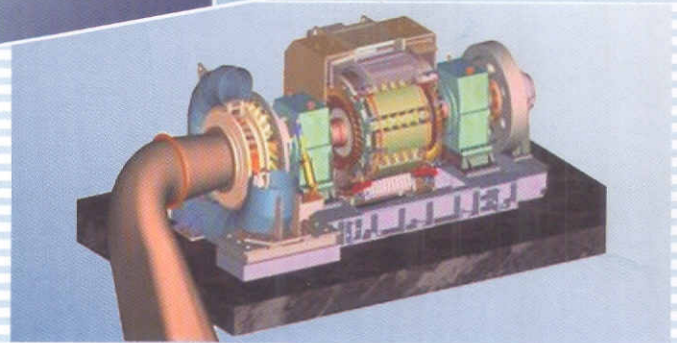
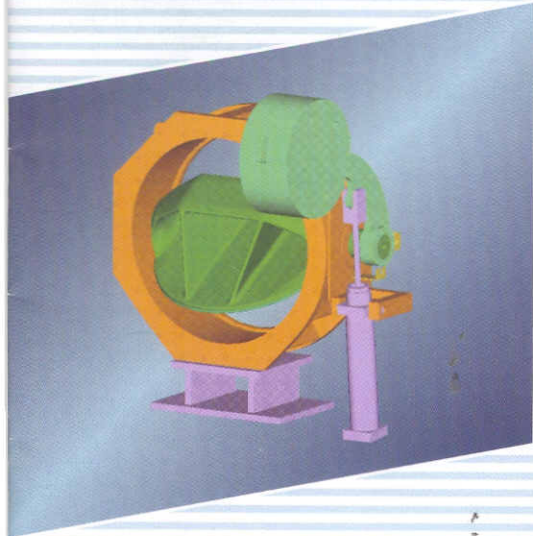
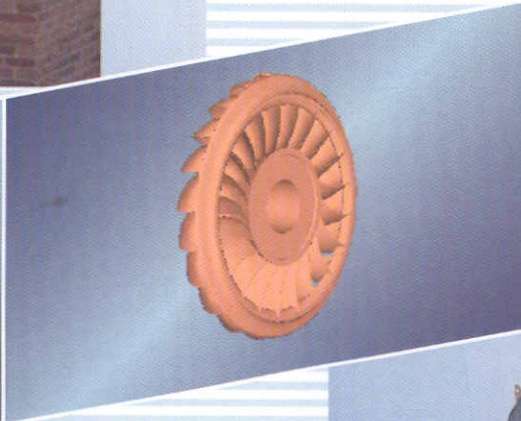
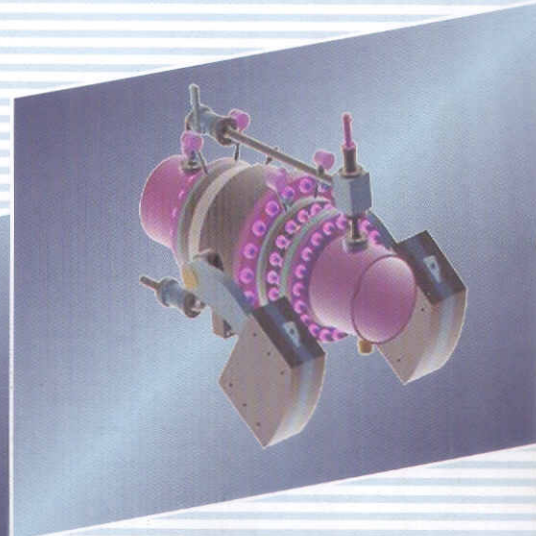
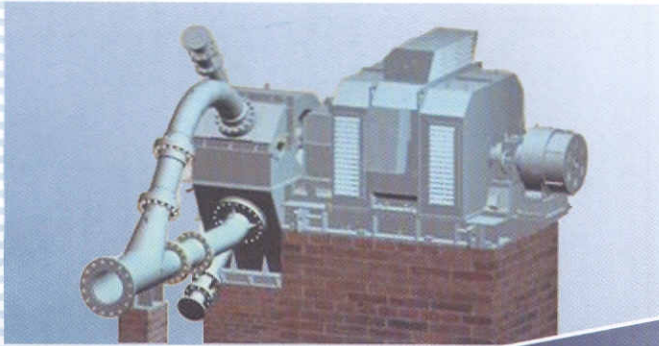




Jyoti Ltd.

Water • Power • Progress

'Jyoti' Hydrel Sets



तमसो मा ज्योतिर्गमय
dispelling darkness and
bringing light to millions





Sounds of Efficient Silence

Transforming Tricklelets of water into Kilowatts of Happiness

Small Hydro Power (SHP) is one of the important non-polluting renewable sources of energy which can substantially contribute to Power Generation to meet ever increasing demand for electricity.

Small Hydro Power project essentially harnesses energy from flowing or falling water from rivers, rivulets, artificially created storage dams or canal drops.

