

Field Test & Site Commissioning

27th June, 10:15-11:00

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Technical Advisor to GTG Industries

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Learning Objectives

- Why performance of some best products sometimes cannot meet Designer or Owner's requirements
- Why Manufacturers have no say in overall design of system but yet get the blame or have been dragged into construction dispute?
- How can we get out of such situation by advising the Designers or Owners
- The value of understanding Testing Procedures & Commissioning

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What is the worth of this paper?



ASHRAE Certified

Be it known that

SOONG PENG SOON, CPMP

I.D. 8105179

having successfully completed all requirements and criteria has been certified as a

Commissioning Process Management Professional

and has accordingly been awarded all the rights, honors, and privileges thereunto appertaining. The CPMP certification validates competency to develop and manage the whole building commissioning process with the owner.

ANSI

Timothy G. Wentz, P.E. Fellow ASHRAE, HFDP
ASHRAE President 2016-2017

Jeff Littleton
Executive Vice President

01-30-2013 / 12-31-2019
Effective Date/Expiration Date

Let's see what happens on site.....

ASHRAE CPMP – COMMISSIONING PROCESS MANAGEMENT PROFESSIONAL CERTIFICATION

3

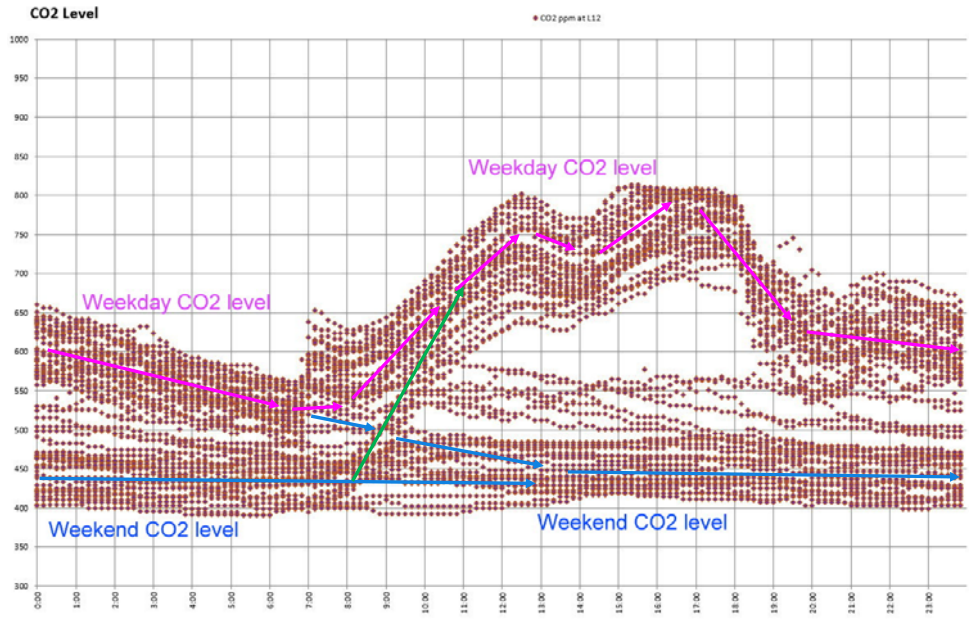
Stuff happens during testing & commissioning:



Large fresh air supply system: much to comment

4

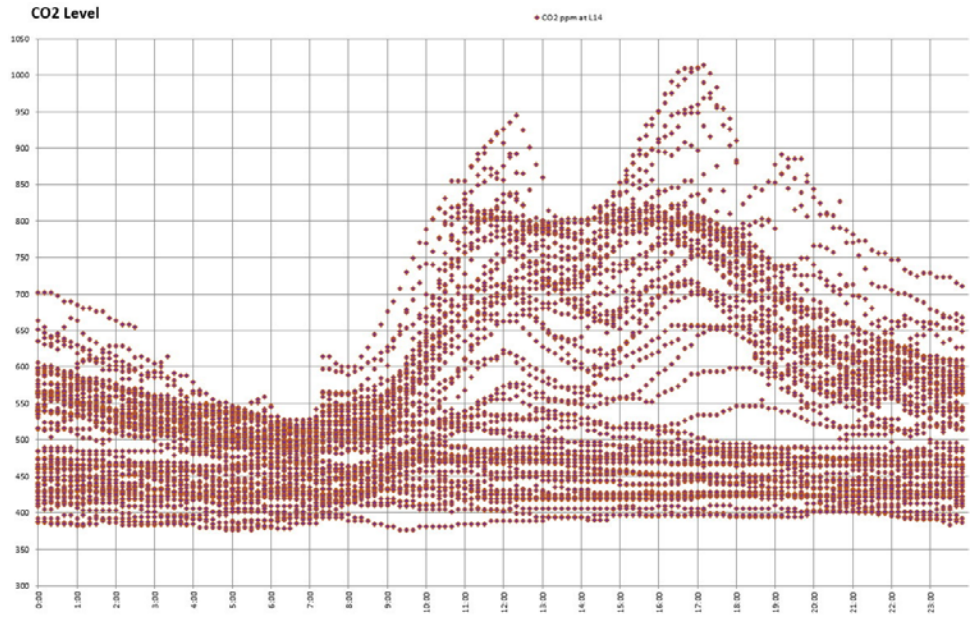
Stuff happens during testing & commissioning:



Carbon dioxide concentration as reverse indication of ventilation adequacy

5

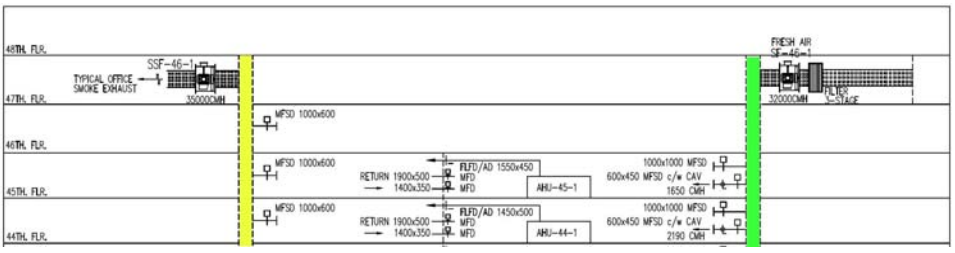
Stuff happens during testing & commissioning:

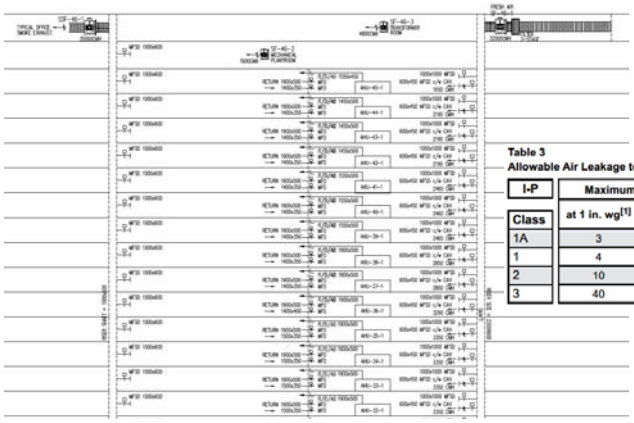


Carbon dioxide concentration as reverse indication of ventilation adequacy

6

Stuff happens during testing & commissioning:





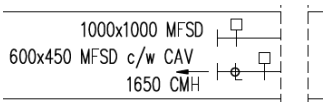


Table 3
Allowable Air Leakage to Achieve Classification

I-P	Maximum Allowable Leakage, cfm/ft²		
Class	at 1 in. wg[1]	at 4 in. wg[1]	at x in. wg[2]
1A	3	N/A	N/A
1	4	8	$\sqrt{x} \times 4$
2	10	20	$\sqrt{x} \times 10$
3	40	80	$\sqrt{x} \times 40$

