

LOCAL LAW 87/09

Energy Audits & Retro-commissioning

MAY 25, 2017

WHAT IS LOCAL LAW 87/09?

Energy Audits & Retro-commissioning of *Base Building Systems in Covered Buildings*



LOCAL LAWS OF THE CITY OF NEW YORK FOR THE YEAR 2009

No. 87

Introduced by Council Member Gennaro, the Speaker (Council Member Quinn), Brewer, Comrie, Dickens, Garodnick, Gioia, James, Koppell, Lappin, Mitchell, Palma, Recchia Jr., Reyna, Rivera, Stewart, Liu, Yassky, Sears, White Jr., Mendez, de Blasio, Mark-Viverito, Vann, Avella, Vacca, Gerson, Jackson, Gonzalez, Ferreras, Vallone Jr., Barron, Arroyo, Crowley and Mealy

A LOCAL LAW

To amend the New York city charter and the administrative code of the city of New York, in relation to requiring energy audits and retro-commissioning of base building systems of certain buildings and retro-fitting of certain city-owned buildings.

Be it enacted by the Council as follows:

Section 1. Chapter 3 of title 28 of the administrative code of the city of New York is amended by adding a new article 308 to read as follows:

ARTICLE 308 ENERGY AUDITS AND RETRO-COMMISSIONING OF BASE BUILDING SYSTEMS

§28-308.1 Definitions. As used in this article, the following terms shall have the following meanings:

BASE BUILDING SYSTEMS. The systems or subsystems of a building that use energy and/or impact energy consumption including:

1. The building envelope.
2. The HVAC (heating ventilating and air conditioning) systems.
3. Conveying systems.

IMPLEMENTATION & ENFORCEMENT

- The **NYC Department of Buildings** is responsible for implementation and enforcement
- Implementation includes processing and reviewing submissions of Energy Efficiency Reports, Extension Requests, and Deferral Requests
Fees:
 - Initial Filing Fee.....**\$375**
 - Extension Request Fee.....**\$155**
 - Amendment Fee.....**\$145**
- Failure to comply with LL87/09 subjects properties to fines of **\$3,000** the first year and **\$5,000** for each additional year

WHAT IS A COVERED BUILDING?

Check the **Covered Buildings List** and **Department of Finance Tax Bills** to determine if a property needs to comply

- A single building on a lot over 50,000 square feet
- Two (2) or more buildings on the same tax lot that together are more than 100,000 square feet
- Two (2) or more buildings held in condo ownership that together are more than 100,000 square feet

10 DIGIT BBL	BOR-OUGH	BLOCK	LOT	STREET ADDRESS	ZIP CODE	DOF SQUARE FOOTAGE*
1000047501	1	4	7501	WATER STREET	10004	2621563
1000050010	1	5	10	BROAD STREET	10004	1016406
1000057501	1	5	7501	BROAD STREET	10004	1354691
1000087501	1	8	7501	WHITEHALL STREET	10004	169061
1000090001	1	9	1	WHITEHALL STREET	10004	845018
1000090014	1	9	14	STATE STREET	10004	544015
1000090029	1	9	29	WHITEHALL STREET	10004	896956
1000100014	1	10	14	WHITEHALL STREET	10004	365792
1000100016	1	10	16	BROAD STREET	10004	336025
1000100023	1	10	23	WHITEHALL STREET	10004	321994
1000110014	1	11	14	BEAVER STREET	10004	51387

Sample list of Properties Covered by LL87/09

WHAT IS A COVERED BUILDING?



- HVAC (Heating, Ventilation and Air Conditioning)
- Electrical and Lighting
- Domestic Hot Water
- Building Envelope
- Conveying Systems

EXEMPTIONS | EXCEPTIONS | DEFERRALS

EXEMPTIONS

Energy Efficiency Report (EER)

- Building owners do not have to file if the building is classified as Class 1 pursuant to subdivision 1802 of the real property tax law of the state of New York (1, 2, or 3 family dwellings that are not condominiums or 1, 2, or 3 family condos of 3 stories or less – status should be indicated on your tax bill from the Department of Finance)

EXEMPTIONS | EXCEPTIONS | DEFERRALS

EXCEPTIONS

Conducting an Energy Audit

- Building owners need not conduct an energy audit if:
 - The building has received an EPA Energy Star label for at least two (2) of the three (30 years preceding the filing of the building's Energy Efficiency Report (EER))*
 - The building has received LEED Certification within 4 years prior to the filing of the building's EER*
 - The building is a SIMPLE BUILDING and 6/7 of the items listed in the law are satisfied (This only applies to the building's first EER filing.)*



Simple Building: No central cooling or chilled water system

****Certified by an RDP***

EXEMPTIONS | EXCEPTIONS | DEFERRALS

Conducting Retro-commissioning

- Building owners do not have to conduct retro-commissioning if:
 - The building has received LEED Certification within **two (2) years prior** to the filing of the building's EER

AND

- The building has earned the **LEED point for Existing Building Commissioning investigation and analysis**

AND

- The building has earned the **LEED point for Existing Building Commissioning implementation**



EXEMPTIONS | EXCEPTIONS | DEFERRALS

DEFERRALS

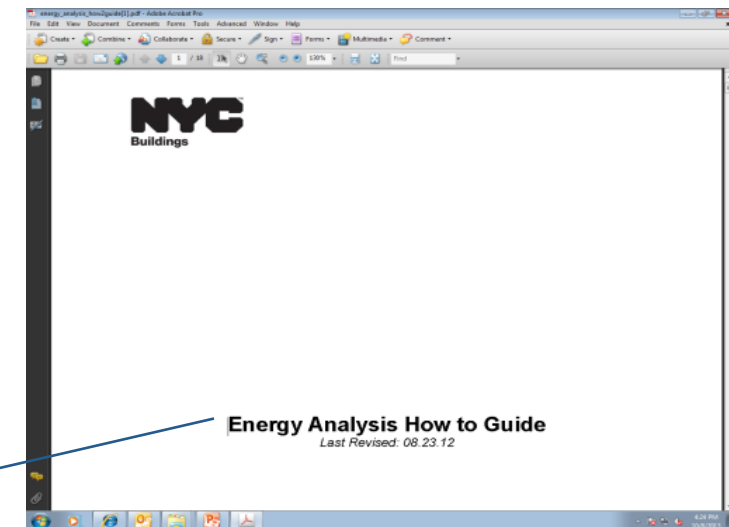
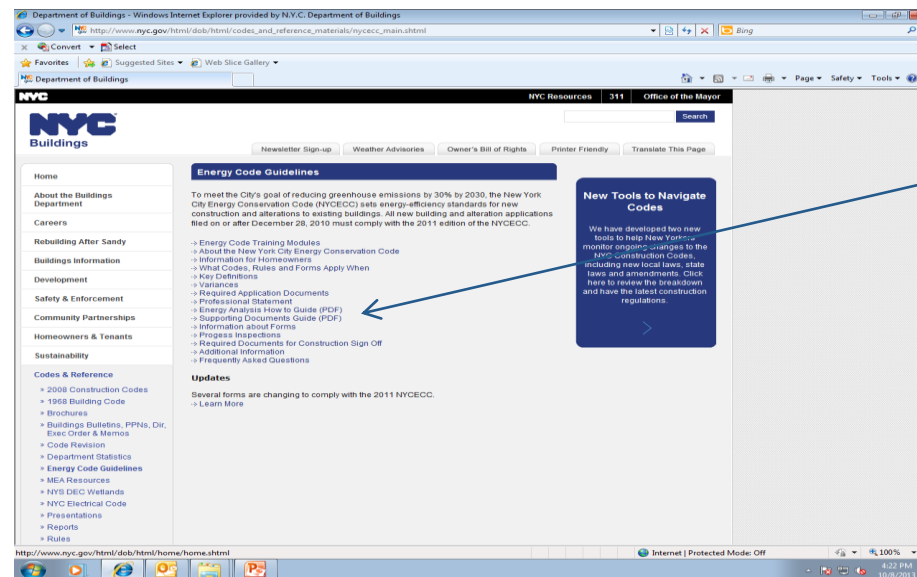
Filing an EER Deferral

