Request for Proposals for Construction Services

Value Based Selection Method

March 1, 2010

BOILER PLANT CONTROLS UPGRADE

WEBER STATE UNIVERSITY

OGDEN, UTAH

DFCM Project No. 08052810

Stanley Consultants
383 West, Vine Street
Murray Utah

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Technical Specifications:
Drawings:

Current copies of the following documents are hereby made part of these contract documents by reference These documents are available on the DFCM web site at http://dfcm.utah.gov/StdDocs/index.html "Standard Documents" "Reference Documents I" – "Item 6. Supplemental General Conditions" or are available upon request from DFCM:

DFCM Supplemental General Conditions dated July 1, 2009 *
DFCM Supplemental General Conditions dated July 15, 2008
DFCM General Conditions dated May 25, 2005

*** NOTE: THE NEW SUPPLEMENTAL GENERAL CONDITIONS EFFECTIVE JULY 1, 2009 ADDRESSING HEALTH INSURANCE AND IMMIGRATION ARE REFERENCED AT THE LINK ABOVE.**

The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at http://dfcm.utah.gov

NOTICE TO CONTRACTORS

The State of Utah - Division of Facilities Construction and Management (DFCM) is requesting proposals for the construction of the following project:

BOILER PLANT CONTROLS UPGRADES
WEBER STATE UNIVERSITY – OGDEN, UTAH
DFCM PROJECT No. 08052810

Installation of a complete programmable logic process control system, to include remote I/O panels and all associated equipment. Project also includes the instllation of Boiler feed water pumps and condensate transfer pumps. Construction cost is estimated at $ 1,000,000.00

The Request for Proposals (RFP) documents, including the selection requirements, the selection schedule, and construction documents will be available on **Monday, March 1, 2010** from DFCM, in electronic format only, at 4110 State Office Building, Salt Lake City, Utah 84114, telephone 801-538-3018 and on the DFCM web page at http://dfcm.utah.gov. For questions regarding this project, please contact Tim K Parkinson, DFCM, at 801-450 2478. No others are to be contacted regarding this project.

The procurement shall be under the Value Based Selection RFP method. A **MANDATORY** Pre-Proposal Meeting and Site Visit will be held at **10:00 AM on Wednesday, March 10, 2010** at Weber State University Boiler Plant, 1400 Edvalson Street on Campus. All prime contractors wishing to submit on this project must attend this meeting.

Cost proposals must be submitted by **12:00 noon on Monday, April 5, 2010** to DFCM at 4110 State Office Building, Salt Lake City, Utah 84114. Additional information, including a management plan and references, will be required as stated on the Project Schedule. Note: Submittals must be received at 4110 State Office Building by the specified times.

The contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

A Bid Bond in the amount of five percent (5%) of the proposal amount, made payable to the Division of Facilities Construction and Management on DFCM's bid bond form, shall accompany the cost proposal.

The Division of Facilities Construction & Management reserves the right to reject any or all proposals or to waive any formality or technicality in any proposal in the interest of the State.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT
JOANNA REESE, CONTRACT COORDINATOR
4110 State Office Bldg., Salt Lake City, Utah 84114

DESCRIPTION OF WORK

Work will consist of the general upgrade of the existing control system, demolition and the installation of the Boiler Feed water and condensate transfer pumps, and associated electrical serving the central heating plant of Weber State University as indicated on the drawings. Services will inlcude the installation of a new programmable logic process control system with remote I /O panels / relays in accordance with the contract Drawings and Specifications. Project will have to be coordinated and work peformed in stages. Coordination will be done with the using agency and under the direction of the owner.

Contractor must have detailed prior experience in the installation of DDC controls and DDC management systems to include the retrofit and programming. Programming shall include the training of described system as per the Contract Documents and Drawings.

Project Risk Factors

1: **Plant wide shut down. Contractor must minimize shut downs with little or no impact To the using agency. A 72 hour notice to the Agency is required prior to utility shutdowns.**

2: **Hi Pressure Steam**

3: **Contractor will be working in a fully staffed and operational Boiler Plant.**

PROCUREMENT PROCESS

1. Request for Proposal Documents

The Request for Proposal (RFP) documents consist of all of the documents listed in the Table of Contents and all said documents are incorporated in this RFP by reference.

2. Availability of Requests for Proposals

A compact disc containing the full contract documents is available free of charge at the locations stated on the Project Schedule. Certain Contract Documents are available at DFCM's internet web site at http://dfcm.utah.gov.

3. Contact Information

Except as authorized by the DFCM Representative or as otherwise stated in the RFP or the pre-proposal meeting, communication during the selection process shall be directed to the specified DFCM's Representative. In order to maintain the fair and equitable treatment of everyone, contractors shall not unduly contact or offer gifts or gratuities to DFCM, any Board officer, employee or agent of the State of Utah, users or selection committee members in an effort to influence the selection process or in a manner that gives the appearance of influencing the selection process. This prohibition applies before the RFP is issued as the project is developed, and extends through the award of a contract. Failure to comply with this requirement may result in a disqualification in the selection process. Contractors should be aware that selection committee members will be required to certify that they have not been contacted by any of the contractors in an attempt to influence the selection process.

4. Requests for Information

All requests for information regarding this project shall be in writing and directed to:

Tim K Parkinson
Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114
E-mail: tparkins@utah.gov
Facsimile: 801-450-2478

5. Project Schedule

The Project Schedule lists the important events, dates, times and locations of meetings and submittals that must be met by the contractor.

6. Mandatory Pre-Proposal Meeting & Registration

A mandatory pre-proposal meeting will be held on the date and time and at the location listed on the Project Schedule.

A representative from each interested prime contractor is required to attend. During the meeting, a presentation will be made to describe the overall scope of work and intended schedule. Interested prime contractors may ask questions and request clarification about the project and the procurement process.

Subcontractors and suppliers are invited to attend this meeting but it is not mandatory for them.

THE PRIME CONTRACTORS ABSENCE FROM THE PRE-PROPOSAL MEETING AND/OR FAILURE TO REGISTER PRECLUDES PARTICIPATION AS A PROPOSER ON THIS PROJECT.

7. Submittal Due Dates and Times

All required submittals must be delivered to, and be received by, the Division of Facilities Construction and Management prior to the date and time indicated in the Project Schedule. Submittals received after the specified time will not be accepted. Please allow adequate time for delivery. If using a courier service, the contractor is responsible for ensuring that delivery will be made directly to the required location. It is your responsibility to allow for the time needed to park on Capitol Hill as recent construction activity has made the parking more difficult. Identification is required to enter the building.

8. Last Day to Submit Questions

All questions must be received at the office of DFCM no later than the time and date listed on the Project Schedule. Questions must be submitted in writing to Tim K Parkinson at DFCM.

9. Addendum

All responses to questions and requests for clarification will be in writing and issued as addenda to the Request for Proposals. The addenda will be posted on DFCM's web site.

Any addenda issued prior to the submittal deadline shall become part of the Request for Proposals and any information required shall be included in your proposal.

10. Past Performance and References

As a contractor completes each DFCM project, DFCM, the architects/engineers and the using agency will evaluate the contractor. It is the intent of DFCM that this process will be the major source for evaluating past performance.

Contractors shall submit past performance and reference information by the time indicated on the Project Schedule.

For all DFCM projects completed in the last five years identify the project by name, number and DFCM project manager. Each contractor wishing to compete for this project that has not completed at least three DFCM projects in the last five years, will be required to provide one copy of a list of references on additional similar projects for a total of three projects.

For non-DFCM projects provide the following information:

Point of Contact:
Phone Number:
User Name:
Project Name:
Date Completed:
Address:
Size:
Duration:
Type:

11. Cost Proposal

Before submitting a proposal, each contractor shall carefully examine the RFP; shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the proposal the cost of all items required by the RFP. If the contractor observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the contractor shall promptly notify the specified DFCM Representative and the necessary changes shall be accomplished by Addendum.

The proposal, bearing original signatures, must be typed or handwritten in ink on the Cost Proposal Form provided in the procurement documents and submitted in a sealed envelope at the location specified below prior to the deadline for submission of cost proposals indicated on the Project Schedule.

A bid bond properly signed by a qualified surety, as indicated on the DFCM Bid Bond form provided along with this Instruction to Bidders, in the amount of 5% of the bid, shall accompany the bid submission to DFCM. THIS BID BOND MUST BE ON THE DFCM BID BOND FORM PROVIDED WITH THIS INSTRUCTION TO BIDDERS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID unless only one bid is received by DFCM, or the failure to comply with the bid bond requirements is determined by the Director of DFCM to be nonsubstantial based on the following:

(a) the bid bond is submitted on a form other than DFCM's required Bid Bond form and the bid bond meets all other requirements including being issued by a surety firm authorized to do business in the State of Utah and be listed in the U.S. Department of the Treasury Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies for an amount not less than the amount of the bond to be issued. A co-surety may be utilized to satisfy this requirement; and

(b) the contractor provides a bid bond properly signed by a qualified surety and on the required DFCM Bid Bond form by the close of business of the next succeeding business day after the DFCM notifies the bidder of the defective bid bond.

Cost Proposals will be accepted at the office of DFCM, 4110 State Office Building, Salt Lake City, UT 84114. Late proposals will be disqualified and returned to the proposer unopened. One copy of the cost proposal is required. The contractor shall bid the base bid price and the add alternates.

12. Compliance with Construction Budget

DFCM expects to receive cost proposals that are within the stated construction budget. While all contractors are generally encouraged to submit cost reduction proposals as appropriate, those who are not able to submit a cost proposal within the budget are particularly requested to submit cost reduction proposals to bring the cost within the budget. Contractors may, however, submit cost proposals that exceed the budget but they will be addressed in the manner explained below.

After the deadline for submitting cost proposals, DFCM staff will open proposals to identify those contractors whose cost proposals, less any potentially acceptable cost reduction proposals, are within the stated budget.

Cost proposals will be kept confidential and will not be disclosed to the selection committee until after the interviews and preliminary deliberations are completed. No information regarding a contractor's cost and cost reduction proposals will be disclosed to competing contractors prior to the completion of the selection process.

If no proposals are received from responsive and responsible contractors whose cost proposal, less any potentially acceptable cost reduction proposals, are within the stated budget for the contract, DFCM will determine which of the following actions to take:

A. DFCM may increase the stated budget for the contract and proceed with the selection process with only those contractors whose cost proposals, less any potentially acceptable cost reduction proposals, are within the revised budget for the contract. The determination of sources of additional funding and how much the budget will be increased is solely at the discretion of DFCM.

B. DFCM may reduce the scope or requirements of the contract. This will be evidenced in an addendum to the RFP which will also set a new deadline for submitting revised cost proposals and cost reduction proposals. Only qualified contractors who had previously submitted a cost proposal in accordance with the RFP may be considered in this extended procurement process.

C. DFCM may reject all proposals.

13. Cost Reduction Proposals

Any cost reduction proposals must be submitted in writing to DFCM by the deadline indicated in the Project Schedule. Cost reduction proposals may include value engineering or any modification of the original cost proposal, including but not limited to a simple reduction in price. The cost reduction proposals may be evaluated by DFCM, the Using Agency and the A/E to determine if they are potentially acceptable. The selection committee and/or the Director of DFCM, reserves the right to reject any cost reduction proposal that is not reasonable or desirable for the Project. The selection

committee will consider the reasonable and desirable cost reduction proposals in the evaluation of the cost criterion. DFCM reserves the right to use any value engineering information presented in a cost reduction proposal for the Project, and use the concept for the benefit of the Project.

14. Listing of Subcontractors

Listing of Subcontractors shall be as required by the Request for Proposals and as summarized in the "Instructions and Subcontractor's List Form", which are included as part of this RFP. The Subcontractors List shall be delivered to DFCM or faxed to DFCM at 801-538-3677 by the date and time stated in the Project Schedule and will be included in the Contract. Requirements for listing additional subcontractors are as follows: **NO ADDITIONAL REQUIREMENTS**

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements is subject to a debarment hearing and may be debarred from consideration for award of contracts for a period of up to three years.

15. Time

One of the selection criteria will be proposed contract time. The contractor will include in the management plan the schedule for completing the work including any items required by DFCM or the A/E. A completion date prior to **August 2, 2010** is requested, but not mandatory.

The actual notice to proceed will be based on how quickly the contractor returns the contract and the required bonds as well as the resolution of any issues that may arise in the procurement process. The contractor shall allow sufficient time in their schedule to accommodate receipt and signing of contract and bonds.

All plans, schedules, and the cost proposals are required to reflect the project construction time. Non-compliance with the schedule will not result in automatic disqualification; it will be evaluated by the selection committee in determining the final selection.

Of particular interest and concern are the management team and the ability of the prime contractors to deliver the project within the construction time. Contractors will need to demonstrate the method of delivery and the competency of the individuals who will manage its successful completion.

16. Management Plan

The contractor shall provide five copies of the management plan by the time indicated on the Project Schedule. The management plan should contain information on how the construction will be managed including items such as security and safety controls, staging areas, delivery routes, crane locations and interfaces required at the site with the using agency. It should contain an organization chart of key project personnel and also address how critical subcontractors were selected and will be managed.

Address project specific criteria, risks that have been identified by the RFP and additional risks that the team has identified. State how those risks will be mitigated.

As part of the management plan include your proposed project schedule. Indicate critical dates and other information in sufficient detail for the selection committee to determine if the time frames are reasonable.

The management plan should be concise yet contain sufficient information for evaluation by the selection committee.

17. Statements of Qualifications

The contractor shall provide five copies of the statements of qualifications by the time indicated on the Project Schedule. The statement of qualifications is a short document that indicates the experience and qualifications of the firm, the project manager and the site superintendent. It should include information on similar projects that have been completed by the firm, project manager and site superintendent. Include the experience and special qualifications that the project manager and site superintendent have that are applicable to this project and/or are part of the project specific selection criteria.

18. Termination or Debarment Certifications

The contractor must submit a certification that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from soliciting work by any governmental department or agency. The contractor must also certify that neither it nor its principals have been terminated during the performance of a contract or withdrew from a contract to avoid termination. If the contractor cannot certify these two statements the firm shall submit a written explanation of the circumstances for review by DFCM. Firms are to submit these certifications with their Statement of Qualifications.

19. Selection Committee

The Selection Committee may be composed of individuals from DFCM, the User Agency/Institution, and representatives from the design or construction disciplines

20. Interviews.

Interviews will be conducted with all responsive and responsible contractors except as follows. If more than six contractors submit proposals and meet other requirements, DFCM may convene the selection committee to develop a short list of **four** contractors to be invited to interviews. This evaluation will be made using the selection criteria noted below except that cost will not be considered. The information provided by the past performance/references, preliminary management plan and statement of qualifications will be the basis for this evaluation.

The purpose of the interview is to allow the contractor to present its qualifications, past performance, management plan, schedule and general plan for constructing the project. It will also provide an opportunity for the selection committee to seek clarification of the contractor's proposal.

The proposed primary project management personnel, including the project manager and superintendent, should be in attendance. The project manager is the contractor's representative who will be in daily control of the construction site. The project manager has overall job authority, will be in attendance at all job meetings, and is authorized by the contractor to negotiate and sign any and all change orders in the field, if necessary. Unless otherwise noted, the attendance of subcontractors is at the discretion of the contractor.

The method of presentation is at the discretion of the contractor. The interviews will be held on the date and at the place specified in the Project Schedule.

21. Selection Criteria for VBS Construction

The following criteria will be used in ranking each of the construction firms. The firm that is ranked the highest will represent the best value for the state. The criteria are not listed in any priority order. The selection committee will consider all criteria in performing a comprehensive evaluation of the proposal. Weights have been assigned to each criteria in the form of points.

A. Cost. **20 Points.** The contractor's proposal, inclusive of accepted alternates and cost reduction proposals will be scored in accordance with the following formula:
The Lowest cost proposal will be awarded full points.
Proposals within 3% of the lowest cost proposal will receive 90% of the points.
Propoasls within 6% of the lowest cost proposal will receive 80% of the points.
Proposals within 9% of the lowest cost proposal will receive 70% of the points.
Proposals within 12% of the lowest cost proposal will receive 60% of the points.
Proposals within 15% of the lowest cost proposal will receive 50% of the points.

B. Schedule. **10 Points.** The contractor's schedule will be evaluated as to how well it meets the objectives of the project. Unless other objectives are stated, the shorter the construction duration that is evaluated to be feasible while maintaining safety and quality in conformance with the construction documents is preferred. The contractor shall discuss during the interview the project schedule, identifying major work items with start and stop dates that are realistic and critical subcontractors and if they have reviewed and agree to the schedule.

C. DFCM Past Performance Rating. **10 Points.** Each construction firm will be given a past performance rating. The rating will be based first on how well the firm did on past projects with DFCM. If a minimum of three DFCM past performance ratings are not available, a rating will be established using any DFCM past performance ratings that are available, supplemented by references supplied by the contractor at the time the proposals are submitted.

D. Strength of Contractor's Team. **25 Points.** Based on the statements of qualifications, the interview, and management plan, the selection team shall evaluate the expertise and experience of the construction firm the project manager and the superintendent as it relates to this project in size, complexity, quality and duration. Consideration will also be given to the portions of the project that the contractor will self perform and the strength brought to the team by critical subcontractors including how they were selected and the success the contractor has had in working with them.

E. Project Management Approach. **25 Points.** Based on the information provided in the management plan and information presented in the interview the selection team shall evaluate how each team has planned the project and determined how to construct the project in the location and in the time frames presented. The firm should present how they plan to move material and people into and out of the site. Keep the site safe; minimize disruption to the facility etc. The construction firm shall also discuss what portions of the project they plan to self perform. The selection team will also evaluate the degree to which risks to the success of the project have been identified and a reasonable solution has been presented. This may include cost reduction ideas or proposals.

The following criteria are project specific. They are added to the above criteria in determining the selection that represents the best value for the state.

F. Specific project Experience. **10 Points.** Based on the information provided in the management Plan and information presented int heinterview the selection team shall evaluate the contractor's prior DDC Controls installation and extensive experience in detail programming.

Total Points Possible: 100 Points

22. Award of Contract

The selection of the prime contractor will be made using the Value Based Selection system (VBS). The award of the Contract shall be in accordance with the criteria set forth in the Request for Proposals (RFP). The State of Utah intends to enter into an agreement with the prime contractor to construct the project as outlined. Individual contractors or alliances between two or more contractors are allowed in this process. The State will contract with only one legal entity.

23. Contract and Bond

The contractor's agreement will be in the form found in the specifications. The contract time will be as indicated in the proposal. The selected contractor, simultaneously with the execution of the contract agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the RFP. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the contract sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for subcontractors will be specified in the Supplementary General Conditions.

24. Interpretation of Drawings and Specifications

If any person or entity contemplating submitting a proposal is in doubt as to the meaning of any part of the drawings, specifications or other contract documents, such person shall submit to the specified DFCM representative a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by

addenda posted on DFCM's web site. Neither DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

25. Licensure

The contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

26. Permits

In concurrence with the requirements for permitting in the general conditions, it is the responsibility of the contractor to obtain the fugitive dust plan requirements from the Utah Division of Air Quality and the SWPPP requirements from the Utah Department of Environmental Quality and submit the completed forms and pay any permit fee that may be required for this specific project. Failure to obtain the required permit may result in work stoppage and/or fines from the regulating authority that will be the sole responsibility of the contractor. Any delay to the project as a result of any such failure to obtain the permit or noncompliance with the permit shall not be eligible for any extension in the Contract Time.

27. Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors

Contractors shall respond promptly to any inquiry in writing by the DFCM to any concern of financial responsibility of the contractor, subcontractor or sub-subcontractor.

28. Product Approvals

Where reference is made to one or more proprietary products in the contract documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the contract documents, the products of other manufacturers will be accepted, provided they equal or exceed the standards set forth in the drawings and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

29. Withdrawal of Proposals

Proposals may be withdrawn on written request received from proposer until the notice of selection is issued.

30. Time is of the Essence

Time is of the essence in regard to all the requirements of the contract documents.

31. Right to Reject Proposals

DFCM reserves the right to reject any or all proposals.

PROJECT SCHEDULE

PROJECT NAME: BOILER PLANT CONTROLS UPGRADES - WEBER STATE UNIVERSITY – OGDEN, UT.
DFCM PROJECT NO. 08052810

Event	Day	Date	Time	Place
Request for Proposals and Construction Documents Available	Monday	March 1, 2010	8:00 AM	DFCM 4110 State Office Bldg SLC, UT and the DFCM web site *
Mandatory Pre-Proposal Site Meeting	Wednesday	March 10, 2010	10:00 AM	Weber State University Boiler Plant Conference 1400 Edvalson St.
Last Day to Submit Questions prior to submittal of Statements of Qualifications	Monday	March 15, 2010	8:00 AM	Email to: tparkins@utah.gov Tim K Parkinson
Addendum Deadline	Wednesday	March 17, 2010	1:00 PM	DFCM web site *
Prime Contractors turn in References, Statements of Qualifications, Management Plans (including Schedule), and Termination/Debarment Certifications	Monday	March 22, 2010	1:00 PM	DFCM 4110 State Office Bldg SLC, UT
Short Listing by Selection Committee	Wednesday	March 24, 2010	1:00 PM	DFCM web site *
Last Date to Submit Questions for Final Addendum	Monday	March 29, 2010	8:00 AM	Email to: tparkins@utah.gov Tim K Parkinson
Final Addendum Deadline (exception for bid delays)	Wednesday	March 31, 2010	1:00 PM	DFCM web site *
Prime Contractors Turn In Cost Proposals and Cost Reduction Proposals, Subcontractors list	Monday	April 5, 2010	12:00 Noon	DFCM 4110 State Office Bldg SLC, UT
Interviews	Wednesday	April 7 2010	9:00 AM	Weber State University Facilities Management Office Conference Room
Announcement	Thursday	April 8, 2010	9:00 AM	DFCM web site *
Substantial Completion Date	Monday	Aug. 2, 2010	5:00 PM	ONSITE

* **DFCM's web site address is http://dfcm.utah.gov.**

COST PROPOSAL FORM

NAME OF PROPOSER _____ DATE _____

To the Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the "Request for Proposals" for the **Boiler Plant Controls Upgrade – Weber State University – Orem, Utah – DFCM Project No. 08052810**and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _____

For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

_____ DOLLARS ($_____)
(In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete by August 2, 2010 should I/we be the successful proposer, and agree to pay liquidated damages in the amount of $ 250.00 per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of _____

The undersigned Contractor's License Number for Utah is _____._____

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in the Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract. The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable l00% Performance and Payment bonds are not delivered within the time set forth.

Type of Organization:

_____
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

_____

Respectfully submitted,

_____
Name of Proposer

ADDRESS:

_____

_____

_____
Authorized Signature

BID BOND

(Title 63, Chapter 56, U. C. A. l953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and_____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed, (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the STATE OF UTAH, hereinafter referred to as the "Obligee," in the amount of $_____ (5% of the accompanying bid), being the sum of this Bond to which payment the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal has submitted to Obligee the accompanying bid incorporated by reference herein, dated as shown, to enter into a contract in writing for the_____ _____ Project.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that if the said principal does not execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the principal, then the sum of the amount stated above will be forfeited to the State of Utah as liquidated damages and not as a penalty; if the said principal shall execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the Principal, then this obligation shall be null and void. It is expressly understood and agreed that the liability of the Surety for any and all defaults of the Principal hereunder shall be the full penal sum of this Bond. The Surety, for value received, hereby stipulates and agrees that obligations of the Surety under this Bond shall be for a term of sixty (60) days from actual date of the bid opening.

PROVIDED, HOWEVER, that this Bond is executed pursuant to provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument under their several seals on the date indicated below, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

DATED this _____ day of _____, 20_____ .

Principal's name and address (if other than a corporation):

_____

_____

By:_____

Title: _____

Principal's name and address (if a corporation):

_____

_____

By:_____

Title: _____

(Affix Corporate Seal)

Surety's name and address:

_____

_____

By: _____

Attorney-in-Fact (Affix Corporate Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.
My Commission Expires: _____
Resides at: _____

_____
NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

INSTRUCTIONS AND SUBCONTRACTORS LIST FORM

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, based on the following:

DOLLAR AMOUNTS FOR LISTING

PROJECTS UNDER $500,000: ALL FIRST-TIER SUBS $20,000 OR OVER MUST BE LISTED
PROJECTS $500,000 OR MORE: ALL FIRST-TIER SUBS $35,000 OR OVER MUST BE LISTED

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- If there are no subcontractors for the job that are required to be reported by State law (either because there are no subcontractors that will be used on the project or because there are no first-tier subcontractors over the dollar amounts referred to above), then you do not need to submit a sublist. If you do not submit a sublist, it will be deemed to be a representation by you that there are no subcontractors on the job that are required to be reported under State law. At any time, DFCM reserves the right to inquire, for security purposes, as to the identification of the subcontractors at any tier that will be on the worksite.

LICENSURE:

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

'SPECIAL EXCEPTION':

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A.Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

GROUNDS FOR DISQUALIFICATION:

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for

such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

(1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
(2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
(3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
(4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
(5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
(6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

EXAMPLE:

Example of a list where there are only four subcontractors:

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONTRACTOR LICENSE #
ELECTRICAL	ABCD Electric Inc.	$350,000.00	123456789000
LANDSCAPING	"Self" *	$300,000.00	123456789000
CONCRETE (ALTERNATE #1)	XYZ Concrete Inc	$298,000.00	987654321000
MECHANICAL	"Special Exception" (attach documentation)	Fixed at: $350,000.00	(TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR)

* Bidders may list "self", but it is not required.

PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS SUBCONTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

SUBCONTRACTORS LIST

FAX TO 801-538-3677

PROJECT TITLE: _____

Caution: You must read and comply fully with instructions.

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #

We certify that:

1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed "Self" or "Special Exception" in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: _____

DATE: _____ SIGNED BY: _____

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR OWNER'S REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY OWNER. ATTACH A SECOND PAGE IF NECESSARY.

4110 State Office Building, Salt Lake City, Utah 84114 - telephone 801-538-3018 – facsimile 801-538-3677 – http://dfcm.utah.gov

300/300/____/FVA/____/_____/__/_
Project No. _____

CONTRACTOR'S AGREEMENT

FOR:

_____
_____
_____

THIS CONTRACTOR'S AGREEMENT, made and entered into this ____ day of _____, 20__, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and _____, incorporated in the State of _____ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is _____.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at _____ _____.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

ARTICLE 1. SCOPE OF WORK. The Work to be performed shall be in accordance with the Contract Documents prepared by _____ and entitled "_____."

The DFCM General Conditions ("General Conditions") dated May 25, 2005 and Supplemental General Conditions dated July 15, 2008 and July 1, 2009 ("also referred to as General Conditions") on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

ARTICLE 2. CONTRACT SUM. The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of _____ _____ DOLLARS AND NO CENTS ($_____.00), which is the base bid, and which sum also includes the cost of a 100%

Performance Bond and a 100% Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY. The Work shall be Substantially Complete by _____. Contractor agrees to pay liquidated damages in the amount of $_____ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

ARTICLE 4. CONTRACT DOCUMENTS. The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Notice to Contractors, Instructions to Bidders/Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

ARTICLE 5. PAYMENT. The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the

Contractor requests payment and agrees to safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor’s obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

ARTICLE 6. INDEBTEDNESS. Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

ARTICLE 7. ADDITIONAL WORK. It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

ARTICLE 8. INSPECTIONS. The Work shall be inspected for acceptance in accordance with the General Conditions.

ARTICLE 9. DISPUTES. Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT. This Contractor’s Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF. The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

ARTICLE 12. INDEMNIFICATION. The Contractor shall comply with the indemnification provisions of the General Conditions.

ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT. The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor’s Agreement. The Contractor shall not assign this Contractor’s Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor’s Agreement, without prior written consent of the DFCM.

ARTICLE 14. RELATIONSHIP OF THE PARTIES. The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT. Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

ARTICLE 16. ATTORNEY FEES AND COSTS. Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.

IN WITNESS WHEREOF, the parties hereto have executed this Contractor's Agreement on the day and year stated hereinabove.

CONTRACTOR: _____

_____
Signature Date

Title: _____

State of _____)
)
County of _____)

_____
Please type/print name clearly

On this ____ day of _____, 20____, personally appeared before me, _____, whose identity is personally known to me (or proved to me on the basis of satisfactory evidence) and who by me duly sworn (or affirmed), did say that he (she) is the _____ (title or office) of the firm and that said document was signed by him (her) in behalf of said firm.

_____
Notary Public

(SEAL)

My Commission Expires _____

APPROVED AS TO AVAILABILITY OF FUNDS:

_____
David D. Williams, Jr. Date
DFCN Administrative Services Director

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

_____
Lynn A. Hinrichs Date
Assistant Director Construction Management

APPROVED AS TO FORM:
ATTORNEY GENERAL
July 1, 2009
By: Alan S. Bachman
Asst Attorney General

APPROVED FOR EXPENDITURE:

_____
Division of Finance Date

PERFORMANCE BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That _____ hereinafter referred to as the "Principal" and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee, " in the amount of _____ _____ DOLLARS ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____, for the approximate sum of _____ _____ Dollars ($_____), which Contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20_____.

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____ (Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____ (Seal)

Attorney-in-Fact

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20___, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.

My commission expires: _____

Resides at: _____

_____

NOTARY PUBLIC

Agency: _____

Agent: _____

Address: _____

Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

PAYMENT BOND

(Title 63, Chapter 56, U. C. A. l953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____ _____, a corporation organized and existing under the laws of the State of _____authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of _____, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of _____ Dollars ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____ for the approximate sum of _____ _____ Dollars ($_____), which contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, l953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____
(Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____
Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20_____, personally appeared before me _____ _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.

My commission expires: _____
Resides at: _____

_____
NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT _____ PROJECT NO: _____

AGENCY/INSTITUTION _____

AREA ACCEPTED _____

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM - (Owner) accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at _____ (time) on _____ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

_____

_____

The Owner acknowledges receipt of the following closeout and transition materials:

As-built Drawings O & M Manuals Warranty Documents Completion of Training Requirements

A list of items to be completed or corrected (Punch List) is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof. The amount of _____(Twice the value of the punch list work) shall be retained to assure the completion of the punch list work.

The Contractor shall complete or correct the Work on the list of (Punch List) items appended hereto within _____ ____calendar days from the above date of issuance of this Certificate. The amount withheld pending completion of the list of items noted and agreed to shall be: $_____. If the list of items is not completed within the time allotted the Owner has the right to be compensated for the delays and/or complete the work with the help of independent contractor at the expense of the retained project funds. If the retained project funds are insufficient to cover the delay/completion damages, the Owner shall be promptly reimbursed for the balance of the funds needed to compensate the Owner.

_____ by: _____

CONTRACTOR (include name of firm) (Signature) DATE

_____ by: _____

A/E (include name of firm) (Signature) DATE

_____ by: _____

USING INSTITUTION OR AGENCY (Signature) DATE

_____ by: _____

DFCM (Owner) (Signature) DATE

4110 State Office Building, Salt Lake City, Utah 84114 cc: Parties Noted
telephone 801-538-3018 • facsimile 801-538-3267 • http://dfcm.utah.gov DFCM, Director

Project Manual

for

Weber State University
Heat Plant Controls and
Feedwater and Condensate Transfer
Pumps Upgrade

Weber State University
Ogden, Utah

Issue for Construction
January 29, 2010

REGISTERED PROFESSIONAL ENGINEER
No. 5048550
CHEOL H.
KIM
STATE OF UTAH
1/29/10

LICENSED PROFESSIONAL ENGINEER
334187
LYLE DARNELL
VANCE
1/29/10
STATE OF UTAH

Stanley Consultants INC.

A Stanley Group Company
Engineering, Environmental and Construction Services - Worldwide

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ISSUE FOR CONSTRUCTION

HEAT PLANT CONTROLS, FEEDWATER, AND
CONDENSATE TRANSFER PUMPS UPGRADE

WEBER STATE UNIVERSITY
OGDEN, UTAH

SPECIFICATIONS GROUP

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FACILITY CONSTRUCTION SUBGROUP

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EXHIBIT A – SYSTEM DESCRIPTION Bound Herein

EXHIBIT D – INPUT/OUTPUT LISTING Bound Herein

EXHIBIT E – INSTRUMENT INDEX Bound Herein

EXHIBIT F – DATA SHEETS Bound Herein

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. Work of this Agreement comprises general upgrade of the control systems, demolition and installation of the boiler feedwater and condensate transfer pumps, and associated electrical serving the central heating plant of Weber State University as indicated on drawings.

B. Services of qualified Service Engineer to inspect and check installation of programmable logic process controller, remote I/O panels, and associated equipment; supervise preliminary operation, and provide operation and maintenance training.

1.02 AGREEMENT

A. Construct Work under single lump sum Agreement.

1.03 WORK SEQUENCE

A. Construct Work in stages to accommodate Owner's use of premises during construction period; coordinate construction schedule and operations with Owner's Representative.
   1. Stage work associated with Boiler No. 1, Deaerator No. 1, and Condensate Tank No. 1 including boiler feedwater and condensate transfer pumps to be complete and operational prior to initiating work associated with Boilers No. 2 and 3, Deaerator No. 2, and Condensate Tank No. 2.
   2. Schedule Work to minimize interruptions to utility service or use of street barricades and detours.

1.04 CONTRACTOR USE OF PREMISES

A. Limit Contractor's use of premises for Work and for storage, to allow for:
   1. Owner occupancy and operation of the boiler plant 24 hours a day.

B. Coordinate use of premises under direction of Owner. Contractor shall confine construction equipment, storage of materials and equipment and operations of workers to areas permitted by law, ordinances, permits, or requirements of Contract Documents, and shall not unreasonably encumber premises with construction equipment or other material or equipment.

C. Assume full responsibility for protection and safekeeping of items under this Agreement, stored on Site.

D. Move any stored items, under Contractor's control, which interfere with operations of Owner or separate contractor.

E. Obtain and pay for use of additional storage or Work areas needed for operations.

1.05 OWNER OCCUPANCY

A. Owner will occupy premises during entire period of construction for conduct of its normal operations. Cooperate with Owner's Representative in all construction operations to minimize conflict, and to facilitate Owner usage.
   1. Maintain existing service in substantially continuous operation during construction, making and removing temporary connections as necessary.
      a. Boilers No. 2 and 3, Deaerator No. 2, and Condensate Tank No. 2 in operation during construction on work associated with Boiler No. 1, Deaerator No. 1, and Condensate Tank No. 1 including boiler feedwater and condensate transfer pumps.
      b. Boiler No. 1, Deaerator No. 1, and Condensate Tank No. 1 in operation during construction on work associated with Boilers No. 2 and 3, Deaerator No. 2, and Condensate Tank No. 2 including boiler feedwater and condensate transfer pumps.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Bid documents: Quotation of cost of each alternate.

B. Agreement between Owner and Contractor: Alternates accepted by Owner for incorporation into Work.

C. Sections of Specifications identified in each Alternate.

1.02 PROCEDURES

A. Alternates will be exercised at option of Owner.

B. Coordinate related Work and modify surrounding Work as required to complete Work, including changes under each Alternate, when acceptance is designated in Agreement between Owner and Contractor.

1.03 ALTERNATE NO. 1: INDIVIDUAL NATURAL GAS FLOW METERS

A. Provide natural gas flow meters to each individual boiler in lieu of natural gas flow meter for entire natural gas system.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 70 00 - Execution Requirements: Final payment.

1.02 FORMAT

A. Contractor's electronic media driven form including continuation sheets when required.

B. For each item, provide a column for listing each of the following:
1. Item Number.
2. Description of work.
3. Scheduled Values.
4. Previous Applications.
5. Work in Place under this Application.
6. Authorized Change Orders.
7. Total Completed to Date of Application.
8. Percentage of Completion.
9. Balance to Finish.
10. Retainage.

1.03 PREPARATION OF APPLICATIONS

A. Present required information on electronic media printout.

B. Execute certification by signature of authorized officer.

C. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed.

D. List each authorized Change Order per DFCM requirements, listing Change Order number and dollar amount as for an original item of Work.

E. Prepare Application for Final Payment as specified in Section 01 70 00.

1.04 SUBMITTAL PROCEDURES

A. Submit three copies of each Application for Payment.

B. Submit an updated construction schedule with each Application for Payment.

C. Payment Period: Submit at intervals stipulated in the Agreement.

D. Submit with transmittal letter as specified for submittals in Section 01 33 00.

1.05 SUBSTANTIATING DATA

A. When Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question.

B. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

C. Include the following with the application:
   1. Partial release of liens from major subcontractors and vendors.
   2. Affidavits attesting to off-site stored products.
   3. Construction progress schedules, revised and current.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

PART 1 GENERAL

1.01 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate space requirements, supports, and installation of mechanical and electrical Work which are indicated diagrammatically on Drawings. Follow routing shown for pipes and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion.

E. After project completion, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.02 COPIES OF DRAWINGS AND PROJECT MANUALS

A. After Notice of Award, Contractor may obtain, at no charge, up to 5 printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction plus handling charge.

