Retrocommissioning Process

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Retrocommissioning Experience:

- Working in Facilities Since 1975.
- Began Developing Current Retrocommissioning Process in Late 70's Early 80's.
- Worked for U.S. Air Force at Base Level 1983-1988.
- Worked for HQ AFCESA as Commissioning/Retrocommissioning Expert 1988-1991.
- Served On NEBB, ASHRAE and ASHE Committees Relating To Commissioning.

Retrocommissioning…….
what is it?

- Comparison to New Building Commissioning
- Retrocommissioning Verses Energy Audits

New Building Commissioning

- Two Basic Approaches:
  - Process Manager- Above work, management/development only
  - Technical – Team Leader
    - Process is skeleton that the flesh and blood of commissioning is held together.
    - Commissioning Authority leads team and is involved at all levels of the process.

New Building Commissioning

- Retrocommissioning Is NOT Applying New Building Process To Existing Buildings.
  - Typically No Design Team
  - Typically No Contractor
  - According To Age Of Facility, May Not Have Any Plans Or Documentation
  - Retrocommissioning Is a Process Of Optimization, Not Estimation
  - Immediate Feedback And Payback

Retrocommissioning

- Two Basic Approaches:
  - Energy Audit/+ limited testing
    - Generally advocates believe true retrocommissioning is too expensive.
  - Retrocommissioning
    - Detailed testing of all scoped systems.

When and Why:

1. Facility does not meet CFR.
    a. HVAC Issues
    b. Electrical Issues
    c. Plumbing Issues
    d. Lighting Issues
    e. Vertical Transportation Issues
    f. Envelope Issues
    g. Space Allocation Issues
    h. Specialty System Issues
    i. High Energy Consumption
    j. Change of Use/Function

Environmental Impact of Buildings*

- 65.2% of total U.S. electricity consumption [1]
- > 36% of total U.S. primary energy use [2]
- 30% of total U.S. greenhouse gas emissions [3]
- 136 million tons of construction and demolition waste in the U.S. (approx. 2.8 lbs/person/day) [4]
- 12% of potable water in the U.S. [5]
- 40% (3 billion tons annually) of raw materials use globally [6]

* Commercial and residential (From USGBC)

Energy Consumption Reduction

- Most Facilities “Fail” In a High Energy Consumption State
- Typical Energy Consumption Reduction Varies From 10 – 30%
- Most Properly Executed Retrocommissioning Projects Payback In Less Than 2 Years.

Productivity Benefits

Greatest Impact Of Retrocommissioning is Productivity

Productivity Benefits

Improve occupant performance

- Estimated $29 – $168 billion in national productivity losses per year [1]
- Student performance is better in daylit schools. [2, 3]

Reduce absenteeism and turnover

- Providing a healthy workplace improves employee satisfaction

- From USGBC

Footnotes:

1. Fisk and Rosenfeld, 1998, "Improved Indoor Environment Could Save Billions of Dollars"
2. Nicklas and Bailey, "Analysis of the Performance of Students in Daylit Schools," Innovative Design, Raleigh, NC, www.innovativedesign.net.
3. Hathaway, Hargreaves, Thompson, and Novitsky, 1992, "A Study Into the Effects of Light on Children of Elementary School Age - A Case of Daylight Robbery," Policy and Planning Branch, Planning and Information Services Division, Alberta Education, Canada.

Productivity

- *"Some simple math shows why productivity savings routinely exceed direct energy cost returns: In a typical building, energy costs average $1.50 ($16.50 per Sq Meter) to $2.50 per square foot ($26.91 per Sq Meter), while salaries exceed $200 per square foot ($2,152 per Sq Meter). Cutting energy use in half typically saves $1 per square foot ($10.76 per Sq Meter) per year, while boosting productivity just 5 percent saves more than $10 a square foot ($107.64 per Sq Meter) per year."*
- *http://www.cool-companies.org/profits/*

