BEQ 4 & BEQ 7
Lessons Learned – A Case Study

BEQ Bid Packages 4 and 7

BEQ 4 Project Overview:
$116,000,000
692 units
Four new 3 & 4 story BEQs on two separate sites
Completed August, 2011

BEQ 7 Project Overview:
$125,000,000
800 units
Four new 4 & 5 story BEQs on two separate sites
Completed December, 2011

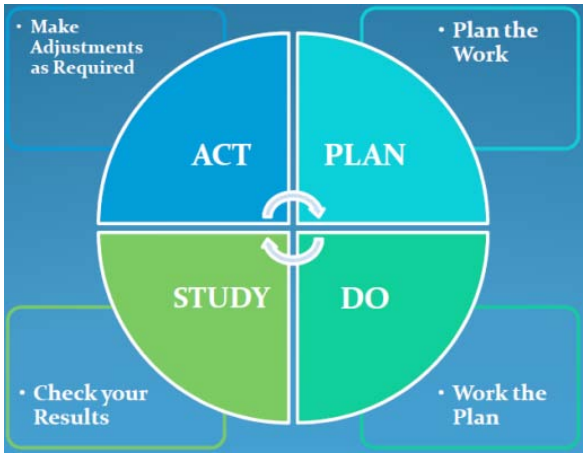
BEQ 4 Hurdles & Mis-Steps

- Project Delays due to roof attic space redesign issues
- Delays caused the Start-up – TAB – Commissioning – PVTs to be rushed to meet the BOD
- Impacts from Interpretation of RFP requirements
- Steep learning curve for Subs performing PVTs
- More Punch List Items than planned with prolonged correction times (multiple layers of costly rework)

BEQ 7 adjusted approach

Used **“Lean Construction”** Methodologies and Techniques

Goal of Lean = Eliminate Waste & Add Value



- Kaizen – Continuous Improvement
- Pull Planning/Last Planner – Developed proper work flows and exposed/eliminated constrains
- 5S’s – Sort, Straighten, Sweep, Standardize & Sustain
- Visual Management – Used visual tools to express and reinforce goals, commitments, work flows and track details
- “Root Cause” problem solving – drill down to uncover problem’s root cause by asking questions
- “One Team – One Goal” approach throughout the Startup-TAB-Commissioning-PVT cycles

Kaizen – Continuous Improvement

We were continually trying to improve on our PVT performances at BEQ 4. We began this process early on in our weekly MEP and Cx meetings tracking all BEQ 4 issues as well as their corrections/solutions

BEQ 4 Stumbling Blocks:

	Issue	Direction	Resp. Party	Due Date
1	Not enough gas flow to buildings	Replace regulator springs prior to gas connection Springs replaced & PacStates to adj when gas is connected	Pac States	6/20/2011
2	Not enough air in HVAC systems	Traverse units at startup to determine proper sheave size and replace ASAP P-094 is complete	SCS & CCS	Ongoing
3	Attic temps are a concern	Trending was completed on Pkg 4 - JL confirmed within specs. Trending will be required on Pkg 7 as well FMS to provide data loggers	CCS	Need to Set date
4	HHW Boilers/Relief Vales maybe undersized.	Mftr to supply new valves w/o 25 psi verbiage. Waiting on Gov review of new conditions. ~~CCS currently working with Mftr to determine if boiler can be certified to 40 PSI~~ CCS to install Clay valves on HHW system to reduce pressure into boiler	Comfort/ NAVFAC	Ongoing
5	Boiler hydro issues brought up by Lee Nelson	CCS to verify the same issues will not affect Pkg 7	CCS	Ongoing

PVT planning started 6 months prior to the actual PVTs on BEQ 7

Kaizen – Continuous Improvement (cont)

We were also fortunate to get input from Jonathan Strausbaugh as to PVT issues that had come up on other projects that we needed to look out for. We tracked these issues in our Cx meetings.