B. Additional copies of project manuals and half-size/full-size Drawings may be obtained under following conditions:
   1. Project manuals:
      a. Furnished at Engineer's reproduction cost plus handling charge.
      b. If Contractor's requirement for additional project manuals necessitates reprinting of project manuals, Contractor shall pay entire cost of such reprinting.
      c. Partial sets of project manuals will not be provided.
   2. Half-size Drawings:
      a. Furnished at Engineer's reproduction cost plus handling charge.
      b. If Contractor's requirement for additional Drawings necessitates reprinting of half-size Drawings, Contractor shall pay entire cost of such reprinting.
   3. Full-size Drawings:
      a. Complete sets of full-size Drawings may be purchased from Engineer at Engineer's reproduction cost plus handling charge per set.

C. Revised Drawings and project manuals, if required, will be provided by Engineer to show authorized changes or extra Work under following conditions:
   1. Project manuals: Furnished at no charge, in same quantity as original issuance.
   2. Half-size Drawings:
      a. One revised, complete set of half-size Drawings will be issued, at no charge, for each half-size set originally issued and for each half-size set purchased by Contractor after Notice of Award.
   3. Full-size Drawings:
      a. One revised, complete set of full-size Drawings will be issued, at no charge, for each full-size set originally issued.
      b. One revised, complete set of full-size Drawings will be issued, at no charge, for each full-size set originally issued, and for each full-size set purchased by Contractor after Notice of Award, up to 4 copies maximum.

4. One full-size reproducible set will be issued to accommodate fifth and subsequent sets purchased by Contractor. Contractor shall use reproducible set to complete printing for additional Drawings in its possession.

1.03 PROJECT SITE ADMINISTRATION

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out Work and perform construction as required by Contract Documents. Contractor shall at all times maintain good discipline and order at site.

B. *Except in connection with safety or protection of persons or Work or property at site or adjacent thereto, and except as otherwise indicated in Contract Documents, all Work at site shall be performed during regular working hours, and Contractor shall not permit overtime work or performance of Work on Saturday, Sunday, or any legal holiday without Owner's written consent given after prior written notice to Engineer.

C. Incompetent or incorrigible employees shall be dismissed from Work by Contractor or its representative when requested by Engineer, and such persons shall not again be permitted to return to Work without written consent of Engineer.

D. Workmanship shall be of best quality.

1.04 PROJECT MEETINGS

A. Representatives of Contractor, Subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of entity each represents.

B. Preconstruction meeting:
1. Engineer will schedule a meeting after 15 days after Notice of Award.
2. Location: A central site, convenient for all parties, designated by Owner.
3. Attendance:
   a. Owner's representative.
   b. Engineer and its professional consultants.
   c. Resident Project Representative.
   d. Contractor's superintendent.
   e. Major Subcontractors.
   f. Major suppliers.
   g. Others as appropriate.
4. Agenda:
   a. Execution of Owner-Contractor Agreement.
   b. Submission of executed bonds and insurance certificates.
   c. Distribution of Contract Documents.
   d. Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.
   e. Designation of personnel representing the parties in Contract and the Engineer.
   f. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   g. Scheduling.
5. Record minutes and distribute copies within 2 days after meeting to participants, with copies to Engineer, Owner, participants, and those affected by decisions made.

C. Progress meetings:
1. Schedule and administer meetings throughout progress of the Work at periodic intervals.
2. Engineer will hold called meetings as required by progress of Work.
3. Location of meetings: Weber State University
4. Engineer will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

5. Attendance:
   a. Engineer, and its professional consultants as needed.
   b. Contractor and Subcontractors as appropriate to agenda.
   c. Suppliers as appropriate to agenda.
   d. Others.
6. Suggested agenda:
   a. Review, approval of minutes of previous meeting.
   b. Review of Work progress since previous meeting.
   c. Field observations, problems, conflicts.
   d. Problems which impede construction schedule.
   e. Review of off-site fabrication, delivery schedules.
   f. Corrective measures and procedures to regain projected schedule.
   g. Revisions to construction schedule.
   h. Progress, schedule, during succeeding Work period.
   i. Coordination of schedules.
   j. Review submittal schedules; expedite as required.
   k. Maintenance of quality standards.
   l. Pending changes and substitutions.
   m. Review proposed changes for:
      1) Effect on construction schedule and on completion date.
      2) Effect on other contracts of Project.
      3) Other business.
7. Record minutes and distribute copies within 2 days after meeting to participants, with copies to Engineer, Owner, participants, and those affected by decisions made.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 CUTTING AND PATCHING

A. Employ skilled and experienced installer to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements which affect:
   1. Structural integrity of element.
   2. Integrity of weather-exposed or moisture-resistant elements.
   3. Efficiency, maintenance, or safety of element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

C. Execute cutting, fitting, and patching to complete Work, and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.
   3. Remove and replace defective and non-conforming Work.
   4. Remove samples of installed Work for testing.
   5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

E. Cut masonry and concrete materials using masonry saw or core drill.

F. Restore Work with new products in accordance with requirements of Contract Documents.

G. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with current separation ratings to full thickness of the penetrated element.

J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

K. Identify hazardous substances or conditions exposed during the Work to the Engineer for decision or remedy.

3.02 SPECIAL PROCEDURES

A. Materials: As specified in product sections; match existing with new products for patching and extending work.

B. Employ skilled and experienced installer to perform alteration work.

C. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.

D. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

E. Remove debris and abandoned items from area and from concealed spaces.

F. Prepare surface and remove surface finishes to provide for proper installation of new work and finishes.

G. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

H. Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring products and finishes to original or specified condition.

I. Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.

J. Where new Work abuts or aligns with existing, provide a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

K. When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation to Engineer for review.

L. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.

M. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.

N. Finish surfaces as specified in individual product sections.

END OF SECTION

PART 1 GENERAL

1.01 SUBMITTAL PROCEDURES

A. Deliver submittals to person listed below when required by Specification Sections:
   1. Owner:
      Mark Halverson
      Email: MarkHalverson@weber.edu
      Weber State University
      3850 University Circle
      Ogden, UT 84408

B. Submittals shall be in English language.

C. Weights, measures, and units shall be English units with SI metric values following in parenthesis.

D. Symbols and drawings shall conform to ANSI Y32.2/IEEE 315/CSA Z99.

1.02 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to submission.

B. Determine and verify:
   1. Field measurements.
   2. Field construction criteria.
   3. Catalog numbers and similar data.
   4. Conformance to Specifications.

C. Coordinate each submittal with other submittals and with requirements of Work and of Contract Documents.

D. Notify Engineer in writing, at time of submission, of any deviations in submittals from requirements of Contract Documents. Any such deviations permitted by Engineer will require modifications of Contract Documents.

E. Provide space on Shop Drawings for Contractor and Engineer stamps.

F. When Shop Drawings are revised for resubmission, identify all changes made since previous submission.

G. Submittals containing language imposing duties on others (such as verification of dimensions or supply of related information) inconsistent with contract language shall be null and void.

H. Submittals shall not be used as media for inquiries for information or for verification of information that must be supplied by others to Contractor. Inquiries or verification of information shall be made by separate Contractor submittal using Request for Information (RFI) process.

I. Begin no fabrication or Work which requires submittal review until return of submittals by Engineer with stamp, as either "Reviewed", “Reviewed as Noted", or “Reviewed as Noted-Resubmit.”

J. Distribute copies of reviewed submittals that carry Engineer stamp as either "Reviewed" or "Reviewed as Noted" as appropriate. Instruct parties to promptly report any inability to comply with requirements.

K. Submittals not requested will not be recognized or processed.

1.03 ENGINEER DUTIES

A. Review required submittals with reasonable promptness and in accord with schedule, only for general conformance to design concept of Project and compliance with information given in Contract Documents. Review shall not extend to means, methods, sequences, techniques, or procedures of construction or to safety precautions or program incident thereto. Review of a separate item as such will not indicate approval of assembly in which item functions.

B. Affix stamp and initials or signature, and indicate requirements for resubmittal, or review of submittal. Engineer's action on submittals is classified as follows:
   1. Reviewed: Submittal has been reviewed and appears to be in conformance to design concept of Project and Contract Documents. Contractor may proceed with fabrication of work in submittal.
   2. Reviewed As Noted: Submittal has been reviewed and appears to be in conformance to design concept of Project and Contract Documents, except as noted by reviewer. Contractor may proceed with fabrication of work in submittal with modifications and corrections as indicated by reviewer.
   3. Reviewed As Noted-Resubmit: Submittal has been reviewed and appears to be in conformance to design concept of Project and Contract Documents, except as noted by reviewer. Contractor may proceed with fabrication of work in submittal with modifications and corrections as indicated by reviewer. Contractor shall make any corrections indicated by reviewer and resubmit for review.
   4. Resubmit: Submittal has been reviewed and appears not to be in conformance to design concept of Project or with Contract Documents. Contractor shall not proceed with fabrication of work in submittal, but instead shall make any corrections required by reviewer and resubmit for review.
   5. Returned without Review: Submittal is being returned without having been reviewed because: 1) not required by Contract Documents; 2) grossly incomplete; 3) indicates no attempt at conformance to Contract Documents; 4) cannot be reproduced; 5) lacks Contractor's completed approval stamp; or 6) lacks design professional's seal when required by law or Contract Documents. If submittal is required by Contract Documents, Contractor shall not proceed with Work as detailed in submittal, but instead shall correct defects and resubmit for review.
   6. For Information Only: Submittal has not been reviewed but is being retained for informational purposes only.
   7. Void: Submittal is voided because it is no longer required or has been superseded by another submittal.

C. Return 1 copy of submittals to Contractor. Contractor shall make additional copies as required.

D. Review of submittals shall not relieve Contractor from responsibility for any variation from Contract Documents unless Contractor has, in writing, called Engineer's attention to such variation at time of submission, and Engineer has given written concurrence pursuant to Contract Documents to specific variation, nor shall any concurrence by Engineer or other reviewer relieve Contractor from responsibility for errors or omissions in submittals.

1.04 SHOP DRAWINGS SUBMITTALS

A. Submit for review for limited purpose of checking for conformance to information given and design concept expressed in Contract Documents. Produce copies and distribute in accordance with article “Submittal Procedures” and for record documents purposes as described in Section 01 70 00.

B. Designate in construction schedule, or in separate coordinated submittal schedule, dates for submission and dates that reviewed submittals will be needed.

C. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in Work or in work of other contractors.

D. Present in clear and thorough manner, complete with respect to dimensions, design criteria, materials of construction, and like information to enable review of information as required.

E. Details shall be identified by reference to sheet and detail, schedule or room numbers shown on Drawings.

F. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

G. Equipment which is identified on Contract Documents with tag number or name shall be identified on Shop Drawing with same tag.

H. Schedule submittals to expedite Project. Coordinate submission of related items.

I. For each submittal for review, allow 7 days excluding delivery time to and from Contractor.

J. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.

K. Shop Drawings may be submitted in electronic format.
   1. Submit electronic copy on CD or E-mail files.
   2. Text documents shall be submitted in .pdf format.
   3. Drawings shall be submitted in .pdf or .tif format.
   4. Electronic submittal shall be suitable for reproduction in black and white.

L. Number required:
   1. Copies of Shop Drawings submitted shall be black line on white background.
   2. Reviewer will reproduce additional copies of Shop Drawings as required for internal distribution.
   3. Shop Drawings shall be suitable for reproduction in black and white. Shop Drawings submitted which are not suitable for reproduction will not be reviewed.*
   4. If Contractor will not grant permission to reviewer to reproduce Shop Drawings, submit 5 copies of each Shop Drawing.
   5. Samples: Submit number stated in each Specification section.
   6. Drawings larger than 8-1/2” x 11” shall be rolled.

M. Submittals shall contain:
   1. Date of submission and dates of any previous submissions.
   2. Project title and number.
   3. Contract identification.
   4. Names of:
      a. Contractor.
      b. Supplier.
      c. Manufacturer.
   5. Identification of product, with Specification section number and article number.
   6. Field dimensions, clearly identified as such.
   7. Relation to adjacent or critical features of Work or materials.
   8. Applicable standards, such as ASTM or Federal Specification numbers.
   9. Identification of deviations from Contract Documents.
   10. Identification of revisions on resubmittals.
   11. An 8" x 3" blank space for Contractor and reviewer stamps.
   12. Indication of Contractor's approval, initialed or signed, with wording substantially as follows:

       "Contractor represents to Owner and Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, or assumes full responsibility for doing so and has reviewed or coordinated each submittal with requirements of Work and Contract Documents."

N. Product Data:
   1. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
   2. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

O. Certificates:
   1. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor.
   2. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   3. Certificates may be recent or previous test results on material or product, but must be acceptable to reviewer.

P. Samples:
   1. Samples for selection as specified in product sections:
      a. Submit for aesthetic, color, or finish selection.
      b. Submit samples of finishes and patterns for selection.
   2. Submit to illustrate functional and aesthetic characteristics of product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   3. Include identification on each sample, with full Project information.
   4. Submit number specified in individual Specification Sections; 1 of which will be retained by Owner.
   5. Reviewed Samples which may be used in Work are indicated in individual Specification Sections.
   6. Samples will not be used for testing purposes unless specifically stated in specification section.
   7. Field Samples and mock-ups:
      a. Erect at Project Site, at location acceptable to Engineer.
      b. Fabricate each Sample and mock-up complete and finished.
      c. Remove mock-ups upon acceptance of Work or when acceptable to Owner.

Q. Proposed products list:
   1. Within 15 days after date of Owner-Contractor Agreement, submit list of major products proposed to Engineer for use, with name of manufacturer, trade name, and model number of each product.
   2. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

R. Operations and maintenance manuals:
   1. Designate in construction schedule, or in separate coordinated schedule, dates for submission and dates that reviewed operations and maintenance manuals will be needed.
   2. Operations and maintenance manuals shall be presented in clear and thorough manner, complete with respect to dimensions, design criteria, materials of construction, and like information to enable reviewer to review information as required. Details shall be identified by reference to sheet and detail, schedule or room numbers shown on Drawings.

1.05 RESUBMISSION REQUIREMENTS

A. Make any corrections or changes in submittals required by Engineer and resubmit until stamped as either "Reviewed," "Reviewed as Noted," or “For Information Only.”

B. Text and depictions changed on Submittal shall be back-circled (clouded).

C. Engineer will assume that portions of Submittal not back-circled have not been changed by Contractor from previous submission.

D. Indicate revision number and date in document revision block.

1.06 DISTRIBUTION

A. Distribute reproductions of Shop Drawings which carry Engineer stamp as either "Reviewed" or "Reviewed as Noted" to:
   1. Job site file.
   2. Record Documents file.
   3. Other affected contractors.
   4. Subcontractors.

5. Supplier or fabricator.

1.07 CONSTRUCTION PROGRESS DOCUMENTATION

A. Construction progress schedules:
   1. Submit initial schedules to Engineer within 15 days after date of Owner-Contractor Agreement. After review, resubmit required revised data within 5 business days.

B. Form of schedules:
   1. Prepare schedules in form of horizontal bar chart.
      a. Provide separate horizontal bar for each trade or operation.
      b. Horizontal time scale: Identify first work day of each week.
      c. Scale and spacing: To allow space for notations and future revisions.
      d. Minimum sheet size: **8-1/2** x **11**.
   2. Format of listings: Chronological order of start of each item of Work.
   3. Identification of listings: By major Specification Section numbers.

C. Construction progress schedule shall show:
   1. Complete sequence of construction by activity, with Contract Price breakdown at each stage.
   2. Projected percentage of completion for each item, as of first day of each month.

D. Submittal schedule shall show:
   1. Dates for Contractor's submittals.

E. Progress revisions:
   1. Indicate progress of each activity to date of submission.
   2. Show changes occurring since previous submission of schedule:
      a. Major changes in scope.
      b. Activities modified since previous submission.
      c. Revised projections of progress and completion.
      d. Other identifiable changes.
   3. Provide narrative report as needed to define:
      a. Problem areas, anticipated delays, and impact on schedule.
      b. Corrective action recommended, and its effect.
      c. Effect of changes on schedules of other prime contractors.

F. Distribution copies of reviewed schedules to:
   1. Job site file.
   2. Subcontractors.
   3. Other concerned parties.

G. Instruct recipients to report promptly to Contractor, in writing, any problems anticipated by projects shown in schedules.

1.08 SUBMITTAL TRANSMITTAL FORM PROCEDURES

A. Submittals shall be accompanied by completed copies of Submittal Transmittal form, bound herein. An electronic version of transmittal form is available and may be obtained from Engineer. Reproduce additional copies required.

B. Submit transmittal form for initial submittals and resubmittals. Sequentially number transmittal form. Revise submittals with original number and sequential alphabetic suffix.

C. Prior to submittal, complete information under heading “Contractor's Transmittal.”

D. Engineer will complete information under “Reviewer's Action.”

E. Do not include submittals for more than one section of Specifications on Submittal Transmittal form.

F. Identify project title, location, and number and contract title and number.

G. Identify preparer name and, submittal number, including preparer's submittal revision number.

H. A brief description under "Title" should clearly identify specific application of equipment or material covered by Submittal, utilizing where possible same title used in Drawings and Specifications.

I. Identify Specification Section number.

J. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of Work and Contract Documents.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

Date Received _____

Date Distributed _____

SUBMITTAL TRANSMITTAL

Transmittal No.

Project Title _____ Project No. _____ Contract No. _____

Project Location _____ Contract Title _____

CONTRACTOR'S TRANSMITTAL

ENGINEER'S/ARCHITECT'S ACTION

Status Abbreviations:

R - Reviewed
RN - Reviewed as Noted
RNR – Reviewed as Noted Resubmit
RS – Resubmit
RET - Returned Without Review
FIO - For Information Only
V - Void

Preparer	Preparer Submittal No.	Rev. No.	Title	Section No.	SC Submittal No.	Status	Distribution (No.)					
							Cont	RPR	Own	Des		

Contractor Remarks

Address

By _____ Date _____

By Signature above, the Contractor shall certify that they have reviewed the submittal and that they comply with all applicable specification sections and contract drawings. Action of any kind on submittal by Engineer/Architect does not relieve Contractor from responsibility for errors, correctness of details, or conformance to the contract.

Engineer/Architect Remarks

Stanley Consultants
A Stanley Group Company
Engineering, Environmental and Construction Services - Worldwide

By _____

Date _____

Date Received _____

Date Distributed _____

SUBMITTAL TRANSMITTAL

Transmittal No.

Project Title _____ Project No. _____ Contract No. _____

Project Location _____ Contract Title _____

CONTRACTOR'S TRANSMITTAL

ENGINEER'S/ARCHITECT'S ACTION

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							Cont	RPR	Own	Des		

Contractor Remarks

Address

By _____ Date _____

By Signature above, the Contractor shall certify that they have reviewed the submittal and that they comply with all applicable specification sections and contract drawings. Action of any kind on submittal by Engineer/Architect does not relieve Contractor from responsibility for errors, correctness of details, or conformance to the contract.

Engineer/Architect Remarks

Stanley Consultants
A Stanley Group Company
Engineering, Environmental and Construction Services - Worldwide

By _____

Date _____

PART 1 GENERAL

1.01 QUALITY CONTROL AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on Shop Drawings or as instructed by manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.02 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.03 BUILDING CODES AND PERMITS

A. Obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses.

B. Pay all governmental charges and inspection fees necessary for prosecution of Work, which are applicable at time of opening of Bids. Pay all charges of utility service companies for connections to Work. Owner will pay all charges of such companies for capital costs related thereto.

C. Give all notices and comply with all laws, ordinances, building and construction codes, rules, and regulations applicable to Work. If Contractor observes that Specifications or Drawings are at variance therewith, give Engineer prompt written notice thereof, and any necessary changes shall be adjusted by appropriate Modification.

D. If Contractor performs any Work knowing or having reason to know that it is contrary to such laws, ordinances, rules, and regulations, and without such notice to Engineer, Contractor shall bear all costs arising therefrom; however, it shall not be Contractor's primary responsibility to make certain that Specifications and Drawings are in accordance with such laws, ordinances, rules, and regulations.

1.04 REFERENCES

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids, *date of Owner-Contractor Agreement when there are no Bids,* except where a specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. Should specified reference standards conflict with Contract Documents, request clarification from the Engineer before proceeding.

E. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Engineer shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

F. Abbreviations used in Drawings and Specifications are as specified in ASME Y14.38 and IEEE 260.

1.05 WELDING CERTIFICATES

A. Promptly after Notice of Award, submit to Engineer one copy, unless specified otherwise, for each person, by name, assigned to do field welding of materials installed under this Agreement.

B. Show on certificates that each person has passed tests described in Specifications.

C. Submit certificates prior to execution of any welding. Certificates not required for nonstructural tack welding.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

END OF SECTION

PART 1 GENERAL

1.01 BUILDING CODES AND PERMITS

A. Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for prosecution of Work, which are applicable at time of opening of Bids. Contractor shall pay all charges of utility service companies for connections to Work, and Owner shall pay all charges of such companies for capital costs related thereto.

B. Contractor shall give all notices and comply with all laws, ordinances, building and construction codes, rules, and regulations applicable to Work. If Contractor observes that Specifications or Drawings are at variance therewith, Contractor shall give Engineer prompt written notice thereof, and any necessary changes shall be adjusted by appropriate Modification. If Contractor performs any Work knowing or having reason to know that it is contrary to such laws, ordinances, rules, and regulations, and without such notice to Engineer, Contractor shall bear all costs arising therefrom; however, it shall not be Contractor's primary responsibility to make certain that Specifications and Drawings are in accordance with such laws, ordinances, rules, and regulations.

1.02 TAXES

A. Contractor shall pay all sales, consumer, use and other similar taxes required to be paid by it in accordance with law of place of Project.

B. After delivery to Site of items on which Contractor is required to pay such taxes, Contractor shall submit to Owner statement of such taxes paid.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

PART 1 GENERAL

1.01 WELDING REQUIREMENTS

A. Welding shall be performed by qualified welding operators using procedures which have been qualified in accordance with applicable codes and standards specified.

1.02 PROCEDURE QUALIFICATION

A. Contractor, subcontractor, or fabricator performing welding under jurisdiction of referenced codes shall be responsible for obtaining and qualifying welding procedures. Structural welding procedures conforming to AWS D1.1 are prequalified as defined in AWS D1.1.

B. Contractor shall maintain records, and make available to Engineer when requested, certifying successful completion of procedure qualification tests.

1.03 PERFORMANCE QUALIFICATION

A. Contractor, subcontractor, or fabricator performing welding under jurisdiction of referenced codes shall be responsible for testing and qualifying its welding operators in accordance with applicable procedures.

B. Unless welding operators have been previously qualified by Contractor within last 6 months and have been continuously employed as welders by Contractor following qualification, requalification tests must be performed.

C. Engineer reserves right to require any welder to retake tests when, in opinion of Engineer, work of welder creates reasonable doubt as to welder's proficiency; Engineer reserves right to witness any required retesting; conduct such tests at no additional expense to Owner.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SERVICE ENGINEER RESPONSIBILITIES

A. Contractor shall provide qualified Service Engineer(s), as necessary to:
   1. Supervise assembly of programmable logic process controller, remote I/O panels, and associated equipment as specified in Section 40 91 00.
   2. Inspect equipment after it is installed to assure that all details of installation are correct and that equipment is prepared for operation in accordance with manufacturer's instructions and recommendations.
   3. Check connections to equipment and adjust, or supervise adjustment of, control and indicating devices after equipment has been installed and connected.
   4. Fully instruct Owner's operating personnel in operation and maintenance of equipment.
   5. Supervise preliminary operation of equipment and necessary adjustments.

B. Presence of Service Engineer will in no way relieve Contractor of any responsibility assumed under Agreement.

C. Work and abilities of Service Engineer shall be subject to review of Owner. If Owner determines that any Service Engineer is not properly qualified, Contractor shall replace Service Engineer upon written notification by Owner.

D. Contractor shall provide continuity in assignment of Service Engineer to Work. In event substitution of Service Engineer is made which is not at request of Owner, substitute's time for "familiarization" shall be at Contractor's expense.

E. Provide services of Service Engineer who will perform functions specified herein for programmable logic process controller, remote I/O panels, and associated equipment as specified in Section 40 91 00.
   1. Contractor shall pay for cost of time and trips to site of Service Engineer as follows:
      a. Equipment checkout and start up – Stage 1: Minimum 3 days at site.
      b. Equipment checkout and start up – Stage 2: Minimum 3 days at site.
      c. Operation and Maintenance training: Minimum 2 days at site.
      d. Round trips from point of origin to site: Minimum of 3.
   2. .Contractor shall include in lump sum price additional days and round trips as necessary to complete Service Engineer responsibilities defined in this Specification.
   3. If additional time or trips are required because of defective workmanship, materials, or equipment furnished under this Agreement.
   4. Owner will be sole determining agent as to reasonableness of Service Engineer's claim for added compensation.

F. Service Engineer shall make trips only with approval of Owner, shall report in person daily to Owner's Representative while at site, and shall submit written record of time spent at site and report on results of trip to site to Owner's Representative weekly. Only that time spent by Service Engineer at site with Owner's approval shall be credited against total service day as estimated in Agreement. Hours worked in excess of normal 8 hours in any day will be paid for at one-eighth of per diem rate per hour.

G. If any of Service Engineer's time spent at site or if any of his trips to site are required to make corrections to equipment supplied under Agreement resulting from defective design, material, or workmanship used in manufacture of equipment, such time and trips will be at Contractor's expense and will not be counted against number of working days or trips specified, nor will unit adjustment prices apply.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

PART 1 GENERAL

1.01 PRODUCTS

A. Provide products of qualified manufacturers suitable for intended use. Provide products of each type by a single manufacturer unless specified otherwise.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

C. Provide interchangeable components of the same manufacturer for components being replaced.

1.02 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.03 RECEIVING, UNLOADING AND STORING

A. Receive and unload shipments to plant site from suppliers of equipment under this Contract.

B. Unload equipment as soon as possible after arrival.

C. Pay freight car and truck demurrage, detention, and any other costs which may be billed to Owner due to failure to unload cars or trucks within time required by freight companies.

D. Provide physical protection for equipment placed in storage.
   1. Store and maintain materials and equipment after receipt until completed installation is accepted by Owner. Such storage and maintenance shall be in accordance with manufacturer's recommendations and requirements of these Specifications. Provide materials, equipment, and labor required for such storage and maintenance. Contractor shall be accountable for any deterioration of materials or equipment occasioned by improper storage or maintenance, and shall recondition, repair, or replace any such materials or equipment without addition cost to Owner.
   2. Stored equipment shall be supported above ground and shall be covered with canvas or other heavy-duty sheeting. Cover shall be securely fastened and shall be replaced if torn or otherwise damaged during storage period.
   3. Motors shall be stored in dry, warm place and in accordance with manufacturer's recommendations. Motors over 20 hp shall have shaft rotated 90º each month. Provide Owner with evidence that this requirement is met.
   4. Desiccant shall be maintained between cover and motor frames on motors. Provide desiccant of type permitting visual determination of condition of desiccant. Replace desiccant when it becomes ineffective.
   5. Following items shall be stored in weatherproof building complete with bins for storage of small pieces of equipment. Heat to a minimum of 50ºF (10°C).
      a. Electronic instruments and cabinets.
      b. Electrical equipment with general-purpose enclosures.
      c. Insulation materials.
      d. Rotating equipment.
      e. Miscellaneous electronic equipment, gaskets, and small, machined parts.
      f. Instruments and controls.
      g.

E. Inspect stored equipment weekly. Renew protective coatings as necessary to preserve fitness of equipment.

F. Contractor shall take custody of equipment and materials received and shall be solely responsible for damage and shortages until acceptance of Contractor's work by Owner.

G. Unload equipment as soon as possible after arrival. Contractor shall pay freight railcar and truck demurrage, detention, and any other costs which may be billed to Owner due to failure to unload railcars or trucks within time required by freight companies.

H. Use of bare wire rope slings for unloading and handling equipment and materials is prohibited without Owner approval.

I. Storage areas will be allocated by Owner for Contractor's use. Equipment shall be stored in assigned lay-down areas.

J. Equipment and materials shall be stored and maintained in accordance with manufacturer's recommendations and these specifications.

K. Provide physical protection for equipment placed in storage.
   1. Stored equipment shall be supported above ground and shall be covered with canvas or other heavy-duty sheeting. Cover shall be securely fastened and shall be replaced if torn or otherwise damaged during storage period.
   2. Motors: Store in dry, warm place (minimum 50ºF).
   3. Following items shall be stored in weatherproof, heated (minimum 50ºF) building complete with bins for storage of small pieces of equipment.
      a. Electronic instruments and cabinets.
      b. Electrical equipment with general purpose enclosures.
      c. Insulation materials.
      d. Rotating equipment.
      e. Miscellaneous electronic equipment, gaskets, and small machined parts.
      f. Instruments and controls.
      g. Protection panels.

L. Inspect stored equipment weekly and document activities performed. Renew protective coatings as necessary to preserve fitness of equipment.

M. Contractor shall provide materials, equipment, and labor required for such storage and maintenance. Contractor shall be accountable for any deterioration of materials or equipment occasioned by improper storage or maintenance, and shall recondition, repair, or replace any such materials or equipment without additional cost to Owner.

N. Electrical equipment or equipment with any electrical components stored outdoors shall be supported at least 12" above ground.

1.04 GENERAL STORAGE

A. Store products immediately on delivery in accordance with manufacturer's instructions, with seals and labels intact. Protect until installed.

B. Arrange storage in manner to provide access for maintenance of stored items and for inspection.

1.05 ENCLOSED STORAGE

A. Store products subject to damage by elements in substantial weathertight enclosures.

B. Maintain temperature and humidity within ranges required by manufacturer's instructions.

C. Provide humidity control and ventilation for sensitive products, as required by manufacturer's instructions.

D. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.

1.06 MAINTENANCE OF STORAGE

A. Periodically inspect stored products on scheduled basis.

B. Verify storage facilities comply with manufacturer's product storage requirements.

C. Verify manufacturer required environmental conditions are maintained continually.

D. Verify surfaces of products exposed to elements are not adversely affected and if weathering of finishes is acceptable under requirements of Contract Documents.

1.07 PRODUCTS LIST

A. Within 30 days after effective date of Agreement, submit to Engineer five copies of complete list of major products which are proposed for installation.

B. Tabulate products by Specification section number and title.

C. For products specified only by reference standards, list for each such product:
   1. Name and address of manufacturer.
   2. Trade name.
   3. Model or catalog designation.
   4. Manufacturer's data:
      a. Reference standards.
      b. Performance test data.

1.08 PRODUCT OPTIONS

A. For products specified only by reference standard, select product meeting that standard, by any manufacturer.

B. For products specified by naming several products or manufacturers, select any one of products and manufacturers named which complies with Specifications.

C. For products specified by naming one or more products or manufacturers and stating "or equal," submit request as for substitutions for any product or manufacturer which is not specifically named in accordance with Section 01 25 13.

D. For products specified by naming only one product and manufacturer, there is no option and no substitution will be allowed.

E. Whenever Specifications call for item by manufacturer's name and type and additional features of item are specifically required by Specifications, additional features specified shall be provided whether or not they are normally included in standard manufacturer's item listed.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

PART 1 GENERAL

1.01 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.

B. Provide submittals to Engineer that are required by governing or other authorities.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

D. Owner will occupy all portions of the building.

1.02 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.

C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

D. Clean filters of operating equipment.

E. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.03 STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Engineer and Owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions.

G. Submit a written report in accordance with Section 01 30 00 that equipment or system has been properly installed and is functioning correctly.

1.04 TESTING, ADJUSTING AND BALANCING

A. .

1.05 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.06 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed Shop Drawings, Product Data, and Samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
3. Field changes of dimension and detail.
4. Details not on original Contract Drawings.

G. Submit documents to Engineer *with claim for final Application for Payment.* *_____.*

1.07 OPERATION AND MAINTENANCE DATA

A. Refer to Section 01 78 23.

1.08 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Provide spare parts, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to Project site and place in location as directed; obtain receipt prior to final payment.

1.09 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.

B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

C. Verify that documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Provide Table of Contents and assemble in binder with durable cover.

F. Submit prior to final Application for Payment.

G. Time of Submittals:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty or bond period.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in specification sections for 1 year from date of Substantial Completion.

B. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

D. Maintenance service shall not be assigned or transferred to any agent or Subcontractor without prior written consent of the Owner.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

PART 1 GENERAL

1.01 OPERATING AND MAINTENANCE DATA REQUIREMENTS

A. Operating and maintenance data shall be in English language.

B. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under Agreement.

C. Prepare operating and maintenance data as specified in this section and as referenced in other pertinent sections of Specifications.

D. Instruct Owner's personnel in maintenance of products and in operation of equipment and systems.

1.02 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel:
   1. Trained and experienced in maintenance and operation of described products.
   2. Familiar with requirements of this section.
   3. Skilled as technical writers to extent required to communicate essential data.
   4. Skilled as draftsmen competent to prepare required drawings.

1.03 CONTENT OF MANUAL

A. Neatly typewritten table of contents for each volume, arranged in systematic order.
   1. Contractor, name of responsible principal, address, and telephone number.
   2. List of each product required to be included, indexed to content of volume.
   3. List, with each product, name, address, and telephone number of:
      a. Subcontractor or installer.
      b. Maintenance contractor, as appropriate.
      c. Identify area of responsibility of each.
      d. Local source of supply for parts and replacement and list of recommended spare parts.
   4. Identify each product by product name and other identifying symbols as set forth in Contract Documents, including nameplate information and shop order numbers for each item of equipment furnished.

B. Product data:
   1. Include only those sheets which are pertinent to specific product.
   2. Annotate each sheet to:
      a. Clearly identify specific product or part installed.
      b. Clearly identify data applicable to installation.
      c. Delete references to inapplicable information.

C. Drawings:
   1. Supplement product data with Drawings as necessary to clearly illustrate:
      a. Relations of component parts of equipment and systems.
      b. Control and flow diagrams.
   2. Coordinate Drawings with information in Project record documents to assure correct illustration of completed installation.
   3. Do not use Project record documents as maintenance Drawings.

D. Written text, as required to supplement product data for particular installation.
   1. Organize in consistent format under separate headings for different procedures.
   2. Provide logical sequence of instructions for each procedure.

E. Copy of each warranty, Bond, and service contract issued.

1. Provide information sheet for Owner's personnel, giving:
   a. Proper procedures in event of failure.
   b. Instances which might affect validity of warranties or Bonds.

1.04 SUBMITTAL SCHEDULE

A. Preliminary draft:
   1. Provide 2 copies shipped with equipment.
   2. Submit 2 copies to Owner.
   3. Submit 2 copies to Engineer of proposed formats and outlines of contents prior to start of Work. Engineer will review draft and return 1 copy with comments.

B. Submit 1 copy of completed data in final form 15 days prior to final inspection or acceptance. Copy will be returned after final inspection or acceptance, with comments.

C. Submit specified copies of approved data in final form 10 days after final inspection or acceptance.

1.05 DEMONSTRATION AND INSTRUCTION OF OWNER'S PERSONNEL

A. Demonstrate operation and maintenance of products to Owner's personnel 2 weeks prior to date of final inspection.

B. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time and location.

D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

E. Amount of time required for instruction on each item of equipment and system is that specified in individual sections.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal and disposal of existing boiler feed water and condensate transfer pumps, piping, valves, conduit, electrical and control wiring, control equipment, and associated work as shown in mechanical, controls system, and electrical drawings.

B. Demolition work includes, but is not limited to:
   1. Stage 1:
      a. System No.1 boiler feed water pumps and associated electrical and control equipment.
      b. System No.1 condensate transfer pumps and associated electrical and control equipment.
      c. System No.1 feed water and condensate piping, valves, etc. as shown on drawings
      d. System No. 1 field instruments as indicated on Drawings.
      e. System No. 1 control wiring and conduits associated with existing single loop controllers in Control Room to/from field instruments.
      f. FD fan motors and associated electrical and control wiring serving Boilers No.1 and No.2
   2. Stage 2:
      a. System No.2 boiler feed water pumps and associated electrical and control equipment.
      b. System No.2 condensate transfer pumps and associated electrical and control equipment.
      c. System No.2 feed water and condensate piping, valves, etc. as shown on drawings.
      d. FD fan motor and associated electrical and control wiring serving Boiler No.3.
      e. System No. 2 field instruments as indicated on Drawings.
      f. System No. 2 control wiring and conduits associated with existing single loop controllers in Control Room to/from field instruments.
      g. Existing control panel in Control Room.

C. Inspect buildings and structures where demolition is required. Contractor shall also inspect existing Drawings of buildings and structures before bidding; Drawings are available from Owner. Contractor shall be familiar with items that require demolition and patching.

D. Contractor is responsible for determining actual site conditions, extent to which demolition is required, and method of demolition.

E. Schedule work with Owner and work in other parts of these Contract Documents.

F. Perform work in accordance with Drawings and Specifications and as required for proper execution of work under this Contract. Conform to applicable requirements of state and other governmental agencies for demolition work.

1.02 QUALITY ASSURANCE

A. Temporary electrical construction necessary to maintain existing system during construction shall comply with NEC Article 590.

1.03 SCHEDULING

A. Perform Work in manner which will provide least interference and most protection to public and existing construction. Contractor's operations subject to approval by Owner prior to commencement of Work.

B. Carefully coordinate time and manner of demolition work with Engineer to assure continued operation of existing facilities and to maintain construction schedule requirements.

