be employed (truck, rail, barge etc.) and the availability of a roll-on/roll-off (RORO) jetty in port or at site must be determined at the beginning of the project as they also have an impact on the way design is carried out. Ultimately the modularization must provide definite cost benefits over the in-situ method.
- Deciding which part of the plant lends itself to modularization: The dimensions and weight of a module have a direct bearing on the shipping cost of the



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Figure 1: 3D Model of a process module for an onshore plant. Note the extent of detailing that has been carried out.

module, and must therefore be evaluated carefully. For example, very long or heavy equipment cannot be a part of modularization as they would result in large module sizes. These would be difficult to transport, and in fact may end up being more expensive than the in-situ method. In projects which involve extremely tight schedules, multiple module fabricators may be considered, but the coordination between them is critical.

- **Advancement of engineering activities:** One of the success factors in employing modularization is to have the modules delivered to the construction site as soon as the foundations or structures to receive them are ready. Modules therefore have to be engineered in advance so as to extract the full advantage of the concept.
- **Minimizing revisions to documents:** As mentioned above, the construction of modules should start early in order to have them delivered early. Engineering revisions can have a negative impact on the module progress, and must be avoided. A project that is likely to see concurrent engineering may be a bad candidate for modularization.

- **Procurement:** When using modularization, it may be a good idea to let the module fabricator procure the majority of the module components so as to reduce interfaces within the module. This will also give the fabricator a freer hand in developing the module.
- **Monitoring:** Adequate monitoring of the module constructor's progress is essential, though too much interference can be counter-productive. In case the purchase of materials is not in the module builder's scope, it is important to monitor the supply of materials to the module minutely to ensure that module construction is not affected.

Design Considerations:

While modular designs do not differ greatly from conventional design methods, they need some special design considerations. Some of these are listed below.

- A clear scope split between the module vendor and the contractor is essential. The scope document must clearly define the contents of the module as well as the termination details. Since the module vendor will be working with limited space, it may not be possible to accommodate

scope additions at a late stage without causing a major impact on cost and delivery. The termination details such as pipe ends, flanges and junction boxes should be located towards the edges of the module so that field construction has minimal (or preferably no) interface inside the module.

- The module size and weight are the governing factors and will drive the layout, rather than the layout considerations driving the module size. The size of the transporting truck or the capacity of the barge that is used to transport the module will usually drive the design. The module vendor will therefore work within a very limited space.
- However modularization does not provide any concessions on the basic safety distances to be maintained between facilities within the module, access and egress requirements, operability and maintenance requirements. All these are to be met within the given size, and this poses the biggest challenge to design.
- Modules may be oriented differently during module construction and transportation as compared to the final position in the field. It is therefore extremely important for the design team to be aware of the fabrication and transport details and account for any additional forces in design.
- Modules will be subject to lift forces as they are being lifted for transportation and erection. Such lifting points must be clearly identified and the corresponding forces determined. The modules will also encounter acceleration forces during transport, including pitching, surge, sway and rolling if they are being transported to the job site by ship or barge. The structures must thus be designed not only for design and operating considerations, but also for lifting and transport.
- In other words, modular structures need to be designed to be safe in the assembled module as well as in the final erected form. Additional strengthening may be provided to avoid damage to the structure under different circumstances. On account of the



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Figure 2: Modular pipe racks being erected at site. The alignment of the foundations is extremely important in such cases as a mismatch would directly result in misaligned pipes at the interface. Note the gaps between the pipes in the module. A make-up piece is field-welded in the gap and takes care of any site tolerances.

additional considerations of orientation, lifting and transport, modular structures usually use more steel than in-situ ones.

- Weight management is an important aspect that often gets overlooked while designing modules. Determination of the weight and the center of gravity (COG) is a key component in the weight management process. The weight and COG are also important factors for transportation as they will proportionately increase acceleration forces. Some allowances should be made in the weight and COG calculations initially so as to provide a degree of flexibility during design. These allowances can be gradually reduced during the course of detailing when more definitive information is available.

Pros and Cons:

Based on the above, the pros and cons for the modularization concept can be summarized as follows:

Pros:

- Higher productivity
- Shorter construction schedules
- Heavy construction equipment such as cranes need to be deployed for a shorter duration
- Minimum field inventory
- Better quality
- Increased safety
- Cost benefits

Cons:

- High module transportation costs
- Heavier cranes and machineries to be deployed for construction to handle complete modules as compared to individual components
- Heavier structures since transportation and lifting must be factored into design
- Detailed planning is required upfront
- Increased coordination required between multiple agencies

In short, modularization adheres to the age-old principle that it is prudent to spend extra efforts and resources in the engineering office rather than spending more time at construction sites!

Modularization can be a cost and time saving alternative to the conventional in-situ construction methods. With good initial planning, a clear scope split and proper follow-up, it can be a winning strategy. ■

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Think You've Got a Lot of Data? Think Again!

This article explores the data requirements that allow plant-wide monitoring and diagnostic technologies to accurately characterize changes in performance. In particular it examines the requirements of key performance indices (KPIs) common to control loop performance monitoring (CLPM) technologies. These KPIs are essential to identifying issues and isolating the associated root-causes that undermine both production and asset reliability.

Manufacturers are looking increasingly to technology to make sense of their facility's abundant process data. Indeed, a surge in the number of available diagnostic technologies provides the ability to detect changes in all manner of performance from production output to OEE and asset reliability. For anyone who has leafed through an industry publication or visited an automation blog the persistent uptick in demand for diagnostic technologies isn't surprising. Still, for all of the headlines about the impact of Big Data and IIoT on the manufacturing industry, there's only limited content that points out a simple reality: More often than not the masses of data being collected is simply not enough.

Distinguishing Information from Analytics

While used interchangeably the words 'information' and 'analytics' aren't synonyms. The data for general information purposes such as performance trending is limited. Whether used to indicate performance relative to safety limits or production goals, a single data sample every minute is often all that's displayed on control room HMIs. One reason is that the human brain can only process a limited amount of data. According to researcher Fermín Moscoso del Prado Martín of University of California, Santa Barbara that limit is just 60 bits of data per second. That's 'bits' with a very small 'b'. Another and more common reason is the production facility's limited data storage capacity. With lower cost sensor and higher capacity storage technologies, the steady influx of diagnostic technologies is pushing manufacturers past their traditional use of information and into the more actionable realm of analytics. Even so the data required to fuel these advanced technologies continues to lag.

More often than not HMI trends showcase data that is sampled once every minute.

The word 'trend' itself describes a general direction in which something is heading whether that direction indicates Up vs. Down or Good vs. Bad. Such information is not intended to provide a detailed picture of a system's health or a process' performance. Rather, trend information is generally displayed in relation to historical benchmarks or physical constraints. Only when a threshold is exceeded is a detailed investigation or corrective action considered. That's precisely what distinguishes analytics from information and why analytics requires so much more data. Whereas information trends need only limited data to indicate a general direction, analytics require as much data as is available to proactively uncover hidden insights that will impact performance.

An Inconvenient Truth about Data

Increasingly analytics capabilities are being developed to proactively optimize process control. According to a study produced by Future Market Insights the

market for analytics is projected to exceed USD 13 Billion by 2022. Just as predictive analytics continue to gain traction in asset reliability, so too control loop performance monitoring (CLPM) solutions have become a staple across the process industries for continuous improvement. CLPM is software that analyzes a production facility's process. It focuses on the performance of a facility's core regulatory control systems, the 100s or 1000s of PID control loops that regulate production plant-wide. Those regulatory controllers serve as the foundation on which advanced control systems operate, and their efficient operation has been shown to be instrumental in achieving and maintaining profitable production.

Failing to sample data sufficiently fast relative to the Time Constant of the process can result in a condition called Aliasing. While the necessary sample rate will vary from process to process advanced analytic technologies depend on access to high





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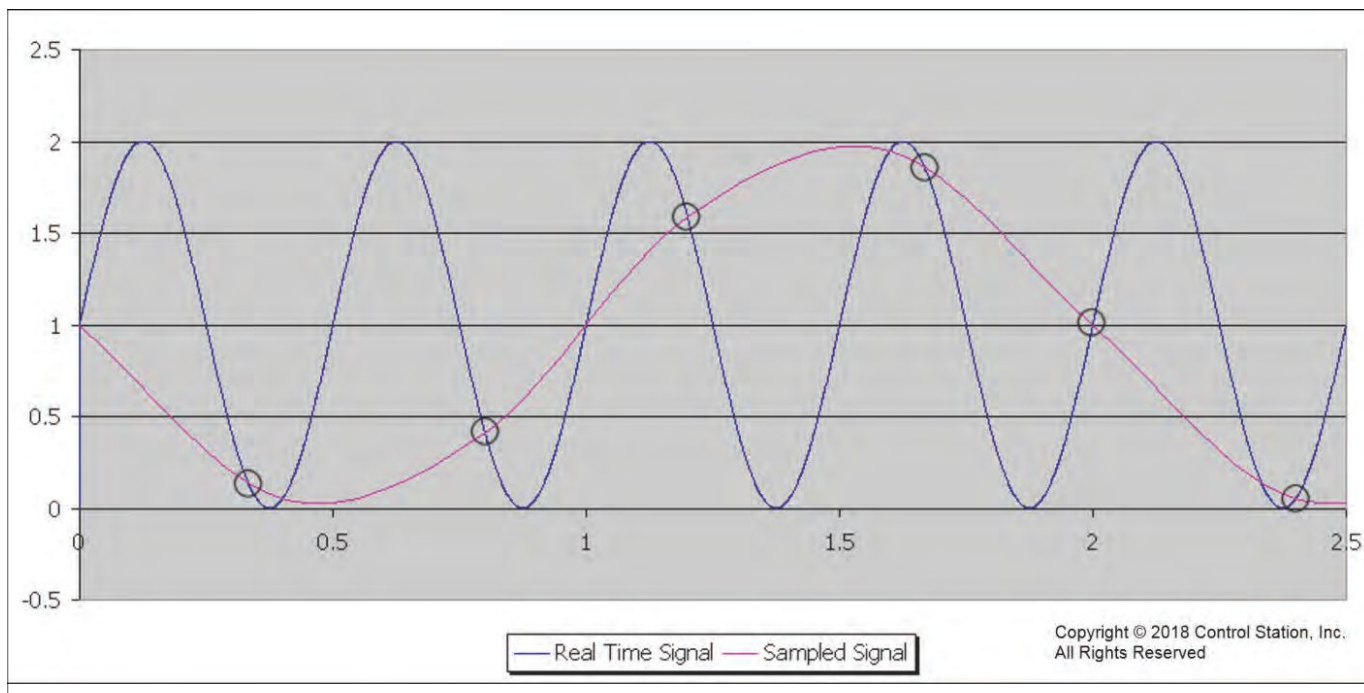
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Failing to sample data sufficiently fast relative to the Time Constant of the process can result in a condition called Aliasing. While the necessary sample rate will vary from process to process advanced analytic technologies depend on access to high resolution data in order to fully capture relevant details.

resolution data in order to fully capture relevant details.

While the data requirements of key performance indices (KPIs) vary, there are minimums. What's widely understood is that most metrics offer insight when they're provided with higher resolution data. Indeed, in the world of process control the sample speed for data is dictated by its Time Constant. The Nyquist-Shannon theorem stipulates that such data should be collected at a speed ten times faster than the process Time Constant. That's a necessity for fully capturing the relevant detail within a process. Whereas data from typical Temperature, pH and Concentration processes can be sampled at rates between 5- 30 seconds, faster processes such as Level, Flow and Pressure usually require data sampled at 1-2 seconds. This underscores the challenge with the 60-second standard. If the documented findings from Nyquist and Shannon are to be believed, then data collection practices are woefully inadequate on an industry-wide basis. Manufacturers looking to leverage CLPM solutions as a means of improving process performance must first confront the limitations of their data sampling and storage practices. Fortunately for those concerned

about the storage requirement there is good news: Most CLPM solutions only require the data to be stored for a limited time.

