

No.: CPRI/ERED/133/12

Report

Submitted to

**Maharashtra State Electricity Regulatory
Commission,
Mumbai**

On

**Certification of “Technical Minimum Limit” of
Thermal Power Generating plants**

(Work order no. MERC/TECH/CPRI-1213/08/01020)

Submitted by



January 2013

ENERGY EFFICIENCY & RENEWABLE ENERGY DIVISION

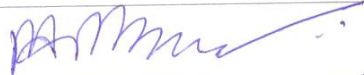
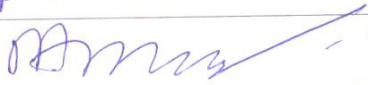
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Project Summary

01	Title:	Certification of “Technical Minimum Limit” of Thermal Power Generating plants.
02	Work Order No.	MERC/TECH/CPRI-1213/08/01020.
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07	Energy audit team : (At site)	M. Siddhartha Bhatt, Additional Director N. Rajkumar, Engineering Officer Team was also accompanied by Mr. Vasant Pande, Executive Engineer, MahaSLDC for all the tests.
08	Objectives:	To conduct a Certification of “Technical Minimum Limit” of Thermal Power Generating plants.
09	Scope of work:	<ul style="list-style-type: none"> i. To study the data on technical minimum parameters by MSLDC. ii. To conduct the experimental measurement of “Technical Minimum Limit” of Thermal Power Generating plants. iii. To measure the ramp up rate and ramp down rates of Thermal Power Generating plants during the study. iv. Reports preparation.
10	Report No.:	CPRI/ERED/133/12
11	Power station:	All power stations indicated by MERC
12	Date of conduct of study:	December 2012 to Jan 2013
13	Date of issue of report:	28 th January 2013
14	Signature of Energy Audit Team Leader:	
15	Signature of the Division Head:	

Executive Summary

This report pertains to experimental measurement of Technical minimum (TM) load limit of power generating units in Maharashtra.

TM refers to the minimum technical load at which the unit can operate safely without the support of secondary fuel (i.e., fuel oil). The TM can be measured at three points:

- Generator terminal
- Generator transformer secondary (exit point of the TPS or injection point into the grid). This is normally the power at generator terminal minus the unit auxiliary transformer (UAT) power.
- Generator terminal minus total auxiliary power (UAT + ST).

The TM at injection point will be in-between the two extreme limits [at Generator and at Generator minus UAT +ST]. ***The TM at injection point can be considered as the operational TM from considerations of system operation because this is what can set by the operator.*** The load on ST does not directly figure in TM during system operations but is reflected as a lowering of the total auxiliary power.

The detailed experimental studies were conducted on 35 units and 12 units were not available for testing either due to long term outage or inability to demonstrate the TM (fuel oil free loading) because of technical limitations in the units. These 12 units are not likely to be available in near future (next 1-2 months) also.

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Abbreviations/Nomenclature

ABT	Availability based tariff
AC	Alternating current
AP	Auxiliary power
C & I	Control and instrumentation
CHP	Coal handling plant
MERC	Maharashtra Energy regulatory commission
FO	Furnace oil
GCV	Gross calorific value (kcal/kg or MJ/kg)
GoI	Govt. of India
GT	Generating transformer
H	Time period block (hours)
HCV	Higher calorific or heating value (kcal/kg or MJ/kg)=GCV
KPI	Key performance indicators
LDO	Light diesel oil
Max.	Maximum
MCR	Maximum continuous rating of the unit
Min.	Minimum
PLF	Plant load factor (%)
R & M	Renovation and modernization
SFC	Specific coal consumption (kg/kWh = t/MWh)
SH	Superheater
SHR	Station heat rate ((kcal/kWh)
SOC	Secondary specific fuel oil consumption (ml/kWh)
SR	Steaming rate (t of steam /t of coal)
SSC	Specific steam consumption (kcal/kWh=t/MWh)
ST	Station transformer
T	Temperature (⁰ C)
TPS	Thermal power station
UAT	Unit auxiliary transformer
UHR	Unit heat rate (kcal/kWh)
Greek letters	
Δ	Difference
η	Efficiency (dimensionless or %)

1.0 INTRODUCTION

The objective of the study is the Certification of “Technical Minimum Limit” of Thermal Power Generating plants.

1.1 Scope of the heat rate study

The scope of the fuel audit study is as follows:

- i. To study the data on technical minimum parameters by MSLDC.
- ii. To conduct the experimental measurement of “Technical Minimum Limit” of Thermal Power Generating plants.
- iii. To measure the ramp up rate and ramp down rates of Thermal Power Generating plants during the study.
- iv. Reports preparation.

1.2 Methodology for the work

- i. Study of internal certification report submitted by MSLDC.
- ii. Queries/comments on the internal certification report to MSLDC.
- iii. Making a test schedule as per the work plan mentioned above and intimating the same to MSLDC for coordination of site work.
- iv. Conducting of field test to verify the technical minimum limit on each unit of the station.
- v. Certifying the technical minimum (as an absolute value presented in MW or % of MCR).
- vi. Submission of certification report to the commission after completion of the work and making a presentation.
- vii. If any issues are arising out of the field work, MSLDC shall co-ordinate with the generating companies to address the issues effectively

1.3 Experimental work and work plan

The field work of the tests on Technical minimum (TM) study and ramping rates was carried out as per scope during December 2012 and January 2013.

Work plan

Step-1: Scrutiny of internal certification report

The internal certification report submitted to CPRI is scrutinized and consolidated comments/queries is submitted to MSLDC with intimation to MERC.

Step-2: Field work and certification

The field work is proposed to be completed in two phases:

In phase-I, study was carried out in:

Field work: 15 days;

In phase-II, study was carried out in:

Field work: 15 days; Report preparation: 15 days

2.0 RESULTS OF STUDY

2.1 List of stations

The list of the power station for the Technical Minimum is given in Table 1 of Annexe-2.

Details of field testing for Technical Minimum Certification work are as follows:

Sl. No.	Date	Station	Installed Capacity in MW	No. of Units	No. of units tested	Balance units	Remark
1	04.12.2012	WPCL Warora	4 x 135	4	3	1	One unit shut down due to less schedule
2	05.12.2012	AMNEPL Nagpur	4 x 61.5	4	1	3	Three units shut down due to less schedule
3	06 & 07.12.2012	Khaparkheda TPS	4 x 210 1 x 500	5	5	0	All units tested
4	07.12.2012	Koradi, TPS	1 x 200 2 x 210	3	0	3	Unit 5 COH, Unit 6 & 7 could not demonstrate Technical Minimum
5	08 & 09.12.2012	Chandrapur, TPS	4 x 210 3 x 500	7	7	0	All units tested
6	10.12.2012	GEPL, Usegaon.	2 x 60	2	2	0	All units tested
7	11.12.2012	Paras TPS	2 x 250	2	2	0	All units tested

8	12.12.2012	Bhusawal TPS	2 x 210 1 x 500	3	1	2	Unit 2 AOH Unit 4 BTL
9	13.12.2012	Nasik TPS	3 x 210	3	2	1	Unit 4 BTL
10	10.01.2013	Parli TPS	3 x 210 2 x 250	5	3	2	Unit 4 & Unit 7 out due to water shortage
11	11.01.2013	DTPS Dahanu	2 x 250	2	2	0	All units tested
12	14.01.2013	JSWEL, Ratnagiri	4 x 300	4	4	0	All units tested
13	16.01.2013	TPCL, Trombay	2 x 500 1 x 250	3	3	0	All units tested
				47	35	12	

APML Tiroda unit was out in the month of Dec. 2012.

No. of Units	No. of units tested	Balance units	Remark
47	35	12	During the test period the units were shut down due to various reasons such as COH, water shortage, etc. , for long periods and are not likely to come in the near future.

In the case of Koradi TPS CPRI visited the test site but the tests could not be demonstrated on the running units by Mahagenco as the oil support could not be withdrawn due to technical reasons.

2.2 Present practice in change over from primary fuel firing (coal) to secondary fuel (fuel oil) on load reduction in Indian coal fired TPS

Most Indian boilers operate on tangential firing system (except Chandrapur Units 1 & 2 which are front wall fired) with Raymond bowl mills or drum type tube mills. The same mill feeds to the four corners of an elevation. The oil elevations are located in-between coal elevations. There will be one stand-by elevation. Flame scanners sense both coal flames and oil flames. When coal flame is not sensed the flickering of coal scanners enables operators to take up fuel oil support in the elevation under distress. When fuel oil is fired into the furnace the oil sensors will indicate the oil flame and when the oil burner is shut off it will show no oil flame. If sensors in all elevations indicate no flame, then the boiler trips on flame failure.

2.2.1. Technical Minimum definition

It is the minimum load at which the unit can be operated on primary fuel alone without the assistance of secondary fuel (i.e., fuel oil in the case of coal fired units).

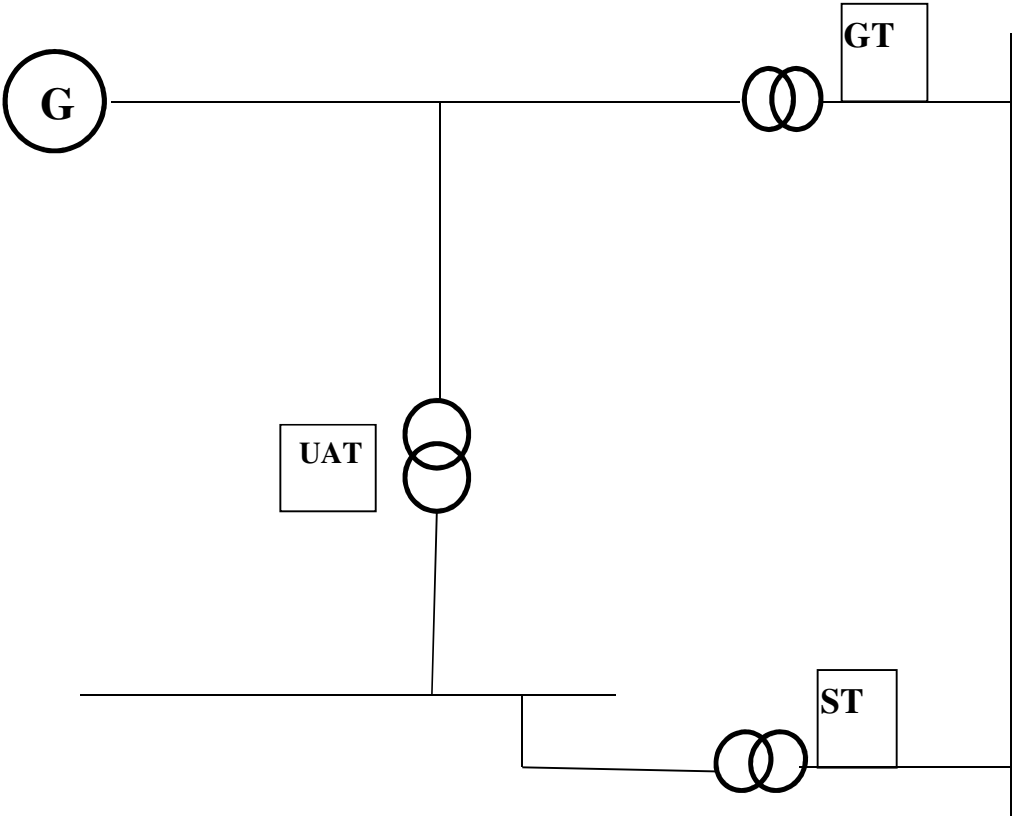
There are three values to be considered:

- i. TM at generator terminal (this would exclude Auxiliary power at UAT & ST)
- ii. TM at generator transformer (GT) outlet (this would include UAT power but would exclude ST power as ST power is drawn from a separate grid line)
- iii. TM considering UAT & ST power is the net technical minimum.

