NORTH LONDON WASTE AUTHORITY

ICHEME

SCHEDULE 13: PRE-INSTALLATION TESTS AND PROCEDURES

CONTENTS

1.	**Introduction**	**2**
2.	**Factory Acceptance Tests (FAT)**	**3**
2.1	Mechanical Systems	3
2.1.1	Systems designed in accordance to the ruling Pressure Equipment Directive	3
2.2	Control and Monitoring System (CMS)	4
2.3	Electrical Systems	5
2.4	Computerised Maintenance Management System (CMMS)	5
2.5	Continuous Emissions Monitoring System (CEMS)	5
2.6	Building Services	6
2.7	Architectural Components	6
2.8	Other Systems	6

1. INTRODUCTION

This Schedule covers pre-installation tests and procedures applicable to the Works and includes off-site inspections and tests, including one or more Factory Acceptance Test (FAT), before all appropriate equipment is transported to Site and installed. For equipment in which FAT is not appropriate, for example instances where FAT would void calibration, the Project Manager may agree to Site Acceptance Testing (SAT), as detailed in Schedule 14 *Criteria for the completion of construction,* and evaluation of the manufacturer's quality documentation. However, such instances in which FAT is not required is at the sole discretion and approval of the Project Manager.

The Contractor shall ensure that pre-installation tests include appropriate inspections and functional tests to demonstrate that the equipment can be operated safely and in accordance with the design specifications and operations and maintenance manuals.

In accordance with Schedule 2 *Documentation*, the Contractor shall submit a plan of the testing and inspection. A preliminary plan shall be delivered 1 month after the Effective Date and be updated by the Contractor as subcontracts are awarded. All such updates are to be described in the Contractor's monthly progress report.

The Contractor shall submit a complete and detailed Inspection and Test Plan (ITP) before manufacture of the equipment commences and no later than one (1) month after the relevant subcontract has been awarded. The Contractor shall ensure the ITP includes all the relevant information relating to the FATs and that it is maintained and kept up to date. Any proposed changes to the ITP shall require prior approval by the Project Manager.

The Project Manager will advise the Contractor of each FAT it and/or nominated parties, including the Operator, ~~intended~~intend to witness, and the Contractor shall arrange and facilitate all such witnessing. ~~The~~Subject to Clause 22 of the Conditions of Contract, the Project Manager reserves the right to inspect any and all Documentation and Materials supplied as part of the Works, regardless of inclusion on the ITP, and to consider compliance with relevant Legislation or insurance requirements. The Contractor shall provide a notice period of at least one (1) month for FATs with a duration of more than eight (8) hours where the Purchaser and/or its nominated parties are required to obtain a travel visa. All other FATs require a notice period of at least fifteen (15) Business Days for tests to be undertaken away from the Site.

The Purchaser may nominate a representative and/or an approved independent third party to perform inspections on the Purchaser's and Project Manager's behalf. In the event of a failure of FAT test, the Contractor shall bear all costs of the additional trip(s) needed for the Project Manager and Purchaser and/or nominated parties to witness the repeated testing.

The Contractor shall provide records, results and calculations of all pre-installations tests conducted as soon as practicable and in any event no more than two weeks after the date of the test. The Contractor shall ensure records are kept in accordance with quality management requirements as specified in Schedule 6 *Quality assurance.*

The Contractor shall ensure that the pre-installation tests are carried out in accordance with the detailed ITP as described in this Schedule.

The Contractor shall not accept nor receive on Site any components that have not passed FAT. In specific cases, components which have failed a FAT can be accepted on Site if agreed in advance and confirmed in writing by the Project Manager. Note the Project Manager has no obligation to accept delivery of components that have failed FAT. In such a case, the Contractor shall submit a non-conformity-report (NCR) to the Project Manager which describes the cause for the failed FAT and any Defects in the component. NCR's shall follow applicable QA / QC systems and procedures as described in Schedule 6 *Quality assurance and validation*.

