















# GLOBALLY BENCHMARKED PROUDLY BUILT IN INDIA



### THE COMPANY

Larsen & Toubro is an Indian multinational engaged in EPC Projects, Hi-Tech Manufacturing and Services. It operates in over 50 countries worldwide. A strong, customer focused approach and the constant quest for top class quality have enabled L&T to attain and sustain leadership in its major lines of business for eight decades.

Headquartered in Mumbai, Larsen & Toubro Limited is one of the largest and most respected companies in India's private sector. L&T has unmatched capabilities across Technology, Engineering, Construction, Manufacturing and maintains a Leadership Position.

L&T's businesses include Buildings & Factories, Infrastructure, Heavy Engineering, Water & Effluent Treatment, Power, Minerals and Metals, Smart World & Communication, Defence, Shipbuilding, Hydrocarbon, Machinery & Industrial Products, Realty, Financial Services and IT & Technology Services. Team L&T comprises over 50,000 people worldwide.

VISION

L&T shall be a professionally-managed Indian multinational, committed to total customer satisfaction and enhancing shareholder value.

L&T-ites shall be an innovative, entrepreneurial and empowered team constantly creating value and attaining global benchmarks.

L&T shall foster a culture of caring, trust and continuous learning while meeting expectations of employees, stakeholders and society.

LARSEN & TOUBRO

**HEAVY ENGINEERING** 

L&T Heavy Engineering business is global leader in supply of the Engineered to order hi-tech equipment needs of Refinery, Oil & Gas, Fertilizer, Petrochemicals and Nuclear power plants. The business has been at the forefront of introducing digital Industry 4.0 techniques, products and materials into manufacturing sector for over eight decades. Dedicated engineering, procurement, project management and construction teams of our Modification, Revamp and Upgrade (MRU) business offer technology-driven, quick turnaround solutions for process plants.

A.M. Naik Heavy Engineering complex at Hazira is globally benchmarked state-of-the-art fully integrated , digitally enabled manufacturing complex.

Our capability spectrum not only covers in-house engineering, R&D centres, and world class fabrication facilities, but also includes a highly talented team, committed to a safe and sustainable work culture. The business achieved international recognition through an impeccable track record of executing large complex projects and constantly creating new international benchmarks.

Our state-of-the-art manufacturing facilities are located at:

- Hazira (Surat) A. M. Naik Heavy Engineering complex with its own waterfront 'Load on' and 'Ro-Ro' jetties
- Ranoli (Vadodara) Vadodara Heavy Engineering Works, a facility that handles stainless steels, non-ferrous, exotic materials, and process plant internals
- Powai (Mumbai) Supports Modification, Revamp and Upgrade Business



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PRODUCT BUS			INT'L OFFIC	
<ul> <li>Reactors &amp; Pressure Vessels</li> <li>Heat Transfer Equipment</li> <li>Nuclear Power Plant Equipment</li> <li>Modification, Revamp &amp; Up grade Services</li> <li>Process Plant Internals</li> <li>Critical Piping</li> </ul>	• L&T S and H Forgin	pecial Steels leavy	<ul> <li>Houston, US</li> <li>Shanghai, C</li> <li>Sharjah, U.A</li> <li>Jakarta, Inde</li> <li>Paris, France</li> </ul>	
		Glob	oal Benc	
121 m		USD 421 Mn		
World's Longest Co for Reliance Industrie		World's Single Largest Order of 22 Reactors for KNPC, Kuwait		
658 мт		36 Months		
World's Heaviest Drums - 6 No: PEMEX, MEXIC	5.	Manufactured Nuclear Steam Generator for NP		