- Building owners can defer filing until the next filing year for a building (10 years) if:
 - The building is less than 10 years old, **AND/OR**
 - The building has substantially changed its base building systems**AND**
 - The building can demonstrate that it meets the Energy Code as in effect
 - for new buildings constructed on or after July 1, 2010**OR**
 - as in effect at the time the building was built/alterred, whichever is later

DEMONSTRATING ENERGY CODE COMPLIANCE

DOB WEBSITE

- Codes & Reference
 - Energy Code Guidelines
 - Energy Analysis How To Guide



EXEMPTIONS | EXCEPTIONS | DEFERRALS

Filing Extension for an EER

- Building owners **must** file by **October 1st** of their reporting year:
 - Financial Hardship (one year – may be renewed annually)
 - Property taxes in arrears within 2 years prior to filing of EER on the DOF's annual New York City tax lien sale list
 - Exempt from real property taxes pursuant to sections 420-a, 420-b, 446 or 462 of the real property tax law
 - Had outstanding balances under the Department of Housing Preservation and Development's Emergency Repair Program that resulted in the property's inclusion, within two (2) years prior to filing of EER, on the DOF's annual New York city tax lien sale list
 - Has an active or effective commitment letter from a governmental agency that provides for the financing of the rehabilitation, within a period of five (5) years or less, for the purposes of affordable housing for low or moderate income families
 - Good Faith Effort (one year – may only be granted twice)

EXAMPLE: Hurricane Sandy wiped out base building systems, so unable to complete LL87 work

WHO CAN DO THIS WORK?

- NYS Registered Design Professionals (PE or RA) can act as the Auditor and/or Retro-cx Agent if they have the required certification(s) **OR** they can supervise a team that has an individual with the required certification(s)
- For retro-cx, a certified Refrigerating System Operating Engineer or a licensed High Pressure Boiler Operator can be substituted for the RDP
- Non-Registered Design Professionals (not a PE or an RA) can act as the Auditor and/or Retro-cx Agent if they have the required certification(s) **AND** they have registered with the Department of Buildings

NOTE: The energy auditor or retro-cx agent performing or supervising may not be on the staff of the building being audited/retro-commissioned

ENERGY AUDITOR CERTIFICATIONS

(RDPS OR THOSE ON RDP TEAM)

- NYSERDA approved Flex-Tech consultant
- CEM or CEA – Certified Energy Manager/Auditor (AEE)
- HPBD – High Performance Building Design Professional (ASHRAE)
- BEAP – Building Energy Assessment Professional (ASHRAE)
- MFBA – Multifamily Building Analyst (BPI) – **for multifamily audits ONLY**

RETRO-CX AGENT CERTIFICATIONS

(RDPs OR THOSE ON RDP TEAM)

- CCP - Certified Commissioning Professional (BCA)
- CBCP - Certified Building Commissioning Professional (AEE)
- EBCP - Existing Building Commissioning Professional (AEE)
- CPMP - Commissioning Process Management Professional (ASHRAE)
- ACPAP - Accredited Commissioning Process Authority Professional (University of Wisconsin)

REQUIRED CERTIFICATION(S) FOR Non-RDPs REGISTERED WITH THE DEPARTMENT

- To perform energy audits
 - CEM/CEA from AEE
 - HPBD from ASHRAE
 - BEAP from ASHRAE
 - MFBA from BPI (for multifamily audits only)
- To perform retro-commissioning
 - CCP from BCA
 - CBCP from AEE
 - EBCP from AEE
 - CPMP from ASHRAE

WHAT IS AN EER?

An **Energy Efficiency Report (EER)** is the report required to be filed pursuant to section 28-308.4. An EER includes:

- EERC1 (Professional Certification: Energy Auditor and Owner Statements) form
- Energy Audit Workbook
- EERC2 (Professional Certification: Retro-commissioning Agent and Owner Statements) form
- Retro-commissioning Workbook

EER SUBMISSION PROCESS

Owners **must** submit by 12/31 of the building’s filing year

- The filing year is the calendar year that coincides with the last digit of the building’s tax block number

Last digit of tax block number:	3	4	5	6	7	8	9	0	1	2
Year first energy efficiency report must be complete by 12/31 of:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022

- Hire a professional to conduct energy audit and retro-commissioning activities. Allow enough time for a service provider to complete the work

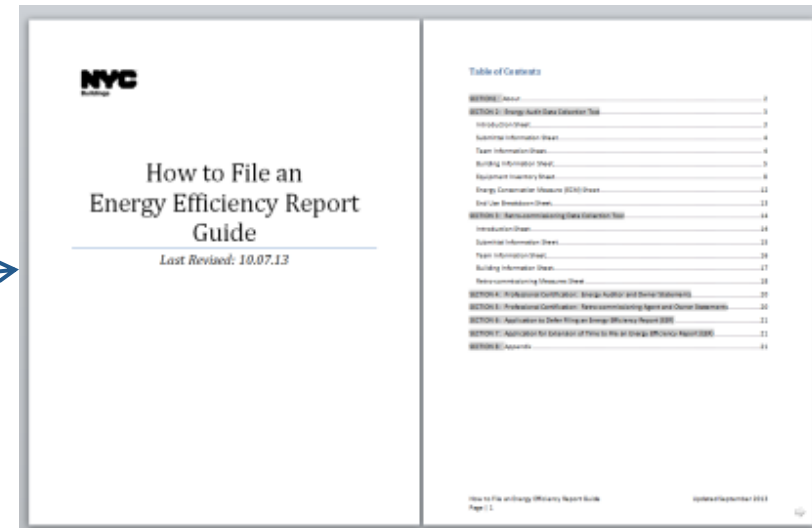
EER SUBMISSION PROCESS *(CONTINUED)*

- Complete the **EA Professional Certification Form (EERC1)** and **EA Reporting Workbook** and the **Retro-cx Professional Certification Form (EERC2)** and the **Retro-cx Reporting Workbook**.
- Submit the four parts of the EER via email to LL87@buildings.nyc.gov
 - DOB Sustainability Auditors will perform an initial review of the submission for completeness and will issue preliminary comments
 - An email request for payment will also be sent
 - Mail in payment (as described in the email) and respond with a resubmittal to any of the comments