Empowering Advanced Diagnostics

There is a degree of irony in the data requirements of basic vs. advanced CLPM KPIs – a fact that warrants explanation. It is true that basic KPIs do not require access to high resolution data whereas the more advanced metrics included in CLPM solutions are dependent upon access to it. Essentially, basic CLPM metrics are used to calculate fundamental attributes such as Average, Variance and Time in Automatic. Such information provides relative insight into process performance, and it can be accurately calculated using the 60-second data that is commonly captured. These KPIs are generally used to track how well a controller maintains Set Point and operates in its assigned mode. Additionally, the output of basic KPIs is often used in the calculation of composite metrics such as a process' overall health. Even so basic KPIs are not the ones that assess the variability associated with complex process dynamics. It is their advanced counterparts that deliver those assessments along with actionable insights.

High speed data is needed to conduct the advanced CLPM diagnostics associated with process and system dynamics, and it is needed to perform detailed interaction analysis. When given access to high resolution 1-second data CLPM solutions can apply these KPIs to offer significant insight. Such data allows CLPM solutions to thoroughly assess valve characteristics in a fashion similar to predictive analytic tools. Specifically, it supports the identification of final control element behavior that either inhibits efficient production or leads to catastrophic failure. Similarly, high speed data permits CLPM solutions to isolate underperforming PID controllers and calculate alternative tuning coefficients that are capable of reestablishing optimal regulatory control. So too cross correlation and spectral analysis used in isolating root-causes are made possible with access to high resolution data. Conversely data that is too slow according to the Nyquist-Shannon theorem undermines any CLPM solution's ability to effectively perform these advanced diagnostics.

Select CLPM solutions utilize high resolution data to automatically isolate process changes, model the associated dynamics,

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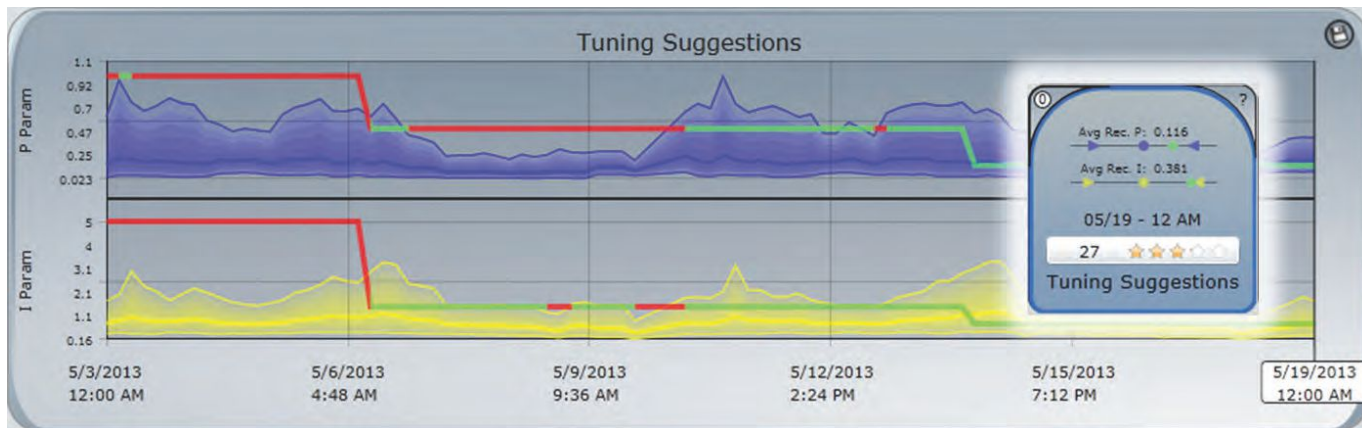
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Select CLPM solutions utilize high resolution data to automatically isolate process changes, model the associated dynamics, and calculate optimal PID tuning coefficients. The image from PlantESP's TuneVue™ utility indicates when existing coefficients fail to satisfy the control objective (Red) and how recommended coefficients would satisfy the same objective (Blue/Yellow).

and calculate optimal PID tuning coefficients. The image from PlantESP's TuneVue™ utility indicates when existing coefficients fail to satisfy the control objective (Red) and how recommended coefficients would satisfy the same objective (Blue/Yellow).

A Short-Term Requirement with Benefits

It is common practice to configure a historian to capture and store information for extended periods of time. In most cases data storage procedures adhere to industry best-practice. In other cases those procedures are dictated by regulatory requirements. The Good Automated Manufacturing Practice guidelines are among the regulations applied to the pharmaceutical industry that assure production facilities maintain auditable production information. CLPM solutions are not as demanding in their need for long-term storage and integrity. Their requirement for storage is limited to the short-term. Indeed, once CLPM solutions perform their analysis the resulting calculations are stored in a separate database and the original process data is purged. As such the need for storing data in a facility's process historian is generally limited to a matter of weeks. That requirement offers a unique benefit during the initial configuration of select CLPM solutions, and it addresses an increasingly common IT issue.

Select CLPM solutions possess the ability to backfill data both during initial solution configuration and whenever access to the historian is lost. The ability to backfill during configuration is unique to a select subset of

CLPM solutions. It significantly reduces the time involved with setup as initial KPI values can be automatically established using a facility's historical process data. These same solutions allow benchmarks to automatically update as the performance of individual control loops improves, thereby supporting the general goal of continuous plant-wide improvement. The ability of select CLPM solutions to backfill data also addresses common IT disruptions. Such disruptions result from routine updates to a plant's IT infrastructure, network or switch upgrades or other communication failures. The potential for disruptions such as these increases in IT environments where multiple historians are utilized whether within a single plant location or across an enterprise. With the ability to backfill for any data gaps resulting from IT disruptions, specialized CLPM solutions assure the integrity of their analytics. Since most IT disruptions are of limited duration the need for long-term storage of high resolution data isn't necessary.

An Industry in Motion

Industry continues to move towards plant-wide optimization through advanced analytics. This shift beyond simple information trending tools is evident in the growing number of analytical applications. The common challenge that manufacturers face when implementing these advanced solutions is the shared need for high resolution data. Current data sampling practices fall well short of what's needed to gain meaningful insights and realize the full value of advanced technologies.

As a subset of the advanced analytical market CLPM solutions require access to high resolution data to accurately assess factors that negatively impact plant-wide process performance. The benefits of CLPM have been proven to increase production throughput and quality in addition to decreasing energy consumption and the risks of asset failure. Although they require high resolution data when performing calculations, their benefit is more than worthwhile and the need is only limited in duration. This short-term requirement enables faster solution configuration and it assures the integrity of the solution's analysis considering occasional IT disruptions.

In the end individual manufacturers need to choose between information and analytics. Given the steady growth of the advanced analytics market, it seems clear which of the two, manufacturers will chose. ■

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3D Printing in Biomedical Applications

Three-dimensional (3D) printing is an additive manufacturing process. This technology provides us with the opportunity to create 3D structures by adding material on a layer-by-layer basis, using different kinds of materials such as ceramics, metals, plastics, and polymers. Nowadays, tissue engineering investigations are taking place on a widespread basis in the fields of regeneration, restoration, or replacement of defective or injured functional living organs and tissues. For this reason, it is important to understand the basic concept of 3D bioprinting as a tool for producing a 3D structure combining living cells and biomaterials and controlling cell proliferation, attachment, and migration within 3D structures.

3D printing technology has garnered huge attention of medical researchers because of its ability to build human tissues. With the help of advanced biomaterials and proper polymerization technique a lots of unique features of human tissues can be recapitulated. Microfluidic approach in 3D cell printing has led to a significant leap in the vascularization of engineering.

Recent advancement in the field of genetic engineering and stem cell development can be adapted to the 3D tissue fabrication technique. It also has huge potential of disease modelling and carrying out study of unknown disease mechanisms required for precise medication.

The primary aim of Tissue engineering is to develop functional tissues/organs for transplantation purpose. Not only this. It also helps in studying disease mechanisms and discover drugs. There is requirement of mimicry of the cellular components and extracellular matrix of the human body for the reproduction of functional tissues/organs. The in-depth understanding of human disease is crucial to determine appropriate therapeutic approaches.

A lots of new drugs and therapeutic targets are being developed and they are mostly examined by 2D or 3D cell cultures or genetically modified transgenic animals. But these technologies have limitations because they are unable to mimic human physiological conditions because of their insufficient complexity. In such scenario 3D tissue model is an outstanding alternative because it represents the spatial and chemical complexity of living tissue in more detailed way than their 2D counterpart.

Thus, engineered tissues apart from being used as testing device outside human body, It can also be used in implantation of regenerative medicine.

Recently, 3D cell printing technique is proved to be the one of the most emerging technology for precise cell-positioning fabrication method. The best advantage of this technique is that it enables in recapitulation of unique features of human tissue. It also has the ability to deliver multiple types of cells in controlled distribution.

Printing Technology

For the fabrication of tissues, cellular components are surrounded by flowable and biologically compatible hydrogels to prevent damage of components from shear stress. There is great advantage of using bioinks as it can mimic the tissue-specific microenvironments under the provision of a natural ECM-like nanofibrous structure. 3D cell printing techniques for biomedical application has been categorized into four major types: 1) Laser assisted, 2) Stereolithography (SLA)-based, 3) Jetting-based, 4) Micro extrusion printing system.

Types of Biomaterial Inks Used in 3D Printing

For a material to be used in biomedical applications materials used must: (1) be bio-compatible, (2) not form toxic substances, and (3) have appropriate structural properties, among other characteristics. There are various inks that have resulted either from a need for better biomaterials or those, which are application specific. Some of them are:

Hydrogels: These are hydrated networks of crosslinked or synthetic polymers. They are hydrophilic and have the ability

to swell. The extent of swelling can be controlled using factors such as the polymer material, viscosity, shear stress among others. Higher swelling capacity hydrogels are used in hygiene fields where retention of water is expected. For drug delivery applications, hydrogels with lower swelling capacity is used.

Ceramic-Based Inks: Ceramic based materials have high stiffness, and provide a surface naturally needed in bone tissue development. Current technology is limited to provide direct printing of such materials. Some commonly used ceramic-based inks are Hydroxyapatite (HA) and Tricalcium Phosphates. These materials enhance mechanical strength in scaffolds.

Polymer-Based Inks: These inks come in the forms of powder, gels and solutions. Some of the commonly used polymers are Polylactic acid (PLA), Polycaprolactone (PCL) and Acrylonitrile Butadiene Styrene (ABS). Their usage ranges from craniofacial implants and bone scaffolds- which assist bone formation and regeneration, to musculoskeletal tissue engineering applications. The advantage of polymeric biomaterial inks is that their properties can be altered by choosing suitable monomers and processing techniques.

Composite Inks: These are primarily used in tissue engineering applications. With additives such as carbon nanotubes and biomolecules, their usability expands across multiple fields. The main reason these inks are used is to enhance mechanical properties and bioactivity. There are two major types of composite based inks-

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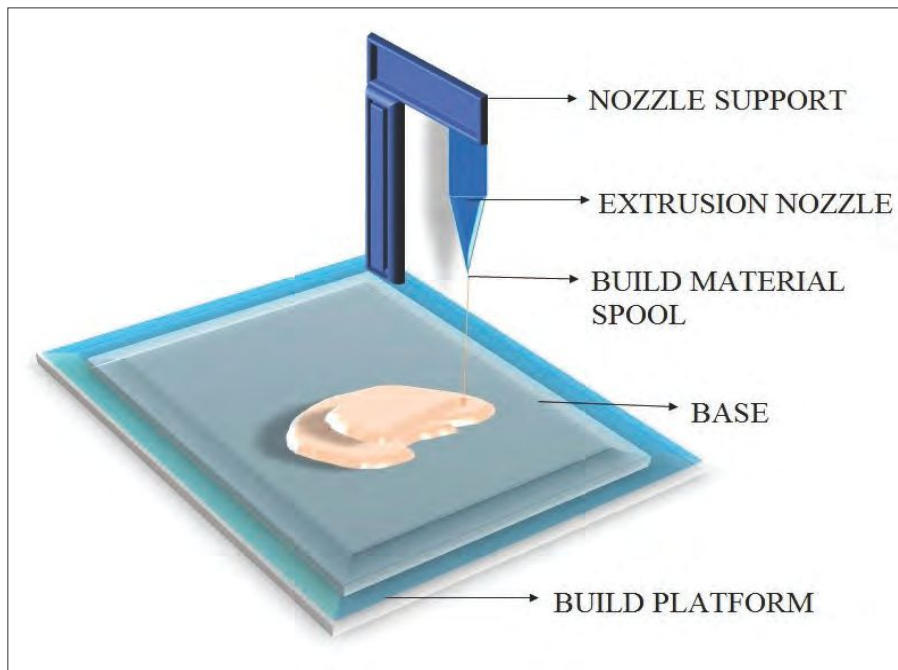


Figure 1: Representation of 3D printer used in biomedical application

hydrogel-based and polymer-based. There has been evidence that particular composite inks enhance ability to accelerate healing.

