Enriching Lives

SUPERIOR PUMPING SOLUTIONS FOR NUCLEAR INDUSTRY

आत्मनिर्भर भारत

MAKE IN INDIA

KIRLOSKAR BROTHERS LIMITED

Established 1888

A Kirloskar Group Company

Energizing the Future

At Kirloskar Brothers Limited, we are associated with the Nuclear Power Industry from generation to distribution through our comprehensive fluid management solutions. Our expertise in producing pumps for critical applications in the nuclear sector makes us the preferred leader of the industry. Our association with Bhabha Atomic Research Centre (BARC), Nuclear Power Corporation of India Limited (NPCIL), Department of Atomic Energy (DAE) and Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI) has enabled us to contribute to the growth and development of the nuclear power industry.

Accredited by the American Society of Mechanical Engineers (ASME), we rank 1st in India and 9th in the world to receive N & NPT certificate for providing high-quality pumping solutions for critical applications in the nuclear industry.

Company Overview

Kirloskar Brothers Limited (KBL) is a world-class pump manufacturing company with expertise in the engineering and manufacturing of fluid management systems. Established in 1888 and incorporated in 1920, KBL is the mother company of the Kirloskar Group. KBL provides complete fluid management solutions for large infrastructure projects in the areas of water supply, power plants, irrigation, building & construction, oil & gas industry, and marine & defence. KBL manufactures industrial, agriculture and domestic pumps, valves and hydro-turbines.

Over the years, KBL has developed innovative products, which have enabled it to carve a niche globally. It is a global conglomerate and is equipped with the best technologies in the world. It is also India's largest centrifugal pump manufacturer with nine manufacturing facilities in India along with other international subsidiaries and operations in the Netherlands, South Africa, Thailand, the United Kingdom, and the United States of America. KBL has over 16,000 channel partners globally and is supported by best-in-class Pan-India network of authorised service and refurbishment centres.

KBL is the first Indian pump manufacturing company to be certified for Integrated Management System, (ISO 9001:2015, ISO 14001:2015, ISO 45001:2018, ISO 50001:2018).

Its factories deploy Total Quality Management tools using the European Foundation for Quality Management (EFQM) model.

In India, subsidiaries and joint ventures include:

- Kirloskar Ebara Pumps Limited (KEPL) manufactures API, Non-API pumps, and steam turbines.
- The Kolhapur Steel Limited (TKSL) is a

notable foundry facility with an in-house pattern shop.

- Kirloskar Corrocoat Private Limited (KCPL) is the leading solution provider in long-term corrosion protection and energy conversion.
- Karad Projects and Motors Limited (KPML) specializes in electric component manufacturing, particularly in the production of stampings, stators, rotors, AC rotating machines, and aluminium die-cast connecting rods.

International, subsidiaries and joint ventures include:

- SPP Pumps Limited, United Kingdom is a 140-year-old leading pumps manufacturer of centrifugal pumps and associated systems, a global principal in the design, supply and servicing of pumps, renowned fire pump packages and high-quality equipment for a wide range of applications and industry sectors. It is the largest pump manufacturer in the United Kingdom.
- SyncroFlo, Inc., United States of America manufactures pre-assembled pumping systems and provides solutions for HVAC systems, fire protection and turf irrigation.
- Rodelta Pumps International is a Dutch pump manufacturing company that offers products for flood control, irrigation, drinking water, wastewater, pulp & paper, power, chemical, oil & gas and general industries.
- Kirloskar Brothers Thailand Limited (KBTL), Bangkok is the Thailand Board of Investment (BOI) promoted headquarters and assembly plant of the KBL Group companies for the ASEAN and East Asia regions.
- Braybar Pumps (Pty) Limited, Republic of South Africa is engaged in the manufacturing and sales of high-head multi-stage pumps, rubber-lined slurry pumps and metal-lined bearings.

