BHARAT HEAVY ELECTRICALS LIMITED
RC PURAM :: HYDERABAD – 502032
T&C Engineering
Annexure I

Technical Specification for Offloading of Performance Guarantee tests for TG Sets of Industrial and Captive Power Plants

1. Introduction:

1.1 As per contract requirement the guarantees to be proved / demonstrated for STG sets are

- Output at rated and at VWO (valves wide open) condition.
- Output at part loads
- Heat rate or specific steam consumption.
- Aux Power consumption
- Noise level at turbine floor

1.2 The TG sets for which PG tests are to be carried out are located throughout the country. The TG sets are installed in cement, sugar, paper, sponge iron, and steel industries apart from captive power plants ranging from 10 MW to 150 MW capacities. List of projects enclosed.

1.3 The types of turbines are mostly (Controlled) Extraction condensing turbines; and condensing turbines with (re-heat) regenerative Feed heating cycle.

1.4 Operating Parameters:

Inlet steam parameters are 125 ata /535^0 C and below.

2.0 The following documents will be furnished to the party for preparations of PG Test, for each project after the contract is signed with Bidder.

- PG Test scheme
- PG Test procedure

3. 0 Test Code:

In almost all the projects, the applicable test code is DIN 1943 / IEC 953 – part II. Test code of PTC – 6 is to be followed in a few projects. For better understanding by the contractor, three typical PG test schemes are attached which are only informative, but may be used for estimation purpose. The expected no.of sets per year is 21, liable for variation (eg- upto 45 MW range – 8 no.s, from 46 to 80 MW range – 3 no.s and from 81 to 150 MW range – 5 no.s)

a) 3-303-00-82021, PG Test scheme up to 45 MW range, which is a condensing turbine with three uncontrolled extractions with regenerative feed heating system.

b) 3-303-00-93422, PG Test scheme around 80 MW range, which is a condensing turbine with five uncontrolled extractions with regenerative feed heating system.

c) 3-303-00-90122, PG Test scheme around 150 MW range, which is a two cylinder condensing turbine with five uncontrolled extractions and with reheat regenerative feed heating system.

4.0 Instruments required for the test:

4.1 For flow measurement, DP transmitters are to be installed across the second (spare) pair of tap offs of plant flow elements (designed as per ISO - 5167).

4.2 Pressure transmitters & RTD/ TC are to be installed in the place of plant gauges (Pressure Gauge/ dial type thermometers).

4.3 Power meter to be connected at panel / DCS

4.4 The above test instruments are to be suitably connected with cable and the same is to be terminated to the data logger.

4.5 The party shall identify the no .of instruments and its range, based on the test scheme & test procedure

4.6 Details of instruments are given below.

	Accuracy class, min
1. Power analyser , for Generator output measurement	0.10%
2. DP Transmitters & Pressure Transmitters	0.10 %
3. Transmitters for vacuum measurement	0.05 %
4. Four wire RTD (Resistance thermal detectors ,⅓ DIN accuracy)	± 0.2 ° C, t< 100ºC ± 0.5%t> 100ºC
5. Thermocouples	±1ºC , for t < 300ºC ±0.5%, t >300ºC
6. Clamp on Digital Multi meter for aux power measurement below 200 KW	0.5%
7. Data logger With PC and Printer	0.03%
8. HART Communicator	
9. Barometer	
10. Laser type thermometer	
11. Instrument for sound level measurement	

12. The following are required for temporary connection at site for PG Test

- Cables (15M length each to be considered on average),
- Compensating cables for Thermo Couples.
- 4 Wire cable for RTD & 2 wire cable for Transmitters.
- Flexible hoses for DP transmitters and pressure transmitters approximate length of 1.5 meters for each point.

Notes:

1. The required cable length for connecting the instruments for the test is to be assessed during the preliminary visit to site
2. The above requirements are indicative only. However contractor has to ensure other necessary inputs/material if required for successful completion of PG Test

4.7 The party shall ensure availability of calibration certificates for all the above instruments and its validity shall be max one year. Calibration shall be carried out by a reputed test institution like ETDC having traceability to NABL accreditation.