AMCA Green Tips for High-Performance Air Systems
Tip #3: Specify Low-Leak Dampers

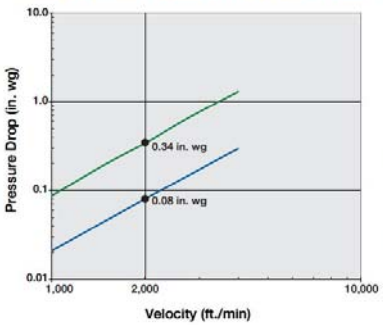


Larger system can have great pressure loss along the duct… balancing can be an issue

7

Stuff happens during testing & commissioning:

AMCA Licensed Pressure Drop Data



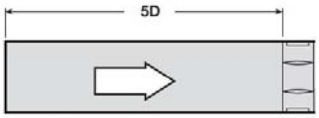
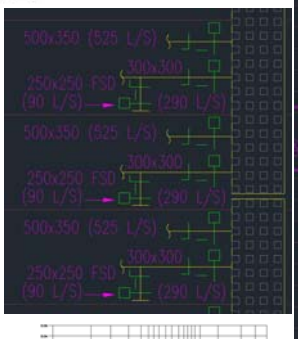
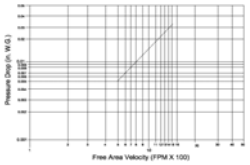


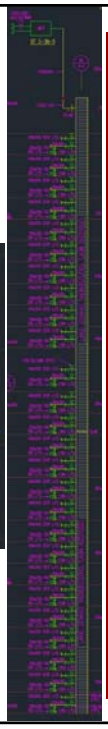
Figure 5.2

$$D = \sqrt{\frac{4\,(W)\,(H)}{3.14}}$$

Dimension inches	12x12			24x24			36x36			12x48			48x12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min.)	Pressure Drop in. wg														
500	.03	.01	.05	.02	.01	.05	.01	.01	.04	.01	.01	.04	.03	.01	.05
1000	.11	.04	.23	.08	.03	.21	.05	.02	.14	.06	.02	.18	.14	.06	.22
1500	.25	.09	.52	.19	.08	.47	.11	.04	.33	.14	.06	.42	.32	.14	.51
2000	.45	.17	.93	.34	.14	.84	.21	.08	.58	.25	.10	.74	.57	.25	.90
2500	.71	.26	1.44	.53	.22	1.32	.33	.12	.91	.40	.17	1.16	.89	.40	1.41
3000	1.03	.38	2.08	.77	.32	1.90	.47	.18	1.31	.57	.24	1.68	1.29	.58	2.04
3500	1.40	.52	2.83	1.05	.43	2.59	.64	.24	1.79	.78	.33	2.28	1.76	.79	2.78
4000	1.83	.67	3.70	1.37	.57	3.39	.84	.32	2.34	1.02	.43	2.98	2.30	1.03	3.70



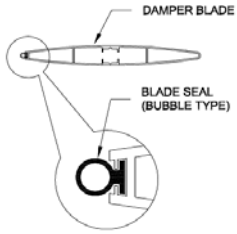


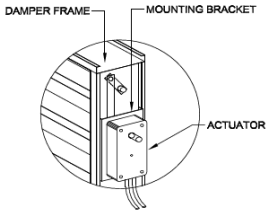


Sizing dampers differently along a long shaft with AMCA test data

8

Stuff happens during testing & commissioning:





Damper actuator with spring return and positioner

Parameters	
Running time for 90° motor	90 s
Running time for 90° spring	15 s
Torque	7 Nm
Holding torque	7 Nm
Angle of rotation	Max. 95°



Description of operation

The built-in positioner controls the positioning motor depending on the controller's output signal y. When the positioning signal is increasing, the coupling piece turns to the 90° position (scale on actuator) until the power-dependent cut-off. In the two end positions (limit stop of damper or limit stop due to angle-of-rotation limit, max. angle of rotation of 95° reached) or in the case of an overload, the torque-dependent cut-off is activated (no limit switches). If the power is cut off or is switched off by a safety device at connection 2 (cable = red), the motor releases the gear unit so that the spring turns the coupling piece back to the 0° position. The direction of rotation for the safety function is determined by how the actuator is mounted on the damper spindle. A signal converter is required for the reverse direction of operation.

15.3 Published ratings

15.3.1 Air leakage performance
Published ratings of air leakage performance shall be presented in either tabular form, graphical form or both as a statement of the maximum tested air leakage at the following:

- A specified differential pressure
- Standard air density
- AMCA figure or figures to which air leakage performance is tested

15.3.2 Torque statement
The following statement shall be included:

"Data are based on the maximum torque of [#] N•m/m^2 (in.-lb/ft^2) applied to the damper during the test."

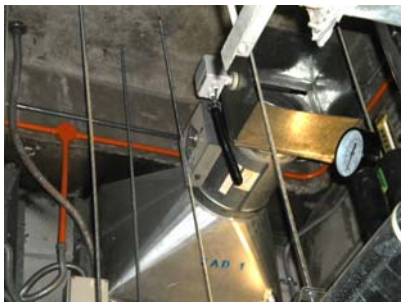
[Any number ending with a decimal greater than 0.02 shall be rounded to the next higher number, e.g., 6.12 N•m/m^2 = 6.1 N•m/m^2 and 6.13 N•m/m^2 = 6.2 N•m/m^2 (5.12 in.-lb/ft^2 = 5.1 in.-lb/ft^2 and 5.13 in. lb/ft^2 = 5.2 in.*lb/ft^2)]

Select actuator that can close damper tightly…

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Stuff happens during testing & commissioning:





Selecting the operating pressure to ensuring minimum ventilation is achieved…

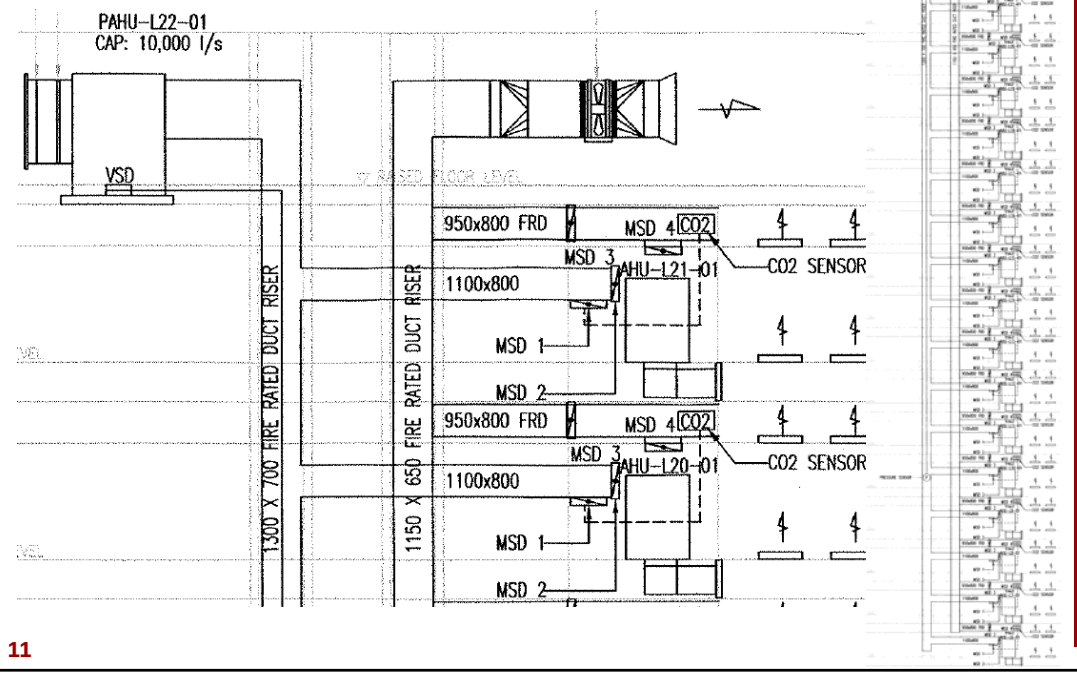


Nominal sizes	80 – 400 mm
Volume flow rate range	11 – 1400 l/s or 40 – 5040 m^3/h
Volume flow rate control range	Approx. 25 to 100 % of the nominal volume flow rate
Scale accuracy	± 4 %
Minimum differential pressure	50 Pa (nominal size 80: 100 Pa)
Maximum differential pressure	1000 Pa
Operating temperature	10 – 50 °C