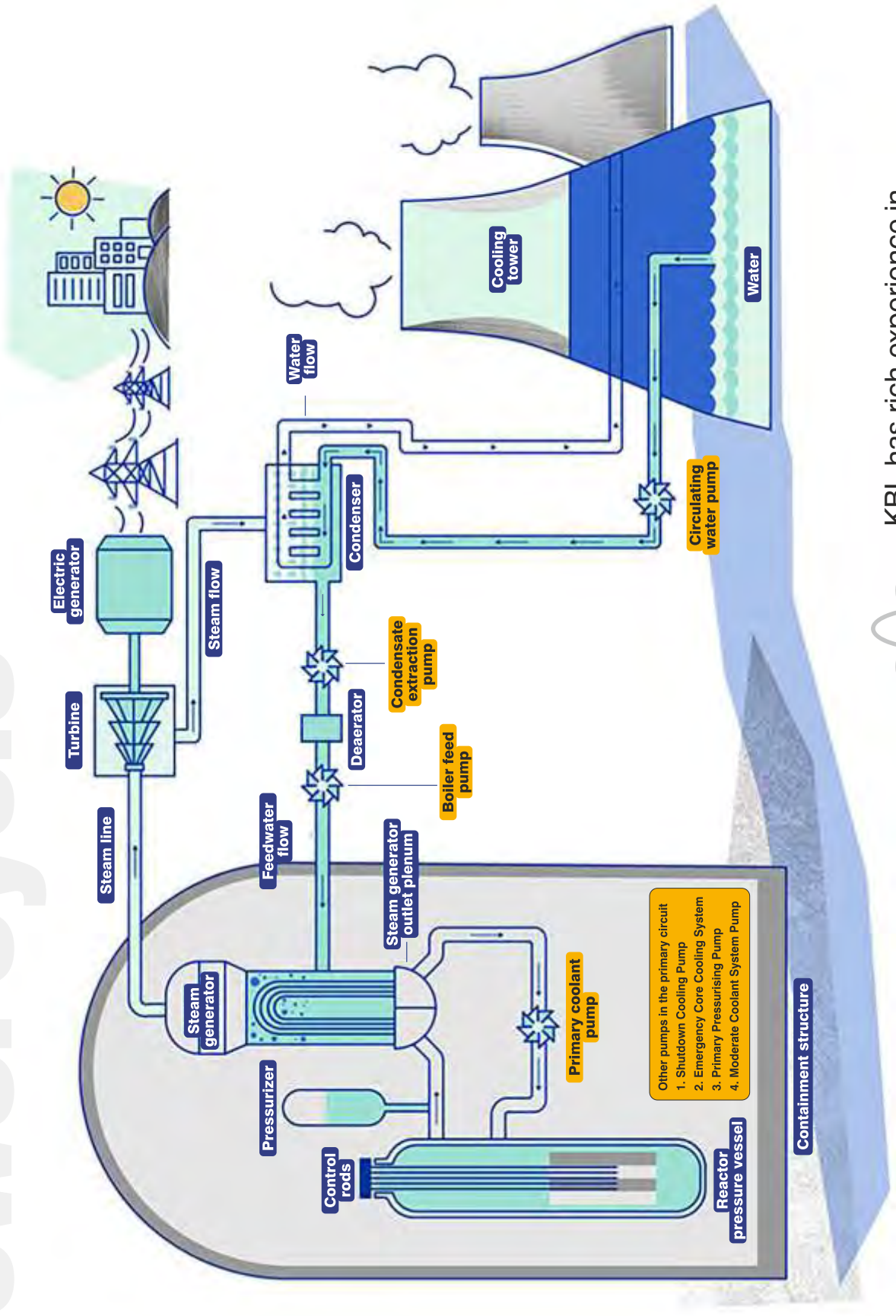
India's Pump Manufacturing Leader

Successful journeys start with the

Glorious Legacy of Creating Many Firsts in the Last 135 Years

Nuclear Energy Power Cycle

Pressurised Heavy Water Reactor (PHWR)



KBL has rich experience in supplying specialised pumps to Nuclear Power Plants.

Powercycle

Pump Technology in Nuclear Energy Plants

Primary Circuit

A) **Pressurized Heavy Water Reactor (PHWR)**
1. Primary Heat Transfer Pump (PCP)
2. Shut-down Cooling Pumps (SDCP)
3. Emergency Core Cooling Pumps (ECCS)
4. Primary Pressurizing Pump (PPP)
5. Moderator Coolant Pump

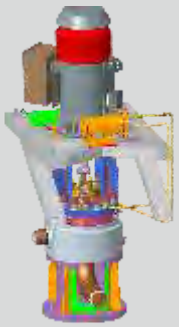
B) **Fast Breeder Reactor (FBR)**
1. Primary Heat Transfer (Sodium) Pump (PSP)
2. Secondary Heat Transfer (Sodium) Pump (SSP)
3. Secondary Circuit Pumps