The current spectrum of biomaterial inks has limited scope of alteration in properties to enhance their use. Therefore, this is a challenge to overcome in 3D printing and there is tremendous potential to develop such biocompatible inks which offer application-specific characteristics.

3D Printing in Bio-Medical Application

Dental Implants: For more than 20 years, researchers have been trying to automate conventional manual processes in dental technology with the hope of producing more uniform-quality materials, standardizing manufacturing processes and reducing production costs. Existing dental CAD/CAM systems cannot yet acquire data directly in the mouth and produce the full spectrum of restoration types (with the

breadth of material choices) that can be created by traditional techniques. Emerging technologies may expand dramatically the capabilities of future systems, but they also may require a different type of training to use them effectively.

Bio-printing: 3D bio-printing is a versatile emerging technology that is finding its way through all aspects of human life. The potential of 3D printers can be exploited in areas of biomedical engineering such as fundamental research, drug delivery, testing, as well as in clinical practice. Nearly all current medical non-biological implants, such as ear prostheses, are manufactured in predetermined sizes and configurations that are widely used for patients. This technique allows more accurate personalized manufacturing of devices created to the patient's own specifications. Bio-printing is being used to create more accurate non-biologic and

biologic research models for research purposes in a wide variety of applications like cancer research.

Drug Delivery: The drug development process is extremely costly and it takes around ten years before a new drug gets regulatory approval. Currently, drugs are tested in 2D cell culture formats, followed by animal testing and clinical trials. 2D cell cultures fail to represent the complex 3D nature of human tissues, making them non-predictive and unreliable. 3D cell culture platforms together with perfusion culture technologies are creating more representative and predictive models of the behaviour of cells in vivo. 3D bio-printing is able to generate 3D models containing human cells to create a microenvironment that most closely resembles the native environment, and facilitates cell-cell and cell-matrix interactions. These allow high-throughput screening of compounds to accelerate the drug discovery process.

Tissue Engineering: Tissue engineering technology has the potential to resolve the organ transplantation crisis. However, assembly of vascularized 3D soft organs remains an enormous challenge. Organ printing, which we define as computer-aided, jet-based 3D tissue-engineering of living human organs, offers a possible solution. A cell printer that can print gels, single cells and cell aggregates have been developed. Computer-aided layer-by-layer assembly of biological tissues and organs, is presently possible, fast evolving and predicted to be a major technology in tissue engineering. It is safe to predict that within the 21st century, cell and organ printers are going to be as broadly used as medical analysis tools as was the electron microscope within the twentieth century.

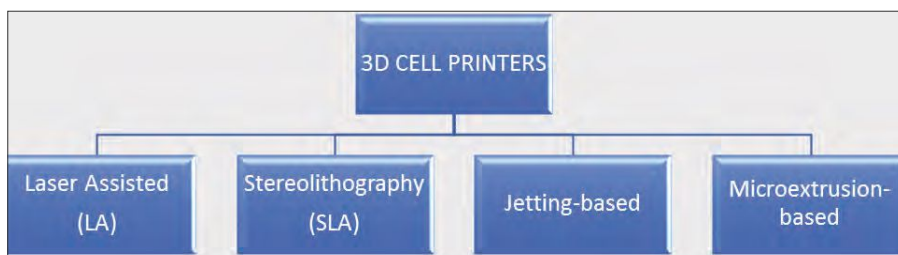


Figure 2: 3D cell printing techniques for biomedical applications

Conclusion

It is evident that 3D printing technology has truly revolutionized the biomedical engineering sector offering flexibilities both in terms of functionality and design. However, there are challenges to be addressed for not only furthering the



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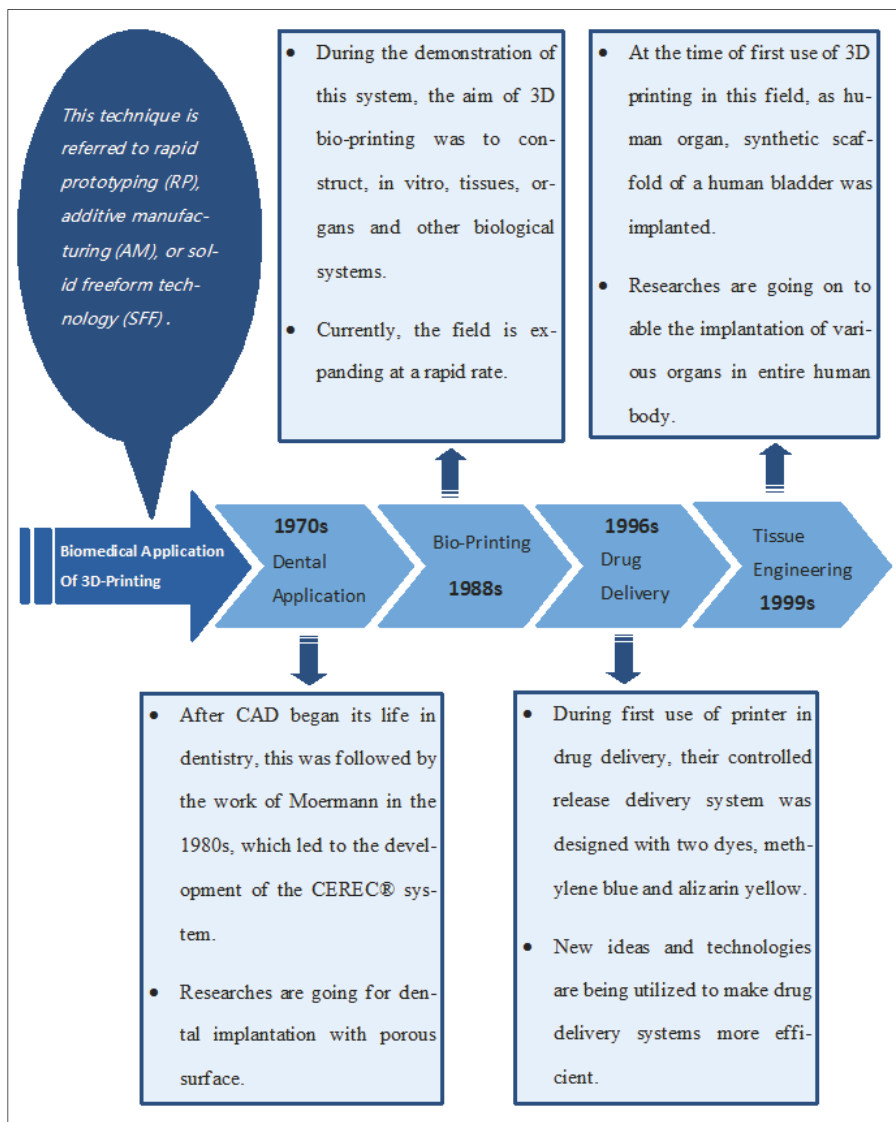


Figure 3: Chronological order of 3D Printing technology in various applications

technology but also pose 3D printing as one-stop solution for biomedical engineering solutions. Presently a universal bioink able to print variety of organs can be a real breakthrough technology lending more versatility to the technology. Shifting from simple criss-cross patterned scaffold structure and mimicking true structure of the transplant can also be researched into. Importantly there is lot of scope of improvement in design of 3D printer themselves in order to lend versatility to its applications. From a holistic perspective, 3D printing technology can be developed to cover the entire range of medical application beginning from diagnosis ending with prognosis. ■

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Are M&As Shaping the New Road Map for Chemical Industry?

Merger and Acquisition activity has significantly shaped the chemical industry landscape in the recent past, and it will continue to do so. Chemicals companies are constantly in quest of growth in an industry that offers ever-fewer and ever-smaller attractive growth segments and where incumbents face greater competition from upstarts in developing markets. This article try to analyze how the mergers and acquisitions poised to reshape the industry.

The chemical industry in India is the third largest producer in Asia and sixth largest in the world. According to the Department of Chemicals and Petrochemicals, as of 2017, the domestic chemical industry's size is pegged somewhere between USD 150-155 billion, accounting for 2.1% of the country's gross domestic product (GDP) but only a little more than 3.4% of the global chemical market.

With more than 80,000 chemical products being developed for either directly or indirect consumption for almost all the other sectors, the chemical sector is highly diversified. Besides the obvious petrochemicals, agrochemicals, specialty chemicals and fertilizers, other sectors such as pharmaceuticals, textiles and paints offer a huge market opportunity too in India. Hence, the chemical sector is instrumental for the overall economic development of the country.

The government itself expects the chemical industry to double in size to over USD 300 billion by 2025, clocking an annual growth rate of nearly 8-10 percent. According to leading market players, plans to introduce a new policy to promote the domestic industry and curb imports are already in motion.

Taking all these factors into account, the domestic chemical market shines bright as a lucrative space to invest. Bundle these with a significantly lower cost of labour, easy availability of key raw materials, a large consumer base and the potential to scale-up with the adoption of technology, it becomes too good an opportunity to give it a miss for both existing and aspiring players. A number of local and MNC firms are already vying to get a larger share of

the market as even more players make plans to enter the Indian market.

Faced with many handicaps like lesser funding than their foreign counterparts and intense domestic competition, local chemical companies continue to survive though with slim margins. As the global economic order awkwardly shuffles along with low growth volumes, the hypercompetitive environment continues to throw many new challenges.

Sluggish sales volumes in the industry clocked low growth rates in 2016 riding on the wave of a severe shortfall in industrial production and a large-scale optimization of inventories by their customers. Petroleum-based products were worse hit in particular recording a lower-than-normal industry average.

In a bid to maintain sustainable production levels and take home encouraging profit margins in the face of weakened industry fundamentals, chemical companies are proactively exploring inorganic growth avenues such as mergers and acquisitions. The limitations of organic growth are in fact forcing firms to look at strategic mergers and acquisitions (M&As) as a viable way forward for sustaining high valuations.

Most firms take the plunge keeping scalability as the central motivating factor for their growth plans. A consolidation of product offerings not only enables the players to leverage organisational synergies, but even allows them to explore previously unexplored business areas, which are in line with their long term objectives. The restructuring of the merged DuPont and Dow entity is a perfect example of this.

A flurry of inbound and outbound deals have taken place. Larger corporations abroad have made big tickets purchases to enter the promising Indian market.

Huntsman Corporation, an American chemicals major acquired Gujarat-based chemicals producer Laffans Petrochemicals in 2010. This gave quick access to Huntsman to implement their technology and expertise in the Indian market. The company's plant at Ankleshwar became an integral part of Huntsman Performance Products, giving the group its first dedicated production plant in the country.

The pull of the Indian chemical sector as a strategic investment for foreign investors was further strengthened with the Japan-based Nihon Nohyaku Co. Ltd acquiring a majority of 74% stake in Hyderabad Chemical Ltd. in 2014. This gave the firm an opportunity to utilize the agrochemical manufacturer's own distribution network and research and development function.

Another notable example of a foreign firm making a quick entry into the Indian market is the acquisition of Monarch Catalyst by the German specialty chemicals maker Evonik Industries in June 2015. Abroad, Evonik has a presence in almost 100 countries, serving life sciences and fine chemicals, industrial and petrochemical market segments. The acquisition allowed Evonik Industries to hit the ground running.

Balance sheets of companies and investment decisions also play a vital role in influencing M&A deals. Caught between steep investor expectations and frequent lull periods in demand, companies are increasingly turning

to M&As to ensure uninterrupted business operations and sustainable profitability.

In 2016, The Chatterjee Group (TCG) picked up a majority stake in Mitsubishi Chemical Corporation's (MCC) Indian unit in Haldia, West Bengal for an estimated \$48 million which gave TCG management control of the ailing company. TCG bought a 90 per cent stake in the company with MCC retaining limited shares. The MCC PTA had been making losses for several years as revenue had declined due to cheaper imports from China. The Competition Commission of India cleared the acquisition, giving MCC a second lease of life.

The lure of increasing export revenues and acquiring technical expertise potent factors for Indian firms to scout for partnerships abroad.