EER SUBMISSION PROCESS (CONTINUED)

- For help, consult:

- Service Notice
- How to File an Energy Efficiency Report Guide
- Example Tools (EA & Retro-cx)



- Secondary technical reviews of the tools will be conducted, and randomly-selected properties will have full reviews of the actual audit and retro-commissioning full reports

HELPFUL LINKS

- General questions about LL87:
LL87Questions@buildings.nyc.gov
- Submissions or inquiries related to a specific submission:
LL87@buildings.nyc.gov
 - <http://www1.nyc.gov/site/buildings/business/energy-audits-and-retro-commissioning.page>

STATISTICS

- Almost 5000 submissions received
- Almost 400 chosen for comprehensive review
- Almost half of those are **still responding to objections**

PROGRAMMATIC DETAILS

- What's New?
- Deficiencies
 - No deficiency observed throughout
 - Not corrected/corrections verified before submitting
- Comprehensive Reviews: full reports
 - Violations: after one year
- Shared BBS: different blocks due in later years
- Addition/Deletion of certifications
- What qualifies as a capital project (**not steam trap replacement**)

INITIAL SUBMISSIONS

- Attachments
 - BBL **must be consistent** on all documents
 - All BBLs associated with the submission **must be included** on the initial submission forms (no late entries)
 - All submissions (including re-submissions) are to be sent **only** to LL87@buildings.nyc.gov
 - Email address for the building Owner **is required**

PRIMARY REVIEWS

- SECTION 1 on EERC1 and EERC2 forms (filing status, etc.) **must** be filled in **COMPLETELY**
- SECTION 5 on EERC1 and EERC2 forms **must be signed**
- RCx Deficiencies – Corrections must have been completed/verified by the RCx Agent **prior to submission**
- Corrections **must have**: Date, Cost, and by Whom the correction was made
- Language on the forms must reflect that the corrections **have been completed**

PAYMENTS

- ALL LL87/09 payments **must be mailed**
- Checks **must** have the reference number, or violation number, as well as the BIN

TECHNICAL REQUIREMENTS

COMPREHENSIVE REVIEW – NOTICE OF OBJECTIONS

- ✓ Revised Format
- ✓ Retro-Commissioning has Energy Auditing component

NYC

Buildings

Department of Buildings

280 Broadway

New York, New York 10007

www.nyc.gov/dob

Notice of Local Law 87/2009 Objections

Applicant/Owner's Representative:

Service Provider (Energy Audit):

Service Provider (Retro-Cx):

Review Date:

Reference #:

Facility Address:

Building Type (%):

Year EER is Due:

Year EER is Submitted:

XX/XX/201X; XX/XX/201X [Rev 1]; XX/XX/201X [Rev 2]; XX/XX/201X [Rev 3]

XXXX_YEAR_BBL_A_CR

NYC Department of Buildings Sustainability Enforcement Auditor: Syed Abidi [Sabidi@buildings.nyc.gov]

To discuss and resolve these objections, please call our office at 212.393.2475 to schedule an appointment with the Sustainability Enforcement Auditor listed above. You will need the reference number found at the top of this objection sheet. To make the best possible use of the auditor's and your time, please make sure you are prepared to discuss and resolve these objections before your scheduled appointment. The individuals required to attend this meeting must be listed as Energy Auditor and Retro-Commissioning Agent on the submitted EERC1 and EERC2 forms.

The "Objections" columns (E & F) are the main categories of review. If the language is **crossed-out**, it has been satisfied. The "Comments" column (G) will tell you what the specific objection is, and if there is no objection, it will be written in **green**. For each revision, the "Explanation of Correction (To be completed by the Applicant)" and the remaining columns (H, I, J, K, L, and M - depending upon revision status) should be in a new and different color. The color indicates the date on which the objection was satisfied. On the second and subsequent reviews, the items that have been satisfied will be changed to a new color and **crossed-out**. Those items that remain in **red** and are **not crossed-out** will indicate which objections remain. The Review Date will have subsequent dates added in the corresponding color(s). **References:** Local Law 87/09, Promulgation Details for 1 RCNY 103-07, Level 2 Energy Survey and Analysis of the 2011 edition of Procedures for Commercial Building Energy Audits (ASHRAE), and applicable NYC Buildings Code as in effect on or after July 1, 2010.

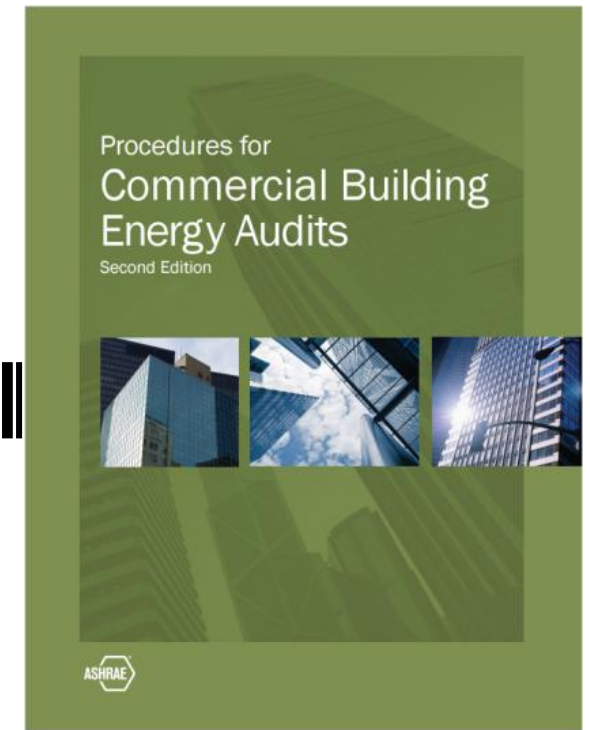
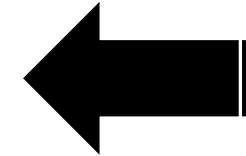
Obj. #	Section of Law or Rule	Objections: The following are required and where indicated , have NOT been correctly performed by the applicant.	Comments	Explanation of Correction (To be completed by the Applicant)			Modified Page Number AND Tab/Cell (To be completed by the Applicant)			(DOB Only) Date Resolved				
				REV1	REV2	REV3	REV1	REV2	REV3					
Energy Audit + Retro-Commissioning														
Project and Team Information Schedule														
1	§28-308.1, 308.2, 308.7, and 1 RCNY 103-07	Building owner, manager, O&M staff, contractors, energy auditor, retro-commissioning agent, energy service companies (ESCOs), utility companies												

