

A REPORT ON ONE DAY INDUSTRIAL VISIT

Place of visit: Bhatghar Hydro Power Station.

Date: 14th October 2022.

A batch of 5th semester students of Electrical engineering department of Kamalnayan Bajaj Institute of Engineering & Technology, Baramati visited Bhatghar Hydro Power Station along with 75 students and 4 faculty members.

This visit was mainly focussed on to understand the procedure involved during generating electrical energy using hydro electric power station. We began our journey at 6.00 A.M and we reached our destination at 9:30 A.M where we meet our guid. Students were split into three groups. Each group visited the site for approximatly 1.5 hours. The officer present there explained about various equipments and their specifications used in Hydro Power Station and actual process of generation of electricity in Power Station. She also explained about the importance of maintenance of equipments and how it is done.

The visit was truly professional and well managed till the end. The faculty members and students have thanked the staff of Bhatghar Hydro Power Station and VPKBIET College for granting permission for the visit.

A glimpse of the visit:



Outcome of the visit:

- The technology and the equipment used in Hydro Power Station was made familiar.
- The various processes involved in and generating electrical energy and its components was explained.
- Discussion on the difficulties faced and possible solutions to overcome these difficulties was held

The specification and the features of Hydro Power Station are joined as below.

Bhatghar HPS Particulars:

Salient Particulars of Generating Units Associated Equipments and Power House Auxiliaries

I. Power House Installation

1.	Name of Hydro Power House & State in which situated.	Bhatghar, Maharashtra
2.	Installed Capacity & Type of Turbine:	
	Total (MW)	16MW
	No of units x Rated capacity (MW)	1 x 16 MW
	Years of Commissioning of Unit	02.08.1977
	Turbine Type	Vertical, Kaplan
	Rated Net Head range	32Mtrs.
	Gross Head Range	18.35 to 45 Mtrs.
3.	Annual Energy Benefit for which designed-in a 90% year 36Mus -in a 50% year	20 MUs
4.	Type of Installation	Dam foot Power House to release water for drinking water & irrigation purposethrough Intake gate, Penstock, Turbine of Generator.
5.	Type of Storage	Reservoir
6.	Salient Constituents of Water Conductor system.	Steel conduit

7.	Location of Power House	
	River/State	Yelwandi / Maharashtra
	Nearest Rail Head/ Railway	Lonand/ Pune
	Zone Nearest Airport	Pune
	Climatic conditions at site	Max. Temp 41 ⁰ C Min. Temp 12 ⁰ C
8.	Silt content	Negligible

II. Main Generating Plant & Power House Auxiliaries

Hydro Turbine

a.	Type of Turbine		Vertical, Kaplan
b.	Manufacturer		BHEL, Hardwar
c.	Year of the manufacture	Year	1972
d.	Capacity at the design / rated Head	MW	16.6
e.	Max. Output at the max. Head	MW	17
f.	Max. Output at min. Head	MW	7
g.	Rated Speed	RPM	214.3
h.	Specific speed	RPM	421
i.	Runway speed	RPM	475
j.	Guaranteed efficiency at rated head	%	90.6% at 16.6 MW
k.	Momentary rise in speed on full throw-off		NOT EXCEEDING 50%
l.	Fly wheel effect of generating unit	TM ²	1000

m.	Direction of rotation when viewed from top		Anti-clockwise
o.	Turbine Centre line level		575.6
p.	Hydraulic Thrust	Tonne	310
q.	Runner material	Stainless steel	
r.	Nominal dia. Of runner (PCD)	mm	3000
s.	No. of blades	Nos.	8
t.	Balancing Method	statically balanced	
u.	Weight of turbine rotating parts	Tonne	23
v.	Weight of runner	Tonne	16
w.	Velocity of water at runner exit at rated head	M/Sec	12

Turbine Guide Bearing:

a.	Type	Water Lubricated
b.	Bearing material	Rubber
c.	No. of pads/ Sleeves	4 Parts
d.	Shaft Dia at brg. location	520.4 mm