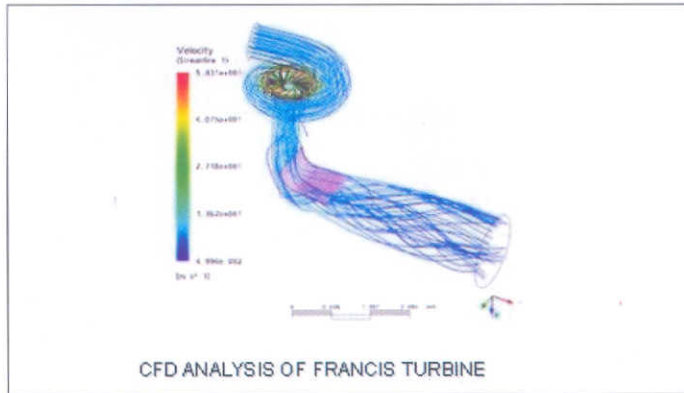
In India, Jyoti Ltd. pioneered designing, manufacturing and installing Hydro Electric Generating sets for SHP projects in late fifties. At Jyoti, Hydro Turbines to match varying heads and outputs are designed and manufactured in wide range. In addition, the auxillary hydro-generating equipment such as Generators, Inlet Valves,

Governors, Switchgears etc. are also designed and manufactured. This single source responsibility guarantees uninterrupted performance of the entire Hydro Generating System. Jyoti is one of the very few companies in the world to assume such single source responsibility.

Jyoti undertakes Design, Manufacturing, Installation and Field Testing of Pelton, Turgo Impulse, Francis & Axial Flow Hydel Set on Turn-key basis as single source responsibility.

Here is an overview of various types of Turbines and other hydraulic auxillaries manufactured at Jyoti for high, medium and low head applications upto 20,000 kW output.

RESEARCH & DEVELOPMENT



Jyoti has its own R&D Centre to assist its production line for better design, quality and performance of its products which suit Indian / International site conditions.

Jyoti has strong back up of an experienced R&D team undertaking research, development & design activities for more than 40 years.

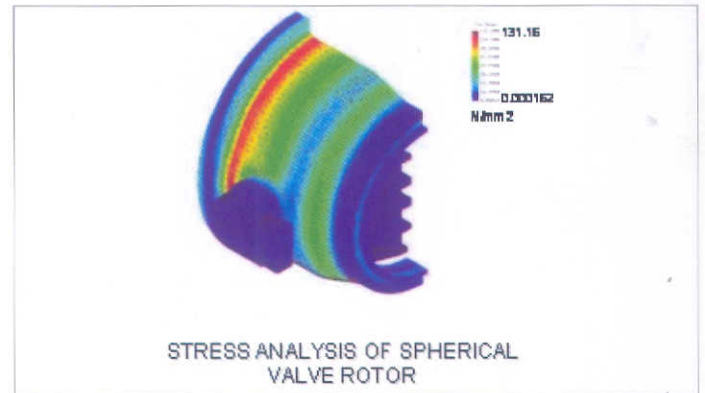
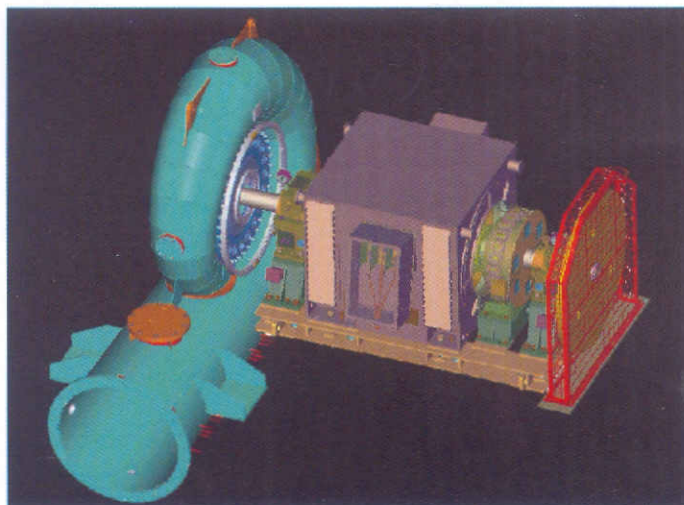
Jyoti's R&D centre, established in 1964, is recognized by the Department of Scientific & Industrial Research (DSIR), Government of India.

Since the inception of R&D Centre, Jyoti has developed series of models for turbines & pumps, meeting individual customer requirements. These models are designed, manufactured and tested as per IEC in house and under certification of MANIT, Bhopal

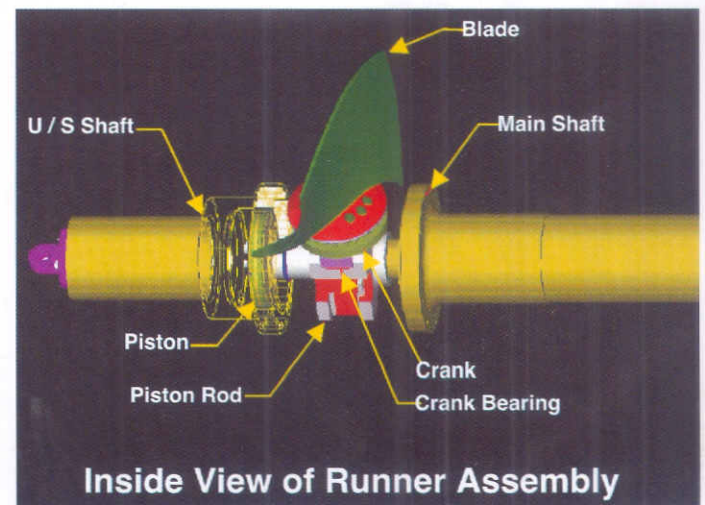
Jyoti has versatile system for design & development activities. The system includes latest software for Hydraulic Design, Mechanical design & analysis of the key components, which verifies the mechanical design before its shop floor execution.