C) **Small Modular Reactor (SMR)**
1. Primary Heat Transfer Pumps
2. Shut-down Cooling Pump
3. Component Cooling Water (CCW) Pumps

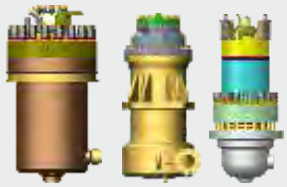
Secondary Circuit

A) PHWR/FBR/SMR
1. Boiler Feed Pumps
2. Auxiliary Feed Pump
3. Main Circulating Cooling Water Pumps
4. Auxiliary Cooling Water Pumps
5. Makeup Water Pump
6. Condensate Extraction Pumps (CEP)
7. Firefighting Pumps
8. Dewatering Pumps
9. Autoprime Pumps
10. General Service Water Pumps

Bespoke Pumps for Nuclear

Pump Type	Pump Location	Pump Application
Primary Coolant Pump 	Primary Coolant Pump for PHWR **Design Parameters** • Flow: 8,700 m^3/hr • Head: 217 m • Speed: 1,500 rpm (6 MW) • Design Pressure: 126 kg/cm^2 • Fluid handled: Heavy Water (D_2O) • Design Temperature: 326 °C	To transfer the heat from primary circuit to steam generator.
Shutdown Cooling Pump 	Primary circuit of PHWR inside reactor building. **Design Parameters** • Flow: 700 m^3/hr • Head: 30 m • Fluid temperature: 55 °C to 266 °C • Speed: 980 rpm (90 kW) • Fluid handled: Heavy water (D_2O) • Design Pressure: 126 kg/cm^2 • Design temperature: 326 °C	To remove decay heat from primary circuit.
Emergency Core Cooling Pump 	Location of Emergency Core Cooling System is inside reactor building. **Design Parameters** • Flow: 1,480 m^3/hr • Head: 120 m • Speed: 1,480 rpm • Fluid handled: H_2O/D_2O radio active mixture • Design Pressure: 20 kg/cm^2 • Design temperature: 125 °C	Provide makeup water to cool the reactor in the event of a loss of coolant from the reactor cooling system. This cooling is needed to remove the decay heat still in the reactor's fuel after the reactor is shutdown.
Primary Pressurizing Pump 	Location of Primary Pressurizing Pump is inside reactor building. **Design Parameters** • Flow: 52.5 m^3/hr • Head: 1,155 m • Fluid temperature: 40 °C • Synchronous speed of Motor: 3,000 rpm • Fluid handled: Heavy water (D_2O) • Design Pressure: 165 kg/cm^2 • Design temperature: 125 °C	Primary Pressurizing Pump (PPP) draw heavy water from storage tank and discharge it at high pressure to common header of PHT circuit to maintain the pressure.

Bespoke Pumps for Nuclear

Pump Type	Pump Location	Pump Application
Moderator Coolant Pump 	Location of Moderator Pump is inside reactor building. **Design Parameters** • Flow: 870 m^3/hr • Head: 55 m • Operating temperature: 35 °C to 85 °C • Fluid handled: D_2O (Heavy water) • Specific gravity: 1.105 • pH range: 5.5 to 8.0 • Speed: 1470 rpm • Design Pressure: 12 kg/cm^2 • Design Temperature: 100 °C	Moderator Pumps are used in the circuit to control the Nuclear Reaction.
Boiler Feed Pump 	Secondary Circuit. **Design Parameters** • Flow: 2,175 m^3/hr • Head: 570 m • Motor Power: 4,500 kW • Speed of Main Pump: 4,200 rpm • Liquid Temperature: 170 °C	To transfer high-temperature DM water into the boiler with higher pressure than boiler.
High Pressure High Temperature Canned Motor Pumps 	Primary Circuit. **Design Parameters** • Flow: Up to 3,000 m^3/hr • Head: 100 m • Motor Power: 500 kW • Speed: 3,000 rpm • Liquid Temperature: 350 °C	To transfer the heat from primary circuit reactor vessel to secondary side steam generator by Primary Heat Transfer (PHT) Pump. To remove decay heat by Shutdown Cooling Pump (SDCP). To supply cooling water for auxiliary cooling by Component Cooling Water Pump (CCW).

