DLHP **DODSON-LINDBLOM HYDRO POWER PVT. LTD.**

Note:

Sub: Bhandardara HEP (12 MW): Ref No 0430
Clarification on Maximum Plant Output

It has been clarified to DOE that the Maximum Plant Output of BHEP (12 MW) can be 14.84 MW, based on the limitations imposed by the Hill Diagram provided by the plant manufacturer. To support this we have already submitted manufacturer's documents, drawings, Hill Diagram along with tabulated data giving output at various discharge and head.

As regards our Letter No PP/MHB-152/3863 dated November 13, 2006, addressed to BVC, wherein we have stated that maximum power that can be generated is 14.59 MW. With this letter we also enclosed the documents which were same as presently provided to DOE. But the Hill-Chart table provided was a tabulation prepared by DLHPPL from the Hill Diagram. It may be noticed that in the table following is given:

HRL in Mtr	Net Head in Mtr	Discharge in M^3 / Sec	Average Gen Load at Generator
745.00	73.30	23.00	14.59

DLHPPL had made a mistake in reading the Hill Diagram while preparing the table. This is evident from the table authenticated by VATECH, since at same parameters the Generator Output is 14.84 MW.

New Table Figures are:

HRL in Mtr	Discharge in M^3 / Sec	Net Head in Mtr	Generator Output (MW)
745.00	23.00	73.30	14.84

The above figures are authenticated and the same should be considered.

For Dodson Lindblom Hydro Power Private Limited

Dodson Lindblom Hydro Power Pvt. Ltd. Mumbai

Prem Paunikar
Director (Projects)

Dodson-Lindblom Hydro Power Pvt. Ltd.

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Shri Sameer Pendse
Bureau Veritas Certification (I) Pvt. Ltd.
Pune Office

By : Fax / Courier
Ref: PP/MHB-152/3863
Date : November 13, 2006

Sub: BH-I Clarification

Dear Sir,

Vide our letter PP/MHB-152/3854 dated November 8, 2006, we have clarified to you that maximum power that can be generated at BH-I with maximum Head is 14.59 MW. This is also evident from the limitation imposed by the Hill chart. The maximum recorded generation also is 14.5056 MW.

As required by you, we enclose here the Design documents for Turbine and Generator supplied by the Manufacturer.

You may see that the owner's requirement stipulated is 12 MW + 17% overload, both for Turbine and Generator.

Design and Test data are:

1) Turbine
   3.2 OUTPUT
   a) Guaranteed (KW) : 12564 + 17%
   b) Max. expected Overload (KW) : 15500
   c) Optimum (KW) : 12200

2) Generator
   C 3.6 Electrical Output
   a) Guaranteed : 12.000 MW + 17%
   b) Max. expected overload : 15.111 MW

It may be seen that Rated as well as Guaranteed output for both Turbine and Generator is below 15 MW and even though Turbine is designed for overload of 15.5 MW and Generator for 15.111 MW, we can not operate at these loads due to limitation imposed by Hill chart. Overload Designs are adopted by manufacturer for various reasons, which includes design deficiency, manufacturing deficiency and also ageing effect.

We once again confirm that we will never go beyond limitations prescribed by Hill chart.

The Type Test documents which you have asked are not available with us.

Thanking You.

Sincerely,
For Dodson-Lindblom Hydro Power Pvt. Ltd.

Prem Paunikar
Director (Maharashtra Projects)

Cc: 1) Mr.Sandeep Lele, BVQI, Mumbai
2) Mr.Ilango Bharathi, Bunge, Mumbai.

(5)

DODSON - LINDBLOM HYDRO POWER PVT. LTD.

POWER HOUSE NO. - I, Bhandardara

HRL CHART

HRL in Mtrs	NET HEAD in Mtrs.	DISCHARGE in M³/sec	Average Generation Load at Generator point
745.00	73.30	23.00	14.59
744.50	72.80	23.10	14.54
744.00	72.30	23.20	14.50
743.50	71.75	23.30	14.40
743.00	71.25	23.40	14.35
[illegible] 50	70.75	23.50	14.30
742.00	70.25	23.55	14.30
741.50	69.75	23.60	14.21
741.00	69.25	23.65	14.11
740.50	68.70	23.70	14.02
740.00	68.20	23.75	13.97
739.50	67.70	23.80	13.87
739.00	67.20	23.85	13.82
738.50	66.65	23.90	13.68
738.00	66.15	23.95	13.63
737.50	65.65	24.00	13.58
737.00	65.15	24.05	13.44
736.50	64.65	24.05	13.34
736.00	64.15	24.05	13.25
735.50	63.65	24.10	13.10
73[illegible]00	63.15	24.10	13.01
734.50	62.65	24.10	12.91
734.00	62.15	24.05	12.77
733.50	61.65	23.90	12.62
733.00	61.15	23.80	12.48
732.50	60.65	23.70	12.34