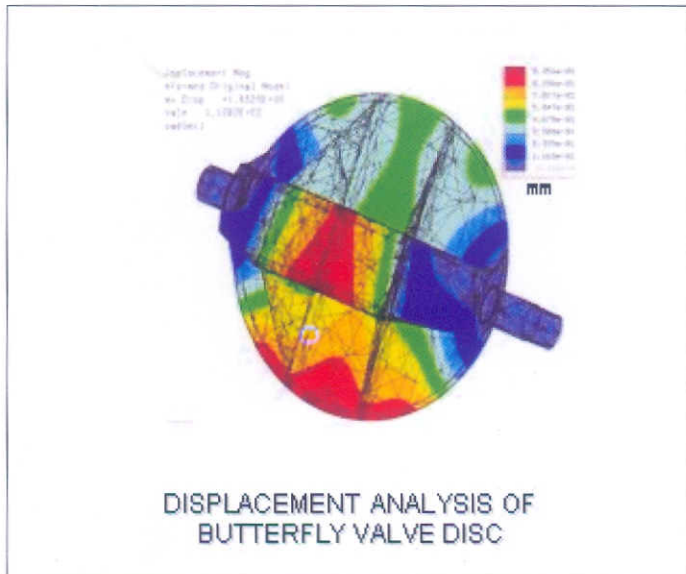
The software include:-

- Ansys CFX Module 13 (For Hydraulic Design)
- Ansys Structure (For Mechanical Analysis Of Turbine/Pumps Components)
- Pro-E Version WF-5 (For Modeling & Detailing Of Components)

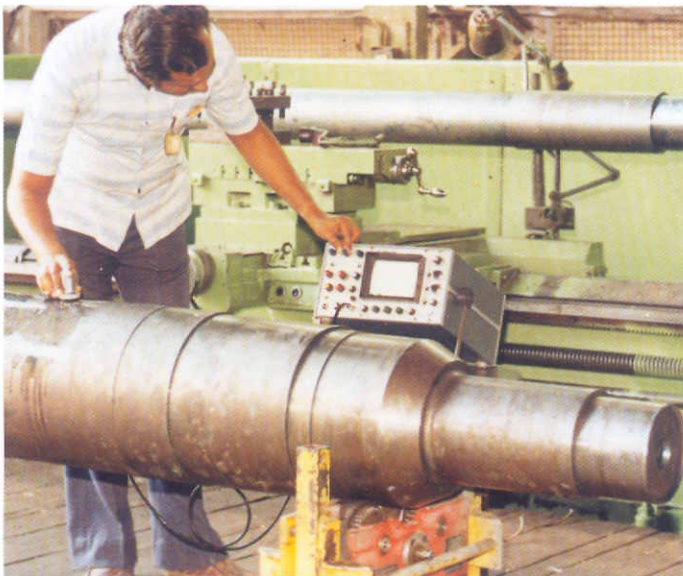


- Pro Mechanical (For Mechanical Analysis Of Components)
- Auto CAD-2011 (For Detailing Of Components & Preparing Customer Drawings)
- Catia (For Surface Modeling)
- In addition to the hydraulic machine dynamic studies, the softwares enable hydraulic system simulation like sump and intake structures for turbines and pumps and studying the operational behaviour of turbines for different geometry layout.
- Computational Fluid Dynamics is the state of art technique for fluid flow analysis. It is also used for hydraulic design and analysis of the turbine & pump. The objective of CFD analysis is, to predict turbine performance and to design a product that leads to higher performance. The CFX centre at Jyoti facilitates simulation of the flow pattern inside Runner, Draft Tube, etc. which is very helpful for diagnosing any problem. The CFD Analysis centre is working as "Virtual Equipment Testing Laboratory"
- Ansys software at Jyoti enables simulation of structural analysis on hydraulic units. Hydraulic loading as computed in CFD is used for this purpose to assess structural integrity of components like runner, impeller, spiral casing etc.





QUALITY CONTROL AND ASSURANCE



At JYOTI, Quality has become a way of life. There are modern quality control equipments for assuring quality of every product at each stage. There is a well equipped Metrology Department and a Material Science Laboratory. There is an independent Quality Control and Assurance Department with facilities for carrying out all Destructive and Non-Destructive tests. These include Universal Testing Machine, Dye Penetrant Inspections, Magnetic Particle testing, Ultrasonic Flaw Detector and Radiography equipment.

CUSTOMER SERVICE

The quality standards, for which Jyoti has earned a wide reputation, have resulted in a continuous relationship of more than 4 decades with our customers spread throughout the country and abroad. Customer satisfaction through our high quality hydro generating sets is our commitment.

It begins with meticulous erection, the foremost requirement for ensuring trouble-free operation of our Hydel Systems for a long period of time. Recognizing

this fact very well, our qualified, well-trained and well equipped customer service engineers are stationed at all the Zonal Offices. They are always ready to immediately respond to a call from our valued customers even from the remotest area to undertake any trouble-shooting assignment under most onerous conditions.

In Dual-block configuration, Turbine and Generator have their own bearings making it a four-bearing system. The Hydel set can be offered in vertical or horizontal axis orientation.