Auto-balancing damper must be selected properly

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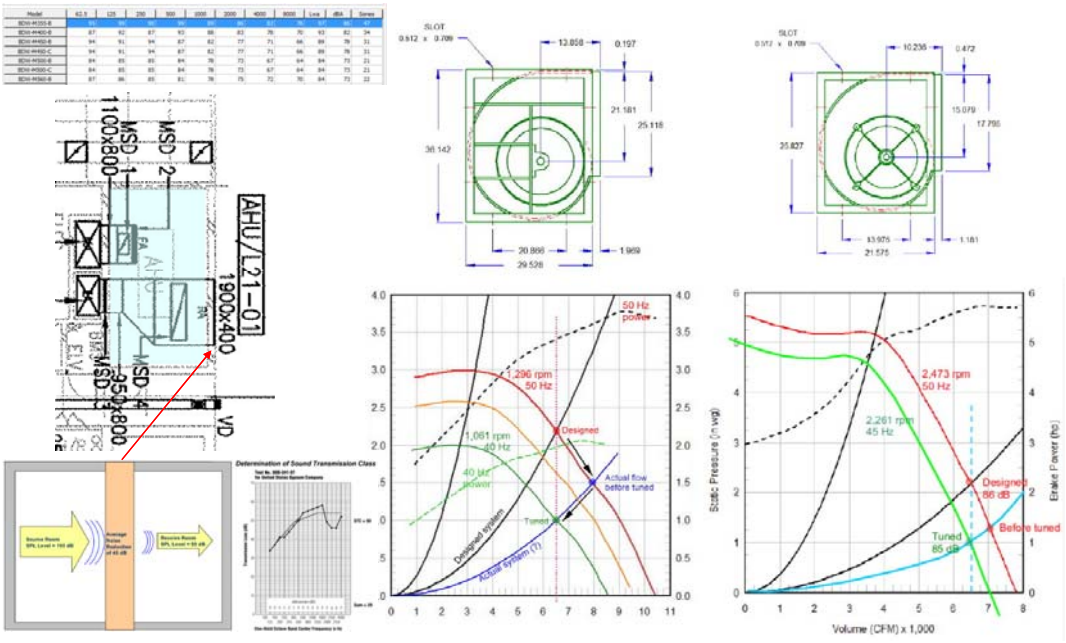
Stuff happens during testing & commissioning:



A super shaft with multiple damper is challenging

11

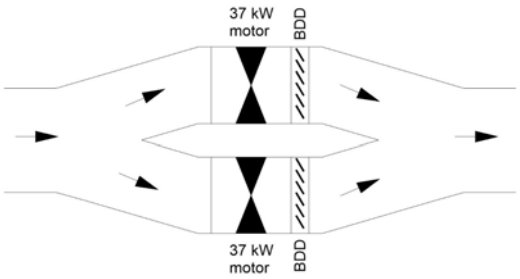
Stuff happens during testing & commissioning:



Beware of noise when AHU room is too small…

12

Stuff happens!





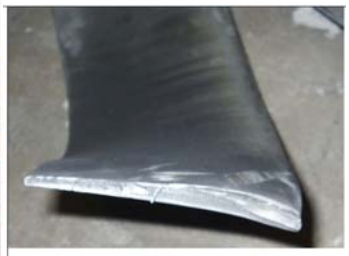
Bent blade



Hub and blade (12 pcs) smashed



Left on motor shaft



Scratched mark at edge

An old story… Can anyone know why?

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Stuff happens!



Scratched mark at edge



Bent blade



Scratched mark at edge



Scratched mark at edge

An old story… Can anyone know why?

14

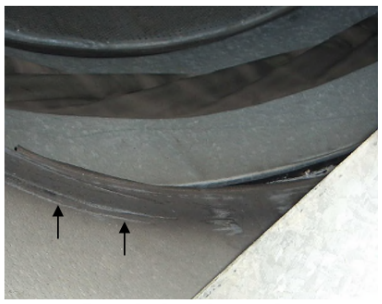
Stuff happens!



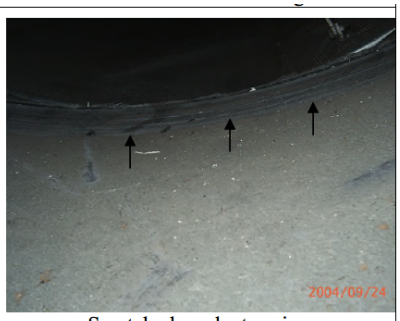
Only 1 blade not bent (out of 12)



No scratched mark at edge



Scratched mark at casing

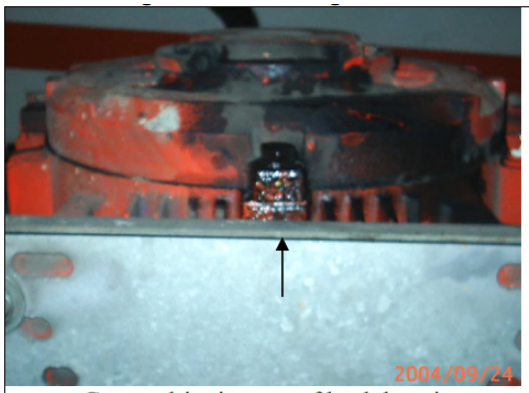


Scratched mark at casing

An old story… Can anyone know why?

15

Stuff happens!



Grease dripping out of back housing



Grease dripping out of front housing

An old story… Can anyone know why?

16

Stuff happens!



Vanes stuck at frame

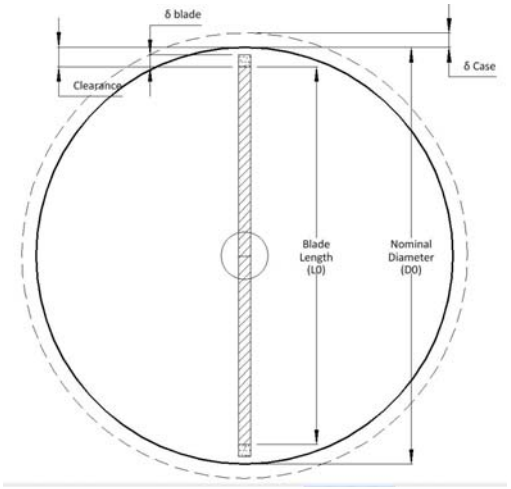


Vanes apparently too heavy

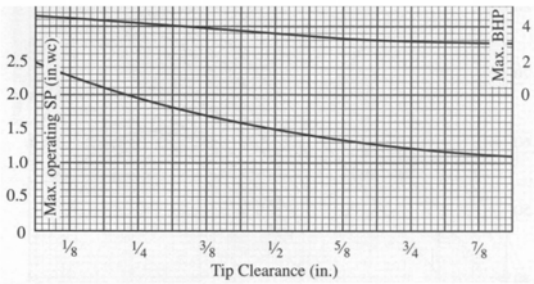
An old story… Can anyone know why?

