Commissioning Report

Brewery, Winery & Food Pilot Facilities
University of California Davis

UCDAVIS
DESIGN AND CONSTRUCTION MANAGEMENT

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Commissioning Report Overview

Commissioning Report Overview

The Brewery, Winery and Food Pilot Facilities project is intended to provide a facility that will demonstrate California's, leadership in wine experimentation and innovative technology and provide a teaching platform for leading technologies. It will also serve as an extension and industry outreach showcase for experimentation and improved processing technologies. The project is designed to house specific facilities for brewing, wine production, and sundry food sciences including tomato and milk research areas. Besides some classic rooms and display areas, the project has space dedicated to the equipment that will be used to achieve these goals.

Commissioning Plan

The heart of the commissioning effort is described in the Commissioning Plan. UC Davis prepares the Commissioning Plan as both a formal narrative and an easy-to-reference commissioning flow chart that accompanies this narrative. The flow chart lays out the procedures and deliverables so contractors could easily understand their roles and expectations in the commissioning process.

Roles and Protocols

The commissioning team was well established and documented and included members from the University and the Design Build Contractor with his subcontractors and design team. The University team consisted of the Commissioning Authority and registered mechanical and electrical engineers who were also active in viewing field activities and tests. The Commissioning Authority Peter Shahrokh was part of this group. He has certification as an accredited Commissioning Process Authority Professional from the University of Wisconsin and is an accredited LEED professional. Other University team members included the project manager and a group of field inspectors, including another registered engineers in the mechanical trade. A copy of the group members for the entire project is contained in the appendices of the commissioning plan. A description of the roles and protocols is also described there.

Design Review Period Process

The University has a thorough and engrained reviewing and communication protocol during the design phase. Project Managers are required to follow the procedures of a standard Project Managers Manual, which describes in detail all of the exchanges and tasks in the Design Period. At that time, the Commissioning Authority and the engineers from the Engineering and Commissioning division of the Architects and Engineering office assisted in these exchanges and reviews. The design reviews had phases and required both back-checks and progression through the design phase to ensure campus requirements are adhered to.

Commissioning Specifications

The University has its own commissioning specifications that it makes sure are part of the contract documents. These specifications discuss submittal requirements and the need for a Quality Assurance Manager, and they offer examples of both an Installation and Start-up Verification (ISV) test form and Functional Performance Tests to show the rigor of testing and sign-offs. Each ISV checklist requires certain checks be verified in the field before the form is signed off, a requirement for the next round of testing the systems' performances, the Functional Performance Tests. The expectations of the equipment performance are linked to the OPR in that they enforce the specifications which become, through the thorough review process, the best statement of an in-progress requirement process. .

Submittal Review

As with the design review process, UC Davis has a rigorous means of reviewing contractor submittals during the early construction phase. All pieces of equipment are matched against project contract drawings and specifications, engineering standards, University standards, and codes, all of which are part of the Owner's Project Requirements. The University's commissioning authority is charged with the review of the most critical system for commissioning, the EMS.

Commissioning Verification of Equipment and Systems

This process is documented by the completed ISV and FPT forms which, due to their mass and importance, had their own dedicated binders. They provided a means of validating and documenting the successful performance of each piece of equipment as listed above. Each ISV form has check points for installation, an issue log sheet, serial number recording and comparison of the supplied equipment to the ones originally specified. Each FPT form has pertinent information checklists (including trending requirements) and a sequence testing section. All forms are available for review.

System Manuals

The systems manuals capture how the building operates so that those responsible for its performance on a long-term basis can understand how the system works at different times of the years and under different environment situations. First a final sequence of operation was assembled to clearly describe the modes of operation and the intent of each one. This came largely in the energy-management system (Siemens) layout drawings. These not only showed all of the EMS components and terminations, but also the configurations of the equipment. A large portion of the depiction of how the building operates appears in the EMS graphical and programming database. This, along with hard copy and electronic information, will be readily accessible to those operating the system from the Energy Management Office on the campus.

Verification of Training for Operating Personnel and Occupants

The Facilities staff was trained on the specific components and systems of the building, using the project specifications as the guide for allotted time durations of training sessions. The Contractor built an all-inclusive training grid using the requirements in the specifications and provided training sessions to meet these requirements. The training was systematic and utilized an Outlook calendar referenced by Facilities so that training sessions were listed by date and time. This led to a high turn-out of participants in the training programs.

Benefits of Commissioning

The primary beneficial result of the commissioning process was the delivery of a project that met the expectations of the vast majority of the stakeholders, principally the occupants and those who operate and maintain the building. Without commissioning processes and a commissioning mentality, this project would not be considered the success that it became to the occupants and users. Most important was that the commissioning process produced a focused sense of responsibility among the project participants to achieve this success. This focused sense of responsibility is evident also in the approach towards the warranty phase of the commissioning process which is now occurring.

Commissioning Plan Narrative

COMMISSIONING PLAN FOR CONSTRUCTION AND WARRANTY PHASES

PART 1 - OVERVIEW

GENERAL PROJECT INFORMATION: The Brewery, Winery, and Food Pilot Facilities is an innovative project intended to demonstrate California's leadership in wine experimentation and innovative technology, provide a teaching platform for leading wine, beer, and food technologies, and provide a leadership platform for sustainable winemaking. It is a 34,000 square-foot building, intended to be the first wine-production facility in the world that is fully solar-powered at peak load, equipment to capture and sequester all carbon dioxide from its fermentations, and operated on captured rainwater for its cleaning needs and recycling solutions.

1.1 ABBREVIATIONS & DEFINITIONS

A. Terms are as defined in Specification Section 01 91 00 – Commissioning of Systems and Equipment attached herein except as modified or augmented below.

B. University Commissioning Consultant (UCC): Person hired and designated by the University to provide some or all of the duties of the University's Commissioning.

1.2 PURPOSE OF THE COMMISSIONING PLAN: The Commissioning Plan supplements the Commissioning Specifications by providing a summary of the scope as well as details on specific team members, communication protocols, scheduling information, etc.

1.3 COMMISSIONING SCOPE

A. Commissioning is a systematic process of ensuring that all of the building systems perform interactively according to the design intent and the University's operational needs. It has the following objectives during the Construction Phase.
   1. Ensure that equipment and systems are installed properly and receive adequate operational check out.
   2. Verify and document proper performance of equipment and systems.
   3. Ensure that the O&M documentation is complete.
   4. Ensure that the University's operating personnel are adequately trained.

1.4 COMMISSIONED SYSTEMS AND EQUIPMENT

A. The following systems will be commissioned on this project:
   1. Fire and Life Safety Systems
   2. Plumbing

3. HVAC

4. Electrical

B. A detailed list of equipment and systems that will be commissioned is below:

1. Controlled Environmental Rooms
2. Domestic & Industrial Water Piping System
3. Sanitary Waste & Vent System
4. Facility Storm Drainage Piping
5. Submersible Sump Pump & Basin - SP-1
6. Domestic Hot Water Converter & Pump - DHW-1 & DCP-1
7. Plumbing Fixtures
8. Gas, Vacuum and CA Piping for Labs
9. Air Compressor - AC-1, CAD-1, CAR-1, APR-1
10. Vacuum Pump - VP-1
11. Processed Water Piping Systems - WS-1, CF-1 thru 3, FH-1&2, RO-1, ROST-1, RODS-1
12. Regenerative Blower RB-1
13. Condenser Water Piping System
14. Chilled Water Piping System
15. Heating Water Piping System
16. Tempered Water Piping System
17. Hydronic Pumps - CWP-1
18. Hydronic Pumps - CWP-2
19. Hydronic Pumps - CHWP-1
20. Hydronic Pumps - CHWP-2
21. Hydronic Pumps - HWP-1
22. Hydronic Pumps - HWP-2
23. Hydronic Pumps - THWP-1
24. Hydronic Pumps - THWP-2

25. Steam & Steam Condensate Piping System
26. Ductwork System
27. Fan - HEF-1
28. Fan - REF-1
29. Fan - EF-1
30. Fan - EF-2
31. Fan - EF-3
32. Fan - EF-4
33. Fan - EF-5
34. Fan - EF-6
35. Fan - EF-7
36. Fan - EF-8
37. Fan - CEF-1
38. Single Duct Terminal Units VAV-1 thru 14
39. Steam-to-Water Heat Exchanger - HX-1
40. Fluid Cooler - FC-1
41. Air Handling Unit - AHU-1
42. Water-Source Air Conditioning Unit - WSAC-1
43. Water-Source Air Conditioning Unit - WSAC-2
44. Water-Source Air Conditioning Unit - WSAC-3
45. Water-Source Air Conditioning Unit - WSAC-4
46. Water-Source Heat Pump – WSHP-1
47. Renewable Energy Systems
48. DDC EMS
49. Electrical System
50. Low-Voltage Electrical Power Conductors and Cables
51. Grounding & Bonding for Electrical Systems
52. Lighting Control Devices (LCD)
53. Medium-Voltage Transformers

54. Low-Voltage Transformers
55. Switchboard & Metering
56. Panelboards
57. Wiring Devices
58. Enclosed Controllers
59. Central Battery Equipment
60. Interior & Exterior Lighting
61. Access Control
62. Fire Detection and Alarm
63. Site HVAC and Plumbing Utilities
64. Storm Water Collection Storage System
65. Storm Water Treatment Skid
66. Storm Water Lift Station

PART 2 - COMMISSIONING TEAM

2.1 CONTACT LIST

A. Refer to Appendix A.

PART 3 - ROLES AND RESPONSIBILITIES

3.1 GENERAL

A. Roles, Responsibilities and Deliverables are described in Cx Process Flow Chart and Specification Section 01 91 00 – Commissioning of Systems and Equipment attached as Appendix B and Appendix E, except as modified or augmented below. See Appendix C for University Representative Commissioning Tasks.

3.2 COMMUNICATION PROTOCOLS

A. Contractor and Subcontractor correspondence shall in all cases come through the Contractor. Open discussions about job conditions and issues can be down without a layered protocol. See appendix A for commissioning team.

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PART 4 - CONSTRUCTION PHASE COMMISSIONING PROCESS

4.1 GENERAL

A. The following narrative provides a brief overview of the typical commissioning activities during construction and the general order in which they occur. Refer to the Construction Phase Cx Flow Chart and the Specifications for more detailed information.

4.2 DESIGN REVIEW: Not Used.

4.3 CONSTRUCTION PHASE MEETINGS

A. The Construction-Phase Commissioning process begins with a kickoff meeting conducted by the contractor's QAM (Quality Assurance Manager). The meeting objectives are to:

1. Review the commissioning process with the commissioning team members.

2. Define and clarify roles and responsibilities, commissioning tasks, submittals and schedule.

B. Additional coordination meetings shall be scheduled throughout construction by the QAM with necessary parties attending, to plan, schedule and coordinate, commissioning activities and to resolve issues. Refer to paragraph 1.4 A 2 in Specification Section 01 91 00 – Commissioning of Systems and Equipment paragraph for more details.

4.4 SUBMITTAL REVIEW: Equipment documentation is reviewed by the QAM and the UR during the usual submittal period to ensure equipment and systems are provided with all features required to facilitate commissioning.

4.5 SCHEDULING

A. The QAM includes commissioning activities in the project schedule.

B. The UR reviews project schedule for progress of commissioning activities.

4.6 ISV AND FPT CHECKLIST DEVELOPMENT

A. Under the direction of the QAM and with the UR's assistance, the contractor customizes the ISV and FPT checklists that have been included in the project specifications or, when required, develops new ISV checklists following the same model. The customizing work is intended to address characteristics and requirements of equipment actually provided. The ISV checklists are submitted to the UR for review.

B. The UR reviews and accepts the customized ISV and FPT checklists.

4.7 SYSTEM START UP

A. Under the direction of the QAM, the contractor develops startup plans and startup documentation formats and submits these to the UR for review.

B. The UCR reviews and accepts the startup plans and startup documentation formats.

C. Under the direction of the QAM, the contractor performs initial checkout and startup of equipment and documents this on the ISV checklists.

D. The UR witnesses that the installation and startup have been performed and the checklists are correctly filled out. This may include the UR witnessing startup of selected equipment. A University Representative shall witness all startups.

4.8 FUNCTIONAL PERFORMANCE TESTING

A. Under the direction of the QAM, and with the assistance of the UR, the contractor develops specific equipment and system functional performance test procedures.

B. The UR reviews and accepts the functional performance test procedures.

C. Under the direction of the QAM and with the UR's assistance, the contractor performs the EFPT, OT and SFPT and documents this on the FPT checklists.

D. The UR witnesses that the testing has been performed and the checklists are correctly filled out. This may include the UR witnessing all or a sample of testing. A University Representative shall witness all SFPTs.

E. Items of non-compliance in material, installation, operation or performance are corrected by the contractor and the systems are retested.

4.9 OPERATIONS AND MAINTENANCE DOCUMENTATION

A. Refer to Specification Section 01 00 99 Operations and Maintenance for more details.

B. Under the direction of the QAM, O&M documentation is submitted to the UR for review.

C. The UCR reviews and accepts the O&M documentation.

4.10 TRAINING AND ORIENTATION

A. Refer to Specification Section 01 79 00 Training for more details.

B. Under the direction of the QAM, the contractor develops the orientation and training plan for MEP related systems and submits it to the UR for review.

C. The UR reviews and accepts the orientation and training plan.

D. Under the direction of the QAM, the contractor schedules and conducts orientation and training for University operating personnel.

E. The UR monitors that orientation and training are provided and that they are adequate in scope and quality.

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PART 5 - SCHEDULING

5.1 GENERAL

A. Refer to sample Commissioning Schedule attached as Appendix D for recommended format and level of detail.

B. The commissioning is completed before Substantial Completion.

C. Seasonal / Deferred Testing: Execute seasonal or deferred functional performance testing, witnessed by the University Representative. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

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PART 6 - WARRANTY PHASE COMMISSIONING TEAM AND SCOPE

6.1 CONTACT LIST

A. Refer to Appendix H, Warranty Phase Participants

6.2 WARRANTY PHASE COMMISSIONING SCOPE

A. Commissioning during the Warranty Phase shall focus on the satisfactory operation of the project and shall do the following:

1. Ensure that equipment and systems continue to operate properly.
2. Verify proper performance of equipment and systems through reviews of trend graphing.
3. Communicate with Energy Management Office to make sure building control systems are operating correctly.
4. Refine warranty period plans for reviewing operation of the building after a period of occupancy.

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PART 7 - WARRANTY PHASE ROLES AND RESPONSIBILITIES

7.1 GENERAL

A. Roles, Responsibilities and Deliverables are described in Cx Warranty Process Flow Chart (Appendix I)

7.2 UNIVERSITY'S COMMISSIONING CONSULTANT (UCC) RESPONSIBILITIES

A. Review and comment on building performance per plans and trending information.

B. Oversee delivery of warranty information to Facilities.

C. Conduct Warranty Phase Cx Guarantee Defect Notice Meetings with the University Facilities

D. Based on building design and trend graphic reports, construct a plan for building-performance in-the-field examination of building performance.

E. Maintain Log of Post Occupancy Issues including party responsible for the issue, and the time and date of each resolution.

F. Assist with diagnostic testing as necessary.

7.3 COMMUNICATION PROTOCOLS

A. Contractor and Subcontractor Involvement. In general the Contractor removes himself from the project when the building is accepted. But the burden of warranty work rests with him. See the Warranty Phase Issues Resolution Flow Chart (see Appendix J). Communication will be open, though all correspondence from the contractor to the University Representatives and vice versa will come through the University's project manager.

B. Internal communication will formally take place between the DCM Cx Representative and the Facilities' Single Point of Contact. Often the communication will be between the Cx Representative and the particular shop whose personnel need to be involved with a particular issue. The Single Point of Contact will be kept informed of such communications.

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PART 8 - WARRANTY PHASE PROCESS

8.1 GENERAL

A. Refer to the Warranty Cx Flow Chart (Appendix I) for a brief overview of the commissioning activities during the warranty phase and the general order in which they occur.

8.2 PERFORMANCE REVIEW: Periodic Meetings with reviews of key Facilities personnel. Review work orders as indications of possible warranty work (as opposed to routine service calls)

8.3 WARRANTY PHASE MEETINGS.

A. During the warranty phase, an initial warranty phase meeting will be called for by the University Cx Authority and will include the Facilities Single Point of Contact as well as personnel as he deems fit. Meetings thereafter shall be coordinated between the Facilities Single Point of Contact and scheduled as need dictates. Warranty phase

meetings shall not be held to discuss normal maintenance and typical project service calls.

8.4 WORK ORDERS DURING THE WARRANTY PERIOD

A. The DCM Project Coordinator will issue work orders as directed by the Project Manager who will be informed of such needs for work from Facilities to attend to problems.

B. Requests for Work Orders shall be channeled to the DCM Project Manager from Facilities' single point of contact.

C. Upon the receipt of a work order in the appropriate amount, Facilities will address the issue and take care of it. This again refers to minor problems or problems with the design, which are not the responsibility of the Contractor.

D. See : Flow Chart for Issues Resolution with Facilities (Appendix J)

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PART 9 - SCHEDULING

9.1 GENERAL

A. Examination of completed projects is on-going.

B. Seasonal / Deferred Testing: Contractor to execute seasonal or deferred functional performance testing, witnessed by the University Representative per the Contract documents. He shall correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

C. The review of building operation after substantial completion with the Facilities staff and building occupants will take place within 10 months of substantial completion.

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PART 10 - APPENDICES

Binder 1 Appendix A: Commissioning Team
Binder 1 Appendix B: Commissioning Flow Chart
Binder 1 Appendix C: University Representative Commissioning Tasks

Binder 1 Appendix D: Sample Schedule with Cx Tasks (ISVs and FPTs) Incorporated
Binder 1 Appendix E: Commissioning Specifications
Binder 1 Appendix F: University Project Requirements
Binder 1 Appendix G: Basis of Design

Binder 4 Appendix H: Warranty Phase Commissioning Team
Binder 4 Appendix I: Warranty Commissioning Flow Chart
Binder 4 Appendix J: Flow Chart for Issues Resolution with Facilities
Binder 4 Appendix K: Issues Log
Binder 4 Appendix L: CxA Certification

END OF SECTION Cx PLAN

Appendices

Appendix A:
Commissioning Team

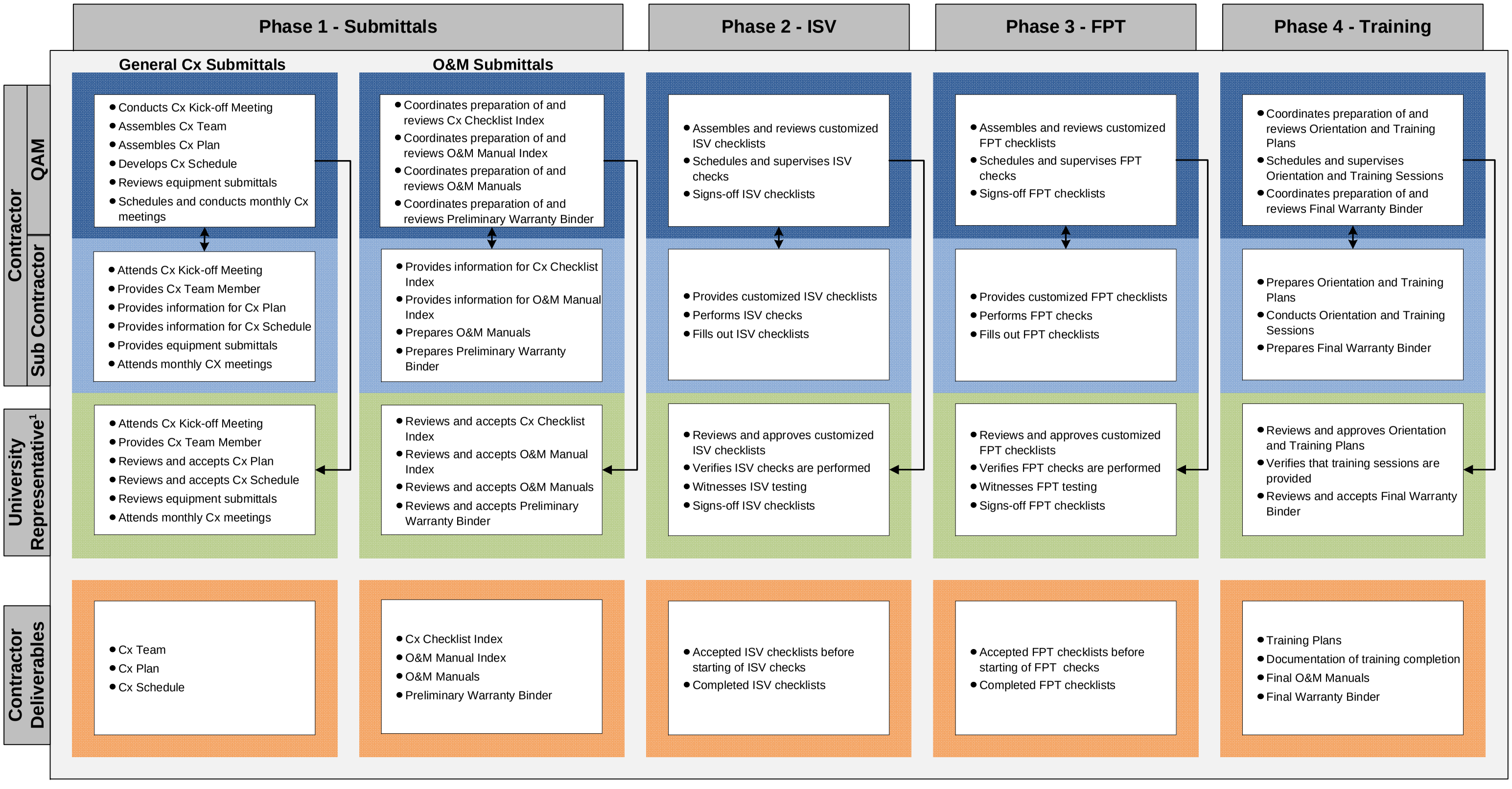
UC Davis Brewery, Winery and Food Pilot Facilities