### chmarks



World's Heaviest LC-Max Reactors for HPCL Vizag Refinery

### 16.3 m Diamter

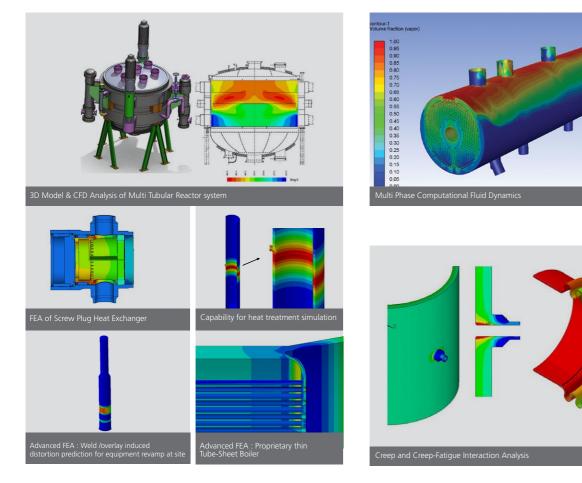
Largest RFCC Package for Reliance Industries, India

### 1500 мт

World's Largest Tubular Reactor for Equate, Kuwait

### 29.4 m Diamter

The Cryostat - world's largest stainless steel, high vacuum pressure chamber weighing 3,850 MT for ITER, France



## DESIGN & ENGINEERING: TECHNOLOGICAL EXCELLENCE

L&T's engineering capabilities are geared to design equipment as per customer specific requirements, and international codes and standards. Fabrication drawings for critical equipment are generated through 3D automation which have been developed in house. The perpetual endeavour of design engineers is to generate optimum solutions leading to lowest capital and operating costs.

### TECHNOLOGY SOLUTIONS UNDER ONE ROOF

MECHANICAL	THERMAL	ANALYSIS	SPECIAL
MECHANICAL Design to International- Codes & Standards • ASME Sec. I, III & VIII • EN 13445 • PD5500 - British • IBR • AS1210 - Australian • ADM - German • KTA - German • JJS - Japanese • Stoomwezen - The Netherlands • TEMA Standards • EJMA Standards • GB 150 - Chinese Wind & Seismic Analysis Automated	Members of HTFS & HTRI         Design of Equipment         • All types of Shell & Tube Exchangers         • Screwplug Closure (Breech lock) HP Heat Exchangers         • Helixchanger/Helitower         • Transfer Line Exchangers         • Nuclear Steam Generators         • Multi Tubular Reactors         • Shell & Tube LNG Vaporisers         Heat Transfer Systems         • Waste Heat Boiler Systems         • Molten Salt Bath Reactor (MSBR) Systems	ANALYSIS Finite Element Analysis Static & Dynamic Linear & Non-linear Response Spectra Analysis Thermo-structural Steady state & transient Buckling Fatigue & Fracture Creep & Creep-Fatigue Interaction Computatinal Fluid Dynamics Conjugate Heat Transfer Single & two-phase flows Reactor Chemical Kinetics Particle Dynamics	SPECIALFluid Structure Interaction Analysis (FSI)Simulation of weld induced distortion and stress patternAnalysis for metalChemical Process SimulationCollaborative Research & Process DevelopmenFailure AnalysisAnalysis and engineering for Site Fabrication and RevampsExperimental Stress AnalysisDestructive / Non-destructive Testing
Modelling - 2D/3D	Vaporiser Systems	Piping Flexibility Flow Induced Vibration (FIV)	lesting
		Integrated System Analysis	
		Lifting & Transportation	



### UNCOMPROMISING STANDARDS: QUALITY ASSURANCE

The Total Quality Management approach ensures that deliveries are made as per customer specifications. The quality procedures guarantee that safety and reliability of operations are built into the equipment and systems delivered.

The quality systems are backed by the latest facilities for radiography, including 12 MeV linear accelerator, ultrasonic, ToFD & PAUT, magnetic particle & liquid penetrant examination, high pressure and high vacuum testing, helium and freon leak testing.