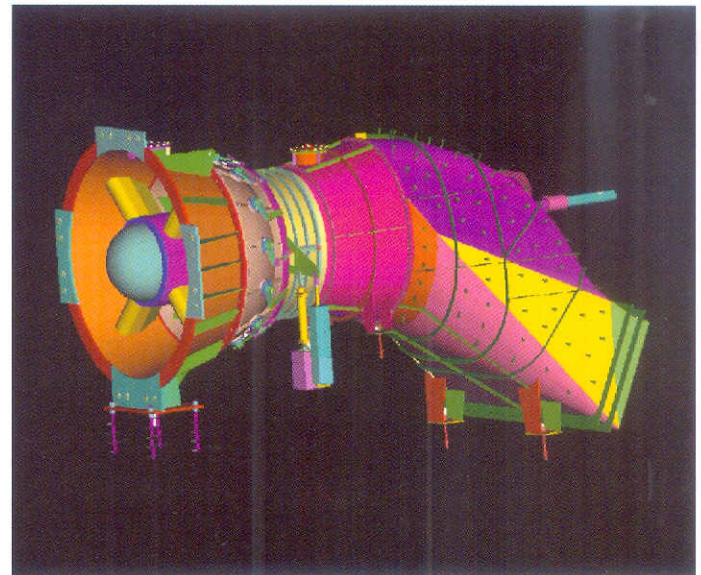
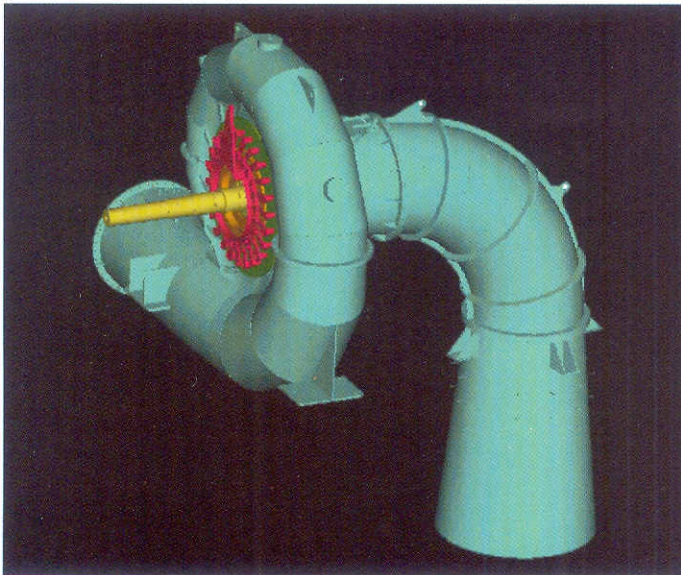
In both the above arrangements, turbine is regulated by an adjustable guide vane system, operated either by hydraulic cylinder mounted on spiral case of turbine or built into Hydro-Mechanical Governor, through connecting rod.

Our customer services includes

- Erection, Commissioning and Testing of Electro Mechanical equipments at Hydro power plants
- Refurbishment of hydro power plants
- Supervision of operation and maintenance
- Training to the personals
- Supply of spare parts as an when required
- Cater all service support need of customer



**OUR EXPERIENCE
YOUR ADVANTAGE**



MILESTONES

- ❑ 2x2800 kW Ukai HEP erected in 1984, in concrete volute construction has been generating power for more than 25 years.
- ❑ 2 x 1500 kW WBSEB, Darjeeling High Head (720 m) Pelton turbine.
- ❑ First unmanned remotely controlled small hydro project (2x1600 kW) for at Bhivpuri for TATA Power
- ❑ Award from IASH (International Association for Small Hydro) for outstanding contribution to the development of small hydro power in India.
- ❑ 4x6000 kW Shimsha HEP (On EPC basis including Civil and hydro mechanical works)
- ❑ 3x6000 kW Kemphole HEP, commissioned in 2004
- ❑ Largest 3500 mm size Butterfly valve designed, manufactured and supplied and commissioned and is working satisfactorily.
- ❑ 3x1200 kW Sheetla HEP with 2700 mm runner diameter, horizontal Kaplan turbine for low head.
- ❑ 4x3600 kW Suoi-Sap HEP, commissioned in Vietnam jointly with Tata International.
- ❑ 3x5000 kW Mannapitlu SHP, commissioned in year 2009
- ❑ 3x4000 kW Hullahalla HEP, commissioned in the year 2009
- ❑ 2x7500 kW Vanala SHEP, commissioned in the year 2009
- ❑ 2x8000 kW Namchim HEP, commissioned in Vietnam
- ❑ 2x5000 kW Manjanadka HEP, commissioned in the year 2009
- ❑ 2x4100 kW Silau I HEP, commissioned in Indonesia
- ❑ 2x1600 kW Cikotok HEP, in Indonesia is under erection
- ❑ 8 X 13000 kW Volute Pump turbines supplied and commissioned in collaboration with CKD Blansko Engineering of Czech Republic.

- ❑ 6 X 16000 kW and 2 X 22000 kW Volute Pump Turbines under execution.

AXIAL FLOW TURBINES : (Output Range : 5-10000 kW)

Manufactured for head range of 2 to 50 M, Horizontal and Vertical Shaft orientation turbine is developed to obtain most cost effective solution for any specific requirement.

Jyoti has developed Vertical (conventional with spiral casing) and Horizontal Tubular ('S' type) Turbine with Kaplan/Semi Kaplan / Propeller arrangement. Horizontal Tubular is specifically developed for low head 2-25 M sites i.e. canal drops. Above 25 M to 50 M, vertical orientation unit is provided.

Propeller type machines are controlled by adjustable guide vanes. In case of Semi-Kaplan, runner blades are regulated by a mechanism and in case of Kaplan, both guide vanes and runner blades are regulated.

These types of arrangements are available with both types of regulating facilities, but for economic consideration, a smaller machine may only have one of the regulating facilities. Especially, this is the case when water flow/head variations are relatively low.

MAIN INLET VALVE

'Jyoti' main Inlet Valve is used for emergency shut down of the unit. Main inlet valve is divided in two categories on the basis of the head. Upto 200 M head, Butterfly Valve is used and above 200 M, Spherical valve is used to minimise head loss in the system.

Generally, Spherical Valve and Butterfly Valve (Bi-plane or single plane disc) are opened by oil pressure and closed by dead weight - a fail safe arrangement.