17

Stuff happens!



INFLUENCE OF THE TIP CLEARANCE ON THE PERFORMANCE OF VANEAXIAL FANS

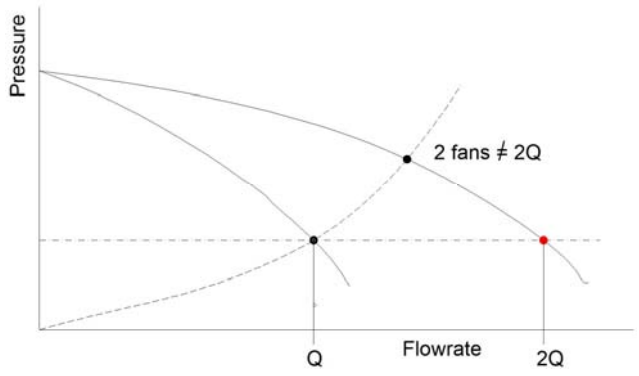


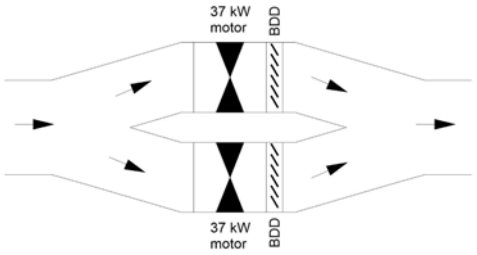
1. The air volume decreases, but not too much.
2. The maximum static pressure in the operating range decreases considerably, from 2.5 in at a 1/16-in tip clearance to 1 in at a 1-in tip clearance.
3. The brake horsepower in the operating range decreases considerably, but not as much as the static pressure.
4. As a result, the mechanical efficiencies decrease considerably, from a maximum of 82 percent at a 1/16-in tip clearance, to 72 percent at 5/16 in, to 60 percent at 13/16 in, to 58 percent at 1 in.

An old story… Can anyone know why?

18

Stuff happens!





18. Backdraft Damper | Air Leakage Rating Requirements

18.1 Testing requirements

18.1.1 Air leakage test
All testing for air leakage through mounted dampers shall be per ANSI/ AMCA 500-D, Figure 5.4 or Figure 5.5. Dampers shall be mounted such that the airflow closes the blades.

18.1.2 Test sizes

18.1.2.1 Rectangular test size
A 610 mm x 610 mm (24 in. x 24 in.) damper shall be tested. If the largest size damper produced is smaller than 610 mm x 610 mm (24 in. x 24 in.), the largest cataloged size shall be tested.

18.1.2.2 Round test size
A 610 mm (24 in.) diameter damper shall be tested. If the largest size damper produced is smaller than 610 mm (24 in.), the largest cataloged size shall be tested.

18.1.3 Cycling
Prior to testing for air leakage, the test sample shall be opened 15° and allowed to close under its own force with zero ΔP_s across the damper.

18.1.4 Test pressure
The testing shall be conducted from the lowest rated differential pressure up to the highest.

18.1.5 Number of tests
Two tests shall be conducted on each sample. Each test shall be conducted over a range of pressures consisting of at least five points.

Between each test, the damper shall be opened 15° and allowed to close under its own force with zero ΔP_s across the damper. If a motor is used, the damper shall be cycled from its full open to its full closed position between tests.

18.2 Calculated performance

18.2.1 Air leakage
Air leakage performance at each ΔP_s shall be the maximum L/s/m² (cfm/ft²) of two tests conducted.

18.2.2 Extrapolation

18.2.2.1 Pressure
Extrapolation above the maximum test ΔP_s or below the minimum ΔP_s shall not be permitted.

18.2.2.2 Test size
Extrapolation outside the test size shall not be permitted.

18.3 Published rating

18.3.1 Air leakage performance
Published rating of air leakage performance shall be a statement of the maximum tested air leakage flow rate at a specified ΔP_s at standard air density.

18.3.2 Test setup
Published data shall show the test figure and airflow direction used during testing.

18.3.3 Test size
Published data shall show the test sample size.

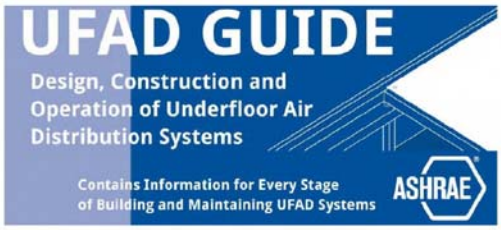
18.3.4 Operational statement
Published data shall state:
"Air leakage is based on operation between 0 °C - 49 °C (32 °F - 120 °F)."

18.3.5 Air performance requirement
To publish air leakage ratings, air performance ratings of the test sample defined in Section 18.1.2 only shall be tested and published in accordance with Section 13.

AMCA 511-10 (Rev. 11-13) | 19

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Stuff happens!



14.4.9 Determine Method for Air Leakage Test

This section discusses decisions that have to be made in preparation for conducting detailed tests.

Purpose. Based on the building/plenum and air distribution system configurations, determine the best approach for conducting the air leakage test and measuring airflow rate: (1) use blower panel assembly or (2) use the building's air handling unit (AHU).

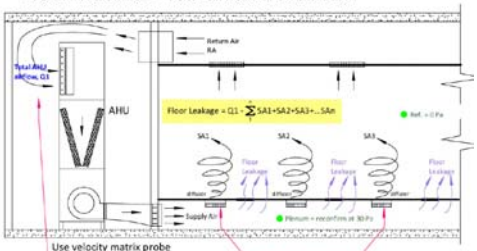
Description. Air leakage testing in UFAD systems requires that the airflow to the plenum zone being tested be delivered and accurately measured over the lower end of the range of desired airflow rates typical of variable-volume operation. This requires good calibration and measurement accuracy at lower flow rates. Two primary methods of air delivery have been used in practice. The contractor should review these methods, consider the pros and cons, and decide what approach will be used for the air leakage test.

Method 1: Contractor-provided blower panel assembly. A separate fan unit (or multiple fans in larger spaces) is installed to blow air into the plenum being tested through one or more removed or specially fitted floor panels (similar to a blower door assembly). As shown in Figure 14.5, to

Method 2: Building's AHU. The contractor relies on the building's AHU to deliver and control the airflow into the plenum zone being tested. The installed airflow sensors for the building management system (BMS) (if they exist) must be calibrated (e.g., using a hot-wire anemometer, Pitot tube

EVALUATION OF RAISE FLOOR AIR LEAKAGE

= Total AHU airflow - Total airflow of all diffusers











We need the air velocity matrix sensor and low flow air measuring hood for AHSRAE Method 2.

