Enriching Lives

Kirloskar

Concrete Volute Pumps

Kirloskar Brothers Limited

We are the Kirloskar Group of Companies

At Kirloskar, listening to the customer and his needs is a tradition as old as the group itself. For it is they who drive us further, make us reach higher, and engineer better solutions. In the customer's often unspoken wish for better implements lies the seed for new inventions, and path-breaking industrial concept. Business for us is the best service, customer care and a lifelong relationship.

Our pumps have wide ranging applications from gardening and domestic water supply to irrigation, large water supply schemes, process industries, aqua-culture, air conditioning, sewage, power stations, fire fighting, process industries - refineries, fertilisers, sugar, petro-chemicals, chemicals, domestic, utilities and many more.

Kirloskar *Concrete Volute Pumps*

At Kirloskar Brothers
we carry out disciplined
and yet flexible
manufacturing activities to offer
specific customer solutions
and attain highest quality

Kirloskar Brothers Limited, KBL, incorporated in1920 is the acknowledged leader in fluid handling and largest manufacturer and exporter of centrifugal pumps from India. An ISO 9001 and ISO 14001 company, with state-of-the-art plants at Kirloskarwadi, Dewas, Kondhapuri, and Shirval. It houses all manufacturing facilities under one roof. KBL's machine shops have over 500 machines including CNC machines and machining centres and Asia's largest hydraulic research center with testing facility for hydraulic performance upto 50,000 cum/hr (220,150 US GPM) and 5000kW (6700 HP) motor ratings.

The company's product range includes end suction pumps to DIN 24255, process pumps to DIN 24256 and ISO 5199, mixed flow pumps, multi stage pumps, horizontally split case pumps, vertical turbine pumps, vertical mixed flow, vertical propeller pumps, concrete volute pumps and also small agricultural and domestic pumps. The range varies from 0.1 kW(0.13 HP) domestic pumps to large volute pumps of 12,000 kW (16,080 HP).

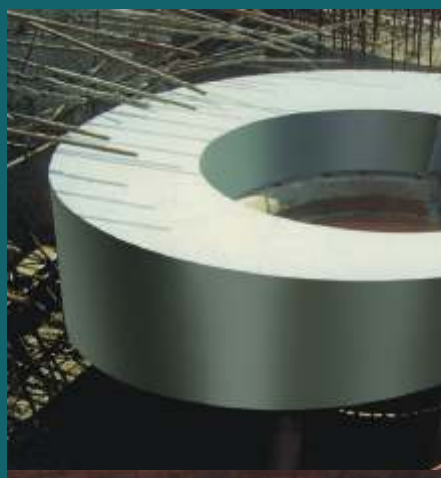
We at Kirloskar have carefully and systematically built our infrastructure to cover every aspect of manufacturing and testing. This has widen our scope for research and development in allied areas like metallurgy, special machine tools and hydraulic testing and research. This comprehensive infrastructure has given us an in-depth understanding of the entire manufacturing process, which in turn ensures handling of most complex fluid-handling requirements with confidence.

History of Concrete Volute Pump

The first Concrete Volute Pump was installed almost 90 years ago for raising sea water in the harbour basin. Till today, this pump is in an excellent working condition.

The concept of Concrete Volute evolved due to scarcity of steel during first world war.

Originally developed to provide a solution to the problem associated with reclamation of vast areas, where huge water is to be lifted by few meters.



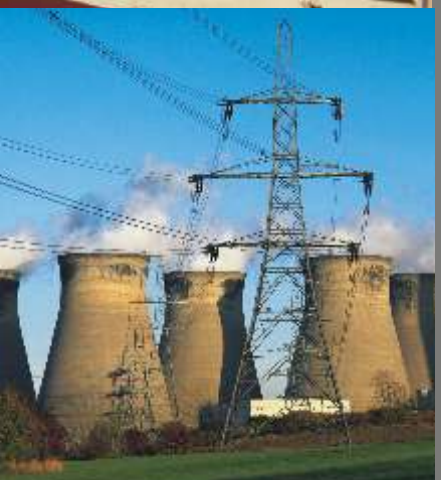
Concrete Volute Technology

Concrete Volute Pump is a technique widely used in several countries like Germany, UK, Italy, Netherlands, Portugal, Soviet Union, to name a few apart from India.

In addition to being India's largest pump manufacturer, exporter and turnkey contractor of pumping machinery, Kirloskar is an undisputed leader and pioneer in the field of fluid handling in India. Kirloskar Brothers Ltd. has been able to achieve this success for more than 100 years because of its pioneering spirit. As a result, KBL has many firsts in India to its credit, such as the first End Suction Pump, the first Canned Motor Pump, the first Sodium Pump for fast breeder reactor and also - **The Concrete Volute Pump (CVP)**

In today's applications, pumps are expected to run continuously for prolonged times. Thus, "Operational Reliability" is a crucial factor. As the size of the pump increases, the dimension and weights of the heaviest parts have a large influence on the choice of construction material used. Concrete is therefore, the natural choice for the pump body.

The Concrete Volute Pump was hence, a revolutionary development in the pump industry. As the casing is constructed in concrete at site, CVP is the most suitable pumping option from techno-economic consideration for handling large volumes of water. Concrete Volute Pump guarantees strength and rigidity and virtually eliminates the problems of corrosion and erosion. It also ensures higher & consistent pump efficiencies over a sustained period of operation. Due to simplicity of construction and ease of maintenance; the reliability achieved is of the order of 99.95%.



Concrete Volute Pump Constructional Features :

These pumps are called Concrete Volute Pumps because the Casing and Suction Draft Tube is cast in-situ Concrete. The rotating parts are metallic. The simple mechanical design is the major advantage of a Concrete Volute Pump.

Concrete Volute Pump Construction can be grouped into three major sections as follows:

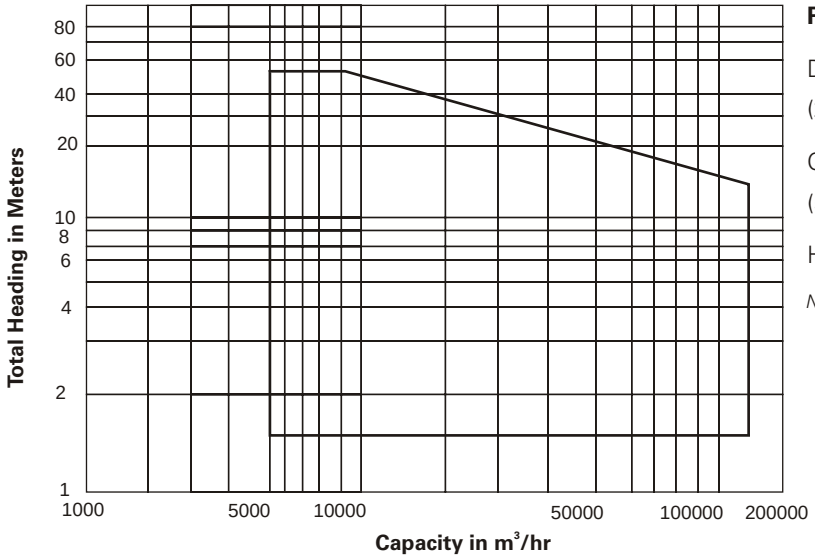
- Concrete Volute Casing and Draft Tube
- Grouted Embedded Components
- Rotating Assembly

Applications :

Concrete Volute Pumps are working mainly for applications where large quantity of flow is required to be handled, and most suitable for Sea Water application.