Strausbaugh Heads up List:

1. Domestic hot water system:
   - The washing machines I the activity room need 140 degree water in no more than 2 cycles.
   - The residence unit fixtures need 105-115 degree water within 28 seconds.
2. Residence building dryers: Speedqueen needs to setup the air/fuel ratio and document it.
3. Maintenance/damper access needs to be coordinated and demonstrated.
4. 72 hour Trending:
   - The activity building needs to be in cooling mode for trending (normal operation).
   - FCUs need to be set to maximum setpoint (85 degrees) to demonstrate heating capacity
   - AHUs need to be set at the appropriate setpoint to demonstrate a 30 degree delta T
   - CCS needs to include the data logger points in the 72 hour trends submitted to the gov.
5. TAB report needs to include muli-speed pump curves and both minimum and maximum speeds need to be plotted on the curve.
6. HHW pumps need to be balanced to supply design max flow at no less than 55Hz. Flow is to be set at the circuit setter. Min and max flow will be demonstrated to Jonathan Strausbaugh during PVT.
7. All conduit terminations need to be tight. No flex to be used on equipment that does not vibrate.
8. NAVFAC would like to see illuminated switches used for the attic lights.

Pull Planning & Last Planner Methodologies

We used these methodologies to plan/schedule the work flow and this helped uncover “constraints” so that they could be removed prior to work starting

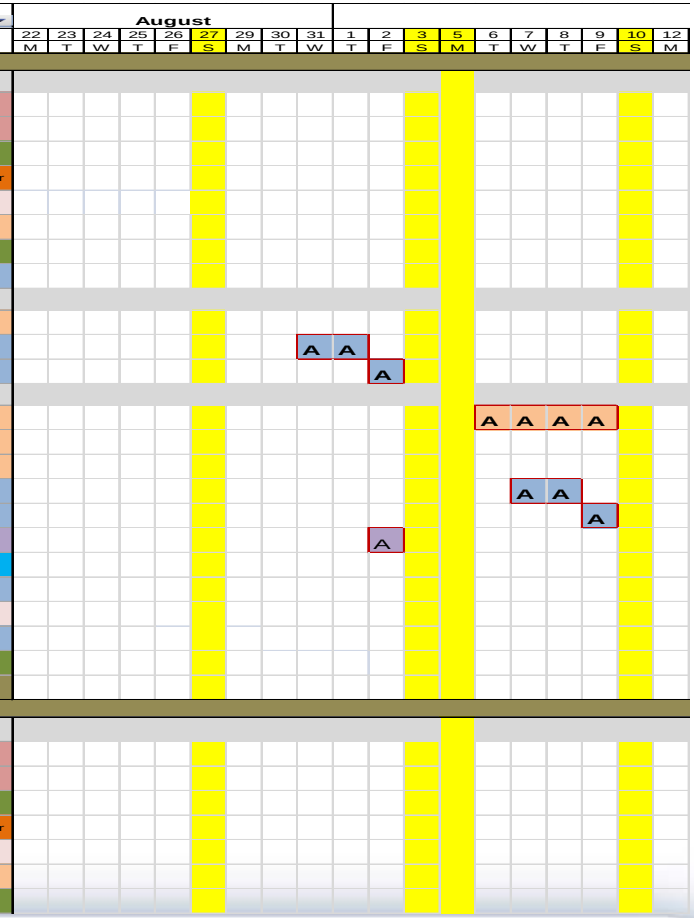
Constraint Log:

1. Need off site gas line installed and turned on by 4/29/11
2. Need all AHAs turned in and approved before work is scheduled to start (what is required ?)
   - Scaffold to install boiler flues
   - Energize Main Switchgear
   - Startup
3. Trim needs to be complete to energize panels to FCU's
4. Painter needs to stay out ahead of FCU install
5. Tile/Solid Surfaces needs to stay out ahead of Trim install

Pull Planning & Last Planner Methodologies (cont)

This method allowed us to use input from the experts (Trades) to properly sequence work and get reliable commitments for completion which was put Into our Cx-PVT work plan