COMMISSIONING TEAM

Firm			E-mail	Telephone	Cell
BNB NorCal	**General Contractor**	**1825 S. Grant St., San Mateo, CA**			
	Janelle Allen	Project Manager	janelle.allen@bnbuilders.com	650-227-1957	650-773-2336
	Mark Lewis	Superintendent	mark.lewis@bnbuilders.com	650-227-1957	650-293-1083
	Craig Debrine	Commissioning Agent	craig_debrine@att.net	650-227-1957	650-400-3497
	Rourke Benson	MEP Coordinator	rourke.benson@bnbuilders.com	650-227-1957	650-200-5565
Flad Architects	**Architecture Firm**	**650 California Street, 8th Floor,**	**San Francisco, CA, 94108**		
	Andrew Cunningham	Project Manager	acunningham@flad.com	415-398-1600	510-282-1274
	Brett Leonhardt	Project Architect	bleonhardt@flad.com	415-398-1600	415-310-7775
Frank M. Booth	**HVAC-Plumbing Contractor**	**4220 Douglas Boulevard, Suite 5**	**Granite Bay, CA 95746**		
	Dave Slane	Project Manager	daves@fmbdbc.com	916-870-8051	916-878-3832
	Scott Karpinen	Mechanical Engineer	scottk@fmbdbc.com	916-870-8051	916-871-0342
Siemens	**Controls Contractor**	**3650 Industrial Boulevard Suite 100**	**West Sacramento, CA 95691**		
	Gary Elnan	Project Manager	gary.elnan@siemens.com	510-579-4116	510-579-4116
Red Top Electric	**Electrical Contractor**	**6751 Southfront Road**	**Livermore, CA 94551**		
	Floyd Young	Superintendent	floyd.young@teamredtop.com	510-782-8600	510-566-4175
	Dennis Anchondo	Project Manager	dennis.anchondo@teamretop.com	510-782-8600	510-385-0922
Estes Refrigeration	**Refrigeration Contractor**	**1400 Potrero Avenue**	**Richmond, CA 94804**		
	Mike Doninelli	Project Manager	miked@estesrefrigeration.com	510-232-5464	510-812-4682
UCD Architects & Engineers	**UCD - Owner**	**255 Cousteau Place**	**Davis, CA 95618**	**530-754-1111**	
Julianne Nola		Project Manager		530-754-1055	530-304-1382
Peter Shahrokh		Cx Analyst		530-754-1004	530-979-1468
Matt Brown		Senior Mechanical Engineer		530-754- 1078	530-979-7091
Lee Tolentino		IOR			530-304-1329
Keman Lim		Electrical Inspector			530-219-2495
Phil Haman		M/P Inspector			530-304-0831
Pete Lentino		Facilities Representative		530-757-6259	916-240-5974

Appendix B:
Commissioning Flow Chart

Construction Phase Cx Flowchart



General Notes: *This chart is for the Contractor's information only and does not supersede the requirements of the Commissioning Specification included in the Contact Documents.*
Numbered Notes: *1. See University Representative (UR) Cx Tasks Matrix for additional details.*

Appendix C:
University Representative Commissioning Tasks

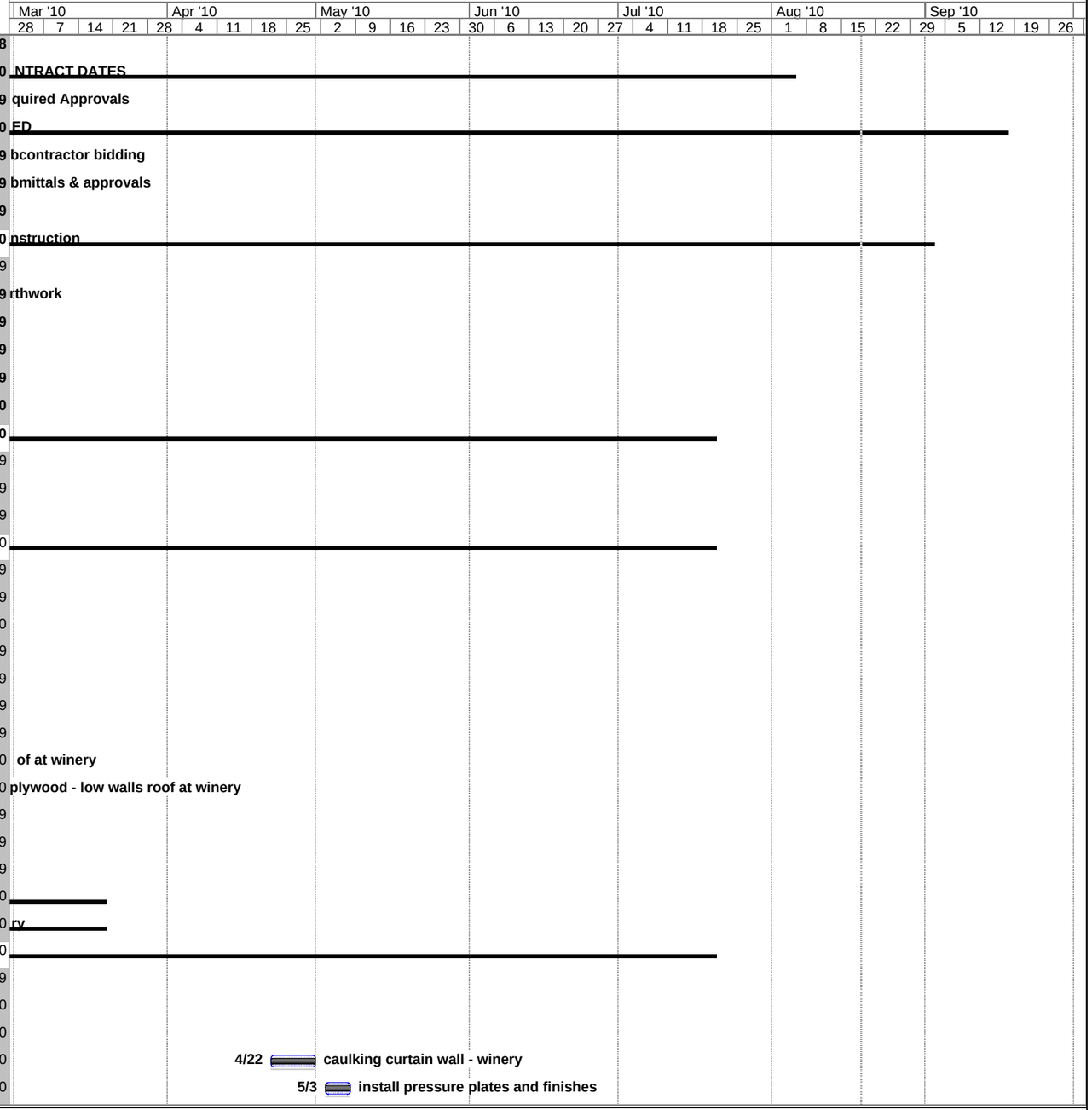
Construction Phase
University Representative Commissioning Tasks

Legend: P = Primary Responsibility A = As Needed

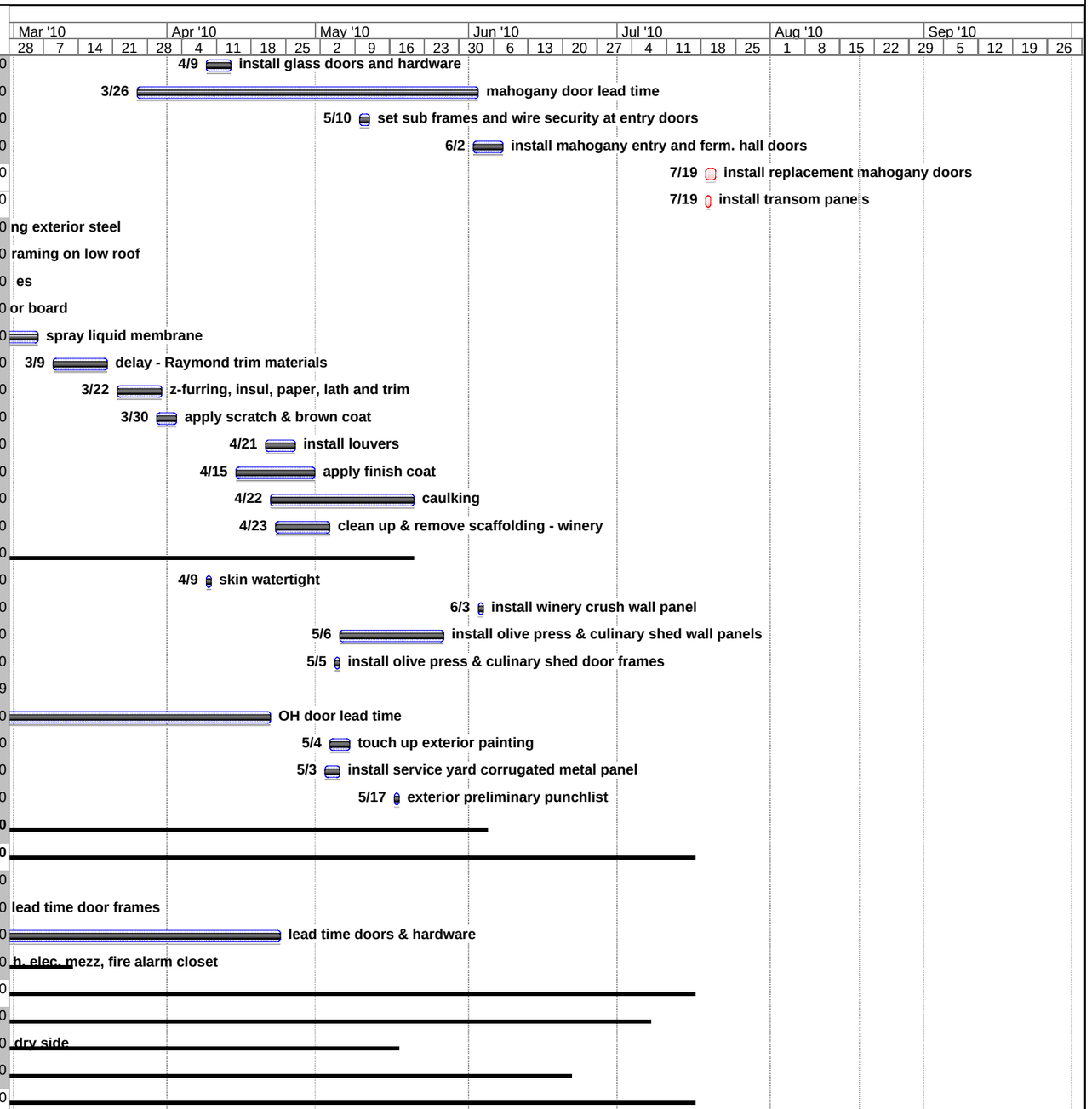
Phase		Task	PM	Cx Analyst	Cx Consult.	IOR	MEP Inspect.	O&M Rep	Design Consult.
Phase 1A General / CX Submittals	1	Coordinate with O&M to appoint single point of contact representative		P					
	2	Participate as team member	P	P	P	P	P	P	P
	3	Attend Cx kick-off meeting	P	P	P	P	P	P	P
	4	Attend scheduled Cx meetings	A	P	P	A	P	P	A
	5	Review and accept Cx plan	P	P	P				A
	6	Review and accept Cx schedule	P	P	P				
	7	Review selected submittals for Cx issues		P	P				
	8	Verify equipment submittals are approved		P					
Phase 1B O&M Submittals	9	Review and accept Cx checklist index		P	P				
	10	Review and accept O&M manual index		P	A				
	11	Review and accept O&M manuals	P	P	A				
	12	Review and accept preliminary warranty binder	P	P					
	13	Review and accept preliminary extended service contract binder	P	P					
	14	Review and accept preliminary spare parts binder	P	P					
Phase 2 ISV Testing	15	Attend scheduled Cx meetings	A	P	P	A	P	P	A
	16	Oversee ISV activities		P	P				
	17	Review and accept customized ISV checklists	P	P	P				A
	18	Verify ISV checks are performed by contractor		A	A	A	P		
	19	Witness ISV testing and sign-off individual checks		A	A	A	P		
	20	Track incomplete items and delegate responsibility for resolution		P	P				
	21	Verify and sign-off completed ISV checklists		P	P				
	22	Coordinate walk-thru with O&M trades at agreed mile stones				P	P	P	
Phase 3 FPT Testing	23	Attend scheduled Cx meetings	A	P	P	A	P	P	A
	24	Oversee FPT activities		P	P				
	25	Review and accept customized FPT checklists	P	P	P				A
	26	Verify FPT checks are performed by contractor		A	P	A	P		
	27	Witness FPT testing and signs-off individual checks		A	P	A	P		
	28	Verify testing of CR systems is performed					P		
	29	Verify CR testing results have been reviewed and approved by UCD CR Dept.					P		
	30	Track incomplete items and delegate responsibility for resolution		P	P				
	31	Verify and sign-off completed FPT checklists		P	P				
	32	Coordinate walk-thru with O&M trades at agreed mile stones				P	P	P	
	33	Coordinate FM-Utility Group activation of Building Utilities					P	A	
	34	Coordinate FM-Utility Group participation in Utility Metering and Interface testing					P	A	
	35	Coordinate FM-Utility Group participation in Emergency Generator testing					P	A	
	36	Coordinate FM-Utility Group participation in Lift Station testing					P	A	
	37	Coordinate FM-Fire Alarm Shop participation in Preliminary Fire Alarm testing					P	A	
	38	Coordinate Fire Department participation in Final Fire Alarm testing				P			
	39	Coordinate FM-Plumb. Shop participation in Preliminary Fire Protection System testing				P		A	
	40	Coordinate Fire Department participation in Final Fire Protection System testing				P			
	41	Coordinate FM-Elevator Shop participation in Elevator testing					P	A	
	42	Coordinate State Elevator Inspector participation in Elevator testing				P			
	43	Coordinate EH&S participation in Fume Hood testing					P		
	44	Coordinate FM-Control Shop participation in Point to Point and SOO verification					P	A	
	45	Coordinate FM-Grounds Shop participation in Irrigation Systems testing				P		A	
Phase 4 Training	46	Attend scheduled Cx meetings	A	P	P	A	P	P	A
	47	Oversee training activities		P				A	
	48	Review and accept orientation and training plans	P	P				P	
	49	Coordinate participation of FM personnel in training sessions		P				P	
	50	Verify that training sessions are provided		P				P	
	51	Review and accept final O&M manuals	P	P				A	
	52	Review and accept final warranty binder	P	P				A	
	53	Review and accept extended service contract binder	P	P				A	
	54	Review and accept spare parts binder	P	P					
	55	Accept spare parts	P			P	P	P	
	56	Verify Cx is complete and prepare Cx Report	P	P	P			A	

Appendix D:
Sample Commissioning Schedule

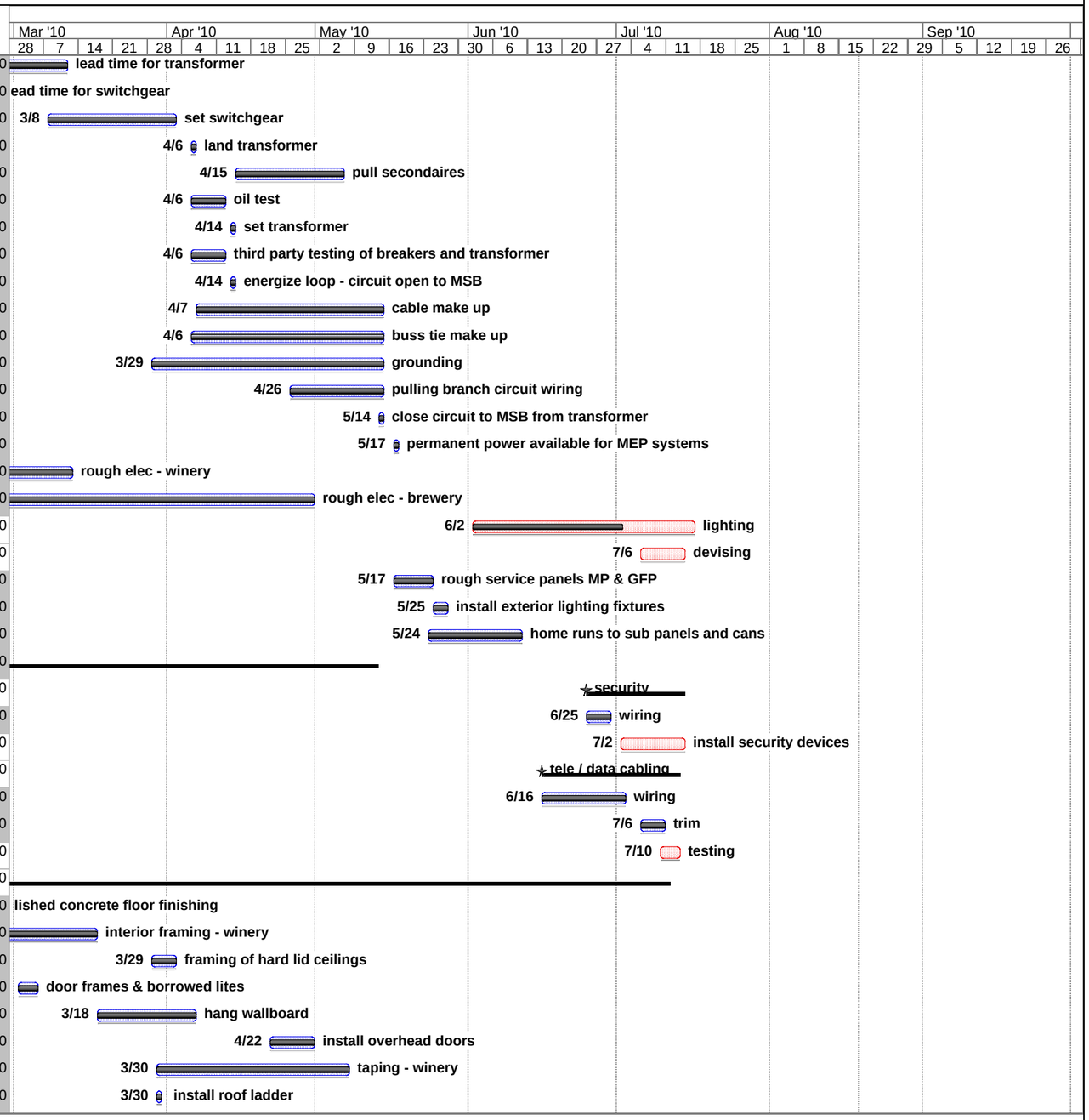
ID	Resource Names	Task Name	Duration	Start	Finish
1		**DESIGN / BUILD RFP PROCESS**	**128 days**	**Wed 4/9/08**	**Wed 10/8/08**
42		**CONTRACT DATES**	**467 days**	**Thu 10/9/08**	**Thu 8/5/10**
62		**Required Approvals**	**240 days**	**Thu 10/23/08**	**Wed 9/30/09**
83		**LEED**	**417 days**	**Thu 2/5/09**	**Fri 9/17/10**
90		**subcontractor bidding**	**64 days**	**Thu 7/16/09**	**Tue 10/13/09**
125		**submittals & approvals**	**122 days**	**Mon 7/6/09**	**Tue 12/22/09**
235		**mobilization**	**16 days**	**Mon 7/6/09**	**Mon 7/27/09**
239		**construction**	**286 days?**	**Fri 7/24/09**	**Thu 9/2/10**
240		NTP	1 day	Tue 7/28/09	Tue 7/28/09
241		**earthwork**	**112 days**	**Fri 7/24/09**	**Mon 12/28/09**
259		**foundations**	**72 days**	**Mon 8/3/09**	**Tue 11/10/09**
278		**underslab utilities**	**37 days**	**Tue 8/25/09**	**Wed 10/14/09**
282		**slab on grade**	**51 days**	**Tue 9/15/09**	**Tue 11/24/09**
309		**superstructure**	**62 days**	**Thu 10/22/09**	**Fri 1/15/10**
323		**exterior skin**	**173 days**	**Mon 11/16/09**	**Tue 7/20/10**
324	Raymond	layout	13 days	Mon 11/16/09	Fri 12/4/09
325	BNB	strip edge form	3 days	Wed 11/25/09	Tue 12/1/09
326	BNB	winterize perimeter of bldg	3 days	Wed 12/2/09	Fri 12/4/09
327		winery	173 days	Mon 11/16/09	Tue 7/20/10
328	Raymond	install scaffolding - winery	3 days	Mon 12/7/09	Wed 12/9/09
329	shared	install exterior framing clips - winery	6 days	Thu 12/17/09	Thu 12/24/09
330	Raymond	frame exterior skin - winery	16 days	Mon 12/14/09	Wed 1/6/10
331	Raymond	layout framing for sloped roofs	8 days	Mon 11/23/09	Fri 12/4/09
332	Raymond	framing of cupola	11 days	Mon 11/23/09	Wed 12/9/09
333	Raymond	layout framing for low roofs	3 days	Wed 12/9/09	Fri 12/11/09
334	Raymond	framing knee wall under clerestory at winery	4 days	Mon 12/21/09	Thu 12/24/09
335	Raymond	board & z furring - low walls roof at winery	7 days	Thu 1/7/10	Fri 1/15/10
336	Raymond	insulation & plywood - low walls roof at winery	10 days	Tue 1/26/10	Mon 2/8/10
337	BNB	drill holes in purlins for MEP attachment	8 days	Mon 11/16/09	Wed 11/25/09
338	Raymond	exterior board at cupola	3 days	Mon 12/7/09	Wed 12/9/09
339	W&W	install exterior window system clips	6 days	Tue 12/8/09	Tue 12/15/09
340		clerestory windows- winery	67 days	Tue 12/15/09	Fri 3/19/10
347		cupola windows - winery	38 days	Tue 1/26/10	Fri 3/19/10
354		curtain wall - winery	151 days	Wed 12/16/09	Tue 7/20/10
355	W&W	install window system metal	10 days	Wed 12/16/09	Wed 12/30/09
356	W&W	install glazing	4 days	Mon 1/4/10	Thu 1/7/10
357	W&W	temp bars ready for caulking	4 days	Tue 1/5/10	Fri 1/8/10
358	W&W	caulking curtain wall - winery	7 days	Thu 4/22/10	Fri 4/30/10
359	W&W	install pressure plates and finishes	5 days	Mon 5/3/10	Fri 5/7/10