Retrocommissioning Cost

- Energy Audit approach averages $.25 per Sq Foot ($2.70 per Sq Meter)
- Retrocommissioning averages $1.60 per Sq Foot ($17.33 per Sq Meter)
- Current project:
  - 4 Military Bases
  - 758,560 square feet (70,472 Sq Meters) of Buildings
  - Largest Building 101,000 Sq Feet (9,383 Sq Meters) Cost $1.04 per Sq Foot ($11.19 per Sq Meter)
  - Smallest Building 7,161 Sq Feet (665 Sq Meters) Cost $4.41 per Sq Foot ($47.47 per Sq Meter)

RCx Meaningful Solutions

When and Why to Retro your facility.

- When and Why:
  - Anytime Facility Does Not Meet CFR
  - Must Have a CFR To Evaluate a Facility's Performance
  - Fix the 'Unfixable'
  - Improved Occupant
  - Productivity and Comfort
  - Improved Energy Efficiency

RCx Meaningful Solutions

When and Why to Retro your facility.

- Poor Performance (Unhappy Tenants)
- Energy Savings / Energy Optimization
- LEED-EB

Developing A CFR

What is my facility suppose to be?

- Must Identify Critical Aspects of the Facility Environment
- Must describe the form and the function of the facility.
- Is the facility a 25, 50 or 100 year building?
  - Speaks to how much money should we invest.
- How long will you own it.
- Participants must include the facility occupants, maintenance team and owner.

CFR

WHAT WE WANTED……

CFR

WHAT WE GOT!!!!!!!

Retro-Cx Definition

- Retro-Commissioning (RCx) is the systematic process by which the Owner ensures that the building and systems are optimized to perform interactively to meet the Current Facility Requirements (CFR) as closely as possible. The amount of investment will vary drastically from building to building. There is an economic sliding scale that determines how much to invest in any given facility. This may include remedial design and construction to accomplish this goal. The RCx process is drastically different than new building commissioning. (NEBB)

Retro-Cx Definition

- What Retro-CX is NOT:
  - The Commissioning Process applied to an existing building.
  - An Energy Audit (Level I, Level II or Level III)
  - A Facility Condition Assessment (FCA)
  - A Systems Performance Study

Retro Commissioning Purpose

Deliver Solutions that are Meaningful to the Owner and Occupants of the Facility

RCx Meaningful Solutions

When and Why to Retro your facility.

Proper Solutions Will:

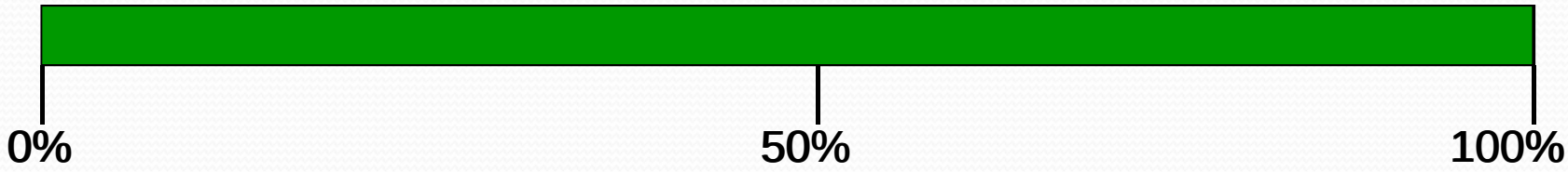
- ✓ Result in an improvement in the Owner's Business Operation;
  - ✓ Employee Productivity
  - ✓ Lower Maintenance Costs
  - ✓ Risk Management
  - ✓ Lower Energy Consumption