#### ToFD Inspection on Job

#### Advanced NDE - ToFD & PAUT Station

- Compliant to ASME requirements to replace Radiography by Ultrasound (UT).
- Weld Thickness range inspected: 6mm to 430mm
- Fast Inspection due to no Radiation hazard
- No Job handling at assembly stage
- Recordable UT data of weld as base line data to refer in future
- Automatic twin engine Scanner used to straddle the probes along weld length



length & 24 m height capable of performing Heat Treatment & stress relieving of sections and equipment of large size.

Systematic configuration of gas burners and regulated air flow ensure uniform heat treatment.



IOT Enabled Shell Overlay Statior

## WORLD CLASS CAPABILITIES: FABRICATION

L&T's world class fabrication capabilities have been achieved through the perfect integration of efficient material handling and preparation, precision machining and welding processes for a range of materials in varying thickness, backed by technological excellence in design and engineering and responsive quality as well as IT systems.



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CNC Vertical multi-spindle deep-hole drilling achine. Drilling Depth: 900mm Number of Spindles: 2

The capabilities of CNC Floor Mounted and Special Purpose machines are supported by a battery of general purpose

### **COMPREHENSIVE WELDING CAPABILITIES**

WELDING PROCESSES	MATERIALS WELDED	SPECIALISED WELDING TECHNIQUES
<ul> <li>SMAW</li> <li>SAW (Semi-Auto/Machine) <ul> <li>NG SAW</li> <li>Tandem/Twin-Head SAW</li> <li>LSO SAW</li> </ul> </li> <li>GTAW (Manual/Semi-Auto/Machine) <ul> <li>Hot Wire GTAW</li> <li>Activated TIG</li> <li>Keyhole TIG</li> <li>Automatic Tube # Tubesheet</li> <li>Inner Bore welding</li> <li>Orbital TIG</li> </ul> </li> <li>GMAW (Semi-Auto/ Machine) <ul> <li>Pulse GMAW</li> <li>CMT</li> <li>Robotic welding</li> </ul> </li> <li>FCAW (Semi-Auto/Machine) <ul> <li>Self-Shielded/Gas Shielded</li> </ul> </li> <li>ESW <ul> <li>Conventional/High speed cladding</li> <li>PAW</li> </ul> </li> <li>Laser Beam Welding</li> </ul>	<ul> <li>Carbon steel</li> <li>Low alloy steel (C-Mo, Mn-Mo-Ni, 3.5 Ni, Cr-Mo, CrMoV)</li> <li>Quenched &amp; Tempered Steel</li> <li>Stainless Steel</li> <li>Austenitic stainless steel</li> <li>Super austenitic stainless steel</li> <li>Duplex stainless steel, Super &amp; Hyper duplex stainless steel</li> <li>Ferritic stainless steel</li> <li>Maraging Steel</li> <li>Nickel based alloys (Inconel, Incolloy, Monel, Hastelloy)</li> <li>Copper based alloys (Cupronickel, Aluminum Bronze, Brass)</li> <li>Titanium &amp; titanium alloys</li> </ul>	<ul> <li>Tandem / Twin SAW</li> <li>Semi-Automatic GTAW/SAW</li> <li>Robotic</li> <li>Hot Wire GTAW</li> <li>Activated - TIG</li> <li>Narrow/ Ulra-Narrow Gap SAW / GTAW</li> <li>Pulsed GTAW/GMAW</li> <li>Internal BoreTube to Tubesheet</li> <li>Cold Metal Transfer (CMT)</li> <li>Self - Shielded FCAW</li> <li>Strip Cladding</li> <li>High Speed ESW</li> </ul>

Continuous improvement in Welding Technology has enabled the development of over 8000 welding procedures qualified as per international codes and standards - ASME, BS, EN/BS, AS/NZ - for a variety of materials in a range of thickness (0.5 to 800 mm) covering the complete spectrum of welding processes. Specialised fabrication facilities include 100,000 class of dust-free enclosures with areas of 1000 sq. m. and 400 sq.m.