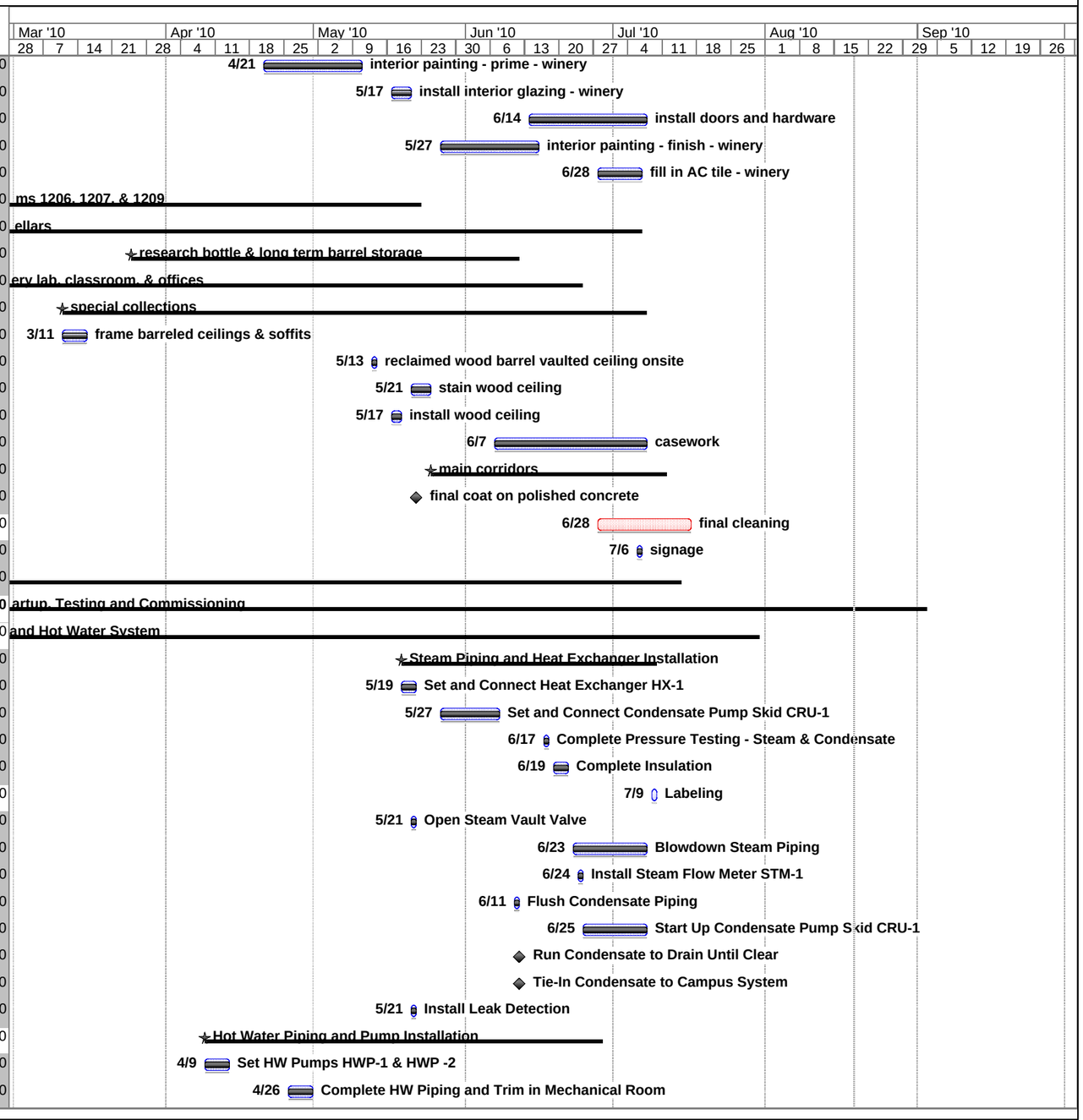
ID	Resource Names	Task Name	Duration	Start	Finish
360	W&W	install glass doors and hardware	3 days	Fri 4/9/10	Tue 4/13/10
361	Boyett	mahogany door lead time	48 days	Fri 3/26/10	Wed 6/2/10
362	shared	set sub frames and wire security at entry doors	2 days	Mon 5/10/10	Tue 5/11/10
363	Boyett	install mahogany entry and ferm. hall doors	4 days	Wed 6/2/10	Mon 6/7/10
364	Boyett	install replacement mahogany doors	2 days	Mon 7/19/10	Tue 7/20/10
365	Boyett	install transom panels	1 day	Mon 7/19/10	Mon 7/19/10
366	Harris	painting exterior steel	24 days	Thu 1/14/10	Thu 2/18/10
367	Raymond	install framing behind window framing on low roof	8 days	Mon 1/4/10	Wed 1/13/10
368	Boyett	install door frames	35 days	Wed 12/16/09	Thu 2/4/10
369	Raymond	hang exterior board	23 days	Mon 1/11/10	Wed 2/10/10
370	Raymond	spray liquid membrane	14 days	Tue 2/16/10	Fri 3/5/10
371	Raymond	delay - Raymond trim materials	9 days	Tue 3/9/10	Fri 3/19/10
372	Raymond	z-furring, insul, paper, lath and trim	7 days	Mon 3/22/10	Tue 3/30/10
373	Raymond	apply scratch & brown coat	4 days	Tue 3/30/10	Fri 4/2/10
374	Booth	install louvers	4 days	Wed 4/21/10	Mon 4/26/10
375	Raymond	apply finish coat	12 days	Thu 4/15/10	Fri 4/30/10
376	Raymond	caulking	21 days	Thu 4/22/10	Thu 5/20/10
377	Raymond	clean up & remove scaffolding - winery	7 days	Fri 4/23/10	Mon 5/3/10
378		brewery and food processing	116 days	Tue 12/8/09	Thu 5/20/10
416	shared	skin watertight	1 day	Fri 4/9/10	Fri 4/9/10
417	Olson	install winery crush wall panel	1 day	Thu 6/3/10	Thu 6/3/10
418	Olson	install olive press & culinary shed wall panels	15 days	Thu 5/6/10	Wed 5/26/10
419	Boyett	install olive press & culinary shed door frames	1 day	Wed 5/5/10	Wed 5/5/10
420	Smith	measure OH doors for fabrication	1 day	Tue 12/15/09	Tue 12/15/09
421	Smith	OH door lead time	44 days	Fri 2/19/10	Wed 4/21/10
422	Harris	touch up exterior painting	4 days	Tue 5/4/10	Fri 5/7/10
423	Olson	install service yard corrugated metal panel	3 days	Mon 5/3/10	Wed 5/5/10
424	shared	exterior preliminary punchlist	1 day	Mon 5/17/10	Mon 5/17/10
425		**roof**	**119 days**	**Thu 12/17/09**	**Fri 6/4/10**
455		**interior construction**	**151 days**	**Mon 12/14/09**	**Fri 7/16/10**
456	AJ	layout and mobilization	10 days	Mon 12/21/09	Tue 1/5/10
457	Boyett	lead time door frames	32 days	Wed 1/13/10	Fri 2/26/10
458	Boyett	lead time doors & hardware	72 days	Wed 1/13/10	Fri 4/23/10
459		priority spaces - mech, elec, mezz, fire alarm closet	30 days	Fri 1/29/10	Fri 3/12/10
468		MEP - back bone	151 days	Mon 12/14/09	Fri 7/16/10
469	Booth	mechanical - wet side	144 days	Mon 12/14/09	Wed 7/7/10
510	Booth	mechanical - dry side	69 days	Tue 2/9/10	Mon 5/17/10
524	Cosco	fire sprinkler	100 days	Fri 1/29/10	Mon 6/21/10
535	Redtop	electrical	146 days	Mon 12/21/09	Fri 7/16/10



ID	Resource Names	Task Name	Duration	Start	Finish
536	Redtop	lead time for transformer	56 days	Mon 12/21/09	Thu 3/11/10
537	Redtop	lead time for switchgear	44 days	Wed 12/23/09	Thu 2/25/10
538	Redtop	set switchgear	20 days	Mon 3/8/10	Fri 4/2/10
539	Redtop	land transformer	1 day	Tue 4/6/10	Tue 4/6/10
540	Redtop	pull secondaires	16 days	Thu 4/15/10	Thu 5/6/10
541	Redtop	oil test	5 days	Tue 4/6/10	Mon 4/12/10
542	Redtop	set transformer	1 day	Wed 4/14/10	Wed 4/14/10
543	Redtop	third party testing of breakers and transformer	5 days	Tue 4/6/10	Mon 4/12/10
544	Redtop	energize loop - circuit open to MSB	1 day	Wed 4/14/10	Wed 4/14/10
545	Redtop	cable make up	28 days	Wed 4/7/10	Fri 5/14/10
546	Redtop	buss tie make up	29 days	Tue 4/6/10	Fri 5/14/10
547	Redtop	grounding	35 days	Mon 3/29/10	Fri 5/14/10
548	Redtop	pulling branch circuit wiring	15 days	Mon 4/26/10	Fri 5/14/10
549	Redtop	close circuit to MSB from transformer	1 day	Fri 5/14/10	Fri 5/14/10
550	Redtop	permanent power available for MEP systems	1 day	Mon 5/17/10	Mon 5/17/10
551	Redtop	rough elec - winery	44 days	Mon 1/11/10	Fri 3/12/10
552	Redtop	rough elec - brewery	69 days	Mon 1/25/10	Fri 4/30/10
553	Redtop	lighting	33 days	Wed 6/2/10	Fri 7/16/10
554	Redtop	devising	7 days	Tue 7/6/10	Wed 7/14/10
555	Redtop	rough service panels MP & GFP	6 days	Mon 5/17/10	Mon 5/24/10
556	Redtop	install exterior lighting fixtures	3 days	Tue 5/25/10	Thu 5/27/10
557	Redtop	home runs to sub panels and cans	14 days	Mon 5/24/10	Fri 6/11/10
558	Code Red	fire alarm	64 days	Fri 2/12/10	Thu 5/13/10
563	Point 1	security	13 days	Fri 6/25/10	Wed 7/14/10
564	Point 1	wiring	3 days	Fri 6/25/10	Tue 6/29/10
565	Point 1	install security devices	9 days	Fri 7/2/10	Wed 7/14/10
566	Point 1	tele / data cabling	19 days	Wed 6/16/10	Tue 7/13/10
567	Point 1	wiring	13 days	Wed 6/16/10	Fri 7/2/10
568	Point 1	trim	4 days	Tue 7/6/10	Sat 7/10/10
569	Point 1	testing	2 days	Sat 7/10/10	Tue 7/13/10
570		winery	136 days	Mon 12/28/09	Sun 7/11/10
571	Floorseal	polished concrete floor finishing	40 days	Mon 12/28/09	Tue 2/23/10
572	AJ	interior framing - winery	49 days	Thu 1/7/10	Wed 3/17/10
573	AJ	framing of hard lid ceilings	5 days	Mon 3/29/10	Fri 4/2/10
574	Boyett	door frames & borrowed lites	4 days	Tue 3/2/10	Fri 3/5/10
575	AJ	hang wallboard	14 days	Thu 3/18/10	Tue 4/6/10
576	Smith	install overhead doors	7 days	Thu 4/22/10	Fri 4/30/10
577	AJ	taping - winery	29 days	Tue 3/30/10	Fri 5/7/10
578	Olson	install roof ladder	1 day	Tue 3/30/10	Tue 3/30/10

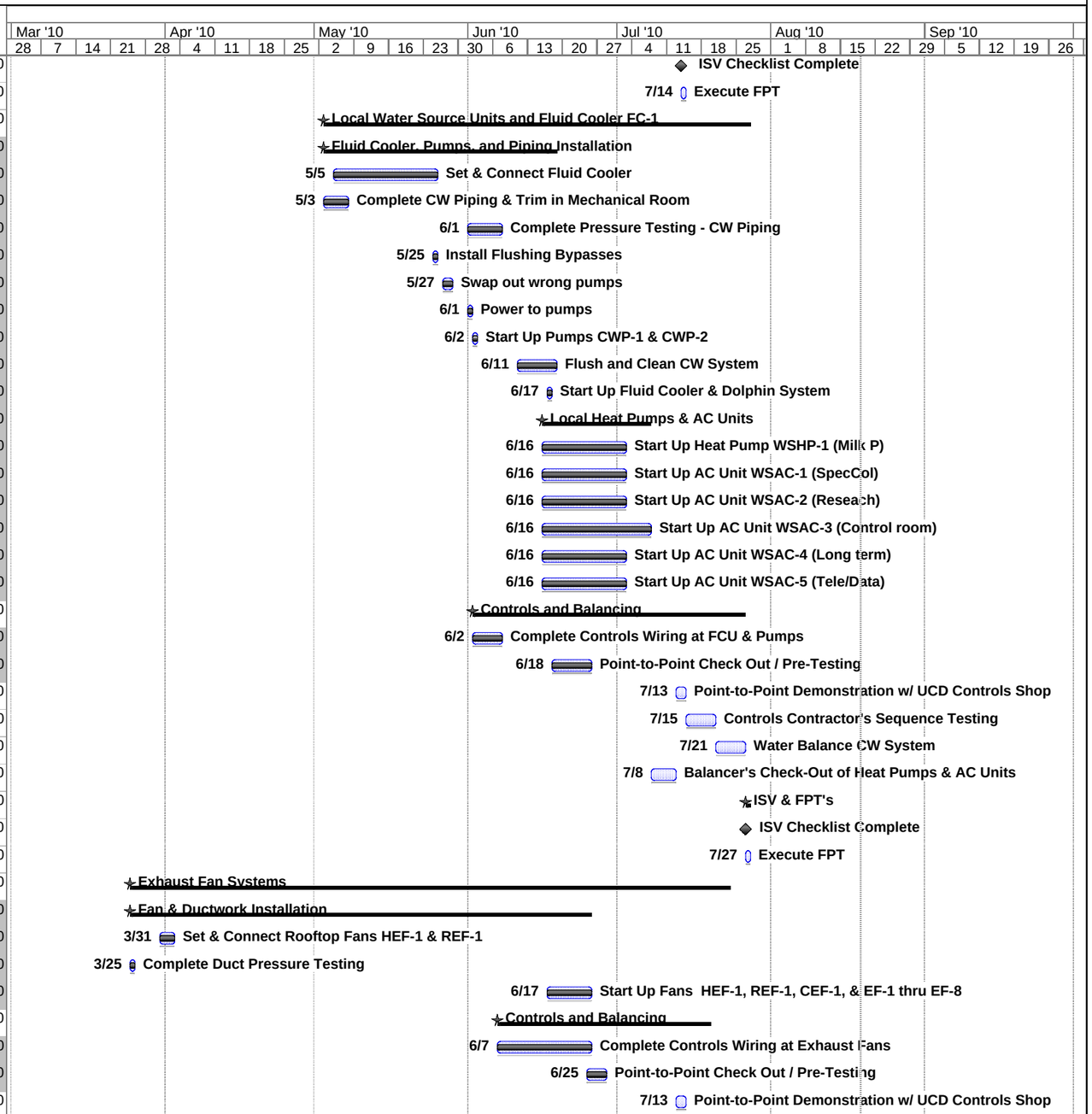


ID	Resource Names	Task Name	Duration	Start	Finish
579	Harris	interior painting - prime - winery	14 days	Wed 4/21/10	Mon 5/10/10
580	Royal	install interior glazing - winery	4 days	Mon 5/17/10	Thu 5/20/10
581	Boyett	install doors and hardware	18 days	Mon 6/14/10	Wed 7/7/10
582	Harris	interior painting - finish - winery	13 days	Thu 5/27/10	Tue 6/15/10
583	Ad-In	fill in AC tile - winery	6 days	Mon 6/28/10	Tue 7/6/10
584		fermentation hall & support rooms 1206, 1207, & 1209	89 days	Fri 1/15/10	Sat 5/22/10
593		cellars	91 days	Fri 2/26/10	Tue 7/6/10
605		research bottle & long term barrel storage	56 days	Thu 3/25/10	Fri 6/11/10
612		winery lab, classroom, & offices	88 days	Mon 2/22/10	Thu 6/24/10
628		special collections	83 days	Thu 3/11/10	Wed 7/7/10
629	AJ	frame barreled ceilings & soffits	3 days	Thu 3/11/10	Mon 3/15/10
630	Braun	reclaimed wood barrel vaulted ceiling onsite	1 day	Thu 5/13/10	Thu 5/13/10
631	Harris	stain wood ceiling	2 days	Fri 5/21/10	Mon 5/24/10
632	Braun	install wood ceiling	2 days	Mon 5/17/10	Tue 5/18/10
633	Braun	casework	23 days	Mon 6/7/10	Wed 7/7/10
634		main corridors	32 days	Tue 5/25/10	Sun 7/11/10
641	Floorseal	final coat on polished concrete	0 days	Sat 5/22/10	Sun 5/23/10
642	BNB	final cleaning	15 days	Mon 6/28/10	Fri 7/16/10
643	Weidner	signage	1 day	Tue 7/6/10	Tue 7/6/10
644		brewery & food processing	139 days	Mon 12/28/09	Wed 7/14/10
746		**MEP Startup, Testing and Commissioning**	**140 days**	**Wed 2/17/10**	**Thu 9/2/10**
747	Booth	Steam and Hot Water System	116 days	Wed 2/17/10	Fri 7/30/10
748	Booth	Steam Piping and Heat Exchanger Installation	36 days	Wed 5/19/10	Fri 7/9/10
749	Booth	Set and Connect Heat Exchanger HX-1	3 days	Wed 5/19/10	Fri 5/21/10
750	Booth	Set and Connect Condensate Pump Skid CRU-1	7 days	Thu 5/27/10	Mon 6/7/10
751	Booth	Complete Pressure Testing - Steam & Condensate	1 day	Thu 6/17/10	Thu 6/17/10
752	Booth	Complete Insulation	1 day	Sat 6/19/10	Mon 6/21/10
753	Booth	Labeling	1 day	Fri 7/9/10	Fri 7/9/10
754	Booth	Open Steam Vault Valve	1 day	Fri 5/21/10	Fri 5/21/10
755	Booth	Blowdown Steam Piping	11 days	Wed 6/23/10	Wed 7/7/10
756	Booth	Install Steam Flow Meter STM-1	1 day	Thu 6/24/10	Thu 6/24/10
757	Booth	Flush Condensate Piping	1 day	Fri 6/11/10	Fri 6/11/10
758	Booth	Start Up Condensate Pump Skid CRU-1	9 days	Fri 6/25/10	Wed 7/7/10
759	Booth	Run Condensate to Drain Until Clear	0 days	Sat 6/12/10	Sat 6/12/10
760	Booth	Tie-In Condensate to Campus System	0 days	Sat 6/12/10	Sat 6/12/10
761	Booth	Install Leak Detection	1 day	Fri 5/21/10	Fri 5/21/10
762	Booth	Hot Water Piping and Pump Installation	56 days	Fri 4/9/10	Mon 6/28/10
763	Booth	Set HW Pumps HWP-1 & HWP -2	3 days	Fri 4/9/10	Tue 4/13/10
764	Booth	Complete HW Piping and Trim in Mechanical Room	5 days	Mon 4/26/10	Fri 4/30/10

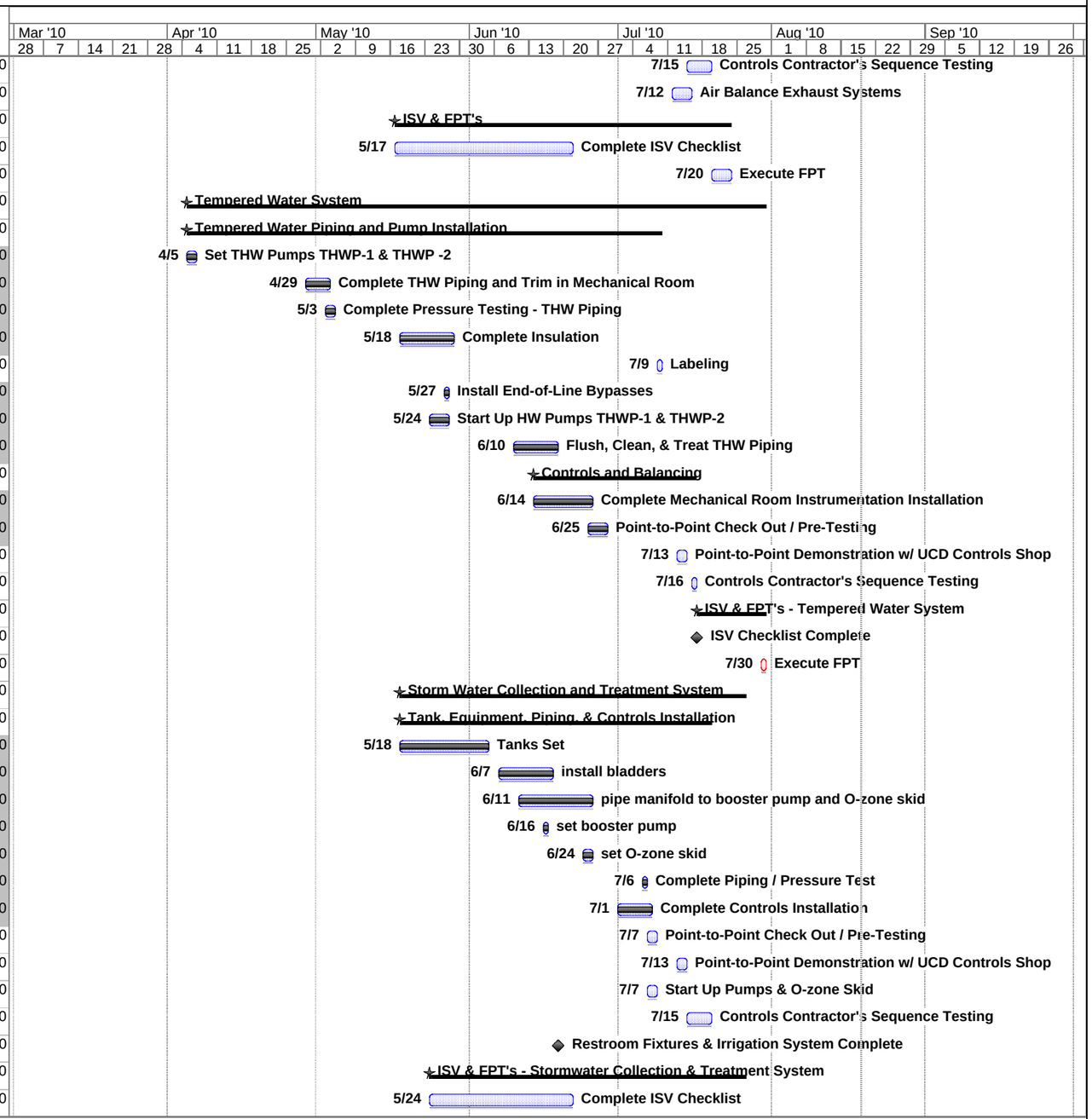


ID	Resource Names	Task Name	Duration	Start	Finish
765	Booth	Complete HW Piping Connections at AHU-1	0.8 wks	Tue 4/27/10	Fri 4/30/10
766	Booth	Complete Pressure Testing - HW Piping	1 day	Mon 5/3/10	Mon 5/3/10
767	Booth	Complete Insulation & Labeling	30 days	Mon 5/17/10	Mon 6/28/10
768	Booth	Start Up HW Pumps HWP-1 & HWP-2	4 days	Mon 5/24/10	Thu 5/27/10
769	Booth	Flush, Clean, & Treat HW Piping	7 days	Thu 6/10/10	Fri 6/18/10
770	Booth	Culinary Steam	115 days	Wed 2/17/10	Thu 7/29/10
771	Booth	steam unit lead time	106 days	Wed 2/17/10	Thu 7/15/10
772	Booth	Set and Connect Clean Steam Generator (USG-1)	1 wk	Fri 7/16/10	Thu 7/22/10
773	Booth	Complete Pressure Testing	1 day	Fri 7/23/10	Fri 7/23/10
774	Booth	Complete Insulation & Labeling	2 days	Mon 7/26/10	Tue 7/27/10
775	Booth	Tie-In to Steam System	1 day	Wed 7/28/10	Wed 7/28/10
776	Booth	ISV Checklist Complete	0 days	Wed 7/28/10	Wed 7/28/10
777	Booth	Execute FPT	1 day	Thu 7/29/10	Thu 7/29/10
778	Booth	Controls and Balancing - Steam & Hot Water System	33 days	Mon 6/14/10	Thu 7/29/10
779	Booth	Complete Mechanical Room Instrumentation Installation	15 days	Mon 6/14/10	Fri 7/2/10
780	Booth	Point-to-Point Check Out / Pre-Testing	2 days	Thu 7/8/10	Fri 7/9/10
781	Booth	Point-to-Point Demonstration w/ UCD Controls Shop	1 day	Tue 7/13/10	Tue 7/13/10
782	Booth	Place Steam & Hot Water System in Automatic Control	0 days	Tue 7/13/10	Tue 7/13/10
783	Booth	Controls Contractor's Sequence Testing	7 days	Wed 7/14/10	Thu 7/22/10
784	Booth	Water Balance - Hot Water System	6 days	Thu 7/22/10	Thu 7/29/10
785	Booth	ISV & FPT's - Steam & Hot Water System	1 day	Thu 7/29/10	Fri 7/30/10
786	Booth	ISV Checklist Complete	0 wks	Thu 7/29/10	Thu 7/29/10
787	Booth	Execute FPT	1 day	Fri 7/30/10	Fri 7/30/10
788	Booth	Chilled Water System	75 days	Tue 4/6/10	Wed 7/21/10
789	Booth	Chilled Water Piping and Pump Installation	62 days	Tue 4/6/10	Thu 7/1/10
800	Booth	Controls and Balancing - Chilled Water System	25 days	Mon 6/14/10	Mon 7/19/10
801	Booth	Complete Mechanical Room Instrumentation Installation	10 days	Mon 6/14/10	Fri 6/25/10
802	Booth	Point-to-Point Check Out / Pre-Testing	2 days	Fri 6/25/10	Mon 6/28/10
803	Booth	Point-to-Point Demonstration w/ UCD Controls Shop	2 days	Tue 7/13/10	Wed 7/14/10
804	Booth	Place Chilled Water System in Automatic Control	1 day	Thu 7/15/10	Thu 7/15/10
805	Booth	Controls Contractor's Sequence Testing	1 day	Fri 7/16/10	Fri 7/16/10
806	Booth	Water Balance - Chilled Water System	2 days	Fri 7/16/10	Mon 7/19/10
807	Booth	ISV & FPT's - Chilled Water System	2 days	Mon 7/19/10	Wed 7/21/10
808	Booth	ISV Checklist Complete	0 wks	Mon 7/19/10	Mon 7/19/10
809	Booth	Execute FPT	2 days	Tue 7/20/10	Wed 7/21/10
810	Booth	Air Handling Unit AHU-1 System	90 days	Thu 3/25/10	Fri 7/30/10
811	Booth	AHU-1 Installation	56 days	Thu 3/25/10	Mon 6/14/10
816	Booth	Controls and Balancing - AHU-1	43 days	Mon 5/10/10	Fri 7/9/10
824	Booth	ISV & FPT's - AHU-1 System (including VAV-1 thru 12)	1 day	Wed 7/14/10	Wed 7/14/10