The number of Joint Ventures too have picked up pace. For example, Pidilite Industries Ltd., a maker of adhesives, construction chemicals, consumer

adhesives, sealants and specialty chemicals, entered into a joint venture agreement in 2016 with the Italy based Industria Chimica Adriatica Spa (ICA), a leading wood finish manufacturer. Pidilite holds 50% of the shareholding in the JV and the balance is held by ICA and Pratik Mehta, an India-based distributor. Such joint ventures with foreign firms will help all sides to scale their business operations and tap new markets with specialized products. Though valuations have soared, many companies continue to pursue M&A as a strategy to achieve growth and spur innovation.

AVA Chemicals has been formulating and providing premium-grade chemicals to national and international clients in over 20 countries. In time, has progressed to become an accredited supplier of organic and inorganic chemicals in bespoke compositions and is recognized as a leading producer of various grades of different Fine Chemicals besides chelating agents. With a solid value chain in place, AVA Chemicals is open to explore JV's and new business opportunities.■

Reference

1. <http://www.moneycontrol.com/news/business/economy/government-says-indias-chemical-industry-to-hit-300-billion-by-2025-2449457.html>
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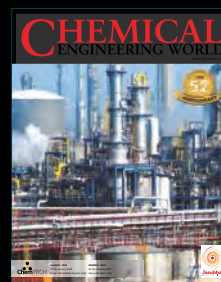
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Chemical Engineering World (CEW), the Official Organ of ChemTECH Foundation, is India's premier technology magazine for the chemical process industry professionals. This highly reputed monthly publication provides novel insights on the dynamics of Indian and global process industries. CEW, a niche publication with proven track record, has been disseminating authentic information on process industry innovations for more than five decades.

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■ CASE STUDY

Implementation of Wireless Instrumentation in a Brown Field NPK Granulation Plant

Deepak Fertilizers and Petrochemicals Limited (DFPCL) is India's leading producer of Industrial Chemicals, Petrochemicals and Fertilizers located in Taloja near Mumbai. DFPCL commissioned a NPK granulation plant having two trains of 1000 MTPD capacity each. M/s Incro Spain is the licensor and M/s tkIS India was engineering consultant. DFPCL was evaluating various latest technologies for their upcoming project. After evaluation DFPCL & tkIS jointly decided to go for non-critical open loops on Wireless technology. The benefits of wireless technology include flexibility, scalability, maintenance free and lower capex cost. During implementation, hook up of existing plant feed (ammonia and phosphoric Acid) to new NPK DCS was also a concern due to long distance (2 to 3 Km) from NPK control room. This was successfully done using wireless thumb adaptors which was specifically needed for monitoring the data.

Technology and Process of NPK Plant

The plant has two identical streams of 1000 MTPD to produce several grades of NPK/NP with and without Ammonium Nitrate Solution (ANS) granular fertilisers. Twin granulation plants (GI & GII) use INCRO's Pipe Reactor process for the production of DAP and NPK grades without ANS (like 12-32-16, 10-26-26 or similar DAP + KCl products) and INCRO's mixed process (Pre-neutralizer (PN) + PR or PN) for the production of NPK/NP with ANS (like 16-16-16 and 24-24-0). Each train is equipped with 2 Pipe Reactors (PRs) (installed in parallel inside Granulator drum) and one Pre-neutralizer (PN) reactor. Ammonia requirement is met from captive ammonia plant and phosphoric acid and potassium chloride are imported. The plant is having DCS system Delta V from Emerson Automation Solutions. The new plant is 2-3 kilometers away from the existing ammonia plant, ANP plant and other raw materials storage area.

Challenges in Selection of Technology

Wireless instruments that too at such a large number were to be used in Fertiliser Industry may be for the first time in India. Selection of right type of instruments in NPK plant is more crucial especially due to dusty atmosphere and elevated process building (9 storied) and control room being located within the process building (at second floor). In nine storied concrete plant building design, cabling and installation of devices

on various equipment's was expensive. At the same time, it's difficult to reach location like stack where due to high temperatures safety remains the main concern. In such applications, wireless transmitters can be installed to take care of safety concerns. In addition, complex fertilizer plants are corrosive in nature, hence need lot of maintenance for traditional installations like instruments, cable, cable tray, JB etc.

Meeting project schedule was challenging as there was delay in getting statutory approvals. Project budget was also insisting for cost saving by use of new proven technology.

In order to get confidence on working of wireless instruments in harsh conditions, visits to various plants having wireless installations and having similar environment were made. During visits, it was observed that even in the enclosed places like inside the tunnel, and control room at second floor inside close building where mobile network was not available, the communication with wireless system was taking place. The communication between field devices and gateway was established even in the underground concrete tunnel where High voltage lines were laid which lead to high RF signal noise.

After visits to two sites, it is concluded that wireless instruments can work for NPK plant having dusty environment with 9 stored concrete building and control room situated at second floor.

Accordingly, a number of transmitters were identified for monitoring pressure,

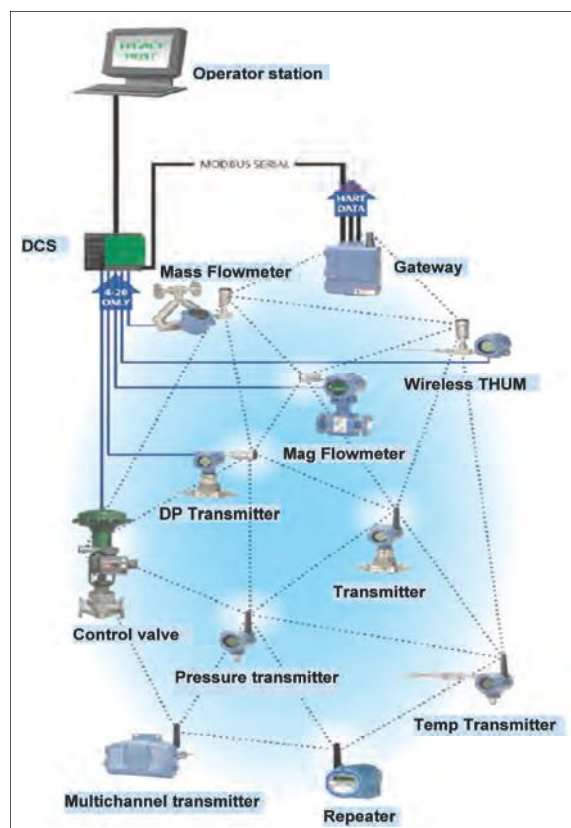


Figure 1: Emerson Wireless Network Architecture



Figure 2: Wireless Instruments installed on Tail Gas scrubber



Figure 3: Wireless Pressure transmitter



Figure 3: Wireless Gateway

temperature and flow level outside battery limit (OSBL) & inside battery limit (ISBL) for 188 loops with 128 transmitters. These transmitters were to be located even at a distance of even 2 km from NPK control room. tkIS designed plant enabled with wireless Hart architecture. Wherever required wireless thumbs used for the transmitters which were located at far distance. Figure 1 shows the wireless network architecture.

Complex fertiliser plants having corrosive nature hence needs lot of maintenance. Some of the concerns which were considered while selecting wireless instruments are given below:

1. Stack height of nearly 45 meters with remote location of instrument creates access issue for approach and maintenance.
2. High density and single point temperature monitoring in OSBL pump area and level monitoring of various vessels.
3. Integration of data over long distance of about 2 to 3 km from different adjacent (existing ammonia and ANP) plant which needs lot of steel structure, cable trays and wiring and related hardware including route clearance.
4. Routine maintenance activities like painting of junction box, cable trays.

5. Field transmitter in canopy to avoid corrosion impact on enclosure MOC.
6. Exposure of operators to hazardous area e.g. ammonia plant, Nitrogen plant etc.

DFPCL evaluated all potential applications to optimize performance of plant with new path breaking technology and decided to go in with wireless transmitters for New NPK project.

The order for wireless transmitters was placed on M/s Emerson India for 188 no's transmitters along with 2 no Gateways separate for each train as per the details in Table-1.



Figure 5: Wireless THUMB



Figure 6: Wireless Antenna



Figure 7: Wireless Antenna Transmitter



Figure 8: Wireless

| Sr | Type | Model | Total |
|----|-------------------------------|----------|-------|
| 1 | Multi CH RTD (4 CH x 24) | 848T | 96 |
| 2 | Temperature Transmitter | 248T | 22 |
| 3 | DP transmitter | 2051CG/T | 42 |
| 4 | Diaphragm type DP transmitter | 2051CD | 28 |
| | | Total | 188 |

Table-1. Details of transmitters

Erection and Commissioning

As DCS system Delta V is also from M/s Emerson, interface between transmitters and DCS went trouble free. Erection and commissioning of these transmitters were very smooth and time saving. The communication was established in minimum time of two days with all the 188 transmitters and without facing any major problem.

Results / Benefits Achieved

1. Commissioning time for wireless system has been reduced to 50 % compared to wired system as there is no need of termination, glanding etc.
2. Reduction in DCS hardware and number of panels as marshalling need gets

reduced and the space taken by cards in case of wired solution also reduced and so the effective no. of controllers and licenses.

3. Elimination of other maintenance Issues with wired solution like JB maintenance which can be very tough due to rusting and water spillage.
4. Reduction in manpower cost involved in the maintenance.
5. Wireless transmitters save cost of barriers which are normally used in wired solution for intrinsic safety philosophy. Wireless power module life is expected to be 10 years with 1 minute update rate. Power module today's costing is Rs 6000/- per module.

Cost of Wireless field devices across plant for monitoring loop was justified which helped in drastic reduction in time for erection commissioning and loop checking by 1/3rd in case of normal instruments, besides direct cost benefit of 29 per cent against alternate required investment. (Table-2) Other unique benefits include less maintenance more reliable, safe, productive and future ready plant build at design stage.

Limitations

Wireless can be used for both open and closed loops based on the scan time requirement and criticality of the service.

| Overall cost | Amount in |
|------------------------|-----------|
| Indian Rupees (Lakh) | |
| Wireless | 97.75 |
| Non-wireless | 131.49 |
| Net saving in wireless | 33.74 |

Table 2: Cost savings due to Wireless Instrumentation

Mostly wireless transmitters are used for monitoring points only where scan time does not determine the measurement accuracy. For closed loops, wireless can be used for slow moving control loops like temperature and level control wherein update rate up to 1 minute are acceptable not otherwise.

Conclusion

Deepak Fertilisers and Petrochemical Ltd adopted the wireless technology for its new complex fertiliser plant from design stage. The wireless system offer lower capital investment and lesser commissioning compared to conventional wired systems. The plant was able to integrate the system smoothly with existing ammonia plant, ANP plant and other raw materials storage facilities. The wireless system has also resulted in reduction in maintenance cost and enhanced safety and reliability of the instrumentation system. ■

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B&R steps up efforts advancing OPC UA

Automation specialist appointed to OPC Foundation's Technical Advisory Council

B&R is now represented in the OPC Foundation's Technical Advisory Council (TAC). This move further strengthens B&R's role in the strategic advancement of the OPC UA standard. Appointment to the TAC is a tribute to B&R's committed involvement throughout numerous OPC Foundation working groups.

Drawing its membership from the likes of Microsoft, SAP, Rockwell and Siemens, TAC is the highest technical body within the OPC Foundation. The council is tasked with setting the strategic course for

advancing OPC UA in a way that maximizes user benefits. It has the authority to establish technical working groups and approve new OPC UA specifications.

Pub/Sub and TSN

B&R will be represented in the TAC by Dr. Dietmar Bruckner. As Technical Manager of Open Automation Technologies at B&R, Dr. Bruckner is responsible for all development activities surrounding OPC UA TSN. "I'm very much looking forward to working in the TAC," he

says. "Together, we will make rapid progress in the development of Pub/Sub and TSN. In combination with application-specific OPC UA companion specifications, we will very soon be able to offer a uniform standard for seamless communication from the sensor to the cloud."

About B&R

B&R is an innovative automation company with headquarters in Austria and offices all around the world. On July 6, 2017, B&R became a business unit of the ABB Group. As a global leader in industrial automation, B&R combines state-of-the-art technology with advanced engineering to provide customers in virtually every industry with complete solutions for machine and factory automation, motion control, HMI and integrated safety technology. With Industrial IoT communication standards like OPC UA, POWERLINK and openSAFETY as well as the powerful Automation Studio software development environment, B&R is constantly redefining the future of automation engineering. The innovative spirit that keeps B&R at the forefront of industrial automation is driven by a commitment to simplifying processes and exceeding customer expectations. ■

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Dr. Dietmar Bruckner represents B&R on the OPC Foundation's Technical Advisory Council.