RCx Meaningful Solutions

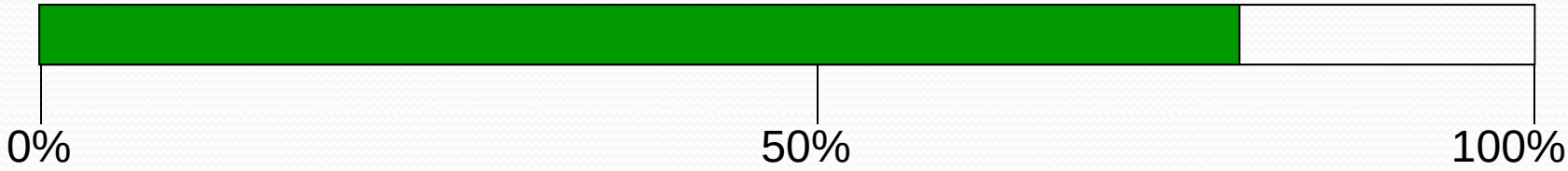
When and Why to Retro your facility.

Sliding Scale Of Economics

Commissioning

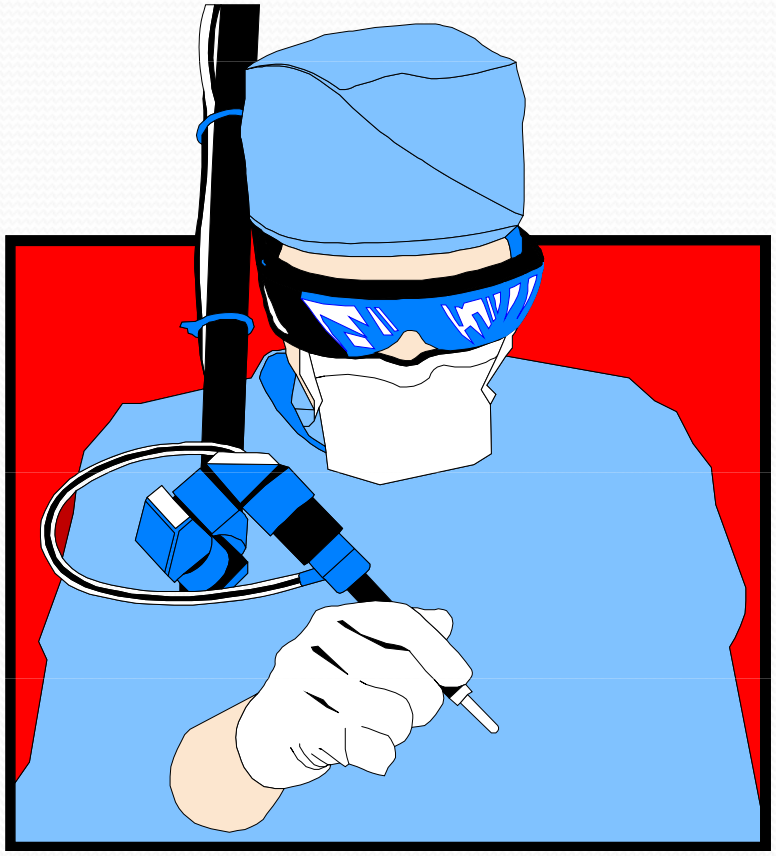


RetroCommissioning



Beyond HVAC:
Understanding All Elements of the Retro-Cx process

Retro-Commissioning



Retro-Commissioning

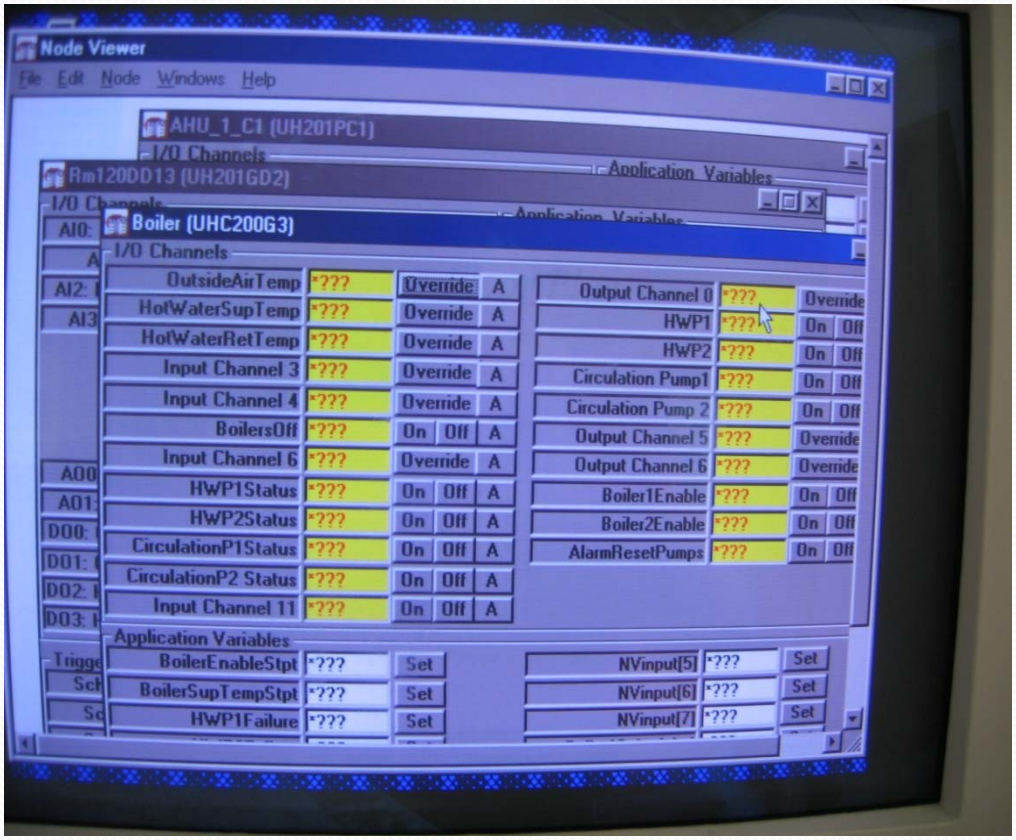
- Existing Buildings
- Contract between RC_X and Owner
- C_X performs tests and documents results
- Must Include 'Quick Fixes' For Immediate Results
- May include:
  - Remedial Design
  - Remedial Construction
  - Commissioning of the Remedial Construction

Retro-Commissioning

- Systematic Process
- Identify AND CORRECT ALL THE PROBLEMS, Not The Symptoms!
- Solutions Are Holistic In Nature
- Maintenance Staff Training

Beyond HVAC

- Systems Retro-Commissioned:
  - HVAC
  - Controls
  - Electrical
  - Elevators
  - Plumbing
  - Roofs
  - Envelope



RCx Team

- Retrocommissioning Professional
- Specialty Members
  - Experts in each disciplines
  - Must understand process