- Circulating / Condenser Cooling Water for Power Plants
- Lift Irrigation
- Water Supply
- Drainage and Flood Control
- Dry Docks
- Desalination

Operating Range



Range

Delivery size upto 6000 mm, (236'')

Capacity upto 120,000 m^3/hr, (528,360 US GPM)

Head upto 50 meters (164ft)

Note : Higher Heads possible with special design.

Why Kirloskar Concrete Volute Pumps prove to be a better choice?

- High Reliability
- Design Simplicity
- Superior Operating Performance
- Vibration Free Equipment
- Lowest Maintenance Costs
- Excellent Corrosion Resistance
- Other Technical Advantages

High Reliability

High Reliability upto 99.95% that eliminates stand by pumps.

The French Electricity Board installed a single pump for 700MW Thermal Power Plant and two 50% pumps for 900MW and 1300MW Nuclear Power Plants. Stand - by pumps are not required.

Design Simplicity

Seven main parts only, each one specifically engineered for any of the particular pumping system.

Simple removable wooden formworks and standard quality concrete without special surface finishing are sufficient.

Superior Operating Performance

For given parameters CV Pumps offer 1-2% higher efficiency compared to Metallic Vertical Pumps due to hydraulic design.

Lowest Life-cycle cost.

Vibration Free Equipment

Low Rotating speed

Impeller Dynamically balanced

Mass casing in concrete provides excellent inertia

Antiseismic construction

Lowest Maintenance Cost

Simple preventive maintenance on yearly schedule

Recommended inspection after every 40,000 hours only

Many pumps are running upto 70,000 hours without major component replacement

Main pump parts can be checked is-situ and without pump dewatering

Excellent Corrosion Resistance

Few moving and metallic parts in contact with water

Perfect Hydraulic design of Draft Tube and Volute eliminates Vortices and risks of concrete deterioration

Other Technical Advantages

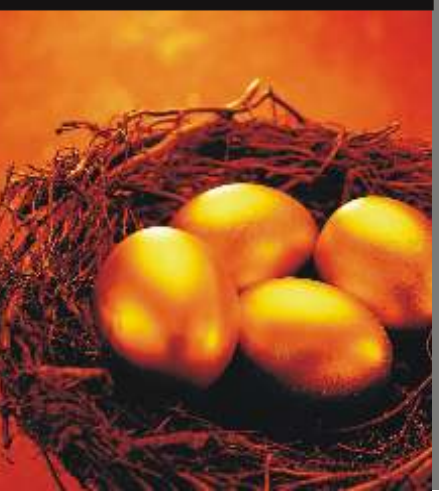
Low submergence required.

Lower Crane height & lifting capacity requirement.

Full accessibility

- Easy internal inspection without dismantling
- Impeller can be examined from suction elbow
- Rotor from manhole

Simple to construct Volute and Draft tube, can be carried out by Civil Construction Company at site.



Concrete Volute Pump an Economical Concept

- Overall expenditures for the complete pumping system are substantially lower than other solutions

Transportation & Installation Costs

- No pump casing therefore total weight of removable components is a small fraction of that of conventional units
- No anchoring necessary

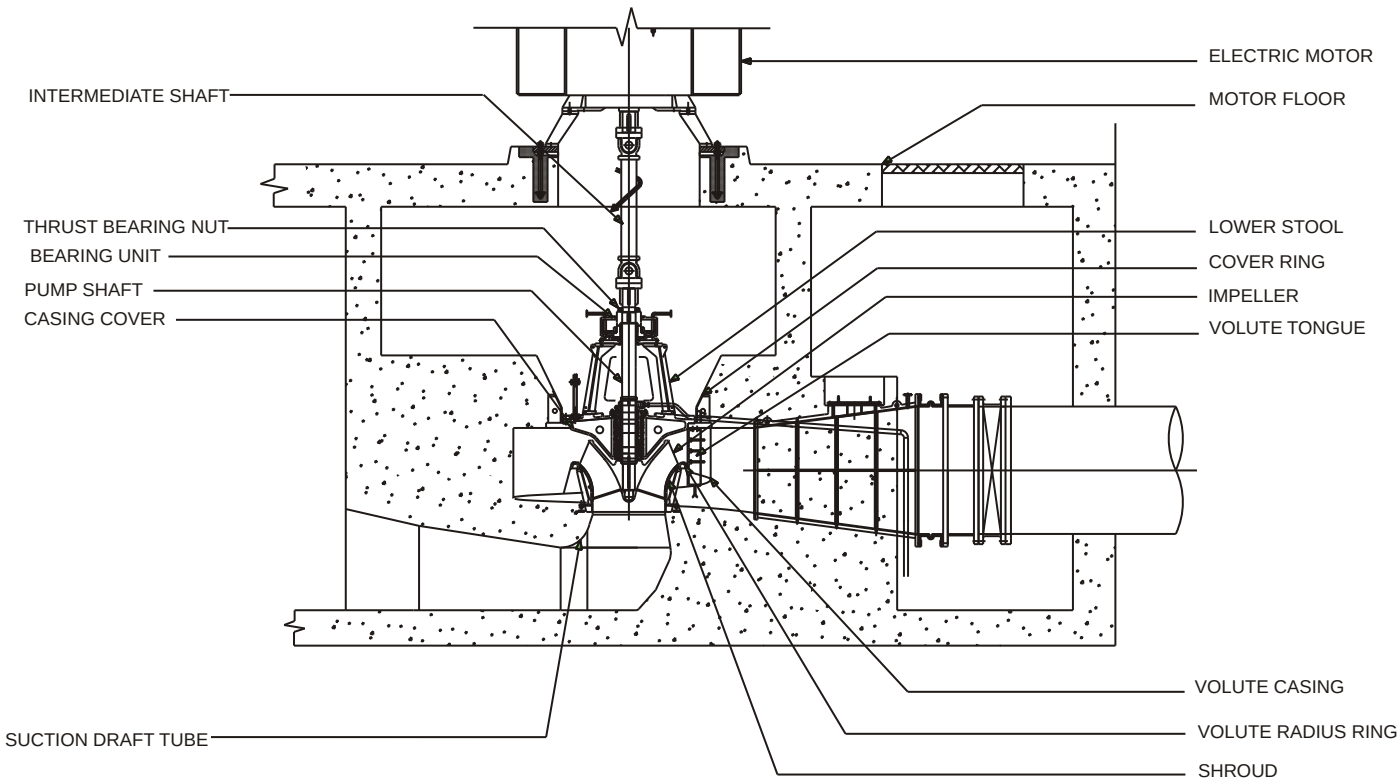
Operating Costs

- Excellent efficiency and reliability
- Low Maintenance equipment and less manpower required
- Fewer spare parts to be kept handy