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LL87/09 - DEFINED SCOPE OF WORK

ENERGY AUDIT

- Project and Team Information
- Building Operating Schedule
- Space Function Summary Schedule
- Baseline Building Key Operating Parameters (Measured/Existing)
- Building Description - Conditional Assessment
- Utility Billing Analysis (Base Building + Tenant)
- List of Mechanical Equipment and Lighting Inventory
- List of Testing Equipment Used
- Master List of Findings & ECMs List
- Energy Savings Calculations
- Economic Analysis
- Pre and Post End Use Breakdown Schedule

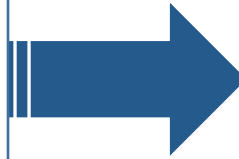


- ✓ As Referenced within §28-308.1 of LL87/09 under **Energy Audit** or **Audit Definition**
- ✓ At a minimum ASHRAE Level-II Energy Audit

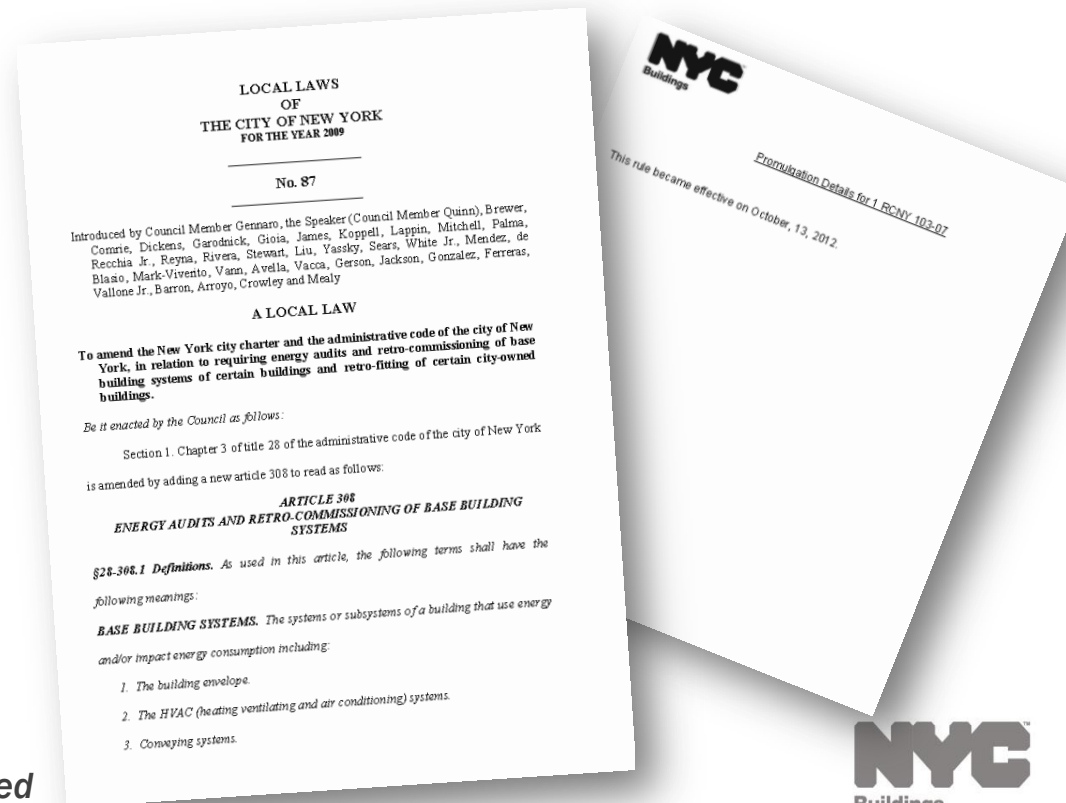
LL87/09 - DEFINED SCOPE OF WORK

RETRO-COMMISSIONING

- Project and Team Information
- Baseline Building Information
- Current Facility Requirements (CFR)
- Testing Protocols/Functional Performance Testing (FPT)
- Master list of findings
- Deficiencies corrected
- Training and Documentation



As per §28-308.3.1 of LL87/09 **Contents of Retro-Commissioning Report**



- ✓ *Retro-Cx is a Sequential Exercise*
- ✓ *CFR → FPT → List of RCMs*
- ✓ *Comprehensive reviews are focused towards **Approach Taken to Reach Conclusion***
- ✓ *Law and rules of the law **DO NOT** capture all fine details -Refer to published industry standards*

COMPREHENSIVE REVIEW – NOTICE OF LL87/09 OBJECTIONS

ENERGY AUDIT – SCOPE OF WORK

- Project and Team Information
- Building Operating Schedule
- Space Function Summary **Schedule**
- Baseline Building Key Operating Parameters (**Measured/Existing**)
- Building Description - **Conditional Assessment**
- Utility Billing Analysis (Base Building + **Tenant**)
- List of Mechanical Equipment and Lighting Inventory
- List of **Testing Equipment Used**
- Master List of Findings & ECMs List
- **Energy Savings Calculations**
- **Economic Analysis**
- Pre and Post End Use Breakdown Schedule

RETRO-COMMISSIONING – SCOPE OF WORK

- CFR - **Current Facility Requirements** (Reference: **NYC Building Codes, ASHRAE/ANSI/IES Standards and Guidelines& Manufacturer Guidelines**)
 - FPT - **Testing Protocols (Pre-Functional and Functional Performance Test Forms)**
 - Master list of findings - RCMs Lists
 - Retro-Commissioning Deficiencies Corrected
 - Training and Documentation **Statements**
- ✓ *Energy Auditing & Retro-Cx go hand-in-hand; not to be considered two mutually exclusive exercises*
- ✓ *Retro-Cx has Energy Auditing component*

COMPREHENSIVE REVIEW – NOTICE OF LL87/09 OBJECTIONS

SPACE FUNCTION SUMMARY SCHEDULE

Space Function Summary Schedule			
3	§28-308.1, 308.2, 308.7, and 1 RCNY 103-07	Space function type, gross floor area, weekly operating hours, weeks/year, principal HVAC type, % of spaces heated, % of spaces cooled [Common Area + Tenants]	