## **DELIVERING ENHANCED VALUE THROUGH DIGITALISATION!**

L&T Heavy Engineering embraces digital soulutions to enhance its operatinal excellence and offer your business value - added benefits

WE CONSTANTLY STRIVE TO INCREASE VALUE FOR YOU THROUGH:





Smart Machines

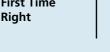
Smart Stations

Smart AR Glass

• Asset Tracking & Utlizaiton

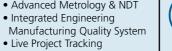
Remote Monitoring by







Smart Processes Advanced Metrology & NDT • Integrated Engineering Manufacturing Quality System





Significant

Productivity

Improvement

Reactor Regenerator Package for Pertamina, Indonesia



## **TIMELY DELIVERIES: LOGISTICS**

### **TRAFFIC & LOGISTICS**

Specialists provide traffic and logistics services for domestic and international customers. All arrangements are made for safe, low-cost and timely deliveries.

Traffic and logistics regularly carry out comprehensive route surveys from point of origin to final destination; plan and

arrange the right mode of transport; obtain statutory clearances and organise inter-agency co-ordination as per the specific needs of customers.



















Coal Gasifiers (30+)









**Products exported to more than 50+ Countries spread over all five continents.** 



## **PETROCHEMICAL PROJECTS**

### **EQUIPMENT SUPPLIED**

- Ethylene Oxide Reactors
- ACN Reactors
- Dissolver Reactors
- Methanol Convertors
- Convection Section modules for Cracker Furnace
- RG Boiler for Methanol Plant
- Molten Salt Bath Reactor
- Ti clad Dehydration Towers
- TLX & USX Heat Exchangers
- Oleflex Reactors

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- Catofin Reactors & Products Splitters
- PO Reactor
- AM Reactor
- PTA Equipment
- Rod Baffle Exchangers
- Zirconium & Titanium Heat Exchangers





RAPID FCC Reactor-Regenerator Package, total 2 nos. weighing 8750 MT

## **REFINERY PROJECTS**

### **EQUIPMENT SUPPLIED**

- Hydrocracker & ARDS / VRDS reactors
- HDS/Hydrotreater reactors
- Fluid Catalytic Crackers including Reactors, Regenerators and Accessories
- High pressure heat exchangers with threaded lock closures
- Heat exchangers in various materials of construction including 1-1/4 Cr - 0.5 Mo, 2-1/4 Cr - 1 Mo, Nickel Alloys, Duplex SS

- Reactors for Renewable Diesel
- Coke Drums
- Helixchangers/Helitowers





High Pressure Screw Plug Heat Exchangers 66 nos. supplied to KNPC, Kuwait

- High-pressure vessels (separators for hydrocracker, merox vessels, etc.)
- Columns including Vacuum columns, Crude columns, fractionators



## **FERTILIZER PROJECTS**

### **EQUIPMENT SUPPLIED**

- Ammonia Converters
- Ammonia Converter Basket
- Waste Heat Recovery Boiler package including RG, CG Boiler, Steam Super heaters, Synthesis Loop Boiler, Steam Drums, and R&D Piping
- High Pressure Exchangers for Synthesis Loop

- Secondary Reformer Waste Heat Boiler & Steam Super heaters
- Ammonia Unitized Chillers
- KRES Exchanger

• Urea Strippers

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• Urea Reactors

• Carbamate Condensers & Separators





Amine Absorber for Saipem(Marjan, KSA)