POWERLINK now IEEE 61158 standard

Only Industrial Ethernet protocol to be adopted by IEEE

B POWERLINK has been adopted by the IEEE under international standard IEEE 61158. It is the only Industrial Ethernet protocol to achieve this status. The IEEE views its standards for TSN and POWERLINK as core components for real-time industrial communication.

The Institute of Electrical and Electronics Engineers (IEEE) is the world's largest professional association in its field. Among its most prominent accomplishments is the IEEE 802.3 standard commonly known as Ethernet.

The IEEE's industrial real-time communication working group has been working for the past two years on the definition of an Industrial Ethernet

standard. In March 2017 POWERLINK was adopted as the sole IEEE standard with 97% of the vote.

Unrestricted openness

"Real-time industrial communication had previously been a gap for the IEEE," explained Dr. Victor Huang, responsible for standardization at the IEEE Industrial Electronics Society (IES) following the vote. "With its combination of high performance and unrestricted openness, POWERLINK is the perfect complement to the other IEEE communication standards." "The adoption of POWERLINK as an IEEE standard is an important step toward standardizing industrial automation technology at the field level," added Prof. Aleksander Malinowski, IEEE Industrial

Electronics Society (IES) Senior AdCom Member.

EPSG Managing Director Stefan Schönegger sees great potential for POWERLINK as an IEEE standard, particularly in combination with another IEEE-development: TSN technology. "In every aspect of global industry, openness has a way of winning out."

About the EPSG

The Ethernet POWERLINK Standardization Group (EPSG) is an independent organization founded in 2003 by leading companies from the fields of motion control and automation technology. Its aims are the standardization and further development of the POWERLINK protocol first introduced by B&R in 2001. This high-performance real-time communication system is an advanced protocol based on the IEEE 802.3 Ethernet standard designed to ensure real-time data transfer in the microsecond range. The EPSG cooperates with leading standardization organizations such as CAN in Automation (CiA), the OPC Foundation and the IEC. ■



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Automation Fair 2018 Hones To Boost Manufacturing Industry Towards GDP 25%

New Delhi, Feb 03, 2018 – More than 200 CXOs representing 22 leading corporate vowed to contribute towards India's GDP target from 17.1% to 25% at the India's largest automation fair RAOTM 2018 held in Gurugram. The Fair was attended by more than 1,000 manufacturing engineers and software experts from corporate such as Cisco, Endress & Hauser, HMS Industrial Networks, ESK Automation, Pentair& Hoffman to mention a few.

Amitabh Kant, CEO, Niti Aayog who has been the driving force behind the

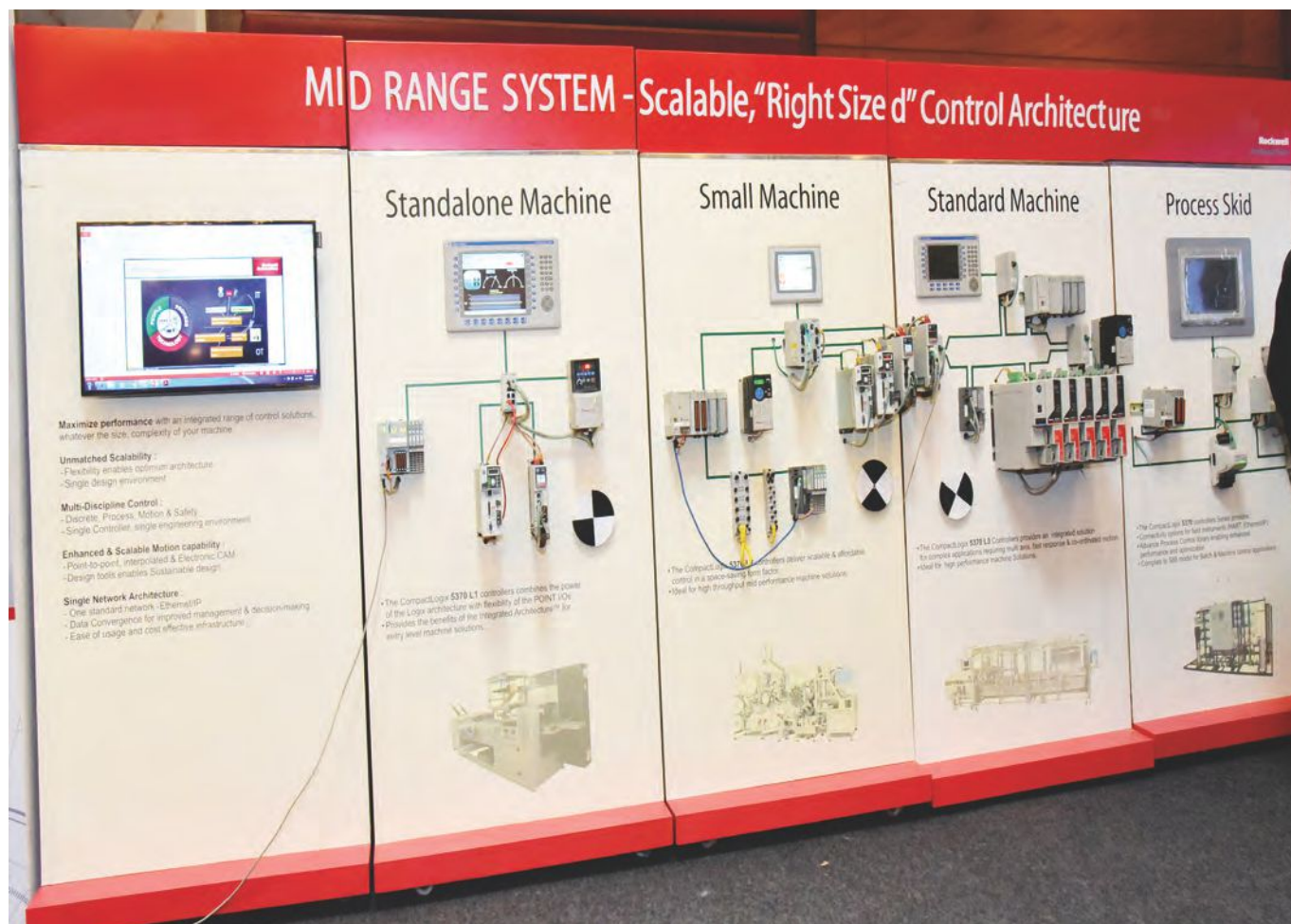
governments " Make in India" project, in his message, sent for the occasion, focused on how automation can bring radical change in manufacturing . He said, "Smart manufacturing practices will not only increase productivity but also improves the quality of employment opportunities."

Dilip Sawhney - Managing Director, Rockwell Automation said, 'Automation is an important step in the development

RAOTM 2018 is an extension of the Annual Automation Fair held in the US. This automation fair showcases the

innovative strategies which shall help the industry to be globally competitive.

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Kipp Umwelttechnik offers fast and gentle cleaning for all types of fin heat exchanger with its JetMaster+ system. Made up of four combination devices, the JetMaster+ system is also successful where other cleaning systems cannot help. Kipp Umwelttechnik is now 100 per cent effective in cleaning spiral-finned tubes in tight spaces, even with extremely hard deposits. Stones have even been removed from the equipment. Many other companies had already tried and failed. Kipp Umwelttechnik has been successful in cleaning tube bundle heat exchangers for many years. The TubeMaster process from its sister company mycon GmbH cleans tubes without residue and removes even the toughest deposits. The interior of the tubes can even be polished at the same time – significantly reducing energy costs and increasing production capacity. Cleaning removable plate heat exchangers using the PowerMaster system has also long been part of Kipp Umwelttechnik's work. Supported by a regional university in 2017 Kipp Umwelttechnik developed its own flushing technique for cleaning closed plate/tube bundle heat exchangers. Kipp Umwelttechnik based the new

system primarily on green chemistry that cleans gently, can be reused and after multiple uses, can later be recycled or neutralised. For the biogas plant sector, there is a fully-equipped vehicle that carries the necessary cleaning equipment at all times. In collaboration with the system's manufacturer, sister company mycon GmbH, Kipp Umwelttechnik also offers the JetMaster system for cleaning all types of fin heat exchanger for hire, together with the compressor required if necessary. All heat exchangers can also be cleaned at their premises for a fixed price. If required, we can collect the equipment from your site and return it after cleaning.

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 E-mail: pcssales@tepl.co.in / teplinbox@gmail.com

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Rocking Piston and Diaphragm Pumps and Compressors



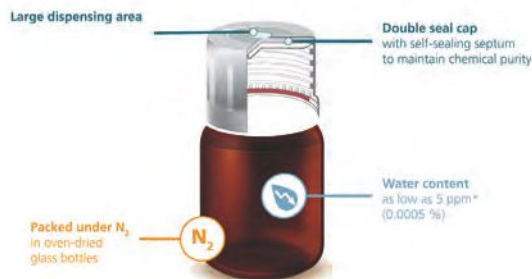
Piston pumps may be used in the presence of moisture and have no particular restrictions on use. They are very versatile and sturdy and may be equipped with dual heads connected in series or parallel layout, to improve the vacuum or flow rate. Diaphragm pumps have similar features but are built in two versions (FKM or EPDM), and may operate with certain aggressive flows. Versions are also available (Series ZA or MA box) with safety guard and intake filter for use as mobile units. The main

areas of use include: electromedical, suction cups conveyors, laboratory applications, construction, steam sterilisers and dental ovens.

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or Circle Readers' Service Card 11

Anhydrous Solvents



* ROMIL Hi-Dry[®] anhydrous solvents are specially produced to a water specification of 50 ppm (0.0050%), with many routinely produced to 5 ppm (0.0005%).

ROMIL's Hi-Dry anhydrous solvents take the high purity concept of ROMIL-SpS Super Purity Solvents one step further. This exceptional range of solvents delivers extremely low water levels of 50 ppm (0.0050%) or less, with many products routinely manufactured to below 5 ppm (0.0005%), using coulometric Karl Fischer analysis to ensure specifications are met. All ROMIL Hi-Dry solvents are supplied in packaging designed to maintain the anhydrous state achieved during purification. The amber glass bottles are oven dried to remove all traces of moisture before filling under inert dry nitrogen and sealing with a tamper-evident, screw-on Hi Dry cap. The cap's double seal design features a PTFE wad and self-sealing septum, helping to maintain chemical purity while enabling solvent to be withdrawn by syringe via the dispensing hole, which has been enlarged in response to customer feedback.

The standard ROMIL Hi-Dry range of solvents is complemented by pyridine-free ROMIL Hi-Dry KF reagents and calibrants, enabling Karl Fischer determination of water content without the accompanying hazard and unpleasant odour associated with traditional reagent formulations. Certified reference materials manufactured using Hi-Dry anhydrous solvents are also available for calibration of volumetric Karl Fischer reagents prior to use.

For details contact:

ROMIL Ltd

The Source

Convent Drive, Waterbeach

Cambridge CB25 9QT, U.K.

Tel: +44 (0) 1223 863876

or Circle Readers' Service Card 12

Heat Sealable Thermoplastic Elastomer Tube



Imaweld is thermoplastic elastomer opaque tubing designed for fluid transfer in pharma and biotech applications. Imaweld is specially formulated which meets requirement of pharma industries with superiority compared to PVC and silicone.

Imaweld complies with FDA 21 CFR 177.2600, USP Class VI and ISO 10993. It is manufactured and packaged under GMP guidelines in dust-free area of ISO 9001 QMS, ISO 14001 and OHSAS 18001 Certified facility. It is heat sealable and weldable. It can be laser etched for traceability. It has excellent flexibility and flex crack resistance. It also has excellent acid and alkali resistance. It's smooth bore surface eliminate particle entrapment. It has superior chemical resistance compared to silicone. It is sterilizable by Steam, Gamma Radiation and Ethylene Oxide. It has custom dimension and length size available. It is also available in transparent colour.