HRL in Mtrs.	NET HEAD in Mtrs.	DISCHARGE in M³/sec	Average Generation Load at Generator point
732.00	60.15	23.65	12.19
731.50	59.65	23.50	12.05
731.00	59.20	23.40	11.90
730.50	58.70	23.30	11.76
730.00	58.25	23.20	11.62
729.50	57.75	23.10	11.47
729.00	57.25	23.05	11.33
728.50	56.75	22.90	11.18
728.00	56.30	22.80	11.04
727.50	55.80	22.70	10.90
727.00	55.30	22.65	10.75
726.50	54.80	22.50	10.61
726.00	54.30	22.40	10.46
725.50	53.85	22.30	10.32
725.00	53.35	22.20	10.22
724.50	52.85	22.10	10.08
724.00	52.40	22.00	9.94
723.50	51.90	21.90	9.79
723.00	51.40	21.80	9.65
722.50	50.90	21.70	9.46
722.00	50.40	21.60	9.31
721.50	49.95	21.50	9.17
721.00	49.45	21.40	9.02
720.50	48.95	21.30	8.93
720.00	48.45	21.20	8.83

EXHIBIT C-3
MANUFACTURER'S DATA SHEETS

C3.1 TURBINE

It is proposed that the existing embedded spiral casing cum speed ring and the draft tube be used as it is or with only minor adjustments. To achieve the Owner's requirement of a Facility with an output of 12 MW and to achieve the ability to operate at a 17% overload capacity for extended periods of time, the generating components will be designed and tested to a higher rating.

1.General

a)	Make	:	SULZER HYDRO
b)	Type	:	Vertical Francis
c)	Unit setting level (Guide vane center line to TWL)(M)	:	(-5.25)
2.	Rated net head (M)	:	69.00
3.	Operating Data for design and testing		
3.1	Discharge		
	a) Guaranteed (cum/sec)	:	23.67
	b) Optimum (Cum/sec)	:	approx. 21.5
3.2	Output		
	a) Guaranteed (kW)	:	12564 + 17%
	b) max. expected overload(kW)		15500
	c) Optimum (KW)	:	approx. 12200
3.3	Efficiency		
	a) Guaranteed (%)	:	92.1
	b) Optimum (%)	:	93.3
4.	Speed		
a)	Design (RPM)	:	428.6
b)	Maximum runaway speed (RPM)	:	880
5.			
6.	Maximum pressure rise (%)	:	35 of H_{max} stat.
7.	Runner		
a)	Material	:	Stainless steel

				(Cr:Ni - 13:4)
	*b)	Discharge diameter (mm)	:	1550
	*c)	No. or runner blades	:	15
8.	Shaft			
	a)	Material	:	Forged steel CK35N (DIN 17200)
9.	Guide Vanes (wicket gates) and Operating Mechanism			
	a)	Material of guide vanes	:	Stainless steel (Cr:Ni - 13:4)
	b)	Number of guide vanes	:	20 (Nos.)
10.	Stay Rings and Spiral Casing			
	a)	Material and dimensions	:	As is where is.
11.	Draft Tube Liner			
	a)	Material and dimensions	:	As is where is.
12.	Turbine Guide Bearing			
	a)	Type of bearing	:	Oil lubricated bearing
13.	Shaft Seal			
	a)	Type	:	Mechanical seal
	b)	Material	:	Special non-metallic material
	c)	Cooling/Flushing water requirements and source	:	Required from cooling water circuit
	d)	Micro strainer included	:	Yes
	e)	Maintenance seal	:	Yes
14.	Guide Vane Servomotors			
	a)	Location	:	Inside of turbine pit
	b)	Type	:	Double acting
	c)	Nominal oil pressure (kg/cm²):		Less than 160
15.	Guaranteed Particulars for Total Rotating Mass			
	a)	Pressure rise for full load throw off (above max static pressure)(%)	:	<35
	b)	speed rise (above rated speed) for full load throw off (%)	:	approx. 60

16. Elevations

a)	Bottom of draft tube exit (M)	:	
b)	Top of draft tube exit (M)	:	
c)	Deepest point of the draft tube (M)	:	Same as existing levels
d)	Turbine floor level (M)	:	
e)	Highest elevation of crane hook (M)	:	
f)	Unloading/maintenance bay floor level	:	

* Discharge channel might be modified to raise downstream water level

EXHIBIT C-3
MANUFACTURER'S DATA SHEETS

To achieve the Owner's requirement of a Facility with an output of 12 MW and to achieve the ability to operate at a 17% overload capacity for extended periods of time, the generating components will be designed and tested to a higher rating.