RCx Process

- NEBB Retro-Commissioning Matrix Φ

RCx Process

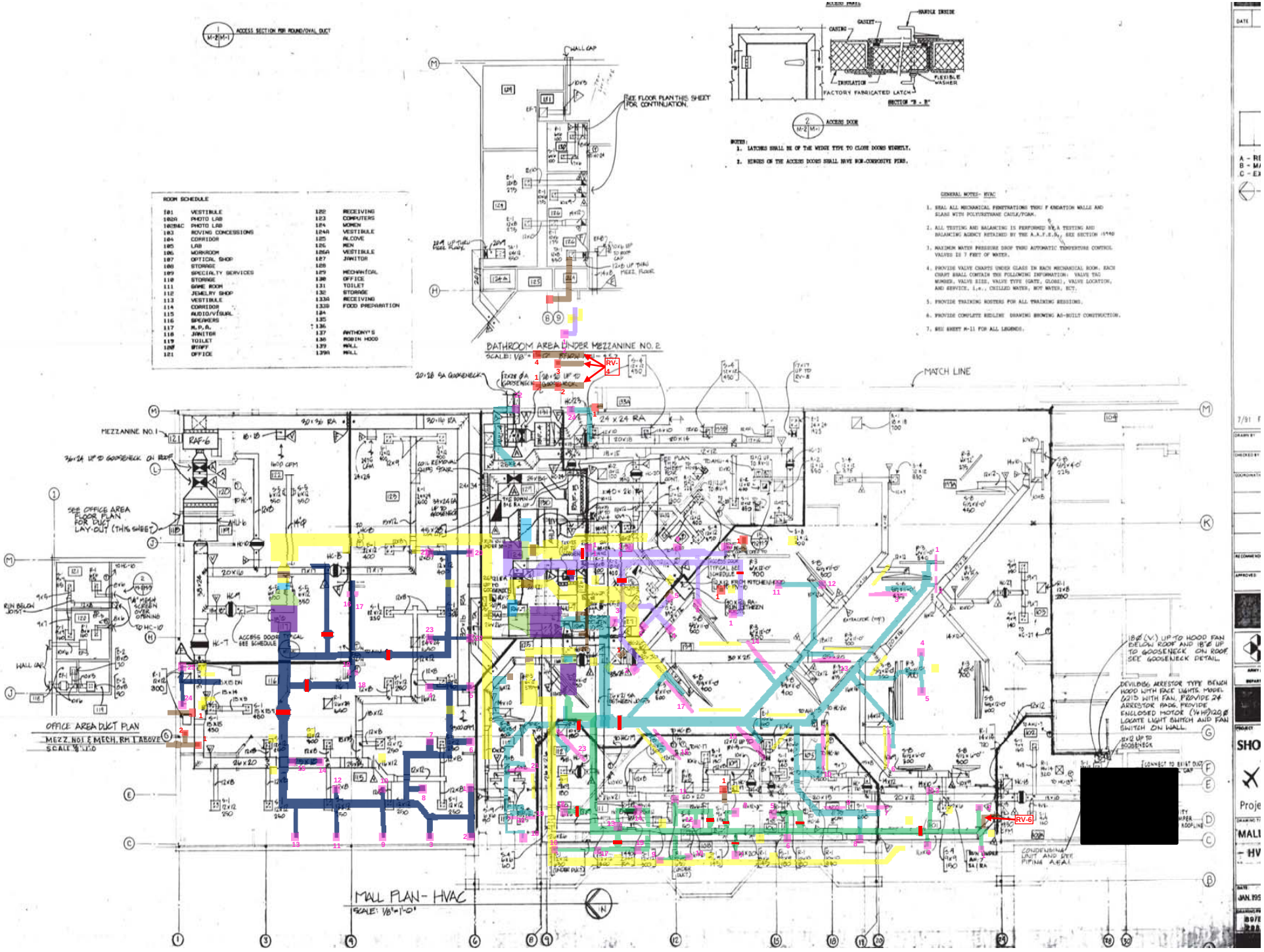
- Professional Services Contract
- Planning Phase
- Discovery Phase
- Corrective Action Phase

RCx Process

- Professional Services Contract
  - Building Walk-thru
    - May not be able to walk facility, what do you do?
  - Assemble Team
  - Proposal

RCx Process

- Planning Phase
  - RCx Plan Development
  - RCx Kickoff Meeting
  - Document Procurement & Review
    - Drawings & Specifications
    - O&M Manuals
    - TAB Reports
    - Utility Bills
    - Maintenance, Repair & Replacement Orders
  - Interviews
    - Management
    - Maintenance Personnel
    - Occupants