C. Schedule and perform work in accordance with following general sequence. Coordinate specific details of work with Owner. Owner's use of premises shall have priority over work in all Contract(s).

D. Take care to minimize outages of electrical systems.

E. Coordinate electrical system outages with Owner and service utility. Notify Owner in writing at least 24 hours prior to electrical outage. Indicate system to be disabled, buildings affected, proposed date and time of outage, duration, and work to be performed.

F. Outages of following electrical systems shall be performed only with written permission of Owner.
   1. Power distribution.
   2. Fire alarm.
   3. Telephone.
   4. Steam distribution.
   5. Natural gas.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 PROTECTION

A. Protect existing facilities from damage by falling debris, dust, and construction operations.

B. Provide temporary supports and bracing where necessary to support existing construction and protect personnel during demolition operation.

3.02 DEMOLITION - GENERAL

A. Remove existing construction as specified and shown and as required to permit new construction.

B. Perform removal in manner that will minimize dust, noise, and other nuisance. Maintain haul routes for disposal of material clean and free of debris.

C. Remove existing construction carefully providing for neat and orderly junctions at construction to remain in place. Final appearance of exposed surfaces shall be similar and equal to that of adjacent existing work. Grind off rough surfaces to remove sharp projections.

D. Perform demolition operations in manner that in no way endangers personnel, public, existing structures, utilities, roadways, or facilities not to be demolished.

E. Any portion of existing construction whether structural, or accessory which has become unstable through removal of other parts of construction shall be removed as soon as practicable, and no such unstable part shall be left free-standing or inadequately braced against causes of collapse at end of each day's work.

F. No demolition shall be performed on piping, electrical circuits, or equipment until system has been isolated by Owner. Contractor shall verify isolation of system.

G. Contractor shall relocate existing active miscellaneous piping, conduit, and electrical circuits and devices not detailed on Drawings but required for installation of equipment and items installed by this Contract.

H. To reduce fire hazards during demolition, Contractor shall:
   1. Before removing any part of any building, remove volatile or flammable materials, such as fuel oil, gasoline, kerosene, benzene, cleaning fluids, paints, thinners, cloth, loose paper, combustible trash, coal, and similar materials which might serve as ready fuel for small fires.

2. Maintain stairways in usable condition to highest or lowest level until that portion of structure is removed.
3. Maintain sufficient number of fire extinguishers to check and extinguish small fires in areas where Work is being performed.
4. Wherever cutting torch or other equipment which might cause fire is being used, fire extinguishers shall be kept nearby and ready for instant use. Users of such equipment shall be instructed in proper method of preventing fires and extinguishing fire.
5. Fires will not be permitted in Project area.
6. Burning of waste lumber and other building materials or trash on Site will not be permitted.

I. Use of cranes and wrecking balls for demolition work are not permitted.

J. Use of blasting will not be permitted.

K. Provide temporary personnel and vehicle protection at openings or ledges made by demolition.

3.03 DEMOLITION OF MECHANICAL ITEMS

A. Remove mechanical equipment and materials as shown on Drawings and as specified.

B. Removal shall include but not limited to piping, valves, pumps, hangers, and associated accessories.

3.04 DEMOLITION OF ELECTRICAL ITEMS

A. Examination:
1. Verify that abandoned wiring and equipment serve only abandoned facilities.
2. Demolition drawings are based on cursory field observation and existing record documents. Report discrepancies to Owner before disturbing existing installation.

B. Preparation:
1. Contact Owner to determine equipment items are to be salvaged and delivered to storage area. Other equipment shall become property of Contractor and shall be removed from job site.
2. Disconnect electrical systems in or on walls, floors, and ceilings scheduled for removal.
3. Coordinate utility service outages with utility company.
4. Provide temporary wiring and connections to maintain existing systems in service during construction.
5. Existing electrical service: maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
6. Existing fire alarm system: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner at least 24 hours before partially or completely disabling system.
7. Existing telephone system: Disable system only to make switchovers and connections. Notify Owner at least 24 hours before partially or completely disabling system.

C. Demolition and extension of existing electrical work:
1. Remove, relocate, and extend existing installations to remain to accommodate new construction.
2. Remove abandoned wiring to source of supply.
3. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
4. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
5. Disconnect and remove the following:
   a. Devices and equipment serving utilization equipment that has been removed.
6. Repair adjacent construction and finishes damaged during demolition and extension work.
7. Maintain safe access to existing electrical installations which remain active.

D. Disposal of equipment containing polychlorinated biphenyl compounds (PCBs): Transformers, capacitors, and lamp ballasts containing PCBs shall be disposed of in accordance with CFR 40 Part 761. Ballasts, even those labeled "no PCBs", shall be disposed of accordingly. Deliver equipment to an Environmental Protection Agency (EPA) approved incinerator or ballast recycling service for disposal. Provide Owner with manifest and certificate of destruction pursuant to CFR 40 Part 761, Subpart K.

3.05 SALVAGE OF MATERIALS

A. Salvageable materials, except items specified to remain property of Owner, shall become property of Contractor and shall be removed from site as Work progresses.

B. Certain equipment and material shall be removed and reinstalled as indicated on Drawings and specified herein. Contractor shall remove such items, store if required, and reinstall as indicated. In the event of loss or damage to such material or equipment, Contractor shall replace items without additional cost to Owner.

3.06 DISPOSAL OF MATERIALS

A. Storage of materials to be removed not permitted to accumulate on site. Promptly remove and dispose of nonsalvageable equipment and materials.

B. Debris shall not be allowed to accumulate on roofs, floors, or in areas outside of and around any buildings being removed. Waste materials and debris resulting from Work shall be removed and disposed of daily by Contractor in disposal area obtained by Contractor.

C. Burning of waste lumber and other building materials or trash on Site will not be permitted.

D. No material, obstructions, or debris shall be placed or allowed to accumulate within 15' of any fire hydrant. Fire hydrants shall be accessible at all times.

3.07 PATCHING

A. Patch openings in walls, foundations, etc. caused by demolition. Use materials comparable to adjacent undisturbed surfaces for patching.

B. Any new construction work that affects existing building structures shall be patched to match existing surrounding materials. This includes walls, flooring, and any other materials that affect structural or architectural integrity of building.

3.08 REPAIR AND RESTORATION

A. Contractor shall be responsible for damage to personnel, public, roadways, streets, structures, utilities, facilities, and equipment caused by operations and shall repair any damage at its own expense or replace items damaged beyond repair.

B. Do not operate vehicles or equipment on existing construction or roadways that could be damaged.

C. Replace construction removed to facilitate operations with construction of equal quality to that removed.

3.09 CLEAN-UP

A. Maintain public streets, alleys, or other thoroughfares used in carrying out disposal free of litter or soil attributable to this operation. Equip and load trucks or other vehicles to prevent leakage, blowing off, or other escape of any portion of whatsoever is being hauled. Cost incurred by Owner in cleaning up such litter will be charged to Contractor and deducted from monies due or to become due it under this contract.

B. Upon completion of demolition work in each area, thoroughly clean area of materials not to remain.

C. Remove materials (except paint) adhered to construction to remain.

D. Leave areas in broom clean and vacuumed condition.

END OF SECTION

1) C.H. Kim
2) N. E. Casalino

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Coating systems for concrete floors.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.

B. Samples: Submit manufacturer's color samples showing full range of standard colors.

C. Quality assurance:
1. Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.

D. Warranty: Submit manufacturer's standard warranty.

1.03 QUALITY ASSURANCE

A. Manufacturer's qualifications:
1. Specialize in manufacture of coatings with a minimum of 10 years successful experience.
2. Able to demonstrate successful performance on comparable projects.
3. Single-source responsibility: Coatings and coating application accessories shall be products of a single manufacturer.

B. Applicator's qualifications:
1. Experienced in application of specified coatings for a minimum of 5 years on projects of similar size and complexity to this Work.
2. Applicator's personnel: Employ persons trained for application of specified coatings.

C. Mock-Ups: Prepare 10' x 10' mock-up for each coating system specified using same materials, tools, equipment, and procedures intended for actual surface preparation and application. Obtain Engineer's approval of mock-ups. Retain mock-ups to establish intended standards by which coating systems will be judged.

D. Preapplication meeting: Convene preapplication meeting 2 weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Contractor, Engineer, applicator, and manufacturer's representative. Review the following:
1. Environmental requirements.
2. Protection of surfaces not scheduled to be coated.
3. Surface preparation.
4. Application.
5. Disinfection.
6. Repair.
7. Field quality control.
8. Cleaning.
9. Protection of coating systems.
10. One-year inspection.
11. Coordination with other work.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

1. Coating or material name.
2. Manufacturer.
3. Color name and number.
4. Batch or lot number.
5. Date of manufacture.
6. Mixing and thinning instructions.

B. Storage:
1. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
2. Keep containers sealed until ready for use.
3. Do not use materials beyond manufacturer's shelf life limits.

C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Weather:
1. Air and surface temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
2. Surface temperature: Minimum of 5°F (3°C) above dew point.
3. Relative humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
5. Wind: Do not spray coatings if wind velocity is above manufacturer's limit.

B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with AWWA D102.

C. Dust and contaminants:
1. Schedule coating work to avoid excessive dust and airborne contaminants.
2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Carbonline.

B. DuPont.

C. Rust-Oleum.

D. Sherwin Williams Company.

E. Tnemec Company, Incorporated.

2.02 COATING SYSTEMS FOR CONCRETE FLOORS

A. System 24 – Moderate Chemical Exposure: Model No. based on Rust-Oleum
1. Type: Aggregate-filled epoxy.
2. Surface preparation: SSPC-SP 13/NACE 6. Shot blast or mechanically abrade, diamond blade grind perimeter edges.
3. Primer: Penetrating Prime & Seal. 250 sf per gallon.
4. Finish coat: Overkote Plus E-100 DFT 16 mils with anti-skid textured finish.
5. Finish color: As selected by OWNER from manufacturer's standard colors.

2.03 ACCESSORIES

A. Coating application accessories:
   1. Accessories required for application of specified coatings in accordance with manufacturer's instructions, including thinners.
   2. Products of coating manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which coating systems are to be applied. Notify Engineer of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.02 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.

B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.03 PREPARATION

A. Concrete floors:
   1. Remove dirt, loose mortar, scale, powder, and other foreign matter. Remove oil and grease with solution of trisodium phosphate, rinse well and allow to thoroughly dry.
   2. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after being thoroughly wetted with water. Allow to thoroughly dry.

3.04 APPLICATION

A. Apply coatings in accordance with manufacturer's instructions.

B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.

C. Keep containers closed when not in use to avoid contamination.

D. Do not use mixed coatings beyond pot life limits.

E. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.

F. Uniformly apply coatings at spreading rate required to achieve specified DFT.

G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

H. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

3.05 REPAIR

A. Materials and surfaces not scheduled to be coated: Repair or replace damaged materials and surfaces not scheduled to be coated.

B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.

C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.06 FIELD QUALITY CONTROL

A. Inspector's services:
1. Verify coatings and other materials are as specified.
2. Verify surface preparation and application are as specified.
3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gages.
4. Coating defects:
   a. Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
   b. Check for holidays on interior steel immersion surfaces using holiday detector.
5. Report:
   a. Submit written reports describing inspections made and actions taken to correct nonconforming work.
   b. Report nonconforming work not corrected.
   c. Submit copies of report to Engineer and Contractor.

B. Manufacturer's field services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.07 CLEANING

A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.08 PROTECTION OF COATING SYSTEMS

A. Protect surfaces of coating systems from damage during construction.

3.09 ONE-YEAR INSPECTION

A. Owner will set date for one-year inspection of coating systems.

B. Inspection shall be attended by Owner, Contractor, Engineer, and manufacturer's representative.

C. Repair deficiencies in coating systems as determined by Engineer in accordance with manufacturer's instructions.

END OF SECTION

1) CH Kim
2) N. E. Casalino

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe materials.

B. Fittings, unions, flanges, and couplings.

C. Welding fittings.

D. Pipe sleeves and seals.

E. Piping identification.

F. Motor starters

G. Wiring

H. Equipment guards.

I. Pipe joining methods.

J. Cleaning and protection.

K. Leakage tests.

L. Piping schedules.

1.02 SUBMITTALS

A. Quality assurance data: Certified records, indicating that procedures used and welding operators employed are in compliance with codes referenced in article "Quality Assurance."

1.03 QUALITY ASSURANCE

A. Regulatory requirements:
   1. Piping construction criteria shall conform to requirements of ANSI B31.1, B31.2, B31.5, and B31.9 as applicable. Work shall also comply with applicable state and local codes.
   2. Qualification of welding procedures to be used and welding operators shall be in accordance with ASME Boiler and Pressure Vessel Code, Section IX.

B. Certifications: New materials and equipment shall bear manufacturer's name, model number, or other identification marking.

C. Standard product shall be of latest design with published properties of manufacturer regularly engaged in production of specified material or equipment for minimum 5 years (unless exempted by Engineer).

D. Unless otherwise indicated, equipment of same type in same room shall match color, finish, and design.

E. Standardization: Unless otherwise submitted to and accepted by Engineer, equipment and its devices shall be of same manufacturer; or devices must be approved and warranted by equipment manufacturer.

1.04 COORDINATION

A. Coordinate with all trades regarding location and size of pipes, equipment, ducts, openings, light fixtures, and other similar items mutually located in same or adjacent spaces.

B. Make minor modifications in Work required by interferences (structural, work of other trades) following notification to Engineer.

PART 2 PRODUCTS

2.01 DESIGN REQUIREMENTS

A. Fire protection, plumbing, heating, ventilating and air conditioning, and temperature control designs are based on specified or scheduled equipment manufacturers.

B. Transformers, conduit, disconnects, breakers, fuses, and wire sizes are selected on basis of scheduled or specified equipment.

C. Increased current requirements requiring larger wire, additional wires, larger conduit, starters, breakers, or switches not indicated on Drawings to accommodate alternate or substitute manufacturer's equipment shall be provided by supplier furnishing substituted equipment.

2.02 PIPE MATERIALS

A. Pipe materials shall be as specified herein and in Mechanical Standards bound at end of Project Manual. No asbestos shall be used. If pipe wall thickness specified is not available, use next heavier wall.

2.03 FITTINGS - GENERAL

A. Material, wall thickness, and pressure class: As specified in article "Pipe Materials," unless otherwise noted.

B. Use long radius fittings, except where space limitations require short radius.

C. Provide dielectric unions at connections between ferrous and nonferrous piping and at connections of nonferrous piping to ferrous equipment.

2.04 UNIONS, FLANGES, AND COUPLINGS

A. Pressure class, material, and facing: As specified in article "Pipe Materials."

B. Pipe size 2" and smaller: Malleable iron unions for threaded ferrous piping; cast bronze or wrought copper unions for copper piping with soldered or brazed joints.

C. Pipe size 2-1/2" and larger: Forged steel welding neck or slip-on flanges for ferrous piping; bronze flanges for copper piping; 1/8" thick preformed synthetic fiber gaskets, Garlock "Blue-Gard 3000," or equal.

2.05 WELDING FITTINGS

A. Material and wall thickness: As specified in article "Pipe Materials."

B. Use welding tees for socket-welded piping for field-fabricated branch tees in butt-weld end piping.

C. Nozzle-welded branches or "Weldolets" and "Threadolets" will be permitted instead of butt welding tees for shop-fabricated black steel piping, provided that such nozzles are fabricated in accordance with ASME B31.9. Use tees for branches in nonblack piping.

D. Mitering of pipe to form elbows, notching straight pipe to form tees, and similar construction will not be acceptable for pressure piping except where specifically permitted in Mechanical Standards.

2.06 PIPE SLEEVES

A. Provide sleeves for piping passing through building structure, except where otherwise shown on Drawings.

B. Above grade: Steel pipe, sheet steel not lighter than 16 U.S. Standard gage, or fiber with 1/4" minimum wall thickness or thermoplastic construction Link-Seal "Century-Line," or equal.

C. Size:
1. Walls and floors: 2" larger than carrier pipe.
2. Floors: Extend 4" above floor.

2.07 PIPE SLEEVE SEALS

A. Rubber expandable seals as manufactured by Link-Seal, or equal.

B. Fire-rated floors and walls: Link-Seal "Pyro-Pac," or equal.

2.08 PIPE MARKERS

A. Type: SNA "Setmark," snap-on type with arrows as manufactured by Seton, or equal.

B. Wording and color combinations: ANSI A13.1.

2.09 MOTORS AND STARTERS

A. Motors 1/2 hp and larger shall be TEFC induction motors in NEMA frames suitable for operation on 208-volt ac, 3-phase, 60 Hz, unless noted otherwise.

B. Motors shall have starting and torque characteristics compatible with driven equipment.

C. Motors shall have 1.15 service factor rated at 90ºC ambient temperature (Class B insulation) with 40ºC temperature rise.

2.10 WIRING

A. Provide wiring not indicated on Drawings including electrically operated control modules, electrical conduit, wire and connections related to mechanical equipment controls.

B. See Division 26 for additional information.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Work provided shall be complete and operable, and shall include required accessories, specialties, fastenings, supports, auxiliary building steel, and similar items.

B. Determine required location, arrangement, and quantities of equipment and materials from Drawings.

C. Equipment shall be installed in accordance with manufacturers' recommendations.

D. Power wiring and interconnection of electrical accessories specified under this Division will be performed under Division 26.

E. Install piping as shown on Drawing and as specified.

F. Route piping parallel to building lines.

G. Provide sufficient unions and flanges to permit removal of equipment.

H. Spacing of piping shall be adequate to permit servicing valves and specialties and replacing sections of pipe.

I. Slope pipe to permit complete draining. Install drain valves at low points.

J. Provide nuts, bolts, gaskets, and washers for complete and proper installation.

3.02 PIPE JOINING METHODS

A. Comply with Mechanical Standards listed under article "Pipe Materials" and with requirements of ANSI B31, unless otherwise indicated.

B. Threaded joints:
1. Clean-cut threads, ream pipe ends, and remove burrs.
2. Apply suitable lubricating, noncorrosive, flexible pipe joint compound to male threads only.

C. Flanged joints:
1. Clean mating surfaces of flanges.
2. Install gasket and tighten bolts evenly.

D. Weld joints:
1. Cut pipe square, and prepare pipe ends for welding as required by ANSI B31.
2. Workmanship shall conform to details and requirements of ANSI B31.

E. Brazed joints:
1. Cut tube square and prepare for brazing as required by ANSI B31.
2. Workmanship shall conform to details and requirements of ANSI B31.
3. Qualifications of brazing procedures and brazing operators shall be in accordance with Part C, Section IX, ASME Boiler and Pressure Vessel Code.

F. Other joints and jointing methods: In accordance with Pipe Material Schedule and Mechanical Standards.

3.03 LEAKAGE TESTS

A. Notify Engineer and Owner of intent to test piping at least 1 week prior to test. Test in presence of Engineer and Owner, unless notified otherwise.

B. Other piping: Test hydrostatically, in accordance with ANSI B31.

C. Provide pumps, compressors, meters, gages, piping, fittings, accessories, and labor required to conduct tests.

D. Isolate equipment that may be damaged by test pressure.

E. Refit joints indicating leakage, replace defective pipe, fittings, and accessories.

3.04 CLEANING AND PROTECTION

A. Remove foreign material from pipes before erection.

B. Close ends of partially erected systems.

C. Remove temporary preservative coatings from valves and accessories.

D. Flush or otherwise clean systems after erection.

E. Prior to conducting final performance test Contractor shall verify that strainers are clean.

F. Contractor shall be responsible for malfunctioning of pumps, valves, controls, or other equipment due to presence of foreign material. Contractor shall clean, repair or replace malfunctioning equipment at no cost to Owner.

3.05 PIPE IDENTIFICATION

A. Provide pipe markers on new piping to match existing.

B. Install markers on both horizontal and vertical section of pipe to match existing.

3.06 EXPOSED INTERIOR PIPING SCHEDULE

Service	Pipe	Mechanical Standard No.
Steam, boiler feed water, condensate and compressed air		
3/8" and smaller	ASTM B88 hard drawn or soft annealed copper	
1/2" and larger	ASTM A53 black steel screwed or welded	ACS1
Natural gas		
2-1/2" and larger	ASTM A53 black steel Schedule 40, socket-welded with 150 lb fittings and flanged, lubricated plug valves	None

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2) N.E. Casalino

Stanley Consultants INC.

PIPE CLASS SPECIFICATION - ACS1

MAWP	TEMP, °F	100	200	300	400	500	600	650	700	750	775
	PRESS, PSIG	285	260	230	200	170	140	125	110	95	87

PIPE	MATERIAL, ASTM	A53 GR B, TYPE S OR A106 GR B	
	NOMINAL PIPE SIZES AND SCHEDULE	3/4" - 2"	XS
		2-1/2" - 24"	STD

JOINT	TYPE	THREADED	SOCKET WELD	BUTT WELD	FLANGED
	USE FOR PIPE SIZES	NONE	3/4" - 2"	2-1/2" - 24"	NONE
FITTINGS	MATERIAL, ASTM		A105	A234 WPB	
	PRESS CL, ASME B16.11		3000		
	MINIMUM WALL THICKNESS			MATCH PIPE	
	WELDING END			ASME B16.25	
	UNIONS		GROUND JOINT	NONE	

FLANGES	MATERIAL, ASTM	A105
	PRESS CL, ASME B16.5	150
	FACING	1/16" RF SERRATED
	GASKETS ASME B16.20	304 SS SPIRAL WOUND FLEXITALLIC FLEXICARB STYLE CG OR EQUAL, UNLESS SPECIFIED OTHERWISE.
	BOLTS & NUTS	A193 GR B7 STUD BOLTS & A194 GR 2H HEAVY HEX NUTS

GENERAL NOTES & COMMENTS:

1. THREADED JOINTS NOT ALLOWED UNLESS SPECIFIED OTHERWISE.
2. THREADED JOINTS ALLOWED FOR INSERTION TYPE TEMPERATURE WELLS. WELLS SHALL BE SEAL WELDED. USE CLASS 2000 A105 FITTINGS.
3. BACKING RINGS NOT PERMITTED.
4. BUTT WELD END PREPARATIONS
   1. NOMINAL PIPE WALL THICKNESSES 0.375" AND LESS: CONFORM TO ASME B16.25, FIGURE 2, DETAIL (A).
5. FURNISH FLAT FACED FLANGES AND USE FULL-FACED GASKETS WHERE REQUIRED FOR CONNECTION TO CAST IRON FLANGES.
6. FLANGES SHALL BE WELD NECK.
7. FITTINGS SHALL BE SEAMLESS.

NO.	REVISION	DATE	DESIGN	CHECK	APVD
0	REVISION 0	9-Dec-04	JSM	JC	MAE

ASME CLASS 150

SEAMLESS CARBON STEEL

NO. **ACS1**

M-1802, M-2000

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gate valves.

B. Globe valves.

C. Ball valves.

D. Swing check valves.

E. Gas cock.

F. Gage cocks.

1.02 QUALITY ASSURANCE

A. Uniform Plumbing Code.

B. Uniform Mechanical Code.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Valves meeting the requirements specified as manufactured by Nibco, Clow, DeZurik, Trerice, Watts, Cash Acme, MKM Valve Co., Doves Corporation, or Bell & Gossett ITT.

B. Wherever possible, provide valves of same manufacturer throughout.

C. Manufacturer's name and pressure rating shall be clearly marked on outside of valve body.

2.02 GATE VALVES

A. 2-1/2" or larger:
1. Body: Flanged OS&Y iron.
2. Solid bronze wedge, rising stem.
3. Pressure class: 150 psi.
4. Internals: Renewable bronze.
5. Packing: Graphite impregnated nonasbestos fibers.
6. Manufacturer: Nibco Model F-617-0, or equal.

2.03 GLOBE VALVES

A. 2" or smaller:
1. Body: ASTM B62 threaded-bronze, union bonnet.
2. Stem: Silicon brass, rising.
3. Disc: Teflon.
4. Packing: TFE impregnated nonasbestos fibers.
5. Pressure class: 150 psi.
6. Manufacturer: Nibco Model T-235, or equal.

B. 2-1/2" through 6".
1. Body: 125 psi, cast iron, OS&Y.
2. Seat ring: Renewable, ASTM B62, bronze.

3. Disc: Renewable, teflon-coated, bronze.
4. Packing: Graphite impregnated nonasbestos fibers.
5. Stem: ASTM B16 brass.
6. Manufacturer: Nibco Model F-718, or equal.

C. Cast steel:
1. Service: High-pressure steam (90 psig).
2. Body: Cast steel, OS&Y body, butt-welded connections.
3. Pressure class: 150 psi.
4. Internals: Chromium-steel with stellite faced seat.
5. Packing: Graphite impregnated nonasbestos fibers.
6. Manufacturer: Nibco Model CS-133-U, or equal.
7. Internals: 11-13% chrome Exelloy disc with stellite seat.
8. Packing: Graphoil and gasket. Graphoil spiral wound with Type 304 stainless steel.
9. Manufacturer: Crane Model 143-1/2 XU, or equal.

2.04 BALL VALVES

A. Size: 1-1/4" through 3".

B. Body: Bronze-threaded, 2-piece construction.

C. Ball and stem: Bronze.

D. Seat and seals: Teflon.

E. Working pressure: 150 psig.

F. Manufacturer: Nibco Model T-580-70, or equal.

2.05 SWING CHECK VALVES

A. 2" and smaller:
1. Body: Threaded bronze, ASTM B62.
2. Bonnet: Screwed bronze, ASTM B62.
3. Seat: Integral bronze.

4. Disc: Buna-N.
5. Working pressure: 150 psig.
6. Manufacturer: Nibco Model T-413, or equal.

B. 2-1/2" and larger:
1. Body and bonnet: Flanged, cast iron, ASTM A395.
2. Seat: Bronze, ASTM B61.
3. Disc: Bronze, ASTM B61.
4. Working pressure: 150 psig.

2.06 GAS COCK

A. Type: Lubricated plug, wrench-operated.

B. Size: 1/2" through 3" NPT.

C. Body and plug: ASTM A126 Grade B, semisteel.

D. Supply each valve with wrench operator with set screw.

E. Baseplate springs: Stainless steel.

F. Lubricant: Suitable for natural gas service up to 250ºF.

G. Full pipe area port.

H. Manufacturer: WKM Valve Co. Figure D-125, or equal.

2.07 GAGE COCKS

A. Size: 1/4" NPT.

B. Body: Brass.

C. Core: Bronze.

D. Cock: T-handle.

E. Working pressure: 300 psi.

F. Manufacturer: Trerice Model 865-1, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install gate valves for shut-off and isolating service, to isolate equipment, part of systems or vertical risers.

C. Install globe valves for control device or meter bypass.

D. Provide silent check valves on the discharge of water circulation pumps.

E. Use butterfly valves in heating and chilled water systems interchangeably with gate and globe valves 2-1/2" and larger.

F. Use ball valves in heating, chilled water, and potable water systems interchangeably with gate and globe valves 2" and smaller.

G. Use gas cocks for gas service.

H. Use calibrated balance valves in water systems for throttling service. Install in discharge piping from circulation pumps.

I. Install gage cocks across pumps and other pieces of equipment where indicated on Drawings.

END OF SECTION

1) C.H. Kim
2) N. E. Casalino

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping specialty items including strainers, relief valve, and flexible connections.

1.02 SUBMITTALS

A. Shop Drawings. Data shall include:
1. Manufacturer.
2. Model.
3. Dimensions
4. Application.
5. Materials of construction.
6. Pressure rating (pressure and vacuum).
7. Temperature rating.

PART 2 PRODUCTS

2.01 GAGE TAPS

A. Type: Brass-needle type.

B. Pressure: 300 psig.

C. Manufacturer: Trerice Model 735-2, or equal.

2.02 PIPELINE STRAINERS

A. Location: See drawings.

B. Type: "Y" type.

C. Strainer basket: Monel; suitable for water service intended.

D. Size:
1. 2" and smaller: Bronze body, 125 psi construction, screwed ends, removable plug screen retainer.
2. 2-1/2" and larger: Cast iron body, 125 psi construction, flanged ends, bolted screen retainer, off-center blow down connection, piped and valved.

2.03 FLEXIBLE PIPING CONNECTIONS

A. Service: Water and pumped condensate 2-1/2" and larger.
1. Connections: Flanged or threaded.
2. Restraining bolts: Rubber isolated.
3. Provide control cable assemblies for units mounted on spring or neoprene mountings.
4. Bellows: Nylon-reinforced neoprene, twin sphere.
5. Hose, 2" and smaller: Seamless, corrugated bronze flexible bronze with braided cover. Mason Industries, Inc. BSSRF, BSMN, or equal.
6. Manufacturer: Mason Industries, Inc. Type MFT, or equal.

B. Service: Boiler feed water and condensate pumps.
1. Connections: 2-1/2" and larger, flanged; 2" and smaller, screwed.
2. Hose:
a. 2-1/2" and larger: Seamless, corrugated flexible, stainless steel with braided cover.
b. 2" and smaller: Seamless, corrugated bronze flexible bronze with braided cover.

3. Manufacturer: Mason Industries, Inc. BSSRF, BSMN, or equal.

PART 3 EXECUTION

3.01 GAGE TAPS

A. Install gage taps as indicated to isolate gages from systems served.

3.02 PIPELINE STRAINERS

A. Install strainers as indicated on Drawings and as detailed.

B. Install strainers in steam and water systems on entering side of automatic valves.

C. Install strainers in water systems on entering side of pumps.

D. Extend drain piping from blowoff connections to nearest floor drains.

3.03 FLEXIBLE PIPING CONNECTIONS

A. Provide flexible pipe connectors at suction and discharge of pump. Pipe connections shall be 12" long for pipes less than 6" in diameter; 18" for pipes 6" or larger in diameter.

END OF SECTION

1) C.H. Kim
2) N.E. Casalino

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and equipment supports.

B. Adequacy check and stiffening of existing steel

1.02 QUALITY ASSURANCE

A. Pipe hangers and supports, fabrication, and installation practices shall be in accordance with MSS SP-89.

B. Where pre-engineered standard supports are used:
1. Contractor's professional engineer's seal is not required for design of support.
2. Contractor's professional engineer's seal is required for design of attachment of support to structure where details are not included as part of the standard support (e.g., weld requirements, bolts, anchor rods, expansion anchors, etc.)
3. Standard supports (including all components) shall be certified by manufacturer as acceptable for intended use on this project; see article "Pipe Support Design".

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Anvil International (Grinnell).

B. Carpenter & Patterson.

C. Lisega.

D. NPS Industries.

E. Piping Technology.

2.02 SYSTEM DESCRIPTION

A. Designing, furnishing, and installing supports for pipe and equipment furnished and/or installed by Contractor. Supports are defined as hangers, guides, rollers, slide supports, springs, anchors or other devices used to restrain movement and provide support to pipe or equipment. The following definitions establish Contractor design responsibilities in addition to definitions of information and materials in MSS SP90. Design categories of pipe supports are defined as follows:
1. Random supports: Defined as supports in which design of randomly selected representative supports establishes criteria for and selection of pipe support components for a group of similar supports. Supports may be field-fabricated from stock materials.

B. Designing, furnishing, and installing following related items:
1. Supplementary support steel framing as required for support of pipe and equipment. Supplementary steel is defined as all steel necessary to support pipe and equipment in addition to existing steel.
2. Localized stiffening of support steel at pipe and equipment support connections.
3. *Stiffening of existing structural steel for pipe and equipment loads as required from adequacy check analysis for additional loads from Contractor furnished pipe and equipment.

2.03 PIPE AND EQUIPMENT SUPPORTS

A. Materials and manufacture: MSS SP-58 and ASME B31.1.

B. Supports and accessory items shall have manufacturer's standard shop-applied primer and standard finish coat, unless specified otherwise.

C. Provide insulation protection shields of sufficient size and gage to prevent crushing of insulation at supports.

D. Supports for pipe designed to receive anti-sweat insulation shall be sized to allow insulation to be continuous through support. Provide insulation saddles sized to prevent insulation damage at each support.

PART 3 EXECUTION

3.01 PIPING SUPPORTS

A. Fabrication and installation: MSS SP-89.

B. Locate top hanger attachment to allow support assembly to hang plumb in hot position at normal operating temperatures.

3.02 ADJUSTMENTS

A. After hydrostatic testing of pipe, adjust supports to appropriate cold settings.

B. Modify or replace supports or hangers that cannot be properly adjusted for full range of conditions.

END OF SECTION

1) C.H. Kim
2) N.E. Casalino

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Perform insulating and jacketing, including, but not limited to:
   1. Piping systems indicated on Drawings.

1.02 SUBMITTALS

A. Schedule for insulating materials, including adhesives, fastening methods, and fitting materials, and intended use. Include catalog sheets indicating density, thermal characteristics, jacket, installation instructions.

1.03 QUALITY ASSURANCE

A. Products shall conform to NFPA 90A and 90B with special regard to fire hazard classification requirements of NFPA 255, including vapor barriers and adhesives.

B. Products shall possess a flame spread rating of not over 25 without evidence of continued progressive combustion and a smoke developed rating no higher than 50.

C. Materials shall be asbestos-free.

1.04 JOB CONDITIONS

A. Perform Work at ambient and equipment temperatures as recommended by adhesive manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver material to job site in original, unbroken factory packaging, labeled with manufacturer's density and thickness.

PART 2 PRODUCTS

2.01 ADHESIVES AND COATINGS

A. Compatible to mechanical surfaces, insulations, and jackets to which they are applied in both wet and dry state.

B. Fire-retardant, moisture-resistant, mildew-resistant and verminproof.

C. Suitable for temperature of systems to which they are applied.

D. Wire mesh reinforcing: 22-gage, 1" galvanized.

E. Glass fabric reinforcing: Owens-Corning Cloth No. 10, or equal.

F. Insulation bonding adhesive to metal surfaces: Benjamin Foster No. 85-20, or equal.

G. Coating and vapor barrier treatment: Benjamin Foster No. 30-35, or equal.

H. Lap adhesives: Benjamin Foster No. 85-20, or equal.

I. Lagging adhesives: Benjamin Foster No. 30-36, or equal.

2.02 JACKETS

A. Puncture resistance rating based on ASTM D781 test method.

B. Permeance ratings based on ASTM E96, Procedure A.

C. Type P-1 jacket:
1. Material: Heavy-duty, fire-retardant, glass fiber reinforced material with self-sealing lap.
2. Factory applied to insulation.
3. Finish: White vinyl or white kraft suitable for painting.
4. Bench puncture resistance: 50 units minimum.
5. Permeance: 0.02 perms, maximum.
6. Vapor barrier: 0.001" aluminum foil adhered to inner surface of jacket.
7. Manufacturer: Owens-Corning Type ASJ, or equal.

D. Banding:
1. Over aluminum jacketing with insulation less than 13" diameter: Stainless steel, 1/2" x 0.020"; A. J. Gerrard & Co., No. 305-SS with No. 202-SS seals.
2. Over aluminum jacketing with insulation larger than 13", but less than 6'-0" in diameter: Stainless steel, 3/4" x 0.020"; A. J. Gerrard & Co., No. 311-SS with No. 204-SS seals.
3. Over aluminum jacketing with insulation larger than 6'-0" diameter: Stainless steel, 3/4" x 0.022" Expand-R-Strap"; A. J. Gerrard & Co.
4. Maximum spacing 12" oc.

2.03 INSULATION

A. Insulating materials: Fire-retardant, moisture- and mildew-resistant, and verminproof. Insulation shall be suitable to receive jackets, adhesives, and coatings as indicated.

B. Insulating cement: P. K. "Super Stick" or Ryder "G.P.," dry density 34 lb/cu ft, thermal conductivity 0.91 Btu-in/hr-sq ftºF at 400ºF.

C. Filling and finishing cement: P. K. "Quick Cote" or Ryder "MW," dry density 40 lb/cu ft, thermal conductivity 0.89 Btu-in/hr-sq ft-ºF at 400ºF.

D. Type BS-2 rigid fiberglass insulation:
1. Temperature rating: -20 to 850ºF only for pipe insulation.
2. Density: 3 lb/cu ft.
3. Conductivity: Not more than 0.22 Btu-in/hr-sq ft-ºF at 75ºF.
4. Manufacturer: Owens-Corning Fiberglas 25, or equal.

E. Type BS-3 calcium silicate pipe or block insulation:
1. ASTM C533, Type 1
2. Temperature rating: 1,200ºF (650°C).
3. Density: 14.5 lb/cu ft (232 kg/cu meter).
4. Conductivity: Not more than 0.50 Btu-in/hr-sq ft-ºF (0.07 W/m-K) at 400ºF (200°C).
5. Manufacturer: Johns-Manville Thermo-12 Gold, or equal.

PART 3 EXECUTION

3.01 PREPARATION

A. Do not install covering before piping and equipment has been tested.

B. Verify surface is clean and dry prior to installation. Verify insulation is dry before and during application. Finish with systems at operating conditions.

3.02 INSTALLATION - GENERAL

A. Verify insulation is continuous through inside walls. Pack around pipes and fireproof self-supporting insulation material, fully seal.

B. Insulate fittings and valves. Do not insulate unions, flanges necessary for maintenance of equipment, strainers, flexible connections, and expansion joints. Terminate insulation neatly with plastic material troweled on bevel.