Stages of Construction of Concrete Volute Pump

The construction of typical Concrete Volute Pump proceeds in the following stages:

1. Placement of Wooden formwork for Suction Draft Tube
2. Placement of Shroud Holder Ring
3. Placement of wooden formwork for Volute
4. Volute formwork and Volute Tongue with reinforcement ready for concreting
5. Placement of Mock up tool for foundation frame for Motor/ Gear box
6. Placement of Shroud
7. Lowering the Impeller
8. Placement of rotating assembly with Pump Shaft
9. Coupling being assembled with the Pump Shaft
10. Rotating assembly with intermediate shaft
11. Drive motor for pump installed on motor foundation block


ELECTRIC MOTOR
INTERMEDIATE SHAFT
MOTOR FLOOR
THRUST BEARING NUT
BEARING UNIT
PUMP SHAFT
CASING COVER
LOWER STOOL
COVER RING
IMPELLER
VOLUTE TONGUE
VOLUTE CASING
SUCTION DRAFT TUBE
VOLUTE RADIUS RING
SHROUD

6

7

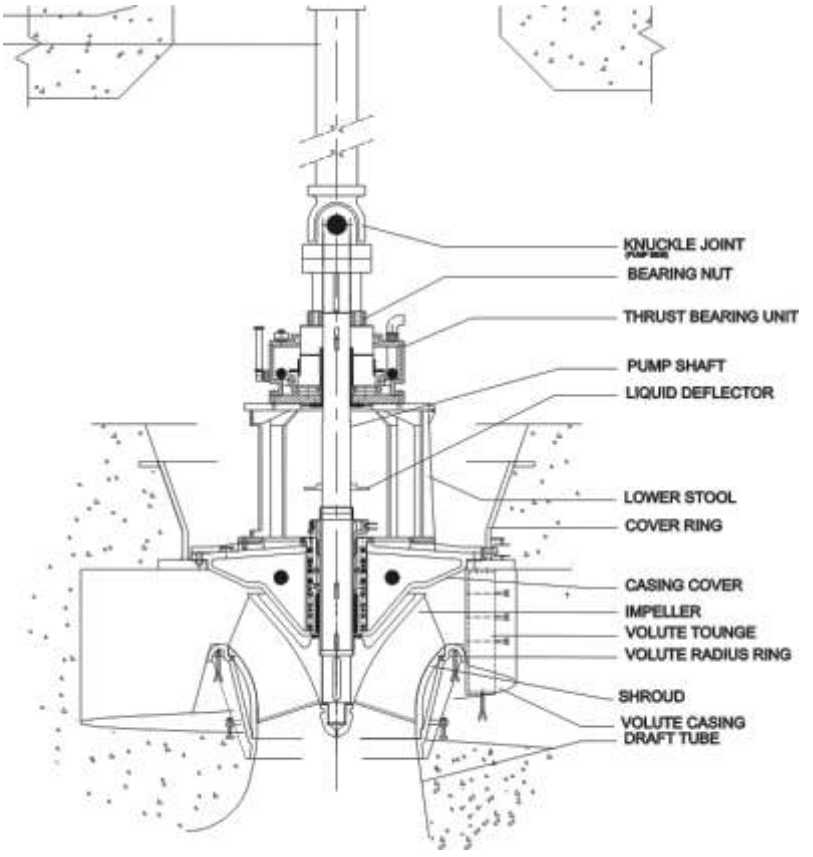
8

9

10

11

Cross Sectional Drawing



Material of Construction

Volute Casing	Reinforced Concrete			
Grouted Component	NiCI	SS 316 L	D2 Ni Resist	Alloy Steel
Casing Cover	NiCI	D2 Ni Resist	D2 Ni Resist	Alloy Steel
Impeller / Impeller Nut	CF8M	CF3M	Duplex Steel/Super Duplex	Alloy Steel
Casing Wear Ring /Shroud	CF8M	CF3M	Duplex Steel/Super Duplex	Alloy Steel
Intermediate Shaft	SS 410	SS 420	SS 420	SS 316
Pump Shaft / Shaft Sleeve	SS 410	SS 316	Duplex Steel	Alloy Steel
Bearing Stool	M S	M S	St St	St St
Coupling	Carbon Steel	Carbon Steel	Cast Steel	Cast Steel
Divergent Pipe	M S	M S	M S	St St