2. FACTORY ACCEPTANCE TESTS (FAT)

The Contractor shall execute various inspections and tests at its workshops / factories and those of its Subcontractors in the presence of the appropriate technical and Subcontractor representatives. The inspections and tests shall verify that the equipment is supplied and can perform in accordance with the appropriate standards and with the Specifications and requirements of the Contract. Any faults, errors or omissions identified at the FAT shall be corrected before installation at Site.

The Contractor shall carry out a “pre-FAT”, where applicable, for equipment that will operate through the control and monitoring system (CMS). Pre-FATs shall involve both the programmers and the respective process specialists / engineers before the actual FAT is carried out (involving participation of the Project Manager and Purchaser). The “pre-FAT” is carried out with the purpose of eliminating malfunctions concerning general functionality and operator and engineer interfaces. The Contractor shall prove that a “pre-FAT” has been executed by means of filled-in checklists.

The Contractor shall ensure that the FAT demonstrates the overall functionality without being interrupted by faults that require correction. This will allow the Project Manager and Purchaser to focus on the overall process implementation and overall functionality of the CMS system when they participate.

Each FAT shall be carried out for all single functionalities, for groups of functionalities and for all process equipment. The following sections outline areas of equipment that the Contractor must consider as part of the FAT:

2.1 Mechanical Systems

The Contractor shall ensure that FAT shall as a minimum be carried out for the following mechanical systems (the list is not exhaustive and not prioritised):

- Ash and IBA conveyor systems
- Rotating units including pumps, fans, compressors
- Primary air fans
- ID fans
- Turbine parts
- Gears
- Dust removal equipment
- SCR equipment
- Flue gas treatment components (tanks, vessels, scrubbers, waste water treatment)
- Cranes
- Make-up water plant
- Raw water pumping and treatment plant
- Water and steam chemical injection
- Odour control system

2.1.1 Systems designed in accordance to the ruling Pressure Equipment Directive

The Pressure Equipment Safety Regulations (PESR) 2016 applies to the design, manufacture and conformity assessment of pressure equipment and assemblies with a maximum allowable pressure greater than 0.5 bar such as but not limited to:

- Incinerator and boiler pressure parts
- Heat exchangers
- Tanks, vessels

- Pipe systems
- Safety and pressure accessories
- Assemblies

These tests shall include inspection of foundries, machining of components, balancing of rotating equipment etc.

It shall be emphasised that the above list does not relieve the Contractor of carrying out FAT for other mechanical systems as required.

2.2 Control and Monitoring System (CMS)

The Contractor shall ensure and witness that each system relating to the CMS is tested at one joint FAT and that each system is fully tested in all operational areas.

The FAT shall cover final functional tests of all application software prepared for Site operation with simulated inputs and outputs connected. During the loop testing the CMS failures shall be recorded on test incident sheets. The CMS data links shall be 100% tested. A 100% string test with system panels and operator interfaces connected by data link / hardwired cables shall be performed. The equipment shall be subject to functional tests following shipment and re-assembling of CMS at Site.

The Contractor shall ensure that the tests prove the operation of the CMS (every part of it) and its performance under all conditions and sequences which may arise in service. The Contractor shall address all FAT requirements for specific safety systems as defined in IEC 60518. Testing shall include, but not be limited to, the following:

- Exercising of all hardwired inputs/outputs and associated logic
- Exercising of all internal signals and associated logic, including those distributed via data link throughout the CMS
- Exercising and presentation of all user interface and facilities including graphics
- Checking all equipment failure modes, i.e. self-diagnostic, power supply dip, I/O, memory battery back-up etc.
- Memory and control processor functions not used in the software shall be fully tested and exercised
- Interaction between logic channels to be checked
- Demonstrate the degeneration and recovery of the CMS following different possible hardware and software failures. This shall include detection of communication errors, and the operation of any self-diagnostic facilities
- Demonstrated the capability of the CMS to remain in operation during corrective maintenance work
- Demonstrate operating of CMS facilities including load, dump, initialisation and recovery
- Demonstrate connection of peripheral devices such as disc drives, VDU’s and printers
- Demonstrate the correct operation of all communication protocols used in the CMS
- Tests on all modules of the CMS demonstrating that all requirements in each area have been met
- Electromagnetic compatibility testing
- Safety system (Failsafe system)

The ITP shall define any database to be used for testing. The content of the databases shall be subject to review by the Project Manager.

