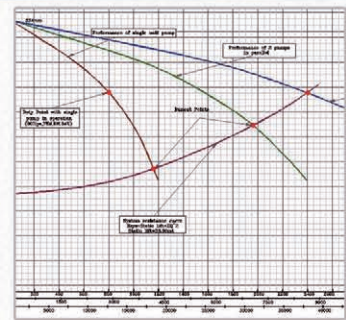
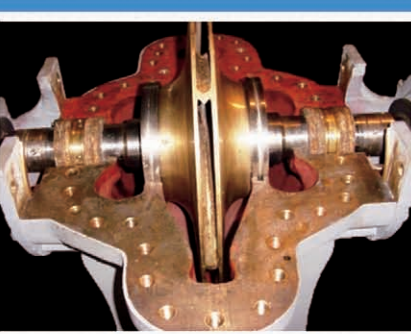




PUMPSENSE
Fluid Engineering Pvt. Ltd



Services for the users of Centrifugal Pumps

- Pump specification and pump selection services
- Training in centrifugal pumps
- Retrofit & pump upgrade services
- Diagnostics of problems in pumping systems & their resolution
- Performance testing of pumps & pump repair services

Pumpsense - an overview

Experience & Capabilities

- › Forty years of learning and experience in pump industry
- › Specialist manufacturer of centrifugal pumps with worldwide customer base - provides product support to many international pump companies.
- › Extensive experience in design of pumps and retrofit services.
- › Dedicated and trained team of engineers equipped with modern analytical tools and software.
- › World-class test facility with state-of-the-art measuring and analytical instruments.
- › Experience of training pump users worldwide.

Centrifugal Pump Services – Business Objectives

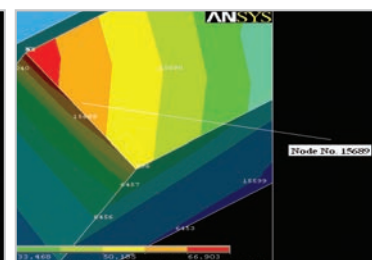
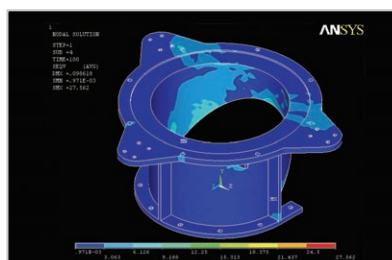
Pumpsense aims to provide high quality service to the users of centrifugal pumps in the following areas:

- › Specification building & selection of centrifugal pumps.
- › Training & workshop for centrifugal pump users.
- › Retrofit & upgrade services for existing pumping installations.
- › Diagnostics and resolution of problems of pumping systems.
- › Performance testing of centrifugal pumps & repair services.
- › Pump audit.

Pump Selection Services & Consulting

The steps in building optimum pump specification

- 1 **Discussions with the customer for engineering the pumping system** | Service, Operating conditions, site conditions, fluid properties, Industry specifications, Customers' preferences, system constraints, customers' past experience
- 2 **Preparation of selection options** | Alternate pump types, broad specifications, estimated cost & lead time for each option
- 3 **Final pump specifications** | Preparation of final pump specification & bid documents based on customer's comments & feedback
- 4 **Bid evaluation** | Bid scrutiny and preparation of deviations list, obtaining clarifications from bidders, preparing bid evaluation document
- 5 **Contract Documents** | Final specifications, data sheets, QA Plan
- 6 **Document Vetting** | Checking contract documents submitted by the vendor
- 7 **Inspection and Testing** | Carrying out witness test at pump vendor's location



Training Programs & Workshops for Centrifugal Pump Users

Benefits of the Program

These training programs have been prepared to empower the pump users to make informed decisions about selection, operation and maintenance of centrifugal pumps and mechanical seals. The program **places special emphasis on energy optimization in pumping systems. To Engineering Consultancies and EPC Contractors, this program provides technology, industry and business perspectives to empower them to serve their customers with excellence.**

The programs address practical needs of the pump users and rotating equipment engineers and are based on the intimate knowledge of the trainer in

the pump industry, as manufacturer and as a consultant in the field of centrifugal pumps. The training is delivered through a combination of lectures and workshop sessions to allow participants to gain skills to solve practical day to day problems of pumping systems.

