

Sustainable Hotel *Siting, Design and Construction*



The industry guide to good practice

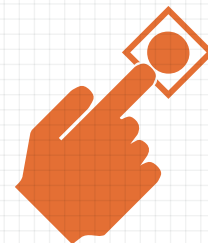
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COMMISSIONING AND OPERATION



Although the building may appear to be complete, commissioning is the true test of whether it functions as a system. Commissioning is best described as the process of ensuring that a building performs according to its design intent and to suit the needs of its owners and occupants.⁶⁵ Proper commissioning of the hotel's mechanical, electrical and plumbing installations is essential to achieve optimum energy efficiency once the building commences full operation. If the water and air systems are not balanced, the equipment will have to run longer and harder to maintain comfort conditions, which increases operating costs and environmentally harmful emissions. Guests may have to wait longer until hot water flows from the tap or for the air-conditioning to respond.



Main image:
Commissioning involves a multitude of inspections, assessments and preparations.

Right: Thermal imagery to check the operation of cooling coils and a chilled ceiling.

Pictures courtesy The Commtech Group.



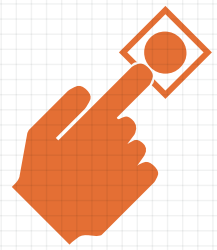
Commissioning is important for any building project, although its role differs according to the size of the individual building and its location. In some countries there is a 'commissioning leader' or dedicated engineer responsible for commissioning, in others it is the responsibility of the designers and contractors. The earlier in the development process it can be started, the more effective it will be, as it is commissioning that generally reveals any weaknesses in the design and construction. Benefits include fewer defects at handover, timely completion and fewer complaints during the building's operational life.

The performance of each system and item of equipment item must be documented in the commissioning report. As buildings and their systems become more complex, so the requirement for commissioning has developed. The process not only ensures that all systems are in good working order, but also confirms that all specified capacities are being achieved. This data can also be used as part of the company environmental management system such as ISO 14001 and in corporate environmental performance reporting.

⁶⁵ 'Achieving the Desired Indoor Climate: Energy Efficiency Aspects of System Design', The Commtech Group, 2003, www.commtech-group.com



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7.1 Planning and design

- A** **Appoint** the commissioning engineer at the earliest opportunity. It is preferable to have one person with overall responsibility for commissioning and ensuring that the building objectives and schedules are met.
- B** Keep systems as **simple** as possible but ensure that adequate time provision is built in for accurate and efficient testing and regulation.
- C** Ensure there is adequate provision of the following:
- **Flushing facilities** to flush and clean water systems thoroughly.
 - **Venting and draining facilities.**
 - Facilities for **water treatment and analysis.**
 - Requirements for **access and maintenance.**
- D** Review fabric requirements particularly with regard to **air leakage** and **infiltration.**
- E** Ensure personnel and plant **safety** during operation.
- F** Review clarity of '**cause and effect**' in fire detection mode and power failure mode.
- G** Determine the need for **plant or equipment testing** by manufacturers at their own works. For example, a full load test of a chiller may be difficult to perform on site. A requirements document should be produced in relation to this and included in the design brief.
- H** Establish **start-up** and **operating** procedures.
- I** The commissioning manager should produce a **logic network**⁶⁶ for the testing and commissioning (T&C) showing the logical sequence of events and also how it interfaces with the construction work. The network should include all the various systems and items of equipment and how they interface with each other, culminating in the final **integrated systems test (IST).**
- J** Ensure that **all parties** to be involved in the T&C process have a chance to influence the time scale required for their activities and agree that they can complete on schedule. The Construction Manager can then determine the critical path necessary to achieve the completion date.

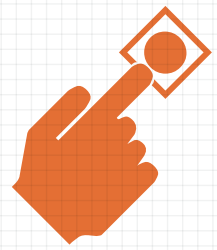
7.2 Installation monitoring

- A** Ensure that installation teams observe **good housekeeping** principles to prevent unnecessary entry of dirt into ductwork and pipe systems.
- B** Review **correct installation** of plant and equipment. Ensure that there is adequate provision for all air to be vented.
- C** Review ductwork and pipework **modifications** which result from co-ordination clashes with other services and the building fabric, since such changes may result in high pressure drop sections and reduce plant efficiency.
- D** Monitor and witness **system pressure tests** and when proved satisfactory, ensure any sectional caps or membranes are removed.

⁶⁶ The logic network is a flow diagram highlighting prerequisites from the various members of the construction teams and indicating testing that needs to be undertaken as construction progresses.