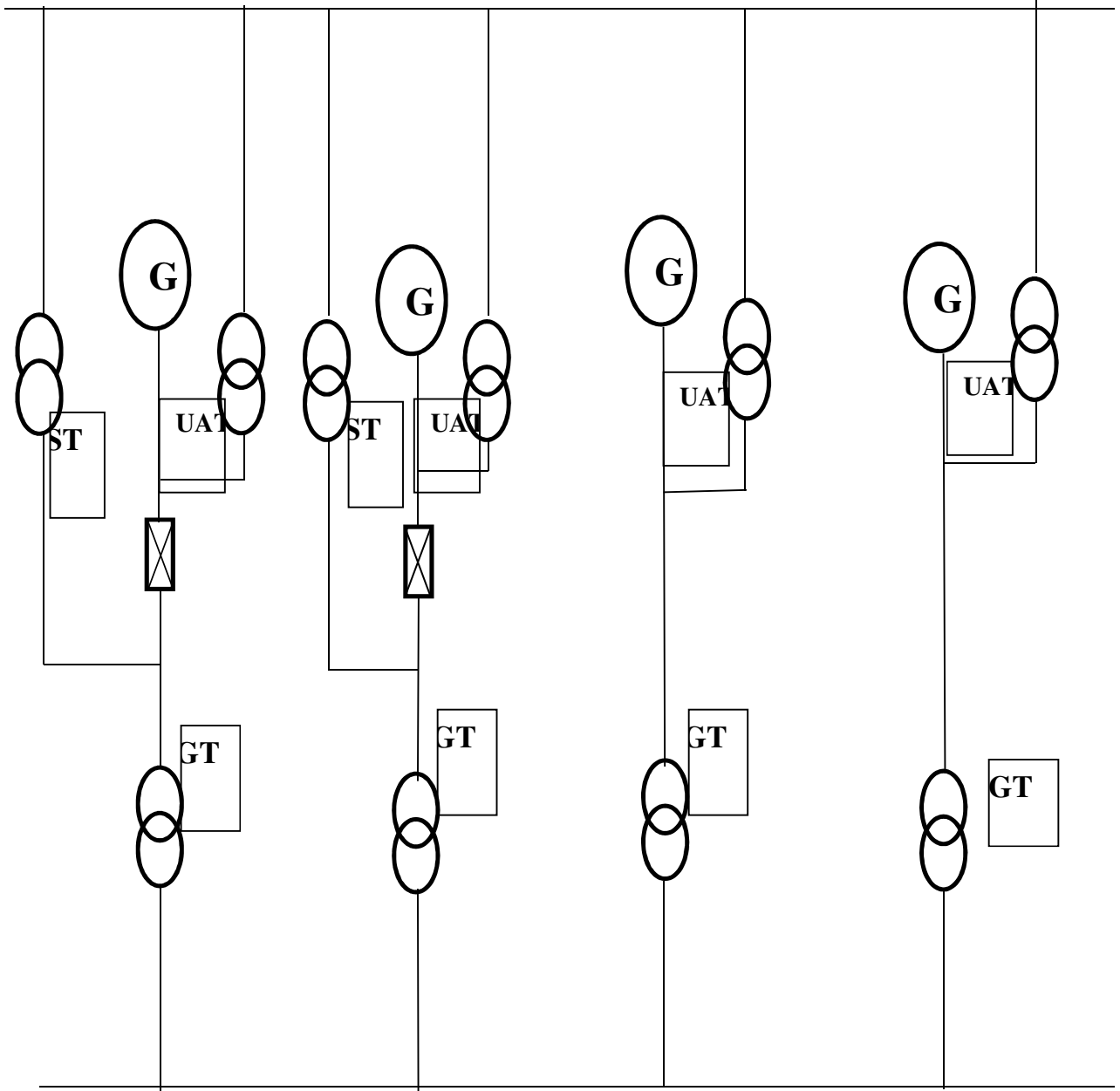
From practical considerations, the TM at GT terminal (which is the injection point) is considered as the TM.

In the case of JSW, both UAT & ST are located before the GT inlet. In the event of unit tripping the GT acts as a ST and draws power from the grid. There is a disconnection in-between ST & UAT.

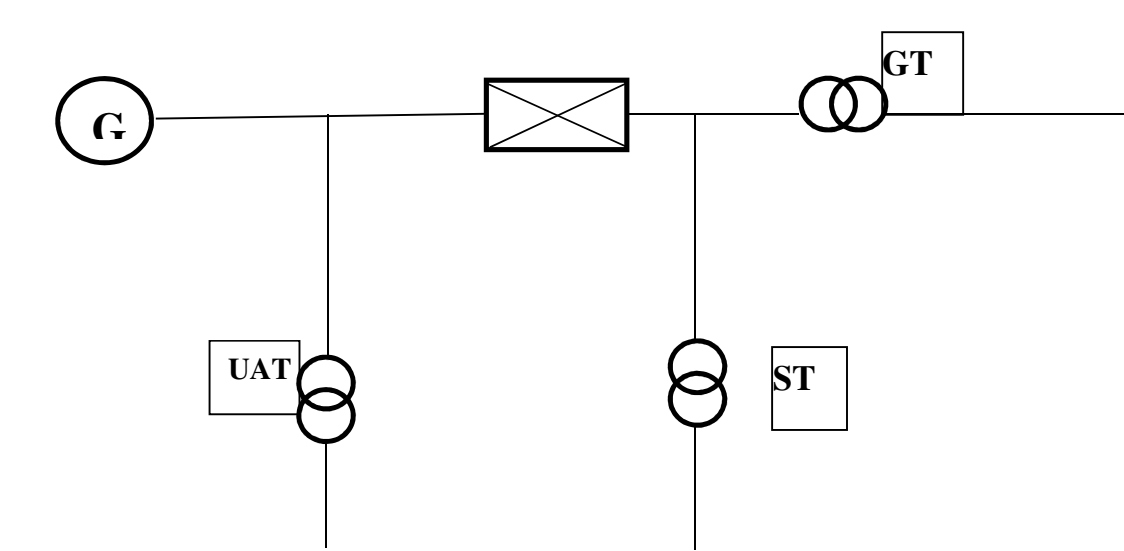
Technical minimum at the Generator Transformer secondary is considered as the TM (injection point).



Standard scheme of UAT and ST for most of the stations tested for TM



Single line diagram for JSW, Ratnagiri Plant



Typical single line diagram for JSW unit.

2.2.2 Ramp rate definition

Ramp rate is the permissible rate at which is increased or decreased as per manufacturer’s recommended settings based on permissible stress values. In co-ordinated master controlled systems (with ***Stress Master or Stress evaluator***) it is of the order of 20-25 MW/min. whereas in manually loaded systems it is of the order of 1-5 MW/min.

2.2.3 Coal and fuel oil mill elevations

In most 210 MW units with Raymond bowl mills there are 6 elevations of which 5 elevations will be in operation and one is standby. In recently installed units the mill capacities are upgraded to handle higher quantities of high ash coals. But in earlier designs, the mills operate without margin in motor current at almost 90-95 % MCR. The commonly used configurations are as follows:

Sl. No.	Particular	210 MW	250 MW	250 MW	500 MW	500 MW
01	Type of mill Raymond bowl mill-R Ball and tube mill-T	R	R	T	R	T
02	No of coal mills installed	6	6	3	8	5
03	No of coal mills in operation	5	4	3	7	4
04	No of coal elevations	6	6	6	8	10
05	No of coal elevations in operation	5	5	6	7	8
06	No of fuel oil stabilization burners (light oil burners)	12	12	12	16	20

07	No of fuel oil load burners (load burners)	12	12	12	32	40
08	Load range (% of MCR) at which MS & RH spray are required	60-70	60-70	60-70	60-70	60-70
09	Minimum primary air flow in each mill (% of MCR flow)	60	60	60	60	60
10	Load reduction per burner (% of MCR)	20	20	25	12.5	20

There are a few exceptions such as Chandrapur Units 1 & 2 which are front wall fired, Tata Unit No. 6 with 6 bowl mills, etc.

Also the bowl mills are of different capacities such as XRP 763, 863, 1043, 1063, etc. Coal GCV causes a 5 to 10 % drop in unit output because of mill and fan currents reaching their 100 % capacity at 90-95 % MCR itself.

A 20 % drop in load (due to one mill being withdrawn) at 95 % MCR results in a loading of nearly 75 % MCR.

2.2.4 Flame scanners

The scanning equipment Safe Flame Scan II of BHEL) is designed to detect flames from oil and coal sources using one scanner head. It will distinguish between an oil flame and a background coal fireball flame by sensing the characteristics (frequencies and intensity levels) of the emitted visible light.

There are four scanners located in guide pipes at each corner of the furnace. The scanner assembly comprised of a scanner head assembly which contains a lens for capturing the flame, and a fibre optic cable. The fibre optic cable transfers the visible light, emitted by the flame and captured by the lens to the electronic components without distorting the flame signal.

The flame signal impinges on the photodiode which converts the visible light (flame) into an electric signal which is conditioned by the amplifiers in the and transferred to a remote system.

In the scanner circuitry, the flame signal is processed to create two limits. One limit establishes a "intense" flame signal and other limit a "no flame" (no visible light signal ("dark furnace" condition).

Each current flame signal is converted into voltage flame signal which is then separated into its intensity and frequency components. The intensity (dc) component of the signal varies between a "no flame" value (dark furnace) and a "normal flame" value based on the actual flame intensity. The frequency (ac) component of the signal is used to prove that an active flame exists.

In any one given elevation, if three of the four coal flame scanners show intensity below the 20 % limit, then it is treated as flame failure. If three of the flame scanners show intensity above 60 %, then flame is proved in the elevation. In-between, the flame can be considered unstable.

If all the elevations of the furnace show 'flame failure', the boiler trips on flame failure.

The frequency of coal flame is in the range of 3-5 Hz while the frequency of oil flame is in the range of 25-30 Hz. In most of the stations only the flame intensity settings are activated and flame frequency settings are not used. The settings are set at 20 % -60 % [60 % intensity full flame and 20 % intensity no flame]. The logic of 3 out of 4 are used to detect flame failure, i.e., if 3 out of 4 coal corners detects no flame, then flame is not proved or flame failure is proved. For furnace flame failure all elevations have to show now flame, i.e., only if all elevations in the furnace detect flame failure or flame not proved then the boiler trips on flame failure.

2.2.5 Lowering of load on unit -coal loading, heat input to boiler and ignition energy

The method of lowering of load is to reduce the fuel fired into the boiler which reduces the steaming rate of the boiler and hence the steam into the turbine. The following points need to be noted as per OEM manuals and actual operational observations:

- i. Since most units operate on sliding pressure operation, the steam pressure drops with load.
- ii. However, the main and RH steam temperature must be constant at loads above 60 % MCR. Below 60 % MCR, the steam temperature will fall down from the set point temperature. However, in actual practice, due to lower GCV of coal the steam temperatures start falling down at around 70 % MCR itself.
- iii. Excess air is maintained at 25 % at above 80 % load. When the load falls in the range of 60-70 %, the excess air is 30-40 %.
- iv. MS & RH spray requirements are very high (6-7 % of 100 % MCR flow) at loads in the range of 60-70 %.

The method of reducing the load on the unit is to lower the feeding of coal into the mill. This can be achieved either by simultaneous reducing the feed into all the mills or through turning down one mill only.

2.2.5.1 Simultaneous turn down of coal feed to all mills

Ideally, the simultaneous turn down of coal to all the mills can lower the load. But this practice is not followed in any station studied herein because there will be

disturbance to the flame in all elevations and the risks and probability of the unit tripping on flame failure is quite high. If the scanner intensity goes below 20 % threshold limit flame failure will be indicated. Simultaneous operation of coal elevations also results in hunting of furnace draft which can affect furnace operational hydrodynamic stability. Therefore the practice of turning down feeding to all mills equally is not followed in any station.

2.2.5.2 Lowering of coal feed to only one mill

The practice being followed in all stations is to turn down the feeding in one mill. The mill feeding is reduced to an minimum level at which either:

- The flame failure in that elevation results in the tripping of the mill feeder; or
- The mill is purged and kept in hot standby with only primary air flow.