This three-day program cover construction details of centrifugal pumps including mechanical seals, hydraulic and mechanical performance, pumping systems, materials of construction, energy optimization, quality assurance, bid evaluation, etc in a comprehensive manner to achieve the learning goals mentioned above.



Training Delivery Method

Presentation	Each program uses over 500 carefully prepared text slides, photographs, drawings & animations to explain the key concepts.
Workshops	Over 50 worked out examples are used from real life situations to highlight pump selection & application issues. Additionally, workshop sessions use multiple choice questions & actual problem solving exercises to consolidate learning.
Training Film	A twenty minute documentary film titled "world of pumps" has been specially produced for these programs. The film highlights all the major steps in the process of manufacture of industrial centrifugal pumps.
Software, Reference Sources, Continuous Help	Software sources for pump applications. Complete reference source for further reading & pump related information. Guidelines for contacting Pump-sense on a continuing basis for pump related information.

Countries in which the training program has been conducted

India, UAE, Qatar, Egypt, South Africa, France, Greece, Singapore, Malaysia, Indonesia, China, South Korea, Vietnam, Australia and Panama.

Contents of a typical three-day training program

1. Introduction to Program – A View of the Forest - Structure and Schedule
2. The Language of Pumps – Defining a few key terms
3. Centrifugal Pumps - Types, Construction, Specifications & Applicable Standards
4. Hydraulic Principles & Performance Characteristics of Centrifugal Pumps
5. Workshop 1: Pumps - Types, Construction, Specifications & Standards – solving a set of ten multiple choice questions
6. Centrifugal Pumps - Hydraulic & Mechanical Performance
7. Workshop 2: Pump - Hydraulic Principles & Performance Characteristics – solving a set of ten multiple choice questions.
8. Pumping Systems
9. Materials of construction
10. Quality assurance & testing of centrifugal pumps
11. Analytical Tools & Software for Pumping Systems
12. Bid Evaluation. Selection Optimization. Pump Specifications & Data Sheets.
13. Worked Examples in pump applications:
14. Workshop 3: Pumps - Hydraulic & Mechanical Performance – solving a set of ten multiple-choice questions.
15. Workshop 4: Pumping systems & Pump Selection- solving a set of ten multiple-choice questions.
16. Mechanical Seals for Centrifugal Pumps
17. Energy Optimization in Pumping Systems, LCC Analysis & Retrofit Opportunities
18. Condition Monitoring in Centrifugal Pumps
19. Maintenance, Diagnostics & Troubleshooting of Centrifugal Pumps
20. Erection & Commissioning Issues in Pumping Installations
21. Assembly & Dismantling of Pumps
22. Workshop 5: Pumping systems & Pump Selection – solving a set of ten multiple-choice questions



Problem Diagnostics and Problem Resolution

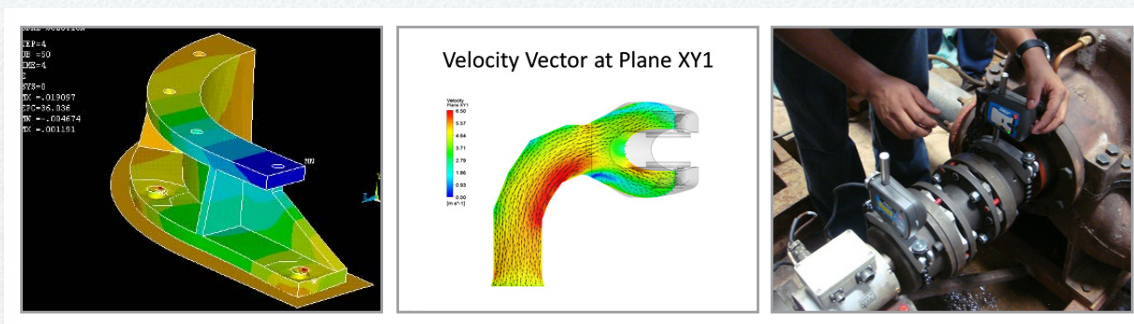
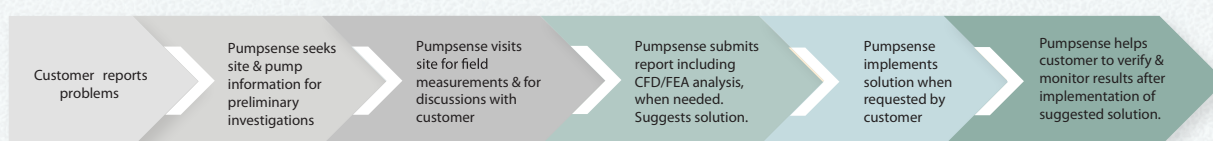
Pumpsense provides these specialized services to the users of centrifugal pumps based on the following resources:

- Rich experience of the in-house pump consultants
- Diagnostic software to detect the root cause of the field problems quickly.
- Ability to analyze pumping systems at site using sophisticated diagnostics aids such as vibration analyzers, ultrasonic flow meters, pressure transducers, etc.
- Ability to provide practical and cost-effective solutions to site problems.

TYPICAL SITE PROBLEMS
1. Pump does not deliver rated discharge or head
2. Excessive noise
3. Excessive vibration
4. Premature impeller failure
5. Frequent bearing failure
6. High power consumption- motor overloads
7. Corrosion/Erosion problem

Solutions range from custom designed impellers/modifications to piping to the replacement of pump, depending on the nature of the problem.

Typical Sequence of problem diagnostics & resolution



Typical problem diagnostics & solution services provided by Pumpsense in the recent past

- Suction pipe-layout problem leading to high vibration.
- Part-flow operation leading to recirculation and cavitation failure.
- Excessive gland leakage problems leading to premature bearing failure.
- Inadequate flow in water supply pumps
- Part-flow operation of large single volute CW pumps leading to frequent shaft failures due to high radial load.

Pump Repair/Refurbishment & Pump Testing

Pump Repair/Refurbishment – This service from Pumpsense allows pump users to give their existing pumps a new lease of life.

The service includes

- Designing and building new patterns for impellers and other components where necessary.
- Enhancing the performance of the existing pump by redesigning the impeller.
- Guidance on the materials of construction of the components of the repaired pump to improve life and reliability.
- Full QA documentation support for the repaired pump
- Hydrostatic pressure test and performance test report.

Performance Test of Pumps - Pumpsense has a state-of-the art test facility where customers can send their pumps for performance test (including NPSH test). Main features of the test bed are:

Types of pumps which can be tested- Centrifugal pumps- Split case, End suction, Multistage, etc.

Maximum Size- Up to 400mm discharge branch

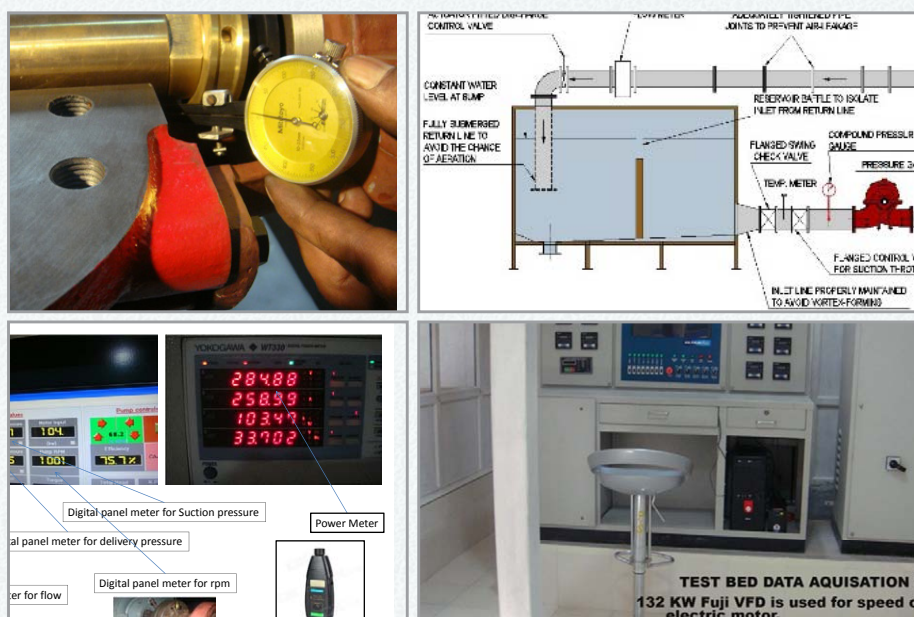
Maximum Head- up to 160m

Maximum power- 132KW (being upgraded to 350KW)