For details contact:

Ami Polymer Pvt Ltd

319 Mahesh Indl Estate, Opp: Silver Park

Mira-Bhayander Road, Mira Road (E)

Thane, Maharashtra 401 104

Tel: 022-28555107, 28555631, 28555914

E-mail: mktg@amipolymer.com

or Circle Readers' Service Card 13

Capping Machine



This is a single head automatic cap sealing-filling machine with cap orientation unit. The cap orientation unit and sealing unit mounted on table-top with height adjustment system.

It is GMP compliant with hard chrome-plated for corrosion-free and OHNS sealing rollers for trouble-free long life of rollers. It

is easy to operate and variation of drive speed to align with filling machine. Output up to 2,400 to 3,600 containers per hour depends on bottle sizes.

For details contact:

Pharma Chem Machineries

311/2484 Motilal Nagar No: 2, M G Road

Goregaon (W)

Mumbai 400 090

Telefax: 91-022-28735321

E-mail: pharmach@gmail.com / pharmachem79@gmail.com

or Circle Readers' Service Card 14

Rotary Vane Oil Sealed High Vacuum Pumps



High vacuum pumps are available in single and double stage directly coupled to motor flange or V-belt driven. Directly coupled to motor flange of the pumps are compact in size, evenly balanced with exceptional size to

performance ratio. V-belt driven pumps are supplied with air or water-cooled available in various capacities. It finds application in chemical, distillation systems, refrigeration plants, electrical, electronic components manufacturing, laboratory and air conditioning plants, etc.

For details contact;

Indovac Pumps & Engg Co

21 Anand Raj Indl Estate, Sonapur Lane, B/h Asian Paints

Off LBS Marg, Bhandup (W), Mumbai 400 078

Tel: 022-25664937, 65062751

Telefax: 91-022-25664917

E-mail: indovac@yahoo.co.in

or Circle Readers' Service Card 15

Solutions for Waterborne Industrial & Architectural Coatings

Ashland offers its comprehensive solutions for waterborne industrial and architectural coatings.

Aquaflo non-ionic synthetic associative thickeners (NSATs), for high-performance waterborne paints and coatings, build rheology through self-association and interaction with other ingredients. Easy-to-handle Aquaflo liquid rheology modifiers are based on hydrophobically-modified polyacetal-polyether (HM-PAPE) chemistry and are often drop-in replacements for urethane-type (HEUR) thickeners.

In waterborne latex paints, Aquaflo XLS NSAT grades improve the usability and efficacy of paints and coatings. They deliver virtually drip-free application, better viscosity retention after tinting, and provide outstanding flow and leveling to paints and coatings. This helps eliminate brush marks and enhances applied hiding, enabling fewer coats while achieving beautiful, lasting finishes.

Natrosol and Natrosol Plus represent the most widely specified thickener brand for waterborne coatings. They are non-ionic, free-flowing powders that are based on hydroxyethylcellulose (HEC). Natrosol offers pseudoplastic or shear-thinning characteristics, biostability and best-in-class colour compatibility for waterborne paint applications.

Drewplus foam control agents are non-ionic blends of hydrophobic silica, silicones and paraffinic oil, and are formulated for use in water-based coatings. These highly efficient foam control agents offer easy incorporation and quick bubble break performance, with excellent persistence and compatibility. Because Drewplus functions as an air release agent, it is particularly effective on microfoam in spray-applied industrial coatings.

For details contact:

Ashland Inc

PO Box 2219, Columbus, OH 43216

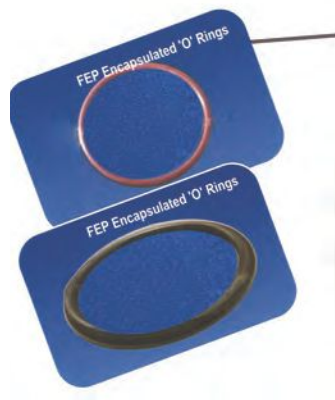
U.S.A.

Tel: +86 (21) 2402-4881

E-mail: gzhou@ashland.com

or Circle Readers' Service Card 16

FEP Encapsulated O-Rings & Gaskets



The seamless, uniform Teflon polymer encapsulation provides the chem-rings near universal sealing capability, whilst the continuous reset and the constant pressure of the encapsulation on to the sealing point is performed by the elastomeric core. The result is an overall sealing compression that increases with media pressure.

The chem-ring behaves like a highly viscous fluid, any pressure exerted on the seal is transmitted practically undiminished in all directions. The chem-ring is an O-ring, consisting of a seamless and uniform Teflon encapsulation, which completely encloses the core material of Silicone or Viton. In brief, the seal is manufactured by pressure injecting the rubber core material into thin wall Teflon tubing. This eliminates any potential gap between the core and the tube wall.

The Teflon tubing is joined by a special heat moulding process to give a true, seamless encapsulation. On Shree Gaurav chem-ring, the mould area exhibits no discernible different characteristics to the rest of the circumference of the seal. There are no joints or ridges to affect the seal's performance or life. The nature of the moulding process is critical to the quality of the ring. Standards for the manufacture of moulded rubber O-rings call for close tolerances on the IDs and particularly, the cross-sections of the rings. Outside these tolerances, any step in the cross-section can severely affect the O-rings ability to seal.

FEP encapsulated O-rings are hand moulded in a very precise and skilled operation.

For details contact:

Shree Gaurav Rubber Products

112-B Marudhar Indl Estate

Opp: Old Syndicate Bank

Goddev Road, Bhayandar (E)

Dist: Thane, Maharashtra 401 105

Telefax: 91-022-28197355

E-mail: gaurav_rubber@rediffmail.com

or Circle Readers' Service Card 17

High-speed Door



Prime Machine's internal door engineered for any industrial application, safety for personnel while robotic operation is in progress. It has a reduced cycle time with fast open and close operation. Galvanised steel structure as standard, SS matt finish structure, which integrates traction unit, rapid wirings and safety photocells. Friction resistant semi-hard PVC door bottom laced with safety sensors. It has a spring steel wind lock in curtain pocket to ensure silent door travel and curtain stability. Integrated motorization for heavy duty use 400 V three phase opening speed up to 2.0 m/s with inverter system. IP 65 electronic panel complete with open-close-emergency stop pushbutton unit and self-test function. Size is up to 4,000 x 4,000 mm (W x H).

For details contact:

Gandhi Automations Pvt Ltd

Chawda Comm1 Centre

Link Road, Malad (W), Mumbai 400 064

Tel: 022-66720200, 66720300

Fax: 91-022-66720201

E-mail: sales@geapl.co.in

or Circle Readers' Service Card 18

Planetary Gearboxes



The servo gearboxes PT complete the whole range of their servo gearboxes that consist of high-end planetary gearboxes, right angle gearboxes, hypoid gearboxes, cycloid gearboxes as well as

various combinations thereof. All common servo motors can be easily installed with all sizes of their gearboxes. PT Series planetary gearboxes guarantee high stiffness and reliable transmission through their unique design. All ring gears, planet gears and sun pinions are case-hardened and ground. This provides for an outstanding transmission quality and allows for precise positioning tasks.

For details contact:

EGT Eppinger Getriebe Technologie GmbH

Breitwiesenweg 2-8
73770 Denkendorf, Germany

Tel: +49 711 934934-626

Fax: +49 711 934934-627

E-mail: info-egt@eppinger-gears.com

or Circle Readers' Service Card 19

V-Blender



V-blender is available in standard cGMP and customised models with SS-304/SS-316/SS-316L contact parts. It is efficient and versatile machinery for mixing and lubrication of dry powders homogeneously.

Best results achieved due to the suitable medium speed (RPM)

and the V-shape of the container.

The V-shape gives sufficient continuous movement to the particles thereby resulting in better quality blending. Safe operation of the unit is ensured. It is available in batch capacities ranging from 50 to 3,000 kg, as per client's requirements, depend on bulk density.

For details contact:

IPEC Engg Pvt Ltd

Plot No: 5175, GIDC, Ankleshwar
Gujarat 393 002

Tel: 02646-221175

Telefax: 91-2646-225175

E-mail: md@ipecegg.com / marketing@ipecegg.com

or Circle Readers' Service Card 20

Reactor Solution



S2 offers a range of SS nickel and exotic alloy reactors in a variety of materials such as SS-316L, SS-316, Ti, SS-904L, Duplex, Titanium and Alloy C22. S2 also offer high chemical resistant reactors with product wetted parts coated in enamel or StanCoat for improved protection.

Probably the highest risk in any reactor process is taking a process media sample at elevated temperatures. Spill over and exposure of sampling liquid is a perennial cause of batch rejection, reprocessing and various quality-related issues ultimately leading to personnel risk and lost profit.

Their sampling systems are designed to provide automatic vacuum-operated safe sampling whereby a pre-established sample quantity is directly pulled into the sampling container in a closed-loop manner. At all times, the operator is in full control, safe and isolated from the product media. Their design is optical sensor powered and is offered with a clear sampling pot so that the operator can see exactly what is happening to the reacted

substances at all stages of the reaction process. Furthermore, distributed control system operation is possible and unlike conventional systems, cleaning is easy, fast and risk-free.

For details contact:

S2 Engg Services

Survey No: 53/4, Bahadurpally Village

Qutabullapur Mandal, R R District

Hyderabad, Telangana 500 043

E-mail: info@s2engineeringindia.com

or Circle Readers' Service Card 21

RCVD Solutions



S2 Engg provides full turnkey solutions for rotary cone vacuum dryers (RCVDs) from design and manufacture to assembly, installation and commissioning. Their solutions provide equipment versatility and space saving benefits which reduce a plants capital and operating costs.

The S2 Engg RCVD is completely jacketed for optimum dryer efficiency. Heat transfer fluid, typically hot water, steam or vapour, is circulated around the conical jacket for even product drying through conduction. S2 can supply the thermal control unit for this purpose, where required.

As the dryer rotates, given the shape of the vessel, the entire product batch is thoroughly mixed and high speed dried. This blending and inter-folding process maintains uniform temperatures and eliminates any probability of product recondensation due to cold spots.

S2 then use a high vacuum to draw off any remaining moisture while the product is in motion and thereafter the batch is easily discharged and cleaned given the conical shape of the vessel. .

RCVDs provide a range of operational benefits making them an ideal dryer for batch production in small laboratories or research and development plants.

For details contact:

S2 Engg Services

Survey No: 53/4, Bahadurpally Village
 Qutabullapur Mandal, R R District
 Hyderabad, Telangana 500 043
 E-mail: info@s2engineeringindia.com

or Circle Readers' Service Card 22

or Circle Readers' Service Card 23

Sigma Mixer Kneader/Extruder



The Sigma 2 blade mixer is used for mixing and kneading of high viscous mass, sticky or dough like paste, gum, rubber, adhesive application in the food and pharma, adhesive, plastic and

pesticides industries. It is available in 10 to 1,500 litre working capacity. W-shape container with double 2 blade with different speed for kneading combined action of bulk movement, stretching, folding, dividing and recombining of high viscous materials.

For details contact:

Prism Pharma Machinery

Plot No: 3713, Phase IV, GIDC
 Vatva, Ahmedabad
 Gujarat 382 445
 Tel: 079-29095204
 Fax: 91-079-25841623
 E-mail: mkt@prismpharmamachinery.com

or Circle Readers' Service Card 24

High Sensitivity Digital Trace O₂ Analyser Range



The DF-300 Series is a full-featured, microprocessor-based O₂ Series offering customers superior value and performance. Based around the DF-310 base model, the DF-300 Series using Servomex's unique, non-depleting coulometric E-sensor technology, the DF-340E enables O₂ measurements at

per cent, trace and ultra-trace levels. It features extensive background gas compatibility and flexible configuration options; variants include CSA hazardous area approved DF-320E for indoor installation and DF-340E for outdoor installation; and Coulometric E-sensor delivers accurate results with no sensor drifting, false low readings or frequent calibration requirements.

For details contact:

Spectris Technologies Pvt Ltd
 Plot No: A-168 MIDC
 Thane-Belapur Road, Khairane
 Navi Mumbai 400 710
 Tel: 022-39342700
 E-mail: MEI_Sales@servomex.com

or Circle Readers' Service Card 25

New Contracts/Expansions/Revamps

The following list is a brief insight into the latest new projects by various companies in India.