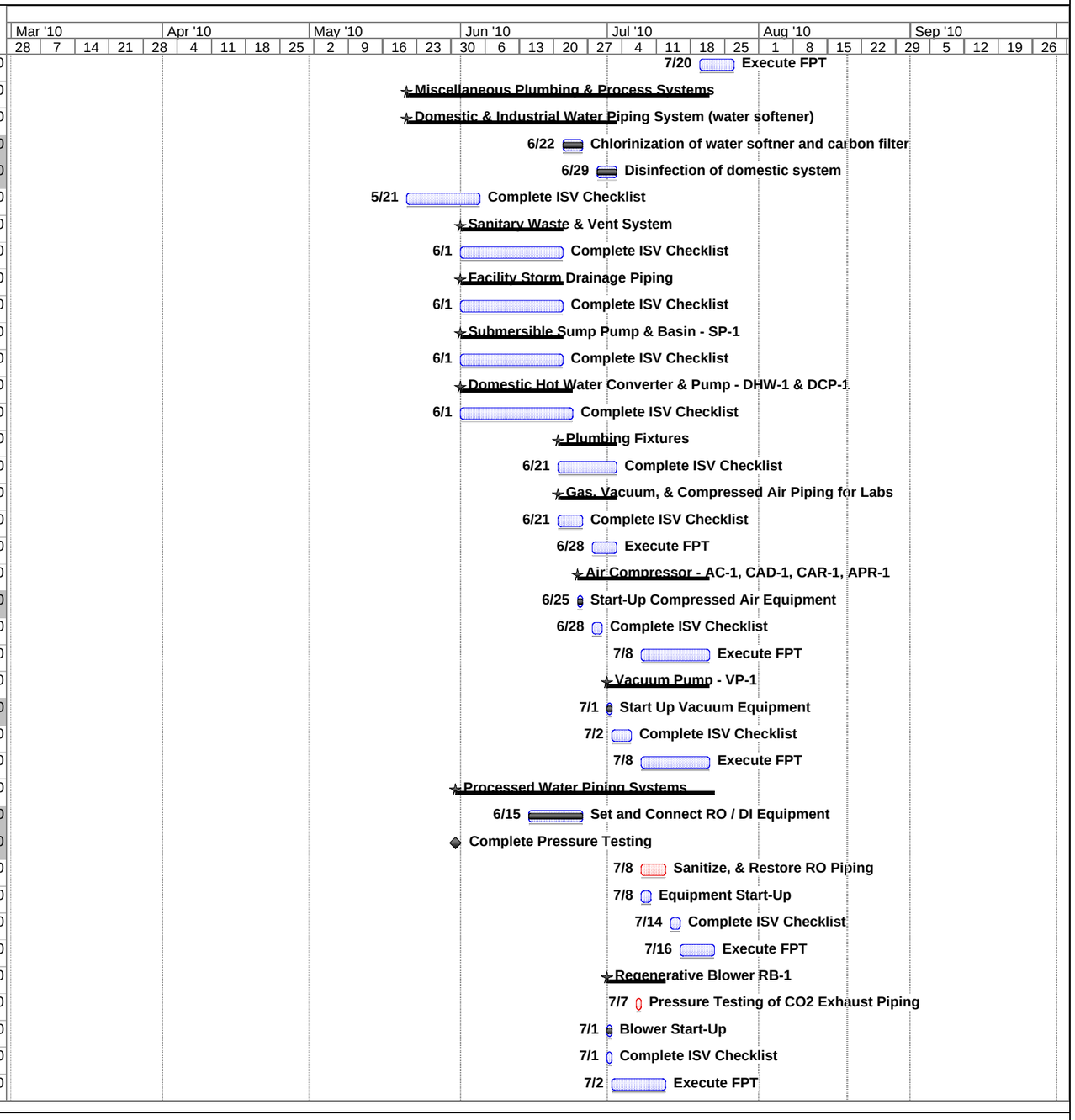
ID	Resource Names	Task Name	Duration	Start	Finish
825	Booth	ISV Checklist Complete	0 wks	Wed 7/14/10	Wed 7/14/10
826	Booth	Execute FPT	1 day	Wed 7/14/10	Wed 7/14/10
827	Booth	Local Water Source Units and Fluid Cooler FC-1	60 days	Mon 5/3/10	Tue 7/27/10
828	Booth	Fluid Cooler, Pumps, and Piping Installation	34 days	Mon 5/3/10	Fri 6/18/10
829	Booth	Set & Connect Fluid Cooler	15 days	Wed 5/5/10	Tue 5/25/10
830	Booth	Complete CW Piping & Trim in Mechanical Room	5 days	Mon 5/3/10	Fri 5/7/10
831	Booth	Complete Pressure Testing - CW Piping	5 days	Tue 6/1/10	Mon 6/7/10
832	Booth	Install Flushing Bypasses	1 day	Tue 5/25/10	Tue 5/25/10
833	Booth	Swap out wrong pumps	2 days	Thu 5/27/10	Fri 5/28/10
834	Redtop	Power to pumps	1 day	Tue 6/1/10	Tue 6/1/10
835	Booth	Start Up Pumps CWP-1 & CWP-2	1 day	Wed 6/2/10	Wed 6/2/10
836	Booth	Flush and Clean CW System	6 days	Fri 6/11/10	Fri 6/18/10
837	Booth	Start Up Fluid Cooler & Dolphin System	1 day	Thu 6/17/10	Thu 6/17/10
838	Booth	Local Heat Pumps & AC Units	15 days	Wed 6/16/10	Wed 7/7/10
839	Booth	Start Up Heat Pump WSHP-1 (Milk P)	13 days	Wed 6/16/10	Fri 7/2/10
840	Booth	Start Up AC Unit WSAC-1 (SpecCol)	13 days	Wed 6/16/10	Fri 7/2/10
841	Booth	Start Up AC Unit WSAC-2 (Reseach)	13 days	Wed 6/16/10	Fri 7/2/10
842	Booth	Start Up AC Unit WSAC-3 (Control room)	16 days	Wed 6/16/10	Wed 7/7/10
843	Booth	Start Up AC Unit WSAC-4 (Long term)	13 days	Wed 6/16/10	Fri 7/2/10
844	Booth	Start Up AC Unit WSAC-5 (Tele/Data)	13 days	Wed 6/16/10	Fri 7/2/10
845	Booth	Controls and Balancing	38 days	Wed 6/2/10	Mon 7/26/10
846	Booth	Complete Controls Wiring at FCU & Pumps	0.8 wks	Wed 6/2/10	Mon 6/7/10
847	Booth	Point-to-Point Check Out / Pre-Testing	6 days	Fri 6/18/10	Fri 6/25/10
848	Booth	Point-to-Point Demonstration w/ UCD Controls Shop	2 days	Tue 7/13/10	Wed 7/14/10
849	Booth	Controls Contractor's Sequence Testing	4 days	Thu 7/15/10	Tue 7/20/10
850	Booth	Water Balance CW System	4 days	Wed 7/21/10	Mon 7/26/10
851	Booth	Balancer's Check-Out of Heat Pumps & AC Units	3 days	Thu 7/8/10	Mon 7/12/10
852	Booth	ISV & FPT's	1 day	Mon 7/26/10	Tue 7/27/10
853	Booth	ISV Checklist Complete	0 days	Mon 7/26/10	Mon 7/26/10
854	Booth	Execute FPT	1 day	Tue 7/27/10	Tue 7/27/10
855	Booth	Exhaust Fan Systems	85 days	Thu 3/25/10	Fri 7/23/10
856	Booth	Fan & Ductwork Installation	66 days	Thu 3/25/10	Fri 6/25/10
857	Booth	Set & Connect Rooftop Fans HEF-1 & REF-1	0.6 wks	Wed 3/31/10	Fri 4/2/10
858	Booth	Complete Duct Pressure Testing	1 day	Thu 3/25/10	Thu 3/25/10
859	Booth	Start Up Fans HEF-1, REF-1, CEF-1, & EF-1 thru EF-	7 days	Thu 6/17/10	Fri 6/25/10
860	Booth	Controls and Balancing	30 days	Mon 6/7/10	Mon 7/19/10
861	Booth	Complete Controls Wiring at Exhaust Fans	15 days	Mon 6/7/10	Fri 6/25/10
862	Booth	Point-to-Point Check Out / Pre-Testing	2 days	Fri 6/25/10	Mon 6/28/10
863	Booth	Point-to-Point Demonstration w/ UCD Controls Shop	2 days	Tue 7/13/10	Wed 7/14/10



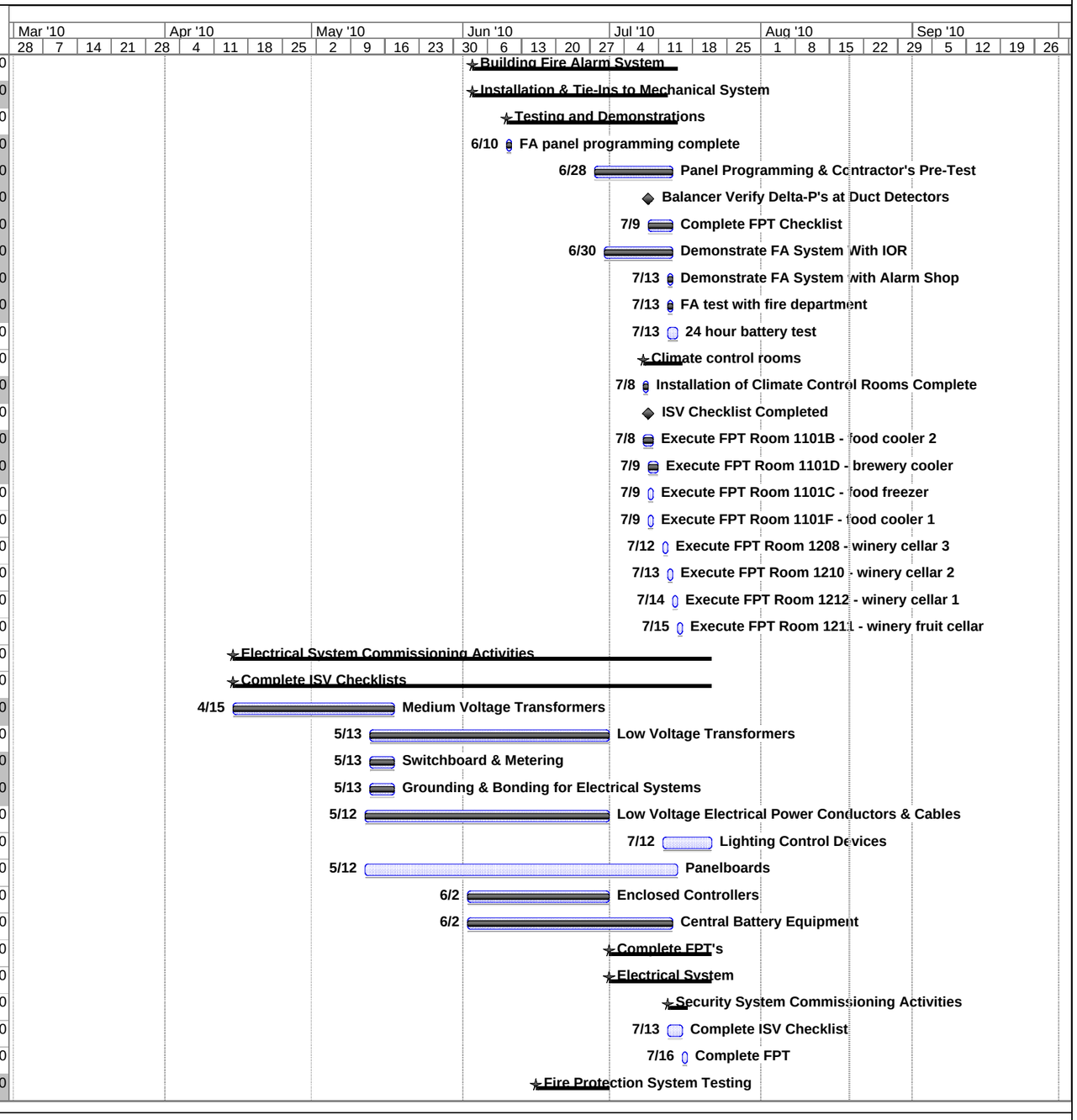
ID	Resource Names	Task Name	Duration	Start	Finish
864	Booth	Controls Contractor's Sequence Testing	3 days	Thu 7/15/10	Mon 7/19/10
865	Booth	Air Balance Exhaust Systems	4 days	Mon 7/12/10	Thu 7/15/10
866	Booth	ISV & FPT's	48 days	Mon 5/17/10	Fri 7/23/10
867	Booth	Complete ISV Checklist	5 wks	Mon 5/17/10	Mon 6/21/10
868	Booth	Execute FPT	4 days	Tue 7/20/10	Fri 7/23/10
869	Booth	Tempered Water System	83 days	Mon 4/5/10	Fri 7/30/10
870	Booth	Tempered Water Piping and Pump Installation	68 days	Mon 4/5/10	Fri 7/9/10
871	Booth	Set THW Pumps THWP-1 & THWP -2	2 days	Mon 4/5/10	Tue 4/6/10
872	Booth	Complete THW Piping and Trim in Mechanical Room	3 days	Thu 4/29/10	Mon 5/3/10
873	Booth	Complete Pressure Testing - THW Piping	2 days	Mon 5/3/10	Tue 5/4/10
874	Booth	Complete Insulation	9 days	Tue 5/18/10	Fri 5/28/10
875	Booth	Labeling	1 day	Fri 7/9/10	Fri 7/9/10
876	Booth	Install End-of-Line Bypasses	1 day	Thu 5/27/10	Thu 5/27/10
877	Booth	Start Up HW Pumps THWP-1 & THWP-2	4 days	Mon 5/24/10	Thu 5/27/10
878	Booth	Flush, Clean, & Treat THW Piping	7 days	Thu 6/10/10	Fri 6/18/10
879	Booth	Controls and Balancing	24 days	Mon 6/14/10	Fri 7/16/10
880	Booth	Complete Mechanical Room Instrumentation Installatic	2 wks	Mon 6/14/10	Fri 6/25/10
881	Booth	Point-to-Point Check Out / Pre-Testing	2 days	Fri 6/25/10	Mon 6/28/10
882	Booth	Point-to-Point Demonstration w/ UCD Controls Shop	2 days	Tue 7/13/10	Wed 7/14/10
883	Booth	Controls Contractor's Sequence Testing	1 day	Fri 7/16/10	Fri 7/16/10
884	Booth	ISV & FPT's - Tempered Water System	10 days	Fri 7/16/10	Fri 7/30/10
885	Booth	ISV Checklist Complete	0 wks	Fri 7/16/10	Fri 7/16/10
886	Booth	Execute FPT	1 day	Fri 7/30/10	Fri 7/30/10
887	Booth	Storm Water Collection and Treatment System	48 days	Tue 5/18/10	Mon 7/26/10
888	Booth	Tank, Equipment, Piping, & Controls Installation	43 days	Tue 5/18/10	Mon 7/19/10
889	ValleyCrest	Tanks Set	2.6 wks	Tue 5/18/10	Fri 6/4/10
890	ValleyCrest	install bladders	9 days	Mon 6/7/10	Thu 6/17/10
891	Booth	pipe manifold to booster pump and O-zone skid	11 days	Fri 6/11/10	Fri 6/25/10
892	ValleyCrest	set booster pump	1 day	Wed 6/16/10	Wed 6/16/10
893	Booth	set O-zone skid	2 days	Thu 6/24/10	Fri 6/25/10
894	Booth	Complete Piping / Pressure Test	1 day	Tue 7/6/10	Tue 7/6/10
895	Booth	Complete Controls Installation	5 days	Thu 7/1/10	Wed 7/7/10
896	Booth	Point-to-Point Check Out / Pre-Testing	2 days	Wed 7/7/10	Thu 7/8/10
897	Booth	Point-to-Point Demonstration w/ UCD Controls Shop	2 days	Tue 7/13/10	Wed 7/14/10
898	Booth	Start Up Pumps & O-zone Skid	2 days	Wed 7/7/10	Thu 7/8/10
899	Booth	Controls Contractor's Sequence Testing	3 days	Thu 7/15/10	Mon 7/19/10
900	Booth	Restroom Fixtures & Irrigation System Complete	0 days	Fri 6/18/10	Fri 6/18/10
901	Booth	ISV & FPT's - Stormwater Collection & Treatment System	44 days	Mon 5/24/10	Mon 7/26/10
902	Booth	Complete ISV Checklist	4 wks	Mon 5/24/10	Mon 6/21/10