C. Finish insulation neatly at hangers, supports, and other protrusions.

D. Locate insulation or cover seams in least visible locations.

E. Insulating materials shall be installed with necessary joints and terminations, to permit easy access and removal of equipment sections where inspection or frequent service or repair is required, and to allow for expansion.

F. Following systems shall be insulated for complete vapor barrier protection:
   1. Make-up water piping.

3.03 INSTALLATION - GLASS COVERING

A. Fit glass without unnecessary wrinkles or seams.

B. Size glass immediately upon application with lagging adhesive.

C. Apply adhesive at no less than 1 gal/80 sq ft of surface.

D. Overlap seams not less than 2".

3.04 INSTALLATION - PIPING, VALVE, AND FITTING INSULATION

A. Apply insulation to piping with bonding adhesive, with butt joints and longitudinal seams closed tightly.

B. Laps on factory-applied jackets shall be 1-1/2" minimum width firmly cemented with lap adhesive, or be pressure sealing type lap.

C. Cover joints with factory furnished tape (2" minimum width) to match jacket, firmly cemented with lap adhesive.

D. Install factory-molded insulation for fittings as indicated for valve insulation.

E. For finishing of insulated pipe fittings, one piece PVC fitting covers may be used.

F. Taper terminations of pipe insulation ends.

G. Where thermal pipe shields are used at hanger locations, insulation shall extend to thermal shield. Where vapor barrier is required, Contractor shall be responsible for continuity of vapor barrier at thermal shield.

H. Where thermal pipe shields are not used at hangers for piping with vapor barrier, insulation shall be Type BS-3 to eliminate compression. Type BS-3 insulation shall extend for twice the length of metal shield.

I. Piping and fittings not to be insulated: Fire protection piping and fittings, sanitary waste, compressed air, natural gas, gasoline, fuel oil, vent, emergency generator radiator piping.

3.05 INSULATION THICKNESS SCHEDULE

A. Furnish and install insulation and jackets on piping, valves, and piping accessories where required. Thickness shall be in accordance with Mechanical Standard M-1008, or as noted below.

B. Piping insulation application schedule:

Service	Insulation	Jacket	Thickness
DA Make-up Water Piping	BS-2	P-1	---
Steam Piping	BS-2	P-1	---
Boiler Feedwater and Condensate Piping	BS-2	P-1	---

END OF SECTION

1) C.H. Kim
2)

MINIMUM NOMINAL INSULATION THICKNESS (INCHES) (NOTE 2)								
FLUID TEMPERATURE RANGES	**39°F & BELOW**	**40°F TO 60°F**	**61°F TO 104°F**	**105°F TO 140°F**	**141°F TO 200°F**	**201°F TO 250°F**	**251°F TO 350°F**	**351°F TO 400°F**
NOMINAL PIPE SIZE								
LESS THAN 1	0.5	0.5	0.5	0.5	1.0	1.5	1.5	2.5
1 - 1.25	1.0	0.5	0.5	0.5	1.0	1.5	2.5	3.0
1.5 - 3	1.0	1.0	1.0	1.0	1.0	2.0	3.0	3.0
4 - 6	1.0	1.0	1.0	1.0	1.5	2.0	3.0	4.0
8 & LARGER	1.5	1.0	1.0	1.0	1.5	2.0	3.0	4.0

NOTES:

1. INSULATION THICKNESSES ARE BASED ON ANSI/ASHRAE/IESNA STANDARD 90.1.
2. ON OUTDOOR EQUIPMENT AND PIPING, THE INSULATING THICKNESS SHOWN ABOVE SHALL BE INCREASED 0.5".
3. INSULATION THICKNESSES SHOWN ARE MINIMUM THICKNESSES AND DO NOT INCLUDE FINISHING OR SEALING COATS.
4. THE MINIMUM INSULATION THICKNESSES ARE BASED ON INSULATION WITHIN THE FOLLOWING CONDUCTIVITY RANGES.

CONDUCTIVITY MEAN RATING TEMPERATURE	100°F	125°F	150°F	200°F	250°F
CONDUCTIVITY (BTU-IN/HR FT-°F)	0.22 - 0.28	0.25 - 0.29	0.27 - 0.30	0.29 - 0.32	0.32 - 0.34

FOR INSULATION WITH CONDUCTIVITY VALUES OUTSIDE THE GIVEN RANGES, THE MINIMUM INSULATION THICKNESS SHALL BE ADJUSTED BASED ON THE FOLLOWING FORMULA.

$$T = r \cdot \left[\left(1 + \frac{t}{r} \right)^{\frac{K}{k}} - 1 \right]$$

WHERE:

T = MINIMUM INSULATION THICKNESS IN INCHES.
r = ACTUAL OUTSIDE PIPE RADIUS IN INCHES
t = MINIMUM THICKNESS FROM ABOVE TABLE.
K= CONDUCTIVITY OF ALTERNATE MATERIAL AT MEAN RATING TEMPERATURE INDICATED FOR THE APPLICABLE FLUID TEMPERATURE IN BTU-IN/HR FT-°F
k = THE UPPER VALUE OF THE CONDUCTIVITY RANGE LISTED IN THE ABOVE TABLE FOR THE APPLICABLE FLUID TEMPERATURE.

REVISIONS	DES	CHK	APP	DATE
3- GENERAL	TJL	JJB	MAE	7/13/2007
2- REV HEADING	JBP	SJS	SJS	10/6/1995
1- REVS & CADD	TRK	SJS	SJS	9/16/1994

Stanley Consultants INC.

MECHANICAL STANDARD

INSULATION

PIPING AND EQUIPMENT

INSULATION THICKNESS

SCALE: NONE

NO. **M-1008**

REV **3**

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures, general.

B. Final reports.

C. Contractor responsibilities.

D. Preparation.

E. Schedule of systems requiring testing, adjusting, and balancing services.

1.02 SUBMITTALS

A. Prior to start of Work, submit name of organization proposed to perform services. Designate managerial responsibilities for coordination of entire testing, adjusting, and balancing.

B. Submit documentation to confirm organization qualifications.

C. Submit 3 preliminary specimen copies of each of report forms proposed for use.

D. Fifteen days prior to Substantial Completion, submit 3 copies of final reports. Submit reports of testing, adjusting, and balancing which is postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.

E. Schedule of start-up to Engineer.

F. Contractor shall prepare instrument calibration reports in duplicate for each instrument and control loop. Include instrument calibration data and status of equipment. Note any deficiencies yet to be corrected on instruments that are suitable for operation (e.g.: broken lenses, faulty local indicators on transmitters that can still perform correct output transmission) Contractor shall correct these deficiencies at earliest possible date. Copies shall be submitted for Resident Project Representative's review. Each calibration report shall be signed by Contractor's representative witnessing test.
   1. Electrical systems test reports: Typewritten, listing equipment used, person or persons performing tests, date tested, circuits tested, and results of tests.

1.03 QUALITY ASSURANCE

A. Cooperate with testing organization.

B. Comply with procedural standards of certifying association under whose standards service will be performed.

C. Notify Engineer 3 days prior to beginning of operations.

D. Accurately record data for each step.

E. Comply with applicable procedures and standards of certification sponsoring association; either:
   1. "National Standards for Field Measurements and Instrumentation, Total Systems Balance, Air Distribution-Hydronics Systems," by AABC, or "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems," by NEBB.
   2. Perform services under direction of supervisor who is designated and qualified under certification requirements of sponsoring association.

3. Calibration and maintenance of instruments shall be in accordance with requirements of standards, and calibration histories for each instrument shall be available for examination.
4. Accuracy of measurements shall comply with requirements of standards.

F. Comply fully with procedural standards of certifying association under whose standards service will be performed.
1. Execute each step of prescribed testing, adjusting, and balancing procedures without omission.
2. Accurately record required data.

1.04 JOB CONDITIONS

A. Prior to start of testing, adjusting, and balancing, verify that required "job conditions" are met:
1. Systems installation is complete and in full operation.
2. Outside conditions are within reasonable range relative to design conditions.
3. Special equipment such as computers, laboratory equipment, and electronic equipment are in full operation.

B. Verify that requirements for preparation for testing and balancing have been met for elements of each of systems that require testing.

1.05 COORDINATION

A. Coordinate services with Work of various trades to ensure rapid completion of services.

B. Promptly report to Engineer any deficiencies noted during performance of services.

PART 2 PRODUCTS

2.01 SYSTEM REQUIREMENTS

A. Prepare each system for testing and balancing.

B. Cooperate with testing organization, provide access to equipment and systems. Operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.

C. Notify testing organization 7 days prior to time system will be ready for testing, adjusting, and balancing.

D. Perform specified services with Contractor's qualified personnel, or employ and pay for qualified organization to perform specified services.

E. Perform testing of control station equipment, balancing of distribution system, and adjustment of terminal devices for HVAC systems of Project.

F. Perform testing of hydronic systems, adjust and record liquid flow at each piece of equipment.

G. Provide instruments required for testing, adjusting, and balancing operations.
1. Make instruments available to Engineer to facilitate spot checks during testing.
2. Retain possession of instruments; remove from Site at completion of services.

H. Furnish material, tools, and labor required to perform start-up of each respective item of equipment, instrument and system:

I. Provide information and assistance required, cooperate with test, adjust, and balance services.

J. Comply strictly with specified manufacturer's or Engineer's procedures in starting up specified systems.

2.02 MATERIALS

A. Provide and maintain tools and test equipment in first-class condition and quantities sufficient to assure successful performance and completion of required Work.

B. Furnish and use materials in accordance with these Specifications. Materials shall be of first-class quality, free from defects or imperfections, of recent manufacture, unused and of classification and grade specified.

C. Test equipment shall have recent calibration checks by equipment manufacturer or authorized facility to assure accuracy of commissioning process.

D. Piping system joint leak testing compound: "Leak-Tek," or equal.

E. Anti-rust compound for packing gland threads and valve stems: "Moly-Cote" or "Fel-Pro."

PART 3 EXECUTION

3.01 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Engineer to facilitate spot checks during testing. Retain possession of instruments and remove at completion of services.

B. Verify installation of system to be tested is complete and in continuous operation.

C. Verify ambient conditions and related facilities are in full operation.

3.02 MECHANICAL SYSTEMS

A. Bearings:
1. Inspect for cleanliness; clean and remove foreign materials.
2. Verify alignment.
3. Replace defective bearings, and those that run roughly or noisily.
4. Grease as necessary, and in accordance with manufacturer's recommendations.

B. Drives:
1. Adjust tension in V-belt drives, and adjust varipitch sheaves and drives for proper equipment speed.
2. Adjust drives for alignment of sheaves and V-belts.
3. Clean; remove foreign materials before starting operation.

C. Motors:
1. Check each motor for amperage comparison to nameplate value.
2. Correct conditions which produce excessive current flow, and which exist due to equipment malfunction.

D. Pumps:
1. Check mechanical seals for cleanliness and adjustment before running pump.
2. Inspect shaft sleeves for scoring.
3. Inspect mechanical faces, chambers, and seal rings; replace if defective.
4. Verify that piping system is free of dirt and scale before circulating liquid through pump.
5. Check expansion joints for proper installation before running.
6. Check sealing fluid supply for flushed mechanical seals.
7. Check impeller for correct installation.

E. Piping systems:

1. Tighten flanges after system has been placed in operation. Replace flange gaskets which show any sign of leakage after tightening.
2. Inspect screwed joints for leakage.
   a. Promptly remake each joint that appears to be faulty; do not wait for rust to form.
   b. Clean threads on both parts, apply compound, and remake joints.
3. After system has been placed in operation, clean strainers, dirt pockets, orifices, valves seats, and headers in fluid systems, to assure they are free of foreign materials.
4. Open air vents; remove operating elements. Clean thoroughly, replace internal parts and put back into operation.
5. Remove any rust, scale, and foreign materials from equipment and renew defaced surfaces.
6. Repair damaged insulation.
7. Vent gasses trapped in any part of systems.
8. Check piping for leaks at every joint, and at every screwed, flanged, or welded connection.
9. Control valves:
   a. Inspect both hand and automatic control valves; clean bonnets and stems.
   b. Tighten packing glands to ensure no leakage, but permit valve stems to operate without galling.
   c. Replace packing in valves to retain maximum adjustment after system is judged complete.
   d. Replace packing on any valve that continues to leak.
   e. Remove and repair bonnets that leak.
   f. Coat packing gland threads and valve stems with surface preparation of anti-rust compound after cleaning.

3.03 ENVIRONMENTAL SYSTEMS

A. Perform testing of central station equipment, balancing of distribution systems, and adjusting of terminal devices for:
   1. Pumps.

B. Hydronic balancing:
   1. Make measurements in accordance with recognized procedures and practices of certifying association.
   2. Measure and adjust water flow for design conditions, within 10% over or under.
   3. Check conditions at heating coils for required performance at design conditions.
   4. Check conditions at primary source equipment for performance of design conditions.

3.04 INSTRUMENTATION SYSTEMS

A. Commission controls and instruments prior to start-up to assure in situ performance in accordance with specifications under simulated operating conditions. Contractor to determine initial start-up conditions.

B. Remove shipping stops from instruments before starting with procedures listed herein. Contractor shall have instruction manuals available, and shall install miscellaneous components such as charts, illumination, mercury, etc., which have been supplied separately but are integral parts of equipment.

C. If any doubt exists as to correct method for calibrating or checking calibration of instrument, manufacturer's printed recommendations shall be used.

D. Many instruments contain small supply pressure gages or output pressure gages. Calibration of these gages will not be required. However, if gage is found to be defective, instrument involved shall be immediately called to attention of Owner and reporting of its condition confirmed in writing.

E. If any instrument cannot be properly adjusted, it shall be immediately called to attention of Owner and report of its condition confirmed in writing.

F. Instrument check: Verify data on nameplate with respect to conditions of range, operating temperature, specific gravity, and components as stated on unit specifications. Any discrepancies shall be immediately called to attention of *Engineer* *Owner* and report of condition confirmed in writing.

G. Verify that control valve seats are free from foreign material, and are properly positioned for intended service.

H. Test procedures:
1. Check handswitches, pushbuttons, and pilot lights.
2. Check interlocking circuits installed for conformance to schematic diagrams and "Sequence of Operation."
3. Perform Work of placing in initial operation equipment installed or wired under this contract, following instructions and recommendations of equipment manufacturers.
   a. After energizing and prior to start-up, check control circuits *and programs* for proper sequence of operation and interlocking functions.
   b. Wiring changes required as result of such checks shall be properly identified by changing terminal strip and/or wiring markers.
4. Contractor shall provide necessary construction labor to make equipment final adjustments that are required to place systems in good operating condition, and furnish labor to assist in solving instrument or control problems.
5. Contractor shall calibrate instruments and components in accordance with manufacturer's calibration data over full operational range, prove instruments to be within published specification, accuracy, and affix calibration sticker. Instruments shall be calibrated individually and where applicable, as system *(i.e., control loop transmitter, controller, and valve).* Components which have adjustable features shall be carefully set for specific conditions and applications of this Project. Each calibration sticker shall be signed by Contractor's representative witnessing test.
6. Calibration sticker shall contain the following information: Equipment identification tag number, range of calibration, and date and name of person doing calibration.
7. Pressure gages: Shall be checked at 10%, 50%, and 90% of their ranges for linearity within Manufacturer's stated specifications.
8. Gages not meeting manufacturer's specifications shall be repaired or replaced.
9. Dial thermometers shall be checked at mid-range and ambient temperature. Thermometers not meeting manufacturer's specifications shall be repaired or replaced.
10. Temperature switches: Calibrate in accordance with manufacturer's specifications.
11. Valves and operations:
    a. Control valves: Operation of control valve shall be verified within limits of practicality. Particular attention must be given to manufacturer's instructions and applicable nameplate data in reference to valve spring scale and actuation conditions. Pay close attention to bench set.
    b. Valve action: Check valve action for conformance to specifications (open or closed on power failure).
    c. Valve positioner: Check for conformance to specifications relative to spring action and input range (particularly for split range applications), valve action, and length of stroke. If valve positioner is fitted with standard characterized cam, check to see if proper cam is mounted. If specifications call for specially cut cam, refer this item in writing to Engineer for handling. Do not cut or modify standard cam.
12. Panel-mounted instruments:
    a. Receiver instruments: Check zero and span at 10%, 50% and 90% of range by impressing measured signal into input or signal connections or instrument.
    b. Controllers:
       1) Controllers shall be checked for proper operation and adjusted in accordance with manufacturer's instructions. Vary process input signal and check output signal for direction.
       2) Set initial proportional band, reset rate, and rate time as recommended by Manufacturer. It may be necessary to determine process dynamics in actual operation before settings can be made.

3) Control loops shall be observed for operability and conformance to specifications by impressing simulated input signal at primary element and checking response of final control element.

c. Integrators, ratio relays, etc.: Check in conformance to manufacturer's recommendations. Receiver integrators can be calibrated for proper operation and multiplication factor by feeding maximum input signal (*15 psig,* *20 mA,* etc.) for specified period of time with stop watch. Check in conformance with manufacturer's recommendations. Ratio signals can be simulated to check proper ratio settings and output.

13. Controllers; field mounted: Simulate "Set Point" and "Measured Variable" signals at controller, with separate regulated signals. Check operation as in Item "11., b." preceding.
14. Acceptable calibration standards:
    a. Vacuum or draft:
        1) 0" to 5" w.c.: Inclined water filled manometer graduated in tenths and inches of water.
        2) 5" to 25" Hg: Mercury manometer graduated in inches of mercury.
        3) 5" to 60" H_20: Water manometer graduated in inches of water.
    b. Pressure:
        1) 0" to 5" w.c.: Inclined water filled manometer graduated in tenths and inches of water.
        2) 5" to 60" w.c.: Water manometer graduated in inches of water.
        3) 3 to 25 psig: Mercury manometer graduated in psi.
        4) 25 to 150 psig: Precision pressure gage, 0-160 psi, 1/4 of 1% accuracy, 8-1/2" dial minimum.
        5) 150 to 750 psig: Precision pressure gage, 0-800 psi, 1/2 of 1% accuracy, 8-1/2" dial minimum.
        6) 750 to 2,750 psig: Precision pressure gage, 0-3,000 psi, 1/2 of 1% accuracy, 8-1/2" dial minimum.
    c. Differential:
        1) 0" to 5" w.c.: Inclined water filled manometer graduated in tenths and inches of water.
        2) 5" to 300" w.c.: Mercury manometer graduated in inches of water.
        3) 5 to 25 psig: Mercury manometer graduated in psi.
        4) Above 25 psig: Use pressure gages listed hereinbefore.
    d. Temperatures:
        1) -20 to 250ºF: Laboratory thermometers of suitable range.
        2) Other ranges: Use thermocouple and precision potentiometer.
    e. Others:
        1) Precision millivolt potentiometer: Portable.
        2) Rotameter: Range, 6.5 to 65 cu cm/min of air.
        3) Equipment as specified by manufacturer's instructions.
        4) Wallace & Tiernan or Mansfield-Green pneumatic calibrator; range, vacuum to +24 psi: For vacuum, pressure, or differential.

END OF SECTION

1) C.H. Kim
2)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plumbing and HVAC system pumps, except where provided as integral part of manufactured piece of equipment, including:
   1. Steam condensate.
   2. Boiler feed.

1.02 SUBMITTALS

A. Shop Drawings including:
   1. Pump curves.
   2. Materials of construction.
   3. Schedule of pumps.
   4. Performance characteristics.
   5. Data concerning physical dimensions.
   6. Motor drive assemblies.
   7. Bearings.
   8. Seals.
   9. Impellers capacities.
   10. Weights.
   11. Ratings.

PART 2 PRODUCTS

2.01 DESIGN REQUIREMENTS

A. Statically and dynamically balance rotating parts.

B. Construction shall permit complete servicing without breaking piping or motor connections.

C. Pumps shall operate at 3,600 rpm.

D. Pump connections:
   1. 2-1/2" or larger: Flanged.

E. Heating pumps shall be suitable for handling fluids at:
   1. Boiler Feed: 218ºF.
   2. Condensate: 190ºF

2.02 BOILER FEEDWATER PUMPS

A. Type: Centrifugal, end suction, top discharge, single-stage, direct-connected.

B. Casing: 316 SS, end suction, rated for greater of 150 psi (1034 kPa) or 1.5 times actual working discharge pressure, renewable bronze wearing rings.

C. Impeller: 316 SS, fully enclosed, keyed to shaft.

D. Shaft: High grade stainless steel with stainless steel shaft sleeves.

E. Bearings:
   1. 15 hp - 500 hp: Ball bearing grease-lubricated.
   2. Oil seal and integral dirt and water seal at each end of reservoir.

F. Drive: Flexible coupling with coupling guard.

G. Seals: Carbon rotating against a stationary ceramic seat.

H. Baseplate: High grade heat treated cast iron or reinforced heavy steel with integral drain rim grout base.

I. Manufacturer: Flowserve, Aurora Pump, Bell & Gossett ITT, Peerless Pump, Pacific, Thrush-Amtrol, Armstrong, or approved equal.

2.03 CONDENSATE TRANSFER PUMPS

A. Type: Centrifugal, end suction, top discharge, single-stage, direct-connected.

B. Casing: Ductile cast iron, end suction, rated for greater of 150 psi (1034 kPa) or 1.25 times actual working discharge pressure, renewable bronze wearing rings.

C. Impeller: Ductile cast iron, fully enclosed, keyed to shaft.

D. Shaft: High grade alloy steel.

E. Bearings:
1. 1/2 hp - 15 hp: Ball bearing grease-lubricated.
2. Oil seal and integral dirt and water seal at each end of reservoir.

F. Drive: Flexible coupling with coupling guard.

G. Seals: Carbon rotating against a stationary ceramic seat.

H. Baseplate: High grade heat treated cast iron or reinforced heavy steel with integral drain rim grout base.

I. Manufacturer: Flowserve, Aurora Pump, Bell & Gossett ITT, Peerless Pump, Pacific, Thrush-Amtrol, Armstrong, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Set base-mounted pumps on concrete bases as shown on drawings, level and bolt down prior to filling entire base with nonshrinking grout.

B. Align base-mounted pumps after mounting and grouting. Maximum allowable misalignment between pump and motor not to exceed 0.004" in both axial and angular planes. Pin with minimum of 3 taper pins to base for each pump and motor.

C. Where pump connections and line sizes do not match, provide concentric reducers/increasers at pump connections in vertical and eccentric connections in horizontal.

D. Valves and piping specialties shall be full line size not pump inlet or outlet size.

E. Install minimum 5 pipe diameters straight run of pipe to suction side of pump. Pump suction diffuser may be used instead of straight pipe requirement.

F. Provide air cock and drain connection on horizontal pump casings.

G. Decrease from line size with eccentric reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4" and over.

H. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are nonoverloading in parallel or individual operation; operate within 25% of midpoint of published maximum efficiency curve.

I. Qualified millwright shall check, align, and certify base mounted pumps prior to startup.

J. Access: Provide access space around pumps for service indicated, but in no case less than that recommended by manufacturer.

K. Support:
   1. Install base-mounted pumps on concrete base as shown on drawngs, with anchor bolts poured in place, and extending 6" beyond equipment in all directions.
   2. Set and level pump, grout under pump base with nonshrink grout.

3.02 ELECTRICAL WIRING

A. Install electrical devices furnished by manufacturer but not specified to be factory-mounted.

B. Furnish copy of manufacturer's wiring diagram submittal to Division 26 installer.

C. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26.

D. Do not proceed with equipment start-up until wiring installation is acceptable.

E. Responsibility: Section providing equipment.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of pumps, and after motors have been energized with normal power source, bleed air from pump casings and test pumps to demonstrate compliance with specifications.

B. Where possible, field correct malfunctioning unit, then retest to demonstrate compliance.

C. Replace units which cannot be satisfactorily corrected.

D. Alignment: Inspect alignment, and realign shafts of motors and pumps within recommended tolerances by manufacturer, and in presence of manufacturer's service representative.

E. Start-up:
   1. Lubricate pumps before start-up.
   2. Start-up in accordance with manufacturer's instructions.
   3. Provide pump start-up in presence of manufacturer's service representative.

F. Cleaning:
   1. Clean factory-finished surfaces.
   2. Repair marred or scratched surfaces with manufacturer's touch-up paint.

3.04 PUMP SCHEDULE

A. See schedules on Drawings.

END OF SECTION

1) C.H. Kim
2)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General electrical requirements for equipment and services including, but not limited to:
1. Factory wiring.
2. Low voltage field wiring.
3. Low voltage splices and terminations.
4. Low voltage cabinets and electrical enclosures.
5. Equipment safety grounding.
6. Low voltage fuses and fuse blocks.
7. Electrical meters.
8. Control relays and switches.
9. Pushbuttons.
10. Indicating lights.
11. Alarm and trip contacts.
12. Low voltage starters.
13. Low voltage circuit breakers and disconnect switches.
14. Outlet, pull, and junction boxes.
15. Plates and covers.
16. Wiring devices,
17. Panelboards.
18. Welding.
19. Shop finish.
20. Rust-inhibiting compounds.
21. Galvanizing.
22. Packaging, identification, and tagging.
23. Nameplates.
24. Trip setting coordination.
25. Grounding and bonding.
26. Fireproofing and fire ratings.
27. Testing and demonstration.

1.02 RELATED REQUIREMENTS

A. Section 02 41 00 –Demolition: Demolition of electrical items.

1.03 INFORMATIONAL SUBMITTALS

A. Product Data:
1. List of proposed material identifying manufacturer, type and model number for equipment to be provided for complete job.
2. Manufacturer’s catalog sheets marked to indicate specific type, model or catalog number of equipment to be provided.
3. Equipment drawings, elementary diagrams, schematics, wiring, performance curves, instruction manuals, and all other documentation necessary for complete description of material being supplied and as required to support installation, commissioning and maintenance of equipment. Manufacturer's standard connection diagram or schematic showing more than one scheme of connection will not be accepted.
4. Manufacturer’s technical descriptions, product data sheets, and applicable manuals for use in protective device system coordination including:
   a. Fuse manufacturer, type, ratings, and protection curves.
   b. Circuit breaker manufacturer, type, trip setting ranges, and protection curves.
   c. Relay trip device ranges, curves, and setting manuals.
   d. Transformer damage curves.
   e. CT ratios and saturation curves.

f. VT ratings.

5. List of recommended spare parts required for equipment start-up, commissioning and operation.
6. List of special maintenance tools required for installation and operation of equipment.
7. If necessary, provide additional data to clearly demonstrate that proposed alternate equipment meets or exceeds equipment as specified.
8. When requested by Engineer, submit system information, including but not limited to, utility feeders, existing relays, circuit breakers, fuses, and transformers.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance manuals. Provide at minimum:
1. Itemized equipment list.
2. General description and technical data.
3. Receiving, storage, installation, and testing instructions.
4. Operating and maintenance procedures.
5. Complete set of final drawings requiring no further action.
6. Complete documentation of inspections and tests performed, including logs, curves, and certificates. Documentation shall note any replacement of equipment or components that failed during testing.
7. Spare parts list.
8. Lubrication recommendations.
9. Warranty information.

1.05 MAINTENANCE MATERIALS

A. Extra materials: Provide touchup paint in same type and color to repair at least 25% of finish-painted equipment surface. Paint shall be sufficient to perform touch-up painting in accordance with shop-applied material instructions for repair painting.

B. Each piece of equipment shall be furnished with special tools as required for installation, maintenance, and dismantling of equipment.
1. Furnish in quantities as necessary to complete work on schedule.
2. Tools shall be new and shall become property of Owner.
3. Tools and intended use shall be identified in assembly instructions. Tools shall only be used for their intended purpose.

1.06 QUALITY ASSURANCE

A. Manufacturer qualifications:
1. Manufacturer of equipment specified shall be recognized in industry for normally supplying this type of equipment.
2. Manufacturer shall be ISO certified.
3. When requested by Engineer, provide list of similar equipment installations that have employed identical equipment from manufacturer.

B. Installer qualifications:
1. Installer shall be skilled in trade and shall have thorough knowledge of products and equipment specified.
2. Cutting, drilling, trenching, or channeling necessary to properly install equipment shall be performed by competent skilled crafts people in safe, professional manner.

C. Regulatory requirements: Perform electrical construction in accordance with NEC, local and state codes as applicable to job site.

D. Materials and equipment furnished for permanent installation shall be new, unused, and undamaged.

E. Asbestos not allowed.

F. Parts shall be manufactured to American industry standard sizes and gages to facilitate maintenance and interchangeability. Metric sized components not allowed unless specifically requested and approved.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Pack, ship, handle, and store in accordance with manufacturer's requirements.

B. Ship equipment completely factory assembled unless physical size, arrangement, configuration, or shipping and handling limitations make this impracticable. Shipping splits and required field assembly shall be identified with equipment submittals.

C. Costs associated with sections, accessories, or appurtenances requiring field assembly shall be Contractor's responsibility.

D. Separately packaged parts and accessories shall be consolidated and shipped together with equipment. Mark each container clearly to identify contents and as belonging with main equipment.
   1. Provide individual weatherproof itemized packing slips attached to outside of each container for contents included. Provide duplicate inside each container.
   2. Attach master packing list, covering accessory items for equipment, to main piece of equipment.
   3. Mark each container with project identification number for equipment and container number followed by total number of containers.

E. Equipment shall be suitably protected during shipment, handling, and storage. Damage incurred during shipment shall be repaired at not cost to Owner.

F. Protect coated surfaces against impact, abrasion, and discoloration.

G. Electrical equipment and insulation systems shall be protected against ingress of moisture. Use space heaters if necessary to protect against moisture.

H. Exposed threads shall be greased and protected.

I. Pipe, tube, and conduit connections shall be closed with rough usage plugs. Seal and tape open ends of piping, tubing, and conduit.

J. Equipment openings shall have covers, and taped to seal equipment.

K. Store materials in clean, dry place. Protect from weather, dirt, water, construction debris, and physical damage in accordance with manufacturer's instructions.

1.08 SCHEDULING

A. Coordinate with Owner early and late shipping and delivery schedules for items requiring storage and handling at Site.

1.09 WARRANTY

A. Electrical equipment shall be provided with manufacturer's standard warranty, but not less than 1 year.

PART 2 PRODUCTS

2.01 DESIGN CRITERIA

A. Service conditions: Provide equipment and material suitable for intended service and installation at location indicated.

B. Low-voltage auxiliary and control power.
   1. Electrical power for ac control and instrumentation equipment:
      a. Provide devices necessary for proper operation and protection of equipment during electrical power supply and ambient temperature fluctuations specified.
      b. Design for continuous operation at any voltage from 85% to 110% of nominal voltage. Dropout voltage shall be 60% of nominal for relays and 75% for contactors and starters.
   2. Electrical power for dc devices:
      a. Design for continuous operation on ungrounded station battery system, capable of maintaining operation at any voltage from 80% to 112% of nominal voltage.
      b. Electrical devices served shall not impose ground connection on supply.

C. Auxiliary power: Design auxiliary equipment for low voltage service, with electrical power designed to operate from one of nominal electrical power sources as follows and as indicated on Drawings:

Volts	Phase	Frequency
208Y/120	3 or 1	60
120/240	3 or 1	60

2.02 FACTORY WIRING

A. Select cable for electrical and environmental conditions of installation, and suitable for unusual service conditions where encountered.
   1. Proper temperature application cable shall be used throughout, but shall be not less than 90ºC rated.
   2. Conductors routed over hinges shall use extra-flexible stranding.
   3. Cable insulation shall be rated for maximum service voltage used, but not less than 600 volts.
   4. Splices not allowed.

B. Panel, control cabinet, switchboard, motor control center, and switchgear wiring shall use flame retardant cross-linked polyethylene (XLP) or flame retardant ethylene-propylene rubber (EPR) insulation that meet or exceed requirements of UL 44 for Types SIS, and XHHW.
   1. Minimum size: No. 14 AWG (1.5 mm^2).
   2. Conductors: Annealed bare copper Class B stranding passing IEEE 1202 and UL VW-1 flame test.

C. Instrumentation, thermocouple, and thermocouple extension wire shall use twisted shielded pairs/triads having flame retardant cross-linked polyethylene (XLPE) insulation, and chlorinated polyethylene (CPE) jacket.
   1. Minimum size: No. 16 AWG (1.0 mm^2).
   2. Conductor type:
      a. Instrument: Annealed copper Class B stranding.
      b. Thermocouple: Solid alloy, ANSI MC 96.1.
   3. Provide each pair/triad with shield.
   4. Shielding shall consist of aluminum-polyester tape and flexible strand tin-coated No.18 AWG (0.75 mm^2) copper drain wire.
   5. Drain wire for each instrument cable shall be insulated with spaghetti sleeve. One end of shield wire shall be terminated on grounded terminal.
   6. Cables shall pass IEEE 1202 and ICEA 70,000 Btu/Hr vertical tray flame test, and each conductor shall pass UL VW-1 flame test.

D. Terminations:
   1. Conductor terminal connectors shall be insulated, ring tongue, compression type connectors properly sized for conductor and terminal.
      a. Connectors shall be constructed of copper and shall be tin-plated.
      b. Interior surface of connector wire barrel shall be serrated; exterior surface of connector wire barrel shall be furnished with crimp guides.
   2. Noninsulated terminal connectors shall be used for conductors terminated on devices equipped with individual fitted covers, such as, but not limited to, control switches and lockout relays.

3. Connections requiring disconnect plug and receptacle type devices shall be provided with factory-terminated conductors on each plug and receptacle.
   a. Plugs and receptacles shall be factory wired into junction boxes containing terminal blocks for external connections.
   b. Conductors on disconnect portion of plug-receptacle assemblies shall be in common jacket.
4. Prior to shipment of equipment, remove temporary wiring installed in factory for equipment testing.
5. Current transformers shall terminate on shorting type terminal blocks. Ship with shorting jumpers installed.

E. Identification and labeling:
1. Provide conductor identification sleeve on each end of each internal conductor. Mark each sleeve with opposite end destination identification with nonsmudging, permanent black ink. Sleeves shall be UV-resistant self-adhesive type or PVC, not less than 1/2" long.
2. Permanently label each terminal block, terminal, conductor, relay, breaker, fuse block, and other auxiliary devices to coincide with identification indicated on manufacturer's drawings.

2.03 FIELD WIRING

A. Nationally or internationally recognized cable manufacturer shall produce cable provided.
1. Metal-clad cable, NEC Type MC, may not be substituted in place of cable and conduit unless specified otherwise, or unless approved in writing.
2. Comply with code and Project requirements directly associated with use of each cable type.

B. Cables specified are for voltages 600 volts and below.

C. Wiring shall be bare copper with not less then 98% conductivity, unless specified otherwise.

D. General-purpose building conductor used on interior lighting circuits and general-purpose branch circuits routed entirely in conduit shall be single conductor.
1. Voltage rating: 600-volt.
2. Conductor: Class B, solid or stranded, annealed, uncoated copper, minimum size No. 12 AWG ($4.0mm^2$).
3. Insulation: PVC complying with physical and electrical requirements of UL for type THHN/THWN.
4. Jacket: Overall clear nylon jacket applied over conductor insulation, UL-listed as gasoline and oil resistant.
5. Provide conductor sizes No. 8 AWG and smaller in colors to match wire color-codes. Sizes No. 6 AWG and larger shall be color-coded with field-applied tape.
6. Rated continuous operating temperature shall be 90ºC in wet and dry locations for operation at maximum 75ºC.

E. Single-conductor, low-voltage power cable for motors, feeders, branch circuits, and dc circuits routed in conduit, duct bank, or cable tray:
1. Voltage rating: 600-volt.
2. Conductor: Annealed, bare copper, Class B, stranded, minimum size No. 12 AWG ($4.0mm^2$).
3. Insulation: Ethylene propylene rubber (EPR), complying with physical and electrical requirements for NEC Type RHH or RHW-2.
4. Jacket: Flame-retardant, heat, moisture, and sunlight resistant; cross-linked low-smoke, nonhalogen polyolefin (XLPO).
5. Conductor sizes No. 8 AWG and smaller shall be provided in colors to match wire color-codes. Sizes No. 6 AWG and larger may be color-coded with field applied tape.
6. Wire shall be identified by surface marking indicating manufacturer, conductor size, conductor material, voltage rating, UL symbol, and listed type.
7. Cables smaller than No. 1/0 AWG ($50\ mm^2$) shall be routed entirely in conduit and duct bank in. Sizes No. 1/0 AWG ($50\ mm^2$) and larger may be routed in cable tray, if so rated.
8. Conductors shall pass IEEE 1202 70,000 Btu/hr, and ICEA T-29-520, 210,000 Btu/hr vertical tray flame tests, and UL VW-1 vertical flame test.
9. Temperature rating shall be 90° C for normal operation in wet or dry locations.