In 5 mill systems this will result in only 4 mills being in operation. Assuming that the load is around 95 % MCR (due to coal quality as against 100 % MCR), these results in loss of around 40 MW or 20 % of the load. This results in a load of around 75 %. At this stage flickering of coal flame scanners in the withdrawn mill as well as adjacent elevations is observed. Below this load, for further load reduction, the fourth mill will have to be turned down which enhances the risk of total flame failure in the furnace.

Raymond bowl mills with indigenous coal

Here all the elevations will have the same coal. Hence when one mill is withdrawn, there is a load drop of around 18-20 %. Since, indigenous coal results in load limitations due to low GCV of coal, to the extent of 5-8 %, there actual load with one mill turned down is 73-75 % of the MCR.

Raymond bowl mill with imported coal/ coal blends

When imported coal is used, the tier blending is used wherein the imported coal is fed from the bottom most elevation or second bottom most elevation. This elevation is not disturbed. Normally the imported coal elevation carries around 30 % load while the other elevations carry around 17-18 % load instead of 20 %. When imported coal is used, almost full load is reached. For load reduction one indigenous coal elevation is turned down for which the load is reduced to around 78 %. With the support of a strong imported coal elevation, there is a possibility of partially turning down an additional elevation to the extent of 3-4 % load. Further load reduction results in coal flame flickering in the other elevations.

Ball and tube mills with indigenous coal

In a 500 MW unit with 4 mills in service or 8 elevations (2 ends of a mill give two different elevations). Each mill accounts for 25 % load and one elevation accounts

for 12.5 % load. Normally if one end is withdrawn and only one end is used, there is a risk of mill fire in the withdrawn end.

Ball and tube mills with total imported coal

In a 250 MW unit with 3 mills in service or 6 elevations (2 ends of a mill give two different elevations). Each mill accounts for 84 MW or 33.34 % load and one elevation accounts for 41-42 MW or 16.67 % load. The unit is not sustainable on 2 mills.

2.3 Methodology of demonstration of TM

The load is kept steady at the original operating level. The unit is ensured to be steady in operation, i.e., without soot blowing cycles, steady deaerator level, condenser hot well level, etc. The load is lowered at a rate of 1-2 MW/min. by the existing mode of control in that unit. When the load goes below a certain value flame flickering is observed through the coal scanners in one elevation where the decrease in the coal feeding rate is initiated. Flame flickering is also observed in neighboring elevations because of lack of ignition support from this elevation. Since many units are on sliding pressure operation the operating pressure drops. Main steam and reheat steam conditions are supposed to be steady down to below the TM but when the main steam temperature drops oil support will have to be taken. Also it is experimentally observed that in many cases the feeder tripped on flame not being proved in that particular elevation. In other cases coal feeder was kept as a hot standby through purging but without significant addition to ignition energy. It is noted for this is sustainable. If not oil support is taken. When oil support is taken the load increases a bit due to addition of ignition energy from oil. The oil support is gradually withdrawn at which the load again drops. The minimum sustainable load is taken as the technical minimum.

The unit is maintained at TM for two to three time slots (15 min. /slot) and the load is gradually increase by cutting in of the originally withdrawn mill and the load is restored back to its operating load.

2.4 Technical Minimum results of the study

The results are given in the following pages.

CPRI Report – Technical Minimum

Technical Minimum Generation of all Units

Station	Unit No.	Design rating (MCR) (MW)	De rated / Present rating (MCR) (MW)	Ramp up rate (MW/min.)	Ramp up rate (%/min.)	Ramp down rate (MW/min.)	Ramp down rate (%/min.)	Technical minimum load at generator terminal (MW)	Auxiliary power (per unit) (UAT + ST) (%)	Auxiliary power (per unit)(UAT + ST) (MW)	Auxiliary power (per unit) (UAT Only) (%)	Auxiliary power (per unit)(UAT Only) (MW)	Technical minimum load at ex-bus (UAT + ST) (MW)	Technical minimum load at ex-bus (UAT Only) (Injection point) (MW)	Technical minimum at generator terminal (% of MCR)	Technical minimum at ex-bus (UAT + ST) (% of MCR)	Technical minimum at ex-bus (UAT Only) (Injection point) (% of MCR)
Mahagenco																	
Bhusawal	2	210	210														
	3	210	210	3	1.43	3	1.43	160	10.07	16.11	7.91	12.66	143.89	147.34	76.19	68.52	70.16
	Total																
Chandrapur	1	210	210	4.17	1.99	4.17	1.99	145	8.91	12.92	6.80	9.86	132.08	135.14	69.05	62.90	64.35
	2	210	210	4.17	1.99	4.17	1.99	150	8.91	13.37	6.80	10.20	136.64	139.80	71.43	65.06	66.57
	3	210	210	4.17	1.99	4.17	1.99	163	8.91	14.52	6.80	11.08	148.48	151.92	77.62	70.70	72.34
	4	210	210	4.17	1.99	4.17	1.99	160	8.91	14.26	6.80	10.88	145.74	149.12	76.19	69.40	71.01
	5	500	500	3	0.60	3	0.60	365	8.91	32.52	6.50	23.73	332.48	341.28	73.00	66.50	68.26
	6	500	500	3	0.60	3	0.60	360	8.91	32.08	6.50	23.40	327.92	336.60	72.00	65.58	67.32
	7	500	500	3	0.60	3	0.60	360	8.91	32.08	6.50	23.40	327.92	336.60	72.00	65.58	67.32
	Total	2340	2340					1703	8.91	151.74	6.61	112.55	1551.26	1590.45	72.78	66.29	67.97

CPRI Report – Technical Minimum

Khaperkheda	1	210	210	20	9.52	20	9.52	161.89	9.92	16.06	6.77	10.96	145.83	150.93	77.09	69.44	71.87
	2	210	210	20	9.52	20	9.52	159.33	10.02	15.96	6.88	10.96	143.37	148.37	75.87	68.27	70.65
	3	210	210	20	9.52	20	9.52	158	10.83	17.11	8.53	13.48	140.89	144.52	75.24	67.09	68.82
	4	210	210	20	9.52	20	9.52	161	11.52	18.55	9.23	14.86	142.45	146.14	76.67	67.83	69.59
	5	500	500	25	5.00	25	5.00	360	6.91	24.88	5.52	19.87	335.12	340.13	72.00	67.02	68.03
	Total	1340	1340					1000.22	9.25	92.56	7.01	70.13	907.66	930.09	74.64	67.74	69.41
Koradi	5	200	200														
	6	210	210														
	7	210	210														
	Total																
Nashik	3	210	210	4	1.90	4	1.90	161	11.8	19.00	8.80	14.17	142.00	146.83	76.67	67.62	69.92
	5	210	210	4	1.90	4	1.90	160	11.8	18.88	8.80	14.08	141.12	145.92	76.19	67.20	69.49
	Total	420	420					321	11.80	37.88	8.80	28.25	283.12	292.75	76.43	67.41	69.70
Paras	3	250	250	5	2.00	5	2.00	186	11.87	22.08	10.22	19.01	163.92	166.99	74.40	65.57	66.80
	4	250	250	5	2.00	5	2.00	190	11.42	21.70	9.89	18.79	168.30	171.21	76.00	67.32	68.48
	Total	500	500					376	11.64	43.78	10.05	37.80	332.22	338.20	75.20	66.44	67.64
Parli	3	210	210	5	2.38	3	1.43	157	11.97	18.79	8.45	13.27	138.21	143.73	74.76	65.81	68.44
	5	210	210	5	2.38	3	1.43	157	11.79	18.51	8.28	13.00	138.49	144.00	74.76	65.95	68.57
	6	250	250	5	2.00	5	2.00	187	11.4	21.32	9.82	18.36	165.68	168.64	74.80	66.27	67.45
	Total	670	670					501	11.70	58.62	8.91	44.63	442.38	456.37	74.78	66.03	68.12
TATA																	
	5	500	500	3	0.60	3	0.60	314.00	7.1	22.29	6.50	20.41	291.71	293.59	62.80	58.34	58.72
	6	500	500	2	0.40	2	0.40	157.7	6.7	10.40	6.20	9.70	145.30	146.00	31.10	29.10	29.20
	8	250	250	3	1.20	3	1.20	189	8.8	17.00	7.30	13.80	172.00	174.80	75.40	68.80	69.92
	Total	1250	1250					660.70	7.52	49.69	6.65	43.91	609.01	614.39	52.86	48.72	49.15

CPRI Report – Technical Minimum

Reliance																	
	1	250	250	20	8.00	20	8.00	189	10.59	20.02	7.39	13.97	168.98	175.03	75.60	67.59	70.01
	2	250	250	20	8.00	20	8.00	188	10.91	20.51	6.81	12.80	167.49	175.20	75.20	67.00	70.08
	Total	500	500					377	10.75	40.53	7.10	26.77	336.47	350.23	75.40	67.29	70.05
ABIJIT																	
	1	61.5	61.5	1.5	2.44	1.5	2.44	40.8	12.74	5.20	5.81	2.37	35.60	38.43	66.34	57.89	62.49
GUPTA																	
	1	60	60	3	5.00	3	5.00	20.9	24.40	5.10	9.09	1.90	15.80	19.00	34.83	26.33	31.67
	2	60	60	3	5.00	3	5.00	20.5	24.15	4.95	9.27	1.90	15.55	18.60	34.17	25.92	31.00
	Total	120	120					41.40	24.28	10.05	9.18	3.80	31.35	37.60	34.50	26.13	31.33
JSW																	
	1	300	300	5	1.67	5	1.67	225.32	11.29	25.44			199.88		75.11	66.63	
	2	300	300	5	1.67	5	1.67	224.37	12.21	27.40			196.97		74.79	65.66	
	3	300	300	5	1.67	5	1.67	224.6	7.039	15.81			208.79		74.87	69.60	
	4	300	300	5	1.67	5	1.67	225.05	7.63	17.17			207.88		75.02	69.29	
	Total	1200	1200					899.34	9.54	85.82			813.52		74.95	67.79	
KSK																	
	1	135	135	4	2.96	4	2.96	94.7	10.00	13.5	8.00	10.8	81.20	83.90	70.15	60.15	62.15
	2	135	135	4	2.96	4	2.96	94.8	10.00	13.5	8.00	10.8	81.30	84.00	70.22	60.22	62.22
	4	135	135	4	2.96	4	2.96	93.6	10.00	13.5	8.00	10.8	80.10	82.80	69.33	59.33	61.33
	Total	405	405					283.10	14.31	40.50	11.44	32.40	242.60	250.70	69.90	59.90	61.90

2.5 Recommendations for coal fired stations

- i. Recommended Device Accuracy for power measurement:
 - Digital frequency transducer ≤ 0.001 Hz
 - MW, MVAR, and voltage transducer ≤ 0.25 % of full scale
 - Remote terminal unit ≤ 0.25 % of full scale
 - Potential transformer ≤ 0.30 % of full scale
 - Current transformer ≤ 0.50 % of full scale

- ii. It is hoped that most units have designed governors for: Dead band of ± 0.036 Hz on generators. Governor droop of 5 % for coal fired thermal sets. For gas turbines it is 2 % and 3 % for hydro sets.

- iii. Flame scanners may be upgraded to include elevation wise visualization of the flame condition.

- iv. Generator capability curve to be provided to MahaSLDC.

- v. Only real time clocks to be coupled to MW meters and other equipment in control room. Stand-alone (non real time synchronized) office clocks to be avoided in control rooms.

- vi. All MW readings indicated in control room must be real time and must tally. Discrepancy in two MW meters in the same control room may be rectified in cases where discrepancies are noticed.

- vi. Operator training in operation without oil support in the vicinity of TM for stable operation to instill confidence higher level.

3.0 CONCLUSIONS

The main conclusions of the study are:

The Technical Minimum has been determined by experimental tests where the load was brought down to the lowest sustainable level without fuel oil support and maintained for a time slot.