Space Function Summary

Space Function Summary								
#	Space Function Type	Area	Weekly Operating Hours	Weeks/Year	# Occupants	HVAC Type	% Heated	% Cooled
1	Mechanical Rooms	800	40	52	Staff (3)	Not Conditioned	0%	0%
2	Utility Rooms	180	40	52	Staff (3)	Not Conditioned	0%	0%
3	Storage Rooms	336	168 - As needed	52	Staff (3)	Not Conditioned	0%	0%
4	Garage	3,100	168		30 Parking Spots	Not Conditioned		
5	Staff Room	220	40	52	Staff (3)	Not Conditioned	0%	0%
6	Laundry Room	340	168	52	98% Occupancy	Not Conditioned	0%	0%
7	Hallways	4,172	168	52	98% Occupancy	Not Conditioned	0%	0%
8	Lobby	416	168	52	98% Occupancy	Heating: Steam from heating plant	100%	0%
9	Stairwells	2,114	168	52	98% Occupancy	Not Conditioned	0%	0%
10	Community Room	306	40	52	98% Occupancy	Heating: Steam from heating plant Cooling: Window AC Units	100%	100%
11	Residential Units	115,626	168	52	98% Occupancy	Heating: Steam from heating plant Cooling: Privately owned AC Units	100%	100%
Total		127,610						

COMPREHENSIVE REVIEW – NOTICE OF LL87/09 OBJECTIONS

BASELINE BUILDING KEY OPERATING PARAMETERS (*MEASURED/EXISTING*)

Space temperature and humidity setpoints & setbacks schedules (Heating, Cooling, Outdoor, List of Representative Sample of Indoor Spaces)
System temperature setpoints (Chillers, Boilers, Cooling Towers, AHUs and Associated Distribution Systems - CHW, HW, CW, SA, MA, RA, OA)
Boiler pressure setpoints & setbacks (Operating, Modulating, High Limit)
System flow and pressure setpoints (Chiller, Cooling Tower, HW Boiler, AHUs and Associated Fans and Pumps)
DHW storage & delivery temperatures (Before Mixing Valve, After Mixing Valve and List of Representative Sample of Faucet Outlets)
Ventilation (Type of Ventilation - Natural and/or Mechanical, OA requirements - CFMs per Person and/or CFMs per Sq.Ft.)

COMPREHENSIVE REVIEW – NOTICE OF LL87/09 OBJECTIONS

BUILDING DESCRIPTION (*CONDITIONAL ASSESSMENT*)

- ✓ *Distribution system*
- ✓ *Controls*
- ✓ *Date stamped photos*
- ✓ *Terminal units*
- ✓ *Insulation*
- ✓ *Leaks*

LIST OF TESTING EQUIPMENT USED

- ✓ *Last calibration date*
- ✓ *Calibration certificate*
- ✓ *Manufacturer recommended calibration frequency*

ECONOMIC ANALYSIS (*WITH REFERENCES*)

- ✓ *Per unit material cost*
- ✓ *Labor cost*

UTILITY BILLING ANALYSIS (*BASE BUILDING + TENANT*)

- ✓ *Consecutive 24 months data*
- ✓ *Whole site including tenant-aggregated*

ENERGY SAVINGS CALCULATIONS

- ✓ *Bin Weather Method - Recommended*
- ✓ *Equations, formulas, Inputs, Outputs, Assumptions, Modeling inputs and output files*

PRE & POST END USE BREAKDOWN SCHEDULE

- ✓ *Post Breakdown by FUEL TYPE and by END-USE TYPE*

COMPREHENSIVE REVIEW – NOTICE OF LL87/09 OBJECTIONS

CURRENT FACILITY REQUIREMENTS

(Suggested References: NYC Building Codes, ASHRAE/ANSI/IES Standards and Guidelines & Manufacturer Guidelines)

Functional and Operational Requirements and Expectations include:

- Goals
- Measurable performance criteria
- Success Criteria
- Supporting information to meet the requirements of occupants, user and owners of the facility

COMPREHENSIVE REVIEW – NOTICE OF LL87/09 OBJECTIONS

CURRENT FACILITY REQUIREMENTS

(Suggested References: NYC Building Codes, ASHRAE/ANSI/IES Standards and Guidelines & Manufacturer Guidelines)

Current Facility Requirements (Reference: NYC Building Codes, ASHRAE/ANSI/IES Standards and Guidelines & Manufacturer Guidelines)					
13	§28-308.1, §28-308.3.1 (2.2)	Space temperature and humidity setpoints & setbacks schedules (Heating, Cooling, Outdoor, Indoor)			
		System temperature setpoints (Chillers, Boilers, Cooling Towers, AHUs and Associated Distribution Systems - CHW, HW, CW, SA, MA, RA, OA)			
		Steam boiler pressure setpoints & setbacks (Operating, Modulating, High Limit)			
		System flow and pressure setpoints (Chiller, Cooling Tower, HW Boiler, AHUs and Associated Fans and Pumps)			
		Ventilation (Type of Ventilation - Natural and/or Mechanical, OA requirements - CFMs per Person and/or CFMs per Sq.Ft.)			
		Climate Controls (Controls Sequence of Operation, Sensors, Measuring and Monitoring Devices including BMS/EMS)			
		Lighting Levels (Foot-candles - FC)			

CURRENT FACILITY REQUIREMENTS

It shall be the responsibility of the Retro-Commissioning Agent to define, document and develop the Current Facility Requirements(CFR) within the Energy Efficiency Report (EER) based on the age of the facility, condition of the base building systems, occupancy status, space use changes within the facility, interviews with occupants/maintenance staff and available design/as-built drawings. CFR must include acceptable seasonal operations set points, adequate operating and run-time schedules, satisfied load conditions under which equipment operates, indoor environmental quality requirements, operation logs and desired equipment efficiencies of the base building systems and sub-systems. However, defined CFR shall be in no case less stringent than applicable building codes (based on the latest approved certificate of occupancy), effective building laws and rules of the City of New York, and acceptable ASHRAE/ANSI/IES standards.

CURRENT FACILITY REQUIREMENTS

Current Facility Requirements (CFR)

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COMPREHENSIVE REVIEW – NOTICE OF LL87/09 OBJECTIONS

TESTING PROTOCOLS: PRE-FUNCTIONAL TEST FORMS

Contents of Pre-Functional Test Forms

- Conditional assessment
- Maintenance and operational components checks
- HVAC sensor calibration
- Leaks
- Insulation

COMPREHENSIVE REVIEW – NOTICE OF LL87/09 OBJECTIONS

TESTING PROTOCOLS: FUNCTIONAL PERFORMANCE TEST FORMS

Contents of Functional Performance Test Forms

- Characteristics of system being tested (Tag, Type, Nameplate information, Date(s) of Test, Location, Area (s) served) and testing parameters (Outdoor Dry Bulb and Wet Bulb temperatures, Indoor Temperature). Note: off-season testing is not acceptable.
- Information on team members involved in testing with signature, date and time.
- List of actual steps/actions taken during the testing procedure to gauge the operational performance of the system including but not limited to the following (as applicable):
 - Controls Actuation & Sequencing
 - Staging and Load Distribution
 - Setpoints and Setback Settings & Controls (Temperature, Pressure and Humidity)
 - Integrated System Level Testing
 - Economizer Functions (Both Air & Water Side)
 - Automatic Reset Functions
 - Simultaneous Heating and Cooling
 - Manual Overrides
 - Simulation of Modes of Operations