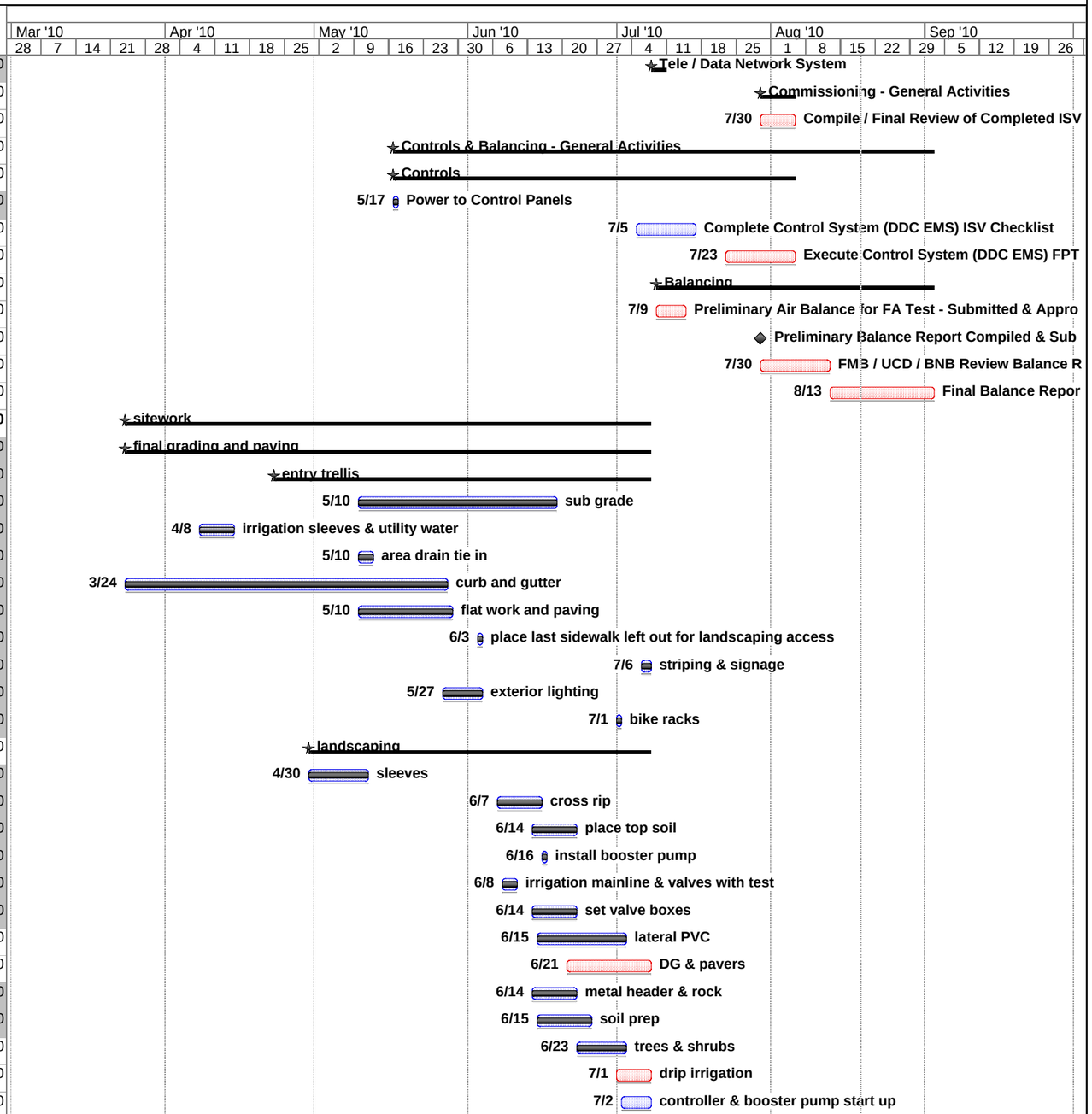
ID	Resource Names	Task Name	Duration	Start	Finish
903	Booth	Execute FPT	1 wk	Tue 7/20/10	Mon 7/26/10
904	Booth	Miscellaneous Plumbing & Process Systems	42 days	Fri 5/21/10	Wed 7/21/10
905	Booth	Domestic & Industrial Water Piping System (water softener)	30 days	Fri 5/21/10	Fri 7/2/10
906	Booth	Chlorinization of water softner and carbon filter	4 days	Tue 6/22/10	Fri 6/25/10
907	Booth	Disinfection of domestic system	4 days	Tue 6/29/10	Fri 7/2/10
908	Booth	Complete ISV Checklist	2 wks	Fri 5/21/10	Fri 6/4/10
909	Booth	Sanitary Waste & Vent System	15 days	Tue 6/1/10	Mon 6/21/10
910	Booth	Complete ISV Checklist	15 days	Tue 6/1/10	Mon 6/21/10
911	Booth	Facility Storm Drainage Piping	15 days	Tue 6/1/10	Mon 6/21/10
912	Booth	Complete ISV Checklist	15 days	Tue 6/1/10	Mon 6/21/10
913	Booth	Submersible Sump Pump & Basin - SP-1	15 days	Tue 6/1/10	Mon 6/21/10
914	Booth	Complete ISV Checklist	15 days	Tue 6/1/10	Mon 6/21/10
915	Booth	Domestic Hot Water Converter & Pump - DHW-1 & DCP-1	17 days	Tue 6/1/10	Wed 6/23/10
916	Booth	Complete ISV Checklist	17 days	Tue 6/1/10	Wed 6/23/10
917	Booth	Plumbing Fixtures	10 days	Mon 6/21/10	Fri 7/2/10
918	Booth	Complete ISV Checklist	10 days	Mon 6/21/10	Fri 7/2/10
919	Booth	Gas, Vacuum, & Compressed Air Piping for Labs	10 days	Mon 6/21/10	Fri 7/2/10
920	Booth	Complete ISV Checklist	1 wk	Mon 6/21/10	Fri 6/25/10
921	Booth	Execute FPT	1 wk	Mon 6/28/10	Fri 7/2/10
922	Booth	Air Compressor - AC-1, CAD-1, CAR-1, APR-1	18 days	Fri 6/25/10	Wed 7/21/10
923	Booth	Start-Up Compressed Air Equipment	1 day	Fri 6/25/10	Fri 6/25/10
924	Booth	Complete ISV Checklist	2 days	Mon 6/28/10	Tue 6/29/10
925	Booth	Execute FPT	2 wks	Thu 7/8/10	Wed 7/21/10
926	Booth	Vacuum Pump - VP-1	14 days	Thu 7/1/10	Wed 7/21/10
927	Booth	Start Up Vacuum Equipment	1 day	Thu 7/1/10	Thu 7/1/10
928	Booth	Complete ISV Checklist	2 days	Fri 7/2/10	Mon 7/5/10
929	Booth	Execute FPT	2 wks	Thu 7/8/10	Wed 7/21/10
930	Booth	Processed Water Piping Systems	37 days	Mon 5/31/10	Thu 7/22/10
931	Booth	Set and Connect RO / DI Equipment	9 days	Tue 6/15/10	Fri 6/25/10
932	Booth	Complete Pressure Testing	0 days	Mon 5/31/10	Mon 5/31/10
933	Booth	Sanitize, & Restore RO Piping	3 days	Thu 7/8/10	Mon 7/12/10
934	Booth	Equipment Start-Up	2 days	Thu 7/8/10	Fri 7/9/10
935	Booth	Complete ISV Checklist	2 days	Wed 7/14/10	Thu 7/15/10
936	Booth	Execute FPT	1 wk	Fri 7/16/10	Thu 7/22/10
937	Booth	Regenerative Blower RB-1	7 days	Thu 7/1/10	Mon 7/12/10
938	Booth	Pressure Testing of CO2 Exhaust Piping	1 day	Wed 7/7/10	Wed 7/7/10
939	Booth	Blower Start-Up	1 day	Thu 7/1/10	Thu 7/1/10
940	Booth	Complete ISV Checklist	1 day	Thu 7/1/10	Thu 7/1/10
941	Booth	Execute FPT	7 days	Fri 7/2/10	Mon 7/12/10



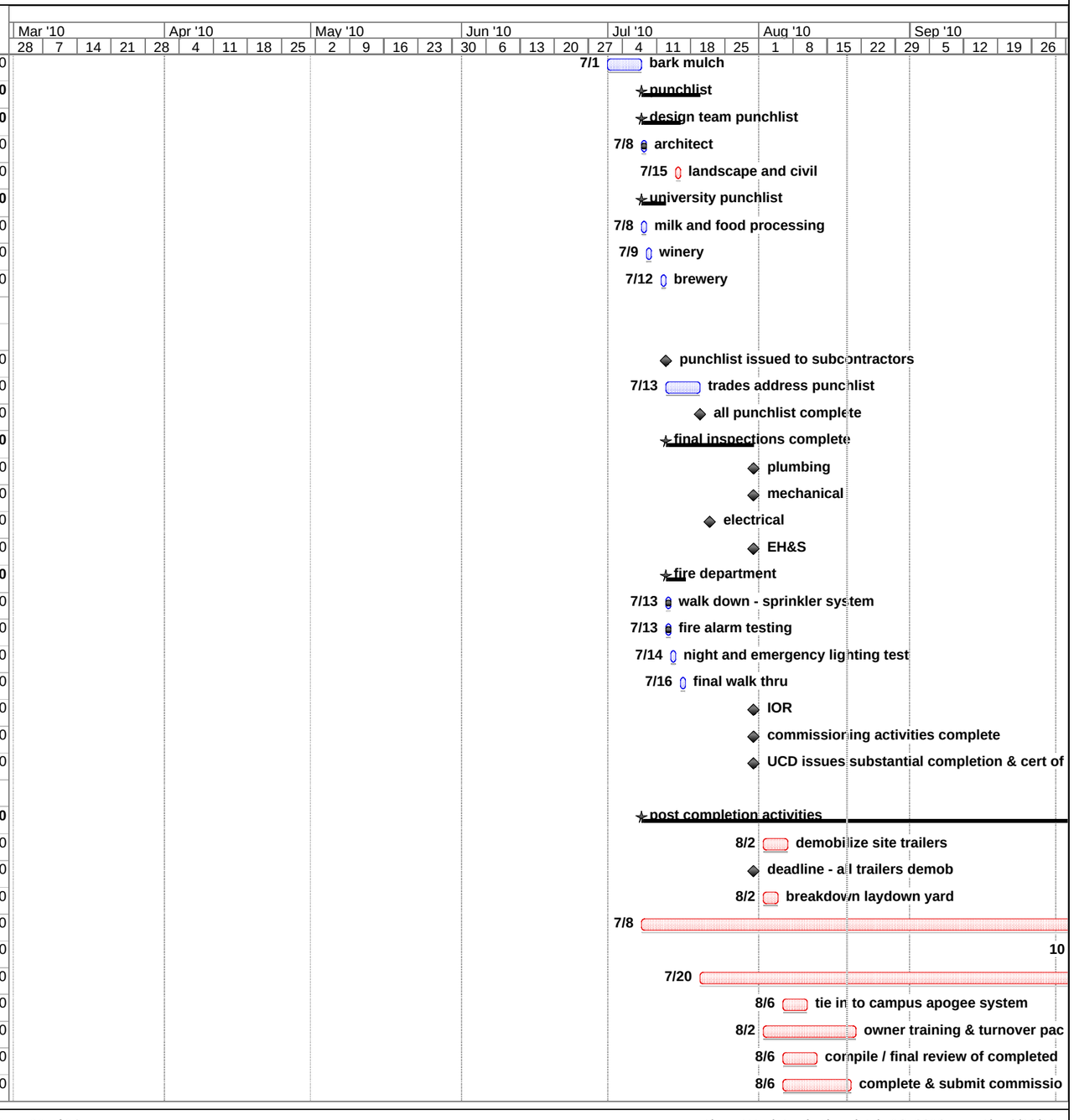
ID	Resource Names	Task Name	Duration	Start	Finish
942	Code Red	Building Fire Alarm System	29 days	Thu 6/3/10	Wed 7/14/10
943	Code Red	Installation & Tie-Ins to Mechanical System	27 days	Thu 6/3/10	Tue 7/13/10
951	Code Red	Testing and Demonstrations	24 days	Thu 6/10/10	Wed 7/14/10
952	Code Red	FA panel programming complete	1 day	Thu 6/10/10	Thu 6/10/10
953	Code Red	Panel Programming & Contractor's Pre-Test	12 days	Mon 6/28/10	Tue 7/13/10
954	Code Red	Balancer Verify Delta-P's at Duct Detectors	0 days	Fri 7/9/10	Fri 7/9/10
955	Code Red	Complete FPT Checklist	0.6 wks	Fri 7/9/10	Tue 7/13/10
956	Code Red	Demonstrate FA System With IOR	10 days	Wed 6/30/10	Tue 7/13/10
957	Code Red	Demonstrate FA System with Alarm Shop	1 day	Tue 7/13/10	Tue 7/13/10
958	Code Red	FA test with fire department	1 day	Tue 7/13/10	Tue 7/13/10
959	Code Red	24 hour battery test	2 days	Tue 7/13/10	Wed 7/14/10
960	Estes	Climate control rooms	6 days	Thu 7/8/10	Thu 7/15/10
961	Estes	Installation of Climate Control Rooms Complete	1 day	Thu 7/8/10	Thu 7/8/10
962	Estes	ISV Checklist Completed	0 days	Thu 7/8/10	Thu 7/8/10
963	Estes	Execute FPT Room 1101B - food cooler 2	2 days	Thu 7/8/10	Fri 7/9/10
964	Estes	Execute FPT Room 1101D - brewery cooler	1 day	Fri 7/9/10	Sat 7/10/10
965	Estes	Execute FPT Room 1101C - food freezer	1 day	Fri 7/9/10	Fri 7/9/10
966	Estes	Execute FPT Room 1101F - food cooler 1	1 day	Fri 7/9/10	Fri 7/9/10
967	Estes	Execute FPT Room 1208 - winery cellar 3	1 day	Mon 7/12/10	Mon 7/12/10
968	Estes	Execute FPT Room 1210 - winery cellar 2	1 day	Tue 7/13/10	Tue 7/13/10
969	Estes	Execute FPT Room 1212 - winery cellar 1	1 day	Wed 7/14/10	Wed 7/14/10
970	Estes	Execute FPT Room 1211 - winery fruit cellar	1 day	Thu 7/15/10	Thu 7/15/10
971	Redtop	Electrical System Commissioning Activities	68 days	Thu 4/15/10	Wed 7/21/10
972	Redtop	Complete ISV Checklists	68 days	Thu 4/15/10	Wed 7/21/10
973	Redtop	Medium Voltage Transformers	4.6 wks	Thu 4/15/10	Mon 5/17/10
974	Redtop	Low Voltage Transformers	6.8 wks	Thu 5/13/10	Wed 6/30/10
975	Redtop	Switchboard & Metering	0.6 wks	Thu 5/13/10	Mon 5/17/10
976	Redtop	Grounding & Bonding for Electrical Systems	0.6 wks	Thu 5/13/10	Mon 5/17/10
977	Redtop	Low Voltage Electrical Power Conductors & Cables	7 wks	Wed 5/12/10	Wed 6/30/10
978	Redtop	Lighting Control Devices	1.6 wks	Mon 7/12/10	Wed 7/21/10
979	Redtop	Panelboards	9 wks	Wed 5/12/10	Wed 7/14/10
980	Redtop	Enclosed Controllers	4.2 wks	Wed 6/2/10	Wed 6/30/10
981	Redtop	Central Battery Equipment	6 wks	Wed 6/2/10	Tue 7/13/10
982	Redtop	Complete FPT's	14 days	Thu 7/1/10	Wed 7/21/10
983	Redtop	Electrical System	14 days	Thu 7/1/10	Wed 7/21/10
990	Point 1	Security System Commissioning Activities	4 days	Tue 7/13/10	Fri 7/16/10
991	Point 1	Complete ISV Checklist	3 days	Tue 7/13/10	Thu 7/15/10
992	Point 1	Complete FPT	1 day	Fri 7/16/10	Fri 7/16/10
993	Cosco	Fire Protection System Testing	11 days	Wed 6/16/10	Wed 6/30/10



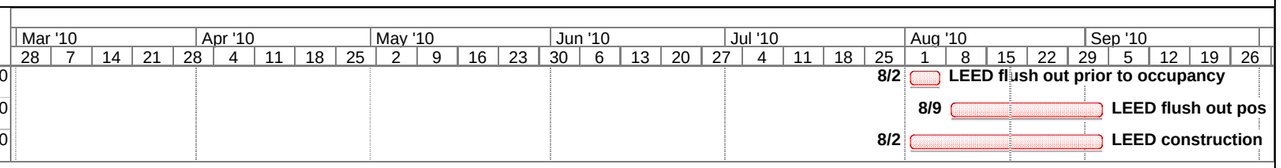
ID	Resource Names	Task Name	Duration	Start	Finish
996	Point 1	Tele / Data Network System	2 days	Thu 7/8/10	Sat 7/10/10
998	BNB	Commissioning - General Activities	5 days	Fri 7/30/10	Thu 8/5/10
999	BNB	Compile / Final Review of Completed ISV Checklists	1 wk	Fri 7/30/10	Thu 8/5/10
1000	Booth	Controls & Balancing - General Activities	77 days	Mon 5/17/10	Thu 9/2/10
1001	Booth	Controls	57 days	Mon 5/17/10	Thu 8/5/10
1002	Redtop	Power to Control Panels	1 day	Mon 5/17/10	Mon 5/17/10
1003	Booth	Complete Control System (DDC EMS) ISV Checklist	2 wks	Mon 7/5/10	Fri 7/16/10
1004	Booth	Execute Control System (DDC EMS) FPT	2 wks	Fri 7/23/10	Thu 8/5/10
1005	Booth	Balancing	40 days	Fri 7/9/10	Thu 9/2/10
1006	UCD	Preliminary Air Balance for FA Test - Submitted & Approved	4 days	Fri 7/9/10	Wed 7/14/10
1007	Booth	Preliminary Balance Report Compiled & Submitted	0 wks	Thu 7/29/10	Thu 7/29/10
1008	shared	FMB / UCD / BNB Review Balance Report	2 wks	Fri 7/30/10	Thu 8/12/10
1009	Booth	Final Balance Report Submitted & Approved	3 wks	Fri 8/13/10	Thu 9/2/10
1010		**sitework**	**74 days**	**Wed 3/24/10**	**Wed 7/7/10**
1011		final grading and paving	74 days	Wed 3/24/10	Wed 7/7/10
1012		entry trellis	52 days	Fri 4/23/10	Wed 7/7/10
1021	Beebe	sub grade	29 days	Mon 5/10/10	Fri 6/18/10
1022	Beebe	irrigation sleeves & utility water	5 days	Thu 4/8/10	Wed 4/14/10
1023	Beebe	area drain tie in	3 days	Mon 5/10/10	Wed 5/12/10
1024	Beebe	curb and gutter	47 days	Wed 3/24/10	Thu 5/27/10
1025	Beebe	flat work and paving	15 days	Mon 5/10/10	Fri 5/28/10
1026	Beebe	place last sidewalk left out for landscaping access	1 day	Thu 6/3/10	Thu 6/3/10
1027	Beebe	striping & signage	2 days	Tue 7/6/10	Wed 7/7/10
1028	Redtop	exterior lighting	5 days	Thu 5/27/10	Thu 6/3/10
1029	BNB	bike racks	1 day	Thu 7/1/10	Thu 7/1/10
1030	Valley Crest	landscaping	47 days	Fri 4/30/10	Wed 7/7/10
1031	Valley Crest	sleeves	8 days	Fri 4/30/10	Tue 5/11/10
1032	Valley Crest	cross rip	7 days	Mon 6/7/10	Tue 6/15/10
1033	Valley Crest	place top soil	7 days	Mon 6/14/10	Tue 6/22/10
1034	Valley Crest	install booster pump	1 day	Wed 6/16/10	Wed 6/16/10
1035	Valley Crest	irrigation mainline & valves with test	3 days	Tue 6/8/10	Thu 6/10/10
1036	Valley Crest	set valve boxes	7 days	Mon 6/14/10	Tue 6/22/10
1037	Valley Crest	lateral PVC	14 days	Tue 6/15/10	Fri 7/2/10
1038	Valley Crest	DG & pavers	13 days	Mon 6/21/10	Wed 7/7/10
1039	Valley Crest	metal header & rock	7 days	Mon 6/14/10	Tue 6/22/10
1040	Valley Crest	soil prep	9 days	Tue 6/15/10	Fri 6/25/10
1041	Valley Crest	trees & shrubs	8 days	Wed 6/23/10	Fri 7/2/10
1042	Valley Crest	drip irrigation	5 days	Thu 7/1/10	Wed 7/7/10
1043	Valley Crest	controller & booster pump start up	4 days	Fri 7/2/10	Wed 7/7/10



ID	Resource Names	Task Name	Duration	Start	Finish
1044	Valley Crest	bark mulch	5 days	Thu 7/1/10	Wed 7/7/10
1045	**shared**	**punchlist**	**8 days?**	**Thu 7/8/10**	**Mon 7/19/10**
1046	**shared**	**design team punchlist**	**6 days?**	**Thu 7/8/10**	**Thu 7/15/10**
1047		architect	1 day?	Thu 7/8/10	Thu 7/8/10
1048		landscape and civil	1 day?	Thu 7/15/10	Thu 7/15/10
1049	**shared**	**university punchlist**	**3 days?**	**Thu 7/8/10**	**Mon 7/12/10**
1050		milk and food processing	1 day?	Thu 7/8/10	Thu 7/8/10
1051		winery	1 day?	Fri 7/9/10	Fri 7/9/10
1052		brewery	1 day?	Mon 7/12/10	Mon 7/12/10
1053					
1054					
1055		punchlist issued to subcontractors	0 days	Mon 7/12/10	Mon 7/12/10
1056	shared	trades address punchlist	5 days	Tue 7/13/10	Mon 7/19/10
1057	shared	all punchlist complete	0 days	Mon 7/19/10	Mon 7/19/10
1058		**final inspections complete**	**14 days**	**Tue 7/13/10**	**Fri 7/30/10**
1059	Booth	plumbing	0 days	Fri 7/30/10	Fri 7/30/10
1060	Booth	mechanical	0 days	Fri 7/30/10	Fri 7/30/10
1061	Redtop	electrical	0 days	Wed 7/21/10	Wed 7/21/10
1062	Booth	EH&S	0 days	Fri 7/30/10	Fri 7/30/10
1063	**shared**	**fire department**	**4 days**	**Tue 7/13/10**	**Fri 7/16/10**
1064	Cosco	walk down - sprinkler system	1 day	Tue 7/13/10	Tue 7/13/10
1065	Code Red	fire alarm testing	1 day	Tue 7/13/10	Tue 7/13/10
1066	Red Top	night and emergency lighting test	1 day	Wed 7/14/10	Wed 7/14/10
1067	BNB	final walk thru	1 day	Fri 7/16/10	Fri 7/16/10
1068	BNB	IOR	0 days	Fri 7/30/10	Fri 7/30/10
1069	shared	commissioning activities complete	0 days	Fri 7/30/10	Fri 7/30/10
1070	BNB	UCD issues substantial completion & cert of occupancy	0 days	Fri 7/30/10	Fri 7/30/10
1071					
1072		**post completion activities**	**99 days**	**Thu 7/8/10**	**Wed 11/24/10**
1073		demobilize site trailers	5 days	Mon 8/2/10	Fri 8/6/10
1074		deadline - all trailers demob	0 days	Fri 7/30/10	Fri 7/30/10
1075		breakdown laydown yard	3 days	Mon 8/2/10	Wed 8/4/10
1076	Valley Crest	grow & kill at bioswale	64 days	Thu 7/8/10	Wed 10/6/10
1077	Valley Crest	hydroseed	1 day	Thu 10/7/10	Thu 10/7/10
1078	Valley Crest	90 day service and maintenance of landscape	90 days	Tue 7/20/10	Wed 11/24/10
1079	Booth	tie in to campus apogee system	3 days	Fri 8/6/10	Tue 8/10/10
1080	BNB	owner training & turnover packages	15 days	Mon 8/2/10	Fri 8/20/10
1081	BNB	compile / final review of completed FPT checklists	5 days	Fri 8/6/10	Thu 8/12/10
1082	BNB	complete & submit commissioning binder	10 days	Fri 8/6/10	Thu 8/19/10



ID	Resource Names	Task Name	Duration	Start	Finish
1083	UCD	LEED flush out prior to occupancy	5 days	Mon 8/2/10	Fri 8/6/10
1084	UCD	LEED flush out post occupancy	20 days	Mon 8/9/10	Fri 9/3/10
1085	Flad	LEED construction phase submittal	25 days	Mon 8/2/10	Fri 9/3/10



Appendix E:
Commissioning Specifications

SECTION 01 91 00 COMMISSIONING

PART 1- GENERAL

1.1 SUMMARY

A. The Contractor shall perform and document commissioning. This Section supplements but does not supersede specific testing requirements found elsewhere in the Contract Documents. The equipment and systems included in the commissioning work scope are described in detail in tables included in the following specification sections:
   1. Design Builder to include all sections where commissioning work scope shall be specified.

B. General Responsibilities
   1. Provide all materials, labor and documentation to execute the commissioning activities as described in the Contract Documents.
   2. Provide a Quality Assurance Manager.
   3. Coordinate the commissioning work and ensure that all subcontractors execute their commissioning responsibilities according to the Contract Documents.
   4. Include commissioning activities in the contract schedule.
   5. Attend commissioning meetings.

1.2 RELATED WORK AND DOCUMENTS

A. Section 01 33 23 - Shop Drawings, Product Data and Samples

B. Section 01 79 00 - Demonstration and Training

C. Division 14 - Conveying Equipment

D. Division 21 - Fire Suppression

E. Division 22 - Plumbing

F. Division 23 - Heating, Ventilating, and Air Conditioning (HVAC)

G. Division 26 - Electrical

H. Division 27 – Communications

I. Division 28 - Electronic Safety and Security

J. Division 33 – Utilities

K. Add all sections where commissioning work scope is specified

1.3 ABBREVIATIONS & DEFINITIONS

A. ASHRAE: American Society of Heating, Refrigerating, and Air Conditioning Engineers.

B. Commissioning (Cx): The process of verifying and documenting that all equipment and systems are correctly installed and perform interactively according to the requirements of the Contract Documents.

C. Commissioning Team: The group of individuals who collaborate to ensure the facility is commissioned including Contractor and University's Representative.

D. Commissioning Plan: The plan that outlines the process, procedures, deliverables, and specific goals of commissioning. It also defines the roles of the parties participating in commissioning the project during construction.