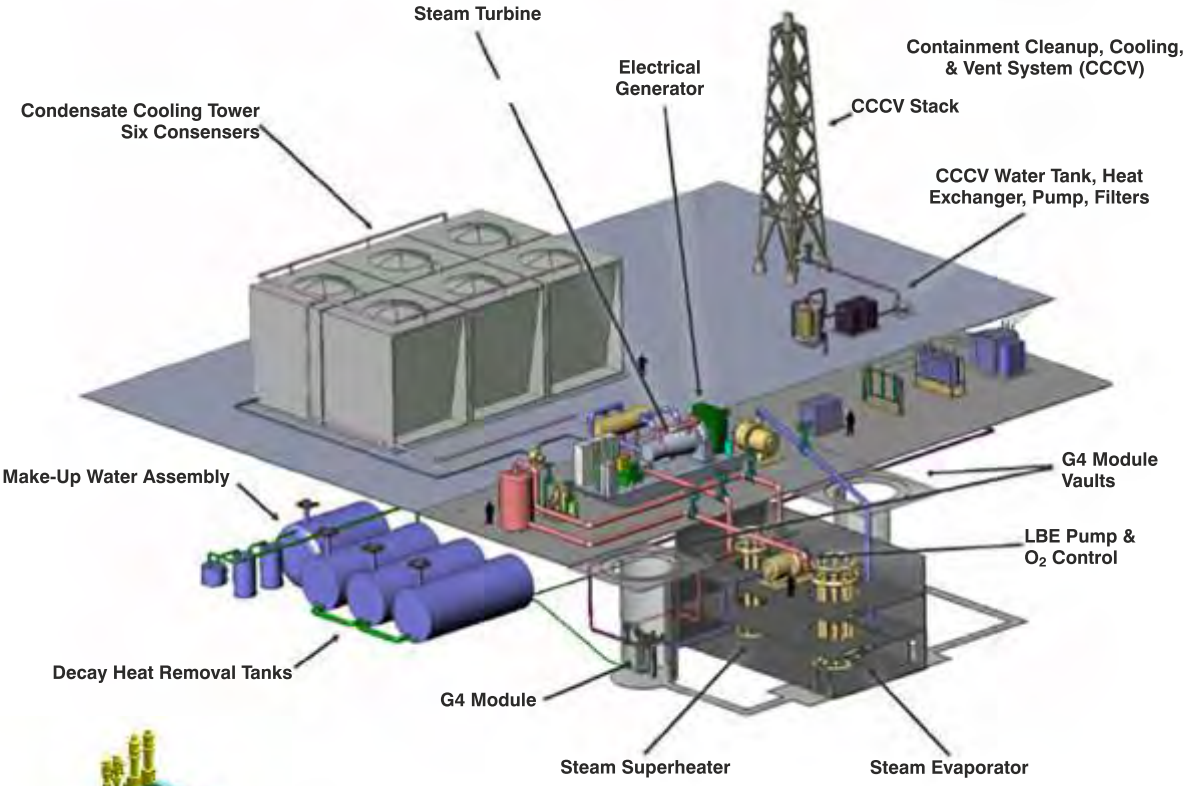
Our Other Range of Products

Our pumps are installed in the -

- Kakrapar Atomic Power Station, Gujarat
- Narora Atomic Power Station, Uttar Pradesh
- Rajasthan Atomic Power Station, Rajasthan
- Prototype Fast Breeder Reactor, Kalpakkam
- Kalpakkam (Madras) Atomic Power Station, Tamil Nadu
- Kaiga Nuclear Power Plant, Karnataka
- Tarapur Atomic Power Station, Maharashtra
- ITER, France

Product	Range	Features
Concrete Volute Pumps 	- Size: Up to 4,000 mm - Capacity: Up to 1,20,000 m^3/hr - Head: Up to 50 m - Temperature: Up to 50 °C	- Oil lubricated bearings - No water contact with shaft hence no corrosion - Corrosion proof volute casing-Reinforced Concrete - Shaft, impeller and other components with special material available
Metallic Volute Pumps 	- Size: Up to 4,000 mm - Capacity: Up to 1,20,000 m^3/hr - Head: Up to 50 m - Temperature: Up to 50 °C	- Oil lubricated bearings - No water contact with shaft; hence no corrosion - Shaft, impeller and other components with special material available
Vertical Turbine Pumps Type: BHR/BHQ/ BHM/BHMA/BHA 	- Size: 150 mm to 2,400 mm - Capacity: Up to 75,000 m^3/hr - Head: Up to 200 m - Temperature: Up to 90 °C	- Vertical mounting - Single stage or double stage - Enclosed or semi-open impellers - Single suction - Direct or right angle drive - Dry pit or wet pit arrangement - Special material of construction - Operating at 50 Hz or 60 Hz
Condensate Extraction Pumps Type: BHRc/ MNCV 	- Delivery Size: Up to 500 mm - Capacity: Up to 2,200 m^3/hr - Head: Up to 380 m	- With double suction impeller - Francis type impeller with bowl - Radial type impeller with diffuser