F. Multiconductor, low-voltage power cables for motors, feeders, and branch circuits routed in cable tray, conduit or duct bank:
   1. Voltage rating: 600-volt.
   2. Conductors: Annealed, bare copper, Class B, stranded, minimum size No. 12 AWG (4.0mm^2).
   3. Insulation: Flame-retardant, cross-linked polyethylene (XLPE) or cross-linked polyolefin (XLPO), complying with physical and electrical requirements for NEC Type XHHW-2.
   4. Jacket: Flame-retardant, heat, moisture, and sunlight-resistant; cross-linked, low-smoke, nonhalogen polyolefin (XLPO).
   5. Phase conductors shall be cabled together with Class B stranded, uncoated copper grounding conductor and fillers. Ground wire size shall comply with requirements of UL 1277.
   6. Cover cable assembly with helically applied polyester binder tape with minimum 10% overlap.
   7. Marking: Insulated phase conductors shall be black and shall have printed numbers in accordance with ICEA Method 4. Each cable shall be identified by means of surface ink printing indicating manufacturer, number of conductors, size, metal, voltage rating, and UL listing as suitable for cable tray use.
   8. Cables shall pass IEEE 1202 70,000 Btu/hr, and ICEA T-29-520, 210,000 Btu/hr vertical tray flame tests, and individual conductors UL VW-1 vertical flame test.
   9. Conductors shall be temperature rated for 90°C maximum continuous operating temperature in wet or dry locations.

G. Multiconductor, low-voltage power cables for motors fed from adjustable speed drives, any installation.
   1. Voltage rating: 600-volt.
   2. Conductors: Annealed, bare copper, Class B, stranded, minimum size No. 10 AWG (4.0mm^2)
   3. Insulation: Flame-retardant, cross-linked polyethylene (XLPE) complying with physical and electrical requirements for NEC Type XHHW-2.
   4. Jacket: Flame-retardant, polyvinyl chloride (PVC).
   5. Armor/shield: Continuously welded and corrugated high conductivity aluminum.
   6. Ground conductors: 3 segmented Class B strand, annealed copper conductors sized to meet requirements of UL 1569.
   7. Marking: Insulated phase conductors shall be black and shall have printed numbers in accordance with ICEA Method 4. Each cable shall be identified by means of surface ink printing indicating manufacturer, number of conductors, size, metal, voltage rating, and UL listing.
   8. Cables shall pass IEEE 1202 70,000 Btu/hr, and ICEA T-29-520, 210,000 Btu/hr vertical tray flame tests, and individual conductors UL-approved and marked with FT-4 designation.
   9. Rated for Class 1, Div 1 hazardous locations.
   10. Conductors shall be temperature rated for 90°C maximum continuous operating temperature in wet or dry locations.

H. Instrumentation cable installed indoor or outdoor routed in cable tray, conduit, and ducts:
   1. Voltage rating: 600-volt.
   2. Conductors: Annealed, bare copper, Class B, stranded, minimum size No. 16 AWG (1.0 mm^2).
   3. Insulation: Flame-retardant, cross-linked polyethylene (XLPE) or cross-linked polyolefin (XLPO).
   4. Jacket: Flame-retardant, heat, moisture, and sunlight resistant; cross-linked, low-smoke, nonhalogen polyolefin (XLPO).
   5. Pairs/triads: Each twisted with lay not exceeding 2" (50 mm).
   6. Color code: Pairs black/white, Triads black/white/red.
   7. Assembly:
      a. Each pair or triad shall be cabled together with aluminum/polyester tape shield helically wrapped with minimum lap of 15% of tape width and isolation tape. Entire cable assembly shall have overall aluminum/polyester tape shield helically wrapped.
      b. Flexible strand tin-coated No.18 AWG (0.75 mm^2) copper drain wire shall be helically wound between twisted conductors and tape shield.
   8. Each instrumentation cable shall be identified by means of surface ink printing indicating manufacturer, conductor size, and quantity, UL listing.
   9. Cables shall pass IEEE 1202 70,000 Btu/hr, and ICEA T-29-520, 210,000 Btu/hr vertical tray flame tests, and individual conductors UL VW-1 vertical flame test.
   10. Temperature rating shall be 90ºC maximum continuous operating temperature in wet or dry locations.

2.04 SPLICES AND TERMINATIONS

A. Splices, except as in lighting and general purpose power circuits specified below, not allowed unless specifically indicated on Drawings or required for connection to equipment.

B. Temperature rating of splices and terminations shall be rated no less than 75°C.

C. Splices allowed in lighting and general-purpose power circuits.
   1. Provide wire and cable connectors of high-conductivity, corrosion-resistant material with contact area equal to at least current carrying capacity of wire or cable.
   2. General lighting and general-purpose building power circuits:
      a. Twist-type, insulated spring connectors for splices on solid or stranded conductors smaller than No. 6 AWG.
      b. Use indent, hex screw, or bolt clamp-type connectors, with or without tongue for splices on solid or stranded conductors No. 6 AWG and larger.
      c. Apply insulating 600-volt tape.

D. Insulating tapes and compounds for terminations and splices shall be UL-listed for intended use, location, and voltage by manufacturer.

E. Termination of conductors to equipment with bolted connections:
   1. Use compression type lugs:
   2. Compression lugs for cables 250 kcmil and larger shall have at least 2 clamping elements of compression indents, and provision for at least 2 bolts for joining to apparatus terminals.
   3. Crimping hand tools used for securing conductors in compression type connectors or terminal lugs shall be made for purpose and conductor sizes involved.
   4. Crimping tools shall be ratchet-type preventing tool from opening until crimp action is completed.
   5. Tools shall be product approved by connector manufacturer.

F. Terminals:
   1. Conductors No. 10 AWG and smaller: Marathon 1500 Series.
   2. Conductors larger than No. 4/0 AWG: Terminate to tinned copper bus bar drilled and tapped with standard NEMA sized and spaced holes.

G. Coordinate sizes and types of conductor terminals for 600-volt power cable terminations in equipment with furnished conductor and terminal connector data.

H. Provide 600-volt rated terminal blocks for instrumentation and control conductors for connection to circuits external to specified equipment, and for internal circuits crossing shipping splits.
   1. Use crimp-on terminals matching termination point terminations in manufacturer-furnished panels. Splices not allowed.
   2. Terminal blocks for thermocouple extension wire: Buchanan “Medium Duty” with thermocouple contacts or Marathon 200 Series with Omega Engineering, Inc. Type TL terminal lugs.
   3. Furnish with white marking strips.
   4. Where permitted by safety codes and standards, provide without covers. Neither step-type terminal blocks nor angle mounting of terminal blocks allowed.
   5. Fuses may be mounted on terminal blocks.
   6. Maximum 2 conductors in accordance with termination point.

I. Terminal blocks for external connections shall leave from centrally mounted location, not from individual devices in enclosure.
   1. Group-in instrument and control compartment for easy accessibility.
   2. Provide sufficient space on each side of each terminal block to allow orderly arrangement of leads to be terminated on block.
   3. Locate auxiliary equipment in compartments, enclosures, or junction boxes so service personnel will have direct access without interference from structural members and instruments without removal of barriers, cover plates, or wiring.

4. Do not mount terminal blocks in compartments containing cables or buses operating at voltages above 600 volts.
5. Size for wire sizes of incoming conductors as necessary.

J. Install shorting-type terminal blocks nearest current transformer in accessible location for each set of CTs supplied with equipment furnished, no other shorting-type terminal blocks allowed, unless specified otherwise.

K. Install din-rail mounted miniature circuit breakers (MCB) for protection of VT circuits on line and load side. Breakers shall have alarm contacts wired to terminal blocks.

L. Terminate each conductor in multiconductor control cable or as shown on Drawings. Provide 10% spare terminals for circuit modifications.

M. Each control switch and lockout relay shall have minimum of 4 spare normally open and 4 spare normally closed contacts wired out to terminal blocks.

N. Circuit identification number listed on either circuit schedule or panel schedule shall be used to identify circuit, positioned as near as possible to end of each conductor on multiple single wire circuits and on cable jacket for multiconductor cables.

O. Cable designations shall be visible after installation without requiring physical movement of cable.

2.05 ELECTRICAL ENCLOSURES

A. Size junction boxes, pull boxes, and enclosures in accordance with requirements of NEC.

B. Junction boxes and pull boxes 4” (100 mm) trade size or smaller in any dimension shall be galvanized malleable iron, or cast ferrous metal NEMA rated for installed location. Do not use concentric knockouts.

C. Junction boxes, pull boxes, and electrical enclosures larger than 4” (100 mm) trade size in any dimension shall be as follows, unless required otherwise.
1. NEMA rating for electrical enclosures installed in nonhazardous locations:
   a. Indoor:
      1) Dry environmentally controlled area: NEMA 12.
      2) Noncorrosive wet or hose-down area: NEMA 4.
      3) Corrosive wet or hose-down area: NEMA 4X
   b. Outdoor:
      1) Corrosive area: NEMA 4X.
      2) Noncorrosive area hose-down or spray area: NEMA 4.
      3) Noncorrosive area nonhose-down area NEMA 3R.
2. Construct noncast-metal electrical enclosures from reinforced steel plate capable of supporting devices mounted on or within enclosure without deflection. Steel plate thickness shall conform to UL requirements.
3. Enclosures shall be of adequate strength to support mounted components during shipment and installation.
4. Conduit entrances shall be field drilled.

2.06 OUTLET BOXES

A. Outlet boxes for concealed wiring systems shall be sheet metal, galvanized or cadmium plated.

B. Boxes shall be minimum 4” (100 mm) square, 1-1/2” (38 mm) deep, sized to accommodate devices and number of conductors in accordance with NEC. Equip with plaster ring or cover as necessary for flush finish.

C. Exposed conduit systems shall have surface-mounted boxes unless specified otherwise. Boxes for exposed wiring in nonhazardous, noncorrosive, and nonweatherproof locations shall be malleable iron, cadmium finish or cast aluminum alloy, minimum 4” (100 mm) square, 1-1/2” (38 mm) deep.

D. Enclosures shall be as required for areas in which they are installed and as specified.
   1. Boxes shall be installed flush in masonry construction and be designed for intended use.
   2. Recessed boxes where fixture will be mounted shall be minimum 4” (100 mm) and octagonal in shape or 4” (100 mm) square by 1-1/2” (38 mm) deep with round plaster ring. Where used as junction box, boxes shall be minimum 4” (100 mm) square by 2-1/8” (53 mm) deep.
   3. Outlet boxes for wall concealed telephone and signaling systems shall be 4” (100 mm) square by 1-1/2”(38 mm) deep, minimum. Furnish with plaster ring and cover plate.
   4. Floor boxes for floor outlets shall be cast-metal with threaded conduit entrances, brass flange ring and brass duplex flap cover plate. Boxes shall be watertight and have leveling and adjustment screws for adjusting cover plate to finished floor. Boxes shall be minimum 4” (100 mm) diameter and 3-1/2” (88 mm) deep with approved gasket or seal between adjusting ring and box.
   5. Floor outlets for combination signaling, data, and power outlets shall be constructed of steel base, PVC housing, and steel bracket to allow feed through wiring as well as activation load-bearing support. Box construction shall meet UL 514A requirements.
      a. Entire housing shall be removable for unrestricted access.
      b. Once assembled, PVC housing shall be capable of carrying 6,000 lb (2722 kg) load.
      c. Coordinate outlet requirements with communication system requirements.
   6. Floor boxes in 2-hour rated floors shall be secured in cored hole and shall be UL classified and listed for 2-hour rated floors.

2.07 PULL AND JUNCTION BOXES

A. Furnish junction boxes and pull boxes were shown on Drawings, and where necessary to facilitate pulling wires and cables without damage.

B. Above ground boxes shall be formed from sheet steel, with corners folded in and securely welded with inward flange on each of 4 edges.

C. Drill box for mounting and attachment of cover; galvanize after fabrication.

D. Cover shall be made of one-piece galvanized steel and provided with stainless steel round head machine screws.

E. Box and cover shall be made of code gage steel, or heavier if shown on Drawings.

F. Boxes shall be minimum 4-1/2” (113 mm) deep. Size shall be in accordance with NEC. Use next larger standard size when necessary in accordance with manufacturer standard sizes.

G. Pull and junction boxes shall be furnished without knockouts for field drilling.

H. Enclosures shall be as required for areas in which installed and in accordance with requirements specified.

I. Underground boxes shall be specifically designed and constructed for intended installed location, and shall be either pre-formed concrete or PVC. Covers shall be capable of withstanding, without failure, type of traffic in general area.

J. If pull and junction boxes are exposed in and around architecturally finished surfaces, paint box to match finish of nearby surfaces, unless indicated otherwise.

K. Bolt-on junction box covers 3'-0" (900 mm) square or larger, or heavier than 25 lb. (11 kg) shall have permanent rigid handles. Covers larger than 3'-0" x 4’-0" (900 mm x 1200 mm) shall be split.

2.08 EQUIPMENT SAFETY GROUNDING

A. Install exposed raceway electrically continuous. Conduit and tray shall not be considered to be only ground conductor.

B. Furnish equipment that is part of integral shipping unit or assembly with bare copper ground conductor extending to central ground connection lug. Lug shall be suitable for field connection to local ground. Electrical equipment shall be considered any device that is energized.

C. Single-point ground connections required for proper operation of electronic equipment shall be insulated from equipment safety ground. Such connections shall be extended, using insulated cable, to single insolated termination point suitable for field connection to appropriate ground system.

D. Conduits that contain power circuits shall have ground conductor installed inside conduit. Ground conductor shall be bonded to equipment or tray or duct ground at both ends.

E. Provide ground bushing on each conduit containing power circuit. Connect ground bushings together inside enclosure and to enclosure ground lug or ground bus.
   1. Use No. 8 AWG conductor for ground bushings trade size 1-1/2” (38 mm) and smaller.
   2. Ground bushings larger than 1-1/2” (38 mm) shall be sized in accordance with requirements of NEC, but in no case shall they be smaller than No. 8 AWG.

F. Ground conductor: Uninsulated, Class B standard, round soft drawn uncoated copper as defined in ICEA S-19-81, unless specified otherwise.

G. Hardware: Clamps, bolts, washers, nuts, and other hardware used with grounding conductor shall be copper, copper alloy, high copper alloy, or silicon bronze.

2.09 PIN AND SOCKET CONNECTORS

A. Unless shown on Drawings, not allowed.

2.10 FUSES AND FUSE BLOCKS

A. Modular-type, Class H screw terminal fuse blocks with Bakelite frame and reinforced retaining clips. Blocks shall be similar in construction and by same manufacturer.

B. Slow blow fuses: Bussmann Type MDL or Gould Shawmut Type GDL with ampere ratings of 1/4, 1/2, 1, or 2.

C. Fast acting fuses: Bussmann Type NON or Gould Shawmut Type OT with ampere ratings of 1, 3, 6, 10, 15, 20, or 30.

D. Extremely fast acting fuses: Bussmann Type KAB with ampere ratings of 1, 3, 6, 10, 15, 20, or 30.

2.11 CONTROL RELAYS

A. General service, industrial grade auxiliary relays rated 600-volt.

B. Contacts shall be reversible from N.O. to N.C. in field.

C. Timing relays for critical service: Agastat Series 7000.

2.12 CONTROL SWITCHES

A. Multistage, rotary-type rated 120 volts ac or 125 volts dc, 3 amperes, as required.

B. Handles shall be black, fixed, modern, pistol grip type. Provide engraved black plastic escutcheon plates with targets.

C. Provide with colored LED lamps and nameplates as required.

2.13 PUSHBUTTONS

A. Standard pushbuttons shall be heavy, industrial-type rated 120 volts ac or 125 volts dc, 3 amperes, as required.

B. Provide with colored LED lamps and nameplates as required.

2.14 INDICATING LIGHTS

A. Status indicating lights shall be high-intensity, cluster, LED-type for panel mounting.

B. Coordinate indicating light colors with indicated conditions as follows. Indicating lights shall be energized when condition exists and shall be de-energized when condition does not exist:
1. Red: Equipment energized: such as motor running, valve open, or breaker closed.
2. Green: Equipment de-energized: such as motor stopped, valve closed, or breaker open.
3. Amber: Equipment abnormality: such as motor trip, breaker trip, or relay trip.
4. White: Monitoring of control power or trip coil: such as lockout relay trip coil monitor or breaker trip coil monitor. Light is on during normal circuit operation and off during loss of power or loss of coil.
5. Blue: Loss of control power.

2.15 ALARM AND TRIP CONTACTS

A. Alarm contacts for remote annunciation shall be suitable for operation at 120 volts ac and 125 volts dc. Contacts shall be rated at least 0.5-ampere make and break, minimum.

B. Alarm contacts shall be normally closed contacts that open to alarm condition.

C. Trip contacts for remote trip shall be suitable for operation at 125 volts dc and shall be rated 5 amperes make or break, minimum.

2.16 SEPARATELY MOUNTED COMBINATION MOTOR STARTERS

A. Enclosed, 3-phase, full-voltage, nonreversing, unless indicated otherwise.

B. Complete combination starter shall have minimum interrupting rating of 65 kA or greater if specified elsewhere or indicated on Drawings.

C. Starter enclosures shall have enclosure NEMA rating specified herein.

D. Provide combination starter with microprocessor-based contactor and integral electronic overload protection; minimum size shall be NEMA 1.

E. Each phase shall have microprocessor-monitored current sensor for motor running overload, phase loss and phase unbalance protection.
1. Provide Class II ground fault protection; set to 20% of maximum continuous ampere rating and have delay of 20 seconds and run delay of 1 second to prevent nuisance trip on start.
2. Single-speed starters shall be furnished with 3 current sensors. 2-speed starters shall be furnished with 6 current sensors.

F. Starters shall be furnished with motor circuit protectors (MCP) rated 600-volt.
1. Each breaker shall be manually operated with quick-make, quick-break, trip-free toggle mechanism.

2. Starters shall have external manual breaker-operating handle with provisions for up to 3 padlocks.
3. Access door shall be interlocked with motor circuit protector, so door cannot be opened while breaker is closed except by interlock override.
4. Starter contactor shall mechanically operate auxiliary contacts. Each starter shall include auxiliary contacts required for application, plus 2 spare NO and 1 spare NC contacts.
5. Provide membrane-style pushbutton control module and LED lights, if indicated on schematics, to control starter functions and indication. Pushbuttons and LEDs shall be clearly identified.
6. Verify and match control power transformers, overload protection, and sizes of starters to actual equipment furnished.
7. Size control power transformers (CPT) to supply control circuit and any additional loading simultaneously. Minimum CPT size shall be 100 volts-amperes for Size 1 starters and 150 volts-amperes for Size 2 and larger starters.
8. CPTs shall have primary leads protected, and one secondary lead protected and one secondary lead grounded. Provide DIN rail-mounted, miniature circuit breakers for protection. Fuses not allowed.
9. Starters for systems with system voltage of 120 volts or less shall not require CPT.
10. Two-speed starters and reversing starters shall be mechanically and electrically interlocked so only one set of contacts can be closed at any one time.

2.17 LOCAL SEPARATE MANUAL STARTERS

A. Separately enclosed manual starters, shall be provided with adjustable, bimetallic, Class 10 ambient-compensated, integral overload relay and fixed magnetic short-circuit trip mechanism designed to trip at 12 times maximum current rating.

B. Starters shall use high-conductivity copper for current carrying parts.

C. Size starters for motors served in accordance with NEC and manufacturer’s recommendations.

D. Mount manual starters in enclosures with NEMA rating for area as specified herein.

E. If applicable, starters shall be UL-listed and CSA-certified for group installations.

F. Accessories shall be available for auxiliary contacts, trip alarm, under-voltage release, and shunt trip for field installation.

G. Starters shall be pad-lockable with 3 padlocks in “On” and “Off” position.

2.18 LOCAL SEPARATE CIRCUIT BREAKERS

A. Provide 3-pole, molded-case, separately enclosed circuit breakers of not less than interrupting rating shown on Drawings at rated voltage.
   1. Provide with thermal and instantaneous trip elements.
   2. Breakers shall use high-conductivity copper for current carrying parts. Breaker enclosures shall have NEMA type enclosure as specified.

B. Each breaker shall be manually operated with quick-make, quick-break, and trip-free toggle mechanism. Thermal elements shall withstand sustained overloads and short-circuit currents without injury and without affecting calibration.

C. Circuit breakers shall have "On," "Off," and "Tripped" indication and shall be pad-lockable with 3 padlocks in “On” and “Off” position.
   1. Breakers rated over 70 amperes shall be rated 100% and have adjustable electronic trip units.
   2. Breakers shall be capable of adding alarm, lockout, shunt trip, and under-voltage as options.

2.19 LOCAL SEPARATE DISCONNECT SWITCHES

A. Three-pole, nonfusible, heavy-duty, rated 600-volt with continuous current rating as shown on Drawings and as required by load.
   1. Type: Either molded-case or blade.
   2. Switches shall use high-conductivity copper for current carrying parts.

B. Switches shall be positive, quick-make, and quick-break mechanisms.
   1. Switch assembly plus operating handle shall be integral part of enclosure base.
   2. Each switch shall have handle whose position is easily recognizable and which can be locked in “On” and "Off" position with 3 padlocks. "On" and "Off" positions shall be clearly marked.

C. Switches shall be UL-listed and horsepower rated. Where applicable, switches shall have defeatable door interlocks that prevent door from being opened while operating handle is in "On" position.

2.20 PLATES AND COVERS

A. Provide finish plates and covers of appropriate type and size for wiring and control devices, signal, and communication outlets.

B. Mark each plate and cover to show circuit and panel designation. Unless indicated to be engraved plate, use self-sticking, clear membrane, UV-resistant labels with typed black letters. Handwritten labels not allowed.

C. Coordinate color with adjacent surfaces.

D. Raised cover galvanized steel plates shall be acceptable for use on surface-mounted outlet boxes in unfinished areas where weatherproof plates are not required.

E. For weatherproof installations, cover plates shall be gasketed and rated for NEMA Type 4 installation.

F. Device plate mounting hardware shall be countersunk and finished to match plate.

2.21 WIRING DEVICES

A. Where more than one flush device is indicated in same location, mount devices in gangs under common plate.

B. Switches for control of ac lighting panel load circuits, single-pole, 3-way, and 4-way, shall be premium, heavy-duty specification-grade, and meet FS W-S-896E. Switches shall be rated for use at 120 or 277 volts and 20 amperes minimum.

C. Device color, if not shown on Drawings, shall be coordinated to match adjacent finishes.

D. Wall switches requiring pilot light indication shall have red LED pilot light when toggled “On.”

E. Pulse control of lighting contactors shall be 20 amperes, 120/277 volts, momentary, double-throw, and center "Off."

F. Standard convenience outlets: Premium, heavy-duty, specification-grade, duplex, 3-wire, grounding, 20-ampere, 125-volt for 120-volt circuits, and rated 250-volts for 240 or 208-volt circuits.

G. Ground fault circuit interrupter (GFI) receptacles: Duplex, 20-ampere, and 125 volts, feed-through type.

H. Isolated ground (IG) outlets: Duplex, 3-wire, with isolated grounding terminal, 20-ampere, and 125 volts. Outlets shall be orange in color, unless specified otherwise.

2.22 PANELBOARDS

A. Dead-front, circuit breaker type, rated for voltage, phase, with main lugs or main breaker as indicated on panel schedules.

B. Enclosure shall be NEMA-rated for installation location and capable of flush or surface mounting.

C. Enclosure cover and access door shall be hinged with breaker operating handles accessible through latchable and lockable door.

D. Typed panel directory located inside door shall have panel and circuits function clearly identified. Handwritten panel schedules not allowed.

E. Provide main and neutral buses insulated from cabinet with separate ground bus. Bus material shall be copper. Ground bus shall be similar to neutral bus in size and number of conductor terminating positions.
   1. Bond ground bus to panelboard enclosure by copper ground strap or copper conductor of appropriate size. Bond neutral bus to ground bus in accordance with requirements of NEC.
   2. Grounding bus connection to enclosure by removable screws not allowed.
   3. Bus shall be capable of terminating clamp type lugs for neutral cable in each supply conduit, and connections for neutral cable in each load circuit.
   4. Neutral bus shall be fully rated, unless specified otherwise.
   5. Isolated ground panelboards: As specified above, except isolated ground bus shall be bonded, by insulated ground conductor, back to source of separately derived system. Do not bond isolated ground bus to panelboard enclosure unless this is first point of grounding for separately derived system.

2.23 CIRCUIT BREAKERS

A. Molded-case, thermal-magnetic, bolt-in, individually front replaceable, and shall visibly indicate "On," "Off," and "Tripped" position.

B. Branch circuit breakers used for lighting circuits shall be switch duty rated, “SWD.”

C. Breakers having multiple poles shall be manufactured as common trip type.

D. Interrupting rating shall be not less than interrupting rating of panelboards, and not series rated to achieve required short circuit interrupting rating.

E. Provide handle clips for 10%, or minimum of 2 whichever is greater, for breakers to prevent casual operation. If no breakers are indicated for installation, then provide on breakers labeled as spare.

F. Breakers, and provisions for future breakers, shall be provided in quantities, poles, and ampere ratings shown on Drawings.

G. Molded-case circuit breakers used in ac and dc panelboards and ac load centers shall be bolt-on type, G-frame size.

2.24 FINISHES

A. Manufacturer’s standard coating systems shall be factory-applied. Coating systems shall provide resistance to corrosion caused by weather and industrial environments.
   1. Surfaces inaccessible after factory or field assembly shall be protected for life of equipment.
   2. Painted surfaces shall be filled to provide smooth, uniform base for painting.
   3. Surfaces requiring field welds shall not be coated within 3” (75 mm) of field weld.

B. Coating material and application techniques shall conform to regulations of air quality management agency having jurisdiction.

C. Exterior surfaces of control and electrical equipment, including panels, cabinets, switchgear, transformers, and motors shall be manufacturer's standard colors unless specified otherwise.

D. Apply high-temperature coating systems to uninsulated equipment operating at temperatures at or above 200°F (93°C).

2.25 RUST-INHIBITOR COMPOUNDS

A. Uncoated machined and ferrous surfaces subject to corrosion shall be protected with rust-inhibitor compounds.

B. Rust-inhibitor compounds used to protect surfaces of equipment and piping exposed to feedwater or steam shall be completely water-soluble.

C. Surfaces to be field welded shall be coated with consumable rust-inhibitor compounds that will not affect quality of weld.

D. External gasket surfaces, flange faces, couplings, rotating equipment shafts and bearings shall be thoroughly cleaned and coated with rust-inhibitor compounds.

2.26 GALVANIZING

A. Galvanized structural steel members and steel assemblies shall be pickled after fabrication. Remove scale, rust, grease, and other impurities, then hot-dip galvanized in accordance with ASTM.

B. If galvanized member is to be bolted, structural bolts shall be galvanized in accordance with ASTM.

2.27 IDENTIFICATION AND TAGGING

A. Conduits inside manholes, hand holes, building entrance pull boxes, and junction boxes shall be provided with 19-gage (1 mm) stainless steel identification tags, with 1/2" (13 mm) stamped letters and numbers.
   1. Attach conduit Identification tags with stainless steel banding. Tag position shall be readily visible for inspection.
   2. Tags shall provide, as minimum:
      a. Circuit origination and destination.
      b. Voltage.
      c. Number of conductors in accordance with phase.
      d. Number of phase conductors.

B. Cables passing through or terminating in manholes, hand holes, and pull boxes shall have 19-gage (1 mm) stainless steel identification tags with stamped lettering that provides circuit identification information.

C. Provide power, control, and instrumentation cables with permanent type identification markers with typed cable numbers and from/to information at each point of termination. Cable numbers and from/to information will be provided for circuits not associated with low-voltage panelboards.
   1. Position cable markers to be readily visible for inspection.
   2. Cable numbers shall match those as shown on Drawings.
   3. Provide wire tags at each termination point for each conductor. Tags shall be permanent, wrap around, heat-shrinkable type with typewritten information.

D. Color-code power conductors with electrical tape or provide with colored jacket.
   1. Source voltage of 208Y/120 volts:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.

d. Neutral: White.
2. Source voltage of 120/240 volts:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Neutral: White.
3. Source voltage of 480Y/277 volts:
   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow.
   d. Neutral: Gray.
4. Source voltage of 240/120-volt delta: High-leg systems shall not be used without Engineer approval.
5. Service entrance and equipment ground conductors shall be bare copper or green insulated conductor. Equipment bonding conductors shall be bare copper.
6. Isolated ground conductors shall be insulated; green in color with integral yellow stripe. No substitutions.

2.28 EQUIPMENT NAMEPLATES

A. Laminated white-over-black plastic such that face is white with black letters, with 1/8” (3 mm) engraved letters securely fastened with minimum of 2 self-tapping, stainless steel screws.

B. Motor starters, either separately mounted or contained in motor control centers, shall have nameplates identifying related equipment. Where separate control and indicating lights are used, starters shall have engraved or etched legends ("start", "stop", etc.) as shown on Drawings.

C. Provide control stations with nameplates identifying related equipment. Control and indicating lights shall have engraved or etched legends as shown on Drawings.

D. Circuit breakers within main switchboards and distribution switchboards shall be provided with nameplates identifying related equipment being served.

E. Fused and nonfused switches shall have 2 front cover-mounted nameplates.
   1. Nameplate containing permanent record indicating switch type, manufacturer's name, catalog number, and appropriate rating for equipment served.
   2. Provide additional nameplate to identify associated equipment.

F. Panelboards shall have front cover-mounted nameplates identifying panelboard, matching information shown on Drawings and associated panel schedule. Nameplate shall have at least 4 lines of text consisting of:
   1. Line 1: Panel equipment identification number.
   2. Line 2: IEEE Voltage Designation.
   3. Line 3: Appropriate description from which power is derived, (i.e. fed from HP1 through XFMR-LP1).
   4. Line 4: Location of power source, (i.e. PP-1, NW wing).

G. Lighting and auxiliary power transformers shall have front cover-mounted nameplates identifying transformer, matching information shown on Drawings. Nameplate shall have at least 2 lines of text that consist of:
   1. Line 1: Transformer equipment identification number.
   2. Line 2: Location of derived power source (i.e. fed from MDB, Elec Rm Basement).

H. Nameplates shall meet requirements of NFPA 70E

2.29 HARDWARE

A. Provide hardware including, but not limited to, anchor bolts, nuts, washers, expansion anchors, wire nuts needed for installation.

B. Hardware smaller than 3/4” (19 mm) shall match NEMA standard size bolt holes on motors and electrical equipment.

2.30 LOGIC SYSTEMS FACTORY TESTING

A. Prior to shipment, test electrical equipment containing solid-state logic systems in accordance with manufacturer’s standard tests for minimum of 120 hours under power.
   1. Components tested shall include electronic devices; power supplies, input-output devices, operator interface devices, and interconnecting cables provided with system.
   2. System shall be tested as complete assembly. Testing of individual components or modules not allowed as system tests.

B. System test shall include:
   1. Means of confirming logic or mathematical design response of system by simulating changes in system input.
   2. Test shall repeatedly cycle system through operations system will be expected to perform in service with loads on various components equivalent to those which will be experienced in actual service.
   3. Adjustment of power source voltages to high and low limits. Verify correct operation of system at both high and low power source voltage limits.

C. System shall be tested and verified capable of providing surge withstand capability in accordance with requirements of ANSI C37.90.1.

D. Perform tests with solid-state logic system exposed to ambient temperature appropriate to service for which associated electrical equipment is designed.

PART 3 EXECUTION

3.01 EXAMINATION OF SITE

A. Contractor shall be responsible for familiarity with Project Site conditions. Equipment furnished and installed shall be capable of withstanding most severe conditions that will be encountered.

3.02 PROTECTION OF WORK

A. Protect installed Work and provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

B. Damage occurring to building or equipment during installation shall be repaired or replaced to conditions existing prior to damage at no additional cost or delay to project or Owner.

3.03 INSTALLATION

A. Install equipment and materials in accordance with manufacturer's recommendations and Drawings.

B. Details for equipment and systems installed in accordance with industry standard techniques will not be furnished.

C. Installation details furnished on Drawings shall be followed unless found to be unsafe, inappropriate for equipment specified, or unachievable due to site conditions.

D. Except as otherwise specified or indicated on Drawings, equipment shall be installed plumb, square, and level.

E. Sheet metal junction boxes, equipment enclosures, sheet metal raceways, and similar items mounted on earth-bearing walls shall be separated from wall not less than 1/4" (6 mm) by corrosion-resistant spacers.

F. Substations, switchgear, motor control centers, and similar equipment located outdoors shall be permanently sealed at base. Openings into equipment shall be screened or sealed as to prevent entrance of birds, rodents, and insects the size of wasps and mud daubers.
   1. Sealing material at base shall be concrete grout.
   2. Small cracks and openings shall be sealed from inside with silicone sealant.
   3. Large openings shall use galvanized screen mesh.

3.04 TRIP SETTING COORDINATION

A. Motor overload protection shall be selected and set by Contractor based on final motor nameplate information. Size motor circuit protectors to coordinate with motor starting characteristics and overload protection. Submit summary of settings to Owner, list:
   1. Equipment project identification number.
   2. Nameplate information.
   3. Overload device trip range.
   4. Overload device setting.
   5. Trip device rating.
   6. Trip device setting if different from rated value.
   7. Set trip devices and verify devices are operating within manufacturer's tolerances. Make changes to settings not complying with requirements furnished by Engineer.

3.05 CABLE

A. Prior to installation of each cable or cable group into assigned raceway, verify that raceway has been correctly sized.
   1. Where raceway is not indicated in circuit schedule or on Drawings, size in accordance with requirements of NEC.
   2. If raceway size indicated on Contract Documents is inadequate, notify Engineer.

B. Replace cables pulled into wrong raceway or cut too short to rack and train.

C. Do not reinstall cables installed in wrong raceway and removed. Discard cables unless inspected and accepted by Owner's Representative in writing.

D. Carefully lay or pull circuits in cable tray so neither cables nor tray is damaged.

E. Protect cables from dirt, water, oil, damaging chemicals, and from physical injury prior to, and during installation.

F. Cables shall be cut sufficiently long to conform to contour of trays, with particular attention paid to vertical inside bends.

G. Remove excessive slack so cables lie parallel to sides of trays.

H. Multiple single-conductor power cables No. 1/0 AWG (50 mm^2) or larger installed in cable tray that constitute single power circuit shall be grouped together in triplexed or quadriplexed arrangement. Maintain cable spacing to be 2.15 x O.D. of largest conductor in group or adjacent group.

I. Multiconductor power cables No. 4/0 AWG (120 mm^2) or larger installed in cable tray shall be installed in single layer with maintained spacing of not less than 1 cable diameter of largest cable.

J. Fasten cables to cable tray with rated nylon ties to hold cables in place.

K. Perform fishing and pulling with flexible round metal tape, CO_2 propelled polyethylene cord, nylon rope, or manila rope.

L. Cable damage caused by improper pulling tension and excessive sidewall pressures shall be considered for any cable pulls that require use of mechanized cable pulling machine, whether installed underground or overhead.
   1. NEC requirements shall be used as guideline. Calculations shall be performed for duct bank runs over 300' (90 m), and for installations in conduit over 100' (30 m).
   2. Monitor pulling tension during installation of cable. Tension shall not exceed maximum recommended by cable manufacturer.
   3. To avoid damage from excessive sidewall pressure at bends, pulling tension shall not exceed cable manufacturer's recommendation.
   4. Pulling mechanisms, manual or power type, shall have rated capacity in tons legibly marked on mechanism.
   5. During installation, observer shall constantly watch dynamometer and record maximum tension achieved during pull.
      a. If excessive strain develops, stop pulling operation at once. Determine difficulty and correct.
      b. Provide records of dynamometer readings to Engineer.
      c. Inform Owner prior to cable pulls.
   6. Do not use woven wire cable grips. Use only pulling eyes for pulling cables.
   7. As soon as cable is pulled into place, remove pulling eyes and reseal cable.

M. Insert reliable nonfreezing type of swivel or swivel connection between pulling rope and eye to prevent twisting under strain.

N. Only use lubricants as recommended by cable manufacturer. Water-based lubricants not allowed.

O. Outside of each cable reel shall be carefully inspected. Remove protruding nails, fastenings, or other objects that might damage cable.
   1. Perform visual inspection for flaws, breaks, or abrasions in cable sheath as cable leaves reel. Pulling speed shall be slow enough to permit inspection.
   2. Damage to sheath or finish of cable shall be sufficient cause for rejecting cable.
   3. Cable damaged during installation shall be replaced at no expense to Owner.

P. Permanent radius of each bend after cable installation shall be in accordance with manufacturer's recommendations.

Q. Cable supports and securing devices shall have bearing surfaces located parallel to surfaces of cable sheath. Install to provide adequate support without deformation of cable jackets or insulation.

R. Provide adequate cable end lengths. Properly install in junction boxes and manholes to avoid longitudinal strains and distorting pressures on cable at conduit bushings and duct end bells.

S. Final inspection shall be made after cables are in place. Where supports, bushings, and end bells deform cable jacket, provide additional supports.

T. Splices, joints, and connections shall be made only in accessible junction boxes in accordance with methods specified and instructions of cable manufacturer. Splices not allowed unless shown on Drawings.

U. Rough-in wiring terminated in junction boxes shall have at least 8" (200 mm) of free conductor coiled in box for connection to equipment and receptacles.

V. Circuit information for circuits originating from panelboards is indicated on panel schedules. Other circuits are identified on circuit schedule.
   1. Do not combine receptacle loads with lighting loads.
   2. Circuits fed from panelboards shall not be combined with circuits from circuit schedule.

