[AUTHORITY LOGO]	
[Project Name]	
Schedule Part 6 Construction Matters **Section 7** Thermal and Energy Efficiency Testing Procedure	**Title:** Thermal and Energy Efficiency Testing Procedure
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[Authority Action Note – This template document should be read and completed in line with the SFT's Schedule Part 6 Section 7 – Guidance Note]

SCHEDULE PART 6 (CONSTRUCTION MATTERS)

SECTION 7

THERMAL AND ENERGY EFFICIENCY TESTING PROCEDURE

In this Section 7 (*Thermal and Energy Efficiency Testing Procedure*) of Schedule Part 6 (*Construction Matters*) and elsewhere in this Agreement (save where Schedule Part 1 provides to the contrary) the following words and expressions shall have the following meanings:

As Built Energy Model	means the Energy Model as updated and approved in accordance with paragraph [2] below
Energy Model	means the energy model contained in [ ] of Sub-hubco's Proposals[1];.
Energy Performance Criteria	means the Authority's requirements in relation to achieving a minimum performance for [BREEAM credit ENE 01[2]] as set out in Section 3 (*Authority's Construction Requirements*) of Schedule Part 6 (*Construction Matters*); [or, if improved, the minimum performance for [BREEAM credit ENE 01] as set out in Section 4 (*Sub-hubco's Proposals*) of Schedule Part 6 (*Construction Matters*);]

1. **INTRODUCTION**

This Section 7 of Schedule Part 6 sets out the structure and main principles of the thermal and energy efficiency testing procedures to be carried out by Sub-hubco at the Facilities in order to ascertain the predicted performance of the Facilities against the Energy Performance Criteria.

2. **AS BUILT ENERGY MODEL**

2.1 Prior to the Commissioning End Date and in accordance with the Final Commissioning Programme Sub-hubco shall update the Energy Model to include the following:

2.1.1 as-built building envelope and construction materials performance;

[1] The Energy Model should be developed using approved software and agreed between the Authority and Sub-hubco prior to Financial Close for inclusion in Sub-hubco's Proposals.

[2] Energy Performance requirements will be specific to each project and need to be agreed between the Authority (in conjunction with its technical advisors) for inclusion in the Authority's Construction Requirements. A minimum of achieving a BREEAM 'Excellent' level of performance for credit ENE 01 'Reduction of Emissions' is one measure of energy performance that an Authority may wish to consider.

2.1.2 as-installed manufacturers' plant and components information, including all associated operating parameters such as co-efficients of performance and specific fan powers;

2.1.3 results of building wide commissioning of completed installations including, but not limited to, all Heating, Ventilation and Cooling (HVAC) systems and lighting systems; and

2.1.4 results of commissioning period tests as detailed in and carried out in accordance with paragraph 3 below

and shall submit the same to the Authority for review and approval together with a report, compiled in accordance with Good Industry Practice, containing supporting input and test information.

2.2 In updating the Energy Model pursuant to paragraph 2.1 above, Sub-hubco shall not amend any parameters in the Energy Model other than with the agreement of the Authority or where those parameters are affected by information and commissioning tests detailed in paragraph 3 below. The report submitted by Sub-hubco pursuant to paragraph 2.1 above must highlight any changes to input parameters from the Energy Model and the reasons for such changes.

3. COMMISSIONING PERIOD TESTS

3.1 Introduction

3.1.1 Notwithstanding Sub-hubco's obligation to undertake all commissioning requirements of Schedule Part 10 (*Outline Commissioning Programme*) and its Appendix B (*Completion Criteria*), Sub-hubco shall undertake the following commissioning period tests as part of Sub-hubco's Pre-Completion Commissioning in an agreed test zone (or with respect to the air tightness test for all zones in the Facilities), to be agreed by the Authority and Sub-hubco, both parties acting reasonably, to demonstrate the actual performance of the Facilities against the Energy Performance Criteria:

3.1.1.1 air tightness test;

3.1.1.2 internal lighting installation test;

3.1.1.3 building fabric performance test; and

3.1.1.4 seasonal heating, cooling and ventilation installation testing.