Annex– 1

(Figures, Graphs & Photographs)

MAHAGENCO

BTPS

MAHAGENCO CSTPS

MAHAGENCO KHTPS

MAHAGENCO

KTPS

MAHAGENCO

NTPS

MAHAGENCO
PARAS TPS

MAHAGENCO

PARLI TPS

TATA POWER

RELIANCE POWER

ABIJIT POWER

GUPTA POWER

JSW RATHNAGIRI

KSK WARDA

INCLUDED IN THE SNAPSHOTS

Annex – 2

(Tables and Charts)

ALL TPS

Table 1: List of TPS covered in this study.

Station	Unit No.	Design rating (MCR) (MW)	Derated /Present rating (MCR) (MW)
MAHAGENCO			
Bhusawal	2	210	210
	3	210	210
	Total	420	420
Chandrapur	1	210	210
	2	210	210
	3	210	210
	4	210	210
	5	500	500
	6	500	500
	7	500	500
	Total	2340	2340
Khaperkheda	1	210	210
	2	210	210
	3	210	210
	4	210	210
	5	500	500
	Total	1340	1340
Koradi	5	200	200
	6	210	210
	7	210	210
	Total	620	620
Nashik	3	200	200
	5	210	210
	Total	410	410
Paras	3	250	250
	4	250	250

	Total	500	500
Parli	3	210	210
	4	210	210
	5	210	210
	6	250	250
	7	250	250
	Total	1130	1130
TATA Power			
	5	500	500
	6	500	500
	8	250	250
	Total	750	750
Reliance Power			
	1	250	250
	2	250	250
	Total	500	500
ABIJIT Power			
	1	61.5	61.5
GUPTA Power			
	1	60	60
	2	60	60
	Total	120	120
JSW Rathnagiri			
	2		
KSK Warda			
	1	135	135
	2	135	135
	4	135	135
	Total	405	405

MAHAGENCO

BTPS

MAHAGENCO CSTPS

MAHAGENCO KHTPS

MAHAGENCO

KTPS

MAHAGENCO

NTPS

MAHAGENCO PARAS TPS

MAHAGENCO

PARLI TPS

TATA POWER

RELIANCE POWER

ABIJIT POWER

GUPTA POWER

JSW RATHNAGIRI

KSK WARDA

Annex– 3

(Certificates)

MAHAGENCO

BTPS

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BHUSAWAL THERMAL POWER STATION

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 FAX 02582-250143, 250308
 EMAIL 'deepnet_jal@sancharnet.in



An ISO 9001:2000 QMS/
 ISO 14001 : 2004 EMS/
 OHSAS 18001 : 1999

Office of the
 Chief Engineer (O&M)
 BTPS, Deepnagar 425307
 Deepnagar, Tal. - Bhusawal
 Dist – Jalgaon (M.S.) 425307

Demonstration of Technical Minimum operational load
 without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	3
2	MCR capacity	MW	210
3	Date of commercial operation	-	4-May-82
4	Date of test	-	12-Dec-12
5	Time of test	-	14.30 to 15:30 Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	3
8	Ramp up rate	%/min.	1.429
9	Ramp down rate	MW/min.	3
10	Ramp down rate	%/min.	1.429
11	Technical minimum load at generator terminal	MW	160
12	Auxiliary power (per unit) (UAT + ST)	%	10.07
13	Auxiliary power (per unit) (UAT + ST)	MW	16.11
14	Auxiliary power (per unit) (UAT Only)	%	7.91
15	Auxiliary power (per unit) (UAT Only)	MW	12.66
16	Technical minimum load at ex-bus (UAT + ST)	MW	143.89
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	147.34
18	Technical minimum at generator terminal	% of MCR	76.19
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	68.52
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	70.16

For CPRI	For SLDC	For MSPGCL BTPS, Bhusawal
M.Siddhartha Bhatt, Additional Director	Vasant Pande Executive Engineer (Operations)	S G Chopade Superintending. Engineer BTPS, Bhusawal

MAHAGENCO CSTPS



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CSTPS / POG / Tech Min / C-52A/ 004961

DATE :- 09/12/2012

Demonstration of Technical Minimum operational load
 without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	1
2	MCR capacity	MW	210
3	Date of commercial operation	-	1-Nov-84
4	Date of test	-	9-Dec-12
5	Time of test	-	12.50 to 13:50 Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	4.17
8	Ramp up rate	%/min.	1.986
9	Ramp down rate	MW/min.	4.17
10	Ramp down rate	%/min.	1.986
11	Technical minimum load at generator terminal	MW	145
12	Auxiliary power (per unit) (UAT + ST)	%	8.91
13	Auxiliary power (per unit) (UAT + ST)	MW	12.92
14	Auxiliary power (per unit) (UAT Only)	%	6.80
15	Auxiliary power (per unit) (UAT Only)	MW	9.86
16	Technical minimum load at ex-bus (UAT + ST)	MW	132.08
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	135.14
18	Technical minimum at generator terminal	% of MCR	69.05
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	62.90
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	64.35

For CPRI	For SLDC	For MSPGCL CSTPS, Chandrapur
<i>M. Siddhartha Bhatt</i> 09/12/2012	<i>Vasant Pande</i> 09.12.12	<i>S. M. Marudkar</i> 09/12/12
M. Siddhartha Bhatt, Additional Director	Vasant Pande, Executive Engineer (Operations)	S. M. Marudkar Supdtg. Engineer - POG, CSTPS, Chandrapur



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CSTPS / POG / Tech Min / C-52A/ 004962

DATE :- 09/12/2012

Demonstration of Technical Minimum operational load
 without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	2
2	MCR capacity	MW	210
3	Date of commercial operation	-	16-Sep-85
4	Date of test	-	9-Dec-12
5	Time of test	-	12.00 to 13:00 Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	4.17
8	Ramp up rate	%/min.	1.986
9	Ramp down rate	MW/min.	4.17
10	Ramp down rate	%/min.	1.986
11	Technical minimum load at generator terminal	MW	150
12	Auxiliary power (per unit) (UAT + ST)	%	8.91
13	Auxiliary power (per unit) (UAT + ST)	MW	13.37
14	Auxiliary power (per unit) (UAT Only)	%	6.80
15	Auxiliary power (per unit) (UAT Only)	MW	10.20
16	Technical minimum load at ex-bus (UAT + ST)	MW	136.64
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	139.80
18	Technical minimum at generator terminal	% of MCR	71.43
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	65.06
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	66.57

For CPRI	For SLDC	For MSPGCL CSTPS, Chandrapur
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CSTPS / POG / Tech Min / C-52A/ 004963

DATE :- 09/12/2012

Demonstration of Technical Minimum operational load
 without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	3
2	MCR capacity	MW	210
3	Date of commercial operation	-	1-Apr-86
4	Date of test	-	9-Dec-12
5	Time of test	-	10.15 to 11:15 Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	4.17
8	Ramp up rate	%/min.	1.986
9	Ramp down rate	MW/min.	4.17
10	Ramp down rate	%/min.	1.986
11	Technical minimum load at generator terminal	MW	163
12	Auxiliary power (per unit) (UAT + ST)	%	8.91
13	Auxiliary power (per unit) (UAT + ST)	MW	14.52
14	Auxiliary power (per unit) (UAT Only)	%	6.80
15	Auxiliary power (per unit) (UAT Only)	MW	11.08
16	Technical minimum load at ex-bus (UAT + ST)	MW	148.48
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	151.92
18	Technical minimum at generator terminal	% of MCR	77.62
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	70.70
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	72.34

For CPRI	For SLDC	For MSPGCL CSTPS, Chandrapur
<i>M. Siddhartha Bhatt</i> 09/12/2012	<i>Vasant Pande</i> 09.12.12	<i>S. M. Marudkar</i> 09/12/12
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CSTPS / POG / Tech Min / C-52A/ 004964

DATE :- 09/12/2012

Demonstration of Technical Minimum operational load
without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	4
2	MCR capacity	MW	210
3	Date of commercial operation	-	4-Nov-86
4	Date of test	-	9-Dec-12
5	Time of test	-	11.00 to 12:00 Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	4.17
8	Ramp up rate	%/min.	1.986
9	Ramp down rate	MW/min.	4.17
10	Ramp down rate	%/min.	1.986
11	Technical minimum load at generator terminal	MW	160
12	Auxiliary power (per unit) (UAT + ST)	%	8.91
13	Auxiliary power (per unit) (UAT + ST)	MW	14.26
14	Auxiliary power (per unit) (UAT Only)	%	6.80
15	Auxiliary power (per unit) (UAT Only)	MW	10.88
16	Technical minimum load at ex-bus (UAT + ST)	MW	145.74
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	149.12
18	Technical minimum at generator terminal	% of MCR	76.19
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	69.40
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	71.01

For CPRI	For SLDC	For MSPGCL CSTPS, Chandrapur
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CSTPS / POG / Tech Min / C-52A/ 004965

DATE :- 09/12/2012

Demonstration of Technical Minimum operational load
 without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	5
2	MCR capacity	MW	500
3	Date of commercial operation	-	1-Dec-92
4	Date of test	-	8-Dec-12
5	Time of test	-	12.30 to 13:30 Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	3
8	Ramp up rate	%/min.	0.600
9	Ramp down rate	MW/min.	3
10	Ramp down rate	%/min.	0.600
11	Technical minimum load at generator terminal	MW	365
12	Auxiliary power (per unit) (UAT + ST)	%	8.91
13	Auxiliary power (per unit) (UAT + ST)	MW	32.52
14	Auxiliary power (per unit) (UAT Only)	%	6.50
15	Auxiliary power (per unit) (UAT Only)	MW	23.73
16	Technical minimum load at ex-bus (UAT + ST)	MW	332.48
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	341.28
18	Technical minimum at generator terminal	% of MCR	73.00
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	66.50
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	68.26

For CPRI	For SLDC	For MSPGCL CSTPS, Chandrapur
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CSTPS / POG / Tech Min / C-52A/ 004966

DATE :- 09/12/2012

Demonstration of Technical Minimum operational load
 without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	6
2	MCR capacity	MW	500
3	Date of commercial operation	-	1-Dec-93
4	Date of test	-	8-Dec-12
5	Time of test	-	15.15 to 16:15 Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	3
8	Ramp up rate	%/min.	0.600
9	Ramp down rate	MW/min.	3
10	Ramp down rate	%/min.	0.600
11	Technical minimum load at generator terminal	MW	360
12	Auxiliary power (per unit) (UAT + ST)	%	8.91
13	Auxiliary power (per unit) (UAT + ST)	MW	32.08
14	Auxiliary power (per unit) (UAT Only)	%	6.50
15	Auxiliary power (per unit) (UAT Only)	MW	23.40
16	Technical minimum load at ex-bus (UAT + ST)	MW	327.92
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	336.60
18	Technical minimum at generator terminal	% of MCR	72.00
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	65.58
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	67.32

For CPRI	For SLDC	For MSPGCL CSTPS, Chandrapur
<i>Mmm</i> 09/12/2012	<i>Vpande</i> 09.12.12	<i>Smm</i> 09/12/12
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CSTPS / POG / Tech Min / C-52A/ 004967

DATE :- 09/12/2012

Demonstration of Technical Minimum operational load
 without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	7
2	MCR capacity	MW	500
3	Date of commercial operation	-	1-Mar-98
4	Date of test	-	8-Dec-12
5	Time of test	-	16.40 to 17:40 Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	3
8	Ramp up rate	%/min.	0.600
9	Ramp down rate	MW/min.	3
10	Ramp down rate	%/min.	0.600
11	Technical minimum load at generator terminal	MW	360
12	Auxiliary power (per unit) (UAT + ST)	%	8.91
13	Auxiliary power (per unit) (UAT + ST)	MW	32.08
14	Auxiliary power (per unit) (UAT Only)	%	6.50
15	Auxiliary power (per unit) (UAT Only)	MW	23.40
16	Technical minimum load at ex-bus (UAT + ST)	MW	327.92
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	336.60
18	Technical minimum at generator terminal	% of MCR	72.00
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	65.58
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	67.32

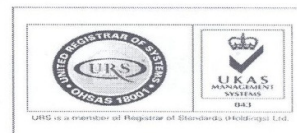
For CPRI	For SLDC	For MSPGCL CSTPS, Chandrapur
M. Siddhartha Bhatt, Additional Director	Vasant Pande, Executive Engineer (Operations)	S. M. Marudkar Supdtg. Engineer - POG, CSTPS, Chandrapur

MAHAGENCO KHTPS



**MAHARASHTRA STATE POWER GENERATION CO. LTD.
KHAPERKHEDA THERMAL POWER STATION**

(ISO 9001:2008, ISO 14001:2004 & ISO 18001:2007)
Office of: Chief Engineer, T.P.S., Khaperkheda, Dist. Nagpur, PIN – 441102



Reg. No. U-40100 MH ZUUS PLL

KHG / OS / 110 / NO.