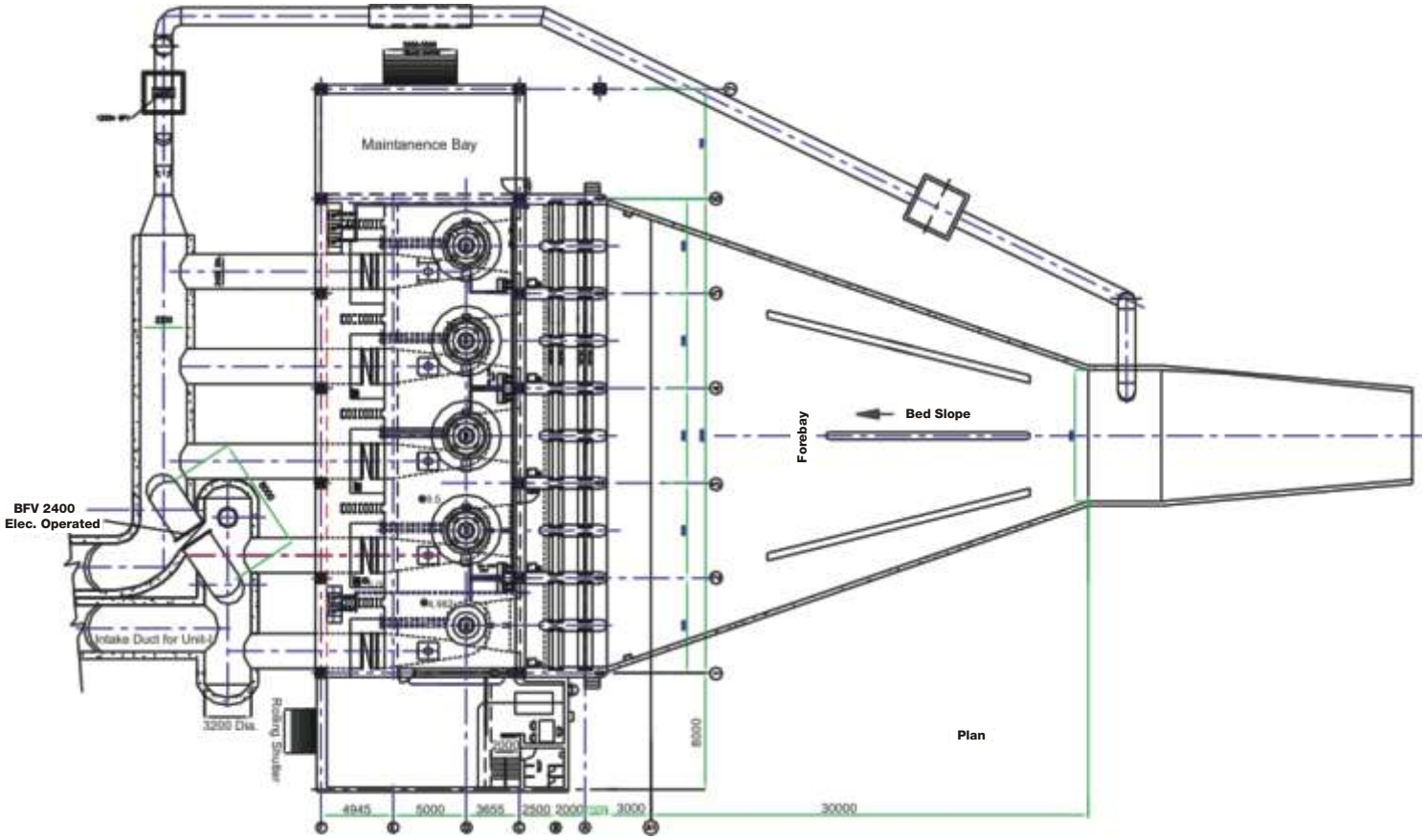
Notes : NiCI Indicates Cast iron with 2 % Nickel.
Alloy Steel indicates Exotic Materials like Super Duplex Stainless Steels. Other materials are also available on request.

Material Standards

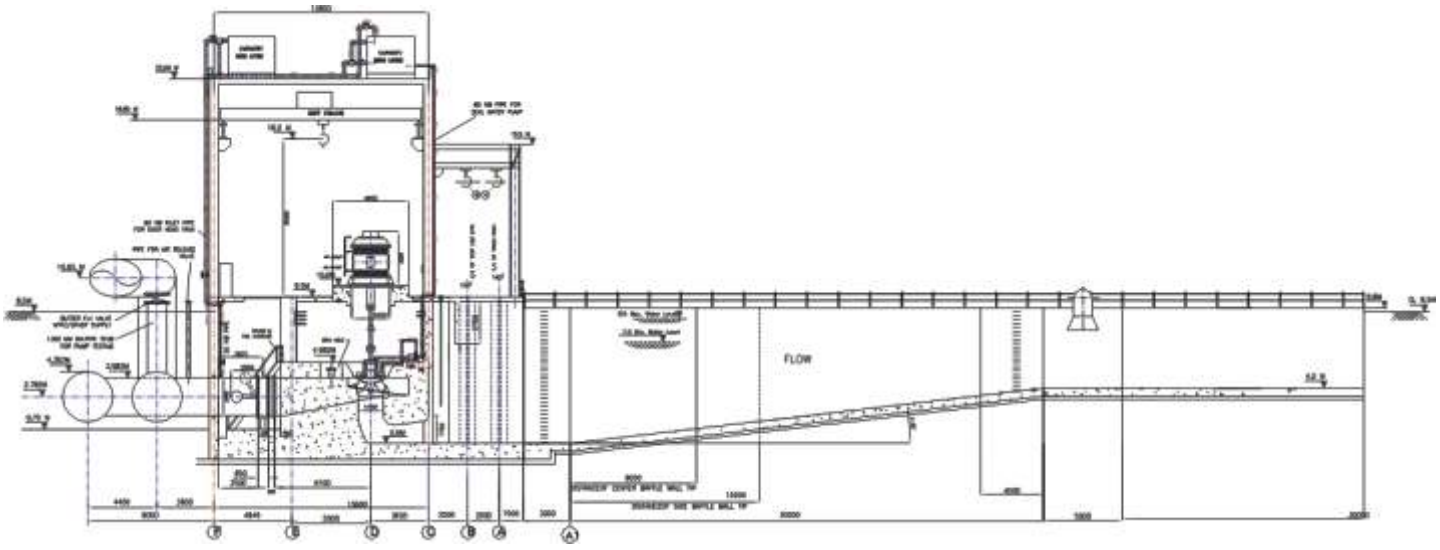
Material	Equivalent International Standards		
	IS	**BS**	**ASTM**
Cast Iron	IS 210 Gr FG 260	BS 1452 Gr.250	ASTM-A 48 CL 35
CF8M	IS 3444 Gr.9	BS 1632 Gr.B	ASTM-A 351 Gr. CF8M
CF3M	IS 3444 gr. 9	BS 1632 Gr.B	ASTM-A 743 type 410
SS 410		BS 970 410 S21	ASTM-A 276 Type 410
SS 420		BS 70 420 S21	ASTM-A 276 Type 420
SS 316	IS 1570 Gr. 05 Cr 18 Ni11 Mo3	BS 970 316 S16	ASTM-A 276 Type 316
SS 316L			ASTM-A 240 Gr. 316L
D2 Ni Resist	IS 2749 Gr. AFG Ni 20Cr3.	BS 3468 Aus 102 Gr. B	ASTM-A 436 Type 2
Duplex Steel			ASTM-A 890 Gr.CD4MCu
Mild Steel (MS)	IS 2062		
Carbon Steel	IS 1570 Gr. 40 C 8	BS 970 080 M40	ASTM-A 107 Gr. 1040
Cast Steel		BS 1504 101A	ASTM-A 216 Gr. WCB

Notes : Other Equivalent International Grades can also be offered.