W. Panelboard circuits are indicated as individual runs. Circuits may be combined into common conduits in accordance with rules of NEC. Perform work associated with combining of circuits at no additional cost to Owner.

3.06 GROUNDING AND BONDING

A. Electrical system and equipment grounding shall be installed in accordance with NEC and shall conform to following, where applicable:
   1. Ground conductors shall be bare or green-insulated in accordance with NEC.
   2. Cable shall be soft-drawn copper or copper bar, sized in accordance with drawings and NEC, but not smaller than No. 12 AWG.
   3. Ground cable splices and joints inaccessible upon completion of construction shall meet requirements of IEEE 837 and shall be exothermic weld or compression system type.
   4. Ground cable through exterior building walls not in conduit shall enter within 3' (1 m) below finished grade and shall be provided with water stop. Installation of water stop shall include filling space between strands with solder and soldering 12" (300 mm) copper disc over cable.
   5. Ground cable near base of structure shall be in undisturbed earth and as far from structure as excavation permits, but not closer than 6" (150 mm).
   6. Copper ground conductor in addition to conduit connection shall ground each piece of electrical equipment.
   7. Copper or high-conductivity copper alloy ground lugs or clamps shall make ground connections to equipment and ground buses. Connections to enclosures not provided with ground buses or ground terminals shall be made by clamp-type lugs added under permanent assembly bolts or under new bolts drilled and added through enclosures other than explosionproof, or by grounding locknuts or bushings. Ground cable connections to anchor bolts; against gaskets, paint, or varnish; or on bolts holding removable access covers not permitted.
   8. Bond grounding system to water piping by connection to first flange inside building from main that will form good ground connection. Make connection with copper bar or strap by drilling and tapping flange and providing bolted connection.
   9. Ground conductors on equipment shall be formed to contour of equipment and firmly supported.
   10. Ground rods not described elsewhere shall be minimum 5/8" (16 mm) diameter by 10' (3.0 m) long, with copper jacket bonded to steel core.
   11. Make connections to ground grid where shown on Drawings.
   12. Verify connections by performing continuity checks.

3.07 FIRE PROOFING AND FIRE RATINGS

A. Maintain fire-resistive integrity during construction.

B. Penetrations through fire-resistive structures shall be sealed with fire-resistive material compatible with construction penetration.

C. Where required by codes, local building officials, or fire marshal, furnish UL fire sealing systems and install in accordance with manufacturer's recommendations.

3.08 STARTUP AND TESTING

A. Clean equipment interiors and exteriors prior to start-up and testing.

B. Unless specified otherwise, tests performed shall be standard tests listed by ANSI/IEEE for intended equipment.

C. Equipment shall be checked and placed in service ready for operation.

D. Circuits shall be electrically tested after installation. Test power and motor circuits prior to final connection to equipment. Splices shall be complete prior to testing.
   1. Provide equipment and labor required for testing.

2. Circuit failing to test satisfactorily shall be replaced or repaired, and retested at no additional cost to Owner.
3. Check power and motor circuits, dc power, and control circuits for:
   a. Correct terminations.
   b. Continuity.
   c. Unintentional shorts and grounds.
4. Check power conductors for correct phasing.
5. Motor circuits shall be checked for proper rotation and motors "bumped" to verify correct machine rotation.
6. Control, instrumentation, and thermocouple wire shall be checked for correct termination, continuity, freedom from shorts or grounds, and identification.
7. Current transformer wiring shall be loop checked by injecting current at one end of loop and checking with clip-on ammeter at each field termination point to assure continuity and phase identification.
8. Voltage transformer wiring shall be tested by applying voltage at one point and checking with voltmeter phase rotation meter and phase angle meter at each field termination point to assure continuity, identification and phase shift.

3.09 DEMONSTRATION

A. Final start-up and check out shall be completed prior to Owner acceptance of project.

B. Electrical installation shall be complete in every detail and capable of normal operation in presence of Owner or Owner’s Representative to verify its readiness.

END OF SECTION

1) LV
2)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Above grade conduit, wireway, boxes, and associated accessories for support, securing, and protection of electrical wiring.

1.02 INFORMATIONAL SUBMITTALS

A. Product Data:
1. List of proposed materials identifying manufacturer and type to be furnished.
2. Manufacturer's catalog sheets, marked as necessary to indicate specific type, model or catalog number for equipment to be furnished for project.

B. Quality assurance data:
1. Component and accessories data sheets.
2. Installation information.

C. Such other similar information as Engineer may request.

1.03 QUALITY ASSURANCE

A. Manufacturer’s qualifications:
1. Manufacturer shall be manufacturer of major components within assembly and shall be ISO certified.
2. Manufacturer shall have produced similar equipment for a minimum period of 5 years.

B. Regulatory requirements
1. Equipment shall be designed and manufactured in accordance with applicable requirements of following: NFPA 70; ANSI C80.1, C80.3, C80.4, C80.5; UL 1, UL 6, UL 360, UL 651, UL 797, UL 870, UL 1242; and NEMA TC2, TC3, TC6, TC9, and RN1.
2. Standards of foreign organizations shall not be used without written approval from Engineer.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Raceway systems and accessories shall include, but not be limited to:
1. Exposed and concealed conduit.
2. Elbows, fittings, and accessories.
3. Hardware for support, securing, and protection.
4. Wireways.

2.02 RIGID METAL CONDUIT, STEEL (RGS)

A. Material: Mild steel tube with continuous welded seam in accordance with ANSI C80.1, and UL 6.

B. Exterior and Interior protective coating: Metallic zinc applied by hot-dip galvanizing or electro-galvanizing. Apply final coat of transparent zinc chromate to exterior. Exterior and interior coatings applied to conduit shall afford sufficient flexibility to permit field bending without cracking or flaking.

C. Thread pitch shall conform to ANSI/ASME B1.20.1. Taper shall be 3/4”/ft (62.5 mm/m).

D. Each length of conduit shall have UL listing label.

E. Couplings, unions, and fittings: Threaded-type, galvanized steel.

F. Conduit bodies: Threaded or threadless type, cast metal or malleable iron type with zinc or cadmium coating. Covers shall have solid gaskets and captive screw fasteners.

G. Running thread not acceptable.

2.03 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Material: Mild steel, galvanized.

B. Construction: One continuous length steel strip of uniform weight and thickness and shaped in interlocking convolutions; fabrication shall result in smooth interior surface.

C. External coating: Provide outer jacket of tough extruded polyvinyl. Jacket shall be positively locked to steel core and be sunlight resistant and listed as oil resistant.

D. Continuous integral grounding strip: Required in sizes 1-1/4” (31 mm) and smaller. Ground wire shall be required for larger sizes.

E. Fittings: Cadmium or zinc-plated steel or malleable iron. Compression type with tapered hub and synthetic rubber gasket and ground ferrule for making positive ground contact with steel core, designed to prevent outer jacket from pulling away from steel core. Connectors shall have insulated insert in throat. Suitable for grounding through 1-1/4” (31 mm) trade size, provide ground wire lug for sizes 1-1/2” (38 mm) and larger.

2.04 PULLBOXES AND JUNCTION BOXES

A. General use areas, protected or indoor: Galvanized sheet steel with a metal thickness meeting UL 50. Provide removable covers attached with round head silicon bronze machine screws.

B. Process or wet locations, indoor or outdoor: Galvanized steel or aluminum with gasketed covers attached with stainless steel hardware using raintight hubs.

C. Hazardous areas: UL-approved for area classification.

D. Where required for elbows, fittings, and accessories to be furnished by same manufacturer as conduit, boxes shall also be furnished by conduit manufacturer or by supplier approved by manufacturer.

2.05 WIREWAY

A. Metal gage thickness shall conform to NEC.

B. NEMA 1: Minimum 16-gage steel with baked enamel finish, hinged or removable covers with captive stainless steel screws.

C. NEMA 3R: Minimum 16-gage galvanized steel with baked enamel finish, gasketed drip-shield cover, with stainless steel screws, weatherproof.

D. NEMA 4X: Minimum 14-gage Type 304 stainless steel with neoprene gasket, hinged cover, stainless steel external screw clamps, and external mounting tabs.

E. NEMA 12: Minimum 16-gage steel with baked enamel finish with gasketed, hinged cover with stainless steel screws, dust-tight.

F. Screws shall be guarded to prevent damage to wire installation.

G. Provide fittings, supports, end plates, and accessories as required.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Coordinate timing of installation and locations of raceway with other trades. Do not block access or impede construction.

B. Locations of above grade raceway indicated on Drawings are approximate. Coordinate actual locations in field to avoid conflicts with other equipment.

C. Areas designated for, but not limited to; access, maintenance, hatchway, tube removal, and expansion shall be kept clear of field-routed raceway.

D. Exposed raceway runs shall be installed parallel or perpendicular to dominant surfaces with right-angle turns made with symmetrical bends or fittings.

E. Install exposed raceway minimum of 6” (150 mm) from outside surface of insulation and lagging on hot water pipes, steam pipes, and other heat sources. Install minimum of 12” (300 mm) from uninsulated heat sources. Avoid long runs parallel to heat sources.

F. Use expansion fittings where necessary. When expansion or deflection will be greater than 6” (152 mm) or greater than fitting is designed to accommodate, provide junction boxes solidly mounted on each side of expansion joint and connect with flexible, liquidtight conduit, or adjust conduit sections to limit expansion to less than 6” (152 mm).

G. Support raceway independently from equipment, and temporary or movable structures.

3.02 USES AND LIMITATIONS

A. Refer to NEC for guidelines regarding use, and limitation of each type of conduit. Follow NEC except as specified otherwise herein, or as shown on Drawings.

B. LFMC: 1/2” (13 mm) minimum size; 5’ (1.5 m) maximum length.

3.03 RIGID CONDUIT

A. Conduits not shown on Drawings shall be sized in accordance with NEC.

B. Drainage: Avoid water pockets in conduit runs; provide suitable fittings at low spots in exposed conduit where pockets cannot be avoided. Weep holes not permitted in conduit.

C. Conduit ends:
   1. Cap spare conduits with fittings designed for intended use.
   2. Conduit terminating in panels or enclosures where exposed to entrance of foreign material shall be plugged with commercial duct-sealing compound around conductors.
   3. Cap conduit ends during construction to prevent entrance of foreign material.

D. Where practicable, provide 3” (75 mm) stubbed up conduit for conduit entering into bottom of freestanding equipment. Coordinate locations with equipment. Terminate with grounding bushings.

E. Clean and swab inside of conduit by mechanical means to remove foreign materials and moisture before wires or cables are installed. Cleaning method shall not damage interior surface of conduit.

F. Bushings: Provide at termination of conduit not terminated in hubs and couplings. Insulating bushings with 150°C rated insulating inserts in metal housings shall be provided on conduit 1-1/4” (31 mm) and larger. Insulating bushings shall be grounding type. Standard bushings shall be galvanized.

G. Apply coat of zinc chromate to zinc-coated conduits where protective coating is damaged.

H. Couplings and unions:
   1. Threaded conduit couplings shall join metal conduit with conduit ends butted. Where standard threaded couplings cannot physically be used, join metal conduit using conduit unions or split couplings.
   2. Use ground-seat type, watertight unions where union may be submerged.
   3. Install coupling nut in upper-most union to prevent entrance of water into union when used in vertical or inclined conduit runs.

I. Bends: Run of conduit shall not contain more than equivalent of three 90º bends, including offsets at outlets or fittings. Use only manufacturer-approved conduit bending equipment. Do not use deformed or crushed conduits.

J. Threads: Cut ends of conduit with saw; do not use wheel cutter. Conduit end shall have same number of threads as present from factory. Apply coat of zinc chromate to steel conduit threads and apply anti-seize compound containing powdered zinc or lubricating graphite to aluminum conduit threads.

K. Use expansion joints as required such that no more than 6” (152 mm) allowance for expansion or contraction of conduit occurs.

3.04 FLEXIBLE CONDUIT

A. Connect equipment that moves due to vibration, normal operation of mechanism, or thermal expansion, in relation to supported conduit using flexible conduit. Install junction boxes as required. Provide green ground wire.

B. Flexible metal conduit 1-1/2” (38 mm) and larger shall be installed with external lugs and external grounding conductor.

3.05 CONDUIT SUPPORTS

A. Supports of structural steel or manufactured framing members shall be fabricated from lightweight channel approved by manufacturer for intended use, provide required rods, anchors, inserts, clamps, spacers, shims, bolts and accessories.

B. Clamps: Galvanized malleable iron 1-hole straps, beam clamps, or other device with necessary bolts and expansion shields.

C. Adjustable hangers: Use to support horizontal runs only. Use trapeze-type supports for parallel runs of conduit. Install U-bolts at end of each run and at each elbow. Install conduit clamps every third intermediate hanger for each conduit. Hanger rods shall be 3/8” (10 mm) minimum diameter threaded galvanized steel rods.

D. Conduits supports mounted on concrete surfaces: Fasten with self-drilling tubular expansion shell anchors with externally split expansion shells, single cone expanders, and annular break-off grooved chucking cones.

3.06 PENETRATIONS

A. Provide required penetrations in floors, walls, or roofs. Penetrations shall be kept to minimum, as small as possible, and installed in neat manner. Surrounding surfaces damaged during installation of penetrations shall be included as part of this work.

B. Seal penetrations in walls, floors, ceilings, and enclosures. Provide fire stops for electrical raceway penetrations. Maintain original fire rating that existed prior to commencement of work. Do not install fire seal for wire openings until interconnecting wiring of equipment is proven to operate properly.

C. Sleeves:
   1. Provide for passage of conduits through walls, floors, or partitions. Set sleeves in masonry during construction; set sleeves through concrete before placement begins.
   2. Material: Rigid conduit or pipe securely fastened in position.
   3. Cut sleeve flush with floor where conduit enters equipment enclosure otherwise extend sleeve 3" (75 mm) above floor.
   4. Sleeves through exterior building walls: Install conduit in center of sleeve. Pack interior and exterior annular space around conduit with plastic backer rod sized to fit annular space in compression as recommended by backing manufacturer. Seal interior and exterior of joint with acrylic polymer sealant.
   5. Sleeves through waterproof construction shall be flanged type.

D. Penetrations required after walls, floors, or ceilings are constructed shall be provided and grouted or sealed. Openings shall be core-drilled, do not jackhammer.

E. Patch and finish openings made in existing walls and floors to match original material in composition and appearance.

F. Cut or punch penetrations in wall panels. External penetration shall be flashed and calked to provide weather tight seal.

G. Limit penetrations in roofs to applications where required for connection to specific piece of equipment. When required, flash and apply seal material after installation of conduit to provide weathertight bond and seal. Materials shall be compatible with roofing system.

3.07 WIREWAY AND BOXES

A. Installed in accordance with manufacturer's recommendations.

B. Connections shall be made such that they maintain NEMA rating of enclosure and system.

C. Locations and quantities shown on Drawings are approximate. Make adjustments as required to eliminate field interferences or to meet requirements of NEC. Provide Engineer with information regarding new locations.

D. To access interior, locate to permit full removal of covers, or such that doors can be opened more than 100°. Mount at height as indicated, or as required by NEC, whichever is more restrictive.

E. Support wireways and boxes independently of conduits by means of bolts, screws, rod hangers, and other suitable means.

END OF SECTION

1) LDV
2)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Low-voltage, 3-phase, fractional and integral horsepower electric motors up to 500 hp.

1.02 SUBMITTALS

A. Shop Drawings:
1. Complete and accurate Data Sheets.
2. General description and technical data cut sheets.
3. Manufacturer's standard O&M manual.

1.03 CLOSEOUT SUBMITTALS

A. Manufacturer's operation and maintenance manuals. Provide, in general:
1. Final reviewed set of drawings listed above.
2. Operating and maintenance procedures.
3. Warranty information.
4. Test reports for each motor.

1.04 QUALITY ASSURANCE

A. Manufacturer's qualifications:
1. Manufacturer shall manufacture major components of motor and shall be ISO certified.
2. Manufacturer shall have produced similar equipment for minimum period of 5 years.
3. When requested by Engineer, provide acceptable list of similar equipment installations complying with requirements of this Section.

B. Regulatory requirements:
1. Motors shall be in accordance with applicable requirements of NEMA MG-1, NFPA 70, IEEE 112, and UL 1004.
2. Standards of foreign organizations shall not be used without written approval from Engineer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. During delivery and storage, handle equipment to prevent damage, denting, or scoring.

B. Store equipment and components in clean, dry place. Protect from weather, dirt, water, construction debris, and physical damage in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Baldor.

B. Ideal Electric.

C. Lincoln Motors.

D. Marathon.

E. Reliance.

F. Siemens.

G. TECO - Westinghouse.

H. Toshiba.

I. U. S. Motors.

2.02 SYSTEM DESCRIPTION

A. Motors rated 1/2 hp and above shall be 3-phase.

B. Motors shall be squirrel-cage, induction type conforming to standards specified.

C. Supply motors either separate or as integral component of equipment package.

D. As a minimum, motors shall meet requirements of this Specification.

E. Motors shall be rated to continuously supply power at rated load, and capable of supplying short-term overload condition calculated by multiplying rated horsepower of motor by service factor at rated voltage and frequency.

F. Motor shall not exceed temperature rise specified when supplying power at nameplate rated horsepower.

2.03 ENCLOSURE SYSTEM

A. Indoor and outdoor: In accordance with Data Sheets.

B. Furnish motors with frames 182T and above with lifting eyes arranged so lifting slings do not become entangled in accessories mounted on motor.

C. Treat materials potentially exposed to process fluids with rust preventing compounds such as Cosmoline, Rust-Veto, or equal.

D. Do not use copper or copper alloy for air coolers.

E. Coat copper conductor windings with nonhydroscopic varnish.

F. Provide drains and breathers for moisture removal.

G. Bolts and nuts exposed to environment shall be of zinc dichromate.

2.04 VOLTAGE AND FREQUENCY

A. Motors shall run successfully at rated load and frequency with ±10% variation in supply voltage.

B. Motors shall run successfully at rated load and voltage with ±5% supply frequency variation.

C. Motors shall run successfully at rated load with combined variation of supply voltage and frequency that is not more than ±10% (sum of absolute values) of rated voltage and rated frequency provided 5% frequency variation is not exceeded.

D. Motors shall be capable of operating within design characteristics for system source voltage as specified on Data Sheets.

E. Motors started directly across line shall accelerate to running speed with connected load, with maximum voltage dip of 20%, at starting.

2.05 CHARACTERISTICS

A. Motor shall be sufficiently sized to start and operate connected load at motor designated speed within installed environment, without exceeding nameplate ratings.

B. Intermittent and repetitive duty motors will have an output horsepower capacity that is determined from maximum load power requirements, time length, of duty cycle, and length of time for energized portion of duty cycle.

C. Do not use service factor to achieve power required to drive load under normal operating conditions.

D. Torque characteristics shall conform to standard NEMA design letter designation and shall be appropriate for mechanical load served. Motor speed and rotation shall be that required by the driven equipment. Motors shall have torque characteristics adequate to “break away” driven load and to accelerate load to rated speed in length of time that is at least 2 seconds less than the hot locked rotor thermal damage time of motor.

E. Locked-rotor, breakdown, and pull-up torque, at rated voltage and frequency, shall meet requirements of NEMA MG-1. Locked-rotor shall not exceed values as specified in NEMA MG-1 for appropriate design type of motor.

F. Motor shall be suitable for number of consecutive cold starts and hot starts as indicated on Data Sheet. As a minimum, motors shall be capable of not less than 4 starts per hour, including 2 successive starts. Motors provided as part of equipment or system having integral or automatic control shall be capable of as many starts per hour as controller will allow.

G. Motor locked-rotor current shall correspond to code letters specified in NFPA 70, Table 430.7(B) and shall not exceed locked rotor code value as indicated on Data Sheet.

H. Power factor shall be not less than 0.85 for motors greater than 1 hp operating at motor full-load current, unless approved by the Engineer.

I. Motor efficiency shall be determined in accordance with IEEE Std. 112, Method B. Test data for similar machines are acceptable instead of individual motor tests See Data Sheet for efficiency requirements.

J. Motor shall meet 90 dBA noise level at 3’ (1 m), unless specified otherwise.

2.06 MOTOR FRAME

A. Type: Heavy-duty, using cast iron construction.

B. Machine sealing parts to high-accuracy to minimize breathing.

C. Where motor may be in contact with corrosive or harmful vapors, equip openings with charcoal air filters.

D. If specified for hazardous areas, motors shall be enclosed and UL-listed for class, division, and group designation in accordance with NEC Article 500.

E. Motor frame, end brackets, fan covers, drip shields, and bearing housing shall be corrosion-resistant. Motor supporting feet shall be an integral part of frame.

F. Provide motors with stainless steel replaceable automatic drainage fittings. Locate drain holes at low point of motor in final mounted position.

G. Drill and tap for ground lug connection. Locate bolt hole on motor frame, external to, and on same side as terminal box. Provide hole size as follows:
   1. Motors up to 50 hp: 1/4-20 unified inch coarse thread (UNC).
   2. Motors over 50 hp and up to 200 hp: 3/8-16 UNC.
   3. Motors over 200 hp: 1/2-13 UNC.

H. For interchangeability, multiple motors provided as part of same system or on same piece of equipment shall have similar motor frame sizes to minimize number of different frame sizes and associated mounting dimensions.

2.07 SLIDING BASES

A. Heavy steel in single-unit construction using 2 adjusting bolts.

B. Heavy-duty bases shall be capable of supporting heaviest weight and largest overhung load for its motor rating without bending, flexing, or vibrating.

C. Provide permanent means for identifying proper motor frames for which base is suitable.

2.08 STATOR AND STATOR ASSEMBLY

A. Maintain assembly in alignment. Provide high-grade material consistent with specified operating efficiency.

B. Insulation:
   1. Multiple dips and bakes of insulating varnish.
   2. Where tropicalization is specified on Data Sheets, provide additional dips and bakes of insulating varnish and either use of special insulating materials or varnish treatment to prevent growth of fungus and ingress of moisture.

C. Windings shall be copper.

2.09 ROTOR AND SHAFT ASSEMBLIES

A. Motor shaft shall be machined, carbon steel capable of transmitting torque produced by motor.

B. Rotor cage shall be fabricated aluminum, or integrally die-cast aluminum.

C. Dynamically balance motors by one of following means:
   1. Drilling out parent metal in such a manner that structural strength of rotor is not weakened.
   2. Use balance washers securely pinned in place.
   3. Chiseling, sawing, or use of solder or similar deposit materials to achieve balance is not acceptable.

D. Rotor assembly removal:
   1. Horizontal motors: Removable through either bell end of motor without requiring removal of stator assembly.
   2. Vertical motors: Removable from top of motor without requiring dismantling or removal of motor.

2.10 WINDING INSULATION AND TEMPERATURE RISE

A. Windings shall be random-wound coils with class of insulation as stated on Data Sheets. Completely insulate windings and winding terminals for ungrounded system.

B. Temperature rise shall not exceed that specified on Data Sheets, at site ambient conditions and elevation.

C. Temperature rise shall not be exceeded when tested under fully rated nameplate values at site ambient conditions and elevation.

D. In accordance with Data Sheet for motor locations where machine may be exposed to high temperature, excessive moisture, corrosion, fungus, insect, or vermin, furnish motors with tropicalization for windings.

2.11 BEARINGS

A. Provide grease-lubricated ball bearings, unless type of installation requires otherwise. Ball bearings shall be vacuum-degassed steel, motor quality.

B. Construct and provide bearing and bearing housing with slingers and seals to prevent dirt or moisture from entering motor.

C. Provide interior bearing caps or other suitable means to prevent lubricant from entering motor.

D. Integrally case bearing supports as part of motor end bell. Rabbet end bell to stator assembly to ensure proper bearing alignment and air gap spacing.

E. Design bearings so damage does not occur by axial rotor movement during motor startup and shutdown.

F. Provide double-shielded bearings using high-temperature greases on motors for air cooler fan applications.

G. Bearings shall be antifriction-type and shall have minimum rated life L10 with median life no less than 50% of L10 life, as defined by ABMA. Reliability of each bearing shall be greater than 90%.

H. Size bearings for horizontal motors mounted in vertical position using V-belt drive to accommodate radial load caused by belt drive on shaft extension end.

I. Shaft and bearings for belt-connected motor shall withstand normal belt pull of equipment furnished and momentary and continuous overloads due to acceleration caused by incorrect belt tension.

J. Bearings for motors driving vertical pumps, including in-line pumps, shall be designed to carry 200% of maximum thrust, up and down, that pump develops during starting and stopping, and while operating at any capacity on rated performance curve.
   1. Minimum momentary up-thrust capacity shall be equal to 30% of down-thrust at rated capacity.
   2. Thrust bearings for in-line pump motors shall be at upper end of motor.

K. Motors shall have metallic bearing isolators on each bearing.

2.12 WINDING AND BEARING TEMPERATURE MEASUREMENT

A. Equip each motor stator winding, or each bearing on motors rated 100 hp and larger with the ability to measure temperature, as indicated on the Data Sheets.
   1. RTD: Platinum resistance thermometers, rated 100 ohms at 0°C.
   2. Thermocouple: Type E, J, K or T as required.

B. Wire and terminate each RTD or thermocouple lead to terminal blocks located in an externally mounted junction box.

2.13 LUBRICATION SYSTEM

A. System shall be capable of operating at least 8,000 hours without requiring addition of grease or complete change of grease.

B. Provide system with readily accessible grease inlet and outlet plugs in bearing housings to enable regreasing while motor is in service.

2.14 FANS

A. Fans shall be bidirectional, air-cooled, equipped with externally mounted, nonsparking fan and fan housing suitable for Class 1, Division 2. Fan housing shall be cast iron construction. Rotation shall be indicated by permanent, legible marker mounted on motor.

B. Fan material shall be nonsparking bronze alloy or conductive plastic. Aluminum, bronze, copper, or copper alloy not acceptable.

C. Provide stainless steel hardware.

2.15 MOTOR TERMINAL BOXES

A. Equip each motor with terminal boxes.
   1. Terminate power leads in terminal box.
   2. Provide separate control terminal box and terminate space heater leads and control leads.
   3. Where instrumentation is provided, furnish a separate low-voltage terminal box independent of power and control boxes.

B. Size motor lead terminal box to allow for bending radius and stiffness of motor supply cables, and for terminating grounding conductor in accordance with Data Sheets.
   1. Frame size 445T and below: Cast iron terminal box shall be at least twice usable volume specified in NEMA MG-1, and not less than 24 in^3 (393.3 cm^3).
   2. Frame size exceeding 445T: Cast iron, cast steel, or steel plate terminal box sized according to NEMA MG-1, Figure 20-3.

C. Provide grounding lug inside motor lead terminal box to accommodate incoming earth conductor. Size in accordance with NEMA MG-1.

D. Motor leads shall have brass, stainless steel ferrules embossed with appropriate lead number, or leads imprint with lead number. Tagging of main leads shall be in accordance with MG-1, Part 2.

E. Fit with neoprene gaskets.

F. Main terminal boxes shall be capable of rotation in 90° increments to permit connection on any one of four sides.

G. Provide motor lead seal and separator gasket between motor frame and terminal box.

H. Provide main terminal boxes with threaded conduit entrances or hubs for cable glands. Coordinate size with Engineer.

I. Motor leads shall have oil-resistant insulation.

J. Terminate main lead electrical connections with tinned lugs.

2.16 IDENTIFICATION AND TAGGING

A. Securely attach embossed or stamped, stainless steel nameplates with stainless steel screws or pins.

B. Nameplate shall contain standard information in accordance with NEMA MG-1 40.1 and as follows:
   1. Year of manufacture.
   2. Type of bearing lubricant and specification number.
   3. Arrow indicating direction of rotation for main lead connections.
   4. Bearing type and manufacturer’s part number.

C. If identification number cannot be included on motor nameplate, provide separate stainless steel equipment identification nameplate in accordance with equipment identification as provided by Owner.

D. Motor power and space heater circuits may be derived from different sources. Covers of motor terminal boxes containing space heater leads shall be provided with nameplate reading: “ISOLATE MOTOR AND HEATER CIRCUITS BEFORE REMOVING COVER”.

2.17 SOURCE QUALITY CONTROL

A. Perform routine and typical shop tests in accordance with NEMA MG-1 for each motor and provide documentation as specified.

B. Where standard designs have been type tested, type test documentation may be furnished for each of tests instead of performing physical tests.

C. In addition to routine tests, perform additional tests for each motor, as indicated on Data Sheets.

D. In event that motor fails tests, additional tests will be witnessed at discretion of Owner at no additional cost to Owner.

E. Test results shall be tabulated, submitted, and approved by Engineer prior to shipment.

F. Defects and defective equipment revealed or noted during testing will be corrected prior to shipment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer’s recommendations.

DATA SHEETS LOW VOLTAGE MOTORS		Equipment Name: FEEDWATER PUMPS Tag No.: FWP-1A,1B,1C,2A,2B,2C Rev.	
DESCRIPTION	**UNITS**	**SPEC DATA**	**VENDOR DATA**
Motor Manufacturer	-	By Manufacturer	
Motor Catalog No.	-	By Manufacturer	
Ratings:			
System Voltage (208, 240, 480, 600)	V	208V	
Operating Frequency (50 or 60)	Hz	60	
Nameplate Voltage (200, 230, 460, 575)	V_t	200	
Frame Size	-	By Manufacturer	
Number of Phases	Qty	3	
RPM @ Rated Load	RPM	By Manufacturer	
Rated Shaft Output	hp	By Manufacturer	
Driven Load (maximum)	hp	26.6	
Design Type (A, B, C, D, E)	-	By Manufacturer	
Locked Rotor Code Letter	-	By Manufacturer	
Enclosure Type		TEFC	
Motor Supply Cables - # per phase and size	-	1 #1/0 Cu	
Characteristics:			
Rated Power Factor: 100% Full Load	%	By Manufacturer	
75% Full Load	%	By Manufacturer	
50% Full Load	%	By Manufacturer	
Locked Rotor	%	By Manufacturer	
Efficiency: 100% Full Load	%	By Manufacturer	
75% Full Load	%	By Manufacturer	
50% Full Load	%	By Manufacturer	
Full Load Current: 100% Full Load	A	By Manufacturer	
75% Full Load	A	By Manufacturer	
50% Full Load	A	By Manufacturer	
Locked Rotor	A	By Manufacturer	
Acceleration Time: No Load	sec	By Manufacturer	
Full Load	sec	By Manufacturer	
Motor Inertia	H	By Manufacturer	
Design Requirements:			
Maximum Site Design Ambient Temperature	ºC	+40	
Minimum Site Design Ambient Temperature	ºC	-25	
Site Altitude	ft	≤ 5000	
Unusual Service Conditions		None	
Minimum Insulation Class (B, F, or H)	-	F (minimum)	
Maximum Operating Temperature Rise (B, F, or H)	-	B (Maximum)	
Insulation Class Temperature Rise	ºC	By Manufacturer	
Hot-Spot Temperature Used to Determine Rise	ºC	By Manufacturer	
Service Factor	-	1.15	
Duty Type (Continuous, short-time, or intermittent)	-	Continuous	
No. of Speeds	1,2,3,4	1	
No. of Windings	1,2	1	
Motor Starting Method	-	FVNR	

DATA SHEETS LOW VOLTAGE MOTORS		Equipment Name: FEEDWATER PUMPS Tag No.: FWP-1A,1B,1C,2A,2B,2C Rev.	
DESCRIPTION	**UNITS**	**SPEC DATA**	**VENDOR DATA**
Type of Speed Control	-	None	
Motor Rated for Use With VFD	Y/N	N	
Minimum System Voltage During Motor Start	%V	80%	
Sound Level @ Full Load (3' (1 meter) distance)	dBA	90 max.	
Bearing Type	-	Ball	
Bearing Estimated Life Expectancy	Hrs	By Manufacturer	
Vibration Monitoring	Y/N	N	
Motor Space Heater required:	Y/N	N	
Rated Voltage	V	N/A	
Operating Voltage	V	N/A	
Wattage	W	N/A	
Weight	Lb	By Manufacturer	

DATA SHEETS LOW VOLTAGE MOTORS		Equipment Name: CONDENSATE TRANS. PUMPS (7.5 HP) Tag No.: CTP-1A,1B,1C,2A,2B,2C Rev.	
DESCRIPTION	**UNITS**	**SPEC DATA**	**VENDOR DATA**
Motor Manufacturer	-	By Manufacturer	
Motor Catalog No.	-	By Manufacturer	
Ratings:			
System Voltage (208, 240, 480, 600)	V	208V	
Operating Frequency (50 or 60)	Hz	60	
Nameplate Voltage (200, 230, 460, 575)	V_t	200	
Frame Size	-	By Manufacturer	
Number of Phases	Qty	3	
RPM @ Rated Load	RPM	By Manufacturer	
Rated Shaft Output	hp	By Manufacturer	
Driven Load (maximum)	hp	5.62	
Design Type (A, B, C, D, E)	-	By Manufacturer	
Locked Rotor Code Letter	-	By Manufacturer	
Enclosure Type		TEFC	
Motor Supply Cables - # per phase and size	-	1 #6 Cu	
Characteristics:			
Rated Power Factor: 100% Full Load	%	By Manufacturer	
75% Full Load	%	By Manufacturer	
50% Full Load	%	By Manufacturer	
Locked Rotor	%	By Manufacturer	
Efficiency: 100% Full Load	%	By Manufacturer	
75% Full Load	%	By Manufacturer	
50% Full Load	%	By Manufacturer	
Full Load Current: 100% Full Load	A	By Manufacturer	
75% Full Load	A	By Manufacturer	
50% Full Load	A	By Manufacturer	
Locked Rotor	A	By Manufacturer	
Acceleration Time: No Load	sec	By Manufacturer	
Full Load	sec	By Manufacturer	
Motor Inertia	H	By Manufacturer	
Design Requirements:			
Maximum Site Design Ambient Temperature	ºC	+40	
Minimum Site Design Ambient Temperature	ºC	-25	
Site Altitude	ft	≤ 5000	
Unusual Service Conditions		None	
Minimum Insulation Class (B, F, or H)	-	F (minimum)	
Maximum Operating Temperature Rise (B, F, or H)	-	B (Maximum)	
Insulation Class Temperature Rise	ºC	By Manufacturer	
Hot-Spot Temperature Used to Determine Rise	ºC	By Manufacturer	
Service Factor	-	1.15	
Duty Type (Continuous, short-time, or intermittent)	-	Continuous	
No. of Speeds	1,2,3,4	1	
No. of Windings	1,2	1	

DATA SHEETS LOW VOLTAGE MOTORS		Equipment Name: CONDENSATE TRANS. PUMPS (7.5 HP) Tag No.: CTP-1A,1B,1C,2A,2B,2C Rev.	
DESCRIPTION	**UNITS**	**SPEC DATA**	**VENDOR DATA**
Motor Starting Method	-	FVNR	
Type of Speed Control	-	None	
Motor Rated for Use With VFD	Y/N	N	
Minimum System Voltage During Motor Start	%V	80%	
Sound Level @ Full Load (3' (1 meter) distance)	dBA	90 max.	
Bearing Type	-	Ball	
Bearing Estimated Life Expectancy	Hrs	By Manufacturer	
Vibration Monitoring	Y/N	N	
Motor Space Heater required:	Y/N	N	
Rated Voltage	V	N/A	
Operating Voltage	V	N/A	
Wattage	W	N/A	
Weight	Lb	By Manufacturer	

DATA SHEETS LOW VOLTAGE MOTORS		Equipment Name: FD FAN MOTORS (40 HP) Tag No.: FD FAN #1 & #3 Rev.	
DESCRIPTION	**UNITS**	**SPEC DATA**	**VENDOR DATA**
Motor Manufacturer	-	By Manufacturer	
Motor Catalog No.	-	By Manufacturer	
Ratings:			
System Voltage (208, 240, 480, 600)	V	208V	
Operating Frequency (50 or 60)	Hz	60	
Nameplate Voltage (200, 230, 460, 575)	V_t	200	
Frame Size	-	By Manufacturer	
Number of Phases	Qty	3	
RPM @ Rated Load	RPM	By Manufacturer	
Rated Shaft Output	hp	40	
Driven Load (maximum)	hp	Existing fan	
Design Type (A, B, C, D, E)	-	By Manufacturer	
Locked Rotor Code Letter	-	By Manufacturer	
Enclosure Type		TEFC	
Motor Supply Cables - # per phase and size	-	1 #2/0 Cu	
Characteristics:			
Rated Power Factor: 100% Full Load	%	By Manufacturer	
75% Full Load	%	By Manufacturer	
50% Full Load	%	By Manufacturer	
Locked Rotor	%	By Manufacturer	
Efficiency: 100% Full Load	%	By Manufacturer	
75% Full Load	%	By Manufacturer	
50% Full Load	%	By Manufacturer	
Full Load Current: 100% Full Load	A	By Manufacturer	
75% Full Load	A	By Manufacturer	
50% Full Load	A	By Manufacturer	
Locked Rotor	A	By Manufacturer	
Acceleration Time: No Load	sec	By Manufacturer	
Full Load	sec	By Manufacturer	
Motor Inertia	H	By Manufacturer	
Design Requirements:			
Maximum Site Design Ambient Temperature	ºC	+40	
Minimum Site Design Ambient Temperature	ºC	-25	
Site Altitude	ft	≤ 5000	
Unusual Service Conditions		None	
Minimum Insulation Class (B, F, or H)	-	F (minimum)	
Maximum Operating Temperature Rise (B, F, or H)	-	B (Maximum)	
Insulation Class Temperature Rise	ºC	By Manufacturer	
Hot-Spot Temperature Used to Determine Rise	ºC	By Manufacturer	
Service Factor	-	1.15	
Duty Type (Continuous, short-time, or intermittent)	-	Continuous	
No. of Speeds	1,2,3,4	1	
No. of Windings	1,2	1	

DATA SHEETS LOW VOLTAGE MOTORS		Equipment Name: FD FAN MOTORS (40 HP) Tag No.: FD FAN #1 & #3 Rev.	
DESCRIPTION	**UNITS**	**SPEC DATA**	**VENDOR DATA**
Motor Starting Method	-	VFD	
Type of Speed Control	-	VFD	
Motor Rated for Use With VFD	Y/N	N	
Minimum System Voltage During Motor Start	%V	80%	
Sound Level @ Full Load (3' (1 meter) distance)	dBA	90 max.	
Bearing Type	-	Ball	
Bearing Estimated Life Expectancy	Hrs	By Manufacturer	
Vibration Monitoring	Y/N	N	
Motor Space Heater required:	Y/N	N	
Rated Voltage	V	N/A	
Operating Voltage	V	N/A	
Wattage	W	N/A	
Weight	Lb	By Manufacturer	

DATA SHEETS LOW VOLTAGE MOTORS		Equipment Name: FD FAN MOTORS #2 (25 HP) Tag No.: FD FAN #2 Rev.	
DESCRIPTION	**UNITS**	**SPEC DATA**	**VENDOR DATA**
Motor Manufacturer	-	By Manufacturer	
Motor Catalog No.	-	By Manufacturer	
Ratings:			
System Voltage (208, 240, 480, 600)	V	208V	
Operating Frequency (50 or 60)	Hz	60	
Nameplate Voltage (200, 230, 460, 575)	V_t	200	
Frame Size	-	By Manufacturer	
Number of Phases	Qty	3	
RPM @ Rated Load	RPM	By Manufacturer	
Rated Shaft Output	hp	25	
Driven Load (maximum)	hp	Existing fan	
Design Type (A, B, C, D, E)	-	By Manufacturer	
Locked Rotor Code Letter	-	By Manufacturer	
Enclosure Type		TEFC	
Motor Supply Cables - # per phase and size	-	1 #1/0 Cu	
Characteristics:			
Rated Power Factor: 100% Full Load	%	By Manufacturer	
75% Full Load	%	By Manufacturer	
50% Full Load	%	By Manufacturer	
Locked Rotor	%	By Manufacturer	
Efficiency: 100% Full Load	%	By Manufacturer	
75% Full Load	%	By Manufacturer	
50% Full Load	%	By Manufacturer	
Full Load Current: 100% Full Load	A	By Manufacturer	
75% Full Load	A	By Manufacturer	
50% Full Load	A	By Manufacturer	
Locked Rotor	A	By Manufacturer	
Acceleration Time: No Load	sec	By Manufacturer	
Full Load	sec	By Manufacturer	
Motor Inertia	H	By Manufacturer	
Design Requirements:			
Maximum Site Design Ambient Temperature	ºC	+40	
Minimum Site Design Ambient Temperature	ºC	-25	
Site Altitude	ft	≤ 5000	
Unusual Service Conditions		None	
Minimum Insulation Class (B, F, or H)	-	F (minimum)	
Maximum Operating Temperature Rise (B, F, or H)	-	B (Maximum)	
Insulation Class Temperature Rise	ºC	By Manufacturer	
Hot-Spot Temperature Used to Determine Rise	ºC	By Manufacturer	
Service Factor	-	1.15	
Duty Type (Continuous, short-time, or intermittent)	-	Continuous	
No. of Speeds	1,2,3,4	1	
No. of Windings	1,2	1	
Motor Starting Method	-	VFD	
Type of Speed Control	-	VFD	
Motor Rated for Use With VFD	Y/N	N	
Minimum System Voltage During Motor Start	%V	80%	
Sound Level @ Full Load (3' (1 meter) distance)	dBA	90 max.	
Bearing Type	-	Ball	

DATA SHEETS LOW VOLTAGE MOTORS		Equipment Name: FD FAN MOTORS #2 (25 HP) Tag No.: FD FAN #2 Rev.	
DESCRIPTION	**UNITS**	**SPEC DATA**	**VENDOR DATA**
Bearing Estimated Life Expectancy	Hrs	By Manufacturer	
Vibration Monitoring	Y/N	N	
Motor Space Heater required:	Y/N	N	
Rated Voltage	V	N/A	
Operating Voltage	V	N/A	
Wattage	W	N/A	
Weight	Lb	By Manufacturer	

END OF SECTION

1) LDV
2)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Motor control centers rated 600 volts and below.