Small Modular Reactors (SMRs)



Conceptual Drawing of Gen4 Module (G4M) based 25MW Electric Power Plant

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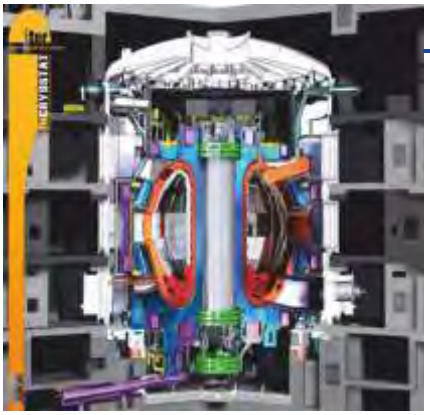
KBL can supply pumps for Small Modular Reactors (SMRs)

Certificate of Commendation by BARC

Bhabha Atomic Research Centre (BARC) appreciated for contribution in developng high pressure high temperature canned motor pumps for various applications of nuclear power plants including Small Modular Reactors (SMRs)

Implemented Installations

Nuclear



ITER, France

Pumping Package for International Thermonuclear Experimental Reactor (ITER) in France

Project: 1 x 500 MW Thermonuclear Reactor (Based on Fusion Technology)

Supply of 45 Pump sets for CCW and Heat Recovery System

Moderator Coolant Pump

Kakrapar Atomic Power Station, Gujarat

Kalpakkam (Madras) Atomic Power Station, Tamil Nadu

Narora Atomic Power Station, Uttar Pradesh

Kaiga Nuclear Power Plant, Karnataka

Rajasthan Atomic Power Station, Rajasthan

Tarapur Atomic Power Station, Maharashtra

Circulating Water System

Kakrapar Atomic Power Station, Gujarat

Kalpakkam (Madras) Atomic Power Station, Tamil Nadu

Narora Atomic Power Station, Uttar Pradesh

Kaiga Nuclear Power Plant, Karnataka

Rajasthan Atomic Power Station, Rajasthan

Tarapur Atomic Power Station, Maharashtra

BHAVINI, Kalpakkam (1 x 500 MW Prototye Fast Breeder Reactor)

Indigenously developed Primary Heat Transfer (Sodium) Pump

BHAVINI, Kalpakkam (1 x 500 MW Prototype Fast Breeder Reactor)

Indigenously developed Secondary Heat Transfer (Sodium) Pump

KBL's manufacturing plant at Kirloskarvadi, one of the largest pump manufacturing facilities in Asia.

We offer

- Comprehensive products range
- System engineering
- Project Management
- Manufacturing-Pattern Shop, Foundry, Machining, Testing, Quality Assurance
- Research and Engineering
- Procurement
- Erection and Commissioning
- Product Support

All facilities under one roof captive foundries

- Cast Iron Foundries
- Alloy Cast Steel Foundry
- Replicast Foundry for Alloy Steel Castings
- Non ferrous Foundry
- Centralised Pattern Shop
- 3D Sand Printing for moulds and cores
- Mechanised Sand Processing System
- Automatic Moulding and Metal Pouring System
- Independent units for Cast Iron, Alloy Steel and Non-ferrous Metals and Exotic materials like Duplex and Super Duplex
- Single Casting (CI) weighing up to 14,000 kg (single piece)
- Extensive and well equipped material testing laboratory
- Non-destructive testing facility including radiography

HYDRAULIC RESEARCH CENTRE

KBL's Hydraulic Research Centre is one of the largest hydraulic research centres in Asia for testing pumps at duty conditions

- for motors up to 5,000 kW (6800 HP)
- discharge up to 50,000 m^3/hr

It is equipped with closed circuit NPSH testing capabilities and computerised data acquisition system.

The centre was designed and built under the supervision of British Hydraulic Research Association (BHRA), UK.