Jyoti has developed a wide range of Butterfly Valves upto size of 3500 mm and Spherical valves to hydro pressure up to 60 bar to ensure standardization.



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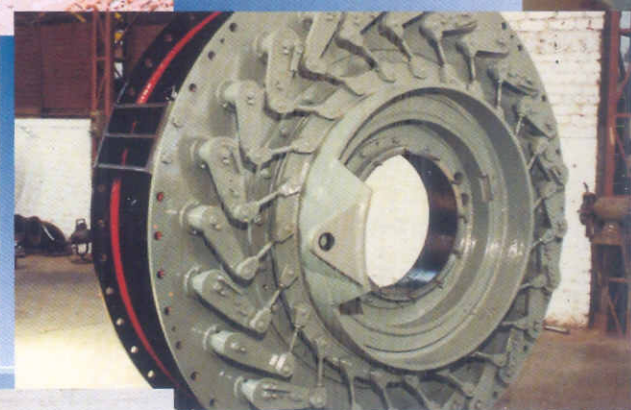
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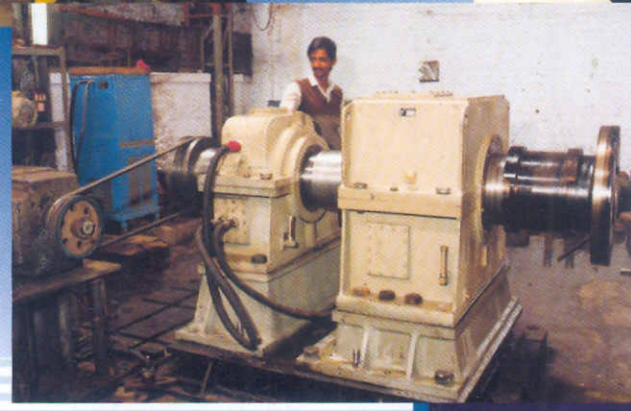
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'JYOTI' HYDEL SETS From Concept to Commissioning



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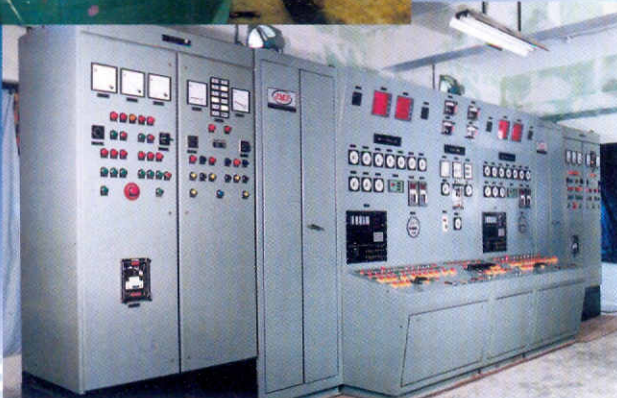
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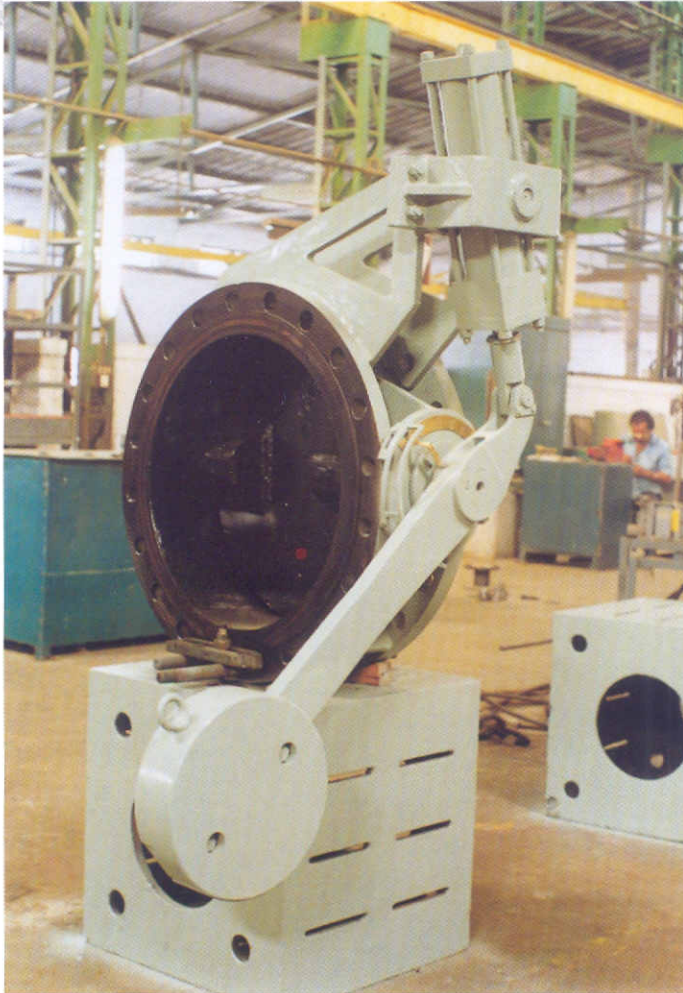
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1. ▶ A view of Jyoti Pro/ENGINEER Design Service Centre.
2. ▶ Guide vane assembly of Kaplan Turbine.
3. ▶ 33 kV Switchyard under construction for 2x1.0 MW Rajankollur Hydel Project in Karnataka.
4. ▶ Rotating Assembly of a Semi-Kaplan Turbine of 1900 mm Runner dia for 2x1.5 MW Shiva Hydel Project in Karnataka.
5. ▶ Guide Apparatus for 2 MW Francis Turbine for Madupatty Small Hydel Project in Kerala.
6. ▶ Tilting Pad type of Thrust & Journal Bearings of 300 mm size on Test Bed for a 2 MW Francis Turbine.
7. ▶ Draft tube of Pump turbine arriving at site.
8. ▶ An overview of 2 x 1.5 MW Power House of Maichem Project in Mizoram.
9. ▶ 'Jyoti' Spiral Casing with Guide Apparatus Assembly of 1.5 MW Horizontal Francis Turbine for Igo-Merchelong Project.
- 10.▶ 'Jyoti' Double Jet Pelton Turbine for 2x1.5 MW Hydel Project at Rabomchu, Sikkim.
- 11.▶ 2 nos. 2.5 MW Vertical Hydro Generator sets installed at Left Bank Canal Power House of Ukai Hydel Project, Gujarat.
- 12.▶ Control Room of 2x1.6 MW Bhivpuri Tail Race Hydel Project in Maharashtra.



