Annex LTSA-4

Material and Service Guarantees and Liquidated Damages

1 General

This Annex sets out
(a) the Material and Service Guarantees referred to in GCC Clause 27
(b) the preconditions to the validity of the Material and Service Guarantees, either in production and/or consumption, set forth below
(c) the formula for calculation of liquidated damages for failure to attain the Material and Service Guarantees.

2 Preconditions

The Contractor gives the Material and Service Guarantees (specified herein), subject to the preconditions defined in Paragraph 3 below being fully satisfied.

All conditions and remarks herein refer to each gas turbine separately. References to the LTSA value mean the total value divided by the number of gas turbines.

3 Guaranteed Open Cycle Net Power Output and Guaranteed Net Heat Rate

The Reference Guaranteed Open Cycle Net Power Output is equal to \( \text{[to be added from EPC Contract]} \) kW and the Reference Guaranteed Open Cycle Net Heat Rate is equal to \( \text{[to be added from EPC Contract]} \) kJ/kWh (based on LHV at \( \text{[to be added from EPC Contract]} \) conditions) for the new and clean condition as per the Performance Guarantees provided under the EPC Contract and in compliance with the Environmental Standards (as defined in the EPC Contract). The Guaranteed Performances, after each relevant Planned Maintenance Services Intervention, shall be provided according to the table 1 below. In addition guaranteed degradation curves, provided by the GT manufacturer shall be integral part of these guarantees.

If the EOH at Performance Test following a minor inspection does not match the values indicated in the table 1 below, the correct guaranteed factor shall be calculated by prorating through linear interpolation of the degradation factors given in the table below.

In case of major inspection (M) and hot gas path inspection (HGPI) the degradation factor indicated in Table 1 below will apply with no respect of the relevant number of EOH or other factors defining degradation.
Table 1 – Open Cycle performance degradation factors

<table>
<thead>
<tr>
<th>EOH</th>
<th>8000</th>
<th>16000</th>
<th>24000</th>
<th>32000</th>
<th>40000</th>
<th>48000</th>
<th>56000</th>
<th>64000</th>
<th>72000</th>
<th>80000</th>
<th>88000</th>
<th>96000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Output Degradation Factor (POD_LTSA) (%)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Heat Rate Degradation Factor (HRD_LTSA) (%)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

The **Net Power Output** $\text{OCNO}_{\text{LTSA}}$ for each operation period under the LTSA shall be defined as:

$$\text{OCNO}_{\text{LTSA}} = \text{OCNO}_{\text{Reference}} \times (1 - \text{POD}_{\text{LTSA}})$$

Where:

- $\text{OCNO}_{\text{LTSA}}$: Guaranteed Open Cycle Net Power Output taking the degradation into account
- $\text{OCNO}_{\text{Reference}}$: Reference Guaranteed Open Cycle Net Power Output as defined above (subject in any case to the specification provided here below)
- $\text{POD}_{\text{LTSA}}$: Power Output Degradation Factor as defined in the Table 1 above.

The **Heat Rate** $\text{OCHR}$ for each operation period under the LTSA shall be defined as:

$$\text{OCHR}_{\text{LTSA}} = \text{OCHR}_{\text{Reference}} \times (1 + \text{HRD}_{\text{LTSA}})$$

Where:

- $\text{OCHR}_{\text{LTSA}}$: Guaranteed Open Cycle Net Heat Rate taking the degradation into account
- $\text{OCHR}_{\text{Reference}}$: Reference Guaranteed Open Cycle Net Heat Rate as defined above (subject in any case to the specification provided here below)
- $\text{HRD}_{\text{LTSA}}$: Heat Rate degradation Factor as defined in the in the Table 1 above.

The basis for the Reference Net Power Output and the Reference Net Heat Rate as indicated above are the guaranteed figures provided by the EPC Contract. However, if during the Performance Test carried out pursuant to the EPC Contract, the Net Power Output is higher or lower than the Net Power Output Guarantee under the EPC contract, the actual “as tested” Net Power Output shall be used as the Reference Net Power Output indicated in the above formula ($\text{OCNO}_{\text{Reference}}$).