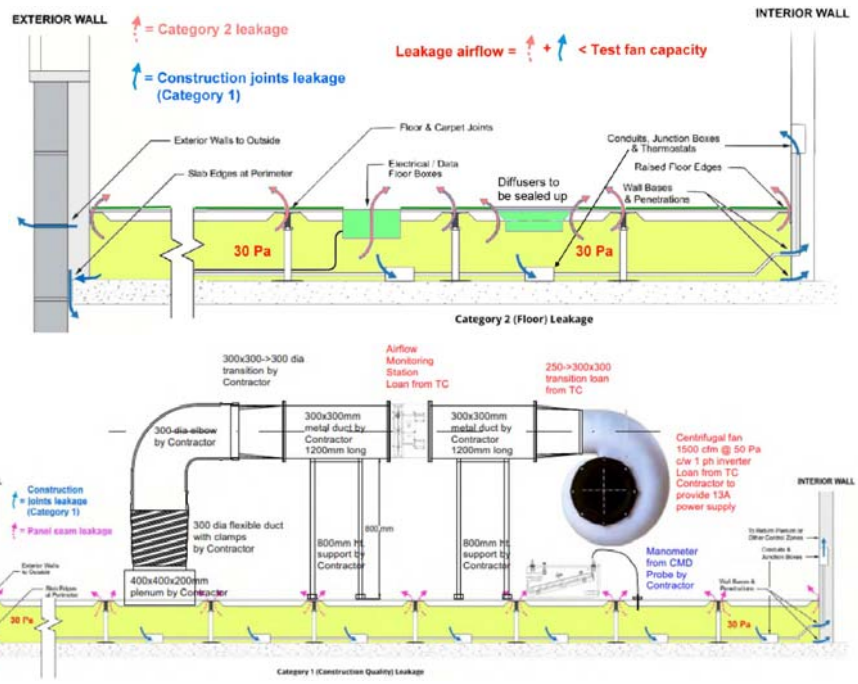
While measuring airflow through AHU and all diffusers for air balancing (a 'must' action whether for ceiling & floor mounted diffuser systems) we can judge air leakage by the formula:

Floor Leakage = Q1 - $\sum_{1}^{n}$ SA1+SA2+SA3+...SAn

Commissioning more advanced system...
Whether it is fan problem...

20

Stuff happens!



Commissioning more advanced system…
Whether it is fan problem…

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Stuff happens!



$$Q_{leak} = C \cdot A_s \cdot \Delta p^{0.65}$$

Where Q_{leak} is the quantity of leaked air,
C is a constant, A_s is the surface area,
Δp is the pressure difference

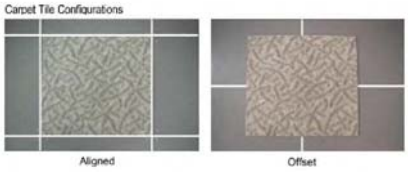


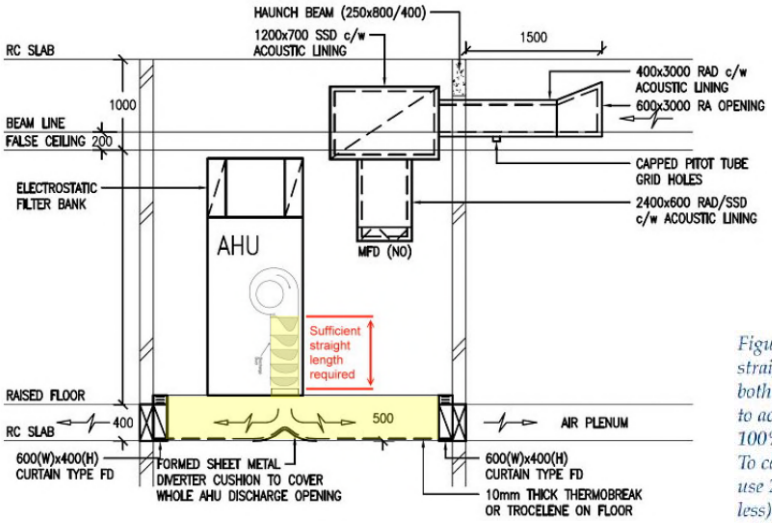
Table 14.1 Comparison of Maximum Allowable Plenum Air Leakage Rates

Category 1 Leakage	Category 2 Leakage	Total Leakage	Plenum Pressure	Source[a]
0.05 cfm/ft^2 (0.26 L/s/m^2)	0.1 cfm/ft^2 (0.5 L/s/m^2)	0.15 cfm/ft^2[b] (0.75 L/s/m^2)	0.05 in. wc (12.5 Pa)	Bauman et al. (2012)
8% of design flow or 0.05 cfm/ft^2 (0.26 L/s/m^2) (whichever is less)	15% of design flow[b]	23% of design flow	0.05 in. wc (12.5 Pa)	PEC (2007)

Commissioning more advanced system…
Whether it is fan problem…

22

Stuff happens!



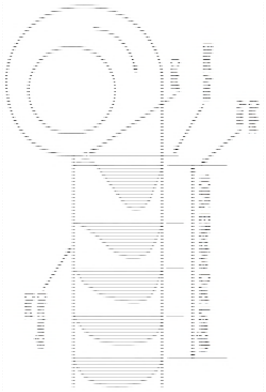


Figure 12 illustrates the need to use a straight duct length on the discharge of both inline and centrifugal fans. In order to achieve a uniform velocity profile, a 100% effective duct length must be used. To calculate the 100% effective length, use 2.5 duct diameters for 2500 FPM (or less). Add one duct diameter for each additional 1000 FPM.

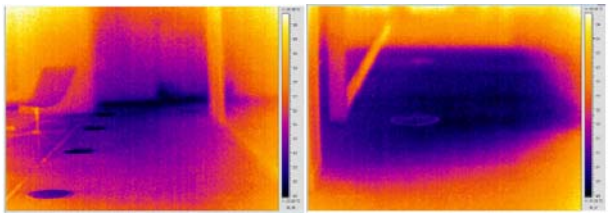
Commissioning more advanced system… Whether it is fan problem…

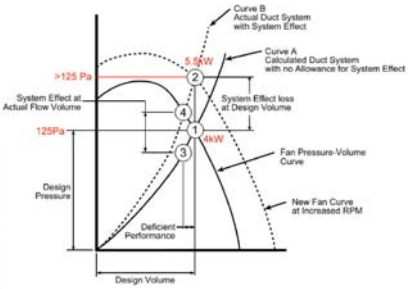
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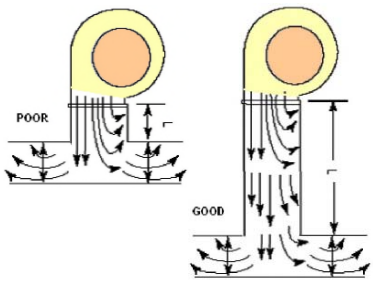
Stuff happens!











Commissioning more advanced system… Whether it is fan problem…

24

Stuff happens!





Commissioning more advanced system…
Whether it is fan problem…

25

Stuff happens!

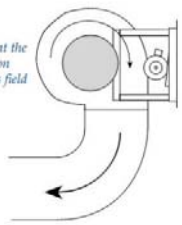






Good

Figure 8b illustrates a typical installation with an elbow directly at the fan discharge. Discharge and rotation have been selected to match the fans field conditions of figure 8a.



Good

Figure 7 is typical of how centrifugal fans are tested. AMCA refers to this set up as "Type B: free inlet, ducted outlet."

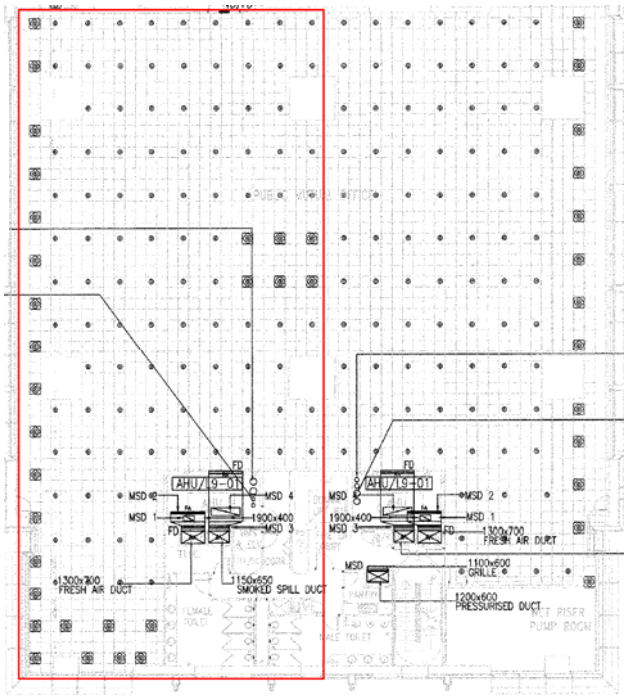
Commissioning more advanced system…
Whether it is fan problem…

26

Stuff happens!