E. Cx Action Item: An issue identified during the verification process that must be resolved prior to acceptance of completed Installation/Start-up Verification (ISV) and Functional Performance Test (FPT) checklists.

F. Deficiency: A condition in installation, operation or performance of equipment and systems that is not in conformance with the Contract Documents.

G. Equipment Functional Performance Tests (EFPT): Tests designed to demonstrate that the operation of equipment and system components meet design intent and project requirements under operating conditions. These tests are documented on the FPT Checklist. These tests may be performed by testing agencies described in the Contract Documents.

H. Functional Performance Test (FPT) Checklist: The checklist used to document the successful operation and performance of equipment and systems. This checklist includes the Equipment Functional Performance Tests, the Operational Tests and the System Functional Performance Tests.

I. Installation/Start-up Verification (ISV) Checklist: The checklist used to document the successful installation and start-up of equipment. This checklist includes requirements for verifying the proper installation and start-up of equipment and systems and preparations required for continuous operation.

J. Operational Test (OT): Tests designed to validate satisfactory system performance over a period of time under normal operating conditions, satisfactory recovery of systems from failure conditions (such as a power outage), and the correct response of systems to emergency conditions (such as encountered during Fire Alarm conditions). In general, the operational tests consist largely of trend data collected prior to the System Functional Performance Tests (SFPT). This data is an historical record of the system operational performance. These tests are documented on the FPT Checklist.

K. Quality Assurance Manager (QAM): Person employed by the Contractor to manage, coordinate, and supervise the installation, start-up and testing of systems and equipment, the Contractor's quality assurance program, and the commissioning process of the project. The QAM qualifications and responsibilities are described in this section.

L. Sequence of Operations (SOO): Narrative describing the modes of operation and control sequences for equipment and systems.

M. Start-up Test: The process whereby the Contractor executes the equipment manufacturer recommended start-up and check out procedures, completes the start-up checklists, energizes the device or equipment, and documents it is in proper working order.

N. System: A system includes all items of equipment, devices and appurtenances connected in such a manner that their operation or function complements, protects or controls the operation or function of the others.

O. System Functional Performance Tests (SFPT): Tests designed to demonstrate the satisfactory operation of equipment as a complete system under operating conditions. This shall include a detailed verification of the Sequence of Operations. Testing of some systems may require the proper functioning of other systems (i.e., the testing of proper performance of air handlers shall require the proper operation of chilled water and hot water systems, and thus these water systems must be tested before the air handlers, and they must be in satisfactory operation during the air handler testing.). These tests are documented on the FPT Checklist.

P. TAB: Testing, Adjusting, and Balancing.

Q. Trending: Monitoring and recording the history of performance and parameters using the Emergency Management System (EMS) or devices like data loggers. Trending is used to prove successful operation of systems over a period of time, and is a prerequisite for a system's Functional Performance Test.

1.4 COORDINATION

A. Commissioning Meetings

1. Cx Kickoff Meeting:

   a. The QAM shall schedule, plan and conduct a commissioning kickoff meeting with the entire commissioning team in attendance within **[60]** days of the commencement of construction.
   b. The objectives of the meeting are to review the commissioning work scope, to clarify team member roles and responsibilities, and to plan the commissioning activities for the entire duration of the project.
   c. The QAM shall prepare and distribute meeting minutes to all participants.

2. Scheduled Cx Coordination Meetings:

   a. The QAM shall plan and conduct regular Cx coordination meetings as construction progresses.
   b. These meetings shall be included in the project schedule and shall occur at the following intervals:
      1) Every 60 days between the initial kickoff meeting and the beginning of the ISV portion of the work;
      2) Every 14 days between the ISV and FPT portions of the work;
      3) Every 7 days during the FPT portion of the work.
   c. The objectives of these meetings are to facilitate coordination and planning with subcontractors and resolve deficiencies.

1.5 SUBMITTALS

A. Documentation supporting QAM qualifications as required in the Quality Assurance article.

B. Installation/Start-up Verification (ISV) Checklists:
1. Specific ISV checklists have been included in the sections listed in the Summary article.

2. The Contractor shall customize and submit ISV checklists for review and acceptance prior to beginning of installation verification and start-up. Manufacturer's installation and start-up instructions shall be included with each ISV checklist. Customized ISV Checklists that incorporate all University review comments shall be submitted by the Contractor **[60]** days prior to the beginning of equipment startup.

3. If the project includes equipment for which checklists have not been included in the Specifications, the Contractor shall develop these checklists using the supplied checklists as models of scope and detail. The sections listed in the Summary article indicate which checklists shall be developed by the Contractor.

C. Functional Performance Test Checklists:
1. Specific FPT checklists have been included in the sections listed in the Summary article.

2. Functional Performance Test (FPT) Checklists include Equipment Functional Performance Tests (EFPT), Operational Tests (OT) and System Functional Performance Tests (SFPT).

3. The Contractor shall customize and submit FPT checklists for review and acceptance prior to beginning of tests. The customizing work shall address characteristics and requirements of equipment actually provided. Contractor shall require all subcontractors and vendors to review FPT procedures to ensure feasibility, safety and equipment protection. Provide necessary alarm limits to be used during the tests. Damage caused to equipment during tests performed in accordance with the approved procedures shall be the responsibility of the Contractor. Customized FPT Checklists that incorporate all University review comments shall be submitted by the Contractor 60 days prior to the beginning of equipment startup.

4. If the project includes equipment for which checklist have not been included in the specifications, the Contractor shall develop these checklists using the supplied checklists as models of scope and detail. The sections listed in the Summary article indicate which checklists shall be developed by the contractor.

D. Commissioning Schedule:
1. The Contractor shall submit a schedule for commissioning activities and provide specific information on the date and duration of individual tests. Any temporary systems or installations that are required to allow start-up and testing shall also be included in the schedule.

E. Final Commissioning Binders and CD:
1. The Contractor shall submit the Final Commissioning Binders in paper format (1 original with wet signatures) and in electronic PDF format scanned from signed originals (1 CD). These binders shall contain completed and signed-off ISV and FPT checklists

documenting the successful installation, start-up, and functional performance of all systems and equipment.

2. Completed and signed off ISV and FPT checklists for all systems and equipment shall be accepted by the University's Representative as a condition for Substantial Completion.

1.6 QUALITY ASSURANCE

A. Quality Assurance Manager (QAM)

1. The Contractor shall employ a competent QAM satisfactory to the University who shall be in attendance at the Project site.

2. The QAM shall be a representative of the Contractor and shall be a different individual than the Superintendent and the Project Manager. All communication between the QAM and the University shall be binding to the Contractor.

3. The QAM shall have at least 5 years experience, or experience on at least 5 separate similar projects, in performing the roles described in this section. The Contractor shall submit to the University the QAM qualifications for review and approval prior to commencement of the Work.

4. The QAM shall manage, coordinate and supervise the Contractor's Quality Assurance Program and the Commissioning activities including the following:

a. Coordinate construction activities.
b. Coordinate submittals, Requests for Information, Coordination Drawings and O&M documentation to the University.
c. Coordinate and supervise the installation, start-up and testing of equipment and systems.
d. Coordinate inspections and testing activities with University's Representative.
e. Supervise the Commissioning Process and coordinate commissioning activities with subcontractors, vendors, manufacturer's representatives and the University's Representative.
f. Assemble the Commissioning Binders.
g. Signoff commissioning checklists.
h. Develop the orientation and training plan.
i. Coordinate orientation and training of University's operating personnel.
j. Attend and conduct Cx coordination meetings and coordinate attendance of specialty subcontractors as applicable.

PART 2- PRODUCTS – Not Used

PART 3- EXECUTION

3.1 QUALITY CONTROL

A. All ISV and FPT testing shall be witnessed by the University's Representative. Notify the University's Representative of testing schedule 48 hours in advance.

B. All testing procedures for electrical systems shall comply with the requirements of the latest version of Acceptance Testing Specification by the National Electrical Testing Association, Inc. (NETA). Include NETA requirements in the checklist.

C. Independent Testing Agencies: For systems where testing by independent agencies is specified, the Contractor shall notify the University's Representative when the testing activities are scheduled. Aspects of EFPT and SFPT accomplished during the independent agency testing may be accepted if they meet the intent of the EFPT and SFPT as determined by the University's Representative. The Contractor shall submit the independent testing agency reports prior to the commencement of EFPT and SFPT for acceptance.

3.2 COMMISSIONING BINDERS

A. The commissioning documents shall be organized in three volumes (binders) which shall be maintained on the project site at all times.
   1. The first volume shall contain the Commissioning Plan which shall consist of:
      a. Commissioning Report (provided by the Contractor when commissioning is completed)
      b. Commissioning Issues Log (provided by the University and updated by the Contractor)
      c. Installation/Start-up Verification Checklist and Functional Performance Checklist Summary (provided by the University and customized by the Contractor)
      d. Commissioning Meeting Minutes
      e. Commissioning Schedule (provided by the Contractor)
      f. Construction Commissioning Plan Narrative (provided by the University)
      g. Training Plan Summary (provided by the Contractor)
      h. Reference Information (provided by the University)
         1) University's Project Requirements
         2) Basis of design Narratives for systems to be commissioned
         3) Commissioning Specifications
   2. The second volume shall contain project specific ISV checklists.
   3. The third volume shall contain project specific FPT checklists.
   4. The second and third volumes shall contain all wet-signature certifications completed as part of the commissioning process. Submittals of completed checklists during the project must be copied from these documents.

3.3 SYSTEM INSTALLATION

A. Document the successful installation of systems and equipment using the ISV Checklists. Completion and sign-off of ISV Checklists are a prerequisite to beginning the FPTs.

3.4 SYSTEM START UP

A. Document the successful start-up of systems and equipment using the ISV checklists.

B. Factory Start Ups: Contractor shall notify the University's Representative 48 hours in advance of scheduled factory start-ups. Aspects of EFPT and SFPT accomplished during the factory start-up may be accomplished and accepted if they meet the intent of the EFPT and SFPT as determined by the University's Representative.

C. Start-up, Testing, Adjusting and Balancing:
   1. Provide the services of a qualified Factory authorized Service Representative to perform equipment/device start-up. Start-up procedures shall be in accordance with the Contract Documents, manufacturer's requirements, and reference or industry standards.

2. Provide the services of a qualified Factory authorized Service Representative or, where required, a certified Independent Testing Agency to perform system testing and adjustment.

3.5 FUNCTIONAL PERFORMANCE TESTING

A. Equipment Functional Performance Tests (EFPT):
   1. Perform all equipment functional performance testing described in the FPT checklists.
   2. Document the successful operation and performance of equipment using the FPT checklists.

B. Operational Tests (OT):
   1. Once EFPTs are completed, each system shall be set up to perform per contract requirements. A preliminary TAB report shall be submitted and approved prior to executing the OTs.
   2. Final sequences of operation and testing procedures shall be developed and submitted as attachments to the FPT Checklists.
   3. OT data shall be generated prior to the System Functional Performance Tests (SFPT). As part of the Operational Testing, all dynamic systems powered by electricity shall be tested to simulate a power outage. Those systems on emergency power shall be tested on all sources. Recovery from power outage conditions shall also be observed for proper return to regular system operation.
   4. All adjusted, balanced, controlled systems shall be assessed to determine the optimal setting for the system as applicable. The optimal settings shall be determined to establish reliable, efficient, safe and stable operation. Electrical settings shall conform to Power System Study. Mechanical systems shall be balanced by the TAB to meet Contract Document requirements.

C. System Functional Performance Tests (SFPT):
   1. Perform all system functional performance testing described in the FPT checklists.
   2. Document the successful operation and performance of systems using the FPT checklists.

D. Test Equipment
   1. The Contractor shall have on site the following equipment in support of commissioning activities:
      a. Standard testing equipment required to perform startup and initial checkout and functional performance testing.
      b. Data logging equipment to trend the operation of standalone equipment which is not connected to an Energy Management and Control System.
      c. Two-way radios for the duration of the FPT testing.
   2. Calibration
      a. All testing equipment shall be of sufficient quality and accuracy to test and measure system performance with the tolerances specified. All equipment used for testing and calibration shall be National Institute of Standards and Technology/National Bureau of Standards (NIST/NBS) traceable and calibrated within the current 12 month period. Calibration tags shall be affixed or certificates

readily available. If not otherwise noted, the following minimum requirements apply:

1) Temperature sensors and digital thermometers shall be calibrated in accordance with ANSI/ASME B40.1, shall have a certified calibration to an accuracy of 0.5 degree Fahrenheit and a resolution of + or - 0.1 degree Fahrenheit.
2) Pressure sensors shall be calibrated in accordance with ANSI/ASME B40.1, and shall have an accuracy of + or - 2.0 percent of the value range being measured (not full range of meter).

E. Calibration of Installed Sensing Equipment
1. All meters, thermometers, and sensing instruments provided on the Project shall have documented calibration using appropriate test equipment or factory calibration certificates. The factory calibration sheet shall identify the device serial number on the certification.

2. Certificates of calibration shall be included with the FPT Checklists.

3.6 SEASONAL / DEFERRED TESTING

A. Provide an allowance for 16 hours of QAM's time and 16 hours of Control Technician's time to assist the University's Representative with seasonal or deferred functional performance testing during the warranty period.

END OF SECTION 01 91 00

Appendix F:
University Project Requirements

RESEARCH and TEACHING WINERY

Introduction

UC Davis has a world-wide reputation as the leader in viticulture and enology research and teaching. The new research and teaching winery is intended to:

- Demonstrate California's leadership in wine experimentation and innovative technology
- Provide a teaching platform for leading technologies
- Serve as an extension and industry outreach showcase for experimentation & improved processing technologies
- Provide a leadership platform for sustainable winemaking

The product of the winery is educated graduates, reliable data and industry innovations. The new facility must provide for flexibility to adapt to various experimental protocols and processes, to demonstrate common production practices, show multiple techniques and allow for innovative practices. The need for experimental reproducibility requires precise and variable control of environmental conditions and closed systems to reduce cross-contamination. Advanced web-based process monitoring and control systems teach students concepts of process monitoring and allow precise control of experimental conditions and process scheduling. Access for students and visitors without disruption of operations, future expandability and a high level of efficiency and functionality are essential.

There are currently about 50 students in the Masters of Viticulture and Enology program and there is a greater demand for trained graduates than the existing facilities can accommodate. The instructional programs in Enology are designed to teach students the scientific principles that underlie making wine. The facility is to be a functional winery that serves as a class room and laboratory.

As a demonstration winery, a total of about 50 tons of grapes are received and processed by the students to simulate real practices in industry. Future instruction may emphasize bulk winemaking over the current small-lot focus. The students are taught how to use equipment used in various winemaking processes, including crusher/stemmers, various pumps, wine presses, filters, and bottling equipment. The Winery Manager/Staff Winemaker oversees the facilities operation and allocates its resources

The school is not bonded and is prohibited by law from producing or selling wine. Eighty percent of the wine produced is destroyed. The remainder is retained for research and teaching purposes.

Certain parts of the facility must be viewable by the public, including the fermentation areas, the laboratory, the long term barrel cellar, and the donation cellar. Visitors must be able to view into these areas without entering the areas or disrupting operations. An indoor or outdoor gathering area should be provided for tour assembly.

One of the principal goals of the facility is to be able to monitor its usage of water and energy, as well as its output of process waste. Therefore, the inputs and outputs have to be measured via meters that can be connected into electronic data collection systems, or at least provision must be made to allow addition of such meters in the future.

Academic Year

Fruit deliveries begin in late summer and continue into fall. The academic year consists of fall, winter and spring terms.

Summer: July to September:

Fruit deliveries begin as early as August 1st with the arrival of fruit from the campus vineyards. Harvest from remote vineyards can last through November. The fruit is processed for upcoming classes. Fruit may be processed for fermentation in cold storage. Research fruit is received and processed in accordance with a variety of study protocols. This is usually performed by 2 staff members, respective faculty and students.

Fall Term: October through December:

Students and instructors will be in the fermentation and barrel areas for up to 8 hours per day, five days a week for six to nine weeks. The maximum number of students, staff and faculty at any given time could be as high as 30 to 35, but would be typically be 15 to 20 students plus instructors.

Spring: January through March:

Teaching activities primarily consist of demonstrations of winery process equipment using bulk wines produced during fall quarter. Bottling will occur from February through August. Research activities involve processing the wine to bottle as directed by study protocol. The maximum number of students, staff and faculty at any given time could be as high as 30 to 35.

Spring: April to June:

Teaching activities primarily consist of demonstrations of winery process equipment using bulk wines produced during fall quarter. Research activities involve processing the wine to bottle as directed by study protocol. The maximum number of students, staff and faculty at any given time could be as high as 30 to 35.

Fruit Volume

Currently 50 tons of fruit are processed annually by the department for teaching and research but only about half is currently processed in the Davis campus winery. It is anticipated that the new facility will process 60 tons of red and 60 tons of white annually when opened, increasing to 100 tons of red and 100 tons of white with the future expansion.

A maximum of 15 tons of fruit would be processed in a single day. The fruit could be all red, all white or a combination. With future expansion, this would be increased to 30 tons maximum per day.

Some of this fruit is harvested and placed in long term storage off-site to be used during classes that begin October 1st. Approximately 20 tons of fruit is made into library wines that are used for teaching. Approximately 10 o 15 tons of fruit may be processed for research.

Fruit Delivery

The fruit will arrive on 20 foot long trailers and 6 ton flatbed trucks. Currently the facility receives a maximum of 6 to 8 tons of fruit per day. That volume will expand to a maximum of 14 to 15 tons per day, arriving in 1/2-ton, 24-A-S MacroBins or 1/4-ton, 16-FV MacroBins. In addition, a maximum of forty 30 lb. containers will arrive stacked in the 1/2-ton MacroBins. On the average, 50% will be white and 50% will be Red, but in a single day, all of the fruit coming in could be either red or white.

Approximately 500 gallons of juice could be delivered during harvest as well. It would be stored in a tank in the winery.

The Winery Service Yard must also be able to accommodate a 60 foot long semi tractor trailer rigs, about 6 times a year. No loading dock is necessary. No provision for the delivery or storage of inert gasses is necessary. The yard must accommodate bin washing under a covered area on a concrete slab sloped to a process waste drain. Bins will be stored off-site.

There should be a fenced site in the winery yard for the disposal of approximately 6 yards of organic solid waste per day from harvest and fermentation. There will be two 3-yard drop boxes for pomace waste on a sloped concrete slab with a process waste drain below it, in addition to dumpsters for normal waste disposal. The solid waste will be removed every day.

Fruit Cooling

A Fruit Cellar capable of cooling 16 tons of fruit from 85 degrees F to 50 degrees F within twelve hours is required. It should be accessible from opposite sides so that small lots can be placed in and removed with ease, and located so that fruit can flow through from the harvest yard to the fermentation room. The bins will be stacked two high and two deep with adequate area around the bins to allow for air circulation.

Sorting & De-stemming

For red wine, the sorting/destem line will consist of a bin dumper, a sorting table allowing four to six people to sort, a destemmer and then a conveyor to the top of the fermentation tanks. The red teaching wine sorting/destem line will move from fermenter to fermenter. The red research wine line will be stationary and the research fermenter will be brought to the line.

For white wine, the fruit will move to the bin dumper to the sorting line to the destemmer and then conveyed to the press. The juice will be pumped from the press into the fermentation tanks. For white wine, the line will be stationary. The sorting/destem line will typically be located in the fermentation area, but this function should be able to be accommodated in the covered area of the yard.

Fermentation

There will be fourteen 2,000 liter stainless steel tanks arranged along either side of a central catwalk. Twelve of the tanks will be closed top; 2 will be open top. The open top fermenters will have a height:diameter ratio on the order of 1:1. The catwalk should be mounted 42" below the tops of the tanks. These tanks will be approximately 14 feet high with the legs. The tank door height must be adequate to place a ½ ton MacroBin under the tank to facilitate pomace removal. The tanks must be bolted to the floor for resistance to seismic loading but should be detachable.

There will be approximately one hundred and fifty 55-gallon research fermenters. They will be mounted in pairs on 3 foot by 5 foot pallets and stand about 4 feet high. Each will hold about 45 gallons of pomace/juice or 30 gallons of wine.

All fermentation tanks will be jacketed and insulated. The tall teaching tanks will have two jackets for heating and cooling, plumbed together to act as one jacket. It is important that all of the research fermenters be equal in performance and capable of being monitored.

The data from the fermenters will be transferred to the managing winemaker's lab. Pumpovers will be accomplished with the use of a side of tank mounted pump or manual pumpovers. If adopted, the punch downs on the open top tanks will be carried out using a pneumatically controlled device yet to be designed but based upon examples currently in use by industry. The framework would be free standing and bolted to the floor.

The tanks will have 2 to 3 fermentations each harvest. The closed top tanks can be used for bulk storage and blending when not in use for fermentation..White wines will be fermented in barrels in addition to the stainless steel fermenters.

The Fermentation Room will be a large, flexible, open high-bay space of 6,000 square feet. Dust control, CO2 control and minimum ventilation rates are required but precise temperature and humidity control is not required. Floors must be sloped to trench drains without any ponding. Wall and floor finishes will be subject to frequent washdown and must withstand

impact from forklifts and equipment. Doors shall insulated and of sufficient width and height for forklift traffic.

CO2 Recovery from the Fermentation Room

Federal/OSHA industrial standards for CO2 allow up to 5,000 ppm average over 8 hours and a peak of not more than 30,000 ppm over 15 minutes. Sensors and fans are required to remove CO2 from the Winery Fermentation Room and the Winery Cellars to maintain CO2 levels below the code limit. Fans and warning lights should automatically be activated if CO2 levels rise above code limits.

Closed top fermenters will typically be used and the CO2 that is generated will be piped off and captured. CO2 recovery from the closed fermenters can be carried out by ducting the breather vent to the CO2 recovery/venting system. CO2 will be recovered by running through a CaOH scrubber. The CaOH is evaporated in the sun.

Cleaning

Fermenters will be cleaned using a clean in place system to reduce usage of water, energy and chemicals. The system will require a separate room adjacent to the fermentation room for the storage of equipment and chemicals. Piping distance to the fermentation room should be minimized to reduce installation cost and pumping energy.

Press

Presses will be mobile and may be used both inside the Fermentation Room and outside in the Winery Receiving Area. Reearch fermenters will be dumped directly into the press by forklift. Must from the teaching fermenter will be moved into MacroBins and dumped by forklift into the press.

Settling

The current compliment of tanks can be used for settling as winery operations allow. In the future, development of a solid removal system is desired. The system would be in-line and carried out during transfer of juice to the fermenter from the press.

Barrel Aging and Barrel Fermentation

Three Winery Cellars provide flexible space for barrel aging, barrel fermentation, bottling and other research and teaching activities. Standard 225 to 240 liter barrels of all different shapes will be used. The cellars will be designed to accommodate up to 24 barrels without stacking, although two high stacking may occur in the future. The cellars do not need to be publicly visible but must connect directly to the Fermentation Room. The cellars will be used 9 months of the year for barrel storage and used at other times for other procedures including bottling.