COMPREHENSIVE REVIEW – NOTICE OF LL87/09 OBJECTIONS

TESTING PROTOCOLS: FUNCTIONAL PERFORMANCE TEST FORMS

Contents of Functional Performance Test Forms

- Test results in terms of observed response for each actions/step taken during the testing procedure. (Does not mean pass/fail or checkmarks) and a comparison with the defined acceptance criteria. List of results include but not limited to:
 - Temperature Measurements
 - Pressure Measurements
 - Flow Measurements
 - Amperage and Voltage Measurements
 - Damper/Valve/Actuator Responses

COMPREHENSIVE REVIEW – NOTICE OF LL87/09 OBJECTIONS

FUNCTIONAL PERFORMANCE TEST FORMS

Primary Chilled Water Pump
(PCHWP-D-1 through PCHWP-D-3)

Load/Description:	Primary Chilled Water System	Date:	05/25/16
Equipment ID:	PCHWP-1	Floor:	D-level
Equipment Manufacturer:	Weinman	Room:	Chiller Plant
Model Number:	Can't see Nameplate 1063-182	Serial Number:	Can't see Nameplate T746200

1.0 PURPOSE

This document will consist of a retro-commissioning test procedure for a pump to confirm that this system component operates as per the requirements set forth by New York City Local Law No. 87 and the current facility requirements (CFR) of the project.

2.0 TESTING PROCEDURES

2.1 GENERAL REVIEW

Item #	Task Description	N/A	Passed	Failed	Date
2.1.1.	Pump rotates in correct direction.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.1.2.	No irregular noise or vibration when pump is in operation.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.1.3.	No leaking apparent around fittings or seals.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.1.4.	H-O-A switch correctly activates and deactivates the unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.1.5.	Pump balancing valve adjusted to water balancing position/mark.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.

2.2 ELECTRICAL DATA

CURRENT			VOLTAGE		
	Motor Nameplate	Motor Actual		Motor Nameplate	Motor Actual
AΦ	444/222		A/B	230/460	
BΦ			B/C		
CΦ			C/A		
Record imbalance between each phase. Imbalance less than 2%?			Record imbalance between each phase. Imbalance less than 2%?		
YES <input type="checkbox"/> NO <input type="checkbox"/>			YES <input type="checkbox"/> NO <input type="checkbox"/>		

Primary Chilled water Pump
(PCHWP-D-1 through PCHWP-D-3)

2.3 SENSOR CALIBRATION VERIFICATION DATA					
Sensor Type (Airflow, DP, Temperature, etc.)	Controlling Sensor (100% Sampling)	Monitoring Sensor (10% Sampling)	JB&B Verified?	Observed Value (At BMS)	Measured Value (Calibrated Test Device)
Ex: Temperature Sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	55°F	56°F
Differential Pressure Switch	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	ON	ON

2.4 SYSTEM OFF					
Item #	Task Description	N/A	Passed	Failed	Date
2.4.1.	With the system not in operation, verify the following:				
2.4.2.	BMS indicates pump status as OFF via current transmitter.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.4.3.	BMS indicates pump flow status as OFF via differential pressure switch.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.4.4.	Pump suction and discharge pressure gauges have same pressure reading.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.4.5.	Verify that all shutoff valves, appropriate automatic control valves and/or a sufficient number of outlets are open to attain pump design flow.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.4.6.	Pump start command from the operator workstation initiates system control operation.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.

2.5 PUMP START AND STOP					
Item #	Task Description	N/A	Passed	Failed	Date
2.5.1.	Start pump with operator command ON via BMS pump ON/OFF selector switch and verify system operation:				
2.5.1.1.	Pump failure alarm 20 second time delay starts (adjustable).	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.



COMPREHENSIVE REVIEW – NOTICE OF LL87/09 OBJECTIONS

FUNCTIONAL PERFORMANCE TEST FORMS

(PCHWP-D-1 through PCHWP-D-3)

(PCHWP-D-1 through PCHWP-D-3)

Item #	Task Description	N/A	Passed	Failed	Date
2.6.1.6.	Plot the pump total head at shutoff of _____ ft. H ₂ O (from above) on pump curve and determine pump impeller size is _____ inches. Pump impeller size matches submitted impeller size of _____ inches.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.6.2.	Using the calibrated test gauge, open pump discharge valve and record the following:				
2.6.2.1.	Pump discharge pressure: <u>136</u> psi	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.6.2.2.	Pump suction pressure: <u>122</u> psi	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.6.2.3.	Pump differential pressure: <u>14</u> psi	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.6.2.4.	Pump operating head (differential psig x 2.31 ft. H ₂ O/psig): <u>32.34</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.6.2.5.	Plot the pump operating head of <u>32.34</u> ft. H ₂ O (from above) on pump curve (sketched) and verify that pump <u>4,300</u> gpm (from sketched pump curve) meets pump design of <u>2,400</u> gpm. <u>@ full speed.</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.6.3.	Manually stop pump with H-O-A selector switch in OFF position.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.

2.7 LL87 REVIEW					
Item #	Task Description	N/A	Passed	Failed	Date
2.7.1.	Temperature and humidity set points and setbacks are appropriate and operating schedules reflect major space occupancy patterns and the CFR.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.7.2.	Sensors are properly calibrated.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.7.3.	Controls are functioning and control sequences are appropriate for the CFR.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.7.4.	Loads are distributed equally across equipment that operates in parallel.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.7.5.	System automatic-reset functions are functioning appropriately.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.7.6.	Adjustments have been made to compensate for oversized or undersized equipment so that it is functioning as efficiently as possible.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.7.7.	Air and waterside distribution systems are balanced.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.7.8.	Water pumps are functioning as designed.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.
2.7.9.	System water leaks have been identified and repaired.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Click here to enter a date.

5.0 APPROVAL AND SIGN-OFF

It is understood that CA's signature in no way prejudices any claim against the Contractor for faulty material, poor workmanship or failure to comply with the Approving Authority's requirements or local ordinances.

Any exceptions, without prejudice to the operability of the aforementioned devices and systems, are detailed below.

non-applicable items and sections have been noted as 'N/A' (Not Applicable) prior to sign-off.