Concrete Volute Pump House for Circulating Water System :

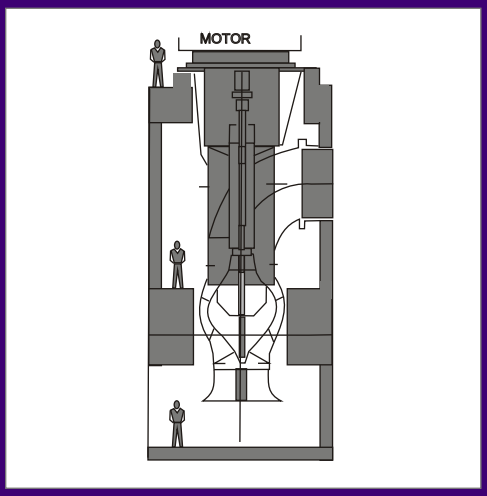


Plan

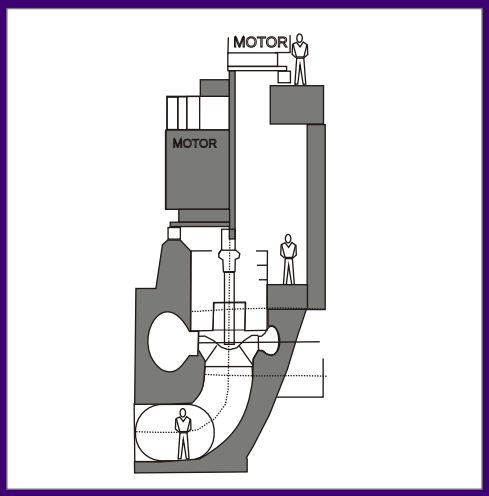


Elevation

Comparison Chart



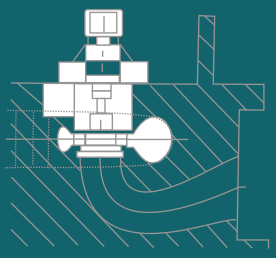
Vertical Metallic Casing Pump



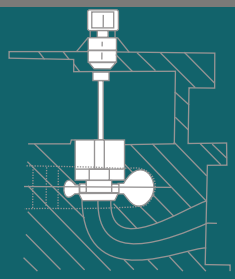
Concrete Volute Pump

Type	Vertical Metallic Casing Pump	Concrete Volute Pump
	Wet-Pit	Dry-Pit
Casing	Corrosion (chemical & electrolytic)	No corrosion
	External fouling	No erosion
	Vibrations, cracks	No fouling
		No vibrations
Inspecting / Maintenance	Difficult to maintain	Minimum maintenance
	Long duration and costly interventions	Simple and easy
	Heavy loads	No heavy loads
	Requires general overhaul	Inspection without dismantling
	at intervals of 2 to 3 years.	General overhaul at intervals
		of 5 to 7 years.
Intake	Sump or pit	Special Hydraulic design
	Chance of vortices	No vortices
	Sand/ Silt deposit	No deposit
	Irregular flow pattern	Stream lined flow pattern
Bearing	Submerged bearing bushes.	Out of water, no wear
	Less reliability	Minimum 10 years life
	Difficult and expensive to maintain	Simplified maintenance
		Easy temperature check
Shaft	In water, subjected to irregular	Dry, no water contact
	stress and problems. Possibility of	No corrosion, long life
	vibrations and cracks	No vibrations

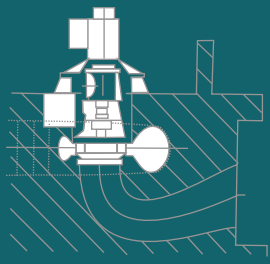
Alternative Arrangements



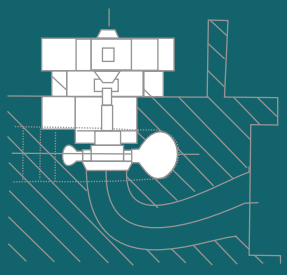
a) High Speed Motor Driving the pump through a reducing Gear Box.
Gear Box on Pump floor + Rigid Coupling.



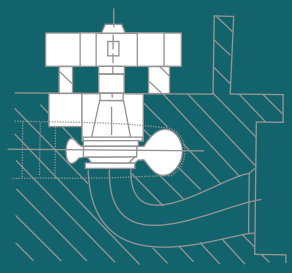
b) High Speed Motor Driving the pump through a reducing Gear Box.
Motor and Gear Box on Upper floor + Rigid Shaft.



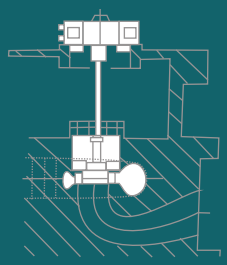
c) High Speed Motor Driving the Pump through a reducing Gear Box.
Gear on Pump Cone.



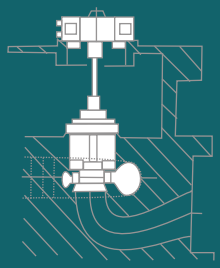
d) Motor Directly coupled and on Pump Floor.
Single Thrust Bearing + Rigid Coupling.



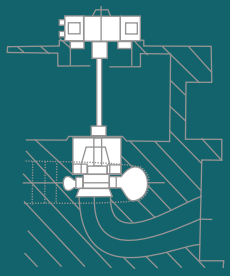
e) Motor Directly coupled and on Pump Floor.
Two Separate Thrust Bearing + Flexible Coupling.



f) Motor Directly coupled through extension shafting motor on upper Floor.
Single Thrust Bearing + Rigid Coupling.



g) Motor Directly coupled through extension shafting motor on Upper Floor
- Separate Pump Thrust Bearing on intermediate floor + Flexible Coupling.



h) Motor Directly coupled on upper Floor
Separate Pump Thrust Bearing on Pump Cone + Flexible Coupling.

Concrete Volute Pump Projects

Reliance Energy Ltd. (Formerly BSES Ltd.)

2 x 250 MW Dahanu Thermal Power Station

(India's first Concrete Volute Pumps)

Sardar Sarovar Narmada Nigam Limited

Saurashtra Branch Canal Pumping Scheme

(World's largest Pumping Scheme)