Conformance to standards- ISO 9906 & Hydraulic Institute Standards

Type of tests - Performance test, 3% head decay NPSH test

Speed Control - By 132 kW VFD of “Fuji” make



Instrumentation at test bed

Flow measurement by- Magnetic Flow Meters, Orifice meters & Ultrasonic Flow meters

Delivery Pressure measured by- Pressure transmitter/Pressure gauge

Suction Pressure measured by- Pressure transmitter/Pressure gauge

Speed measured by- Digital panel meter for rpm/Tachometer

Power measured by- Torque transducer/Power meter

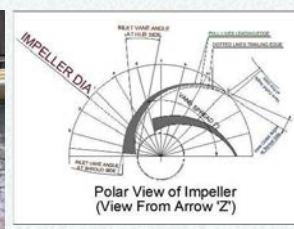
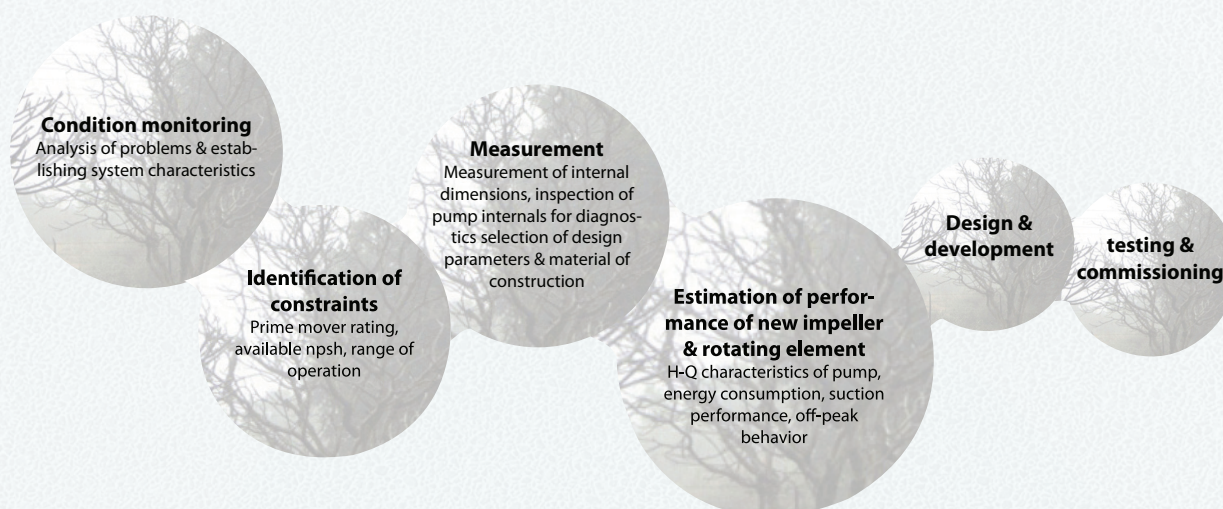
Flow controlled by- Actuator operated butterfly/globe valves

Data Acquisition & Test report/Performance Curve Generation – by proprietary software

Witness test has been done at this test bed by – Lloyds Register of Shipping, American Bureau of Shipping, M.N. Dastur & Co, Tata Consulting Engineers, China Classification Society, amongst others.

Retrofit & Upgradation of Existing Pumps

Retrofit Procedure



Pumpsense – Retrofit Resources

Pump performance enhancement services are based on:

- **Experienced Hydraulic Designer:** This is the most critical resource in a field which is still largely empirical.
- **Design Facilities :** Mechanical & hydraulic design using established procedures and CFD / FEA resources
- **Pumping System Analysis:** Experienced engineers for analysis of pumping systems
- **Pattern Making :** Specialist pattern makers for large & special impellers
- **Foundry :** Access to high quality non-ferrous, and steel foundries
- **QA:** Destructive & non-destructive test facilities for the components. Dynamic balancing as per ISO 1940
- **Field Testing:** experience & equipments to conduct meaningful field tests