GOVERNERS

'Jyoti' Governors are capable for single/double regulation of turbine. Two types of Governors i.e. ELECTRONIC & HYDRO-MECHANICAL are designed, manufactured and supplied.

Electronic Programmable Digital Governor

Keeping with the strides made in the field of Electronics, Jyoti has developed a microprocessor-based, Electronic Programmable digital Governor. The governor has successfully undergone extensive field tests. The governor is running satisfactorily at various sites. It can also perform additional governing and control functions such as :

- Level regulation
- Central governing & control system
- Flow regulation
- Storage volume regulation
- Power regulation

The main advantage of Electronic Governor is its capability to change control parameters 'on-line'. This means when turbine is operating, control parameters can be changed simultaneously. This is a sophisticated governor which can be interfaced with PC/PLC/SCADA for remote and tele - operation.

MANUFACTURING FACILITIES

Jyoti has state of art manufacturing facility located at Vadodara with sufficient area for assembly and testing

Machining, assembly and testing is located under one roof. These facilities are professionally managed by qualified and competent engineers.

Manufacturing is backed by modern technology, software and expertise from R&D centre.

Production shop is equipped with latest CNC machines, Heavy duty crane capable of handling large assembly.

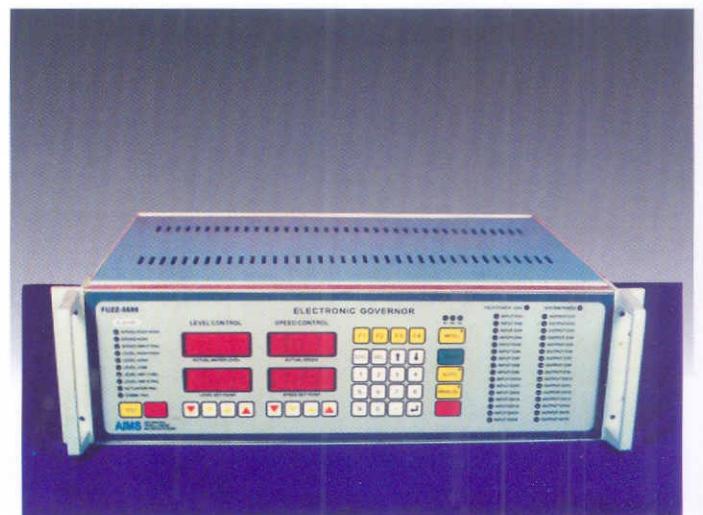
In-house machining and balancing of Runners for accuracy and greater efficiency

Reliable and quality sources for fabrication, forgings and castings.

In-house pattern making facility for castings.

CNC Machines :

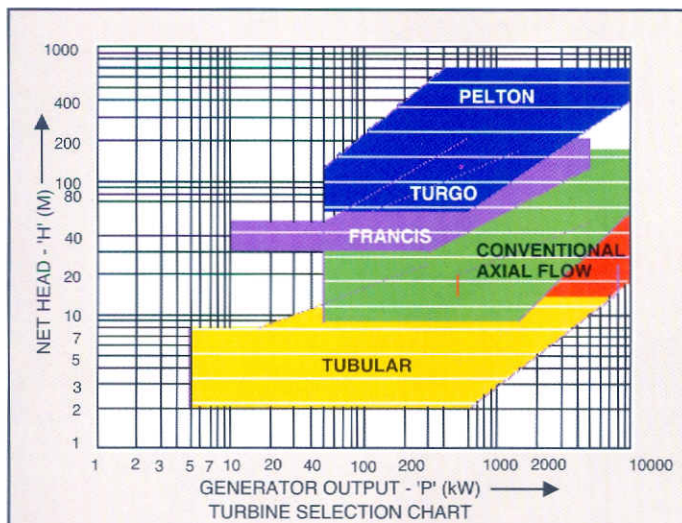
- 4M VTL Boring M/C (R. H. Ram Head CNC) Max. Turning Dia. - 4.25 m
- YOU JI VTL Lathe M/C Max. Turning Dia. - 1.8 m
- JUARISTI Rotary Table Dimension: - 1.25 m X 1.6m
- BMV 60 TC 20 Milling M/C
- CHL 21120 (2-Axis CNC) (Taiwan CNC Lathe) Z-Axis Travel Of Cross Slide: - 2.780 m
- LT 25 (AEC Bangalore)
- BMC-2300 BFW Make (CNC Milling / Boring)
- MI16 (CNC Milling)
- JAPEX Wire cut M/C (LS 500 A) Max. Work Piece Size: - 0.50m X 0.60 m X 0.15 m
- JUARISTI (TX 3K- MG12) Rotary Table Dimension: - 2m X 2m



RANGE OF 'JYOTI' HYDRO TURBINES & AUXILIARIES

(A) TURBINES

Types	Head	Output (kW)
Pelton	60 - 720	50 - 20000
Turgo Impulse	30 - 210	10 - 5000
Francis	9 - 250	50 - 20000
Axial Flow		
- Conventional	15 - 50	500 - 10000
- Tubular	2 - 25	5 - 8000



NOTE : Approx. discharge requirement can be worked out using equation, $Q = K \times P/H$ Cumec, where $K=0.12$ to 0.13

The above H v/s P diagram gives the application field of each type of turbine and help in selecting the turbine type.