Nuclear Power Corporation of India Limited

2 x 500 MW Tarapur Atomic Power Plant

National Thermal Power Corporation Limited

2 x 500 MW Simhadri Super Thermal Power Project

Kirloskar Concrete Volute Pumps Reference List

Sr. No.	Customer	Project	Qty	Liquid Handled
1.	**Reliance Energy Ltd. (Formerly BSES Ltd.)**	2x250 MW Dahanu Thermal Power Station	4	Sea water
2.	**National Thermal Power Corporation Limited**	2x500 MW Vindhyachal Super Thermal Power Project	4	Canal water
3.	**National Thermal Power Corporation Limited**	2x500 MW Simhadri Super Thermal Power Project	5	Sea water
4.	**Nuclear Power Cororation Of India Limited**	2x500 MW Tarapur Atomic Power Plant, Unit III & IV	6	Sea water
5.	**Gujarat Mineral Development Corporation Limited**	2x125 MW Akrimota Power Plant	5	Sea water
6.	**Sardar Sarovar Narmada Nigam Limited**	Saurashtra Brach Canal Pumping Scheme		
		Pumping station - 1	10	Canal water
		Pumping station - 2	5	Canal water
		Pumping station - 3	5	Canal water
		Pumping station - 4	3	Canal water
		Pumping station - 5	3	Canal water
7.	**Irrigation & Command Area Development Department, AP**	Godavari Lift Irrigation Scheme Dharmasagar Pumping Station	2	River water
8.	**Gujarat Electricity Board**	Kutch Lignite Thermal Power Station	2	Brackish water
9.	**Siemens Power Gen, Germany**	1100MW Sugen CCPP	4	River water
10.	**National Thermal Power Corporation Limited**	3 x 660 MW Sipat Super Thermal Power Project	6	Canal water
11.	**National Thermal Power Corporation Limited**	3 x 660 MW Barh Super Thermal Power Project	6	Canal water

Kirloskar *Concrete Volute Pumps*

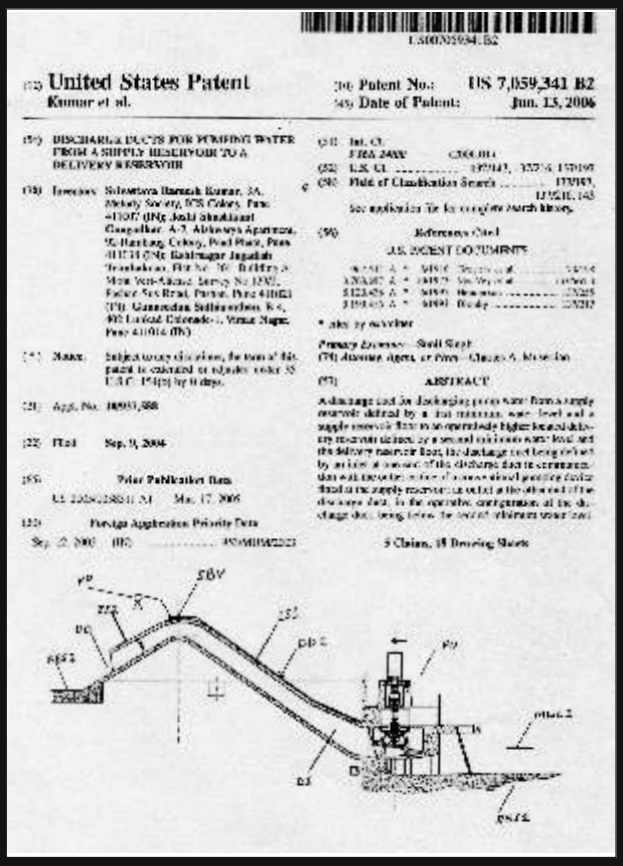
Discharge m^3/ hr (US gpm)	Head mWC (ft)	Speed RPM	Motor Rating KW(HP)
20.750 (91,410)	17 (56)	296	1260 (1689)
30,000 (132,159)	19.5 (64)	330	2050 (2748)
31,000 (136,564)	28 (92)	330	3170 (4249)
40,000 (176,211)	18 (59)	330	2900 (3887)
14,000 (61,674)	24 (79)	490	1250(1676)
72,000	11.4 (37)	150	3250 (4357)
72,000	16.3 (53)	200	4500 (6032)
72,000 (317,181)	16.3 (53)	200	4500 (6032)
72,000	12.6 (41)	160	3250 (4357)
72,000	17.6 (58)	200	4500 (6032)
18,000(79,295)	45 (148)	490	3000 (4021)
15,000 (66,079)	25 (82)	490	1350 (1810)
21,852 (96,264)	24.5 (80)	420	1850 (2480)
40,000 (176,211)	23 (75)	300	2800 (3753)
40,000 (176,211)	27 (89)	330	3405 (4564)

KBL - USA patent
Energy Efficient Siphon System for pumping system

Siphon duct installation at Site

USA patent has been awarded for Siphon creation and breaking arrangement designed by KBL team for Concrete Volute and Vertical Turbine Pumps

Siphon model Test at Hydraulic lab of KBL



United States Patent
Kumar et al.

Patent No.: US 7,059,341 B2
Date of Patent: Jun. 13, 2006

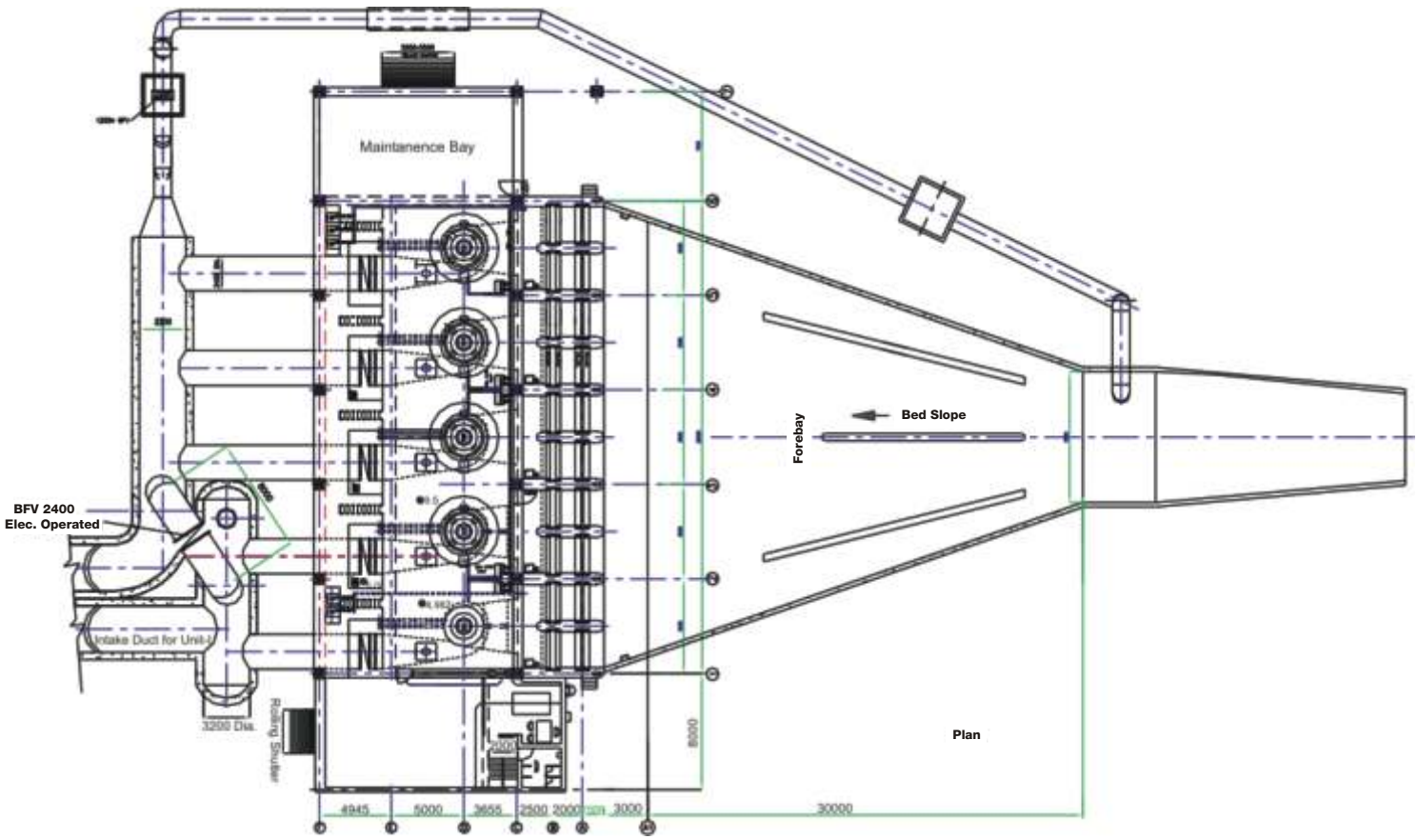
DISCHARGE DUCTS FOR PUMPING WATER FROM A SUPPLY RESERVOIR TO A DELIVERY RESERVOIR