Exceptions:

OWNER			
Name (Print)	Company	Signature	Date
BATC SERVICE PROVIDER			
Name (Print)	Company	Signature	Date
COMMISSIONING AUTHORITY			
Name (Print)	Company	Signature	Date
OWNER'S REPRESENTATIVE			
Name (Print)	Company	Signature	Date

END OF TEST PROCEDURE

q:\projects\144480\1 federal reserve bank-retro commissioning-33 liberty\wp\forms\primary chilled water pump (pchwp-d-1 through pchwp-d-3)_rev.docm

LL87/09 – DEFINED SCOPE OF WORK

AVAILABLE REFERENCES FOR RETRO-COMMISSIONING (a.k.a. Commissioning for Existing Buildings)



STANDARD RETRO-COMMISSIONING PROCESS

Planning Phase

- 1.1 Document owner's operating and current facility requirements
- 1.2 Develop retro-commissioning plan

Investigation Phase

- 2.1 Review facility documentation
- 2.2 Document baseline building operating protocols
- 2.3 Perform and document diagnostic monitoring and functional performance testing
- 2.4 Develop master list of findings and issue logs
- 2.5 Generate list of deficiencies identified to be corrected

STANDARD RETRO-COMMISSIONING PROCESS

Implementation Phase

- 3.1 Develop implementation plan
- 3.2 Implementation summary report including verification of results

Project Hand-Off Phase

- 4.1 Develop final retro-commissioning report
- 4.2 Compile a system manual
- 4.3 Training and documentation

USEFUL INFORMATION | COMMON ERRORS | CHALLENGES

- ✓ What is a base building system
- ✓ Importance of building a balanced team and teamwork
- ✓ Defining roles and responsibilities early in the process
- ✓ Failure to vet and peer review information prior submitting to DOB
- ✓ Plan ahead for compliance – depending upon complexity of building systems
- ✓ Proof of deficiencies corrected under Retro-Commissioning
- ✓ Inconsistent, incomplete and insufficient information provided
- ✓ Generic information – template based and not specific to building in attention
- ✓ Retro-Cx agent to follow up and verify corrected deficiencies

COMBUSTION EFFICIENCY TESTING

- ✓ Must be conducted for all boilers (Domestic Hot Water, Steam Boiler, Heating Hot Water)
- ✓ Combustion efficiency test results must be obtained during the steady state conditions at multiple firing rates for staged firing or fully modulating burners, regardless of the size and capacity of the burner/boiler. For dual fired burner, testing must be conducted for both fuel source types.
- ✓ Documentation of test results (pre and post tuning) must include load%, firing rate (gph/cfh), combustion efficiency (%), O₂ (%), CO₂ (%), excess air (%), CO (ppm), stack temperature (°F), ambient air temperature (°F), draft (in. w.c.), and smoke # (fuel oil).
- ✓ Combustion efficiency test results must be obtained during the steady state conditions at multiple firing rates for staged firing or fully modulating burners, regardless of the size and capacity of the burner/boiler. For dual fired burner, testing must be conducted for both fuel source types.
- ✓ As part of tuning exercise, optimize oxygen levels, excess air, draft in. w.c., carbon monoxide flue stack temperature, and ambient temperature to **industry acceptable ranges OR to manufacturer's specifications**.
- ✓ Refer to Boiler Tune-up Guide 40 CFR part 63 Subpart JJJJJ by National Emission Standards for Hazardous Air Pollutants for Area Sources: Industrial, Commercial, and Institutional Boilers

WHAT ARE OPTIMUM LEVELS?

(PER INDUSTRY STANDARDS)



Oil Fired Power Burners

Combustion Readings	Residential Furnaces, Boilers and Hot Water Tanks	Commercial Boilers
Oxygen (O ₂)	5% to 7%	4% to 6%
Stack Temperature (°F)	450° to 500°	325° to 425°
Draft in Water Column Inches (WC")	-.01 WC" Overfire or PMI*	-.01 WC" Overfire or PMI
Carbon Monoxide in Parts Per Million (ppm) Air Free	<50 ppm (Goal)	<100ppm (Goal)
	>100ppm (Excessive)	>200ppm (Excessive)
Smoke	Zero or PMI	Zero or PMI

Commercial Gas Fired Power Burners

Combustion Readings	Low Fire (Light Off)	High Fire
Oxygen (O ₂)	6% to 9%	3% to 6%
Stack Temperature (°F) <small>These are recommendations, always check with the manufacturer.</small>	Atmospheric boiler	270° + water/steam temp
	2 or 3 pass power burner	170° + water/steam temp
	4 pass power burner	100° + water/steam temp
Draft in Water Column Inches (WC") *	-.01 WC" Over fire or PMI	-.01 WC" Over fire or PMI
Carbon Monoxide in Parts Per Million (ppm) Air Free	<100ppm (Goal)	<100ppm (Goal)
	>300 - 400ppm (Excessive)	>200ppm (Excessive)

* Positive over fire pressure power burner recommended settings vary widely, consult the manufacturer.

TESTING, ADJUSTING AND BALANCING

- ✓ All major systems (serving > 10,000 sq. ft.) excluding steam and exhaust systems
- ✓ **Must be tested.** If the system is found to be out of balance, the condition must be corrected and noted on the retro-commissioning report.
- ✓ System adjusting and balancing may **ONLY** be performed by an individual or entity certified in the testing and balancing of HVAC systems by the National Environmental Balancing Bureau (NEBB), the Testing, Adjusting and Balancing Bureau (TABB), or the Associated Air Balance Council (AABC)
- ✓ EER must include name of TAB certified individual/entity, scanned copy of the certificate, date(s) TAB conducted, statement of completion, list of identified TAB deficiencies, correction of deficiencies and final TAB report. TAB work must be performed in accordance with published NEBB, TABB or AABC standards and guidelines.
- ✓ If the system is not test-able for any reason such as absence of test ports, balancing valves, balancing dampers, and/or circuit setters then Adjusting and Balancing is not required. However, testing component of TAB is still required to be conducted and **documented** with the list of reasons why a particular major system is not test-able and why the work is so extensive that it will require a work permit to adjust and balance the system. Must target under Energy Audit as ECM/EEM accordingly.

ASK QUESTIONS

From:

Sent: Friday, December 04, 2015 11:05 AM

To: Local Law 87 Questions (Buildings)

Subject: Testing and Balancing

If I have a heating only building with hydronic heat. The system is reverse return that is self-balancing. Pumping is constant volume so no variable flow or VFDs. There are no circuit setters or balancing valves. They just have shutoff ball valves. There are no pressure ports except on the pump which I can read. I also have no design drawings to determine what the flows would be or how the piping is actually arranged. Are they required to have a TAB done by a certified company for this case? Can we get a written guideline on when testing and balancing is required stating some common exceptions. Thank you.



ASK QUESTIONS

From: Syed Abidi (Buildings)
To:
Cc: Local Law 87 Questions (Buildings)
Subject: RE: Testing and Balancing (Do not Reply to this Email)

Sent: Tue 12/15/2015 2:00 PM

*****NO NOT REPLY TO THIS EMAIL*****

Good Afternoon

Please find the response below to your question regarding the presented scenario for Testing, Adjusting and Balancing.