Governor :

a.	Manufacture	Leningrad Metal Works. USSR	
b.	Model No.	PKM	100
c.	Type		Velocity Type.
d.	Pendulum speed	RPM	1500
e.	Effecting Pressure	Kg/Cm ²	25
f.	Main slide valve dia.	Mm	100 (Stroke +/- 20)
g.	Sensitivity	%	+ 0.05%
h.	Speed droop adjustment	%	0 to 8%
i.	Range of adjustment according to head (%)	%	+ 10 TO – 15%
j.	Range of adjustment for gate closing time.	sec	ABOVE 3 SEC
k.	Range of adjustment for gate opening time	sec	ABOVE 3 SEC
l.	Speed response drive		DC motor.
m.	Min. turbine speed for Governor pick-up.		75% of full speed.
n.	Max. oil pressure for all system operation.	kg/cm ²	28

Governor O.P.U. :

a.	O.P.U. Sump capacity/ Quantity of oil/ Brand of oil	Ltr	2000
b.	No. of Pumps	Nos.	2

c.	Type of pumps		Screw pump
d.	Make		Leningrad Metal Works
e.	Capacity	LPS	5.8
f.	Drive Specification		
	i) Make		One Siemens , One NGEF make
	ii) Nos.	Nos.	2
	iii) KW/ Vtg/ RPM		30/415/1440
g.	Quantity of oil in one filling of Gov. Sys	Ltrs	4200
h.	Pr. Accumulator		Provided

Main Inlet Valve:

a.	Make	BHEL Hardwar	
b.	Type/Axis of Rotation	BFV/Horizontal axis of rotation	
c.	Size	mm	3600
d.	Weight	Tonne	40
e.	Test pressure	kg/cm ²	6.75
f.	Opening time	Sec	90
g.	Closing time	Sec	90
h.	Operating Mechanism	Hydraulic	
i.	Oil used for Hydraulic Operation	ServoPrime 57(IOC)	
j.	MIV bypass valve (yes/No)	yes	
k.	Manual Operated MIV bypass valve	No	

l.	Hydraulic operated MIV bypass valve	yes	
m	Oil pressure	kg/cm ²	25
n.	Motor Specification Make/KW/V	Hydraulic power cylinder BHEL,	

O.P.U. for M.I.V.

a.	Oil Tank capacity	Ltr.	2000
b.	No. of Pump/ Capacity / Type	2 No., 40 HP, 3 Spindle screw pump	
c.	Working Pressure	Kg/cm ²	25
d.	Motor Specification Make/ Kw/ Voltage	Siemens/ 30 KW, 415 V	

Spiral Casing :

a.	Weight of Spiral casing	Tonnes	22
b.	Velocity of water for rated MW & design head	m/sec.	6.67

c.	Dia. Of circumference of outlet edge	mm	4000
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Guide Apparatus:

a.	No. of guide vanes	Nos	24
b.	Weight of each G.V.	Kg	345
c.	Height of G.V. feather	mm	1050
d.	Method of Lubrication	Grease lubrication through CGLS	
e.	P.C.D.	mm	3500
f.	Max. opening of G.V.	%	100

Guide Vane Servomotor:

a.	No. of S.M/ Make	2 Nos., BHEL Hardwar	
b.	Dia of Piston/ piston rod	350/ 80 mm	
c.	Stroke at rated O/P	350 mm	
d.	Max. Stroke available	mm	420
e.	Working Pr. Of oil for S.M.	Kg/cm ²	25
f.	Brand of Oil	Servo Prime 57 (IOC)	

D.T. Gates:

a.	Lifting arrangement of Draft Tube gates	Electric Hoist
b.	Rating & Make of Ele. Motor	6 HP/ Crompton Parkinson, England