The reference values shall be fixed without tolerance. The measurement uncertainty of the performance measurements under the LTSA shall be allowed with +/- 0.5%.

The test procedure (method) and equipment of measurements under the LTSA shall be the same to that used for the EPC Contract.

Similarly, if during the Performance Test carried out pursuant to the EPC Contract the Net Heat Rate is higher or lower than the guaranteed value, the “as tested” Net Heat Rate shall be considered the Reference Net Heat Rate indicated in the above formula ($\text{OCHR}_{\text{Reference}}$).

The Guaranteed Performances under this LTSA shall be subject to the following conditions:

(a) Any relevant performance measures will be carried out within 72 hrs from the restore full load capability by means of specific instrumentation provided by the Contractor or by other qualified supplier or installed in the Plant and calibrated mutually recognized and agreed entity. The cost of the measures, for the test report and for the temporary instrumentation...
installed will be borne by the Contractor for Performance Test after each HGPI and M under LTSA time period. The execution of the performance test after each minor inspection is optional and may be requested by the Employer. In such case the Employer shall pay the Contractor a sum equal to the sum stipulated in Annex 1 to the Long Term Service Agreement as extra price for the costs associated to the execution of the relevant performance test (temporary instrumentation, test report, measures, etc.) while the Contractor shall guarantee the performance degradation as defined in table 1 above.

(b) Gas Turbine shall be operated in compliance with the O&M Manual.

c) The fuel shall meet the requirements of the EPC Contract.

d) The Ordinary Maintenance (including compressor water washing, air filter maintenance) shall be performed in accordance with the O&M Manual.

e) The Employer shall operate the Plant in such a way to keep in good and clean conditions the Covered Unit in accordance with the O&M Manual, in particular making at least one gas turbine on-line compressor washing once a week (provided in any case that this is in compliance with any relevant Contractor's recommendation); the off-line compressor washing shall be carried out every time is reasonably possible without penalising the availability of the Plant (to the extent reasonably possible, once per month); in any case the maximum interval between two off-line compressor washings shall not be longer than 1500 EOH.

(f) Condition of air filter shall be verified and air filters shall be cleaned or replaced in accordance with the relevant provisions of the O&M Manual.

(g) The Gas Turbines shall be operated at all times with those settings relevant to Output and Heat Rate being the same as the settings during the Performance Test of the EPC Contract.

4 Guaranteed Equivalent Availability Factor

The availability guarantee shall commence without any grace period at the Commercial Operation Date.

The Guaranteed Equivalent Availability Factor (EAF) for each Annual Maintenance Period shall be provided according to the following.

For the first two years of operation:

[The following values shall be entered from the Contractor after clarifications into this Annex to the Long Term Service Agreement]

- year with minor inspection: XX.X%
- Year without minor inspection: XX.X%

For the successive years:

- year with minor inspection on GT: XX.X%
- year with HGPI: XX.X%
- Year with MO: XX.X%
- Year without inspections: XX.X%

The availability shall be calculated with the time base method.

\[
EAF = \left(1 - \frac{POH + UOH + UNDH}{PH}\right) \times 100
\]

whereas:
EAF: Equivalent Availability Factor

PH: Period hours (8760 hours and 8784 in the leap years)

UOH: Unplanned and forced outages (in hours) of the Covered Unit beyond the Planned Maintenance outages under Contractor’s responsibility, which result in a standstill of the Covered Unit.

UNDH: Unplanned and forced outages (in hours) of the Covered Unit beyond the Planned Maintenance outages after any failure event under Contractor’s responsibility, which results in a derating of the power output of the Covered Unit.