ABSTRACT

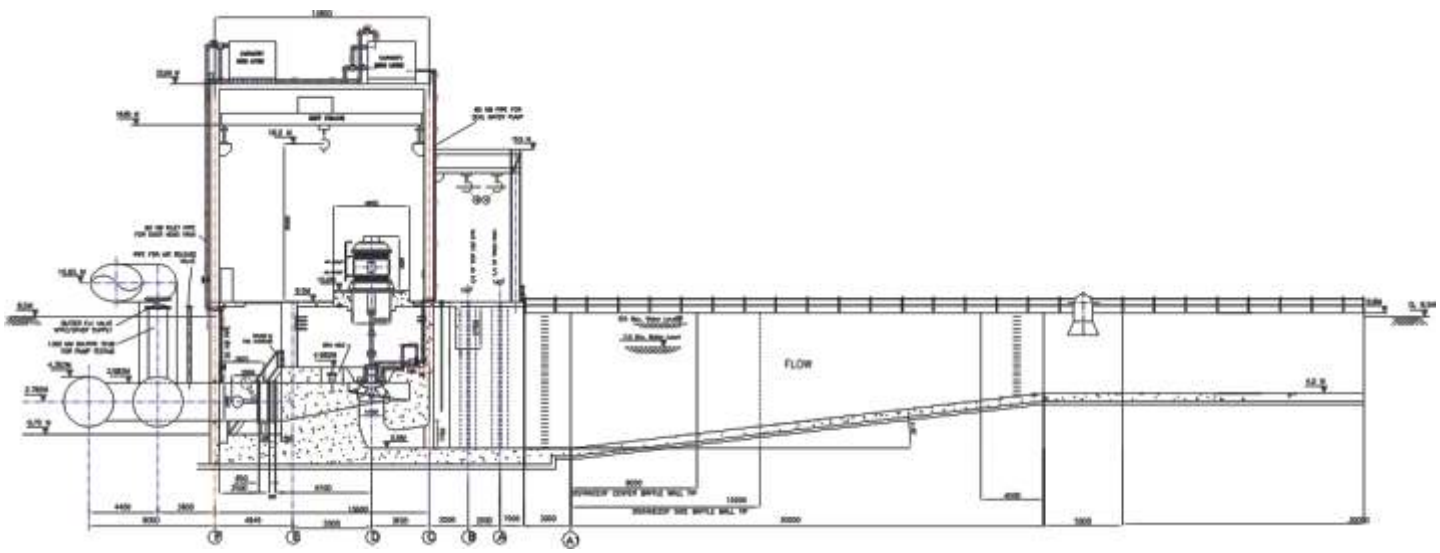
The use of energy efficient Siphon arrangement will provide the following benefits:

- Energy Saving in motor rating : 8.5 MW
- Energy Conservation : 34.96 M units per annum
- Saving in electricity : Rs.122.3 mn. per annum (US $ 2.72 mn.)

Concrete Volute Pump House for Circulating Water System :



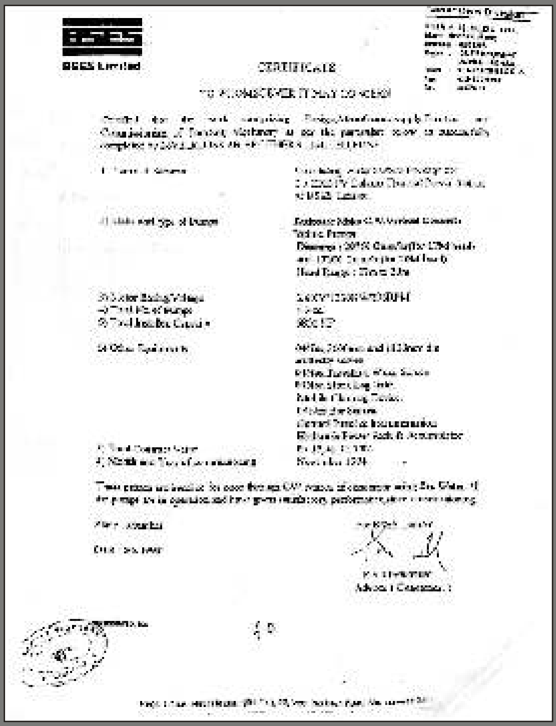
Plan



Elevation

Accolades

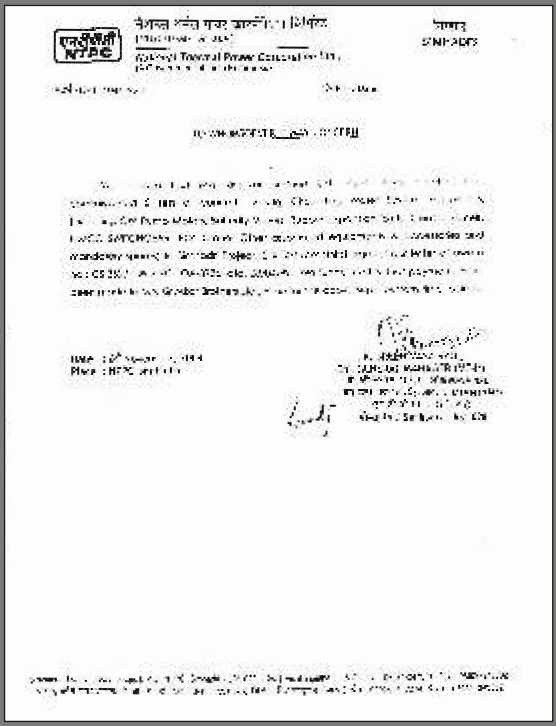
2 x 250 MW Dahanu Thermal Power Project of Reliance Energy(BSES, Limited)