Heavy Thick Vessels for KNPC Al-Zour

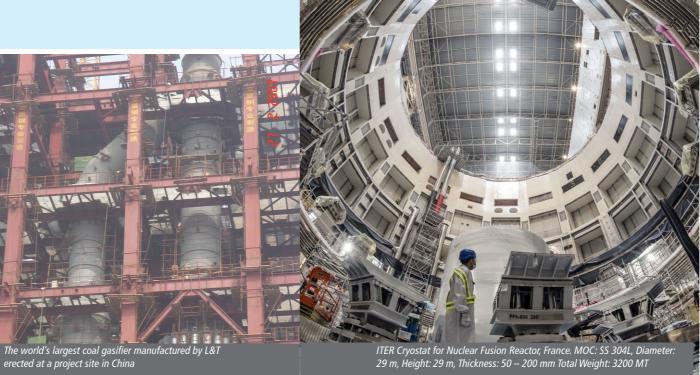
### **OIL & GAS PROJECTS**

### **EQUIPMENT SUPPLIED**

- LNG Vessels
- Gas Processing Equipment







## **COAL GASIFICATION PROJECTS**

L&T is the leading manufacturer of key gasification equipment with supplies to projects in China, Vietnam and India. L&T has supplied

- Nine gasifiers to various projects in China
- Two gasifiers to Vietnam of Shell Technology.
- Nineteen gasifiers in India of Air Products, Lurgi & CB&I Technologies

L&T is also qualified for supplying gasifiers as per GE, KBR, Siemens among other gasification technology providers.

### **NUCLEAR POWER PLANT PROJECTS**

#### EQUIPMENT SUPPLIED

- Steam Generators (220 MWe, 2. 540 MWe & 700 MWe)
- End Shields (220 MWe, 540 MWe & 700 MWe)
- Pressurizer (700 MWe)
- Cryostat for Fusion Reactor (ITER France)

End-shields for 700 MWe (PHWR)

- Spent Fuel Canisters & Casks (for US market under US NRC)
- Reactor Headers
- Calandria
- End Fittings
- Safety Heat Exchangers





## **PROCESS PLANT INTERNALS**

L&T owns dedicated facility to manufacture specialized equipment -internals of exotic metallurgies. Approved by all leading process licensors, this inhouse facility compliments the supply chain.

### **INTERNALS SUPPLIED**

- Hydro processing Reactors Internals
- Gasification Internals
- Urea Internals
- Cyclones
- Air Rings
- Swirl Assemblies

## **EXOTIC MATERIAL EQUIPMENT**

Our state of the art facility also expands our capability to supply complete equipment of exotic metallurgies like SS, DSS, Urea grade Steel, Inconel, Titanium, Zirconium etc. as a one stop solution provider. Our offerings also includes Oxygen mixing spargers / Nozzles.

### Replacement of FCCU Reactor with Internals for OQ at Oman

## **MODIFICATION REVAMP AND UPGRADE SERVICES**

Dedicated Engineering, Procurement, Project Management and Construction teams offer complete solutions for Process Plants.

### Site Services:

- Critical Turnaround & Revamps
- Debottlenecking & Expansion
- Site Fabrication & assembly
- Repair & Maintenance



### **Speciality Services:**

- Failure Analysis and Troubleshooting
- Thermal Performance and Enhancements
- Specialized Welding
- Health Check-up
- Residual Life Assessment

We offer complete solutions from concept to commissioning of static equipment including piping, structural, electrical & instrumentation engineering.

### **GREEN INITIATIVES**

At L&T, we believe that a holistic approach and responsible informed choices can lead to sustainable solutions. Our programmes are aligned to help combat climate change, drive energy efficiency, and encourage renewable energy usage. **Green initiatives at A M Naik Heavy Engineering Complex:** 

- Green Hydrogen Plant for captive usage
- Ecosystem restoration by converting Lawn area to Urban Forest
- Water efficiency and conservation measures



- Green product usage Eco friendly Construction Material
- Energy Efficient Manufacturing Processes
- Upgradation of Indian Green Building Council (IGBC) certification

We foster a culture of responsibility through periodic awareness and trainings for our workforce and thereby embed environmental stewardship within our business.

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#### NUCLEAR EQUIPMENT & SYSTEMS

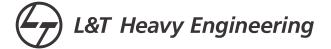
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