Generator:

a.	Manufacturer	BHEL, Hardwar	
b.	Model No.	SV 517/100—28 T	
c.	Type of Generator	Suspended	
d.	Year of Manufacture	Year	1973
e.	Rated output	kVA	20000
f.	Rated Voltage /Current	kV/A	11/1050
g.	Rated power factor	pf	0.8(lag)
h.	Rated speed	RPM	214.3
i.	Runway speed	RPM	475
j.	Over speed	RPM	246.44
k.	Line charging capacity at rated voltage with min.15% rated excitation	kVA	16000
l.	Excitation voltage (DC)	Volts	155
m.	Excitation Current (DC)	AMP	850
n.	Resistance /phase at 75 c	ohm	0.0296
o.	Resistance of field winding	ohm	0.123
p.	Generator Reactance	Direct Axis (%)	Q. Axis (%)
q.	Synchronous	102.00	65.00
	Transient	26.50	65.00
	Sub- Transient	17.20	18.20
	Neg. Sequence	%	17.70
	Zero Sequence	%	6.80

Stator:

a.	Type of Winding	Wave/Double Layer
b.	No. of winding bars	648
c.	Class of Insulation	Class 'B'
d.	Type of stator bolts	High Tensile

Rotor:

a.	Diameter x Height	M	3.456 (incl.poles) x 1.6 m
b.	Type of rotor poles	Salient	
c.	No. of rotor poles	28	
d.	Class of Insulation	Class 'B'	
e.	Weight of rotor with poles	Tonne	96.1
f.	Weight of each pole	Tonne	0.89

Generator Air Coolers:

a.	No. of coolers	Nos.	8
b.	Inlet & Outlet temp. of cooling water	⁰ C	28/45
c.	Working pressure	Kg/cm ²	3
d.	Test pressure	Kg/cm ²	6
e.	Water flow rate	M ³ / hour	200
f.	Tube material	Admiralty Brass	

Excitation System:

a.	Type & Model No.	Rotary Excitation	
b.	Manufacturer	BHEL, Hyderabad	

Pilot Exciter:

a.	Model No & Type	BE72/10-10P/Self Excited	
b.	Rated Capacity	kW	8
c.	Rated Voltage	Volts	230

Main Exciter :

a.	Model No. & Type	BE99/40-8P/ Separately Excited	
b.	Rated Capacity	kW	136
c.	Rated Voltage	Volts	155
d.	Rated Voltage at forcing condition	382 KW 260 V for 5 Sec.	

Slipring & Commutator:

a.	Type & Make	Circular Ring / BHEL, Hyderabad	
b.	No. of Brushes	32	

Generator Bearings:

		LGB	UGB & Thrust
a.	Type	Segmental pad	Seg. pad, spring mattres
b.	No. of pads/sleeves	8	8 + 8
c.	Dia. X Height		

d.	Bearing surface area & its material	1330000mm ² /Babbit	1330000/ Babbit
e.	Oil sump capacity	350 Litres	5000 Ltr.
f.	Oil Brand	Servo Prime – 46	Servo Prime – 46
g.	Type & No. of coolers	W/C oil cooler, 6 Nos	W/C oil Cooler, 4 No
h.	Tube material	Brass	Brass
i.	Cooling water flow rate	7.5 M3/Hr.	7.5 M3/ Hr.

Jacking & Braking System:

a.	Jacking Pump Make	Russian
b.	Motor Rating	3 Ph., 440 V, 1460 RPM, 22 KW
c.	No. of Jack Pads	4 Nos.

AUXILIARY EQUIPMENT:-

E.O.T. Crane:

a	Make	Mukund Iron & Steel works, Mumbai				
b	Year of Mfg.	1972-73				
c	Type	EOT O/H, Indoor				
d	Hoists& Capacities	2 Nos,105/30 Ton				

e	Drive Motor Specification	Longitudenal Travel	CT	MH	AH	Micr o
f	Make	AEI	AEI	AEI	AEI	GEC
g	Nos.	01	01	01	01	01
h	KW / 440 Volts	15	7.5	30	35	3.7

Compressors:

a	Make	Ingersoll Rand
b	Type	Type 30
c	Receiver Capacity	1.6 m3
d	Normal Pressure	27 Kg/cm2
e	Drive motor specification	
f	Make	Crompton Greaves, Nasik
g	Nos.	2 Nos.
h	KW/ Voltage/ Speed/ Current	12.5 HP, 415 Volt, 1440, 19 Amp

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