Cx Activity	Duration	Start	Finish	Trade
P-094 Startup/Cx				
P094 Mechanical Room				
HHW Boiler Change-out	5d	10/3/11	10/7/11	CCS
Clean & Flush	3d	10/13/11	10/14/11	CCS
Boiler Hydro Test	1d	10/7/11	10/7/11	Lee Nelson
Startup Boiler	2d	10/11/11	10/11/11	County Boiler
Pre-Trending		9/19/11	10/14/11	Climatec
Water Side TAB	3d	10/17/11	10/19/11	SCS
Boiler Inspection	1d	10/25/11	10/25/11	Lee Nelson
Mech Room Cx (boiler,pumps)	3d	10/20/11	10/22/11	FMS
P094 Residences (A & B)				
Submit BEQ TAB Report	1d	10/24/11	10/24/11	SCS
Misc EF Cx	2d	8/31/11A	9/1/11A	FMS
Mini Split-System CX	1d	9/2/11A	9/2/11A	FMS
P094 Community Building				
Community Building TAB	4d	9/6/11A	9/9/11A	SCS
Community Building Sound Check	1d	10/11/11	10/11/11	SCS
Submit Comm Building TAB Report	1d	10/24/11	10/24/11	SCS
Split-System AC CX	2d	9/7/11A	9/8/11A	FMS
Exhaust Fan Cx	1d	9/9/11A	9/9/11A	FMS
Elevator Signoff	1d	9/2/11A	9/2/11A	Schindler
Fire Alarm Signoff	5d	9/19/11	9/23/11	ECS
Fire Alarm Voice Activation Cx	1d	9/19/11	9/19/11	FMS
72hr Trend Logging	6d	1017/11	10/24/11	Climatec
Reporting	3d	11/2/11	11/4/11	FMS
Government Review/Acceptance	10d	10/24/11	10/28/11	OICC
Performance Verification Tests (PVT)	5d	10/31/11	11/4/11	All
P-1116 Startup/Cx				
P1116 Mechanical Room				
HHW Boiler Change-out	5d	10/3/11	10/7/11	CCS
Clean & Flush	3d	10/13/11	10/14/11	CCS
Boiler Hydro Test	1d	10/7/11	10/7/11	Lee Nelson
Startup Boiler	2d	10/11/11	10/11/11	County Boiler
Pre-Trending		9/19/11	10/14/11	Climatec
Water Side TAB	3d	10/24/11	10/26/11	SCS
Boiler Inspection	1d	10/25/11	10/25/11	Lee Nelson



The 5 S's – Sort-Straighten-Sweep-Standardize-Sustain

We used 5S principals and maintained clean organized mechanical areas, created checklists to standardize our approach and reviewed them on regular intervals for compliance

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BEQ 7 PVT Checklist

Required Documents –

- "As Built" drawings – 3 sets, 11"x17" min size (1/2 size set prefered)
- TAB Report – 3 copies
- Trend Report – Computer available for online viewing
- Data Loggers data – Copies of raw data and graphs printed on site
- Equipment Startup book

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USMC BEQ 7
CxA Mtg. #14 Agenda
Turner-Penick Jobsite Trailer

July 13th, 2011 @ 8AM

Cx Coordination:

Hot Buttons:

- Definition of "DONE" – If followed by "But….." or "The only thing left….." then it is not DONE.
- We have set the standard for mech space cleanliness – See P-094 Mech Room
- Lock-Out/Tag-Out must be followed at ALL TIMES!

CLIMATEC
BUILDING TECHNOLOGIES GROUP

Subject: Trending Checklist for: BEQ-7
Date: August 25, 2011

General Scope of Work
Before leaving the site each day while we are Trending, the following trades are to review their assigned checklist items. Please report any deficiencies immediately to Jim Taylor, CCS and Matt Imber, Turner.

Climatec:

1. ☐ Release all overrides used for troubleshooting or TAB support:
   - Occupancy Schedules
   - Start/Stop commands
   - Valve position
   - Space Temp
   - Set Points
2. ☐ Titan Panel is on-line and communicating with system.
3. ☐ Confirm Trending Occupancy Schedule – 6pm to 6am.
4. ☐ Confirm Trending Occupancy Set Points – Trane FCU @ 85F.
5. ☐ Confirm Trane FCU configured for ON/OFF switched is disabled.