The Long Term Barrel Storage Room provides space for the storage of up to 40 barrels, 1 high on Western Square racks. This room should be publicly visible and will be used 12 months of the year.

All cellars shall be designed as analytical laboratories that are sanitary, well lit and precisely controlled for a variety of temperature and humidity protocols. No wood or unprotected steel will be allowed in the construction. The structure would ideally be massive and well insulated in order to encourage stable climatic conditions. Each cellar must have smooth walls and enough air movement to prevent mold growth. The cellars should be grouped for efficiency of construction and climate control.

CO2 control and recovery is required for both white and red wines. White wine generates 60 liters of CO2 for each liter of wine going through primary fermentation over a six week period. Red wine generates 5 liters of CO2 for each liter of wine going through malo-latic fermentation. Negligible CO2 should be generated in the long-term barrel cellar.

The barrels will be cleaned two at a time on a barrel cleaner in the adjacent Fermentation Room using water heated to 100 degrees F, with the ability to add treatment chemicals if needed.

Blending and Bottling

Blending and storage can be achieved within the fermentation tanks.

About 500 cases were bottled last year and it is projected that 2,000 cases will be bottled in the future facility. Bottling will be done in the Fermentation Room or one of the cellars. Bottling will be done with a portable mono block. The bottles are then taken to the Research Bottle Storage room.

Long-term Research Bottle Aging

There are currently 30,000 bottles or 2,500 cases of research wines in storage in the existing winery but it is not anticipated that many, if any, will be relocated to the new facility. The new facility will provide about 1,000 square feet for the storage of future individual bottles, cases and other containers of varying sizes. Storage will initially occur on adjustable height metal shelving fixed in place on the perimeter walls. It is anticipated that high density mobile shelving units will be installed in the center of the space in the future as storage demands grow. Precise and reliable control of temperature and humidity is essential. No wood, paper, cardboard or other organics will be permitted in this room.

Special Collections Bottle Storage

A tax-paid Special Collections Bottle Storage room is required to house a small collection of donated wine and special collections. Precise and reliable control of temperature and humidity is

essential. There will be occasional small group tastings and the room should be accessible and viewable by the public. Finishes and lighting in this room should reflect its special character.

Sustainability

The goal of the project is to incorporate, to the maximum extent possible within budget constraints, a variety of innovative sustainability measures specifically relevant to the unique environmental challenges and opportunities in the California wine industry.

The new winery is to be designed to lead by example, to demonstrate and teach students current sustainable practices, to inform the public and industry and to provide a flexible platform for research and future innovation in this area.

Systems and utilities should be designed so that energy and water use can be measured, monitored and displayed at the process level. Extensive signage, exhibits and live information displays are a critical element in successfully using the facility as a platform to teach and inform.

In addition, the project is to achieve a LEED Silver rating as a minimum within the scope of the base bid and a LEED Platinum rating within the scope of an alternate bid.

The Sustainability section of this program describes potential sustainable design features in more detail.

Future Winery Expansion Requirements

It is anticipated that the winery will be expanded in the future by at least 12,000 gross square feet. The site plan and the floor plan of the initial phase must provide sufficient space in logical locations to accommodate the following functions as a minimum:

- 4,000 gsf for additional fermentation room area
- 1,000 gsf for two additional cellars
- 500 gsf for three additional offices
- 1,000 gsf for additional research bottle storage
- 4,000 gsf for two new teaching labs and support space
- 1,500 gsf for a new distillery

Appendix G:
Basis of Design

Appendix G1:
Mechanical Narrative

MECHANICAL BASIS OF DESIGN

Design Criteria

1. Site Information

Location:	Davis, California
Latitude:	38.5° N
Elevation:	50 feet (approx)

2. Outdoor Design Parameters

Summer Dry Bulb:	103°F (ASHRAE 0.1 percent)
Summer Wet Bulb:	72°F (ASHRAE 0.1 percent)
Winter Dry Bulb:	30°F

3. Indoor Design Parameters

Room	Occupied Temp. Range (°F)	Non-occupied Temp. Range (°F)
Brewery	62 to 82	50 to 90
Brewery Dry Storage	64 to 82	64 to 82
Brewery Glycol & CIP Equipment Room	Uncontrolled	Uncontrolled
Brewery Milling Room	64 to 82	64 to 82
Offices	68 to 76	50 to 90
Food Processing Dry Storage	64 to 82	64 to 82
Food Processing Equipment Storage	Uncontrolled	Uncontrolled
Food Science Lab	70 to 74	70 to 74
Classrooms	68 to 76	50 to 90
General Food Processing	62 to 82	50 to 90
Milk Processing Lab	62 to 82	62 to 82
Winery Lab	70 to 74	70 to 74
Winery Clean-In-Place	62 to 82	62 to 82
Winery Data Room	68 to 76	68 to 76
Winery Equipment Storage	Uncontrolled	Uncontrolled
Winery Fermentation Room	62 to 82	50 to 90
Winery Fruit Cellar	25 to 90	25 to 90
Winery Long Term Barrel Storage	50 to 90	50 to 90
Winery Research Bottle Storage	57 to 59	57 to 59
Winery Special Collection Cellar	57 to 59	57 to 59
Corridors	62 to 82	50 to 90

Electrical Room	Uncontrolled	Uncontrolled
Mechanical Room	30 to 95	30 to 95
Telecom/Data Room	68 to 76	68 to 76

4. Ventilation Rates: To achieve LEED credit EQ-2 rates shall exceed ASHRAE 62.1-2004 minimums by 30%. All normally occupied rooms shall have CO2 sensors installed to insure ventilation levels are acceptable.

Classrooms:	20 CFM per person
Fermentation Hall:	25 CFM per person
Winery Equipment:	0.15 CFM/SF
Winery CIP:	0.15 CFM/SF
Labs:	25 CFM per person
Brewery:	10 AC/HR
Brewery CIP/Glycol	0.15 CFM/SF
Offices:	20 CFM per person
Milk Processing:	25 CFM per person

Systems Overview

The mechanical systems for the Brewery, Winery, and Food Pilot Facilities (BWF) consist of many types of systems to condition the environment and process loads within this building. The following is a description of each system:

Air Handling Unit

A single air handling unit will be located outdoors near the mechanical room. This will provide conditioning to a majority of the occupied spaces within the building. The air handler will run continuously. During non-occupied periods, the air handler will ramp down in airflow to only provide conditioned air to the labs. The air handler will consist of:

- Double wall construction for outdoor use.
- Supply and return fans with variable frequency drives, with bypasses.
- Chilled water and hot water coils.
- Full economizer section with low leakage outside, return and exhaust dampers.
- Heat recovery for minimum outside air.
- Airflow station on minimum outside air section.
- 65% filters, upstream of coils.
- Supply air reset.

Exhaust Systems

A variety of exhaust/transfer fans will be utilized to provide room exhaust or to indirectly ventilate the room. Fractional horsepower fans shall utilize ECM motors for energy efficiency. The following is a summary:

- HEF-1: Hood exhaust fan shall operate continuously to ventilate the lab hoods and general exhaust in the Winery Lab and Food Science Lab.
- CEF-1: Ceiling exhaust fan shall operate continuously to ventilate the Janitors Room.
- REF-1: Roof exhaust fan shall operate per the building schedule to exhaust the Restrooms.

- EF-1: Inline exhaust fan shall operate for night purge within the Brewery. The fan shall automatically operate to cool the brewery during the non-occupied hours when temperatures outside are lower than within the space. During fan operation, motorized louvers on the wall shall open to supply the room with filtered outside air.
- EF-2: Inline exhaust fan shall operate for night purge within the Winery. The fan shall automatically operate to cool the brewery during the non-occupied hours when temperatures outside are lower than within the space. In addition, this fan shall start when excess CO2 levels are detected within the Winery Fermentation Room. During fan operation, motorized louvers on the wall shall open to supply the room with filtered outside air.
- EF-3: Inline exhaust fan shall indirectly ventilate the Winery Equipment Room during occupied times. An occupancy sensor shall automatically start the fan for a given amount of time when occupancy is detected within the room. In addition, this fan shall start when excess levels of CO2 are detected within the Winery Fruit Cellar. A motorized damper in the exhaust (between fan and Winery Fruit Cellar) shall open to all the room to be exhausted.
- EF-4: Inline exhaust fan shall indirectly ventilate the Winery CIP Room during occupied times. An occupancy sensor shall automatically start the fan for a given amount of time when occupancy is detected within the room.
- EF-5: Inline exhaust fan shall ventilate the Cellars when excess CO2 levels are detected within any of the rooms.
- EF-6: Inline exhaust fan shall operate per the building schedule to ventilate the Brewery Dry Storage, Food Dry Storage and Brewery Mill.
- EF-7: Inline exhaust fan shall indirectly ventilate the Winery CIP Room during occupied times. An occupancy sensor shall automatically start the fan for a given amount of time when occupancy is detected within the room.

Variable Air Volume (VAV) Boxes

With the exception of the Milk Processing Room, each normally occupied room within the building shall be provided with a VAV terminal box to provide conditioned air. Most boxes will be provided with reheat coils. However, the Tel/Data Room and Mechanical Room will be cooling only.

VAV boxes shall modulate as required during programmed occupied hours to provide desired room setpoints. During non-occupied hours, the boxes shall close. The Food Science Lab and the Winery Lab shall maintain constant airflow to provide makeup for the lab hoods.

Air Distribution Systems

All supply, return and exhaust distribution will be ducted. Supply and return ductwork shall be externally insulated sheet metal duct, with the exception of outdoor ductwork which shall be internally lined. Pre-insulated flexible ducts will be used for connection to supply, return and exhaust air outlets (maximum 10' length) where concealed above ceilings. Manual volume dampers will be provided at each branch to provide individual grille balancing.

Steam Systems

High pressure steam will be supplied from the campus central plant. Connections will be made at the vault near the new building. The steam line and condensate return line shall be routed to the following:

- Food Processing Rooms – To provide 110 psi steam to the Food Pilot Department.
- Winery CIP – To provide 110 psi steam to the future winery CIP equipment.
- Mechanical Room Pressure Reducing Station – To provide 25 psi steam to feed the heating hot water heat exchanger and the domestic steam-to-hot water heat exchanger.
- Mechanical Room Clean Steam Station – To provide 100 psi culinary steam to the Food Pilot Department.

Hydronic Cooling

Chilled water will be supplied from the campus central plant. Connections will be made to the mains running near the new building. Chilled water will be distributed through insulated piping to the cooling coils of the air handling unit. Two pumps with VFD's (no bypass) shall be provided and each pump shall be sized for 60% of the total chilled water flow. A 2-way valve at the end of the run will be provided to insure flow with one pump operating at minimum speed.

Process Cooling

The same chilled water pumps that provide hydronic cooling also provide process cooling for the winery fermentation tanks and the Milk Processing Room.

Hydronic Heating

Hydronic heating is accomplished from the steam to hot water heat exchanger. Hot water will be distributed to the VAV boxes for terminal heat. Two pumps with VFD's (no bypass) shall be provided and each pump shall be sized for 60% of the total hot water flow.

Process Heating

Two secondary hot water pumps shall provide tempered water to the heat exchangers within the fermentation tanks. Two pumps with VFD's (no bypass) shall be provided and each pump shall be sized for 60% of the total hot water flow. A 2-way valve at the end of the run will be provided to insure flow with one pump operating at minimum speed.

Condenser Water System

A closed loop fluid cooler provides condenser water to multiple units within the building. The fluid cooler will operate continuously to serve the process coolers. Two pumps will be sized for 100 percent capacity, with each pump alternating as the backup. Condenser water temperature will be controlled by modulating the fan speed on the cooling tower. The VFD will be provided with a bypass. A two position 3-way valve will bypass water around the fluid cooler when required during low ambient temperatures.

Winery Cellar Units and Fruit Cellar AC Units

Water cooled refrigeration units will be provided to condition the manufactured cold box units. Condenser water will be provided from the fluid cooler system. Steam humidification will be provided in these rooms.

Winery Bottle Storage AC Units

Water cooled air conditioning units will be provided to condition the temperature controlled bottle storage units. Condenser water will be provided from the fluid cooler system. These units will be provided with integral steam humidifiers to maintain room humidity levels.

Winery Barrel Storage

Water cooled air conditioning units will be provided to condition these temperature controlled storage units. Condenser water will be provided from the fluid cooler system. External electric humidifiers with duct dispersion tubes will be provided to maintain room humidity levels.

Milk Processing Heat Pump

The milk processing room shall be provided with water source heat pump for conditioning. Condenser water will be provided from the fluid cooler system. An inline HEPA filter will be provided to meet the program requirements.

Domestic Water Supply

Domestic cold water will be connected to the campus domestic system outside the building. Water will be distributed to all potable plumbing fixtures.

Domestic hot water will be generated with the steam-to-hot water converter located in the Mechanical Room. 120ºF hot water will be distributed to locations where required in the facility. Hot water stops on public lavatory faucets will be set to limit the water to 105ºF maximum temperature. A circulation pump will be provided to maintain continuous hot water throughout the facility. The circulation pump will be on a programmable timer to save energy during non-occupied hours.

Domestic Waste Systems

Sanitary waste, vent and drain systems will be provided as required in the facility. Sanitary waste from the Food Processing Area's will be connected directly to the site sanitary system at the northern point of the building. Sanitary waste from the Brewery and Winery will be routed and join together outside the building near the utility area. The lines will then be directed to the north of the building to connect into the site sanitary system. A provision will be provided for the facility to install a future water processing system in the utility yard.

Storm Water System

Storm water from the building and site will be routed to the site collection basin. A pumping system within the basin will pump the water into storage tanks that will be used for landscape irrigation and for flushing water closets and urinals.

Appendix G2:
Electrical Basis of Design

University of California at Davis Brewery, Winery and Food Pilot Facility

DAVIS, CALIFORNIA

Electrical Basis of Design

100% Construction Documents
August 31, 2009

APPLICABLE CODES AND GUIDELINES

The latest edition of approved year of the following codes and combination codes and guidelines will govern the Electrical Systems and associated support system design. The systems will be designed to meet or exceed these standards.

ADA: American's with Disabilities Act Accessibility Guidelines
ANSI: American National Standards Institute
IEEE: Institute of Electrical and Electronics Engineers
IES: Illuminating Engineering Society of North America
CCR: California Codes of Regulations
CEC: California Electrical Code
CFC: California Fire Code
NECA: National Electrical Contractors Association
NEMA: National Electrical Manufacturers Association
NESC: National Electrical Safety Code
NFPA: National Fire Protection Association
SFM: State and Local Fire Marshal
CBC/OSHA: California Building Code/Occupational Safety Hazard Authority
UL: Underwriters Laboratories, Inc.

PRINCIPAL ITEMS TO BE INCLUDED

New Work: A new electrical service and distribution system will be provided to serve the UC Davis Brewery, Winery and Food Pilot Plant Building. This new building will be a single story and approximately 32,000 square feet (sq ft.). Systems to include 12kV primary to Pad Mounted Transformer for 480/277V secondary power distribution and 120/208V Power Distribution, Feeders, Lighting, Lighting Control, Branch Power, HVAC and Equipment Connections, Voice/Data, Grounding, Fire Alarm, and Security.

Existing Conditions: New facility to be co-located with the Robert Mondovi Institute for Wine and Food Science in the South Entry district of the UC Davis campus.

ELECTRICAL SYSTEM DESIGN CRITERIA

Project Location: Davis California

- Occupancy Classification: CBC Mixed
- Construction Type: 5 Non-Rated
- Seismic design and Anchorage of electrical components shall be in accordance with ASCE 7-05 "minimum Design Loads for Buildings and Other Structure".

LOAD CALCULATION

Service Calculations

- Normal Power:
  The service is sized to serve the building (with 25% spare capacity) and exterior and not future expansion.
  1. Interior: Estimated 45 VA/sq ft. x 32,000 sq ft. = 1,440 kVA
  2. Exterior: Estimated at 10kVA
- Design Loads: Overall Connected Volt-Amperes (VA) per Square Foot

  Office Areas:
  Lighting – 1.1
  Receptacle – 5.0

  Classrooms:
  Lighting – 1.5
  Receptacle – 3.0

  Laboratories:
  Lighting – 1.5
  Receptacle – 10
  Equipment – 20

  Voice/Data Spaces:
  Lighting – 2.5
  Receptacle – 50

  Storage:
  Lighting – 0.5

  Corridors:
  Lighting – 0.8
  Receptacle – 0.5

  Mechanical Areas:
  Lighting – 1.5
  Receptacle – Actual Motor H.P.

  Winery Fermentation Hall:
  Lighting – 1.5
  Receptacle – 2.5
  Equipment – Actual Motor H.P.

  Research Bottle:
  Lighting – 1.5
  Receptacle – 0.5
  Equipment – Actual Motor H.P.

Cellars:
Lighting – 0.5
Receptacle – 0.5
Equipment – Actual Motor H.P.

Long Term Barrel:
Lighting – 0.5
Receptacle – 0.5
Equipment – Actual Motor H.P.

Equipment:
Lighting – 1.5
Receptacle – 2.5
Equipment – Actual Motor H.P.

Brewery:
Lighting – 1.5
Receptacle – 2.5
Equipment – Actual Motor H.P.

Mill:
Lighting – 1.5
Receptacle – 2.5
Equipment – Actual Motor H.P.

Gly/CIP:
Lighting – 1.5
Receptacle – 2.5
Equipment – Actual Motor H.P.

General Food Processing:
Lighting – 1.2
Receptacle – 10
Equipment – Actual Motor H.P.

Dairy:
Lighting – 1.2
Receptacle – 10
Equipment – Actual Motor H.P.

Coolers:
Lighting – 1.0
Receptacle – 0.5
Equipment – Actual Motor H.P.

EQUIPMENT SIZING

Branch Circuit Load Calculations:
- Lighting – Actual installed wattage
- Receptacles – 180VA per outlet
- Surface wireway – 180VA per foot
- Special Outlets/Fixed equipment – Actual installed wattage of equipment served
- Motors – 125% of motor wattage

Demand Factors:
- Lighting – 125% of total wattage
- Receptacles – 100% of first 10kVA plus 50% of balance
- Motors – 125% of wattage of largest motor plus 100% wattage of all other motors
- Fixed equipment – 100% of total wattage

Bus Sizes/ Minimum Feeder sizes:
- 480/277V Normal Lighting Panels – 100A Bussing with feeders sized to match bussing.
- 480/277V Normal Equipment Panels – 225A to 600A with feeders sized to match bussing.
- 208/120V Normal Equipment Panels – 225A Bussing with feeders sized to match bussing.

Dry Type Transformers:
- Maximum allowable size is 300kVA

Spare Capacity:
- Feeders, transformers and switchgear shall be sized for a minimum of 25% future capacity available at completion of construction documents. 20% spaces will be provided at each distribution board and panelboard for flexibility.

GENERAL HORIZONTAL ILLUMINATION LEVELS

Exterior Lighting:

Entry: 5 – 10fc
Parking: 0.5 – 1fc
Walkways: 1 – 3fc
Exterior Yard: 0.5 – 1fc

Interior Lighting:

Office Areas: 30fc
Classrooms: 50fc
Laboratories: 60fc
Voice/Data Spaces: 30fc
Storage Areas: 30fc
Corridors: 10fc
Mechanical Areas: 30fc
Winery Fermentation Hall: 40fc
Research Bottle: 30fc
Cellars: 30fc
Long Term Barrel: 30fc

Equipment Spaces: 30fc
Brewery: 50fc
Mill: 30fc
Gly/CIP: 30fc
General Food Processing: 50fc
Dairy: 50fc
Coolers: 30fc

GREEN BUILDING DESIGN

Integrated Facility Distribution Switchgear:
- Integrates the distribution switchboard, the dry-type distribution transformers and panelboards into a single, factory pre-wired system.
- This space-saving switchboard structure typically requires 40% less electrical room resulting in more room for tenants or less site disturbance.
- This also creates a reduction in use of materials such as copper and steel to manufacture the gear.

Dry Type Transformers:
- Low voltage step down, dry type transformers will be specified as energy efficient NEMA TP-1 to provide additional energy savings.

Electrical Wire and Cable:
- Shall be 100% lead free insulated

Light Pollution Reduction:
- Minimize light trespass from the building and site
- Improve nighttime visibility through glare reduction.
- Reduce development impact in nocturnal environment.

Optimize Energy Performance:
- Establish the minimum level of energy efficiency for the proposed lighting per ASHRAE/IESNA Standard 90.1-2004
- Achieve increasing levels of energy performance above the baseline established per ASHRAE/IESNA Standard 90.1-2004

Lighting System Controls:
- Integrate lighting systems controllability into the overall lighting design, providing ambient and task lighting while managing the overall energy use of the building.
- Provide individual lighting controls for a minimum of 90% of the building occupants to enable adjustments to suit individual task needs and preferences
- Provide dimming or multi-level switching for all spaces larger than 100 square feet in which the connected lighting load exceeds 0.8 watts per square foot.
- Provide photosensor switched lighting controls for daylit spaces.

NORMAL POWER SERVICE AND DISTRIBUTION SYSTEM

The new Brewery, Winery and Food Pilot Facility will be served via new UC Davis service, the point of connection will be as determined by the UC Davis campus. The primary conduits/feeders will be routed below grade to the new UC Davis 1,500kVA pad mounted transformer as located on the plans. Secondary feeders will be extended underground to an Underground Pull Section (UGPS) which will be located in the main electric room at the ground floor main electric room. The service to the building will be 2,500Amps at 480/277 Volts.

The UGPS will connect directly to a 2,500A main distribution switchboard which in turn will feed the normal power distribution throughout the building.

- A dedicated lighting panel and lighting control panel for the entire building will reside in the main electric room.
- A dedicated integrated distribution switchgear package combining 480/277V and 208/120V distribution switchboards, panelboards and transformer, for all major Mechanical loads shall reside in the Main Electrical room.
- A dedicated integrated distribution switchgear package combining 480/277V and 208/120V distribution switchboards, panelboards and transformer, for all Brewery loads shall reside in the Main Electrical room.
- A dedicated integrated distribution switchgear package combining 480/277V and 208/120V distribution switchboards, panelboards and transformer, for all General Foods/Milk Processing loads shall reside in the Main Electrical room.
- A dedicated integrated distribution switchgear package combining 480/277V and 208/120V distribution switchboards, panelboards and transformer, for all Winery loads shall reside in the Main Electrical room.

Building electrical equipment will distribute power to loads as follows:

1. 480V, 3Ø, 3 Wire – Motors 1/2HP and larger
2. 480/277V, 3Ø, 4 Wire – HID and fluorescent lighting and large specialty equipment.
3. 208/120V, 3Ø, 4 Wire – Receptacles, specialized lights, motors under 1/2HP and small equipment.

480/277V, 3Ø, 4 Wire power will be distributed at main electric room to feed the lighting loads, Mechanical, Brewery, Foods and Winery distribution panels. Feeders from distribution boards in main electrical room at 208/120V will be extended throughout the building to feed respective panelboards.