For RTD & thermocouples, the calibration points shall be at an interval / spacing of 25°C covering the working / operating range. For example: the calibration range for an RTD with operating temperature of 250°C , the calibration range may be 0 to 400°C

For other instruments, the calibration shall be with respect to operating parameters range.

5.0. **Scope:**

In short, the party will conduct the test with its own instruments and furnish test data for each test in hard & soft copy to BHEL engineer at site for verification, review and calculations. Detailed scope of work of PG test is given below.

5.1 Pretest visit to site:

- Check availability of tap off points
- Collect set of readings from site at different operating conditions
- Compare them with specified / design values and identify wrong and inconsistent measurement and submission.
- Verify consistency of flow measurement (condensate flow , extraction flow , FW flow & MS flow)
- Verify feasibility of isolating the unit from other units and identify the difference between the PG test scheme & the corresponding layout available at site and suggest revision of PG test scheme if necessary.
- Identify system leakages and assess.

5.2. After getting test schedule from customer**:**

- Mobilise instruments to site
- Installation of RTD / TC, pressure transmitters and cabling to Data logger
- Test DP transmitters installation, connect impulse piping (flex hoses) through manifold and cabling to data logger
- Installation / connection of power analyser
- Installation of power transducer for auxiliary power measurement for BFP and cabling to data logger.

5.3 Test activity:

5.3.1 One set of readings to be taken through data logger for one hour duration at required load, compare average value with design values and check for measurement error and correct the same.

5.3.2. System leakages are to be identified and to be assessed by carrying out deaerator level drop test by isolating the system.

5.3.3 After verifying all the instruments and measurements are in order, preliminary test is to be organized, BHEL engineer will evaluate the data and advise for further checks on instruments if necessary. The preliminary test is to be repeated until consistent & correct results are obtained.

5.3.4 The number of tests is indicated in the test procedure depending on contract / test code and all these tests are to be completed as minimum requirement. If customer requests, one or two tests at part load, same are to be conducted.

5.3.5 Simultaneous measurement of auxiliary power for auxiliaries like CEP, BFP, AOP etc. at rated load.

5.3.6. Instruments are to be removed only after successful completion of the test and with customer's concurrence.

6.0 Estimated number of Instruments for each PG Test are given below

	Qty (approx.) Upto 45MW set	Qty (app.) 80MW set	Qty (app.) 150 MW
1. Data Logger, with PC and printer	1	1	1
2. Power Analyser for Generated Output,	1	1	1
3. Power Transducer for BFP power	1	1	1
4. DP Transmitters	3	3	5
5. Thermocouples	3	3	6
6. RTD	35	45	75
7. Pressure	20	25	35
8. Vacuum transmitter	2	3	4
9. Clamp on digital Multi meter for Aux. Power	1	1	1
10. Atmospheric Pressure Indicator	1	1	1
11. Laser type Thermometer	1	1	1
12. HART communicator	1	1	1
13. Sound level measuring instrument	1	1	1

Vendor to ensure availability of standby instruments in case of any instrument become defective

Notes:

The required data logger features:

1. Average value to be obtained for the chosen interval of readings recorded.
2. Output of the data logger must be in Engg units.
3. Display of variation of important parameters (min to max).
4. Channel scanning rate.

5. No.of channels of the data logger.
6. Provision to apply the calibration error of pressure and temp to the recorded data.
7. Any other feature.

7.0 Contractor's personnel shall have adequate Knowledge on Principles of Measurement of Pressure, Temperature and Flows and Computer Application in MS Office etc.

Qualification:

Team In charge: B.Tech with 5 years experience in Power Plant in TG cycle system

Instrument engineer: B.Tech., with minimum 3 years experience or Diploma with 5 years experience.

Technician: ITI with minimum 2 years experience related to instrumentation.

8.0 The parties shall submit the following details /documents along with their technical offer.

- Plant / commissioning / testing experience of its engineers.
- Details of instruments, its range, accuracy class, make available with the bidder.
- Broachers & any other relevant documents.