

Data Center Test Writing: Overview

Data center test writing - called script writing - can have some characteristics that distinguish it from building commissioning test writing:

- **Presentation** - tests are often done in Excel, in columns, utilizing a spreadsheet format
- **Organization** - instructions are explicit, tests are sequential, each action is numbered
- **Approach** - commands are called out, testing teams are large, there are frequent meetings and heavy coordination



Presentation

While test writers in the commercial building/school markets may also utilize columns or Excel (versus MS Word) in their test writing, data center tests typically utilize a specific style, as shown below. The column headings are nearly always the same, although the order/quantity of the columns may differ slightly. In data center testing, tests are referred to as "Scripts."

SYMANTEC - DATA CENTER FACILITY
HVAC LOAD TEST
INTEGRATED SYSTEMS TESTING PROCEDURE

ITEM	ACTIVITY	DESCRIP	TIME	PARTICIPANT	EXPECTED RESPONSE	ACTUAL RESPONSE	PASS P/F	COMMENTS
Preliminary Activities								
i	PRE-START: This test coordinates with the electrical "System Load Testing" items 6-13.	Chiller Plant GC & Related HVAC	11/04/08 MW	Cx Team	The electrical and mechanical commissioning team will prepare for the load test. The activities and directions in this test procedure are for the mechanical commissioning team. The electrical commissioning team will refer to the "System Load Testing" scripts. Mechanical coordination notes are included in the electrical scripts.		n/a	Load Banks will be taken to 100% during this test. The load being generated will be dissipated as a full load for the HVAC systems. Ensure that a Standby LOAD BANK EMERGENCY SHUTDOWN Plan has been reviewed, and a Ready Team is on standby to kill the load banks if the HVAC fails.
ii	Verify that the chiller plant is fully operational and in a ready state and in automatic mode.	Chiller Plant/BMS	11/04/08 MW	MC/BMS	Mechanical and BMS contractors will indicate a ready state after examining all systems.		n/a	
iii	Verify that the data floor air handlers, make-up air units and all other HVAC systems are in the ready state and in automatic mode.	Data Floor/BMS	11/04/08 MW	MC/BMS	Mechanical and BMS contractors will indicate a ready state after examining all systems.		n/a	
iv	Verify that the storage tanks are charged and in a ready state and in automatic mode.	Storage Tanks/BMS	11/04/08 MW	MC/BMS	Mechanical and BMS contractors will indicate a ready state after examining all systems.		n/a	
v	Verify that the BMS system has NO alarms, and is in a ready state. Verify that the BMS system is set up to track all required trends.	BMS	11/04/08 MW	BMS	BMS contractor will indicate a ready state and that there are NO active alarms. BMS contractor to verify that all required trends are operational.		n/a	
vi	Verify that the electrical team is advised to not move forward to the next phase of the HVAC load test without the mechanical team's release.		11/04/08 MW	EC/GC	Electrical and General Contracting team will indicate understanding.		n/a	
vii	Verify that the System Readiness Form for this portion of the test has been signed.		11/04/08 MW	GC Team	Completed form is given to Cx team.		n/a	
viii	Verify that the blank System Readiness Forms for are available.		11/04/08 MW	GC	Forms will be signed at the end of the 100% test.		n/a	
ix	Review responsibilities with all team members, including observational, reporting and documentation requirements.		11/04/08 MW	GC Team	Completed form is given to Cx team.		n/a	
Testing Activities								
1	Operate the HVAC system for 4 hours at scheduled 2% or normal construction load. No load banks shall be on at this time.	Pre-Test Phase "2%" or "Background" test	11/04/08 MW	MC/BMS/Cx	Use this no-load run as a dress rehearsal for the 25% 50%, 75% and 100% load tests. All team members will practice their responsibilities and verify they understand their responsibilities. BMS to print required trends and/or screen captures.		Pass	Cx aware that the chillers have an approximate 20 minute anti-recycle time, which means they can only start 3 times per hour. This motor protection delay may cause portions of the test procedure to be delayed if a chiller hasn't cycled through this safety time.
2	Indicate to the electrical team that the mechanical team is ready to START the 25% LOAD TEST. This is a 4 hour test.		11/04/08 MW	MC/BMS/EC GC/Cx	Monitor performance.	Cx Observation Reports not needed for this test	n/a	Unless otherwise indicated, when performing chiller plant failure tests, make sure the chillers have run the minimum anti-recycle time, so that they are ready to immediately restart if they go OFF.

Organization

In mission critical facilities the sequence of testing can be vitally important. In a school commissioning project, it might not be at all important if the rooftop units get tested before or after the lighting controls; it might not matter if the unit start/stop verification is tested before the BMS input point verifications. While that can also be true at various phases of data center testing, there are stages of testing when the order of testing itself becomes vital. Integrated and Pull-the-Plug tests (see below) are examples of when strict adherence to the sequencing of the tests becomes important.

- Each test is titled and/or numbered
- Each step of the test is numbered
- Steps are called out
- All lead personnel have up-to-date copies of the scripts
- All participants are aware of what step the team is actively testing at any given moment
- Each step of the test has a written action, accompanied by a written expected response
- Lead members of the testing team sign-off and date stamp each step or series of steps

Approach

Testing is formal and involves the cooperation of a large team, including the GC/CM, various subcontractors, O&M personnel and designers. Coordination occurs constantly throughout the process.

- The Commissioning Authority leads the team
- Senior team members may be assigned to or stationed in various parts of the building
- Walkie-talkies are used extensively
- One team member is often assigned the responsibility of calling out an instant "red alert" or "All Stop" command. An "All Call" command will be issued for an instant meeting, with the meeting area coordinated in advance.
- In the case of an "All Stop" command, testing immediately ceases and any emergency contingency plans can be implemented

Levels of Testing

Data center commissioning is often characterized as having different phases or "levels." An example of how a particular project team may classify various levels could be:

Level 1 Testing - testing performed by manufacturers on their own equipment, using their own test methods and forms - approved/reviewed by the Commissioning Authority - perhaps including factory visits

Level 2 Testing - field testing of installed equipment, performed by manufacturers, contractors or sub-contractors, using their own methods and forms - approved/reviewed by the Commissioning Authority

Level 3 Testing - pre-functional, functional testing and systems testing, performed by the Commissioning Authority

Level 4 Testing - Integrated Tests, performed by the Commissioning Authority, verifying the cross-relationship of various systems

Level 5 Testing - Pull-the-Plug Tests, performed by the Commissioning Authority