1.02 INFORMATIONAL SUBMITTALS

A. Submit with Bid:
1. Completed Data Sheets.
2. Preliminary plan view, elevation, and one-line drawings.
3. Indicate preliminary dimensions and weight.
4. Preliminary Bill of Material with manufacturer and model numbers for components.
5. List of recommended spare parts with pricing.

B. Product Data: Protective relay instruction manuals.

C. Quality assurance data: Certified production test reports.

1.03 ACTION SUBMITTALS

A. Product Data: Current transformer excitation and ratio correction curves.

B. Shop Drawings:
1. Complete and accurate Data Sheets.
2. Certified elevation, plan and outline drawings with dimensions, weights, and center of gravity.
3. Certified cable termination compartment drawings for each size starter showing cable entry/exit locations and indicating space available for cable terminations.
4. Certified drawings for termination of main incoming bus or cable terminations.
5. One-line diagrams and front views.
6. Connection details between close-coupled assemblies.
7. Composite floor plan of close-coupled assemblies.
8. Lifting points.
9. Complete Bill of Material indicating model number of devices used.
10. Detailed wiring and interconnection diagrams that show internal wiring, wire numbers, device ratings, and external wiring terminal points.
11. Detailed schematic control diagrams for each type of controller provided.
12. Nameplate schedule.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance manuals. Provide at a minimum:
1. General description and technical data.
2. Completed Data Sheets modified to include field installation conditions.
3. Receiving, storage, installation, and testing instructions.
4. Operating and maintenance procedures.
5. Complete set of reviewed drawings that require no further action.
6. Complete documentation of inspections and tests performed, including any logs, curves, and certificates. Documentation shall note any replacement of equipment or components that failed during testing.
7. Manufacturer’s warranty on parts, labor, materials, and equipment.
8. Spare parts lists.

1.05 MAINTENANCE MATERIALS

A. Provide complete set of special tools as necessary for installation and maintenance for each piece of equipment. Tools and intended use shall be identified in assembly instructions.

1.06 QUALITY ASSURANCE

A. Manufacturer's qualifications:
   1. Manufacturer shall be ISO certified.
   2. Manufacturer shall have produced similar electrical equipment for minimum period of 5 years.
   3. When requested by Engineer, provide list of acceptable similar equipment installations complying with requirements of this Section.

B. Regulatory requirements:
   1. Equipment shall be in accordance with applicable requirements of NFPA 70, UL 845, and UL 508.
   2. Standards of foreign organizations shall not be used without written approval from Engineer.

1.07 DELIVERY, STORAGE AND HANDLING

A. Ship to job Site as completely assembled as practicable, taking into account shipping restrictions and access to final location. Coordinate transportation with requirements of pertinent authorities.

B. Prepare detailed packing lists and shipping notification.

C. Equipment and accessories shall be clearly labeled, covered and protected from damage during shipment.

D. Each shipping section shall have facilities for lifting. Base construction shall be suitable for rolling or skidding.

E. Handle sections carefully to prevent damage, denting or scoring.

F. Store motor control center and components in a clean, dry place. Protect from weather, dirt, water, construction debris and physical damage in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Allen Bradley.

B. Cutler Hammer.

C. General Electric.

D. Square D.

2.02 SYSTEM DESCRIPTION

A. Motor control center shall be continuous, coordinated, factory assembly ready for installation, connection, and immediate service designed for operation at site ambient temperatures and elevations.

B. Motor control center may include, but is not limited to:
   1. Horizontal power bus.
   2. Dead-front metal enclosed compartments containing power buses.
   3. Ground bus.
   4. Feeder circuit breakers and combination motor controllers.

5. Auxiliary and transition compartments.
6. Auxiliary control devices.
7. Instrument transformers.
8. Control switches.

C. Arrange motor control center as shown on one-line diagrams. One-line drawings are preliminary and are intended to help in understanding scope of equipment to be provided. If detailed engineering design dictates rearrangement is required, new arrangement shall be coordinated. Submit updated manufacturing drawings reflecting actual scope of supply and configuration.

2.03 RATINGS

A. Motor control centers shall be suitable for operation on 3-phasesystem with frequency as noted on the Data Sheets.

B. System operating voltage and number of wires shall be as indicated on Data Sheets.

C. Motor control centers shall be NEMA class wiring type as indicated on Data Sheets.

2.04 CONSTRUCTION

A. Structures shall be totally metal-enclosed, dead-front, freestanding assemblies fabricated with minimum of 12 gage steel. Metal work shall be free from burrs and sharp edges.

B. Dimensions: Approximately 90” (2.25 m) high, manufacturer’s standard for depth, manufacturer’s standard for width.

C. Components shall be accessible from front without removing other components or de-terminating internal or external power or control cables. Power cable termination shall be possible without removing internal components and with no rear access required.

D. Operating heights for unit disconnects and other operable controls shall be located not more than 6’-6” (2 m) above finished floor.

E. Isolation of vertical bus compartment from unit compartment shall be by a full-height, single sheet of glass-reinforced polyester insulating barrier with cutouts to allow unit stabs to engage vertical bus. Provide snap-in covers for unused openings.

F. Motor control center shall be provided with horizontal wire ways as indicated on Data Sheets located at top and/or bottom, isolated from horizontal bus, and shall be readily accessible from front through hinged and removable covers. Provide removable top covers to facilitate field drilling for conduit entrance in field. Adequate space for conduit and wiring to enter top or bottom shall be provided without structural interference.

G. Provide vertical wireway in accordance to Data Sheets adjacent to each vertical unit and covered by hinged door. Vertical wire ways shall contain steel rod cable supports.

H. Compartments for mounting control units shall not be smaller than 2X space.

I. Full-voltage starter units through NEMA Size 5 shall be draw-out type. Draw-out provisions shall include:
   1. Positive guide rail system and stab shrouds to ensure alignment of starter stabs with motor control center vertical bus.
   2. Tin-plated or silver-plated stab assembly per Data Sheets for connection to vertical bus.
   3. Interior of each starter unit shall be painted white.
   4. Equip each starter with side-mounted, positive latch pull-apart type control terminal blocks rated for 600 volts. External connections to these terminal blocks shall be made in vertical wire way.

5. Knockouts shall be provided for addition of future terminal blocks.
6. If Type C wiring is specified on Data Sheets, provide master terminal blocks located in horizontal wireways readily accessible through hinged cover in accordance with Data Sheets.
7. Wiring shall be provided in accordance with Section 16050.

J. Secure drawout units with a spring-loaded quarter turn indicating type fastening device located at top front of unit.

K. Provide each unit compartment with individual, hinged front door, equipped with captive screws.

L. Space:
1. Arrange unused space on motor control center to house Size 1 FVNR starters.
2. Spare compartments shall be completely equipped with bus, guide rails, blank cover plates, and other accessories as required for future use.
3. Blank compartments not allowed.

M. Equipment arrangement:
1. Provide motor control centers with arrangements as shown on Drawings. Deviations shall not be made unless written approval is obtained from Engineer. Arrangements that Contractor cannot support shall be clarified prior to bidding and noted as such in Bid.
2. If arrangement is not shown on Drawings, provide recommended arrangement and submit with Bid.

N. Mount operating mechanism on primary disconnect of each unit.
1. Mechanically interlock with unit door to prevent access unless disconnect handle is in “Off” position.
2. Provide defeater to bypass interlock.
3. Provide interlock to prevent inadvertent closing of disconnect handle when door is open.
4. Provide second interlock to prevent removal or re-insertion of unit while in “On” position.
5. Make provisions to positively lock disconnect handle in “Off” position using up to 3 padlocks with door open or closed. Provide means to padlock unit in partially withdrawn position with stabs free of vertical bus.

O. NEMA 3R enclosure:
1. If indicated on Data Sheets, furnish motor control center in walk-in or nonwalk-in type NEMA 3R enclosure. Enclosure shall have hinged, padlockable doors along entire front of enclosure. Door latching mechanism shall have at least 2 points of engagement of door frame. Each door shall be equipped with toe-operated hold-open device.
2. If indicated on Data Sheets, equip sheltered aisle NEMA 3R enclosure with factory-furnished cable tray located within enclosure running above motor control center. Provide penetrations at both ends of enclosure and cable tray that extend out from enclosure for distance of 1’. Drip shields shall be furnished above cable tray penetrations.
3. If bottom entry is specified, sheltered aisle NEMA 3R enclosure shall be suitable for installation on piers. Provide removable floor cutouts for cable entry. If indicated on Data Sheets, platform and steps shall be furnished with motor control center.
4. Accessories: Integral to motor control center, including power supply.
   a. Exterior photoelectric sensor controlled lighting at enclosure doors.
   b. Interior lighting for enclosure.
   c. One 120-volt GFCI convenience outlet located in interior of enclosure.

2.05 BUSS

A. Main horizontal buss and vertical buss shall be either tin-plated for corrosive environments or silver-plated at bolted connections. Fabricate from either copper or aluminum as specified on Data Sheets. Minimum ampacities shall be as indicated on Data Sheets at 50ºC temperature rise over 40ºC ambient in compliance with UL standards.

B. Vertical buss shall be securely bolted to main horizontal bus. Connection points shall be front accessible.

C. If indicated on Data Sheets, bus bars shall be fully insulated.

D. Motor control center horizontal bus shall be accessible at both ends for future extension.

E. Brace busses for rms symmetrical current as indicated on Data Sheets.

F. Copper ground bus shall run full length along bottom front of each structure for each motor control center with connections to each vertical section structure.

2.06 COMBINATION STARTERS

A. Full-voltage, nonreversing or reversing unless shown otherwise, using motor circuit protector breakers. Combination starters smaller than NEMA Size 1 not acceptable.

B. Units shall be rated for symmetrical short circuit as indicated on Data Sheets.

C. Internal wiring shall be suitable for maximum horsepower rating of contactor.

D. Load-side, solderless cable connectors for copper conductors shall be capable of accepting cables at least 2 sizes larger than cable necessary to serve maximum load. Cable sizes for loads shall be determined by 75ºC ampacity rating of copper conductor, Table 310.16, NEC.

E. Provide adjustable motor circuit protector (MCP) type breakers for each starter.
   1. MCP shall provide instantaneous overcurrent protection and shall have an adjustable trip setting with pin insert to stop adjustment at 1300% motor nameplate full load current to comply with NEC requirements.
   2. MCP shall have quick-make, quick-break, and trip indicating features.
   3. MCP shall include transient override feature for motor inrush current.

F. Motor starters shall be electrically operated, electrically held, 3-pole assemblies with arc-extinguishing characteristics and shall have silver-to-silver renewable contacts.
   1. In addition to required contacts for starter operation, each starter shall be furnished with 2 spare normally open and 2 spare normally closed auxiliary contacts wired to terminal strip for customer use.
   2. Motor overload protection shall consist of current sensor located in each phase, monitored by microprocessor-based protection device. Protection curve shall closely parallel that of motor heating damage boundary and shall be accurate to 2%.
   3. Running overload protection shall be switch selectable for specific motor full load amperes within starter range.
   4. Microprocessor-based protection device shall provide phase-loss and phase-unbalance protection. Phase-unbalance protection shall be field-adjustable. Phase loss and unbalance protection shall not require time delay before reset.
   5. Motor starters shall provide ground fault protection. Ground fault protection pick-up and time delay shall be field-adjustable.
   6. Provide trip alarm contact for remote alarm purposes. Wire to terminal block.
   7. Microprocessor shall measure control circuit voltage and prevent closing of coil on low-voltage or high-voltage conditions.
   8. Coils shall have continuous operating voltage range of 54 volts ac to 145 volts ac.

G. If indicated on Data Sheets, provide control modules or local control switches and lights on front of each combination starter.
   1. Modules:
      a. Faceplates shall have membrane-type pushbuttons with LED indication. Pushbuttons and LEDs shall be identified clearly and permanently.
      b. Modules shall provide “Start,” “Stop,” “Hand,” “Auto,” and other control functions as indicated on Data Sheets.

c. Modules shall provide indicating status of “Run,” “Off,” “Hand,” “Auto,” and “Overload Trip” as indicated on Data sheets.

2. Local control switches and lights:
   a. Type: Heavy-duty, 600-volt. Start and stop shall be momentary contact.
   b. Indicating lights shall be high-intensity, long life LED cluster type.

H. If indicated on Data Sheets provide starter metering module capable of displaying control voltage, status and, when used on starter applications, cause of trip, current at time of trip, and current in each phase. Motor control center voltage and amperage where indicated.

I. Provide control power transformers (CPT) with 120-volt ac secondary for each combination starter.
   1. Size CPT to provide power to control devices and indicating lights. Minimum size shall be 100 volt-amperes.
   2. Each control power transformer shall have both primary legs and one secondary leg protected by fuses with other secondary leg grounded. Connections to both secondary legs shall be provided at control terminal strip.

J. Lighting and resistance heating controllers shall be similar to combination motor starters except furnish with thermal-magnetic, molded-case circuit breakers and without overload relays..

2.07 TERMINATIONS

A. Cable entrance shall, at a minimum, be in accordance with NEC cable bending requirements.

B. Main incoming cables shall terminate within control center on main lug or main breaker termination point as indicated.
   1. Cable sizing will be as indicated on Data Sheets or on Drawings.
   2. Terminations shall have adequate dedicated space for type, number, and size of cable used. Lugs shall be compression-type with anti-turn feature.

C. Feeder cable terminations shall facilitate installation with special attention given to larger size starters and feeder breakers.
   1. Position lugs such that cable opening is oriented in direction cable will enter from, and with sufficient distance between lug and enclosure to permit training of cable.
   2. Termination shall be possible without removing internal components.

2.08 CONTROL DEVICES

A. Contactor and relay coils shall be rated 120 volts ac with operating limits of 54 volts ac to 145 volts ac.

B. Coils shall be capable of operation at 65% rated voltage on pick-up and maintain operation through 45% of rated voltage.

C. Control relays shall be industrial-duty machine tool relays with 600-volt ac rated contacts.

2.09 NAMEPLATES AND WIRE TAGS

A. Provide permanent nameplates with up to 3 lines of text to identify components including, but not limited to, protective relays, meters, instruments, selector switches, indicating lights, terminal blocks, motor control center main nameplate, starters and feeder breakers. Text shall be minimum of 1/8” (3 mm) high unless specified otherwise. Nameplates shall be labeled as shown on Drawings. Manufacturer shall submit a preliminary nameplate schedule for review.

B. Provide main nameplate on front of each motor control center. Mark in accordance with instructions from Engineer. MCC nameplate shall use lettering 1” (25 mm) high.

C. Nameplates shall have black lettering on white background and shall be fastened in place by self-tapping, stainless steel screws.

D. Terminal blocks and internal components shall be marked clearly and permanently.

E. Internal motor control center wiring shall be identified at both ends with sleeve type wire markers. Mark wires with from/to type information in agreement with manufacturer's drawings.

F. Handwritten labels and tags not acceptable.

2.10 PAINTS AND FINISHES

A. Steel structure members shall be cleaned, rinsed, and phosphatized prior to painting.

B. Coating process shall be electrostatically applied polyester powder with final baked-on average thickness between 1.5 and 4.0 mils.

C. Standard exterior finish: ANSI 61 light gray.

D. Finish shall have minimum pencil hardness of 2H as tested in accordance with ASTM D3363.

E. Finish shall pass ASTM B117 salt spray test for minimum of 1,000 hours.

F. Finish shall pass impact testing in accordance with ASTM D2794 with minimum values of 160 in-lb for direct impact and 120 in-lb for reverse impact.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Provide 4" (100 mm) high housekeeping pad under each motor control center, unless indicated otherwise. Level pad so motor control center can be installed directly on top of pad without additional leveling. Provide anchors and other hardware necessary. Anchor in place in accordance with manufacturer's instructions.

C. Seal penetrations with materials designed for intended use that will maintain NEMA rating of enclosure.

D. Make connections to ground grid using fittings designed and rated for intended use.

3.02 FIELD QUALITY CONTROL

A. Test response spectrum shall be based upon 5% minimum damping factor. Tests shall fully envelope response spectrum for equipment natural frequencies up to at least 35 Hz.

B. Select and set overloads for each motor based on actual nameplate ratings. Set adjustable trip functions on breakers and MCPs, adjust soft starters based on motor and load curves.

C. Test field-installed wiring to verify phase-to-ground and phase-to-phase paths are not present.

D. Jog each motor to verify proper rotation and operation.

E. Coordinate motor operation with manufacturer's requirements to avoid damage to motor or system.

DATA SHEETS LOW VOLTAGE MOTOR CONTROL CENTER		Equipment Name: Tag No.: MCC-REV. #	
DESCRIPTION	**UNITS**	**SPEC DATA**	**VENDOR DATA**
Manufacturer	-	By Manufacturer	
Model, Type, or Series	-	By Manufacturer	
Site Requirements:			
Site Design Ambient Temperature	°C	40	
Site Altitude	feet	4600	
Seismic Design Category	-	D	
Characteristics:			
Voltage, nominal	V	208	
Voltage, maximum	V	600	
Main incoming cable size	AWG	(2)250kcmil	
Phase, number	qty.	3	
Wire, number	qty.	4	
Frequency	Hz	60	
Current, continuous	A	600	
Bus material	Cu	Cu	
Bus connection area plating material	Ag/Tin	Tin	
Bus Bracing, rms Symmetrical	kA	65	
Horizontal Phase Bus Bar:			
Rating	A	600	
Maximum Continuous Current Capability at Site Ambient Conditions	A	By Manufacturer	
Material	-	Cu	
Dimensions (L x W x H)	in.	By Manufacturer	
Fully Insulated Bus	Y/N	N	
Vertical Bus Bar:			
Rating	A	600A	
Maximum Continuous Current Capability at Site Ambient Conditions	A	By Manufacturer	
Material	-	Cu	
Dimensions (L x W x H)	in.	By Manufacturer	
Fully Insulated Bus	Y/N	Y	
Ground Bus:			
Rating	A	By Manufacturer	
Material	-	Cu	
Dimensions (L x W x H)	in.	By Manufacturer	
Location	-	Bottom front	
Grounding cable size	AWG	Two #2	
Insulation Levels:			
Basic Impulse Lightning Level (BIL)	kV	By Manufacturer	
Enclosure:			
Enclosure- NEMA Type	NEMA	1A	
Material	-	By Manufacturer	
Material thickness	gage	By Manufacturer	

DATA SHEETS LOW VOLTAGE MOTOR CONTROL CENTER		Equipment Name: Tag No.: MCC-REV. #	
DESCRIPTION	**UNITS**	**SPEC DATA**	**VENDOR DATA**
Protective finish	-	By Manufacturer	
Color	ANSI	61	
NEMA Wiring Classification	-	Class I, Type B	
Master Terminal Block Wireway Location (if required)	Top/Bottom		
Sheltered Aisle NEMA 3R Enclosure	Y/N	N	
Platform and Stairs Required	Y/N	N	
Overhead Cable Tray Width	in.	N/A	
Cable Entry	Top/Bottom	Top	
Space Heaters:	Y/N	N	
Rated voltage	V	N/A	
Operating voltage	V	N/A	
Wattage	kW	N/A	
Vertical section dimension (L x W x H)	in.	By Manufacturer	
Assembled dimension (L x W x H)	in.	By Manufacturer	
Weight installed	lb.	By Manufacturer	
Shipping Dimensions (L x W x H)	in.	By Manufacturer	
No. of Shipping Splits	qty.	By Manufacturer	
Wireways, Cross Sectional Area:			
Horizontal Top Wireway	$in.^2$	By Manufacturer	
Horizontal Bottom Wireway	$in.^2$	By Manufacturer	
Vertical Wireway	$in.^2$	By Manufacturer	
Controls:			
Control Module or Local Control Switches and Lights MCC Controls:	Module/Switches & Lights		
Functions:			
Start/Stop	Y/N	Y	
HOA	Y/N	Y	
Other	-		
Indication:			
Run	Y/N	Y	
Off	Y/N	Y	
Hand	Y/N	Y	
Auto	Y/N	Y	
Overload Trip	Y/N	Y	
Other	-	By Manufacturer	
Low Voltage MCC Motor Starters:			
Manufacturer	-	By Manufacturer	
Model	-	By Manufacturer	
Size 1, FVNR			
CPT	VA	By Manufacturer	
Maximum, HP rating	hp	By Manufacturer	
Quantity	qty.	By Manufacturer	
Electronic relay model no.	-	By Manufacturer	
Physical dimension	in.	By Manufacturer	

DATA SHEETS LOW VOLTAGE MOTOR CONTROL CENTER		Equipment Name: Tag No.: MCC-REV. #	
DESCRIPTION	**UNITS**	**SPEC DATA**	**VENDOR DATA**
Maximum Size Cable Termination Allowable, Determined by Lugs and NEC Bending Radius	AWG	By Manufacturer	
Size 2, FVNR			
CPT	VA	By Manufacturer	
Maximum, HP rating	hp	By Manufacturer	
Quantity	qty.	By Manufacturer	
Electronic relay model no.	-	By Manufacturer	
Physical dimension	in.	By Manufacturer	
Maximum Size Cable Termination Allowable, Determined by Lugs and NEC Bending Radius	AWG	By Manufacturer	
Size 3, FVNR			
CPT	VA	By Manufacturer	
Maximum, HP rating	hp	By Manufacturer	
Quantity	qty.	By Manufacturer	
Electronic relay model no.	-	By Manufacturer	
Physical dimension	in.	By Manufacturer	
Maximum Size Cable Termination Allowable, Determined by Lugs and NEC Bending Radius	AWG	By Manufacturer	
Size 4, FVNR			
CPT	VA	By Manufacturer	
Maximum, HP rating	hp	By Manufacturer	
Quantity	qty.	By Manufacturer	
Electronic relay model no.	-	By Manufacturer	
Physical dimension	in.	By Manufacturer	
Maximum Size Cable Termination Allowable, Determined by Lugs and NEC Bending Radius	AWG	By Manufacturer	
List Parts Requiring Field Assembly	-	By Manufacturer	
List of Required Maintenance Tools Furnished with Equipment	-	By Manufacturer	

END OF SECTION

1)
2)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Low-voltage variable frequency drive (VFD) designed for use on 3-phase squirrel cage induction motor.

1.02 INFORMATIONAL SUBMITTALS

A. Product Data:
1. Completed Data Sheets for each different drive provided. Identify any special accessories required to match with driven load.
2. Complete list an accompanying data for any special equipment required for operation and maintenance of VFD.
3. Receiving, storage, installation, and testing instructions.

B. Quality assurance data:
1. Submittal document index and submittal schedule.
2. Plots of typical efficiency vs. speed and torque curves.
3. Harmonic analysis calculations specific to each installation showing total harmonic voltage and current distortion at PCC. Information to demonstrate that harmonic currents generated by drives will not cause power distribution system to experience harmonic distortion exceeding limits recommended by IEEE Standard 519. Describe product features and equipment furnished to meet harmonic distortion requirements of this Specification.
4. Mean Time-to-Failure data.
5. Standard production testing procedures for drives, certified factory test data and results after completion of factory testing.

1.03 ACTION SUBMITTALS

A. Shop Drawings:
1. Certified outline, general arrangement, assembly, and installation drawings, that includes front view, dimensions, and weight.
2. Elementary diagrams (3-line diagrams) and schematic control diagrams of complete VFD system showing terminal block terminations, device terminal numbers and internal wiring diagrams.
3. Certified drawings of cable termination compartments showing preferred locations for conduit entry/exit locations and indicating space available for cable terminations.
4. Nameplate drawing.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance manuals. Provide, at minimum:
1. Final copies of documents listed above.
2. Operating and maintenance procedures.
3. Spare parts lists with pricing.
4. Installation field reports and Data Sheets updated to reflect field installation conditions
5. Copies of warranty.

1.05 QUALITY ASSURANCE

A. Design and manufacture according to latest editions of applicable NEMA, UL, NFPA, IEEE, and ANSI standards.

B. Manufacturer shall be ISO 9001 certified and shall have produced similar electrical equipment for minimum period of 5 years.

C. When requested by Engineer, provide acceptable list of similar equipment installations complying with requirements of this specification.

D. Completed drive shall be tested for at least 3 hours with induction motor connected.

1.06 DELIVERY, STORAGE, AND HANDLING

A. During delivery and storage, handle equipment to prevent damage, denting, or scoring.

B. Store equipment and components in clean, dry place. Protect from weather, dirt, water, construction debris, and physical damage in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB.

B. Allen Bradley.

C. Cutler-Hammer.

D. Danfoss.

E. Robicon.

F. Toshiba.

2.02 SYSTEM DESCRIPTION

A. VFD shall convert incoming fixed frequency 3-phase ac power into variable frequency and voltage for controlling speed of 3-phase ac motor.

B. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for eliminating need for motor derating.

C. VFD shall be sinusoidal PWM type drive with sensor-less torque vector control capability. Control techniques other than PWM, not acceptable.

D. Components:
1. Full-wave diode rectifier to convert supply ac to fixed dc voltage.
2. Dc link capacitors.
3. Insulated Gate Bipolar Transistor (IGBT) power section, dual rated for either variable or constant torque applications.
4. VFD shall be microprocessor-based with LED and LCD display to monitor operating conditions.
5. Separate control and power terminal boards.

E. VFD shall be of modular construction for ease of access to control and power wiring, and maintenance.

F. Provide in NEMA 1 enclosure for use in normal, nonhazardous industrial environment.

G. Enclosure doors shall include electromechanical interlocking system with safety switch and electrical interlocks tied to main breaker. Whenever doors are open, safety ground switch shall connect plus, minus, and neutral dc buses to ground to ensure stored energy is discharged.

2.03 DESIGN REQUIREMENTS

A. Where manufacturer determines an input drive transformer, input filter, or output filter is required to meet installation requirements, they shall also be provided.

B. Point of Common Coupling (PCC) shall be defined as terminals on input side of circuit breaker directly feeding each individual drive.

C. Total Harmonic Distortion (THD) at each PCC shall not exceed 5%, as recommended for General Systems as listed in Table 10.2 of IEEE Standard 519.

D. Harmonic current distortion at PCC shall not exceed limits listed in Table 10.3 of IEEE Standard 519.

E. Design drive to provide 50,000 hours mean time between failures (MTBF) when specified preventative maintenance is performed.

F. Design motors furnished to meet NEMA MG1, Part 31 for VFD service.

G. Symbols shall conform to ANSI Y32.2/IEEE 315/CSA Z99.

H. Printed circuit boards shall be completely tested and burned-in, in accordance with UL347A before being assembled into completed VFD.

2.04 INPUT POWER

A. System shall be capable of maintaining rated torque and speed with bus voltage deviations of ±10% and frequency deviations of ±5%.

B. Line notching, transients, and harmonics on incoming line shall not affect VFD performance.

C. Below 70% bus voltage, motor will be allowed to coast. If bus voltage is restored within 2 seconds, system can be started, if selected. If bus voltage is not restored within 2 seconds, system shall be automatically shut down. Automatic or manual restart shall be selectable from control panel.

D. VFD shall have provisions for input line reactor to be incorporated into VFD enclosure.

E. Drive efficiency shall be 95% or higher at rated load.

2.05 OUTPUT POWER

A. Operating mode:
   1. Frequency at 60 Hz and below: Constant volts per Hz mode.
   2. Above 60 Hz: Selectively operate in either constant volts per Hz mode or constant voltage extended frequency mode.

B. Rated output voltage: Programmable for either 80 to 240 volts or from 320 to 480 volts depending on 3-phase motor nameplate rating.

C. VFD shall be capable of minimum of 110% of rated full-load current in continuous operation, in accordance with NEC Table 430.150.

2.06 OPERATING RANGE

A. Speed range: 6 to 60 Hz. Both minimum and maximum speeds shall be field-adjustable.

B. VFD shall not have electrical resonance within operating speed range.

C. VFD shall be able to speed search and immediately pick up spinning motor in either forward or reverse direction.

2.07 TORSIONAL REQUIREMENTS

A. VFD, motor, and equipment load shall not develop adverse speed dependent oscillations.

2.08 NOISE

A. Drive shall not cause motor audible noise to increase more than 3 dB at 3' (1 m) above rated noise level for operation on full voltage starter.

2.09 MINIMUM DISPLACEMENT POWER FACTOR

A. PF 0.90 lagging, or higher, at any speed or load without use of power factor correction capacitors.

2.10 HARMONICS MITIGATION

A. Provide output filters, as required, such that motor insulation will not be damaged.

B. If additional equipment is necessary to meet IEEE 519 requirements, it shall be through use of one or more of following:
   1. Input isolation transformer.
   2. Input line reactor.
   3. Input harmonic trap filter with series reactor.
   4. Higher pulse rectifier.
   5. Mirus filter.
   6. Dc link reactor.

C. Drive manufacturer shall select and approve equipment provided.

2.11 DRIVE CONTROL

A. VFD shall use control strategy that maximizes efficiency, performance, and power factor while minimizing motor heating.

B. Drive regulator and control: Digital microprocessor design with following functions:
   1. Speed regulation.
   2. Current regulation.
   3. Load angle regulation.
   4. Drive protection.
   5. Drive diagnostics.
   6. System sequencing.

C. VFD regulator and control functions shall be stored on nonvolatile memory.

D. Drive shall have minimum of 3 programmable prohibited frequency ranges with adjustable span of 0 to 10 Hz.

E. Provide drive with local and remote controls:
   1. Locate 2-position maintained switch on front of enclosure for selection of “Local” or “Remote” control.
   2. Individual momentary buttons for “Local,” “Start,” and “Stop.”
   3. Speed reference potentiometer.

F. Operation:

1. Switch in “Local” position: Drive shall operate at speed set by potentiometer when local “Start” button is pushed. “Stop” button shall stop equipment without delay.
2. Switch in “Remote” position: Drive shall be remotely controlled. Local potentiometer, “Start” button, and “Stop” button shall have no effect on operation.
   a. Speed control shall regulate motor speed corresponding to remote speed signal.
   b. When incoming signal is varying, rate of change of motor speed shall be limited by pre-selected acceleration/ deceleration rate.
   c. Drive shall be programmable to either run at constant speed as determined by minimum speed setting, last signal, preset speed, or to shut down, upon loss of speed signal. Remote speed signal falling below lower limit of range shall also be considered as loss of speed signal. Loss of remote speed signal shall be alarmed.
   d. If remote speed signal is above range upper limit, drive shall run at speed corresponding to upper limit.
   e. Alarms and indication:
      1) Loss of remote speed signal shall be alarmed.
      2) Drive failure alarm.
      3) Drive fault alarm.
      4) Drive in remote and local control indication.
      5) Drive running indication.

G. Following shall be available locally either on control panel display or by use of readouts and LEDs, and remotely through communication interface:
   1. Drive ready.
   2. Drive running.
   3. Current, amps.
   4. Line-line voltage, volts.
   5. Output horsepower, hp.
   6. Speed, rpm.
   7. Frequency, Hz: Digital readout.
   8. Drive alarm conditions.
      a. Missing run or start permissive.
      b. Low control voltage.
      c. Microprocessor problem.
      d. I/O addressing problem.
      e. Loss of speed reference.
      f. Common trouble alarm.
   9. Drive fault conditions requiring immediate attention, and may indicate impending shutdown of drive.
      a. Source undervoltage.
      b. Source overvoltage.
      c. Source loss of phase.
      d. Source reverse phase sequence.
      e. Load overcurrent.
      f. Overspeed.
      g. Ground fault.
      h. Dc Link overvoltage.

H. Provide communications interface for remote monitoring and control of VFD using DeviceNet communications protocol.

2.12 DRIVE DIAGNOSTICS

A. Provide comprehensive diagnostics for maintenance and troubleshooting including:
   1. Self-test of microprocessor drive control system.
   2. LED indicators for status indication on control boards.
   3. Convenient maintenance test points.

2.13 COOLING

A. Provide integral filtered ambient air cooling by natural convection or forced air cooling system as required to maintain drive equipment at its full current rating.

2.14 IDENTIFICATION AND TAGGING

A. Securely attach nameplates with self-tapping stainless steel screws. Adhesive nameplates not acceptable.

B. Lettering shall be black on white background.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean interior and exterior of equipment prior to placing into service. Debris shall be removed and appropriately discarded.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Perform manufacturer's recommended start-up and commissioning tests prior to placing into service.

C. Correct deficiencies with VFD and other furnished equipment until system operates as required for installed equipment, at no cost to Owner.