For overlapping area, relative efficiency and the effect of turbine setting on the civil cost must be considered.

(B) MAIN INLET VALVES (MIV)

Butterfly Valve	300 - 3500 mm size
Spherical Valve	400 - 1000 mm size

(C) GOVERNORS Digital / PLC

(D) HYDRO ALTERNATORS

LT 10 kW - 1000 kW (Synchronous/Induction)	HT 400 kW - 100000 kW (Synchronous)
	HT 400 kW - 5000 kW (Induction)

PELTON TURBINE

(Output range : 50 - 20,000 kW)



Manufactured for head range of 60 to 700 M, with horizontal shaft arrangement and single or multijet configuration. The control mechanism can either be deflector or spear control or both as required by customer. The turbine has high efficiency irrespective of load variation.

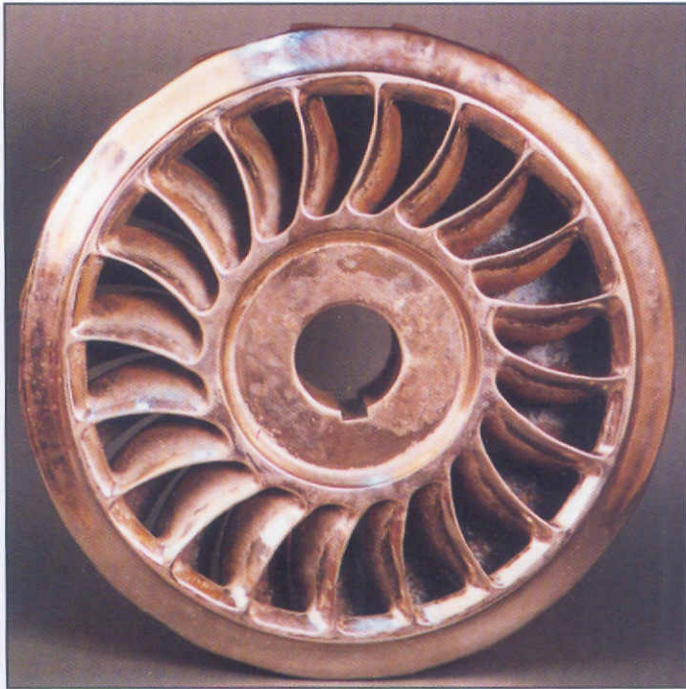
'Jyoti' Pelton turbine is simple in construction and easy to maintain. Runner is directly mounted on flange of generator shaft or mounted on separate turbine shaft with independent bearing system.

Hydraulic profile of the runner is developed for an optimized efficiency curve.

Mechanical design of runner is verified using CAE software to ensure that runner operates with minimum stress concentration factor and low stress.

TURGO IMPULSE TURBINE :

(Output range : 10 - 5000 kW)



Turgo Impulse Turbine is deal for head range of 30 - 210 M. The specific speed of this turbine is almost equivalent to that of six jet Pelton Turbines, thus reducing the size of Turgo Impulse Turbine. Turgo Impulse has an edge over high head Francis installation. Being a Free Jet turbine, it does not have cavitation hazards. The construction and control are similar to those of Pelton turbine facilitating easy maintenance. Turgo Impulse is manufactured with horizontal shaft arrangement as single or multiple jet configuration.

ADVANTAGES OF TURGO IMPULSE TURBINE

Turgo Impulse Turbine combines the best features of Pelton and high Head Francis Turbines. For SHP applications, it is more advantageous to use Turgo Impulse Turbine because :

| The Horizontal Split-casing of Turgo Impulse facilitates easy inspection and repairs as only the top-half of the Turbines is to be removed. It is also easy to repair and replace nozzle and spear-tip. The inspection of runner and maintenance in case of Francis Turbine is difficult because the dismantling of the Turbine and removal of parts for maintenance are cumbersome. Thus it is easy to install Turgo Impulse Turbine in remote areas.

| In case of Turgo Impulse Turbine, efficiency curve is almost flat for a wide range of load, resulting in efficient part load operations. This is not so with Francis Turbine.

| The performance of Turgo Impulse is consistent for a long period. Unlike Francis Turbine, Turgo Impulse Turbine does not have parts like wearing rings which affect the performance adversely when worn out.

| Since it is a Free Jet Turbine, there is no cavitation damage on Turgo runner. While Francis, being a reaction type, the cavitation damage is high, particularly for SHP application, where load-restricted part load operations are predominant.

| Governing the Turgo Impulse Turbine with long penstock is possible without adding substantial flywheel or making provision for surge tank / relief valve. This is not possible with Francis Turbine.

FRANCIS TURBINE :

(Output range : 50 - 20,000 kW)

Manufactured for head range of 9 to 190, this turbine can be supplied in two configurations, i.e. Mono block or Dual block. Mono-block is a two-bearing system in which the runner and flywheel are mounted on Generator shaft, thus minimising the length of the set.