This facility is capable of testing pumps at 50 Hz and 60 Hz frequency, covering all global supply voltages (3.3 to 13.2 kV).

Our Manufacturing Capabilities

A view of the automated foundry at Kirloskarvadi.

An impeller core of a large pump is being set in the mould (3D printed).

Pinnacle machine for aluminium, gun metal patterns manufacturing.

A large pump casting being poured.

CNC machining centre.

A pump impeller under machining on a CNC vertical boring machine.

Metallic volute pump casing.

3D Printer

Capabilities

Innovative Engineering Solutions

KBL's Corporate Research & Engineering Development (CRED) is equipped with the latest computational facilities. The testing facilities are available at our manufacturing plants.

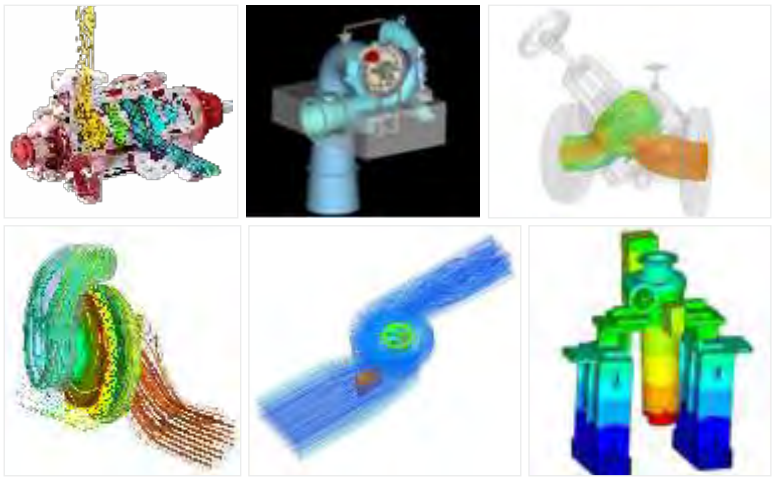
Capabilities

- High performance product design and development
- Sump model studies
- Intake study analysis using computational fluid dynamic techniques
- Surge analysis
- Structural analysis
- Cavitation studies
- Seismic analysis
- Thermal analysis
- Vibration analysis
- Transient analysis
- Heat transfer

Rapid Prototyping

Rapid prototyping is the automatic construction of physical objects using solid free form fabrication.

It takes virtual designs from computer aided design or animation modeling software, which creates each cross section in physical space. The primary advantage is its ability to create almost any shape or geometric feature.



Engineering Excellence

Advanced Technologies

KBL has championed breakthrough technological innovations to give our customers the best service and value.