ACCESS SECTION FOR ROUND/OVAL DUCT
ACCESS DOOR
SECTION "B - B"
NOTES:
1. LATCHES SHALL BE OF THE WEDGE TYPE TO CLOSE DOORS SECURELY.
2. HINGES ON THE ACCESS DOORS SHALL HAVE NON-CORROSIVE PINS.
GENERAL NOTES- HVAC
1. SEAL ALL MECHANICAL PENETRATIONS THRU FOUNDATION WALLS AND SLABS WITH POLYURETHANE CAULK/FOAM.
2. ALL TESTING AND BALANCING IS PERFORMED BY A TESTING AND BALANCING AGENCY RETAINED BY THE A.A.F.E.B.C. SEE SECTION 15990
3. MAXIMUM WATER PRESSURE DROP THRU AUTOMATIC TEMPERTURE CONTROL VALVES IS 7 FEET OF WATER.
4. PROVIDE VALVE CHARTS UNDER GLASS IN EACH MECHANICAL ROOM. EACH CHART SHALL CONTAIN THE FOLLOWING INFORMATION: VALVE TAG NUMBER, VALVE SIZE, VALVE TYPE (GATE, GLOBE), VALVE LOCATION, AND SERVICE, i.e., CHILLED WATER, HOT WATER, ECT.
5. PROVIDE TRAINING ROSTERS FOR ALL TRAINING SESSIONS.
6. PROVIDE COMPLETE REDLINE DRAWING SHOWING AS-BUILT CONSTRUCTION.
7. SEE SHEET M-11 FOR ALL LEGENDS.
ROOM SCHEDULE
101 VESTIBULE
102A PHOTO LAB
102B&C PHOTO LAB
103 ROVING CONCESSIONS
104 CORRIDOR
105 LAB
106 WORKROOM
107 OPTICAL SHOP
108 STORAGE
109 SPECIALTY SERVICES
110 STORAGE
111 GAME ROOM
112 JEWELRY SHOP
113 VESTIBULE
114 CORRIDOR
115 AUDIO/VISUAL
116 SPEAKERS
117 K.P.A.
118 JANITOR
119 TOILET
120 STAFF
121 OFFICE
122 RECEIVING
123 COMPUTERS
124 WOMEN
124A VESTIBULE
125 ALCOVE
126 MEN
126A VESTIBULE
127 JANITOR
128
129 MECHANICAL
130 OFFICE
131 TOILET
132 STORAGE
133A RECEIVING
133B FOOD PREPARATION
134
135
136
137 ANTHONY'S
138 ROBIN HOOD
139 MALL
139A MALL
BATHROOM AREA UNDER MEZZANINE NO. 2
SCALE: 1/8"=1'-0"
MATCH LINE
MEZZANINE NO. 1
RAF-6
24 x 24 RA
SEE OFFICE AREA FLOOR PLAN FOR DUCT LAY-OUT (THIS SHEET)
ACCESS DOOR TYPICAL SEE SCHEDULE
OFFICE AREA DUCT PLAN
MEZZ. NO. 1 & MECH. RM. ABOVE
SCALE: 1/8"=1'-0"
MALL PLAN - HVAC
SCALE: 1/8"=1'-0"
18Ø (V.) UP TO HOOD FAN BELOW ROOF AND 18Ø UP TO GOOSENECK ON ROOF SEE GOOSENECK DETAIL.
DEVILBISS ARRESTOR TYPE BENCH HOOD WITH FACE LIGHTS, MODEL 6215 WITH FAN. PROVIDE 24 ARRESTOR PADS. PROVIDE ENCLOSED MOTOR (¼ HP)/120Ø & LOCATE LIGHT SWITCH AND FAN SWITCH ON WALL.
CONDENSING UNIT AND SEE PIPING AREA
RV-6

RCx Process

- Site Investigation Phase
  - Systems Review
  - HVAC Equipment & System Assessment
  - Building Envelope
  - Controls Systems
  - TAB
  - IAQ
  - Electrical Equipment & Systems
  - Plumbing Equipment & Systems

RCx Process

- Analysis & Synthesis
  - Problem Analysis – Identification of the issues
  - Problem Synthesis – Resolution of issues
  - Recommendations
    - Report Preparation
    - Presentation of Corrective Action Report

RCx Process

- Corrective Action Phase
  - Remedial Design
  - Construction
  - Commissioning
- Follow Up
  - Lessons Learned
  - Performance Verification

Building Performance After RCx

- First Questions Does It Meet The CFR?
- Improved Facility Function
- Improved Productivity
- Proper Expenditure of Energy

Retro-Commissioning

Questions????