POH: Planned outage of the Covered Unit in hours to perform Planned Maintenance Services.

\[
UNDH = \frac{MW_{before} - MW_{after}}{MW_{before}} \times \text{duration of event (hours)}
\]

where:

MW_{before} = Gross Power Output before forced outage or de-rating event

MW_{after} = Average Gross Power Output for forced outage or de-rating

The de-rated hours to be considered for the calculation of EAF shall be only those related to forced de-rating caused by failures, defects or anomalous behavior of the Covered Unit.

Possible de-rating due to Frequency Control Mode or partial load operation, if any, will be not as well considered for the calculation of EAF.

For the purposes of calculating time for the Availability Guarantees the following events shall be excluded:

- outages caused by units and equipment not covered by the LTSA;
- Impediment to carry out the Contractor's Services due to Employer or other Employer’s contractors carrying out maintenance services not associated with the Covered Unit;
- instability of the grid providing the occurrence of any de-loading or trips in accordance with the design criteria specified in the EPC Contract;
- off-line compressor washing.
- Outages for which the Contractor is not responsible or which are due to an Event of Force Majeure or to failures in or from the grid;
- unavailability of fuel, water, consumables and any other fluids, necessary for the operation or maintenance of the Covered Unit for which the Contractor is not responsible;
- fuels, water and other consumables which did not meet any relevant specifications provided in the O&M Manual, especially in regard to but not limited to quality, conditions, constituents, maximum allowed limit of contaminant, etc.;
- unusually high level of dust, contaminants or corrosive constituents in ambient air;
- inability of the grid to take over the electricity produced by the Covered Unit;
impossibility of the Contractor to perform the necessary failure probes and to restore
unscheduled outages and failures because of denied access to the Covered Unit, denied work
(for reasons independent from Contractor responsibility) or unavailability of Unit
lifting/handling equipment or the necessary documentation by the Employer or a third party,
if not under Contractor’s responsibility;

- Deliberate outage by the Employer.

- Time, if any, necessary for Performance Tests preparation, including installation and
removal of ad-hoc instruments;

The Guaranteed Equivalent Availability Factor (EAF) is based upon a base load operating regime.
If the actual operating mode deviates significantly from the conditions stipulated above, especially
concerning the fired hours/starts ratio and the number of annual operating hours, the Contractor
may apply for Employer’s approval, which shall not be unreasonably withheld, to correct the
guaranteed availability factor level to the new plant operating conditions.

These corrections shall be limited to the influence of the operating regime on the scheduled outage
maintenance plan and the influence of higher operating stresses on the risk of unscheduled outages.
The guaranteed values for the availability (EAF) shall be modified as follows as a function of the
number of starts:

[The following values shall be inserted from the Contractor after clarifications into this Annex to
the LTSA]

<table>
<thead>
<tr>
<th>Number of starts per guarantee period</th>
<th>Reduction of the guaranteed availability (EAF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>52 ÷ 100</td>
<td>-0,X %</td>
</tr>
<tr>
<td>100 ÷ 150</td>
<td>-X.X %</td>
</tr>
<tr>
<td>150 ÷ 200</td>
<td>-X.X %</td>
</tr>
<tr>
<td>200 ÷ 250</td>
<td>-X.X%</td>
</tr>
</tbody>
</table>

As a maximum 260 starts are allowed per year.
The unavailable outage/de-rating time begins with the moment in which the Covered Unit ceases
(partly or completely) to export electricity to the grid because of sudden loss of functionality or is
declared unavailable (totally or in part) to the dispatcher. Downtime preparatory activities for
Planned Maintenance Services or Unplanned Maintenance Services in which the Covered Unit is
still able to resume operation to full load if requested by the dispatcher shall be considered as
available time. Cooling of GT is considered as unavailable.

The unavailable outage/de-rating time ends when the Covered Unit declares itself again available
to the grid for restart or load pick-up to 100% load.