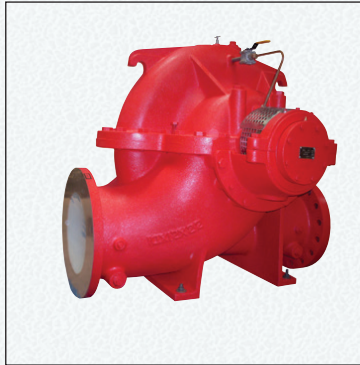
Recent Retrofit Projects

- **Kolkata Municipal Corporation** - New design rotating elements for 9083 m³/hr, 15.2m head raw water pumps at Palta pumping station. The new impeller has significantly reduced power consumption, improved suction behavior and enhanced mechanical reliability.
- **Tata Steel** - Part flow impellers for 350/450mm split case pumps. New impeller have eliminated recirculation flow and consequent cavitation, reduced vibration and increased reliability.

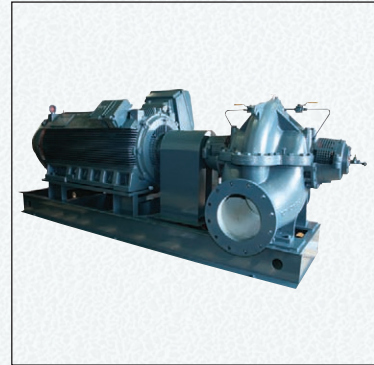
We also build Pumps - Our Products



A comprehensive range of horizontal and vertical dry pit sewage pumps are available to cover a wide range of duties at four pole, six pole and eight pole speeds.



Our single stage range of NFPA20 fire pumps cover duties up to 5000usgpm and beyond. Pumps can be supplied with certification by independent inspection agencies.



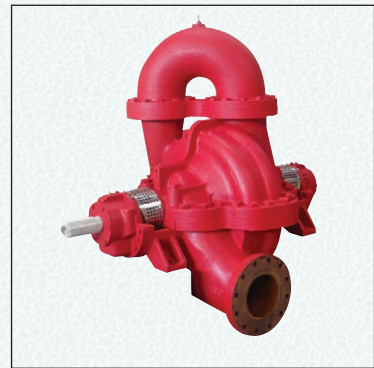
Standard split case range covers both single and two stage pumps for capacities up to 3000 m³/hr and heads up to 200m. Many customized options are available.



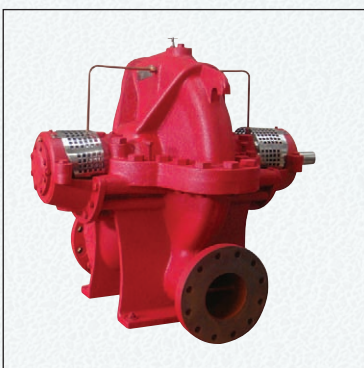
Complete range of ISO 2858 End Suction pumps are optimized for highest possible efficiency. All pumps are available in high working pressure versions with strengthened bearing arrangement.



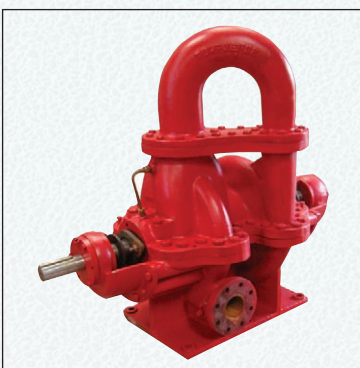
Large end suction pumps cover sizes up to 400mm. These pumps are available for air conditioning, industrial cooling water supply, and marine external fire services.



Two stage split case pumps are available for high pressure cleaning and high head industrial applications. Pumps are offered with both internal and external cross-overs for capacities up to 1200m³/hr and heads up to 400m.



Single stage double volute split case pumps are offered both in horizontal and vertical shaft configuration. Customised designs are offered for special applications.



Two stage NFPA20 Split Case fire pumps incorporate two double entry impellers for high suction lift capability and complete axial thrust balance. The pumps are available for rated flows up to 1500 gpm and heads up to 300 m at 2950rpm.



Test Bed at Pumpsense is fully compliant with the requirements of ISO 9906. Test set up is completely automated for flow control and data acquisition.

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