CCS:

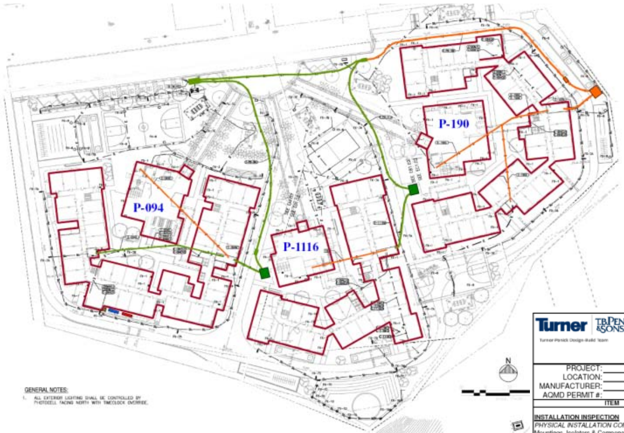
1. ☐ Mechanical Plant Equipment powered - ON.
2. ☐ HVAC Equipment disconnects are – ON
3. ☐ HVAC Equipment HOA's are in – AUTO
4. ☐ Manual Valves are open
5. ☐ VFD's are in AUTO

Turner/Penick JV:

1. ☐ Verify all BEQ doors are closed and latched
2. ☐ Verify all BEQ windows are closed
3. ☐ Verify all Community Building doors are closed and latched
4. ☐ Verify all Community Building windows are closed

Visual Management

We used a wide assortment of Visual Management tools to reinforce our goals and commitments.



BEQ 7 Startup Commissioning Schedule

Rev. Date: 10/18/2011

PVT Activity	12 M	13 T	14 W	15 T	16 F	17 S	19 M	20 T	21 W
P-094									
Domestic Water	Complete								
DDC							Complete		
ATFP Dampers		Complete							
Sound Test		Complete							
Trending Review	Complete								
BEQ TAB Air Review			XX	Complete					
BEQ TAB H2O Review				Complete					
Mech Rooms Inspections									
Attic Space Inspection					XX				
Misc. Exhaust Fans							Complete		
Community Building							Complete		
Laundry Room							Complete		
P-1116									
Domestic Water	Complete								
DDC							Complete		
ATFP Dampers		Complete							
Sound Test		Complete							
Trending Review	Complete								
BEQ TAB Air Review		XX	Complete						
BEQ TAB H2O Review		XX	Complete						
Mech Rooms Inspections			XX	XX	Complete				
Attic Space Inspection									
Misc. Exhaust Fans									
Community Building									
Laundry Room									
P-190									

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Turner-Penick Design-Build Team

EQUIPMENT INSTALLATION CHECKLIST

HOT WATER BOILER

PROJECT: BEQ 7 - Area 62 San Mateo
UNIT NO:
LOCATION:
SERVICE:
MANUFACTURER:
MODEL:
AQMD PERMIT #:
SERIAL #:

ITEM	OK	COMMENT
INSTALLATION INSPECTION		
PHYSICAL INSTALLATION COMPLETE		
Mountings, Isolators & Components Checked		
Burner & Gas Train		
Breaching & Combustion Air		
Water/Gas Valves & Piping Installed & Tested		
Valves Positioned For Start-up		
Electrical Connections Completed		
Disconnect Switch Installed		
Control System Operational		
Integral Controls Operational		
Ready to Start & Run Under Control		
Regulators Vented to Exterior		
Exhaust Ducting Complete to OA		
…es Provided		
…YPE		
…ower		
…ed Drive		
…nt		

…ION BY: DATE:
…ION BY: DATE:
…ness By: DATE:

Bachelor Enlisted Quarters - PKG 7 Equipment List

Building Number	Building Section	System ID	Equipment Tag	Equipment Type	Manufacturer	Model #	Qty	Type	Location	Level	Area	Serves	Panel Feed	Startup Date	Startup By
P094	BEQ	ELV1	EV-1	Public Elevator	Shindler	NA	1	Elevator	Elev Mech Room # 147	1	B	P094 BEQ Towers	MSBA-#3		Shindler
P094	BEQ	ELV1	EV-2	Public Elevator	Shindler	NA	1	Elevator	Elev Mech Room # 147	1	B	P094 BEQ Towers	MSBA-#4		Shindler
P094	BEQ	PWR1	MSBA	Switch Gear	Cutler-Hammer	Pow-R-Line C	1	Switch Gear	Main Electrical Room #149	1	B	P094 BEQ Towers	Transformer X-094		Helix Electric
P094	BEQ	PWR1	A11	Panel	Cutler-Hammer	PRL1A	1	Panel	Main Electrical Room #149	1	B	P094 BEQ Area A Towers	MSBA		Helix Electric
P094	BEQ	PWR1	A12	Panel	Cutler-Hammer	PRL1A	1	Panel	Main Electrical Room #149	1	B	P094 BEQ Area A Towers	A11-25,27,29		Helix Electric
P094	BEQ	PWR1	A13	Panel	Cutler-Hammer	PRL1A	1	Panel	Main Electrical Room #149	1	B	P094 BEQ Area A Towers	A11-31,33,35		Helix Electric
P094	BEQ	PWR1	A14	Panel	Cutler-Hammer	PRL1A	1	Panel	Main Electrical Room #149	1	B	P094 BEQ Area A Towers	A11-37,39,41		Helix Electric
P094	BEQ	PWR1	A21	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #247	2	B	P094 BEQ Area A Towers	MSBA		Helix Electric
P094	BEQ	PWR1	A22	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #247	2	B	P094 BEQ Area A Towers	A21-25,27,29		Helix Electric
P094	BEQ	PWR1	A23	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #247	2	B	P094 BEQ Area A Towers	A21-31,33,35		Helix Electric
P094	BEQ	PWR1	A24	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #247	2	B	P094 BEQ Area A Towers	A21-37,39,41		Helix Electric
P094	BEQ	PWR1	A31	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #347	3	B	P094 BEQ Area A Towers	MSBA		Helix Electric
P094	BEQ	PWR1	A32	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #347	3	B	P094 BEQ Area A Towers	A31-25,27,29		Helix Electric
P094	BEQ	PWR1	A33	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #347	3	B	P094 BEQ Area A Towers	A31-31,33,35		Helix Electric
P094	BEQ	PWR1	A34	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #347	3	B	P094 BEQ Area A Towers	A31-37,39,41		Helix Electric
P094	BEQ	PWR1	A41	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #447	4	B	P094 BEQ Area A Towers	MSBA		Helix Electric
P094	BEQ	PWR1	A42	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #447	4	B	P094 BEQ Area A Towers	A41-25,27,29		Helix Electric
P094	BEQ	PWR1	A43	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #447	4	B	P094 BEQ Area A Towers	A41-31,33,35		Helix Electric
P094	BEQ	PWR1	A44	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #447	4	B	P094 BEQ Area A Towers	A41-37,39,41		Helix Electric
P094	BEQ	PWR1	A51	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #539	5	B	P094 BEQ Area A Towers	MSBA		Helix Electric
P094	BEQ	PWR1	A52	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #539	5	B	P094 BEQ Area A Towers	A51-25,27,29		Helix Electric
P094	BEQ	PWR1	A53	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #539	5	B	P094 BEQ Area A Towers	A51-31,33,35		Helix Electric
P094	BEQ	PWR1	A54	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #539	5	B	P094 BEQ Area A Towers	A51-37,39,41		Helix Electric
P094	BEQ	PWR1	A61	Panel	Cutler-Hammer	PRL1A	1	Panel	Electrical Room #539	5	B	P094 BEQ Area A Roof	MSBA		Helix Electric
P094	BEQ	PWR1	M11	Panel	Cutler-Hammer	PRL1A	1	Panel	Mechanical Room #145	1	B	Mechanical Room #145	MSBA		Helix Electric
P094	BEQ	PWR1	MSBB	Switch Gear	Cutler-Hammer	Pow-R-Line C	1	Switch Gear	Electrical Room #144	1	A	P094 BEQ Towers	MSBA		Helix Electric
P094	BEQ	PWR1	MSBC	Switch Gear	Cutler-Hammer	Pow-R-Line C	1	Switch Gear	Comm Build Elec Room #006	1	CB	P094 Community Building	MSBA		Helix Electric