3.1.2 Sub-hubco shall incorporate the results of the commissioning period tests as detailed in this paragraph 3, in the As Built Energy Model.

3.1.3 Sub-hubco shall interpolate all results from the commissioning period tests such that the confirmed performance of the Facilities following the commissioning period tests is applied across the complete Facilities in the As Built Energy Model.

3.1.4 Sub-hubco shall submit all commissioning period test results and interpolative calculations to the Authority as part of their As Built Energy Model submission for the Authority's review and approval.

3.1.5 Indicative methodologies for the commissioning period tests are outlined below, however the final extent and scope of the tests to be undertaken shall be developed by Sub-hubco and agreed by the Authority and Sub-hubco, both parties acting reasonably.

3.2 **Air Tightness Test**

3.2.1 Sub-hubco shall carry out an air tightness test for the Facilities as outlined in and in compliance with the Scottish Technical Standards and as detailed in CIBSE Technical Memorandum TM23-2000.

3.2.2 This air leakage rate must demonstrate the construction quality of the Facilities and allow a direct correlation to the assumed value used in the As Built Energy Model, detailed in m^3/m^2/hour at an internal pressure of 50 Pascals.

3.3 **Internal Lighting Installation:**

3.3.1 The lighting installation serving the agreed area/zone shall be completed, commissioned and operational and manually enabled for an agreed fixed period of time.

3.3.2 All lighting controls tested shall be the same as those installed in the Facilities and shall include all automatic presence and photocell sensors, time controls and manual switching/dimming controls.

3.3.3 The operating usage and hours for the lighting installation within the test zone and period shall be as the operating profiles in the Energy Model.

3.3.4 The lighting distribution board feeding the agreed area/zone shall be separately metered to provide the actual energy consumption for that area which shall confirm, or otherwise inform, the lighting system efficiency in the As Built Energy Model.

3.3.5 Sub-hubco shall undertake light meter tests in the agreed area/zone to confirm, or otherwise inform, the lighting levels within the respective areas in the As Built Energy Model.

3.4 **Building Fabric Performance**

3.4.1 The thermal performance of the Facilities building fabric shall be assessed by Sub-hubco within the agreed area/zone.

3.4.2 Sub-hubco shall undertake the necessary tests to confirm the thermal performance of windows, external doors, ground floor, roof and external wall areas, as agreed between Sub-hubco and the Authority, both parties acting reasonably, within the agreed test zone.

3.4.3 Sub-hubco shall further undertake thermographic surveys, to the relevant British Standards, of the agreed test areas to prove the quality of the thermal performance of the Facilities.

3.4.4 The thermal performance assessment in the agreed test zone shall confirm the thermal performance figures used for the building constructions, and all assumptions on thermal bridging, assumed within the As Built Energy Model.

3.5 **Seasonal Heating, Cooling and Ventilation Installation Testing**

3.5.1 Energy testing of the heating, cooling and ventilation system shall require seasonal testing of the completed, commissioned and operational main heating plant and any cooling and ventilation plant serving the agreed area/zone.

3.5.2 The Final Commissioning Programme shall incorporate, as part of Sub-hubco's Pre-Completion Commissioning, the ability to monitor the heating, and any cooling and ventilation, installations during extremes of ambient conditions, for example testing heating systems within the winter months, and testing cooling systems in the summer months complete with fully simulated heat gains, as agreed with the Authority in the Energy Model, both parties acting reasonably.

3.5.3 The main heating/cooling distribution pipework feeding the agreed test area/zone shall be separately metered (for the test area/zone) and the BMS/controls installation shall require to be manually adjusted to simulate an agreed operating period.

3.5.4 Ventilation systems shall be assessed at maximum power on maximum pressure drop across the system.

3.5.5 The fuel and power serving the agreed area/zone heating, cooling and ventilation systems shall be further separately metered to provide the actual energy consumption for those services within that area.

3.5.6 The actual power consumption of the installations during the testing period will confirm, or otherwise inform, Sub-hubco's assumed co-efficients of performance, specific fan powers and energy efficiency ratings for the heating, ventilation and cooling systems in the As Built Energy Model; this being based on fuel and power inputs, heat/air flow rates/cooling outputs and associated ambient conditions during the testing procedures.