The Alnor® LoFlo Balometer® Capture Hood is a compact instrument that measures very low air flow rates in HVAC systems. It measures from 10 to 500 cfm (17 to 850 m^3/h, 4.7 to 236 l/s). The LoFlo Balometer® Capture Hood displays standard air volume rate when placed at supply or return diffusers, registers, or grilles located on the ceiling, wall, or floor.





Some Underfloor distribution system can deliver very low airflow with as low as 12 Pa... how to measure?

27

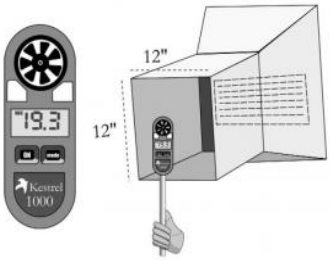
Stuff happens! – Use the right instrument

AIRCONE FLOW HOODS

Aircone Flow Hoods are a fast and accurate method of maximizing the usefulness of your 4-in. (100 mm) rotating vane anemometers. For a modest investment, you can enhance the capability of your rotating vane, turning it into an air volume flow balancing tool.











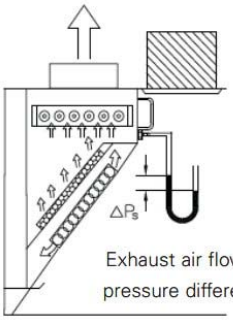
Different method arrives at different result ?
Get the right instrument!

28

Stuff happens!

The capture jet and exhaust air flows are easily and accurately determined by measuring the pressure difference from the T.A.B. ports mounted in each plenum. Corresponding air flows can be read from the diagrams provided.

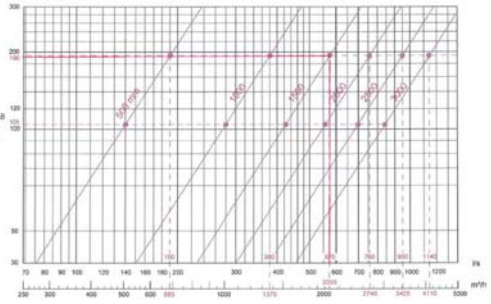
All T.A.B. readings assume cold conditions. To adjust for an exhaust temperature of 110°F, multiply the readings by a factor of 0.93.



Exhaust air flow vs. pressure differential

AIR DENSITY CORRECTION FACTORS

Air Temp. °F	Elevation (Feet Above Sea Level)															
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000
0	0.87	0.90	0.94	0.97	1.01	1.05	1.08	1.13	1.17	1.22	1.26	1.31	1.37	1.43	1.48	1.54
50	0.96	1.00	1.04	1.08	1.11	1.15	1.20	1.24	1.30	1.34	1.40	1.45	1.51	1.57	1.63	1.70
70	1.00	1.04	1.08	1.12	1.16	1.22	1.25	1.30	1.35	1.40	1.45	1.51	1.57	1.64	1.70	1.77
100	1.06	1.10	1.14	1.18	1.22	1.27	1.32	1.37	1.42	1.48	1.54	1.60	1.66	1.74	1.80	1.88
150	1.15	1.19	1.24	1.30	1.33	1.38	1.44	1.49	1.55	1.61	1.67	1.74	1.81	1.89	1.96	2.04
200	1.25	1.29	1.34	1.40	1.44	1.50	1.56	1.61	1.68	1.75	1.81	1.89	1.96	2.05	2.13	2.21
250	1.34	1.39	1.44	1.50	1.55	1.61	1.67	1.74	1.80	1.88	1.95	2.02	2.10	2.20	2.28	2.37
300	1.43	1.49	1.54	1.60	1.66	1.72	1.79	1.86	1.93	2.01	2.08	2.16	2.25	2.35	2.43	2.53
350	1.53	1.58	1.64	1.71	1.77	1.84	1.91	1.98	2.06	2.14	2.22	2.31	2.40	2.51	2.60	2.71
400	1.62	1.68	1.75	1.81	1.88	1.94	2.03	2.09	2.19	2.27	2.37	2.45	2.54	2.66	2.75	2.87
500	1.81	1.88	1.95	2.02	2.10	2.18	2.26	2.35	2.44	2.54	2.63	2.73	2.84	2.97	3.08	3.20
600	2.00	2.07	2.15	2.23	2.31	2.40	2.50	2.59	2.69	2.84	2.91	3.02	3.14	3.28	3.40	3.54
700	2.19	2.27	2.35	2.44	2.53	2.63	2.73	2.83	2.94	3.07	3.17	3.31	3.44	3.59	3.72	3.88
800	2.38	2.48	2.57	2.67	2.76	2.86	2.98	3.09	3.21	3.33	3.45	3.59	3.74	3.90	4.05	4.21
900	2.56	2.66	2.76	2.87	2.97	3.07	3.20	3.33	3.46	3.58	3.71	3.87	4.02	4.20	4.35	4.53
1000	2.76	2.87	2.99	3.09	3.20	3.31	3.45	3.59	3.73	3.86	4.00	4.17	4.33	4.53	4.69	4.89



Got to understand result from rating organization & laboratory…

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Evolution of Testing & Commissioning in local building industry

35 years ago

Technician s



Designer

Engineer



25 years ago

TAB & CxS together



10 years ago

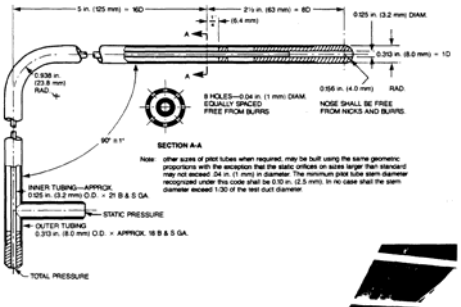
TAB ++ ⟷ Commissioning - CxS

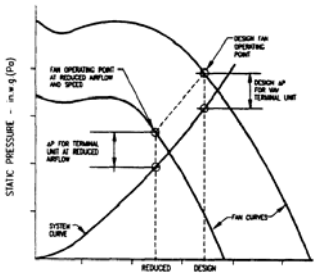


What is commissioning? It is not only TAB…

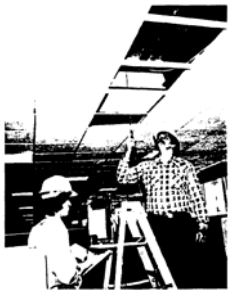
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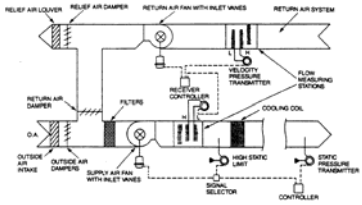
Redefine Commissioning…











What is commissioning?
It is not only TAB…

31

Redefine Commissioning…

5.1 INITIAL PLANNING

5.1.1 Organization

Since testing, adjusting and balancing (TAB) of HVAC systems can best be accomplished by following systematic procedures, the entire TAB process should be thoroughly organized and planned. All activities, including the organization, procurement of required test instrumentation and the actual system balancing should be scheduled as soon as practical after the TAB contract has been awarded. Since building space loads often vary with each change of season and since space temperature levels are a significant factor in TAB work, the total system, which includes both the air and hydronic portions of the system, must be balanced along with all satellite systems (such as exhaust systems operating independently in the same conditioned space).