1. 208/120V branch circuit panels will be located to minimize branch circuit length. Branch panelboards will be located in equipment rooms, close to areas they will serve.

NORMAL POWER DISTRIBUTION EQUIPMENT

Switchboards:
All switchgear bussing shall be copper. Utility metering will be provided on the main service from UC Davis. All circuit breakers will be suitable for group mounting, breakers 400A and larger shall be solid state. All switchgear shall conform to the UC Davis Campus Standards and Design Guide and Electrical Specifications – Division 26.

Distribution' Panelboards:
Distribution panelboards will be dead front, totally enclosed in NEMA I enclosure. Main circuit breaker will be equipped with solid state, true RMS reading trip unit. Feeder circuit breakers will be group mounted front accessible bolt-on thermal-magnetic molded case type with adjustable magnetic trip settings. All switchgear shall conform to the UC Davis Campus Standards and Design Guide and Electrical Specifications – Division 26.

Lighting and Receptacle Panelboards:

- Minimum interrupting capacity will be 10,000 amps for 120Y1208Y and 14,000 amps for 277Y/480Y.
- Panelboards will be factory assembled and bear the UL label.
- All panelboards will have 42 poles per section, except where shown to be less. All unused poles will have spare 20A circuit breakers factory installed.
- Main circuit breakers will be provided in panelboards where panels are not in the same room 'as serving, distribution board. Copper bussing will be provided in all panelboards. No aluminum will be allowed.
- Circuit Breakers will be Molded case quick-make, quick-break, with thermal magnetic trip, bolt-on type.

All switchgear shall conform to the UC Davis Campus Standards and Design Guide and Electrical Specifications – Division 26.

Transformers:

- Air-cooled, 3-coil. 2 winding type, with minimum of four 2 ½% taps above and two 2 ½% taps below rated voltage. 115°C temperature rise above 40°C ambient shall apply to transformers from 25 kVA to 112.5 kVA and shall be capable of carrying a 15% continuous overload without exceeding a 150°C rise in the same ambient. 80°C temperature rise above 40°C ambient shall apply to transformers above 112.5 kVA and shall be capable of a 30% continuous overload without exceeding a 150°C rise in the same ambient. All winding material shall be copper.
- Sound levels shall not exceed:
    1. 45 dB for 25-50 kVA transformers
    2. 50 dB for 51-150 kVA transformers
    3. 55 dB for 151-300 kVA transformers

All switchgear shall conform to the UC Davis Campus Standards and Design Guide and Electrical Specifications – Division 26.

ELECTRICAL DEVICES

Enclosed Rooms/Offices:
Enclosed offices will be provided with receptacle and voice/data outlets per the UC Davis BWF Pilot Facility Program Requirements.

Specialty Areas (Brewery, Winery and Food Process):
Receptacle requirements will be based on final equipment layout and the UC Davis BWF Pilot Facility Program Requirements.

Corridors:
Provide one dedicated 20A, 120V duplex receptacle every 50'-0" on center minimum (a maximum of 4 per circuit).Maximum distance from any end wall shall be 25’-0”.

Building Support (Equipment Rooms, Storage):
One 120V, 20A duplex receptacle for every 50 lineal feet of perimeter wall and as needed so every piece of mechanical equipment is within 25 feet of an outlet as required by the CEC and per the UC Davis BWF Pilot Facility Program Requirements.

Lighting Systems:
- A complete lighting system for all indoor and site illumination will be provided. The indoor lighting system will consist of a combination of energy efficient fluorescent and high intensity discharge (HID) fixtures. The outdoor lighting system will consist of energy efficient fluorescent and high intensity discharge (HID) fixtures. Site lighting fixtures will be specified to match existing facility standards.
- In general, indoor lighting controls will consist of low voltage switches controlled by lighting control system and room occupancy sensors. Outdoor lighting controls will utilize relays controlled by photocells.
- Emergency/night lighting will be provided by unswitched branch circuits. These un-switched branch circuits will be fed from the normal lighting panel. Fixtures will be provided with emergency battery ballast.
- The use of incandescent fixtures will be kept to a minimum.
- All lighting fixtures, controls and their installation shall conform with the UC Davis Campus Standards and Design Guide, Electrical – Division 26.

Lamps and Ballasts:
- For energy savings, combination T8 lamp(s) and ballasts will be Sylvania Quicksystems XPS T8 lamps and Quicktronic Prostart PSX ballasts or equal.
- Fluorescent lamps will be either T5 or T8, 3500 degrees Kelvin color temperature, with a color rendering index (CRI) of 85 or greater.
- Ballasts will be electronic type, with total harmonic distortion less than 10%.

Lighting Control:
- All lighting will be controlled to meet or exceed the requirements of the local Authority Having Jurisdiction.
- Occupancy sensors will be provided in offices, storage rooms, janitor closets, break rooms, clean, utility -rooms, equipment room's and restrooms. Occupancy sensors will be of the passive infrared or combination infrared/ultrasonic type.
- AII corridor lighting, except emergency egress lighting shall be controlled by an automatic lighting sensor and relay control panel.

GROUNDING SYSTEM

The reference ground for the equipment grounding system will be established from a structural ground grid as follows:
- A UFER ground will be provided in the footing of the building consisting of 50' of No. 3/0AWG wire located 3" from the bottom of the footing.
- Wall mounted copper ground bus will be located in the main electrical room. Ground bus will be connected to UFER ground.
    1. A No. 4/0 AWG bare copper grounding electrode conductor will be extended to all telecom rooms so that those systems can be properly bonded.
    2. All connections to grounding electrode system will be made utilizing exothermic welding method.
    3. A separate ground wire will be provided in all conduits.
- All grounding shall conform to the UC Davis Campus Standards and Design Guide and Electrical Specifications – Division 26.

FIRE ALARM SYSTEM

The system shall be comprised of a
manual and automatic system. The system manufacturer shall be per the UC Davis Campus Standards and Design Guide, Electrical – Division 28. The main fire alarm control panel will be located inside the electrical room on the ground floor. Main fire alarm control panel shall be interconnected to existing campus wide fire alarm system.

- Annunciation devices shall be provided in all applicable areas in accordance with NFPA72, CBC, CFC and ADA Guidelines.
- Smoke detectors shall be installed as required by NFPA72. CBC and CFC. Smoke detectors shall be installed in, but not limited to the following locations:
    1. Electrical equipment rooms
    2. Classrooms
    3. Storage rooms
    4. Corridors
    5. Public Spaces
- Smoke detectors will also be provided for operation of smoke/fire dampers, shut down of air conditioning equipment and protection of openings in fire-rated partitions.
- Heat detectors shall be installed in areas which are not feasible for smoke detectors; such as hazardous storage locations.
- Manual pull stations shall be dual action and installed at every point of egress. Install station a maximum of 5ft. from swing side of door at each exit door.
- Fire, sprinkler' system shall be monitored to include. but not limited to, sprinkler flow and tamper switches at all control valves, tamper switches at sprinkler backflow preventor and post indicator valve, if applicable.
- Door controlled systems shall interface with the fire alarm system. All controlled doors shall be released upon an activation of a fire alarm condition.
- Remote annunciator panel(s) shall be located and programmed to meet the requirements of the Authority Having Jurisdiction.

STUDIES TESTING AND COMMISSIONING

Studies:
The following studies shall be performed using digital computer programs made by SKM Systems Analysis, Inc. for the new and existing power systems at this facility.

- Short circuit study
- Overcurrent protective device coordination study

Acceptance Testing:
Items that shall be checked, inspected and tested include:

- Pad Mounted Transformer
- Metering and instrumentation
- Sets of current transformers
- Distribution switchgear
- Dry type transformers
- Distribution panelboards and power & lighting panelboards
- Circuit breakers and switches
- Cables
- Grounding system
- Lighting control systems

- Fire alarm system

Commissioning:
All major building systems will be commissioned. Commissioning will be the process of documenting the proper installation, operation and performance of each system to meet the operational needs of the building within the capabilities of the design and to meet the owner's functional criteria, including training of operator personnel. Electrical commissioning scope will also include Electrical manpower and expertise to support the commissioning of HVAC and Plumbing systems.

The following systems are to be commissioned:

1. Power Distribution System
2. Lighting Controls
3. Emergency Lighting Inverter System
4. Fire Alarm System
5. Security System

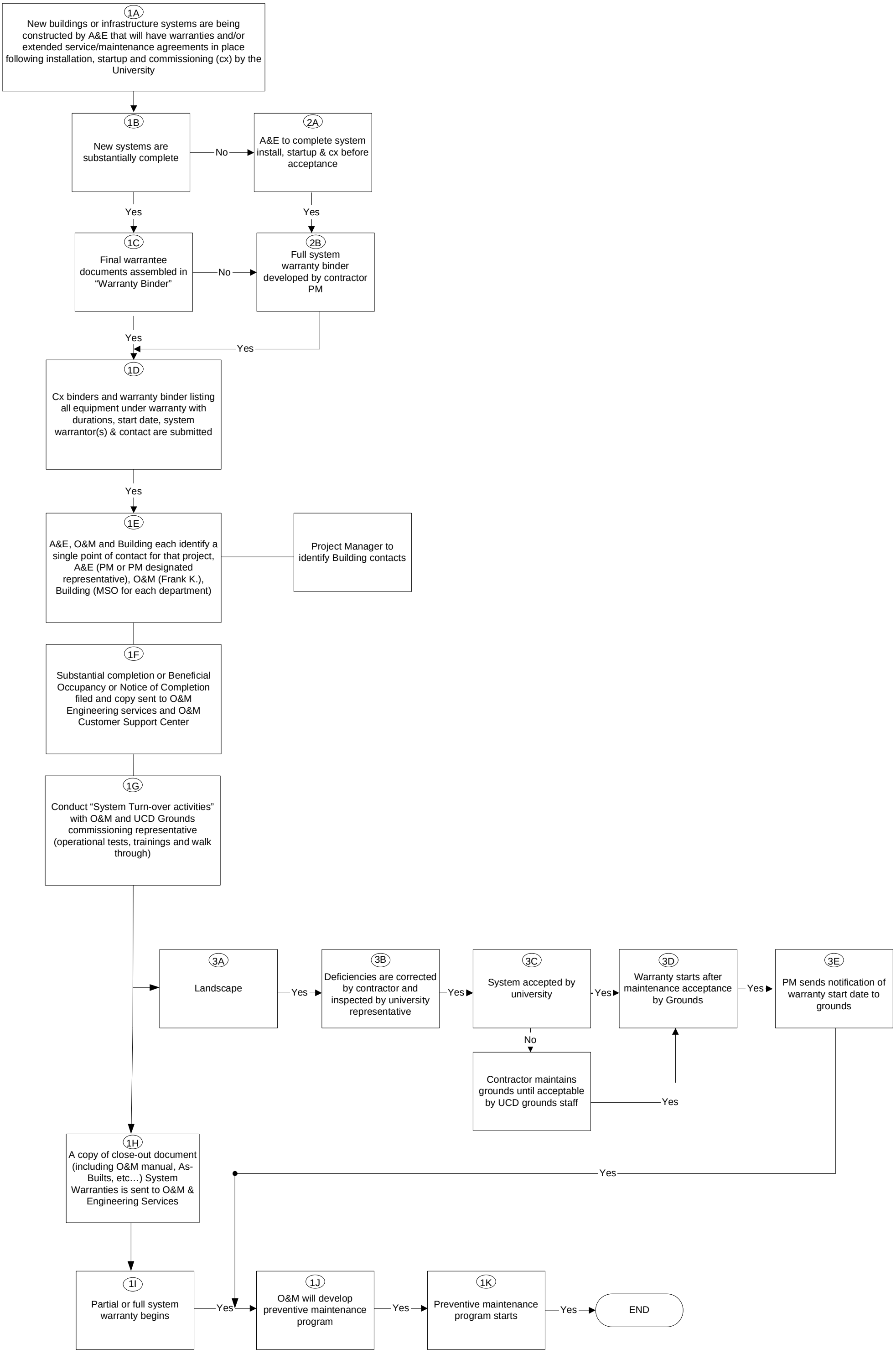
Appendix I:
Warranty Commissioning Flow Chart

Warranty Phase Cx Flowchart

	Initial	1 Month	6 Month	11 Month
Cx Authority	• Review pre-plan for reviewing building performance • Review trend reports in EMS • Develop bldg performance review to meet LEED EA Credit 3 • Prepare estimate for Facility Post-Completion Work Order • Review EMS Operation with EMO	• Set up initial Warranty Meeting • Warranty Scope discussed with Facilities • Set up Training for EMS sequence • Oversee issues resolution under Facilities Work Orders • Create Issues Log	• Monitor building conditions through EMS • Develop Building Occupant Survey • Determine possible Set-point adjustments based on EMS data & Building Occupant Survey • Request trends on points not already trended • Call for Project Walk-thru with Facilities	• Set up Meeting to review Bldg Performance & Operation • Oversee Building Review • Complete Summary of Findings per LEED EA Credit 3
PM / PC	• Initiate Work Order for Facilities & EMO involvement • Communicate the building review LEED EA Credit 3 to MSOs	• Finalize Work Order for Facilities • Finalize Work Order for EMO • Initiate Guarantee Defect Notices per Facilities findings • Attend Warranty Meetings (as needed)	• Conduct Building Occupant Surveys • Discuss issues and Building Occupant survey with MSOs	• Review Issues Log • Initiate issues resolution • Close Work Orders to Facilities and EMO
Facilities	• Review Warranties with Shops • Review Work Orders	• Discuss DCM's role in monitoring EMS/Building Performance with EMO. • Attend Training on EMS sequences for EMO • Attend Warranty Meetings	• Concurrently Monitor building conditions through EMS and notify CxA of "questionable bldg performance" • Adjust Set-points Per DCM • Set-up trends requested by DCM • Include Cx programming (monitoring and Cx only—no changes in control programs) • Attend Warranty Meetings as necessary	• Participate in building review
Deliverables	• Confirmation from Facilities that O&Ms and Warranty information was received • System Turnover Checklist • (Documentation) for LEED requirement of the 10-month review (or sooner) of building performance	• Work Order for Facilities • Work Order for EMO • 1st Warranty Meeting • Warranty Meeting Schedule	• Building Occupant Survey • Documented Set-point & Sequence Adjustments • Documented Trends	• Completed Review of Post Occupancy Survey findings • Confirmation of closed Work Orders and total spent

Appendix J:
Flow Chart for Issues Resolution with Facilities

Construction Phase



Warranty Phase

Customer Support Center receives call from campus department requiring maintenance and/or repair to a system. The appropriate shop or O&M single point of contact dispatched to investigate problem (not necessarily to fix)

Yes

Life safety issue or similar critical issues (research impact, property impact, etc...)

Yes → Maint. Tech. Remediate the problem (isolate or repair)

No

O&M Single Point Of Contact (SPOC) Responds to request

Yes

Maintenance Technician with O&M SPOC reviews the warranty binder and verifies problem is covered by warranty

No

Maintenance Tech implements repair. O&M SPOC notifies A&E the problem is corrected. A&E will inform involved parties & close the issue

End

Yes

Maint. Tech. Remediate the problem (isolate or repair)

1 Isolate

Yes

End

2a Repaired

Yes

2b O&M correct problem and discuss costs with A&E, A&E to bill/negotiate contractor for costs

Yes

2c A&E will inform involved parties & close the issue

Yes

End

Yes

4a O&M Identifies problem, should be corrected by contractor

Yes → 4b O&M SPOC contacts A&E PM (or PM designated representative) advising with the warranty issue

Yes

4c If necessary, A&E PM (or PM designated representative) meets O&M at site to review problem

Yes

4d A&E PM (or PM designated representative) & O&M agree the problem is covered under warranty

Yes → 6a A&E, O&M agree it is contractor responsibility

No → 5a Elevate to Supervisors (PM, Senior PM, etc…)

5b A&E, O&M agree it is their responsibility and maintenance issue

Yes

5c Maintenance Tech implements repair. O&M notifies A&E the problem is corrected. A&E will inform involved parties & close the issue

End

6b A&E notifies Contractor of the warranty problem and issues GDN (10 day to repair)

Yes

6c Contractor responds to warranty issue

Yes

7a If necessary O&M, A&E PM (or PM designated representative) & Contractor meet on site to investigate problem

Yes

7b Contractor corrects work

Yes

7c A&E will notify Building and O&M SPOC informing them with the correction and close the GDN

Yes

End

No → 8a A&E elevates warranty issue within Contractor's organization

No

8b A&E/O&M coordinate and implement all repairs

Yes

8c O&M notifies A&E the problem is corrected. A&E will inform involved parties & close the issue

Yes

8d O&M Discuss costs with A&E. A&E to bill & negotiate cost with contractor

Yes → End

3a O&M identifies the item is O&M maintenance issue or repair is minor and completed quickly with no cost to A&E

Yes → 3b O&M inform A&E that the problem is corrected. A&E will notify all parties

Yes → End

For recharge projects work order maybe required. O&M to contact PM
A&E= A&E SPOC
O&M= O&M SPOC

Appendix K:
Current Issues Log

UC Davis BWF Project

Updated: 8/16/10

Commissioning Issues List

= resolved item

Item #	System	Date Observed	Description	Room Name	Room Number	Resolution / Action Required	FPT Impact? (Y/N)	BN Sign-Off	UCD Sign-Off
1	Compressed Air	7/8/10	Missing Regulator in Lab	Winery Lab	1205	Installed	y	RB	MB
2	Compressed Air	7/8/10	Point of use Valve missing Label	Winery Eq Rm	1209				
3	Compressed Air	7/8/10	Regulator in Hallway outside FSL rm 1104 installed w/ Soft Solder	Corridor	1100	Acceptable at regulator to avoid damaging device per Matt B and Larry Wilson	y	RB	MB
4	Compressed Air	7/8/10	Rms 1102 and 1104 served with one regulator….should be 2 for independent pressure control	Corridor	1100	2nd regulator installed. Rooms now have independent control	y	RB	MB
5	Compressed Air	7/8/10	Room 1102 wall point of use Valves missing labels (including ceiling valves)	MPL	1102				
6	Compressed Air	7/8/10	Unable to test alarm; need further clarificaiton on how it works from vendor/fmb.	Mech	1130	Alarm only for overheating condition. Condition simulated by covering ventilation. Alarm confirmed at BAS during point to point testing.	y	RB	MB
7	Compressed Air	7/8/10	Receiver Auto Blowdown tubing is not supported and is likely to be damaged.	Mech	1130	Tube extended into Floor Sink. Acceptable per facilities during training.		RB	PH
8	Compressed Air	7/8/10	Receiver auto-blowdown tubing blows water all over when discharging.	Mech	1130	Tube extended into Floor Sink. Acceptable per facilities during training.		RB	PH
9	Compressed Air	7/8/10	Valves labels/colors unclear/incorrect	Mech	1130	FMB to install NIT turret caps to clarify type of gas.			
10	Vacuum System	7/8/10	Can't test Alarm, seems to only alarm on oil temp/oil level. A simulated blown fuse and low vacuum condition was performed and neither generated alarm.	Mech	1130	. Alarm is for Hot/Low Oil. FMB tripped alarm output and alarm was confirmed at BAS during Point to Point	y	RB	MB
11	Processed Water System	7/8/10	Piping interconnecting RO/DI tank and filter is blocking lift access to CHW pumps above	Mech	1130	Acceptable per Matt B since piping needs to be routed from Bottom of ROST		RB	
12	Processed Water System	7/8/10	DI valves interfere with operation of adjacent valves	all		Extend DI valves is possible solution			
13	Processed Water System	7/8/10	DI valves not adequately supported	all		Wall bracket or other solution			
14	Chilled Water System	7/8/10	Valves not insulated; will sweat.	all		Need continuous insulation/handle extensions			
15	Culinary Steam System	7/8/10	Carbon Steel fittings and nipples installed at point of use. Should be stainless to match piping.	all		Install stainless fittings/nipples. 8/6 update: (Non-issue per FMB, fittings not permanent.)	y		
16	Regenerative Blower	7/8/10	RB-1 Switch not installed			Installed	y	RB	MB
17	Regenerative Blower		FAILURE DOES NOT GENERATE A BAS ALARM. STATUS ONLY. SIEMENS TO SET UP ALARM	Mech	1130	BAS Alarm programed by Siemens to alarm if override switch flipped and fan status off.	y	RB	FH
18	Regenerative Blower		RELIEF VALVE NOT INSTALLED. EXCESSIVE PRESSURE	Mech	1130	Installed. Need to retest	y		
19	Steam/Hot Water System	8/9/10	Differential pressure setpoint used for HHW loop is a temporary "placeholder" that Siemens put in in order to operate and test the system. The actual required DP setpoint from the T&B sub needs to be used instead	gen					
20	Chilled Water System	8/11/10	The differential pressure setpoint used for the CHW loop is a temporary “placeholder” that Siemens put in in order to operate and test the system. The actual required DP setpoint from the balancing sub-contractor needs to be used instead.	gen					
21	Steam/Hot Water System	8/12/10	The steam-to-hot water heat exchanger cannot control at low load, (it overshoots). This may be caused by the steam valve being oversized or it may be something Siemens can solve with by re-tuning their PID loop.	Mech rm 2					
22	Air Handling System	8/13/10	We were not able to test the auto-bypass feature of the VFD's; need support from ABB.	Elecrical Mezzanine					

UC Davis BWF Project

Updated: **8/16/10**

Commissioning Issues List

= resolved item

Item #	System	Date Observed	Description	Room Name	Room Number	Resolution / Action Required	FPT Impact? (Y/N)	BN Sign-Off	UCD Sign-Off
23	Steam/Hot Water System	8/14/10	The HHW temperature setpoint is locked in at 160 deg. F whenever the tempered water system is enabled. This seems too high (when the tempered water system is not enabled the temperature ranges from 120 to 160 deg. F). It seems like you would want less hot water going into the tempered loop since it only controls to 100 deg. F.	gen					
24	Steam/Hot Water System	8/15/10	We did not test the flow switch at the steam-to-hot water heat exchanger; that needs to be done.						
25	Chilled Water System	8/16/10	Per Peter the CHW temperature reset is not required, (it is not installed). Scott and Matt should also buy off on this.	gen					
26	Condensing Water System	8/11/10	Verify Fluid Cooler blowdown does not spill out of Sump grate onto Service Yard pad.	Service Yard		need to test			
27	Storm Water System	8/16/10	Normally Open Valve in lifting Station needs to be replaced (changed to normally closed)	exterior-south		need to replace			

Appendix L:
Commissioning Authority

THE UNIVERSITY of WISCONSIN MADISON

The College of Engineering and the Department of Engineering Professional Development

proudly presents to

Peter Shahrokh

this certificate for successfully completing all of the requirements for

Certification as Accredited

Commissioning Process Authority Professional

with the designation as

CAP or CxAP

on

June 18, 2007

Phil R. O'Leary, Chair of the Certification Committee

Charles E. Dorgan, Committee Member

Joy E. Altwies, Committee Member

This certification is valid for five years from the date listed above, where upon an additional five-year certification will be provided after requirements for re-certification are satisfied.