DATE :-

Demonstration of Technical Minimum operational load
without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	1
2	MCR capacity	MW	210
3	Date of commercial operation	-	26-03-1989
4	Date of test	-	06-12-2012
5	Time of test	-	18.00 to 19:00 Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	20
8	Ramp up rate	%/min.	9.524
9	Ramp down rate	MW/min.	20
10	Ramp down rate	%/min.	9.524
11	Technical minimum load at generator terminal	MW	161.89
12	Auxiliary power (per unit)(UAT + ST)	%	9.92
13	Auxiliary power (per unit) (UAT + ST)	MW	16.06
14	Auxiliary power (per unit)(UAT Only)	%	6.77
15	Auxiliary power (per unit) (UAT Only)	MW	10.96
16	Technical minimum load at ex-bus (UAT + ST)	MW	145.83
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	150.93
18	Technical minimum at generator terminal	% of MCR	77.09
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	69.44
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	71.87

For CPRI	For SLDC	For MSPGCL KHAPERKHEDA TPS
M. Siddhartha Bhatt, Additional Director	Vasant Pande, Executive Engineer (Operations)	S. P. Vijay kar, Deputy. Chief Engineer (O & M)



MAHARASHTRA STATE POWER GENERATION CO. LTD.
KHAPERKHEDA THERMAL POWER STATION

(ISO 9001:2008, ISO 14001:2004 & ISO 18001:2007)

Office of: Chief Engineer, T.P.S., Khaperkheda, Dist. Nagpur, PIN – 441102



Reg. No. U-40100 MH 2005 PLC

KHG / OS / 110 / NO.

DATE :-

Demonstration of Technical Minimum operational load
without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	2
2	MCR capacity	MW	210
3	Date of commercial operation	-	08-01-1990
4	Date of test	-	06-12-2012
5	Time of test	-	13.00 to 14:00Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	20
8	Ramp up rate	%/min.	9.524
9	Ramp down rate	MW/min.	20
10	Ramp down rate	%/min.	9.524
11	Technical minimum load at generator terminal	MW	159.33
12	Auxiliary power (per unit)(UAT + ST)	%	10.02
13	Auxiliary power (per unit) (UAT + ST)	MW	15.96
14	Auxiliary power (per unit)(UAT Only)	%	6.88
15	Auxiliary power (per unit) (UAT Only)	MW	10.96
16	Technical minimum load at ex-bus (UAT + ST)	MW	143.37
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	148.37
18	Technical minimum at generator terminal	% of MCR	75.87
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	68.27
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	70.65

For CPRI	For SLDC	For MSPGCL KHAPERKHEDA TPS
M. Siddhartha Bhatt, Additional Director	Vasant Pande, Executive Engineer (Operations)	S. P. Vijayar, Deputy. Chief Engineer (O & M)



MAHARASHTRA STATE POWER GENERATION CO. LTD.
KHAPERKHEDA THERMAL POWER STATION
 (ISO 9001:2008, ISO 14001:2004 & ISO 18001:2007)
 Office of: Chief Engineer, T.P.S., Khaperkheda, Dist. Nagpur, PIN – 441102



Reg. No. U-40100 MH 2005 PLC

KHG / OS / 110 / NO.

DATE :-

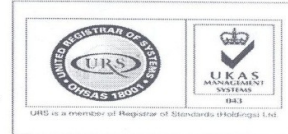
Demonstration of Technical Minimum operational load without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	3
2	MCR capacity	MW	210
3	Date of commercial operation	-	31-05-2000
4	Date of test	-	06-12-2012
5	Time of test	-	15.50 to 16:50 Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	20
8	Ramp up rate	%/min.	9.524
9	Ramp down rate	MW/min.	20
10	Ramp down rate	%/min.	9.524
11	Technical minimum load at generator terminal	MW	158
12	Auxiliary power (per unit)(UAT + ST)	%	10.83
13	Auxiliary power (per unit) (UAT + ST)	MW	17.11
14	Auxiliary power (per unit)(UAT Only)	%	8.53
15	Auxiliary power (per unit) (UAT Only)	MW	13.48
16	Technical minimum load at ex-bus (UAT + ST)	MW	140.89
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	144.52
18	Technical minimum at generator terminal	% of MCR	75.24
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	67.09
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	68.82

For CPRI	For SLDC	For MSPGCL KHAPERKHEDA TPS
M. Siddhartha Bhatt, Additional Director	Vasant Pande, Executive Engineer (Operations)	S. P. Vijayar, Deputy. Chief Engineer (O & M)



MAHARASHTRA STATE POWER GENERATION CO. LTD.
KHAPERKHEDA THERMAL POWER STATION
 (ISO 9001:2008, ISO 14001:2004 & ISO 18001:2007)
 Office of: Chief Engineer, T.P.S., Khaperkheda, Dist. Nagpur, PIN – 441102



Reg. No. U-40100 MH 2005 PLL

KHG / OS / 110 / NO.

DATE :-

Demonstration of Technical Minimum operational load without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	4
2	MCR capacity	MW	210
3	Date of commercial operation	-	07-01-2001
4	Date of test	-	06-12-2012
5	Time of test	-	16.40 to 17:40 Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	20
8	Ramp up rate	%/min.	9.524
9	Ramp down rate	MW/min.	20
10	Ramp down rate	%/min.	9.524
11	Technical minimum load at generator terminal	MW	161
12	Auxiliary power (per unit)(UAT + ST)	%	11.52
13	Auxiliary power (per unit) (UAT + ST)	MW	18.55
14	Auxiliary power (per unit)(UAT Only)	%	9.23
15	Auxiliary power (per unit) (UAT Only)	MW	14.86
16	Technical minimum load at ex-bus (UAT + ST)	MW	142.45
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	146.14
18	Technical minimum at generator terminal	% of MCR	76.67
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	67.83
20	Technical minimum at ex-bus (UATOnly) (INJECTION POINT)	% of MCR	69.59

For CPRI	For SLDC	For MSPGCL KHAPERKHEDA TPS
M. Siddhartha Bhatt, Additional Director	Vasant Pande, Executive Engineer (Operations)	S. P. Vijaykar, Deputy. Chief Engineer (O & M)



**MAHARASHTRA STATE POWER GENERATION CO. LTD.
KHAPERKHEDA THERMAL POWER STATION**

(ISO 9001:2008, ISO 14001:2004 & ISO 18001:2007)
Office of: Chief Engineer, T.P.S., Khaperkheda, Dist. Nagpur, PIN – 441102



Reg. No. U-40100 MH 2005 PLC

KHG / OS / 110 / NO.

DATE :-

07-12-2012

Demonstration of Technical Minimum operational load
without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	5
2	MCR capacity	MW	500
3	Date of commercial operation	-	16-04-2012
4	Date of test	-	07-12-2012
5	Time of test	-	10.30 to 11:30 Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	25
8	Ramp up rate	%/min.	5.000
9	Ramp down rate	MW/min.	25
10	Ramp down rate	%/min.	5.000
11	Technical minimum load at generator terminal	MW	360
12	Auxiliary power (per unit)(UAT + ST)	%	6.91
13	Auxiliary power (per unit) (UAT + ST)	MW	24.88
14	Auxiliary power (per unit)(UAT Only)	%	5.52
15	Auxiliary power (per unit) (UAT Only)	MW	19.88
16	Technical minimum load at ex-bus (UAT + ST)	MW	335.12
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	340.12
18	Technical minimum at generator terminal	% of MCR	72.00
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	67.02
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	68.02

For CPRI	For SLDC	For MSPGCL KHAPERKHEDA TPS
M. Siddhartha Bhatt, Additional Director	Vasant Pande, Executive Engineer (Operations)	P.M. Nikhare Dy. Chief Engineer-II, 500 MW

MAHAGENCO KTPS

MAHAGENCO NTPS

महाराष्ट्र राज्य वीज निर्मिती कंपनी मर्यादित
Maharashtra State Power Generation Company Ltd.

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ई-मेल cegennashik@mahagenco.in
cgm@mahagenco.com

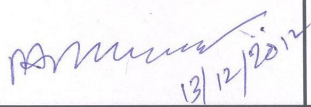
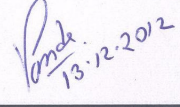
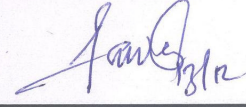
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Office of the Chief Engineer
नाशिक औष्णिक विद्युत केंद्र,
Nashik Thermal Power Station
पोस्ट एकलहारे ४२२ १०५
PO Eklahare 422 105
(Via Nashik-Road)

NTPS / POG / Tech Min /

DATE :- 13/12/2012

Demonstration of Technical Minimum operational load
without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	3
2	MCR capacity	MW	210
3	Date of commercial operation	-	26/04/1979
4	Date of test	-	13/12/2012
5	Time of test	-	11.25 to 12:25 Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	4
8	Ramp up rate	%/min.	1.905
9	Ramp down rate	MW/min.	4
10	Ramp down rate	%/min.	1.905
11	Technical minimum load at generator terminal	MW	161
12	Auxiliary power (per unit) (UAT + ST)	%	11.8
13	Auxiliary power (per unit) (UAT + ST)	MW	19.00
14	Auxiliary power (per unit) (UAT Only)	%	8.80
15	Auxiliary power (per unit) (UAT Only)	MW	14.17
16	Technical minimum load at ex-bus (UAT + ST)	MW	142.00
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	146.83
18	Technical minimum at generator terminal	% of MCR	76.67
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	67.62
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	69.92

For CPRI	For SLDC	For MSPGCL NTPS, Eklahare
		
M.Siddhartha Bhatt, Additional Director CPRI	Vasant Pande, Executive Engineer (Operations) MS SLDC	G.T.Gawande Supdtg. Engineer (Operation) NTPS, Eklahare

महाराष्ट्र राज्य वीज निर्मिती कंपनी मर्यादित
Maharashtra State Power Generation Company Ltd.