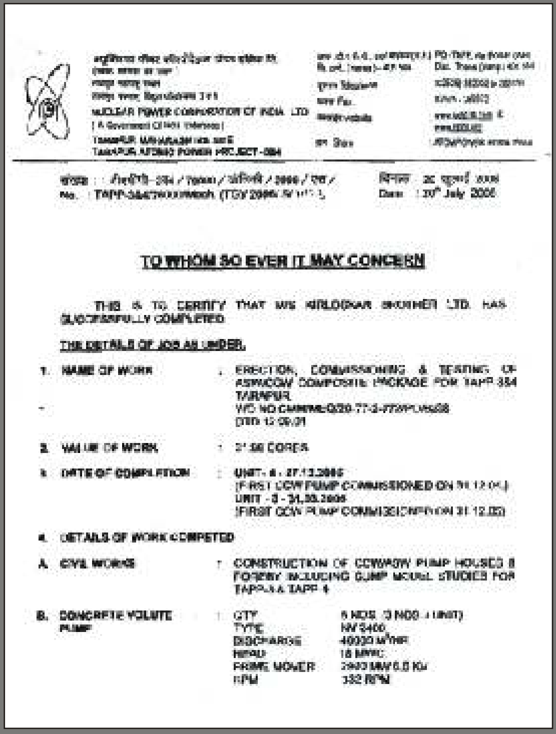
BSES Limited

CERTIFICATE

2 x 500 MW Simhadri Super Thermal Power Plant



2 x 500 MW Tarapore Atomic Power Project



NUCLEAR POWER CORPORATION OF INDIA LTD

TARAPUR ATOMIC POWER PROJECT-3&4

Date : 20th July 2006

TO WHOM SO EVER IT MAY CONCERN

THIS IS TO CERTIFY THAT M/S KIRLOSKAR BROTHERS LTD. HAS SUCCESSFULLY COMPLETED

THE DETAILS OF JOB AS UNDER.

1. NAME OF WORK : ERECTION, COMMISSIONING & TESTING OF ASW/CCW COMPOSITE PACKAGE FOR TAPP 3&4 TARAPUR

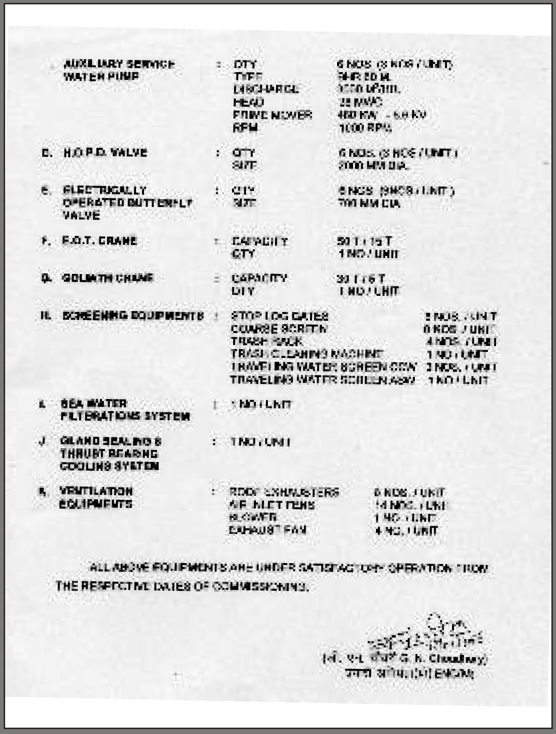
2. VALUE OF WORK : 21.98 CORES

3. DATE OF COMPLETION : UNIT - 4 - 27.12.2006 (FIRST CCW PUMP COMMISSIONED ON 31.12.04) UNIT - 3 - 31.03.2006 (FIRST CCW PUMP COMMISSIONED ON 31.12.05)

4. DETAILS OF WORK COMPLETED

A. CIVIL WORKS : CONSTRUCTION OF CCW/ASW PUMP HOUSES & FOREBAY INCLUDING SUMP MODEL STUDIES FOR TAPP-3 & TAPP 4

B. CONCRETE VOLUTE PUMP : QTY 6 NOS. (3 NOS / UNIT); TYPE NW 3400; DISCHARGE 40000 M³/HR; HEAD 18 MWC; PRIME MOVER 2900 KW 6.6 KV; RPM 332 RPM



AUXILIARY SERVICE WATER PUMP : QTY 6 NOS (3 NOS / UNIT); TYPE; DISCHARGE; HEAD 25 MWC; PRIME MOVER 400 KW - 6.6 KV; RPM 1000 RPM

D. H.O.P.D. VALVE : QTY 6 NOS. (3 NOS / UNIT); SIZE 2000 MM DIA.

E. ELECTRICALLY OPERATED BUTTERFLY VALVE : QTY 6 NOS (3NOS / UNIT); SIZE 700 MM DIA

F. E.O.T. CRANE : CAPACITY 50 T / 15 T; QTY 1 NO / UNIT

G. GOLIATH CRANE : CAPACITY 30 T / 6 T; QTY 1 NO / UNIT

H. SCREENING EQUIPMENTS : STOP LOG GATES 5 NOS. / UNIT; COARSE SCREEN 6 NOS. / UNIT; TRASH RACK 4 NOS. / UNIT; TRASH CLEANING MACHINE 1 NO / UNIT; TRAVELING WATER SCREEN CCW 3 NOS. / UNIT; TRAVELING WATER SCREEN ASW 1 NO / UNIT

I. SEA WATER FILTERATIONS SYSTEM : 1 NO / UNIT

J. GLAND SEALING & THRUST BEARING COOLING SYSTEM : 1 NO / UNIT

K. VENTILATION EQUIPMENTS : ROOF EXHAUSTERS 6 NOS. / UNIT; AIR INLET FENS 14 NOS. / UNIT; BLOWER 1 NO / UNIT; EXHAUST FAN 4 NO. / UNIT

ALL ABOVE EQUIPMENTS ARE UNDER SATISFACTORY OPERATION FROM THE RESPECTIVE DATES OF COMMISSIONING.

(G. N. Choudhary)

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