P094	BEQ	PWR1	C11	Panels	Cutler-Hammer	PRL1A	1	Panel	CB Electrical Room #006	1	CB	P094 Community Building	MSBC		Helix Electric
P094	BEQ	PWR1	C12	Panels	Cutler-Hammer	PRL1A	1	Panel	CB Electrical Room #006	1	CB	P094 Community Building	MSBC		Helix Electric
P094	BEQ	PWR1	C13	Panels	Cutler-Hammer	PRL1A	1	Panel	CB Electrical Room #006	1	CB	P094 Community Building	MSBC		Helix Electric
P094	BEQ	PWR1	C14	Panels	Cutler-Hammer	PRL1A	1	Panel	CB Electrical Room #006	1	CB	P094 Community Building	MSBC		Helix Electric
P094	BEQ	PWR1	C15	Panels	Cutler-Hammer	PRL1A	1	Panel	CB Electrical Room #006	1	CB	P094 Community Building	MSBC		Helix Electric
P094	BEQ	FLS1	FACP	Fire Alarm Control Panel	Gamewell-FCI	E3 Series	1	System	FACP in Tel/Com Rm #148	1	B	P094 BEQ Towers	A11-16		Helix Electric
P094	CMB	HVC6	RH-1	Kitchen Hood Exhaust	NA	NA	1	Fan	Comm Building Kitchen	1	CB	Community Building Kitchen	C11-33		CCS
P094	BEQ	HVC1	AHU-1	Air Handling Unit	McQuay	CAH023GDAM	1	Single Zone VAV	P-094 Attic	RF	A	P094 Living Quarters OA	B61-37,39,41		CCS
P094	BEQ	HVC2	AHU-2	Air Handling Unit	McQuay	CAH023GDAM	1	Single Zone VAV	P-094 Attic	RF	B	P094 Living Quarters OA	A61-37,39,41		CCS
P094	BEQ	HVC4	SF-1	Supply Fan	Greenheck	BSQ-150HP-30	1	Fan	P094 Mech Room # 145	1	A	P094 Mech Room # 145	M11-22		CCS
P094	BEQ	HHW1	P-1	Pump	Armstrong	NA	1	Vertical In-line	P094 Mech Room # 145	1	A	HHW Secondary Pump	M11-1,3,5		CCS
P094	BEQ	HHW1	P-2	Pump	Armstrong	NA	1	Vertical In-line	P094 Mech Room # 145	1	A	HHW Secondary Pump	M11-7,9,11		CCS
P094	BEQ	HHW1	P-3	Pump	Armstrong	NA	1	Vertical In-line	P094 Mech Room # 145	1	A	HHW Primary Pump	M11-2,4,6		CCS
P094	CMB	HVC5	SSHP-1	Split System Heat Pump	Trane	4TWB3060A1000 4TEC3F60B1000	1	Horizontal	Community Building Ceiling	1	CB	Lounge	C12-9,11 C12-2,4		CCS
P094	CMB	HVC5	SSHP-2	Split System Heat Pump	Trane	4TWB3060A1000 4TEC3F60B1000	1	Horizontal	Community Building Ceiling	1	CB	Lounge	C12-21,23 C12-6,8		CCS
P094	CMB	HVC5	SSHP-3	Split System Heat Pump	Trane	4TWB3060A1000 4TEC3F60B1000	1	Horizontal	Community Building Ceiling	1	CB	Lounge	C12-25,27 C12-14,16		CCS
P094	CMB	HVC5	SSHP-4	Split System Heat Pump	Trane	4TWB3060A1000 4TEC3F60B1000	1	Horizontal	Community Building Ceiling	1	CB	Laundry Room	C12-29,31 C12-18,20		CCS
P094	BEQ	HVC3	AC-1-1/CU-1-1	Split System A/C Unit	Fujitsu	NA	2	Horizontal	Telco Room #143	1	A	P094 Telco Room #	B11-28,30		CCS
P094	BEQ	HVC3	AC-1-2/CU-1-2	Split System A/C Unit	Fujitsu	NA	2	Horizontal	Telco Room #148	1	B	P094 Telco Room #	A11-10,12		CCS
P094	BEQ	HVC3	AC-1-3/CU-1-3	Split System A/C Unit	Fujitsu	NA	2	Horizontal	Telco Room #343	3	A	P094 Telco Room #	B11-22,B31-30		CCS
P094	BEQ	HVC3	AC-1-4/CU-1-4	Split System A/C Unit	Fujitsu	NA	2	Horizontal	Telco Room #346	3	B	P094 Telco Room #	A11-18,A31-9		CCS
P094	BEQ	HVC3	AC-2/CU-2	Split System A/C Unit	Fujitsu	NA	2	Horizontal	Elev Equip Room # 147	1	B	P094 Elev Equip Room	A11-15,19		CCS
P094	CMB	HVC5	AC-3/CU-3	Split System A/C Unit	Fujitsu	NA	2	Horizontal	Tel/Data Room # 007	1	CB	P094 Comm Build Tel/Data Room	C12-26,36		CCS
P094	BEQ	HHW1	B-1	Heating Water Boiler	L.E.S.	HW-2011	1	Water Tube	P094 Mech Room # 145	1	A	Heating Hot Water	M11-32		CCS
P094	BEQ	HVC1	EF-1	Exhaust Fan	Greenheck	BSQ-240HP-50	1	Fan	P-094 Attic	RF	A	BEQ Toilet Exhaust	B61-38,40,42		CCS
P094	BEQ	HVC1	EF-2	Exhaust Fan	Greenheck	BSQ-180-30	1	Fan	P-094 Attic	RF	A	BEQ Toilet Exhaust	A61-38,40,42		CCS
P094	BEQ	HVC2	EF-3	Exhaust Fan	Greenheck	BSQ-180-30	1	Fan	P-094 Attic	RF	B	BEQ Toilet Exhaust	A61-32,34,36		CCS
P094	BEQ	HVC2	EF-4	Exhaust Fan	Greenheck	BSQ-240HP-50	1	Fan	P-094 Attic	RF	B	BEQ Toilet Exhaust	A61-31,33,35		CCS