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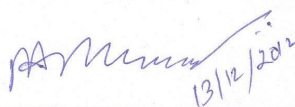
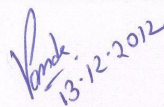
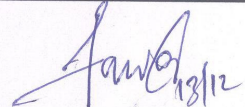
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Office of the Chief Engineer
नाशिक औष्णिक विद्युत केंद्र,
Nashik Thermal Power Station
पोस्ट एकलहारे ४२२ १०५
PO Eklahare 422 105
(Via Nashik-Road)

NTPS / POG / Tech Min /

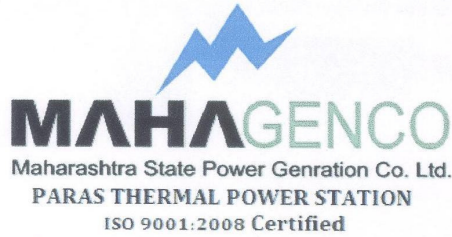
DATE :- 13/12/2012

Demonstration of Technical Minimum operational load
without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	5
2	MCR capacity	MW	210
3	Date of commercial operation	-	30/01/1981
4	Date of test	-	13/12/2012
5	Time of test	-	12.35 to 13:35 Hrs
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	4
8	Ramp up rate	%/min.	1.905
9	Ramp down rate	MW/min.	4
10	Ramp down rate	%/min.	1.905
11	Technical minimum load at generator terminal	MW	160
12	Auxiliary power (per unit) (UAT + ST)	%	11.8
13	Auxiliary power (per unit) (UAT + ST)	MW	18.88
14	Auxiliary power (per unit) (UAT Only)	%	8.80
15	Auxiliary power (per unit) (UAT Only)	MW	14.08
16	Technical minimum load at ex-bus (UAT + ST)	MW	141.12
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	145.92
18	Technical minimum at generator terminal	% of MCR	76.19
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	67.20
20	Technical minimum at ex-bus (UATOnly) (INJECTION POINT)	% of MCR	69.49

For CPRI	For SLDC	For MSPGCL NTPS, Eklahare
		
M.Siddhartha Bhatt, Additional Director CPRI	Vasant Pande, Executive Engineer (Operations) MS SLDC	G.T.Gawande Supdtg. Engineer (Operation) NTPS, Eklahare

MAHAGENCO PARAS TPS



Maharashtra State Power Generation Co. Ltd.
PARAS THERMAL POWER STATION
ISO 9001:2008 Certified

Ph: 07257 - 224848 / 224465 / 66, Fax: 224846, E-mail: cgmparas@mahagenco.in, cgmparas@rediffmail.com

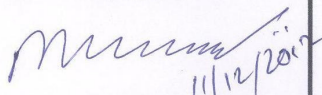
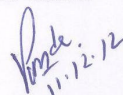

OFFICE OF THE
CHIEF ENGINEER,
MSPGCL, THERMAL POWER STATION,
Vidyut Nagar, Paras
Dist. Akola (MAH) 444 109
www.mahagenco.in

Ref:CE/PRS/TPS

DATE :- 11/12/2012

Demonstration of Technical Minimum operational load without oil support.

S. N.	Particular	Units	Values
1	Unit No.	-	3
2	MCR capacity	MW	250
3	Date of commercial operation	-	31-Mar-08
4	Date of test	-	11-Dec-12
5	Time of test	-	11:15 to 12:15
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	5
8	Ramp up rate	%/min.	2.0
9	Ramp down rate	MW/min.	5
10	Ramp down rate	%/min.	2.0
11	Technical minimum load at generator terminal	MW	186
12	Auxiliary power (per unit) (UAT + ST)	%	11.87
13	Auxiliary power (per unit) (UAT + ST)	MW	22.08
14	Auxiliary power (per unit) (UAT Only)	%	10.22
15	Auxiliary power (per unit) (UAT Only)	MW	19.01
16	Technical minimum load at ex-bus (UAT + ST)	MW	163.92
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	166.99
18	Technical minimum at generator terminal	% of MCR	74.40
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	65.57
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	66.80

<p>For CPRI</p>  <p>Shri. Siddhartha Bhatt Additional Director</p>	<p>For SLDC</p>  <p>Shri. Vasant Pande Executive Engineer</p>	<p>For MSPGCL Paras TPS</p>  <p>Shri. R.T. Malewar Supdtg. Engineer</p>
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Maharashtra State Power Generation Co. Ltd.
PARAS THERMAL POWER STATION
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Ph: 07257 - 224848 / 224465 / 66, Fax: 224846, E-mail: cgmparas@mahagenco.in, cgmparas@rediffmail.com

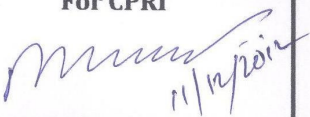
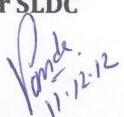

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MSPGCL, THERMAL POWER STATION,
Vidyut Nagar, Paras
Dist. Akola (MAH) 444 109
www.mahagenco.in

Ref:CE/PRS/TPS

DATE :- 11/12/2012

Demonstration of Technical Minimum operational load without oil support.

S. N.	Particular	Units	Values
1	Unit No.	-	4
2	MCR capacity	MW	250
3	Date of commercial operation	-	31-Aug-10
4	Date of test	-	11-Dec-12
5	Time of test	-	12:30 to 13:30
6	Time period of test	Hours	1
7	Ramp up rate	MW/min.	5
8	Ramp up rate	%/min.	2.0
9	Ramp down rate	MW/min.	5
10	Ramp down rate	%/min.	2.0
11	Technical minimum load at generator terminal	MW	190
12	Auxiliary power (per unit) (UAT + ST)	%	11.42
13	Auxiliary power (per unit) (UAT + ST)	MW	21.70
14	Auxiliary power (per unit) (UAT Only)	%	9.89
15	Auxiliary power (per unit) (UAT Only)	MW	18.79
16	Technical minimum load at ex-bus (UAT + ST)	MW	168.30
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	171.21
18	Technical minimum at generator terminal	% of MCR	76.00
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	67.32
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	68.48

<p>For CPRI</p>  <p>Shri. Siddhartha Bhatt Additional Director</p>	<p>For SLDC</p>  <p>Shri. Vasant Pande Executive Engineer</p>	<p>For MSPGCL Paras TPS</p>  <p>Shri. R.T. Malewar Supdtg. Engineer</p>
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MAHAGENCO PARLI TPS



Maharashtra State Power Generation Co Ltd

Parli Thermal Power Station, Parli – Vaijnath

Dist: Beed (MS), Pin: 431520

Phone: 02446-222357, 58, 59, Fax: 02446-222492, email: cegenparli@mahagenco.in

Ref No:- CE/PRL/

DATE :- 10/01/2013

Demonstration of Technical Minimum operational load without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	3
2	MCR capacity	MW	210
3	Date of commercial operation	-	10/10/1980
4	Date of test	-	10/01/2013
5	Time of test	-	10:30 to 11:30 hrs.
6	Time period of test	hours	1.0
7	Ramp up rate	MW/min.	5
8	Ramp up rate	%/min.	2.38
9	Ramp down rate	MW/min.	3
10	Ramp down rate	%/min.	1.43
11	Technical minimum load at generator terminal	MW	157.0
12	Auxiliary power (per unit)(UAT + ST)	%	11.97
13	Auxiliary power (per unit) (UAT + ST)	MW	18.79
14	Auxiliary power (per unit)(UAT Only)	%	8.45
15	Auxiliary power (per unit) (UAT Only)	MW	13.27
16	Technical minimum load at ex-bus (UAT + ST)	MW	138.21
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	143.73
18	Technical minimum at generator terminal	% of MCR	74.76
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	65.81
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	68.44

For CPRI	For SLDC	For MSPGCL Parli TPS
M.Siddhartha Bhatt Additional Director	Vasant Pande Executive Engineer (Operations)	A.P Tayade Dy.Chief Engineer-I



Maharashtra State Power Generation Co Ltd

Parli Thermal Power Station, Parli – Vajinath

Dist: Beed (MS), Pin: 431520

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Ref No:- CE/PRL/

DATE :- 10/01/2013

Demonstration of Technical Minimum operational load without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	5
2	MCR capacity	MW	210
3	Date of commercial operation	-	31/12/1987
4	Date of test	-	10/01/2013
5	Time of test	-	09:15 to 10:15 Hrs
6	Time period of test	hours	1.0
7	Ramp up rate	MW/min.	5
8	Ramp up rate	%/min.	2.38
9	Ramp down rate	MW/min.	3
10	Ramp down rate	%/min.	1.43
11	Technical minimum load at generator terminal	MW	157.0
12	Auxiliary power (per unit)(UAT + ST)	%	11.79
13	Auxiliary power (per unit) (UAT + ST)	MW	18.51
14	Auxiliary power (per unit)(UAT Only)	%	8.28
15	Auxiliary power (per unit) (UAT Only)	MW	13.00
16	Technical minimum load at ex-bus (UAT + ST)	MW	138.49
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	144.00
18	Technical minimum at generator terminal	% of MCR	74.76
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	65.95
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	68.57

For CPRI	For SLDC	For MSPGCL Parli TPS
M.Siddhartha Bhatt	Vasant Pande	A.P Tayade
Additional Director	Executive Engineer (Operations)	Dy.Chief Engineer-I



Maharashtra State Power Generation Co Ltd

Parli Thermal Power Station, Parli – Vajinath

Dist: Beed (MS), Pin: 431520

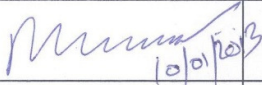

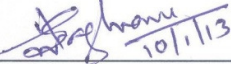
Phone: 02446-222357, 58, 59, Fax: 02446-222492, email: cegenparli@mahagenco.in

Ref No:- CE/PRL/

DATE :- 10/01/2013

Demonstration of Technical Minimum operational load without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	6
2	MCR capacity	MW	250
3	Date of commercial operation	-	31/07/2007
4	Date of test	-	10/01/2013
5	Time of test	-	11:45 to 12:45 hrs.
6	Time period of test	hours	1
7	Ramp up rate	MW/min.	5
8	Ramp up rate	%/min.	2.00
9	Ramp down rate	MW/min.	5
10	Ramp down rate	%/min.	2.00
11	Technical minimum load at generator terminal	MW	187.0
12	Auxiliary power (per unit)(UAT + ST)	%	11.40
13	Auxiliary power (per unit) (UAT + ST)	MW	21.31
14	Auxiliary power (per unit)(UAT Only)	%	9.82
15	Auxiliary power (per unit) (UAT Only)	MW	18.36
16	Technical minimum load at ex-bus (UAT + ST)	MW	165.69
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	168.64
18	Technical minimum at generator terminal	% of MCR	74.80
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	66.28
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	67.46

For CPRI	For SLDC	For MSPGCL Parli TPS
		
M.Siddhartha Bhatt Additional Director	Vasant Pande Executive Engineer (Operations)	A.S. Waghmare Dy.Chief Engineer-II

TATA POWER

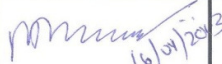




DATE :- 16-Jan-13

Demonstration of Technical Minimum operational load
without oil support

TTJ / Perf / CPRI / 73 / 2012-13

Sl. No.	Particular	Units	Values
1	Unit No.	-	5
2	MCR capacity	MW	500
3	Date of commercial operation	-	25-Jan-84
4	Date of test	-	16-Jan-13
5	Time of test	-	10.45 to 12:45 Hrs
6	Time period of test	hours	2
7	Ramp up rate	MW/min.	3
8	Ramp up rate	%/min.	0.6
9	Ramp down rate	MW/min.	3
10	Ramp down rate	%/min.	0.6
11	Technical minimum load at generator terminal	MW	314
12	Auxiliary power (per unit)(UAT + ST)	%	7.1
13	Auxiliary power (per unit) (UAT + ST)	MW	22.4
14	Auxiliary power (per unit)(UAT Only)	%	6.5
15	Auxiliary power (per unit) (UAT Only)	MW	20.3
16	Technical minimum load at ex-bus (UAT + ST)	MW	291.6
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	293.7
18	Technical minimum at generator terminal	% of MCR	62.8
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	58.3
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	58.7

For CPRI	For SLDC	For Tata Power Company Limited, Trombay Thermal Power Station
 16/01/2013		 16/1/13.
M.Siddhartha Additional Director	Vasant Pande, Executive Engineer (Operations)	A A Bhat Head (Trombay Performance & Efficiency)

TATA POWER

The Tata Power Company Limited

Trombay Thermal Power Station Mahul Road Chembur Mumbai 400 074

Tel 91 22 6717 1000 Fax 91 22 6668 7066 6668 7067

Registered Office Bombay House 24 Horni Mody Street Mumbai 400 001






DATE :- 16-Jan-13

Demonstration of Technical Minimum operational load
without oil support

TTJ / Perf / CPRI / 74 / 2012-13

Sl. No.	Particular	Units	Values
1	Unit No.	-	6
2	MCR capacity	MW	500
3	Date of commercial operation	-	23-Mar-90
4	Date of test	-	16-Jan-13
5	Time of test	-	17:00 to 18:00
6	Time period of test	hours	1
7	Ramp up rate	MW/min.	2
8	Ramp up rate	%/min.	0.4
9	Ramp down rate	MW/min.	2
10	Ramp down rate	%/min.	0.4
11	Technical minimum load at generator terminal	MW	155.7
12	Auxiliary power (per unit)(UAT + ST)	%	6.7
13	Auxiliary power (per unit) (UAT + ST)	MW	10.4
14	Auxiliary power (per unit)(UAT Only)	%	6.2
15	Auxiliary power (per unit) (UAT Only)	MW	9.7
16	Technical minimum load at ex-bus (UAT + ST)	MW	145.3
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	146.0
18	Technical minimum at generator terminal	% of MCR	31.1
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	29.1
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	29.2