KirloSmart™

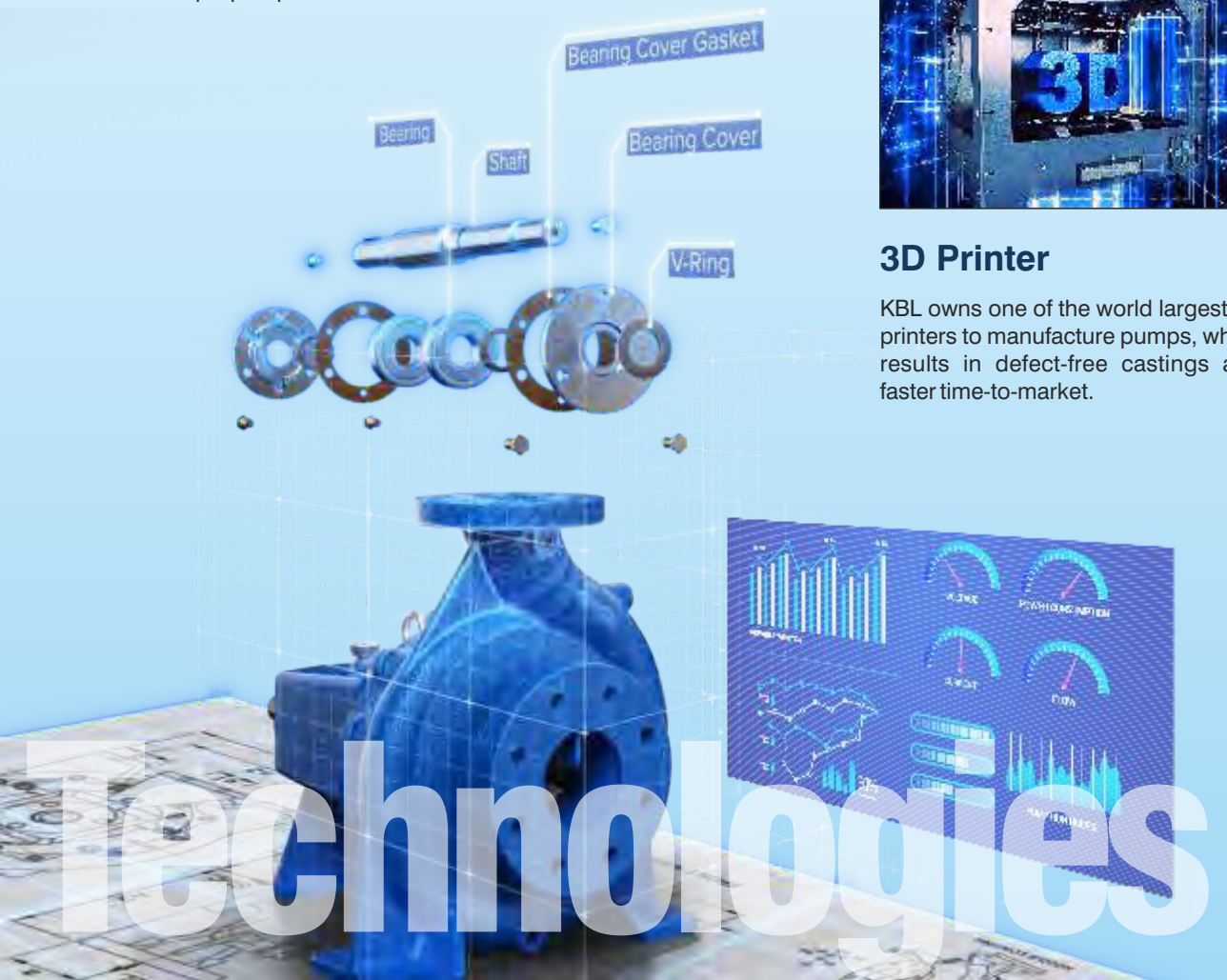
India's First IoT (Internet of things) remote pump monitoring system. KirloSmart™ is an intelligent remote monitoring solution that helps a person to view process parameters through the internet. This system is useful where pumps or pumping systems are catering to critical processes or applications by capturing data from pressure transmitters, flow meters, vibration sensors, bearing RTD, and energy meters. It can monitor parameters like flow, pressure, vibration, bearing temperature, voltage, current, energy consumption for multiple pumps.

Augmented Reality (AR) & Virtual Reality (VR)

KBL's vision to enhance its products and services continuously and effectively, has led us into the world of Augmented and Virtual reality to deliver superior value to our customers.

3D Printer

KBL owns one of the world largest 3D printers to manufacture pumps, which results in defect-free castings and faster time-to-market.



Technologies

Customer Support and Spare Parts Support

Best-in-class customer service and use of genuine spares play a vital role in enhancing overall productivity of an organisation.
Our Customer Service and Spares Division (CSSD) provides a range of services, right from installation to refurbishment.

Genuine Spare Parts

- Quick delivery and reduced downtime
- Perfect fitment
- Cost savings

24 x 7 Reliable Service

- Toll Free No. : 1800-123-4443
- SAP CRM 7.1
- Training and workshops
- QR Code
- Web based pump and valves troubleshooting guide

Refurbishment Centre Services

- Replacement of Old Pumps
- Annual Maintenance Contract (AMC)
- Overhauling
- Pump Testing
- Anti-corrosive Coating
- Energy Audit
- Dynamic Balancing

Enriching Lives

KIRLOSKAR BROTHERS LIMITED

Established 1888
A Kirloskar Group Company

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OUR COMPANIES

BRAYBAR PUMPS (PTY) LTD
Republic of South Africa

KARAD PROJECTS AND MOTORS LIMITED
India

KIRLOSKAR BROTHERS (THAILAND) LIMITED
Thailand

KIRLOSKAR CORROCOAT PRIVATE LIMITED
India

KIRLOSKAR EBARA PUMPS LIMITED
India

RODELTA PUMPS INTERNATIONAL B.V.
The Netherlands

SPP PUMPS LIMITED
United Kingdom

SYNCROFLO, INC.
U.S.A.

THE KOLHAPUR STEEL LIMITED
India