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- E** Ensure that **record drawings** are updated and that they accurately reflect the installation, particularly of services that will be hidden once the building is complete.
- F** Following installation and pressure testing, ensure that **pipework is flushed out** and, where necessary, chemically cleaned. This work may need to be carried out by a water treatment specialist but should be witnessed at all stages by the Construction Manager. After flushing and cleaning, the system must be quickly treated with appropriate levels of inhibitor to prevent corrosion and contamination, and regular checks of inhibitor levels made to ensure adequate concentrations are maintained.

7.3 Pre-commissioning

- A** After installation and prior to commissioning, ensure that the system is **complete** and in a satisfactory and **safe** condition prior to start-up.
- B** Conduct **static** and **electrical checks** of the main plant.
- C** Prepare documentation in advance in the form of **pro forma check and test sheets**.⁶⁷

7.4 Testing and commissioning

- A** Ensure that test instrumentation is **not damaged**, carries a current **calibration certificate** and is reasonably easy to use in the environment in question.
- B** Always select an instrument with an **operating range** greater than expected results.
- C** Be aware that for the test undertaken there may be a **correction factor** that needs to be applied to compensate for reading error.
- D** Observe plant **start-up** and **shut-down** to ensure correct operation.
- E** Monitor conditions within the building to ensure **required conditions are achieved** and the system is stable.
- F** Witness **cause and effect tests** to ensure the services operate as intended in fire detection and power failure modes.
- G** **Liaise** with local authorities, fire officers, building control officers, building insurers and the design team to ensure compliance with all legal and statutory requirements.

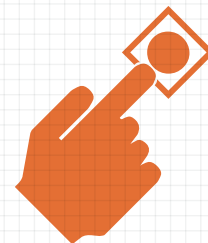
7.5 Operator training and hand-over

- A** Co-ordinate the **training** of the building user's operations team, for example, the chief engineer and department member to ensure that first-hand operational knowledge is transferred.
- B** At the point of hand over to the owner or operator, it is important that **documentation** for all systems and materials is presented to the operations team. These include:
- **Specifications** and **design documents**.
 - **As-built drawings**.
 - **Operation and maintenance (O&M) manuals**.

⁶⁷ Examples of pro forma test sheets can be found in BSRIA application guides 'AG 2/89.3 Commissioning Water Systems' and 'AG3/89.3 Commissioning Air Systems', www.bsria.co.uk



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- **Commissioning reports (testing and commissioning records)** showing all the set points and data relating to the building management system and control systems.
- **Warranties.**
- **Material specifications.**
- **Spare parts and materials.**

7.6 Operation, maintenance and continuous commissioning

Continuous commissioning is the last phase of the commissioning process and takes place after handover to the owner or operator. The process enables the function of the equipment to be checked and optimised for energy efficiency and, when changes are made, enables the '**as-built**' documents to be updated. In these respects, the continuous commissioning process complements the energy management process of a building.

Since the building will use most energy during its operational lifetime, continuous commissioning ensures that existing systems can:

- Handle **changes in activities** in the building.
- Adjust equipment to **new standards and regulations**.
- **Monitor equipment** deterioration.
- Minimise **energy consumption**.

Typical problems that are identified at this stage include negative pressurisation of the building, blocked reheat coils, air volume systems (VAV) temperatures set too low, broken thermostats and high exhaust pressures.

All systems must be **regularly inspected and serviced**. Regular testing should be carried out on large energy consumers such as chillers, boilers and air-conditioning systems, to verify actual performance versus the original conditions. In this way, the building will be able to operate to optimum efficiency and ensure the highest level of comfort for guests and staff.

7.7 Post occupancy evaluation

Post occupancy evaluation (POE) involves the systematic evaluation of opinion about buildings in use, from the perspective of the **people who use them**. It assesses how well buildings match their users' needs, and identifies ways to improve building design, performance and fitness for purpose. POE can be used for many purposes, including fine-tuning new buildings, developing new facilities and managing 'problem' buildings. It is also valuable when establishing maintenance, replacement, purchasing or supply policies; preparing for refurbishment; or selecting accommodation for purchase or rent.



More information

Achieving the Desired Indoor Climate: Energy Efficiency Aspects of System Design
The Commtech Group, 2003
www.commtech-group.com

Building Services Research and Information Association (BSRIA)
www.bsria.co.uk

Building Commissioning Association
www.bcx.org

Whole Building Design Guide
www.wbdg.org