C3.4 not used
C3.5 not used

C3.6 GENERATOR

Electrical Output:			
a) Guaranteed		12.000	MW + 17%
b) max. expected overload		15.111	MW
Above sea level		1000	M
Rated voltage		11	kV
Range of voltage regulation		-10.0 / 10.0	%
Rated power factor		0.9	
Rated frequency		50	Hz
Rated speed		428.6	1/min
Runaway-speed		880	1/min
Moment of inertia (WR^2)		65	tm^2
Permissible unbalanced load (negative sequence current system) of rated current	max.	8	%
Insulation Class			
Stator winding		F	
Rotor winding		F	
Temperature Rise			
At rated voltage 11 kV, rated frequency and continuous rating of		15.925	MVA
with cooling air-inlet temperature of max. (Cooling water max. 30°C)		40	°C
Stator winding (ETD method)	max.	85	K
Rotor winding (resistance method)	max.	90	K
Temperature Rise (max. expected overload)			
At rated voltage 11 kV, rated frequency and continuous rating of		16.790	MVA
with cooling air-inlet temperature of max. (Cooling water max. 30°C)		40	°C
Stator winding (ETD method)	max.	105	K
Rotor winding (resistance method)	max.	110	K

Efficiencies

Referring to a winding temperature of 75 °C and a continuous rating of 15.925 MVA.

Included: - losses of excitation equipment
- generator portion of thrust bearing losses.

	Generator mode	
at power factor	0.9	1.0
and 100% load	97.62%	97.94%
75% load	97.38%	97.73%
50% load	96.69%	97.10%
25% load (approximately)	94.90%	94.91%

The efficiencies are guaranteed with (100-eta)/10 to 1. (except the values for 25% load).

Summation of Losses

at continuous rating of 15.925 MVA and p.f. : 0.9

	Gen.	Mode
Core loss + windage losses	157.3	kW
generator portion of bearings	33	kW
stator-I^2R losses + stray-load losses	109.8	kW
rotor-I^2R losses + excitation circuit losses	49.1	kW
total losses	349.2	kW

Copper losses are referred to a winding temperature of 75°C.
The losses will be guaranteed with 10% tol. (except the exciter losses).

Reactance

Direct-axis synchronous reactance	Xd		
unsaturated		195.4	%
Quadrature-axis synchronous reactance	Xq		
unsaturated		67.6	%
Transient reactance	Xd'		
unsaturated		24.8	%
saturated		22.8	%
Direct-axis subtransient reactance	Xd''		
unsaturated		20.46	%
saturated		17.8	%

Quadrature-axis subtransient reactance unsaturated	Xq"	19.12	%
Negative phase-sequence reactance	X2	19.8	%
Zero phase-sequence reactance	X0	9.4	%

Time Constants

direct-axis transient open circuit time constant	Tdo'	5.17	s
direct-axis transient short circuit time constant	Td'	1.071	s
armature winding short circuit time constant	Ta	0.119	s
direct-axis subtransient short circuit time constant	Td"	0.02	s

Further Electrical Data

Short circuit ratio referred to the no-load characteristic	0.9	-fold
3-phase sustained short circuit current with excitation for continuous rating of 15.925 MVA p.f. 0.9	1.73	-fold
Instantaneous short circuit current peak voltage at rated operation	14.3	-fold
Rise of voltage after removal of full load (without AVR) p.f. 0.9	33	%
The generator will be capable to supply at zero power factor over excited and 11kV continuously without exceeding the specified rotor temperature rise	11.15	MVAr
The generator will be capable to supply at zero power factor under excited and 11kV continuously with a residual positive excitation of appr. 10% of no-load excitation	13.3	MVAr
Telephone harmonic factor acc. IEC 34-1;	1.5	%

Excitation (see Exciter data sheet for details)

Static excitation without exciter connected to the alternator slip rings

Generator mode 15.925 MVA

exciter voltage	53	V
exciter current	1008	A
power factor = 1.0		
exciter current	839	A
no-load excitation:		
exciter current	567	A

Design Details

Number of external winding ends of stator	6	
stator winding connection	star - 7 - fold	
number of stator sections	2	
nominal stress in the rotor at run-away speed max. 67% of the yield strength of material		

Weights

Total net weight of the generator ready for service	87.5	t
weight of stator	32.0	t
weight of rotor	46.0 t	
heaviest part for erection (valid for the rotor incl. lifting device)	50.0	t
heaviest part for transport (valid for the stator)	46.0	t

Dimensions

Stator frame diameter	4800	mm
frame length	1600	mm
max. transport dimensions (LxWxH)	5000x3000x1800	mm