During the shutdown periods for reason not chargeable to the Contractor, maintenance activities
can be performed without effect on availability evaluation, if mutually agreed by the parties.
5 Guaran ted Start-up Reliability

The Contractor guarantees that the gas turbine shall follow the start-up curves (diagram of plant load over time) as provided under the EPC Contract.

The GT Start-up Reliability (SRF) is an important factor for the cycling operation mode. The guarantee shall commence without a grace period immediately after Substantial Completion. The data shall be provided according to the table below.

[The following values shall be entered from the Contractor after clarifications into this Annex to the LTSA]

<table>
<thead>
<tr>
<th>Operating Year</th>
<th>1</th>
<th>2</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start-up Reliability Factor (SRF_LTSA) (%)</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
</tbody>
</table>

The definition of the Start-up Reliability Factor SRF for the gas turbine shall be:

\[ SRF = \frac{NSS}{NSS + NFS} \]

Where:

NSS: Number of successful starts of the gas turbine per year up to the power output intended to reach including a holding time of that power output of not less than 2 minutes

NFS: Number of failed starts of the gas turbine per year not reaching and holding the intended power output for at least 2 minutes

6 Failure in Guarantees and Liquidated Damages

6.1 GT Net Power Output and GT Net Heat Rate

For each negative percentage point of Net Output Deviation (NOD), rounded to the nearest hundredth of a percent, the Contractor shall pay the Employer liquidated damage equal to USD 96’000 per annum.

\[ NOD = \frac{(GTNO_{\text{Actual}} - GTNO_{\text{LTSA}})}{GTNO_{\text{LTSA}}} \times 100 \]

Where:

NOD: Net Output Deviation

GTNO\_Actual: GT Net Power Output from performance test of each major inspection or hot gas path inspection

For each positive percentage point of GT Net Heat Rate Deviation (NHRD), rounded to the nearest hundredth of a percent, the Contractor shall pay the Employer liquidated damage equal to USD 180’000 per annum.

\[ NHRD = \frac{(GTHR_{\text{Actual}} - GTHR_{\text{LTSA}})}{GTHR_{\text{LTSA}}} \times 100 \]

Where:

NHRD: Net Heat Rate Deviation

GTHR\_Actual: Net Heat Rate from performance test of each major inspection or hot gas path inspection

Performance tests shall be conducted using the ASME PTC22 standard and the correction curves submitted with the EPC bid.
6.2 **GT Equivalent Availability Factor**

For each percentage of the guaranteed EAF, rounded to the nearest hundredth of a percent where the GT’s actual EAF is less than the guaranteed EAF of the LTSA, the Contractor shall pay the Employer liquidated damage equal to USD 96’000 per percentage point per year.

For each percentage of the guaranteed EAF, rounded to the nearest hundredth of a percent where the GT’s actual EAF exceeds the guaranteed EAF of LTSA, the Employer shall pay a bonus to the Contractor equal to USD 96’000 per percentage point per year.

7 **Limitation of Liquidated Damages**

The Contractor’s total aggregate liability to pay liquidated damages for failure to attain the Material and Service Guarantees shall not exceed 100 percent (one hundred percent) of the contract price of the LTSA.

The Contractor’s aggregate annual liability to pay liquidated damages for failure to attain the Material and Service Guarantees shall not exceed 100 percent (one hundred percent) of the annual contract price of the LTSA.

The total aggregate liability of the Contractor to the Employer whether under the Contract, in tort or otherwise, shall not exceed the total Contract Price, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment under guarantee, or to any obligation of the Contractor to indemnify the Employer with respect to patent infringement.

The aggregate liability in each period of 3 years (years 1 to 3, years 4 to 6, years 7 to 9, etc.) of the Contractor to the Employer whether under the Contract, in tort or otherwise, shall not exceed the Contract Price of 3 years (years 1 to 3, years 4 to 6, etc.), provided that this limitation shall not apply to the cost of repairing or replacing defective equipment under guarantee, or to any obligation of the Contractor to indemnify the Employer with respect to patent infringement.