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USMC BEQ 7
CxA Mtg. #14 Agenda
Turner-Penick Jobsite Trailer

July 13th, 2011 @ 8AM

Cx Coordination:

Hot Buttons:
- Definition of "DONE" – If followed by "But….." or "The only thing left….." then it is not DONE.
- We have set the standard for mech space cleanliness – See P-094 Mech Room
- Lock-Out/Tag-Out must be followed at ALL TIMES!

Schedule:
- 7/13: Review Cx Production Schedule for opportunities to improve
- 7/6: Review Schedule/Production Plan 3 Week Look Ahead
- 6/29: Review Bar Chart Cx production plan

Electrical:
- 7/13: Need power to P-190 HHW pumps by Thur 7/14 (at latest) for Flush & Fill
- 7/13: Need power at P-094 Community Build equipment startup this week
- 7/6: Power from T-Stats to Exhaust Fans

Mechanical:
- 7/13: This week's startups:

P-094	P-1116	P-190	P-1008
HHW Pump VFDs	HHW Pump VFDs	HHW Pumps	BEQ FCUs
BEQ Exhaust Fans	BEQ FCUs		
CB Split-Sys			
CB Exhaust Fans			

- 7/6: Line voltage Control wire from condensers to evaporators at Split-Systems
- 6/29: Final completion of missing volume dampers in all buildings
- 6/22: Fill starts today for P-1116, Flush on 6/27

3rd Party Mechanical Concerns/Recommendations

1. Independent verification of hydronic and domestic water flow rates
   A. Use an Doppler shift/Ultrasonic Flow meter such as a Polysonic DCT7088 to measure the flow.

2. Expand the scope of the Acoustical Analysis Requirements to cover mechanically generated noise and vibration.
   A. This can be accomplished during the architectural design review by the acoustician and verified in the field post-installation but prior to Performance Verification Testing.

3. Use automatic flow control on small fan coil units to assure that water balance can be easily obtained.
   A. The use of an auto-flow valve such as a Griswold Auto-Flow set at the appropriate flow rate will assist in achieving balance of the system.

Buildup to PVT- Keys to preparing for PVT

- Communication between all parties – NAVFAC-Design Teams-GC-Trades
- Make sure you give yourself the necessary time – be realistic
- Extensive collaborated planning – Plan your work & Work your Plan
- Identify and remove “Constraints”- Nothing should stop the flow of work
- Pay close attention to the details – Do not let things fall through the cracks
- Track issues and resolutions – monitor status’
- Stay focused on the Goal

PVT Showtime - Keys to delivering PVT the First Time

- Know exactly what is expected to be delivered
- Have a detailed plan on how you will deliver the final product for PVT
- Have commitments from all Designers & Sub-Contractors involved
- Have all required personnel and equipment on site on PVT days
  - Hoods, Meters, Tools
  - Engineer of Record
  - Technicians
  - Major Trades Project Managers
- Have all required documentation on hand on PVT days
  - “As Built” Drawings – 3 Sets 11”x17” min size (1/2 size set preferred)
  - Final TAB Report – 3 Copies
  - 72 Hour Trend Report – Computer available for online viewing
  - Data Logger data – Copies of raw data and graphs printed on site
  - Equipment startup books

Q & A

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