CHEMICALS

Coal India is planning a ₹ 10,000-crore joint venture along with GAIL India, Rashtriya Chemicals & Fertilizers (RCF) and The Fertilizer Corporation of India (FCIL) to set up a urea and ammonium nitrate chemicals complex that will run on gasified coal. Coal India has appointed Projects and Development India (PDIL) to conduct a feasibility study on the project. The plan is to use around 6 million tonnes of coal from coalfields at Talcher in Odisha and manufacture about 3 lakh tonnes of urea annually and around 300-400 tonnes of ammonium nitrate per day.

Ammonium nitrate is the principal ingredient for making explosives used as blasting material at coal mines. The country is facing a crunch in the supply of ammonium nitrate and explosive suppliers often jack up prices, resulting in higher input costs for the company.

Songwon Industrial Co Ltd of South Korea has launched its new pilot plant in Panoli, Gujarat, thereby strengthening the organisation's overall specialty chemicals development capability.

Built on Songwon's Indian site with all the necessary main unit operations, the new plant is equipped with the most up-to-date technologies and materials for producing a wide range of chemicals for a broad spectrum of applications - from one kilo up to several hundred kilo samples. To reinforce the organisation's position in existing areas of business and enhance its ability to enter new areas, the new pilot plant will be supported by the Songwon's strong local R&D team in Panoli, as well as its central technology innovation center located in Maeam, Korea.

AkzoNobel and Atul Ltd have agreed to jointly set up a manufacturing plant for monochloroacetic acid (MCA) at Atul's facility in Gujarat. Each partner will hold a 50 per cent stake in the venture. The partnership will build on Atul's status as a leading global supplier of the herbicide 2,4-D (which uses MCA as a key raw material), and AkzoNobel's leading global position in MCA market, with plants in the Netherlands, China, Japan and the US. The investment is subject to regulatory approvals and signing of final agreements. The partnership will use chlorine and hydrogen manufactured by Atul to produce the monochloroacetic acid, taking advantage of both Atul's existing infrastructure and the leading eco-friendly hydrogenation technology supplied by AkzoNobel. From an initial annual capacity of 32 kilo-tonnes (KT) at start-up, the plant has been designed for future expansion to 60 KT. The plant will produce enough MCA to meet the captive requirement of Atul; AkzoNobel will market the rest of it, primarily in India. Monochloroacetic acid is an essential building block in the chemical industry and is used in a wide variety of chemicals.

Camlin Fine Sciences Ltd, which offers shelf-life solutions (anti-oxidants and intermediates), performance chemicals and aroma chemicals, has received environmental clearance from the State Level Environment Impact Assessment Authority of Gujarat for setting up a manufacturing facility for hydroquinone (HQ) and catechol and their down-stream products at Dahej SEZ.

The Dahej plant will expand capacities and provide CFS with a base to manufacture hydroquinone and catechol in India. The plant will also help Camlin Fine Sciences to add capacity for manufacturing of vanillin, for which catechol is a key raw material.

The company expects to commission the Dahej plant in FY18. The plant will have capacity to produce 9,000 metric tonne per annum (MTPA) and 6,000 MTPA of HQ and catechol, respectively.

SRF is planning to invest ₹ 3,500 crore over the next four years, 70 per cent of which would go into its fast-growing chemicals business, to cater to rising global demand. SRF, which exports 90 per cent of its chemicals and counts Syngenta, BASFBSE 0.08 per cent, BayerBSE -0.04 per cent CropScience and other global biggies as its clients, has over the years steered its focus away from technical textiles to chemicals, where it has witnessed a rapid revenue growth and fat operating margin.

LyondellBasell, one of the world's largest plastics, chemical and refining companies, completed the previously announced acquisition of the polypropylene (PP) compounding assets of Zylog Plastalloys Pvt Ltd. The company entered into a definitive agreement to acquire Zylog's PP compounding assets in November 2015. LyondellBasell has supplied the Indian market through imports and tolling arrangements since 2009. In October 2015, LyondellBasell acquired SJS Plastiblends Pvt Ltd's PP compounding business which is located in Aurangabad, Maharashtra. With the acquisition of Zylog's manufacturing operations in Sinnar, Maharashtra, and Chennai, Tamil Nadu, LyondellBasell is now the third largest producer of PP compounds in India with an annual capacity of 44,000 metric tonnes.

In addition to the already existing product lines offered at these sites, LyondellBasell will produce its Hostacom glass fibre-reinforced, mineral filled and unfilled coloured grades as well as Hifax high impact thermoplastic olefins. These compounds are used to manufacture automotive parts, home appliances and other products.

Bodal Chemicals of Ahmedabad has received environmental clearance (EC) from the Ministry of Environment, Forests & Climate Change for the expansion of dyes and dyes intermediates manufacturing facility located at Vadodara, Gujarat. The company is expanding its dyes and intermediates manufacturing capacity from 2,200 metric tonne per month (MTPM) to 6,000 MTPM, and set up a co-generation power plant (5-MW) in Gujarat. Bodal Chemicals, one of the leading manufacturers of dyes and dyes intermediates in the country, has the capacity to manufacture over 25 varieties of dye intermediates and around 150 variants in dyestuff which are mainly used as raw material in textile, leather, paper and other dye consuming industries. Out of the total production, the company exports about 40 per cent to more than 35 countries across the world.

Perstorp of Swedish a specialty chemicals firm is planning to set up a manufacturing facility for pentaerythritol (penta) in Maharashtra. To evaluate the opportunity to invest in a new world scale production plant for penta in India, the company has signed an MoU with Maharashtra



Industrial Development Corporation (MIDC). Pentaerythritol, a white crystalline polyhydric alcohol containing four primary hydroxyl groups, is used as building blocks in alkyd resins for coatings, radiation curing monomers, polyurethanes, rosin esters, synthetic lubricants and explosives. Perstorp currently manufactures producing penta in three different production plants in Germany, the US and Sweden. The related market for coatings in India is growing fast in the country. Building a world scale production plant will be yet another important part of Perstorp's ambitious plan to strengthen the position in the Asian market. In July 2015, Perstorp acquired the penta business from Koei Chemical Co Ltd, a Japanese chemicals producer.

IOL Chemicals & Pharmaceuticals Ltd (IOLCP), a producer of active pharmaceutical ingredients (APIs), has increased the production capacity of ibuprofen to 6,200 tonnes per annum (TPA) at Barnala plant in Punjab. Expansion follows a de-bottlenecking project undertaken by the company at an estimated cost of ₹ 24 crores. IOL Chemicals already exports ibuprofen, a non-steroidal anti-inflammatory drug (NSAID) used as painkiller, to regulated and emerging markets, ie, Europe, Latin America, Middle East, etc. With the recent approval from US FDA, the company is expanding its ibuprofen business in the US as well. Being the only integrated ibuprofen player globally, IOL Chemicals aims to build and sustain the growth of its APIs business in coming years by exploring the higher value regulated markets.

MINING

NTPC Ltd the state-owned power generator hopes its captive coal production will reach 100 million tonne (MT) as soon as its five coal blocks commence operations, aided by faster regulatory clearances and the part-privatization model of Mine Development and Operator (MDO). The success of the plan would determine fuel security of the operations of India's largest power producer.

KIOCL will revive iron ore mining after a decade in Karnataka, after the State granted the company a lease of over 474 hectares at Devadaru hills in Ballari. KIOCL had suspended mining in the eco-sensitive Western Ghats following a Supreme Court directive in 2006. The company has already prepared an action plan and initiated the process for obtaining the necessary statutory clearances. Once approvals are given, it would invest ₹ 1,500 crore in a pellet plant and also a unit to enrich iron ore from the mines.

After suspension of mining, KIOCL had shifted to operating 3.5 million tonne per annum pellet plant in Mangaluru. Last year, it produced 1.46 million tonnes, utilising half its capacity, as against almost nil production in the previous year. Under the Make-In-India programme, International agencies have already implemented pilot projects by bringing high grade iron ore from South America, Iran and other parts of the world and utilising KIOCL's facility, have taken away pellets facilitating better utilisation of its plant capacity and profitability utilising its manpower. The company's blast furnace Unit having a capacity of 216,000 tonnes of pig iron which was put under suspension since 2009 has been taken for repair and the Unit is ready for operation for producing foundry grade pig iron adding towards its profitability in the coming financial year. The firm earned a profit of ₹ 47.93 crore in FY17 as against a loss of ₹ 80.15 crore the previous year. Revenues grew 353 per cent to ₹ 929.36 crore from ₹205.57 crore in the previous fiscal.

JSW Energy, part of the Sajjan Jindal-led JSW Group, is believed to be in the race for buying out the thermal power assets of Monnet Power and Jindal India Thermal Power Ltd (JITPL) in Odisha. Monnet Power's 1,050-MW coal-based power plant near Angul was in advanced stage of commissioning. Monnet Power's parent company, Monnet Ispat & Energy had won the Mandakini coal block in Odisha in competitive bidding, it surrendered the block later on grounds of economic unviability. Monnet Power had accumulated debt in excess of ₹ 5,000 crore. Though lenders had earlier denied a haircut in JSW Energy's prospective deal to acquire majority equity in Monnet Power, the Sajjan Jindal-owned firm is still believed to be in the hunt for the asset. Besides Monnet Power, JSW Energy is also eyeing takeover of BC Jindal controlled JITPL's 1,200-MW coal-based plant at Derang near Angul. The first unit (600-MW) of the 1,200-MW plant had begun commercial operations and started power supplies to the Odisha grid. But, coal paucity and absence of firm linkages had caused disruptions in the operations of the power plant. This project has been completed at a cost of ₹ 7537 crore which includes a debt component of ₹ 5,900 crore. JITPL has power purchase agreements (PPAs) with Odisha's Gridco Ltd, Kerala State Electricity Board and Tata Power Trading Corporation. Apart from JSW Energy, JITPL also had competing offers from Adani Power and Singapore's SembCorp.

NLC India (formerly Neyveli Lignite Corporation) which is in the hunt for buying out power assets is understood to have shown interest in the 700-MW Odisha plant of Hyderabad-based Ind-Barath Power Infra Ltd (IBPIL). The power plant located at Sahajbahal, near Jharsuguda, has commenced commercial operations. Though the exact size of the potential deal is not known, the valuation could be anywhere in the range of ₹ 5000-5,500 crore. In August last year, NLC India had floated an Expression of Interest (Eoi) from companies owning coal and lignite-based power projects, for a possible acquisition. NLC India's installed thermal power capacity is 3, 240-MW. It runs a 10-MW solar power unit and wind power assets with a capacity totalling 37.5-MW.

Western Coalfields, state-run Coal India arm, has received the environment clearance for its ₹ 263 crore expansion project in Nagpur district, Maharashtra. The proposal is to enhance the production capacity of the Gokul open cast mine to 1.875-million tonnes per annum (MTPA) from the existing 1-MTPA. The mine, located in 767.17-hectare, has a mineable reserve of 14.50-million tonnes. Among the conditions specified, the company has been asked to get 'Consent to Operate' Certificate from the State Pollution Control Board for the existing production capacity of 1-MTPA and also the 'Consent to Establish' for the proposed capacity of 1.875-MTPA prior to enhancing the production capacity. With regard to transportation of coal, the company has been asked to carry out by covered trucks and take mitigative measures to control dust and other fugitive emissions all along the roads by providing sufficient number of water sprinklers. The company has been informed to adopt controlled blasting techniques to control ground vibration and flying rocks. It has also been told to implement a progressive afforestation plan covering an area of 376.04-hectare at the end of mining. Of the total quarry area of 231.73-hectare (on floor) and 291.21-hectare (on surface), the backfilled quarry area of 115.39-hectare should be reclaimed with plantation and there will be no void left at the end of the mining operations. The land after mining should be restored for agriculture purpose.

Chemspec India 2018

Date: 25th - 26th April 2018

Venue: Bombay Exhibition Centre, Mumbai

Event: Participating companies at Chemspec India represent diverse sectors of the chemical industry: Organic & Fine Chemicals, Active Pharmaceutical Ingredients (APIs), Drug Intermediates, Dyes & Pigments, Agrochemicals, Contract & Toll Manufacturing, Coatings, Cosmetic Chemicals / Ingredients, Pigments & Solvents, Surfactants, Laboratory Chemicals, and a host of Speciality Chemicals (Coating Additives, Catalysts, Enzymes etc.). Participating companies see India as a significant market, with great growth potential and seek new business opportunities. 2018 will also see a focus on Water Treatment Chemicals and the Wastewater Treatment Industry.