The Contractor shall ensure that all system documentation is complete and residing at the CMS. All listings must be free of pencilled /patched corrections and the CMS must be free of patches. All hardware diagnostic programs shall run during FAT.

2.3 Electrical Systems

The Contractor shall ensure that the FAT shall, as a minimum, be carried out for the following electrical systems (the list is not exhaustive and not prioritised):

- Generator and excitation system
- Transformers
- Medium voltage switchboards
- Low voltage switchboards and motor control centres
- Essential supply equipment (to include emergency generating sets, batteries and UPS)
- Motors
- Variable speed drives
- Motor protection relays

At the FAT for LV assemblies, the Contractor shall make the design verification file available for inspection.

Type tests shall be according to the IEC standards and be carried out or have been carried out on equipment of a similar type and rating. Type test documentation shall be provided for the following:

- Generator and excitation system
- Neutral earthing equipment
- Isolated phase busduct
- Step-up transformer
- Generator circuit breaker
- Medium voltage switchgear
- Motors ≥ 250kW

The Contractor shall ensure that complete copies of certified type test results shall be presented to the Project Manager for consideration one month after the relevant subcontract for equipment supply has been awarded. If appropriate type test certification cannot be provided to satisfy the Project Manager then type tests shall be carried out in accordance with the requirements of relevant standards and this Specification.

All instruments used shall have valid calibration certificates, and calibration data shall be made available to the Project Manager on demand.

It is emphasised that the above does not relieve the Contractor of its responsibility to carry out any other FAT or tests for other electrical systems as required.

2.4 Computerised Maintenance Management System (CMMS)

Detail of the CMMS system to be installed is given in Schedule 22.3.4 *Data Manual CMMS.*

The Contractor shall ensure that the FAT covers the final functional tests of all application software prepared for Site operation with simulated inputs and outputs connected. The Project Manager shall witness population of the input list database, and satisfactory operation of all human machine interface units and servers. The Project Manager shall witness satisfactory integration with all required software packages and platforms.

2.5 Continuous Emissions Monitoring System (CEMS)

The Contractor shall ensure that the FAT covers the final functional tests of all application software prepared for Site operation with simulated inputs and outputs connected. The Project Manager and/or nominated parties shall witness population of the input list database, and satisfactory operation of all human machine interface units and servers.

Each system and each instrument relating to the CEMS shall be tested using simulation and test materials as necessary to demonstrate the safe and reliable functioning across the range of

operating scenarios likely to be encountered, all in accordance with UK regulatory requirements and Good Industry Practice. Test results and calibration information shall be provided to support the FAT.

2.6 Building Services

The Contractor shall ensure that the installation, commissioning and operation of the building services systems comply with the relevant legislation, CIBSE codes, British Standards and authorities' requirements.

The Contractor shall carry out any FAT testing on equipment as necessary to ensure that the performance requirements of building services systems are fulfilled in accordance with the detail design Specification.

2.7 Architectural Components

For architectural components, refer to all testing processes set out in Schedule 22.4 *Architectural specifications.*

2.8 Other Systems

The Contractor shall ensure that FAT shall as a minimum be carried out for the following other systems (the list is not exhaustive and not prioritised):

- Equipment related to fire detection, suppression and protection (see Schedule 22.16);
- Weighbridges (see Schedule 22.1.4).

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