5.1.2 Initial Reviews

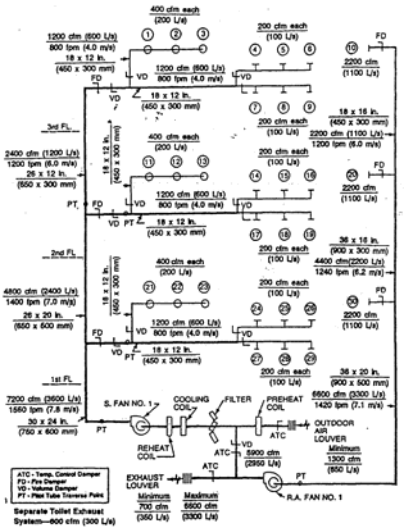
Preparatory work includes the planning and scheduling of all NEBB TAB procedures, collecting the necessary data, reviewing the data collected, studying the systems to be balanced, making schematic system layouts, recording the published data on the test report forms, and finally, making preliminary field checks of the HVAC equipment and systems. If the initial study of the HVAC system plans and specifications by the NEBB Certified TAB Firm indicates that the systems may not be able to be balanced properly, the HVAC system designer should be sent a written notification containing suggestions for changes or the addition of balancing equipment (dampers or valves) that would allow corrective action before starting the balancing procedures. The NEBB Certified Firm is not responsible for the design, installation, or function of the HVAC systems or equipment. Occasionally, a system cannot be balanced or made to perform in accordance with the contract documents regardless of the number of balancing dampers or valves that can be installed.

5.2 PROCUREMENT OF DATA

Obtain all applicable plans and contract documents including change orders, approved shop drawings and equipment submittals, paying particular attention to the items listed below.

5.2.1 HVAC Equipment Performance Data

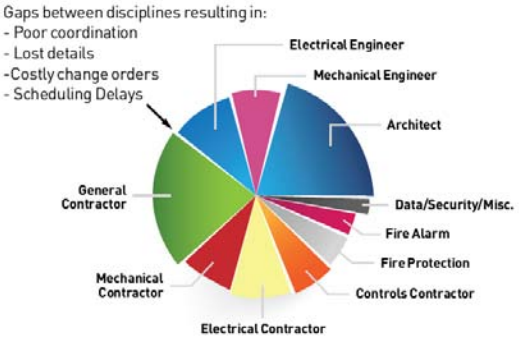
Performance data, including fan and pump curves, should be obtained for all HVAC equipment.

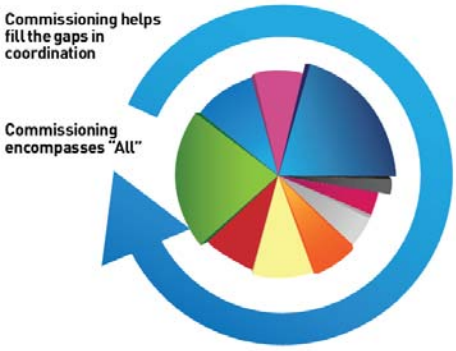


What is commissioning?
It is not only TAB…

32

Green building specifies Commissioning so that system performs as designed..





The green building professional, i.e. GBIF for GBI (or AP for LEED) is often (unfairly) expected to carry out the function of "commissioning" regardless of the type and size of buildings. In reality, due to the complexity of modern buildings, "commissioning" demands knowledge across many specific fields which is difficult, if not impossible, for the GBIF to cover. Hence, such tasks need to be properly performed by the Commissioning Specialist (CxS), who (together with his team) possess most of the specialized knowledge and skill to guide the project team towards achieving the OPR through Communication, Documentation & Verification activities. For rating tools that do not specify (and not award credits) engagement of a CxS, the GBIF is expected to cover any scope of work of such nature.

LEED & GBI follow ASHRAE Guideline

33

What is the role of Commissioning Specialist/Professional:

Owner, Architect, LEED AP, GBI Facilitator, M&E Consultant, Landscape, ID Consultant & other consultants
Come up with great ideas on how the building should look like with:

- **Owner's Project Requirement (OPR)**
- **Basis Of Design (BOD)**

"Do the Right Things"

Commissioning Specialist will explore how to :
Advise the construction team such that the active / CxS related green features are planned, constructed, tested and operates to meet the Owner's Project Requirement (OPR)

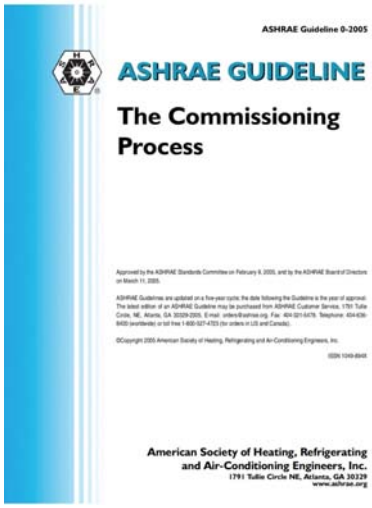
"Do the Things Right"

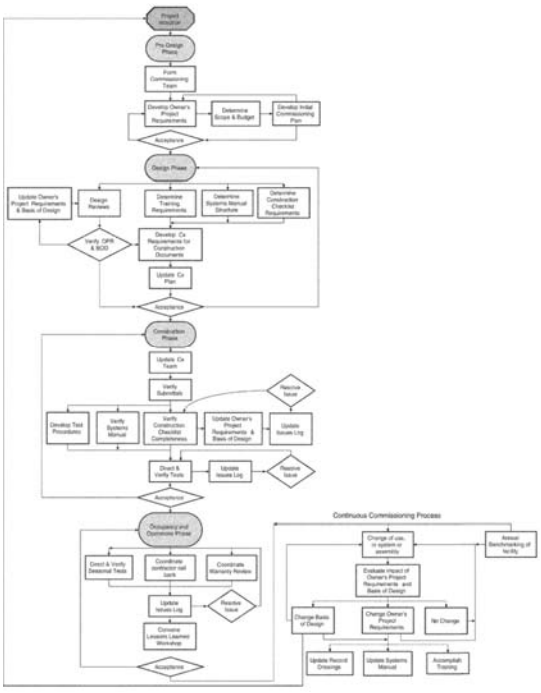
- **Design Review, Commissioning Plan**
- **Sequence of operation, etc.**

LEED & GBI follow ASHRAE Guideline

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ASHRAE Guidelines 0 on Whole Building Commissioning is the most popular





ASHRAE Guideline-0 is good...

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ASHRAE Guidelines 0 on Whole Building Commissioning

Phase	Document	Input By	Provided By	Reviewed/ Approved By	Used By	Notes
Pre-Design	Owner's Project Requirements	O&M, Users, Capital Projects, Design Team (?)	CA or Designer	Owner	CA, Design Team	Design Team may not be hired yet.
	Commissioning Plan	Owner, Design Team (?), CA	CA	Owner	CA, Owner, Design Team	Design Team may not be hired yet.
	Systems Manual Outline	O&M, CA	Owner or CA	Owner	Design Team	May be included in OPR
	Training Requirements Outline	O&M, Users, CA, Design Team	Owner or CA	Owner	Design Team	May be included in OPR
	Issues Log	CA	CA	N/A	CA, Design Team	May be only format at this phase
	Issues Report	CA	CA	Owner	Design Team, Owner	
	Pre-Design Phase Commissioning Process Report	CA	CA	Owner	Owner	Close of Phase report

ASHRAE Guideline-0 is good...