For CPRI	For SLDC	For Tata Power Company Limited, Trombay Thermal Power Station
		
M.Siddhartha Additional Director	Vasant Pande, Executive Engineer (Operations)	A A Bhat Head (Trombay Performance & Efficiency)

TATA POWER

The Tata Power Company Limited

Trombay Thermal Power Station Mahul Road Chembur Mumbai 400 074

Tel 91 22 6717 1000 Fax 91 22 6668 7066 6668 7067

Registered Office Bombay House 24 Homi Mody Street Mumbai 400 001

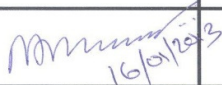

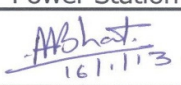


DATE :- 16-Jan-13

Demonstration of Technical Minimum operational load
without oil support

TTJ / Perf / CPRI / 75 / 2012-13

Sl. No.	Particular	Units	Values
1	Unit No.	-	8
2	MCR capacity	MW	250
3	Date of commercial operation	-	29-Mar-09
4	Date of test	-	16-Jan-13
5	Time of test	-	14:15 to 15:45 Hrs
6	Time period of test	hours	1.5
7	Ramp up rate	MW/min.	3
8	Ramp up rate	%/min.	1.2
9	Ramp down rate	MW/min.	3
10	Ramp down rate	%/min.	1.2
11	Technical minimum load at generator terminal	MW	189
12	Auxiliary power (per unit)(UAT + ST)	%	8.8
13	Auxiliary power (per unit) (UAT + ST)	MW	17
14	Auxiliary power (per unit)(UAT Only)	%	7.3
15	Auxiliary power (per unit) (UAT Only)	MW	13.8
16	Technical minimum load at ex-bus (UAT + ST)	MW	172.0
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	174.8
18	Technical minimum at generator terminal	% of MCR	75.4
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	68.8
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	69.9

For CPRI	For SLDC	For Tata Power Company Limited, Trombay Thermal Power Station
		
M.Siddhartha Additional Director	Vasant Pande, Executive Engineer (Operations)	A A Bhat Head (Trombay Performance & Efficiency)

TATA POWER

The Tata Power Company Limited

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RELIANCE POWER



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 Dahanu Thermal Power Station
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 Fax: +91 2528 222 576
 www.rinfra.com

Reg. No. I99999MH1929PLC001530			
DTPS/CTS/TECH/MIN/714		DATE :- 11/01/2013	
Demonstration of Technical Minimum operational load without oil support			
Sl. No.	Particular	Units	Values
1	Unit No.	-	1
2	MCR capacity	MW	250
3	Date of commercial operation	-	01/07/1995
4	Date of test	-	11/01/2013
5	Time of test	-	15:45 to 16:45 Hrs
6	Time period of test	hours	1
7	Ramp up rate	MW/min.	20
8	Ramp up rate	%/min.	8.00
9	Ramp down rate	MW/min.	20
10	Ramp down rate	%/min.	8.00
11	Technical minimum load at generator terminal	MW	189
12	Auxiliary power (per unit)(UAT + ST)	%	10.59
13	Auxiliary power (per unit) (UAT + ST)	MW	20.01
14	Auxiliary power (per unit)(UAT Only)	%	7.39
15	Auxiliary power (per unit) (UAT Only)	MW	13.96
16	Technical minimum load at ex-bus (UAT + ST)	MW	168.99
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	175.04
18	Technical minimum at generator terminal	% of MCR	75.60
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	67.60
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	70.02
For CPRI		For SLDC	For R-Infra DAHANU TPS
M. Siddhartha Additional Director	Vasant Pande, Executive Engineer (Operations)	R. Nandi Station Head (DTPS)	



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 www.rinfra.com

Reg. No. L99999MH1929PLC001530			
DTPS/CTS/TECH/MIN/714		DATE :- 11/01/2013	
Demonstration of Technical Minimum operational load without oil support			
Sl. No.	Particular	Units	Values
1	Unit No.	-	2
2	MCR capacity	MW	250
3	Date of commercial operation	-	01/01/1996
4	Date of test	-	11/01/2013
5	Time of test	-	16:45 to 17:45 Hrs
6	Time period of test	hours	1
7	Ramp up rate	MW/min.	20
8	Ramp up rate	%/min.	8.00
9	Ramp down rate	MW/min.	20
10	Ramp down rate	%/min.	8.00
11	Technical minimum load at generator terminal	MW	188
12	Auxiliary power (per unit)(UAT + ST)	%	10.91
13	Auxiliary power (per unit) (UAT + ST)	MW	20.51
14	Auxiliary power (per unit)(UAT Only)	%	6.81
15	Auxiliary power (per unit) (UAT Only)	MW	12.81
16	Technical minimum load at ex-bus (UAT + ST)	MW	167.49
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	175.19
18	Technical minimum at generator terminal	% of MCR	75.20
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	67.00
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	70.08

For CPRI	For SLDC	For R-Infra DAHANU TPS
M. Siddhartha Additional Director	Vasant Pande, Executive Engineer (Operations)	R. Nandi Station Head (DTPS)

ABIJIT POWER



Abhijeet MADC Nagpur Energy Private Limited

MIHAN Power Plant, Khairy Khurd, Hingna, Nagpur - 440 033.
Ph. : +91 - 7104 - 304900 Fax : +91 - 7104 - 304990

Demonstration of Technical Minimum operational load without oil support

Sl. No.	Particular	Units	Values
01	Unit No.	-	1
02	MCR capacity	MW	61.5
03	Date of commercial operation	-	06/01/2011
04	Date of test	-	05/12/2012
05	Time of test	-	13:15 to 14:15
06	Time period of test	hours	1
07	Ramp up rate	MW/min.	1.5
08	Ramp up rate	%/min.	2.43
09	Ramp down rate	MW/min.	1.5
10	Ramp down rate	%/min.	2.43
11	Technical minimum load at generator terminal	MW	40.8
17	Auxiliary power (per unit)(UAT+ST)	%	12.74
18	Auxiliary power (per unit)(UAT+ST)	MW	5.2
19	Auxiliary power (per unit)(UAT only)	%	5.81
20	Auxiliary power (per unit)(UAT only)	MW	2.37
21	Technical minimum load at ex-bus (UAT+ST)	MW	35.6
22	Technical minimum load at ex-bus (UAT only)(Injection point)	MW	38.43
23	Technical minimum at generator terminal	% of MCR	66.34
24	Technical minimum at ex-bus (UAT+ST)	% of MCR	57.88
25	Technical minimum at ex-bus (UAT only)(Injection point)	% of MCR	62.48

For CPRI	For SLDC	For AMNEPL
M. Siddhartha Bhatt, Additional Director	Vasant Pande, Executive Engineer (Operations)	Ashok Malik, Vice President (O&M)


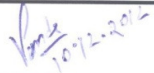
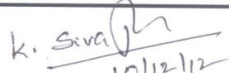
GUPTA POWER



Gupta Energy Pvt. Ltd.

Demonstration of Technical Minimum operational load
without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	1
2	MCR capacity	MW	60
3	Date of commercial operation	-	17-Sep-12
4	Date of test	-	10-Dec-12
5	Time of test	-	11.15 to 13:00 Hrs
6	Time period of test	hours	1 Hr. 45 min.
7	Ramp up rate	MW/min.	3
8	Ramp up rate	%/min.	5.00
9	Ramp down rate	MW/min.	3
10	Ramp down rate	%/min.	5.00
11	Technical minimum load at generator terminal	MW	20.9
12	Auxiliary power (per unit)(UAT + ST)	%	24.40
13	Auxiliary power (per unit) (UAT + ST)	MW	5.10
14	Auxiliary power (per unit)(UAT Only)	%	9.09
15	Auxiliary power (per unit) (UAT Only)	MW	1.90
16	Technical minimum load at ex-bus (UAT + ST)	MW	15.80
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	19.00
18	Technical minimum at generator terminal	% of MCR	34.83
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	26.33
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	31.67

For CPRI	For SLDC	For GEPL, Usegaon
 10/12/2012	 10/12/2012	 10/12/12
M.Siddhartha Bhatt, Additional Director	Vasant Pande, Executive Engineer (Operations)	K. Siva Prasad President

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Regd. Office : 7th Floor, Shriram Tower, Kingsway, Civil Lines, Nagpur - 440 001 (MS) India, Tel. : +91 712 6603300, Fax : +91 712 6613702
Project Office : GEL Project Site, Shengaon Phata, Ghugus Road, Usegaon, Dist. Chandrapur-442 505
 Ph. : +91 712 238185-89/93-96, Fax : +91 712 238185/92, E-mail : guptas_ngp@sancharnet.in Website : www.guptaglobal.com

COAL ■ MINING ■ POWER ■ INFRASTRUCTURE ■ LOGISTICS

12/10/2012

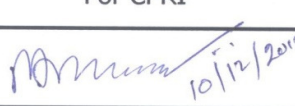
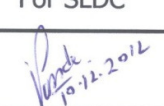
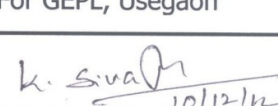
Page 4/4



Gupta Energy Pvt. Ltd.

Demonstration of Technical Minimum operational load
without oil support

Sl. No.	Particular	Units	Values
1	Unit No.	-	2
2	MCR capacity	MW	60
3	Date of commercial operation	-	10-May-12
4	Date of test	-	10-Dec-12
5	Time of test	-	11.15 to 13:00 Hrs
6	Time period of test	hours	1 Hr. 45 min.
7	Ramp up rate	MW/min.	3
8	Ramp up rate	%/min.	5.00
9	Ramp down rate	MW/min.	3
10	Ramp down rate	%/min.	5.00
11	Technical minimum load at generator terminal	MW	20.5
12	Auxiliary power (per unit)(UAT + ST)	%	24.15
13	Auxiliary power (per unit) (UAT + ST)	MW	4.95
14	Auxiliary power (per unit)(UAT Only)	%	9.27
15	Auxiliary power (per unit) (UAT Only)	MW	1.90
16	Technical minimum load at ex-bus (UAT + ST)	MW	15.55
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	18.60
18	Technical minimum at generator terminal	% of MCR	34.17
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	25.92
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	31.00

For CPRI	For SLDC	For GEPL, Usegaon
		
M.Siddhartha Bhatt, Additional Director	Vasant Pande, Executive Engineer (Operations)	K. Siva Prasad, President

Corporate Office : Gupta Tower, 5th Floor, Temple Road, Civil Lines, Nagpur-01, Tel (PABX) : +91 712 6657400, Fax : +91 712 6647144
Regd. Office : 7th Floor, Shriram Tower, Kingsway, Civil Lines, Nagpur - 440 001 (MS) India, Tel. : +91 712 6603300, Fax : +91 712 6613702
Project Office : GEL Project Site, Shengaon Phata, Ghugus Road, Usegaon, Dist. Chandrapur-442 505
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JSW RATHNAGIRI


JSW Energy Limited

 Village - Nandiwade, Post - Jaigad,
 Tal. & Dist. - Ratnagiri - 415 614,
 Maharashtra, India


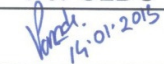
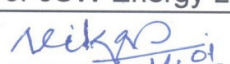
Phone : 02357-242501 to 513