THE GUJARAT ELECTRICITY BOARD

Gram : "SELGRID" HYDRO
FAX No. 02624 33300
PHONE : UKAI 33244
Ref. No. CCUH/HPS/4156

HYDRO CIRCLE
P.O. UKAI DAM, DIST SURAT
Via : Fort Songadh
Pincode No. 394680

Date : 19th Sept. 1997

TO WHOMSOEVER IT MAY CONCERN

This is to certify that 2 Nos. 1600 VP Vertical Hydro Turbines directly coupled with 2800 KW, 11 K.V. 16 Pole, 375 RPM, CACW Vertical Generator with associated equipment and auxiliaries, designed, manufactured, supplied, erected and commissioned by Messrs Jyoti Ltd., in Ukai Left Bank Canal Hydro Electric Project of Gujarat Electricity Board in December 1987 (First Unit) and February 1988 (Second Unit) are working very satisfactorily since commissioning. The performance of both the units is found satisfactory.

The Hydro Generating sets have so far generated a total 207.928 Million Units till 31st August, 1997. There has been no unplanned shut-down in the operation of Hydro Generating Units till date.

We are extremely happy to put on record that Messrs Jyoti Ltd., have been rendering prompt and satisfactory after-sales-services.

Sd/-
Superintending Engineer (HYDRO)
G.E. BOARD : HYDRO CIRCLE : UKAI.



POWER CORPORATION LTD.

TO WHOMSOEVER IT MAY CONCERN

This is to certify that M/s. Jyoti Ltd., were entrusted with erecting, testing and commissioning of 2 x 6 MW Units at the Shimsha Mini Hydel Station of M/s. Atria Power Corporation Ltd.,

Both the Units were commissioned by M/s. Jyoti Ltd., in November 2001.

The repairs and maintenance works of the above 2 Units were also entrusted to them during 2001 - 02. The same was done satisfactorily

Thanking You,

Yours Sincerely,
S. BALAVEERASENA
Chief Engineer

* 3rd unit of another 6MW installed in a November 04

International Power Corporation Limited

TO WHOMSOEVER IT MAY CONCERN

This is to certify that the TG equipments and auxiliaries supplied by M/s. Jyoti Limited, Vadodara for our Kemphole Small Hydro Project (2 x 6000 KW) are commissioned in the month of October 2003 and running satisfactory since last one year.

We are extremely happy to put on record that M/s. Jyoti Limited has been rendering prompt and satisfactorily after sales services

Rated Net Head : 58.0 m
Rated Discharge : 12.02 cumes
Output : 6 MW

This project is successfully designed, supplied created and commissioned by M/s. Jyoti Ltd.

For **INTERNATIONAL POWER CORPORATION LTD.**

sd /-
(M.S.Raghavendra)
Director

INTERNATIONAL ASSOCIATION FOR SMALL HYDRO

SMALL HYDRO DEVELOPMENT AWARD

This certificate is awarded to M/s. Jyoti Ltd.,
in recognition of outstanding contribution to
the development of Small Hydro as
Equipment Manufacturer.

Sd/-
(C.V.J. Varma)
Secretary General
IASH

Sd/-
(Dr. V. Bakthavatsalam)
President
IASH

3 February 1997
Hyderabad

* 3rd unit of another 6MW installed in a December 04

'Jyoti'Hydel Sets

Dispelling Darkness and Bringing Light to Millions



- Product Range : 5 kW to 20,000 kW
- Hydro-Electric Generating Set consisting of Turbine (Francis, Pelton, Turgo-Impulse, Propeller, Kaplan, Semi-Kaplan or Tubular), electronic or Hydro-mechanical Governor, Butterfly or Spherical Valve, Generator, Control Panels, etc.
- Jyoti is one of the very few to assume single source responsibility of designing, manufacturing, erecting and commissioning complete Hydro Generating set.
- Till now, Jyoti has supplied more than 430 hydel sets with total installed capacity of 3,30,000 kW.
- More than 85 'Jyoti' Hydel Sets working in countries like Nepal, Bhutan, New Zealand, Afghanistan, Malaysia, Papua New Guinea, Vietnam, USA etc.
- The first unmanned Small Hydro Power Station in India 2x1600 kW, fully automatic (single push button start) and remote controlled from a distance of 2 Kms was designed, manufactured and commissioned by Jyoti at Bhivpuri Tail Race Power House of Tata Electric Companies in 1997.
- One of the world's highest altitude power stations at 3900 meter having installed capacity of 500 kW at RONGTONG in Himachal Pradesh was designed, manufactured and commissioned by Jyoti Ltd. in 1984.
- In year 1997, Jyoti received award for outstanding contribution to the development of Small Hydro Power in India, as a equipment manufacturer from International Association for Small Hydro (IASH)



Jyoti Ltd.
Water • Power • Progress

VADODARA (INDIA)

FOR FURTHER ENQUIRIES
PLEASE CONTACT

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P.O. Chemical Industries,
Vadodara-390 003.

Phones : 0091-265-3054588-89 (D)
3054444

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- **Pune** : "Omkar", Plot No. 14, Sevanand Society, Sant Nagar, off Pune Satara Road, Pune-411 009. Ph.: 020-24231420, E-Mail: hemanthsg@yahoo.co.in
- **Secunderabad** : 5-4-187/7, 1st Floor, Karbala Maidan, M.G.Road, Secunderabad - 500 003. Ph. : 040-27544587(D), 27541608, Fax: 040-27543673, E-Mail: jyotisecc@yahoo.com, jyotisecc@jyoti.com

In keeping with the technological strides the world is making in the engineering field, we introduce changes in the design of our products. Hence, the products as actually supplied might have features varying herefrom.

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