For details contact:

Vijay Raghavan

Director, Chemspec India

Email: vijay@chemicalweekly.com

Tel: + 91 222 404 4477

India Chem 2018

Date: 4th – 6th October 2018

Venue: Bombay Exhibition Center, Mumbai

Event: The largest event of Chemicals and Petrochemical Industry in India, in its 10th edition i.e. India Chem 2018 would be organized from 4-6 October 2018 jointly by the Department of Chemical and Petrochemicals, Government of India and FICCI. The Indian chemical industry is at the threshold of rapid growth with the Government of India providing an atmosphere of support and encouragement. India's vibrant chemical and petrochemical industry plays a significant role in the economic development of our country. In terms of volume, the Indian chemical industry is the 6th largest in the world and the 3rd largest in Asia with the size worth USD 108.4 Billion.

For details contact:

Girish Ahuja

Senior Assistant Director, FICCI

91 11 2335 9734

Girish.ahuja@ficci.com

INTERNATIONAL

2018 GlobalChem Conference & Exhibition

Dates : February 28 - March 2, 2018

Venue : OMNI Shoreham Hotel, 2500 Calvert Street, Washington, USA

Event : For over 30 years, GlobalChem has been the chemical industry's premier policy and regulatory conference of its kind. Each year, this annual gathering of industry professionals offers a valuable opportunity to review key developments in the global chemicals management arena while looking ahead to some of the most pressing issues the industry faces.

For details contact:

American Chemistry Council

(202) 249 6121

Email: online@americanchemistry.com

Website: <http://www.globalchem.org/>

33rd Annual World Petrochemical Conference (WPC2018)

Date: 19th – 23rd March, 2018

Venue: The Hilton Americas-Houston, Texas, USA

Event: The World Petrochemical Conference (WPC) is the premier gathering for the petrochemical industry, bringing together more than 1,000 senior chemical industry decision-makers from more than 40 countries for networking, unparalleled insight and critical analysis from IHS Markit, your trusted partner in decision-making.

For details contact:

Lynn Urban

Sales Manager, Events

1 877 413 5187 (US only)

+1 303 397 2801 (outside US)

Asia Petrochemical Industry Conference (APIC) 2018

Date: 9th – 10th May, 2018

Venue: Kuala Lumpur Convention Centre, Kuala Lumpur, Malaysia

Event: APIC 2018 is the prime networking place for Asia's Petrochemical industry players. Gain strategic insights and bright ideas from well established players in the field that are well positioned to address the industry's diverse needs and business requirements. Be a delegate to find out more.

For details contact:

Nadiyana

+603 - 2171 3578

Email: nadiyana@icep.com.my

7th International Conference on Chemical and Process Engineering (ICCPE 2018)

Date : 23rd - 25th May 2018

Venue : Chulalongkorn University, Bangkok, Thailand

Event :The primary goal of the ICCPE 2018 is to promote research and developmental activities in Chemical and Process Engineering. Another goal is to promote scientific information interchange between researchers, developers, engineers, students, and practitioners working in Bangkok and abroad. The conference will be held every year to make it an ideal platform for people to share views and experiences in Chemical and Process Engineering and related areas.

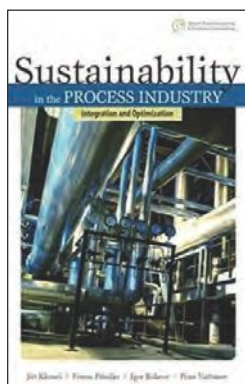
For details contact:

Natureevents

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E-mail: c.paulsen@us.nature.com



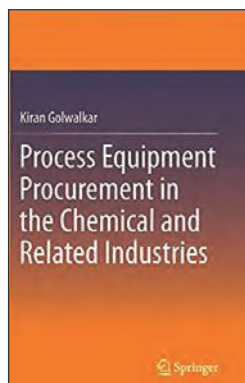


Sustainability in the Process Industry: Integration and Optimization (Green Manufacturing & Systems Engineering)

Authors : Jiri Klemes, Ferenc Friedler, Igor Bulatov, Petar Varbanov
Price : USD 25.36 (Hardcover)
Pages : 384 pages
Publisher : McGraw-Hill Education

About the Book : Sustainability in the Process Industry explains process integration and optimization and discusses applications for improving the energy and water efficiency of industrial as well as nonindustrial energy users. Approaches for adapting these methodologies to include the integration of waste and renewable energy sources are covered. This authoritative text contains eight

industrial-based case studies and nine testing examples with developed solutions. Details on software tools are also included in this practical guide.



Process Equipment Procurement in the Chemical and Related Industries

Authors : Kiran Golwalkar
Price : USD 99.98 (Paperback)
Pages : 259 pages
Publisher : Springer

About the Book : This concise volume explains when to procure new equipment, how to prepare specifications for floating inquiries, and guidelines for detailed technical discussions with vendors in the chemical and related industries. It covers the common equipment and supplies used in chemical plants, refineries—please delete reference to refineries, and effluent treatment facilities such

as pumps, blowers, reactors, heat exchangers, waste heat recovery boilers, heat and acid resistant lining etc. The book serves as a checklist to the plant managements for procurement of the correct equipment in the most efficient timeframe insuring that projects are not delayed due to long time required for procurement of new equipment.

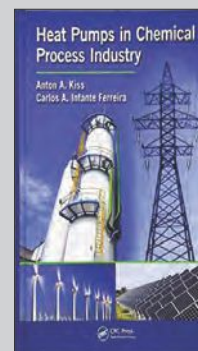


Planning, Estimating, and Control of Chemical Construction Projects, Second Edition (Cost Engineering)

Authors : Pablo F. Navarrete, William C. Cole
Price : USD 77.48 (Hardcover)
Pages : 512 pages
Publisher : CRC Press

About the Book : Contains added chapters emphasizing the importance of choosing the correct project and defining project goals. Stresses the need for adequate front end loading (FEL) and outlines the responsibility of the venture manager in project selection. Provides updated case studies and examples on technical evaluation criteria, construction progress monitoring, offshore estimating, and more. The authors discuss such

topics as initial involvement and plan of action, process design, regulatory compliance, risk analysis, project execution plan/master project schedule, estimating, contracting, detailed engineering, procurement, construction management, project control, contracts administration, communications, and plant start-up.



Heat Pumps in Chemical Process Industry

Author : Anton A. Kiss, Carlos A. Infante Ferreira
Price : USD 103.57 (Hardcover)
Pages : 442 pages
Publisher : CRC Press

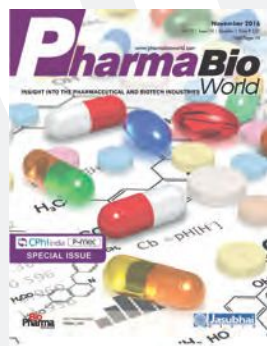
About the Book : As the chemical process industry is among the most energy demanding sectors, chemical engineers are endeavoring to contribute towards sustainable future. Due to the limitation of fossil fuels, the need for energy independence, as well as the environmental problem of the greenhouse gas effect, there is a large increasing interest in the research and development of chemical processes that require less capital investment and reduced operating costs and lead to high eco-efficiency. The use of heat pumps is a hot topic due to many advantages, such as low energy requirements as well as an increasing number of industrial applications. Therefore, in the current book, authors are focusing on use of heat pumps in the chemical industry, providing an overview of heat pump technology as applied in the chemical process industry, covering both theoretical and practical aspects: working principle, applied thermodynamics, theoretical background, numerical examples and case studies, as well as practical applications. The worked-out examples have been included to instruct students, engineers and process designers about how to design various heat pumps used in the industry. Reader friendly resources namely relevant equations, diagrams, figures and references that reflect the current and upcoming heat pump technologies, will be of great help to all readers from the chemical and petrochemical industry, biorefineries and other related areas.

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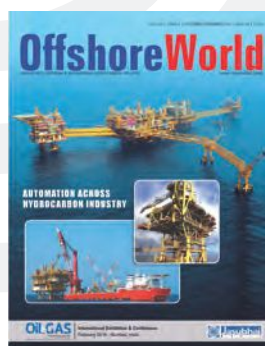
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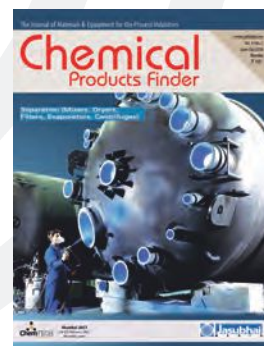
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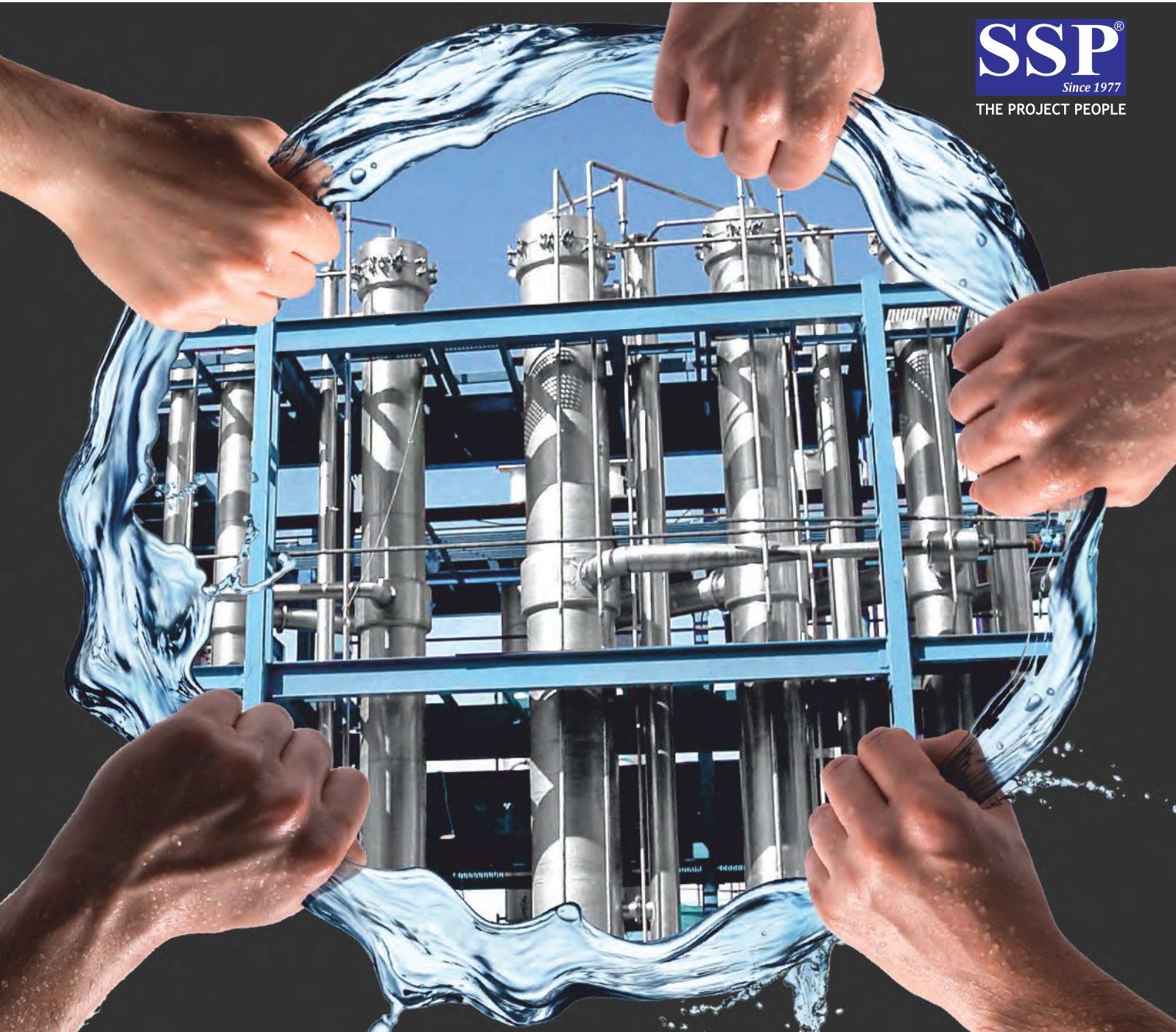
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