Fax : 02357-242508

Website : www.jsw.in

JSWEL / OS / LDC / 14032013
DATE :- 14.01.2013

**Demonstration of Technical Minimum operational load
without oil support**

Sl. No.	Particular	Units	Values
1	Unit No.	-	1
2	MCR capacity	MW	300
3	Date of commercial operation	-	01.09.2010
4	Date of test	-	14.01.2013
5	Time of test	-	11:30 to 12:30
6	Time period of test	hours	1
7	Ramp up rate	MW/min.	5
8	Ramp up rate	%/min.	1.67
9	Ramp down rate	MW/min.	5
10	Ramp down rate	%/min.	1.67
11	Technical minimum load at generator terminal	MW	225.32
12	Auxiliary power (per unit)(UAT + ST)	%	11.29
13	Auxiliary power (per unit) (UAT + ST)	MW	25.44
14	Auxiliary power (per unit)(UAT Only)	%	*
15	Auxiliary power (per unit) (UAT Only)	MW	*
16	Technical minimum load at ex-bus (UAT + ST) (INJECTION POINT)	MW	199.88
17	Technical minimum load at ex-bus (UAT Only)	MW	*
18	Technical minimum at generator terminal	% of MCR	75.11
19	Technical minimum at ex-bus (UAT + ST) (INJECTION POINT)	% of MCR	66.63
20	Technical minimum at ex-bus (UAT Only)	% of MCR	*
* UAT & ST are connected before GT. The GT injection excludes UAT & ST consumption			
For CPRI		For SLDC	For JSW Energy Ltd
 14/01/2013		 14.01.2013	 14/01/13
M.Siddhartha Bhatt,		Vasant Pande,	Vikas Shukla
Additional Director		Executive Engineer (Operations)	AVP (OS&TS)



Part of O. P. Jindal Group

 Regd. Office : Jindal Mansion,
 5 A, Dr. G. Deshmukh Marg,
 Mumbai - 400 026
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 Fax : 022-2352 6400


JSW Energy Limited

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 Tal. & Dist. - Ratnagiri - 415 614,
 Maharashtra, India

 Phone : 02357-242501 to 513
 Fax : 02357-242508
 Website : www.jsw.in

JSWEL / OS / LDC / 14032013
DATE :- 14.01.2013
**Demonstration of Technical Minimum operational load
 without oil support**

Sl. No.	Particular	Units	Values
1	Unit No.	-	3
2	MCR capacity	MW	300
3	Date of commercial operation	-	09.05.2011
4	Date of test	-	14.01.2013
5	Time of test	-	15:30 to 16:30
6	Time period of test	hours	1
7	Ramp up rate	MW/min.	5
8	Ramp up rate	%/min.	1.67
9	Ramp down rate	MW/min.	5
10	Ramp down rate	%/min.	1.67
11	Technical minimum load at generator terminal	MW	224.6
12	Auxiliary power (per unit)(UAT + ST)	%	7.039
13	Auxiliary power (per unit) (UAT + ST)	MW	15.81
14	Auxiliary power (per unit)(UAT Only)	%	**
15	Auxiliary power (per unit) (UAT Only)	MW	**
16	Technical minimum load at ex-bus (UAT + ST) (INJECTION POINT)	MW	208.79
17	Technical minimum load at ex-bus (UAT Only)	MW	**
18	Technical minimum at generator terminal	% of MCR	74.87
19	Technical minimum at ex-bus (UAT + ST) (INJECTION POINT)	% of MCR	69.60
20	Technical minimum at ex-bus (UAT Only)	% of MCR	**
** Station consumptions drawn from ST's of Unit-1&2.			
For CPRI		For SLDC	For JSW Energy Ltd
<i>M. Siddhartha Bhatt</i> 14/01/2013		<i>Vasant Pande</i> 14/01/2013	<i>Vikas Shukla</i> 14/01/13
M.Siddhartha Bhatt,		Vasant Pande,	Vikas Shukla
Additional Director		Executive Engineer (Operations)	AVP (OS&TS)



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JSW Energy Limited

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 Tal. & Dist. - Ratnagiri - 415 614,
 Maharashtra, India

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Fax : 02357-242508

Website : www.jsw.in

JSWEL / OS / LDC / 14032013
DATE :- 14.01.2013

**Demonstration of Technical Minimum operational load
without oil support**

Sl. No.	Particular	Units	Values		
1	Unit No.	-	2		
2	MCR capacity	MW	300		
3	Date of commercial operation	-	30.12.2010		
4	Date of test	-	14.01.2013		
5	Time of test	-	12:30 to 13:30		
6	Time period of test	hours	1		
7	Ramp up rate	MW/min.	5		
8	Ramp up rate	%/min.	1.67		
9	Ramp down rate	MW/min.	5		
10	Ramp down rate	%/min.	1.67		
11	Technical minimum load at generator terminal	MW	224.37		
12	Auxiliary power (per unit)(UAT + ST)	%	12.21		
13	Auxiliary power (per unit) (UAT + ST)	MW	27.40		
14	Auxiliary power (per unit)(UAT Only)	%	*		
15	Auxiliary power (per unit) (UAT Only)	MW	*		
16	Technical minimum load at ex-bus (UAT + ST) (INJECTION POINT)	MW	196.97		
17	Technical minimum load at ex-bus (UAT Only)	MW	*		
18	Technical minimum at generator terminal	% of MCR	74.79		
19	Technical minimum at ex-bus (UAT + ST) (INJECTION POINT)	% of MCR	65.66		
20	Technical minimum at ex-bus (UAT Only)	% of MCR	*		
* UAT & ST are connected before GT. The GT injection excludes UAT & ST consumption					
For CPRI		For SLDC		For JSW Energy Ltd	
<i>M. Siddhartha Bhatt</i> 14/01/2013		<i>Vasant Pande</i> 14/01/2013		<i>Vikas Shukla</i> 14/01/13	
M.Siddhartha Bhatt,		Vasant Pande,		Vikas Shukla	
Additional Director		Executive Engineer (Operations)		AVP (OS&TS)	



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 Fax : 022-2352 6400


JSW Energy Limited

 Village - Nandiwade, Post - Jaigad,
 Tal. & Dist. - Ratnagiri - 415 614,
 Maharashtra, India

Phone : 02357-242501 to 513

Fax : 02357-242508

Website : www.jsw.in

JSWEL / OS / LDC / 14032013
DATE :- 14.01.2013

**Demonstration of Technical Minimum operational load
without oil support**

Sl. No.	Particular	Units	Values
1	Unit No.	-	4
2	MCR capacity	MW	300
3	Date of commercial operation	-	16.10.2011
4	Date of test	-	14.01.2013
5	Time of test	-	14:30 to 15:30
6	Time period of test	hours	1
7	Ramp up rate	MW/min.	5
8	Ramp up rate	%/min.	1.67
9	Ramp down rate	MW/min.	5
10	Ramp down rate	%/min.	1.67
11	Technical minimum load at generator terminal	MW	225.05
12	Auxiliary power (per unit)(UAT + ST)	%	7.63
13	Auxiliary power (per unit) (UAT + ST)	MW	17.17
14	Auxiliary power (per unit)(UAT Only)	%	**
15	Auxiliary power (per unit) (UAT Only)	MW	**
16	Technical minimum load at ex-bus (UAT + ST) (INJECTION POINT)	MW	207.88
17	Technical minimum load at ex-bus (UAT Only)	MW	**
18	Technical minimum at generator terminal	% of MCR	75.02
19	Technical minimum at ex-bus (UAT + ST) (INJECTION POINT)	% of MCR	69.29
20	Technical minimum at ex-bus (UAT Only)	% of MCR	**
** Station consumptions drawn from STs of Unit-1&2.			
For CPRI		For SLDC	For JSW Energy Ltd
<i>M. Siddhartha</i> 14/01/2013		<i>Vasant Pande</i> 14.01.2013	<i>Vikas Shukla</i> 14/01/13
M.Siddhartha Bhatt,		Vasant Pande,	Vikas Shukla
Additional Director		Executive Engineer (Operations)	AVP (OS&TS)



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KSK WARDA



Wardha Power Company Limited

Works
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Chandrapur Dist.
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**Demonstration of Technical Minimum operational load
without oil support**

Sl. No.	Particular	Unit	Values
01	Unit No.	-	1
02	MCR capacity	MW	135
03	Date of commercial operation		15.04.2010
04	Date of test		04.12.2012
05	Time of test		17:00 to 18:00
06	Time period of test	hour	1
07	Ramp up rate	MW/min	4
08	Ramp up rate	%/min	3
09	Ramp down rate	MW/min	4
10	Ramp down rate	%/min	3
11	Technical minimum load at generator terminal	MW	94.7
12	Auxiliary power (per unit)(UAT + ST)	%	10.00
13	Auxiliary power (per unit) (UAT + ST)	MW	13.50
14	Auxiliary power (per unit)(UAT Only)	%	8.00
15	Auxiliary power (per unit) (UAT Only)	MW	10.8
16	Technical minimum load at ex-bus (UAT + ST)	MW	81.20
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	83.90
18	Technical minimum at generator terminal	% of MCR	70.15
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	60.15
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	62.15

For CPRI	For SLDC	For WPCL
	 04.12.2012	
M. Siddhartha Bhatt, Additional Director	Vasant Pande, Executive (Operations) Engineer	Rohit Upadhyay, AGM (Operations)





Wardha Power Company Limited

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**Demonstration of Technical Minimum operational load
without oil support**

Sl. No.	Particular	Unit	Values
01	Unit No.	-	2
02	MCR capacity	MW	135
03	Date of commercial operation		10.04.2010
04	Date of test		04.12.2012
05	Time of test		16:30 to 17:30
06	Time period of test	hour	1
07	Ramp up rate	MW/min	4
08	Ramp up rate	%/min	3
09	Ramp down rate	MW/min	4
10	Ramp down rate	%/min	3
11	Technical minimum load at generator terminal	MW	94.8
12	Auxiliary power (per unit)(UAT + ST)	%	10.00
13	Auxiliary power (per unit) (UAT + ST)	MW	13.5
14	Auxiliary power (per unit)(UAT Only)	%	8.00
15	Auxiliary power (per unit) (UAT Only)	MW	10.8
16	Technical minimum load at ex-bus (UAT + ST)	MW	81.30
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	84.00
18	Technical minimum at generator terminal	% of MCR	70.22
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	60.22
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	62.22

For CPRI	For SLDC	For WPCL
	 04.12.2012	
M. Siddhartha Bhatt, Additional Director	Vasant Pande, Executive (Operations) Engineer	Rohit Upadhyay, AGM (Operations)





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**Demonstration of Technical Minimum operational load
without oil support**

Sl. No.	Particular	Unit	Values
01	Unit No.	-	4
02	MCR capacity	MW	135
03	Date of commercial operation		06.01.2011
04	Date of test		04.12.2012
05	Time of test		13:45 to 14:45
06	Time period of test	hour	1
07	Ramp up rate	MW/min	4
08	Ramp up rate	%/min	3
09	Ramp down rate	MW/min	4
10	Ramp down rate	%/min	3
11	Technical minimum load at generator terminal	MW	93.6
12	Auxiliary power (per unit)(UAT + ST)	%	10.00
13	Auxiliary power (per unit) (UAT + ST)	MW	13.5
14	Auxiliary power (per unit)(UAT Only)	%	8.00
15	Auxiliary power (per unit) (UAT Only)	MW	10.8
16	Technical minimum load at ex-bus (UAT + ST)	MW	80.10
17	Technical minimum load at ex-bus (UAT Only) (INJECTION POINT)	MW	82.80
18	Technical minimum at generator terminal	% of MCR	69.33
19	Technical minimum at ex-bus (UAT + ST)	% of MCR	59.33
20	Technical minimum at ex-bus (UAT Only) (INJECTION POINT)	% of MCR	61.33

For CPRI	For SLDC	For WPCL
	 04.12.2012	
M. Siddhartha Bhatt, Additional Director	Vasant Pande, Executive (Operations) Engineer	Rohit Upadhyay AGM (Operations)