Presented Scenario:

System is reverse return (Reverse return piping arrangement is generally preferred over direct return arrangement but inherently self-balancing claim is a separate debate - *not always the case*. For your presented scenario it is assumed reverse return arrangement is inherently self-balancing)

No circuit setters and/or balancing valves

No pressure ports except for pumps

No design drawings available

Missing information: Are their various zones/zones valves present? Primary/Secondary distribution system? Types of terminal units/ Any three-way valve application/main by-pass valve?

DOB Response:

Based on the above information provided it appears that the existing hydronic distribution system is not capable of being formally ADJUSTED and BALANCED (Exception on page 13 of the rule of the LL87/09 applies- Does not fall under Retro-Cx deficiency). However, still the system, under retro-commissioning, is subject to some level of minimum TESTING (spot testing/measurements, NOT necessarily by certified TABB, AABC,NEBB individual - see below) and DOCUMENTATION. However, testing, adjusting and balancing opportunity may be examined in connection to the energy audit, listing all required missing components necessary to make the distribution system adjust-able/balance-able (number of circuit setter or balancing valves needed and where) and highlighting benefits through balancing.

Note: In such a case, DOB, utilizing its authority, may conduct a site visit to verify the "Presented Scenario".

Spot Testing and Documentation (Water Side – Hydronic heating only) to support retro-cx agent's professional judgment is still required to be presented that shall include, at a minimum, the following:

1. Since the design drawings are not available, Provide specific (not generic) schematic/rough sketch of the distribution system to illustrate the reverse return piping arrangement (as determined). Also, include within the report narrative on existing conditions along with missing information as defined above.
2. Conduct standard pre-functional equipment and system checks (Automatic fill valve, strainers, pumps, motors, expansion tank, water cleanliness)
3. Take FLOW RATE MEASUREMENT (see below) at the main primary and secondary loops under full load condition (Document actual Entering/leaving temperatures in a loop, temperature drop, entering/leaving pressure, pressure drop, flow rate)
4. Take FLOW RATE MEASUREMENT (see below) at the representative sample of terminal units (Document actual Entering/leaving temperatures in a loop, temperature drop, entering/leaving pressure, pressure drop, flow rate)
5. Conduct testing on HWS/HWR pumps/motors (regardless of size) that includes documenting full name plate information and determining actual impeller diameter through pump curve, actual discharge pressures, actual suction pressure, pressure head actually measured, flow rate, voltage (t1-t2, t2-t3, t3-t1), amps (a1,a2,a3)

Flow Rate Measurements:

Following are the basic techniques for flow rate measurements in hydronic piping systems. Choose any one of the method based on your preference/system limitations:

- a. With calibrated balancing valves (N/A in above presented case)
- b. Using pump curves
- c. By the heat transfer method
- d. With flowmeters or orifices/flow fittings, or
- e. Using the equipment pressure loss (N/A in above presented case)

Thank you,

Syed M. Abidi, PE
Sustainability Enforcement Auditor
New York City Department of Buildings
Enforcement Unit
280 Broadway 7th Floor
New York, NY 10007
Phone: 212-393-2461
Fax: 212-566-3848
Sabidi@buildings.nyc.gov



ASK QUESTIONS

UTILIZE RESOURCES

From:
Sent: Friday, May 30, 2014 1:50 PM
To: Syed Abidi (Buildings)
Subject: Chiller Testing Required for LL87

Good Afternoon, Syed.

In regards to testing of chillers are input/output measurements such as leg voltages, Amps, and kW, required to be done in order to satisfy the requirements of LL87?

Thank you for your time.



ASK QUESTIONS

UTILIZE RESOURCES

You forwarded this message on 10/20/2016 11:43 AM.

From: Syed Abidi (Buildings)

Sent: Fri 5/30/2014 3:36 PM

To:

Cc: Robert Scarlett (Buildings); Holly Savoia (Buildings); Local Law 87 Questions (Buildings)

Subject: RE: Chiller Testing Required for LL87

Good Afternoon

Local Law 87/09 requires Functional Performance Testing (FPT) [Termed as "Testing Methodology" & "Integrated System Testing" within LL87] on all base building system/equipment (Chiller/Chilled Water System in your case below). However, it shall be noted that Department of Buildings has not defined the boundaries of such FPTs and left it to the consultants/service providers to follow standard industry guidelines/practices to bring the system/sub-system/component to Current Facility Requirements (CFR).

Based on standard industry practices and just to provide you with an idea, below are our (LL87 team) minimum expected items to be covered under FPT on Chiller(s)/Chilled Water System(s):

- Controls Sequence of Operation (Valves, Pumps, Differential Pressure Bypass e.t.c)
- Conditional Assessment (Pumps, VSDs, Motors, Valves, Distribution Piping, Heat Exchangers e.t.c)
- Sensor Calibration (Critical and Monitoring Sensors)
- Load Distribution Testing (chilled water flow rates, chilled water inlet and outlet temperatures, and chiller electric power (kW) or condensate/steam flow (lbs/hr) readings. Basically, determining chiller performance IPLV/NPLV if operating at optimal efficiencies)
- Automatic Reset/Setback Functions

Answer to your question in short: Yes, input/output measurements such as leg voltages, Amps, and kW are required if they would assist in determining chiller(s) part load performances/curves to complete FPT. I would recommend the following link to further direct you as far as Chiller FPT are concerned:

http://www.peci.org/ftguide/ftg/SystemModules/Chillers/Functional_Testing_for_Chillers.htm

Caution: Above link is for reference only and does not define the LL87 boundaries for Chiller FPT.

Please feel free to reach us if you have additional questions regarding LL87.

Thank you,

Syed M. Abidi, PE, CEM, CBCP, MFBA, LEED AP BD+C
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Sabidi@buildings.nyc.gov

STEAM SYSTEMS

- ✓ **1-Pipe Steam Distribution System:** Main steam system operating and modulating pressures (cut-in and cut-out) must be appropriate to the current facility requirements. **All identified deficiencies that reduce steam pressure and resolve uneven, over or under heating issues to meet the CFR must be corrected under retro-commissioning.** Operational assessment of air vents (master vents, riser vents, radiator vents) must be documented within the retro-cx report including vent tag, type, location, methodology of testing, observed condition/results, and orifice size in sample set of radiators.
- ✓ **2-pipe Steam Distribution System:** Condensate return temperature must be appropriate to the current facility requirements. **All identified deficiencies that reduce temperature of system return, reduce steam pressure and resolve uneven, over or under heating issues to meet the CFR must be corrected under retro-commissioning.** Operational assessment of steam traps (100% of high pressure and low pressure steam traps) must be documented within the retro-cx report including trap tag, type, location, methodology of testing, and observed condition/results. The traps identified as broken, damaged or deficient must be repaired including repairs or replacement of the traps' seat and capsule.

**For more information on Local Law LL87/09
visit our website:**

<http://www1.nyc.gov/site/buildings/business/energy-audits-and-retro-commissioning.page>

OR

Email inquiries to:

LL87Questions@buildings.nyc.gov