



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

Annexure I

Technical Specification for

Off-loading of Performance Guarantee tests for Industrial TG Sets

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.
- 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 up to 100 MW capacity. A list of informative projects for which tests are likely to be carried out during the next two to three years is given in annexure II.

1.3 The type of turbines are mostly (controlled) Extraction condensing turbines; and condensing turbines with regenerative Feed heating cycle.

1.4 Operating Parameters:

Inlet steam parameters are 90 ata /535⁰C 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
- Instrumentation list

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 Bidder, two typical PG test schemes are attached which are only informative, but may be used for estimation purpose.

- a). 3-303-00-62221, PG Test scheme for JP Rewa which is with regenerative feed heating system.
- b). 3-303-00-64021, PG Test scheme for Century pulp & paper which is condensing turbine with one controlled extraction and one uncontrolled extraction.

- 4.0 Instruments required for the test:
- 4.1 For Flow measurement, plant flow elements (designed as per ISO - 5167) are normally used. Separate test DP transmitters are to be installed across the second (spare) pair of tap offs.
- 4.2.1 Pressure transmitters & RTD/ TC are to be installed in the place of plant gauges (Pr. Gauge/ dial type thermometers.).
- 4.2.2 Power meter / Analyser (for generator output measurement) to be connected in the control room.
- 4.3 The above test instruments are to be connected through cable to the data logger, which will be located at one place.
- 4.4 The party shall identify the no .of instruments and its range, based on the test scheme & Instrumentation list.
- 4.5. 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. Absolute Transmitters for vacuum and atmospheric press | 0.05 % |
| 4. RTD (Resistance temperature detectors, 1/3 DIN accuracy) | $\pm 0.2 ^\circ \text{C}$, $t < 100^\circ \text{C}$
$\pm 0.5\%$ $t > 100^\circ \text{C}$ |
| 5. Thermocouples | $\pm 1^\circ \text{C}$, for $t < 300^\circ \text{C}$
$\pm 0.5\%$, $t > 300^\circ \text{C}$ |
| 6. Clamp on, 5 digits display, Digital Multi meter
for auxiliary power measurement up to 300 KW | 0.5% |
| 7. Data logger With Laptop and Printer | 0.03% |
| 8. HART Communicator | |
| 9. Laser thermometer | |
| 10. Instrument for sound level measurement | |
| 11. The following are required for temporary connection at site for PG Test | |
| <ul style="list-style-type: none"> • Cables (15M length each to be considered on average), • Compensating cables for Thermo Couples, • 4 Wire cable for RTD & Transmitters • Flexible hoses for DP transmitters and pressure transmitters approx. length of 1.5 to 2.0 Meters for each point and suitable fittings | |
| The above requirements are indicative only. However Bidder has to ensure other necessary inputs/material if required for successful completion of PG Test | |
| 4.6 The party shall ensure availability of calibration certificates for all the above instruments and its validity shall be 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 50°C covering the working / operating range. For example, the calibration range for an RTD with operating temperature of 45°C, the calibration range may be 0 to 100°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 Pre test 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 inform to BHEL engineers notice.
- Identify system leakages and assess.

5.2. After getting test schedule from customer/BHEL:

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

5.3 Test activity :

- 5.3.1 Take one set of readings through data logger for one hour duration, compare average value with design values and check for measurement error and correct the same .
- 5.3.2. Check for system leakages and asses 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 carried out, 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. On customer requests, if BHEL agrees, one or two tests at part load are also to be conducted.
- 5.3.5 Simultaneous measurement of auxiliary power for auxiliaries like CEP, BFP, AOP etc. at rated load is also to be measured.
- 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 up to 50 MW	Qty. for 51- 100 MW
1. Data Logger, with laptop and printer	1 each	1 each
2. Power Analyser for Generated Output,	1	1
3. Power Transducer for BFP, CEP power	2	2
4. DP Transmitters	3	5
5. Thermocouples	2	5
6. RTD	25	50
7. Pressure transmitter	25	50
8. Absoute Trasnsmitter	3	5
9. Clamp on digital Multi meter for Aux Power measurement. (5 digits display)	1	2
10. Laser type Thermometer	1	1
11. HART communicator	1	1
12. Sound level measuring instrument	1	1
13. Multi meter	1	1

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

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

Qualification:

- Team In charge: B.Tech with 5 years experience in Power Plant in TG cycle Systems.
- 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.
- 8.1 Plant / commissioning / testing experience of its engineers
- 8.2 Details of instruments, its range, accuracy class, make available with the bidder.
- 8.3 Broachers & any other relevant documents.