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ASHRAE Guidelines 0 on Whole Building Commissioning

Phase	Document	Input By	Provided By	Reviewed/ Approved By	Used By	Notes
Design	Owner's Project Requirements Update	O&M, Users, Capital Projects, Design Team	CA or Designer	Owner	CA, Design Team	
	Basis Of Design	Design Team	Design Team	Owner, CA	Design Team, CA	
	Construction Specifications for Commissioning	Design Team, CA, Owner	Design Team or CA	Owner	Contractors, CA, Design Team	May also be provided by Project Manager/ Owner's Rep
	Systems Manual Outline-Expanded	Design Team, CA, O&M, Contractor (?)	Design Team or CA	Owner, CA	Design Team, Contractor	Contractor may not be hired yet.
	Training Requirement In Specification	O&M, Users, CA, Design Team	Owner or CA	Owner	Design Team	Contractor may not be hired yet
	Design Review Comments	CA	CA	Owner	Design Team	
	Issues Log	CA	CA	N/A	CA, Design Team	
	Issues Report	CA	CA	Owner	Design Team, Owner	
	Design Phase Commissioning Process Report	CA	CA	Owner	Owner	Close of Phase report

ASHRAE Guideline-0 is good...

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ASHRAE Guidelines 0 on Whole Building Commissioning

Phase	Document	Input By	Provided By	Reviewed/ Approved By	Used By	Notes
Construction	Owner's Project Requirements Update	O&M, Users, Capital Projects, Design Team	CA or Designer	Owner	CA, Design Team, Contractors	
	Basis of Design Update	Design Team	Design Team	CA, Owner	Design Team, CA	
	Commissioning Plan Update	Design Team, CA, Owner, Contractor	CA	CA, Owner, Design Team, Contractor	CA, Owner, Design Team, Contractors	
	Submittal Review Comments	CA	Design Team	Design Team	Contractor	
	System Coordination Plans	Contractor, Design Team	Contractor	CA, Design Team	Contractor, CA	
	Inspection Checklists	CA, Contractor, Design Team	CA	CA, Design Team	Contractor	
	Inspection Reports	Contractor	CA	CA, Owner	Contractor	
	Test Procedures	CA, Contractor, Design Team	CA	CA, Design Team	Contractor	
	Test Data Reports	Contractor	CA	CA, Owner	Contractor	
	Commissioning Meeting Agendas and Minutes	CA	CA	All	All	
	Training Plans	Design Team, CA, O&M, Contractor	Contractor or CA	Owner, CA	O&M, Users, Contractor	
	Systems Manual	Design Team, CA, O&M, Contractor	Contractor	Owner, CA	O&M, Users	
	Issues Log	CA	CA	N/A	CA, Design Team, Contractor	
	Issues Report	CA	CA	Owner, Design Team	Design Team, Owner, Contractor	
	Preliminary Construction Commissioning Process Report	CA	CA	Owner	Owner	Prior to Occupancy
	Final Construction Phase Commissioning Process Report	CA	CA	Owner	Owner	Close of Phase report

ASHRAE Guideline-0 is good...

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ASHRAE Guidelines 0 on Whole Building Commissioning

Phase	Document	Input By	Provided By	Reviewed/ Approved By	Used By	Notes
Occupancy and Operations	Owner's Project Requirements Update	O&M, Users, Design Team	CA or Designer	Owner	CA, Design Team, Contractors	
	Basis of Design Update	Design Team	Design Team	CA, Owner	Design Team, CA	
	Maintenance Program	O&M, Contractor, CA	Owner or CA	Owner, CA	O&M, Users	
	Test Procedures	Contractor, CA, O&M, Design Team	CA	Design Team, CA	Contractor	
	Test Data Reports	Contractor	CA	CA, Owner	Contractor, O&M	
	Issues Log	CA	CA	N/A	CA, Design Team, Owner, Contrac-tors	
	Issues Report	CA	CA	Owner	Design Team, Owner, Contrac-tors	
	Commissioning Process Report	CA	CA	Owner	Owner	Final report
	Re-Commissioning Plan	O&M, Users, CA	CA or Owner	Owner	Owner	

ASHRAE Guideline-0 is good...

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ASHRAE Guidelines 0 on Whole Building Commissioning

Informative Annex L: Specifications

2. THE COMMISSIONING AUTHORITY (CxA)

2.1 The primary role of the CxA is to verify achievement of the OPR throughout the project, from Pre-Design Phase through Occupancy and Operations Phase. The Owner should perform this role.

2.2 When the Owner cannot perform the CxA duties with qualified personnel, then the CxA should have a separate professional services agreement with the Owner, as this avoids conflicts of interest and provides independence from the other parties (the Owner's project manager, designers of record, construction managers, suppliers, and construction contractors). This professional services agreement defines the duties, rights, and responsibilities of the CxA for each phase of the project. This separate relationship allows the CxA to act independently as director of Commissioning Process activities, to focus on achieving the OPR, and to communicate directly with the Owner.

2.3 The CxA is a group of personnel with expertise and experience in the design, construction, and operations of the various systems and assemblies included in the project. These personnel are led by an individual who has expertise and experience in successfully implementing the Commissioning Process.

2.4 If the CxA is an employee, associate, or partner of the same organization as the designer of record or construction management firm, there is a conflict of interest. While not a recommended approach, in these instances the CxA must have a separate professional services agreement, be organizationally separate from the design team or construction management team, and define and manage the conflicts of interest to provide the Owner with the independence required for the Commissioning Process to be successful.

2.5 The CxA does not perform testing; it directs the process and directs the recording of the results. The CxA plans, schedules, and supervises Commissioning Process activities to verify achievement of the OPR. The Contractor completes construction checklists, performs tests, and accomplishes other Commissioning Process activities.

ASHRAE Guideline-0 is good...

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Green Building Index (NRNC Tool)

LEED & GBI follow ASHRAE Guideline

SPECIFIC TASKS OF THE CxS

Tasks of CxS are mentioned precisely in the following section of GBI Tools:

GBI NRNC EE6 ENHANCED COMMISSIONING OF BUILDING ENERGY SYSTEMS (3 points)

Ensure building's energy related systems are designed and installed to achieve proper commissioning so as to realize their full potential and intent. Appoint an independent GBI recognized Commissioning Specialist (CxS) at the onset of the design process to verify that comprehensive pre-commissioning and commissioning is performed for all the building's energy related systems in accordance with ASHRAE Commissioning Guideline or other GBI approved equivalent standard/s by:

- Conducting at least one commissioning design review during the detail design stage and back-check the review comments during the tender documentation stage.
- Developing and incorporating commissioning requirements into the tender documents.
- Developing and implementing a commissioning plan.
- Verifying the installation and performance of the systems to be commissioned.
- Reviewing contractor submittals applicable to systems being commissioned for compliance.
- Developing a systems manual that provides future operating staff the information needed to understand and optimally operate the commissioned systems.
- Verifying that the requirements for training operating personnel and building occupants are completed.

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Leadership in Energy and Environmental Design (LEED) is a rating system devised by the United States Green Building Council (USGBC)

LEED & GBI follow ASHRAE Guideline

FUNDAMENTAL COMMISSIONING OF BUILDING ENERGY SYSTEMS

	NC	SCHOOLS	CS
Prerequisite	EA Prerequisite 1	EA Prerequisite 1	EA Prerequisite 1
Points	Required	Required	Required

Intent

To verify that the project's energy-related systems are installed, calibrated and perform according to the owner's project requirements, basis of design and construction documents.

Benefits of commissioning include reduced energy use, lower operating costs, reduced contractor callbacks, better building documentation, improved occupant productivity and verification that the systems perform in accordance with the owner's project requirements.

Requirements

EA PREREQUISITE 1

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Hopefully everyone can have great products and knowing the application of each product's relationship with Designer's Intent & Owner's Requirements

Communicating with Designer & Owner on application of product and product data with respect to its rating system

This is Commissioning

Thank You

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