D. Refinish marred spots to match original finish.

DATA SHEETS LOW VOLTAGE VFD		Equipment Name: VFD #1, #3 Tag No.: REV. #	
DESCRIPTION	**UNITS/ OPTIONS**	**SPEC DATA**	**VENDOR DATA**
Manufacturer	N/a		
Catalog/Serial No.	N/a		
General:			
Driven Equipment	-		
Motor NEMA Design	NEMA	Design B	
Nominal Operating Voltage	V	208V	
System Operating Frequency	Hz	60	
Motor Nameplate Voltage	V	200	
Motor Nameplate Horsepower	Hp	40	
Cable information:			
Power Cable Incoming Location	Top/Bottom	Top	
Power Cable Exit Location	Top/Bottom	Top	
Maximum Expected Cable Length	ft	20	
Site information:			
Maximum Ambient Temperature	°C	40	
Minimum Ambient Temperature	°C	0	
Design:			
Rectifier Type	-	PWM	
No of Pulses, Minimum	12, 18, or 24	18	
THD at Point of Common Coupling (PCC)	%	5%	
Available Short Circuit Current at PCC	kA	65	
Mean Time Between Failure (MTFB), Minimum	Hrs	50,000	
Maximum Input Voltage Variation	%	+/- 10	
Maximum Input Frequency Variation	%	+/- 5	
Drive Efficiency, Minimum	%	95	
Displacement Power Factor, minimum	pu	0.9	
Programmable Output Voltage Range	V -V	320 – 480	
Overvoltage Capability of System Voltage, Min.	%	110	
Speed Range	Hz -Hz	6 – 60	
Minimum Programmable Prohibited Freq. Ranges	Qty	3	
Prohibited Freq. Range Span	Hz - Hz	0 – 10	
Enclosure:			
NEMA Rating	NEMA	1	
Dimensions	L x W x H	By Manufacturer	
Weight	lbs	By Manufacturer	
Cooling Method	Air/Water	By Manufacturer	
Controls:			
Local /Remote Switch	Y/N	Y	
Start and Stop Push Buttons	Y/N	Y	
Local Speed Reference Potentiometer/Adjustment	Y/N	Y	
Programmable Speed Setting	Y/N	Y	
Local LCD or LED Readout Panel	Y/N	Y	
Local and Remote Alarm Indication	Y/N	Y	
Monitoring of VFD Fault Conditions	Y/N	Y	
Communication Interface	-	DeviceNet	
Accessories:			

DATA SHEETS LOW VOLTAGE VFD		Equipment Name: VFD #1, #3 Tag No.: REV. #	
DESCRIPTION	**UNITS/ OPTIONS**	**SPEC DATA**	**VENDOR DATA**
Input Isolation Transformer	Y/N	By Manufacturer	
Input Line Reactor	Y/N	By Manufacturer	
Input Harmonic Filter Trap with Series Reactor	Y/N	By Manufacturer	
Output Filter	Y/N	By Manufacturer	
Mirus Filter	Y/N	By Manufacturer	
DC Link Reactor	Y/N	By Manufacturer	
Special Accessories Required:	Y/N	By Manufacturer	

DATA SHEETS LOW VOLTAGE VFD		Equipment Name: VFD #2 Tag No.: REV. #	
DESCRIPTION	**UNITS/ OPTIONS**	**SPEC DATA**	**VENDOR DATA**
Manufacturer	N/a		
Catalog/Serial No.	N/a		
General:			
Driven Equipment	-		
Motor NEMA Design	NEMA	Design B	
Nominal Operating Voltage	V	208V	
System Operating Frequency	Hz	60	
Motor Nameplate Voltage	V	200	
Motor Nameplate Horsepower	Hp	25	
Cable information:			
Power Cable Incoming Location	Top/Bottom	Top	
Power Cable Exit Location	Top/Bottom	Top	
Maximum Expected Cable Length	ft	20	
Site information:			
Maximum Ambient Temperature	°C	40	
Minimum Ambient Temperature	°C	0	
Design:			
Rectifier Type	-	PWM	
No of Pulses, Minimum	12, 18, or 24	18	
THD at Point of Common Coupling (PCC)	%	5%	
Available Short Circuit Current at PCC	kA	65	
Mean Time Between Failure (MTFB), Minimum	Hrs	50,000	
Maximum Input Voltage Variation	%	+/- 10	
Maximum Input Frequency Variation	%	+/- 5	
Drive Efficiency, Minimum	%	95	
Displacement Power Factor, minimum	pu	0.9	
Programmable Output Voltage Range	V -V	320 – 480	
Overvoltage Capability of System Voltage, Min.	%	110	
Speed Range	Hz -Hz	6 – 60	
Minimum Programmable Prohibited Freq. Ranges	Qty	3	
Prohibited Freq. Range Span	Hz - Hz	0 – 10	
Enclosure:			
NEMA Rating	NEMA	1	
Dimensions	L x W x H	By Manufacturer	
Weight	lbs	By Manufacturer	
Cooling Method	Air/Water	By Manufacturer	
Controls:			
Local /Remote Switch	Y/N	Y	
Start and Stop Push Buttons	Y/N	Y	
Local Speed Reference Potentiometer/Adjustment	Y/N	Y	
Programmable Speed Setting	Y/N	Y	
Local LCD or LED Readout Panel	Y/N	Y	
Local and Remote Alarm Indication	Y/N	Y	
Monitoring of VFD Fault Conditions	Y/N	Y	
Communication Interface	-	DeviceNet	

DATA SHEETS LOW VOLTAGE VFD		Equipment Name: VFD #2 Tag No.: REV. #	
DESCRIPTION	**UNITS/ OPTIONS**	**SPEC DATA**	**VENDOR DATA**
Accessories:			
Input Isolation Transformer	Y/N	By Manufacturer	
Input Line Reactor	Y/N	By Manufacturer	
Input Harmonic Filter Trap with Series Reactor	Y/N	By Manufacturer	
Output Filter	Y/N	By Manufacturer	
Mirus Filter	Y/N	By Manufacturer	
DC Link Reactor	Y/N	By Manufacturer	
Special Accessories Required:	Y/N	By Manufacturer	

END OF SECTION

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2)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Impulse tubing.

B. Control and instrument supply tubing.

C. Instrument wiring.

D. Instrument mounting stands.

1.02 SUBMITTALS

A. Product Data:

B. Shop Drawings:
1. Control loop diagrams. Diagrams shall be in accordance with requirements of ANSI/ISA S5.4. Control loop diagrams shall also include manufacturer, model number, and calibrated range; setpoint values for alarm and shutdown devices; equipment numbers for racks, panels, and junction boxes; exact location of device including column, row, and elevation; and control of solenoid valve fail-safe operation. Assign cable, wire, and tube numbers oriented to instrument tag number.
2. Schematic drawings for motor or relay-based control logic. Show color of wire, all termination points, terminal numbers, cable and wire numbers. *Assign cable and wire numbers for external panel wiring. Cable and wire numbers shall be instrument tag number oriented.*

C. Quality assurance submittals:
1. Installation drawings including mounting and grounding requirements.
2. Calibration report summarizing setpoints, calibration ranges, and tuning constants.
3. Wiring diagrams defining terminal numbers and functions for interface with other instruments and equipment.
4. Circuit schedule.
5. Grounding and shielding drawings.

D. Closeout submittals: Record Documents.
1. Control loop diagrams.
2. Schematic drawings.
3. Wiring diagrams.
4. Circuit schedule.
5. Calibration report.

PART 2 PRODUCTS

2.01 IMPULSE TUBING

A. Tubing: Type 316 seamless stainless steel, 1/2" OD x 0.049" wall, ASTM A269.

B. Joints: Compression fittings, Type 316 stainless steel.

C. Fittings: Compression, Type 316 stainless steel.

D. Valves:
1. Type: Ball.
2. Material: Type 316 stainless steel, ASTM A479.
3. Pressure class: 1,500 psig to 150ºF.

4. Internals: Type 316 stainless steel ball, Teflon packing.

2.02 CONTROL AND INSTRUMENT SUPPLY TUBING

A. Tubing:
1. Soft annealed bright seamless, copper, ASTM B68 and B75 Type DHP Alloy No. 122.
2. Size:
a. 1/4" OD with 0.030 wall: Instrument air supply lines to single instruments and signal lines.
b. 3/8" OD with 0.032 wall: Instrument air supply lines to multiple instruments, control valves, and controllers.

B. Joints: Compression fittings, brass.

C. Fittings: Compression, brass.

D. Valves:
1. Type: Ball.
2. Material: Brass, ASTM B16.
3. Pressure class: 1,500 psig to 150ºF.
4. Internals: Type 316 stainless steel ball, Teflon packing.

2.03 INSTRUMENT WIRING

A. Provide No. 16 AWG single twisted shielded pair cable for 24-volt dc analog signals in accordance with Section 26 05 00

B. Provide No. 16 AWG, 600-volt wire for 120-volt ac signals in accordance with Section 26 05 00.

C. Provide No. 12 AWG, 600-volt wire for 120-volt ac power circuits in accordance with Section 26 05 00.

D. Provide RTD or thermocouple extension wire:
1. RTD extension wire:
a. 3-wire system:
1) Configuration: Twisted triad, shielded, and jacketed.
2) Insulation: 600-volt, 60ºC, PVC, color-coded to permit identification of each conductor.
3) Conductors: Stranded copper, 16 AWG.
4) Shield: Metallized foil or tinned copper braid providing 100% coverage against noise together with 18 AWG stranded tinned drain wire.
b. 4-wire system:
1) Configuration: 4-conductor twisted, shielded, and jacketed.
2) Insulation: 300-volt, 80ºC, PVC, color-coded to permit identification of each conductor.
3) Conductors: Stranded copper, 18 AWG.
4) Shield: Metallized foil or tinned copper braid providing 100% coverage against noise together with 20 AWG stranded tinned drain wire.
2. Thermocouple extension wire:
a. Configuration: Single twisted pair, shielded, and jacketed.
b. Conductors: Stranded, 16 AWG.
c. Insulation: 300-volt, 105ºC, FEP Teflon, color-coded as defined below.
d. Conductor, jacket, and color:
1) Type EX:
1) Jacket color: Purple.
2) Positive conductor: Chromel, purple.
3) Negative conductor: Constantan, red.
4) Tolerance: ±3ºF for 0 to 400ºF.
2) Type JX:
1) Jacket color: Black.
2) Positive conductor: Iron, white.
3) Negative conductor: Constantan, red.

4) Tolerance: ±4ºF for 0 to 400ºF.
3) Type KX:
1) Jacket color: Yellow.
2) Positive conductor: Chromel, yellow.
3) Negative conductor: Alumel, red.
4) Tolerance: ±4ºF for 0 to 400ºF.
4) Type TX:
1) Jacket color: Blue.
2) Positive conductor: Copper, blue.
3) Negative conductor: Constantan, red.
4) Tolerance: ±1.5ºF for 75 to 200ºF.

e. Shield: Metallized foil or tinned copper braid providing 100% coverage against noise together with 18 AWG stranded tinned drain wire.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install instrument and control devices in accordance with manufacturer's recommendations and/or where approved by Owner's Representative.

B. Locate instruments and control devices where shown on Drawings,s shown on P&IDs, and/or designated by Owner's Representative.

C. Mount instruments so they are rigidly supported, level and plumb, and in such a manner as to provide accessibility; protection from damage; isolation from heat, shock and vibration; and freedom from interference with other equipment, piping, and electrical work.

D. Do not install instruments until heavy construction work adjacent to instruments has been completed to extent that damage will be unlikely to installation by such construction work.

E. Manufacturer's recommendations referred to herein shall be as stated in manufacturer's installation manual and/or by manufacturer's service representative. Final interpretation of "installation requirements" will be by Owner's Representative.

F. Installation of instruments shall be in accordance with installation details and/or manufacturer' recommendation.

3.02 INSTRUMENT EQUIPMENT MOUNTING

A. Mount instrument equipment to building steel, concrete floors, or walls using pipe mounting stands or field-fabricated mounting brackets.
1. Secure instrument equipment mounting bracket to building steel by welding, and to concrete or masonry building structure by expansion-type anchors. Do not mount instrumentation equipment to exterior removable panels.
2. Grout mounting brackets on concrete floors with nonmetallic, chloride-free gypsum material, ASTM C1107, Grade A; formulation suitable for application.
3. If vibration-free location is not available for instrument mounting, appropriate vibration shock mounting shall be provided by use of rubber grommets or other vibration dampeners designed for vibration absorption subject to Owner's review. Mounting of process pressure and temperature gages or process pressure and temperature switches to process piping shall be allowable only if vibration is minimized.

B. Instrument accessibility: Following general rules shall be adhered to, unless limited by other requirements in design of system.

1. Locate instrument process connections for maximum convenience in operation and servicing of instrument. Orient connections so instruments or piping will not obstruct aisles, platforms, or ladders.
2. Install field-mounted instruments so they are accessible from grade, platform, or permanent ladder.
3. Locate remote instruments and control devices (devices not located in or on process lines) at nominal height of 4-1/2' above finished floor, grade, or platform. Provide instrument racks for location in which 3 or more instruments or control devices are located within close proximity of each other.
4. Mount local indicators, recorders, and controllers so they are readable, controllable, and serviceable from grade or platforms.

3.03 IMPULSE TUBING INSTALLATION

A. Install instrument impulse piping parallel (except for slope) to building lines and other piping following instrument manufacturer's instructions.
   1. Instrument impulse piping work shall be from last block valve through, and including, blowdown piping to nearest equipment drain.
   2. Install horizontal impulse piping with slope of 1" per foot.
      a. Slope impulse piping toward instrument for liquid and steam service.
      b. Slope impulse piping away from instrument for gas service.
   3. Impulse piping shall be continuously supported with 12-gage aluminum angle and held in place with appropriate tubing clips and fasteners. Install tubing supports in such a manner to preclude fatigue failure of tubing due to vibration.

B. Blowdown and drain valves are required in impulse lines to all transmitters and instruments used on water, steam, and condensing vapor services.

C. Attach isolation valves to instruments so that it is possible to disconnect instrument from connecting pipe without having to drain pipe.

D. Install expansion loops in impulse piping installations where movement of last block valve and instrument is not in same plane or length of expansion varies.

E. Support pressure gages and other instruments connected to impulse piping independently of tubing. Provide ample expansion loops in tubing connections to instruments subject to vibrations to prevent failure due to metal fatigue.

F. Furnish and install accessories required for complete impulse piping system including instrument isolation valves, snubbers, siphons, and calibration and test connections at instrument.

3.04 CONTROL TUBING AND INSTRUMENT SUPPLY TUBING INSTALLATION

A. Single runs of control tubing shall be 1/4" or 3/8" outside diameter copper tubing. 3/8" tubing shall be used for instrument air supply lines to valves and controllers. Unless otherwise specified, other instrument air lines shall be 1/4".

B. Instrument tubing shall be routed an adequate distance from outside walls, doorways, and areas of extreme heat to minimize ambient effects on control lines.

C. Lines in instrument supply distribution system shall be sized such that maximum pressure drop from air dryer to most remote air user does not exceed 5 psig with a 100 psig supply when all users are taking air at approximately 2 to 5 scfm.

D. Only tool-made bends shall be acceptable.

E. Support each run of instrument supply tubing with 12-gage aluminum angle, installed parallel to building lines and other piping, and held in place with appropriate tubing clips and fasteners. Tubing supports shall be installed in such a manner to preclude fatigue failure of tubing due to vibration.

F. Signal tubing termination at each instrument shall have gage tee with plug for calibration and service.

3.05 CLEANING

A. Before assembly or erection, thoroughly clean instruments of temporary protective coatings and foreign materials.

B. After erection of equipment, clean external surfaces of oil, grease, dirt, or other foreign material.

END OF SECTION

1) T, J. Mergen

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide supervision, labor, coordination, tools, material, equipment, and services required to perform commissioning and start-up of each respective item of equipment and systems furnished and/or installed as a part of this contract.

B. Provide supervision, labor, and assistance to manufacturer's field representative, Service Engineer, and technical directors of installation for equipment and controls installed as a part of this Contract. Follow specified procedures and instructions provided by these representatives. Representatives will not be present at all times. Owner or Owner's Representative will determine when representatives are required.

C. Provide construction labor required for commissioning process necessary to support schedule as determined by Owner or Owner's Representative, including initial total plant startup.
   1. Plant startup will proceed on a schedule determined by Owner or Owner's Representative and will likely entail 24-hour a day activity until startup is complete.
   2. Owner will provide operators for commissioning process. Owner or Owner's Representative will determine when startup has been completed.
   3. Startup refers not only to startup of total plant but also to individual systems requiring checkout prior to total plant startup.

D. Verify operation performance of equipment and associated accessories for compliance, as described in Contract Documents.

E. Document test inspections.

F. Verify application of operation and maintenance manuals, record documents, spare parts listings, and other items as may be specified for supporting of piping systems and equipment.

1.02 SUBMITTALS

A. Quality assurance data:
   1. Commissioning responsibilities list including breakdown of each trades responsibilities during commissioning activities.
   2. Sample documentation for tests and inspections required by Code Authorities.

B. Record documents.
   1. Test data: Test equipment used, test performance data for each breaker input/output. Document each input has been functional tested and correctly displays on the operator humane machine interface
   2. Date of test and name of individual performing test.

1.03 QUALITY ASSURANCE

A. Assure participation and cooperation of specialty contractors under its jurisdiction as required for commissioning process.

B. Check-out each piece of equipment and each system with approved checklist to ensure Contract Document conformance prior to start-up.

C. Keep track of commissioning activities with acceptance for operation checklist. Refer to Divisions 26 and 40 for specific requirements and Exhibits A and B for individual equipment and component requirements.

D. Develop detailed commissioning documents for Owner's approval.

E. Conform to Owner's plant operating procedures for commissioning and startup of equipment.
   1. Notify Owner, in writing, 1 day in advance of commissioning of equipment or systems.
   2. Notify Owner, in writing, 1 day in advance of startup of equipment or systems upon completion of commissioning process.
   3. Upon completion of start-up, equipment or systems shall be turned over to Owner and tagged as accepted. No additional work on or operation of equipment or systems shall be allowed by Contractor without written consent of Owner.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide test equipment required for commissioning and startup of equipment.

B. Provide and maintain tools and test equipment in first-class condition and quantities sufficient to assure timely, successful performance and completion of required Work.

C. Test equipment shall have recent calibration checks by equipment manufacturer or authorized facility to assure accuracy of commissioning process.

PART 3 EXECUTION

3.01 SITE VERIFICATION OF CONDITIONS

A. Installation verification:
   1. Prior to system start-up, the Contractor, Owner, and Owner's Representative shall conduct final installation verification audit. Contractor shall be responsible for completeness of work to Owner's satisfaction including change orders and punch list items. Audit shall include, but not be limited to, checking of:
      a. Piping specialties including balancing, control, and isolation valves.
      b. Control sensor types and locations.
      c. Identification of piping, valves, equipment, controls, etc.
      d. Major equipment, fans, valves, starters, gages, thermometers, etc.
      e. Documentation of prestart-up tests performed, including manufacturer's factory tests.
   2. If Work is found to be incomplete, incorrect, or nonfunctional, Contractor shall take corrective action before system start-up work proceeds. If during system start-up additional items are found, Contractor shall take corrective action before system start-up is completed.

B. Operation verification:
   1. After system equipment, wiring, piping, and component installation has been verified, system start-up and calibration shall commence.
   2. Contractor shall be responsible for operation and control of installed systems.
   3. During system checkout, operation checklist shall be filled out to verify system operation.
   4. Owner and/or Owner's Representative shall verify system operation with responsible Contractor.

3.02 EQUIPMENT COMMISSIONING

A. Bearings:
   1. Inspect for cleanliness; clean and remove foreign materials.
   2. Verify alignment.

B. Drives:
   1. Inspect for cleanliness; clean and remove foreign materials before starting operation.
   2. Adjust drives for all alignment of sheaves, V-belts, and couplings.
   3. Adjust tension in V-belt drives, and adjust varipitch sheaves and drives for proper equipment speed.

C. Lubrication:
   1. Lubricants for initial operation shall be furnished by Contractor.
   2. Lubricants required for storage and flushing of equipment furnished shall be furnished by Contractor.
   3. Lubricate bearings and fill oil reservoir prior to operation. Perform lubrication in accordance with manufacturer's recommendations.
   4. After Contractor lubricates equipment, Contractor shall affix a tag to equipment stating lubricant used, quantity, date lubricated, and name of person lubricating equipment.
   5. Submit 2 volumes of lubrication requirements to Owner at site for each item of equipment furnished requiring lubrication.

D. Motors:
   1. Check each motor for amperage comparison to nameplate value.
   2. Correct conditions which produce excessive current flow, and which exist due to equipment malfunction.

E. Pumps:
   1. Check mechanical seals and packing for cleanliness and adjustment before running pump.
   2. Verify that pump and connecting piping are free of dirt, debris, and scale before circulating liquid through pump.
   3. Check running clearances.

F. Inspect fan wheels for clearance and balance. Provide factory authorized personnel for adjustment when needed.

G. Remove any rust, scale, and foreign materials from equipment and renew defaced surfaces.

3.03 PIPING SYSTEMS COMMISSIONING

A. Check settings of pipe hangers.

B. Check piping for leaks at every joint, and at every screwed, flanged, or welded connection, using approved compound.
   1. Examine flanged joints:
      a. Tighten flanges after system has been placed in operation.
      b. Replace flange gaskets that show any sign of leakage after tightening.
   2. Inspect screwed joints:
      a. Promptly remake each joint that appears to be faulty; do not wait for rust to form.
      b. Clean threads on both parts, apply compound, and remake joints.

C. Vent gasses trapped in any part of liquid systems. Verify that liquids are drained from all parts of gas or air systems.

D. After system has been placed in operation:
   1. Clean strainers, dirt pockets, orifices, valves seats, and headers in fluid systems, to assure they are free of foreign materials.
   2. Open steam traps and air vents; remove operating elements. Clean thoroughly, reinstall internal parts and put back into operation.

E. Repair damaged insulation.

3.04 INSTRUMENT PIPING COMMISSIONING

A. Branch instrument air headers shall be blown down and leak tested prior to time air is admitted to any instrument. Purpose of blowing down header is to remove moisture, foreign particles, etc., to assure cleanliness of header. Larger outlets shall be blown first and ultimately each supply line shall be disconnected at instrument and blown.
   1. In testing branch headers, pressurize header to 120 lb, close valves, and observe pressure loss during 30-minute period. A loss of greater than 2% will be considered excessive.
   2. If leakage is excessive, perform bubble test to locate leaks in main header, and at joints in individual instrument supply lines.
   3. Perform necessary repairs to air header and retest until satisfactory.

B. Pneumatic tubing circuits shall be blown down and tested for continuity, restrictions, tightness, and elimination of leaks.
   1. Test for continuity, restrictions, and plugging shall consist of applying 35 psig air supply to input end of tubing under test, with tubing disconnected from instruments and open to atmosphere.
   2. Reasonable flow of air shall be present at open end of tubing. If tubing leads to more than 1 unit or piece of equipment, same procedure shall be followed at each unit after reconnecting tubing to previous unit.
   3. Test for tightness and elimination of leaks shall be that outlined in procedure entitled "Pneumatic Control Circuit Pressure Test," latest revision, Recommended Practice, RP7.1, of Instrument Society of America.
   4. Wherever possible, instrument or instruments at outlet end of tubing shall remain connected to tubing during test so that instrument may be tested simultaneously, provided instrument has suitable pressure rating.
   5. Appropriate allowances shall be made in extending duration of length of test to offset additional volume of instrument. Where tubing terminates in large valve diaphragm housing or other large volume, tubing may be disconnected, plugged, and tested.
   6. After tubing test has been completed, tubing shall be reconnected to various units involved, and broken connections shall be bubble-tested.
   7. In testing diaphragm control valves or other large volumes for leaks, use small rotameter and 35 psig air supply. Rate of flow indicated by rotameter shall not exceed 5.0 std. cc/min. of air.
   8. In event instrument air is not available during time that commissioning is required, supply instrument quality air from portable compressor or bottled dry air or nitrogen.

3.05 CONTROLS AND INSTRUMENTATION COMMISSIONING

A. Check out controls and instruments prior to start-up to assure in situ performance in accordance with Contract Documents under simulated operating conditions. Contractor to determine initial start-up conditions.

B. Prior to commissioning:
   1. Remove shipping stops from instruments before starting with procedures specified.
   2. Contractor shall have instruction manuals available.
   3. Install miscellaneous components including charts, illumination, mercury, etc., furnished separately.
   4. Verify nameplate data with respect to conditions of range, operating temperature, specific gravity, and components as stated on unit specifications. Discrepancies shall be immediately called to attention of Owner and report of its condition confirmed in writing.

C. Commissioning responsibilities:
   1. Verify instrument installation in conformance with manufacturer's recommendations.
   2. Follow manufacturer's recommendations for calibrating control system components including instruments, switches, valves, etc.
      a. Calibrate instruments individually and where applicable, as system (i.e. transmitter, controller and control valve).

b. Verify control system components calibration meets published accuracies over full operational range.
c. Defective equipment: If any instrument cannot be properly adjusted or does not meet manufacturer's specifications, immediately call to attention of Owner and report of its condition confirmed in writing. Repair or replace equipment furnished as part of this contract.
d. Calibration of supplementary supply and output pressure gages contained on instruments will not be required. Follow defective equipment guidelines if gage is found to be faulty.

3. Complete calibration report form for each instrument and control device. See Exhibit H for example of calibration forms.
4. Calibration Stickers: Upon successful calibration, affix calibration sticker to instrument or control component. Calibration sticker shall contain equipment identification number, calibrated range or switch set and reset conditions, date of calibration, due date for next calibration, and name of person performing calibration.
5. Check instrument and control wiring for proper operation.
   a. After energizing and prior to start-up, check control circuits and programs for proper sequence of operations and interlocking functions.
   b. Correct any wiring changes required as result of checks including properly changing terminal strip and/or wiring markers, and associated documentation including schematics and termination diagrams.

D. Test procedures:
1. Analog devices: Include 9-point span test (0%, 25% increasing, 50% increasing, 75% increasing, 100%, 75% decreasing, 50% decreasing, 25% decreasing, 0%) verifying linearity and hysteresis meets specified values.
2. Discrete devices: Use multiple state changes to verify set point, reset point, and deadband.

E. Acceptable calibration standards:
1. Vacuum or draft:
   a. 0" to 5" w.c.: Inclined water-filled manometer graduated in hundredths of inches of water.
   b. 5" to 25" Hg: Mercury manometer graduated in tenths of inches of mercury.
   c. 5" to 60" w.c.: Water manometer graduated in tenths of inches of water.
   d. Electronic: Digital manometer, ±0.25% full scale accuracy, 3.5-digit LCD display, ranges of 0 to 19.99" w.c. and 0 to 199.9" w.c., ±1 LSD.
2. Pressure:
   a. 0" to 5" w.c.: Inclined water-filled manometer graduated in hundredths of inches of water.
   b. 5" to 60" w.c.: Water manometer graduated in tenths of inches of water.
   c. 3 to 25 psig: Mercury manometer graduated in tenths of psi.
   d. 25 to 150 psig: Precision pressure gage, 0-160 psi, 1/4 of 1% accuracy, 8-1/2" dial minimum.
   e. 150 to 750 psig: Precision pressure gage, 0-800 psi, 1/2 of 1% accuracy, 8-1/2" dial minimum.
   f. Electronic: Digital manometer, ±0.1% full scale accuracy, 3.5-digit LCD display, ranges of 0 to 19.99 psig, 0 to 199.9 psig, and 0 to 1,999 psig, ±1 LSD.
3. Differential:
   a. 0" to 5" w.c.: Inclined water-filled manometer graduated in hundredths of inches of water.
   b. 5" to 300" w.c.: Mercury manometer graduated in tenths of inches of water.
   c. 5 to 25 psig: Mercury manometer graduated in tenths of psi.
   d. Above 25 psig: Use pressure gages specified.
   e. Electronic: Digital differential manometer, ±0.1% full scale accuracy, 5-digit LCD display, ranges of 0 to 200" w.c. and 0 to 2,000" w.c., ±1 LSD.
4. Temperatures:
   a. -20 to 250ºF: Laboratory thermometers of suitable range.
   b. Other ranges: Use thermocouple and precision potentiometer.
   c. Electronic: Digital thermometer, ±0.1% of reading accuracy, 4-digit LCD display, ±1 LSD.
5. DC process signal calibrator: 2-wire transmitter simulator:
   a. 4-20 mA range: ±0.5% full scale accuracy, 4-digit LCD display, ±1 LSD.
   b. 10-50 mA range: ±0.06% full scale accuracy, 4.5-digit LED display, ±1 LSD.

3.06 PANEL MOUNTED INSTRUMENTS

A. Receiver instruments: Perform 9-point span test (0%, 25% increasing, 50% increasing, 75% increasing, 100%, 75% decreasing, 50% decreasing, 25% decreasing, 0%) verifying linearity and hysteresis by impressing measured signal into input or signal connections on instrument.

B. Controllers (panel or control room mounted):
   1. Check for proper operation and adjust in accordance with manufacturer's instructions. Vary process input signal and check output signal for direction.
   2. Set initial proportional band, reset rate, and rate time as recommended by manufacturer. It may be necessary to determine process dynamics in actual operation before settings can be made.
   3. Control loops shall be observed for operability and conformance to Specifications by impressing simulated input signal at primary element and checking response of final control element.

C. Integrators, ratio relays, etc.:
   1. Check in conformance to manufacturer's recommendations. Receiver integrators shall be calibrated for proper operation and multiplication factor by feeding maximum input signal for specified period of time with stopwatch.
   2. Check in conformance to manufacturer's recommendations. Ratio signals shall be simulated to check proper ratio settings and output.

D. Graphics panel: If possible, trip each alarm actuator (field device) in sequence and observe Graphics. Check "acknowledge" and "test" pushbuttons.

3.07 CONTROL VALVES

A. Prior to commissioning: Inspect both hand and automatic control valves.
   1. Verify control valve seat is free from foreign material and properly positioned for intended service.
   2. Clean bonnets and stems.
   3. Coat packing gland threads and valve stem with surface preparation of anti-rust compound after cleaning.
   4. Tighten packing glands to assure no leakage, but permit stems to operate without galling.

B. Test procedures:
   1. Perform 9-point span test (0%, 25% increasing, 50% increasing, 75% increasing, 100%, 75% decreasing, 50% decreasing, 25% decreasing, 0%) verifying linearity and hysteresis meets specified values.
   2. Check valve action and fail position for conformance to Specifications (i.e. open, close, or in-place on loss of power source).
   3. Valve positioner:
      a. Check for conformance to Specifications relative to spring action and input range (particularly for split range applications), valve action, and length of stroke.
      b. If valve positioner is fitted with standard characterized cam, check to see if proper cam is mounted.
      c. If specifications call for specially cut cam, refer this item in writing to Engineer for handling.
      d. Do not cut or modify standard cam.

C. After commissioning, replace packing on any valve which continues to leak.

3.08 ACCEPTANCE FOR OPERATION

A. Each piece of equipment installed by this contract shall carry "Acceptance for Operation Checklist." Each checklist shall be signed by the Contractor's Representative and Owner, or Owner's Representative. Each list shall have applicable blanks filled in and attached to items indicating that it is prepared for operation.

B. Owner will accept equipment and systems for operation when construction has been substantially completed by Contractor. "Acceptance for Operation" shall mean Owner will assume operational and routine maintenance duties. "Acceptance for Operation" does not relieve Contractor from

responsibilities related to defective materials and workmanship; neither does it constitute final acceptance of materials and equipment.

C. After Owner has accepted a system for operation, Contractor shall continue to perform following as requested and scheduled by Owner at no additional cost to Owner until final acceptance:
   1. Troubleshooting, adjustments, and repairs until system operation and performance is acceptable.
   2. Assist instrument and control personnel with instrument calibration.
   3. Craft labor as required.

D. After Owner has accepted a system for operation, Contractor shall continue to supply technical services when needed until final acceptance.

3.09 TRAINING

A. Coordinate and direct training of personnel for operation and maintenance of systems and equipment specified.

B. Provide Owner's selected staff with adequate training to fully operate and maintain the individual systems. Training shall be in accordance with the Contract Documents.

END OF SECTION

1) T. J, Mergen

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Digital process control computer hardware and associated hardware, including:
   1. Operator workstations.
   2. Data historian/engineering workstation.
   3. Associated software.

1.02 SUBMITTALS

A. Submit information as indicated in table in accordance with Section 01 33 00:
   1. Submittal shall clearly identify each item by instrument tag number or specification section number and paragraph, part or catalog number and options or accessories provided.

B. General requirements:
   1. Furnish manufacturer standard product information.
   2. Product data:
      a. Manufacturer standard documentation including specifications, drawings, installation instruction, user's manuals, operation and maintenance manuals.
      b. Include only those sheets which are pertinent to specific product.
      c. Annotate each sheet to:
         1) Clearly identify specific product or part installed.
         2) Clearly identify data applicable to installation.
         3) Delete references to inapplicable information.

1.03 QUALITY ASSURANCE

A. Design, construct, and test in conformance to NEMA ICS 1, ICS 2, and ICS 3.

B. Input/Output performance requirements:
   1. I/O point cards shall utilize optical or other isolation techniques to protect system against damage due to voltage spikes.
   2. I/O cards shall have common mode voltage rejection of 500 volts, except relay outputs which shall be 250 volts ac.
   3. Accuracy of analog I/O throughout entire system shall be not less than 0.1% of full scale.
   4. Analog inputs shall have a common-mode rejection ratio of 100 dB and differential rejection ration of 30 dB at line frequency and harmonics to ensure proper plant noise elimination.

1.04 DELIVERY, HANDLING, AND STORAGE

A. Delivery, storage, and protection shall be in accordance with manufacturer's recommended procedures.

B. Accept products on site in factory containers and verify damage.

C. Store products in clean, dry area. Maintain temperature in accordance with NEMA ICS 1.

1.05 EXISTING ENVIRONMENTAL CONDITIONS

A. Control room:
   1. Temperature ranges, °F: 60 to 90.
   2. Humidity, %: 10 to 90, noncondensing.

B. Power supply: 120 volts ac, single-phase, 60 Hz.

1.06 WARRANTY

A. Vendor's warranty shall not begin until final acceptance of system by Owner.

PART 2 PRODUCTS

2.01 COMPUTER HARDWARE

A. Computers:
1. Purpose:
   a. Operator Workstation
   b. Data Historian/Engineering Workstation
2. Central processing unit: 300 MHz, High Performance.
3. Memory type: SRAM, Flash.
4. User logic memory: 10 MB.
5. Communications Options: Ethernet,
6. Internal Power Usage: 1250 mA @ 3.3-volt dc; 1000 mA @ 5-volt dc.

B. Monitors:
1. Monitors shall be provided with each computer.
2. Provide 22” (559 mm) minimum, 16-color flat panel based monitors with high-resolution graphics.

C. Accessories:
1. Operator keyboard and mouse shall be provided with each computer.
2. From operator keyboard and monitor, operator shall be capable of performing functions which includes, but are not limited to, issuing commands to programmable controller, displaying graphics for information/control of field devices, and acknowledgment of alarms.

2.02 COMPUTER SOFTWARE

A. Operating system: Latest version of Microsoft Windows platform on which DCS is certified to operate.

B. Operator interface software:
1. Provide control system manufacturer’s operator interface software and functionality from each operator workstation.
2. Interfaces to third party systems.
   a. Provide complete set of system software including gateway drivers including but not limited to following:
      1) Modbus data interface.
      2) HART devices.
      3) Ethernet gateway.

C. Engineering tools software:
1. Provide control system manufacturer’s engineering tools software and functionality to allow full configuration, programming, updating control logic, developing graphic screens, developing trends, updating data historian, and troubleshooting DCS from Engineering Workstation.

D. Data historian software:
1. Provide data historian software.
2. Point license: Minimum 2,000 points.
3. Third-party interface software: Provide server software in acceptable format(s) (OPC, ODBC, DDE, etc.) for data transfer with:
   a. Microsoft Excel.

E. Manufacturer shall have application training and customer assistance services available.

PART 3 EXECUTION

NOT USED

END OF SECTION

1) T.J. Mergen

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Instruments and control equipment.

B. Installation of instrumentation and control equipment including field transmitters, sensing elements, control valves, analyzers, and miscellaneous devices.

1.02 EXISTING ENVIRONMENTAL CONDITIONS

A. Indoor applications:
1. Temperature: 50 to 100ºF.
2. Humidity: 10 to 90%.

B. None of equipment covered by this Specification requires hazardous rating.

C. Electrical power source: 120-volts ac, 60 Hz.

D. Instrument air source: 80 to 100 psig, nominal.

E. Analog signals:
1. Voltage: 24-volt dc.
2. Range: 4 to 20 mA.
3. Load impedance: 0 - 750 ohms, minimum.

F. Discrete signals:
1. Voltage: 120-volt ac.
2. Contact type: Form C (1 NO, 1 NC), minimum.
3. Rating: 5 amperes at 120-volts ac, minimum.

G. Pneumatic signals:
1. Supply pressure: 80 psig.
2. Range: 3 to 15 psig.

1.03 SUBMITTALS

A. Submitted information relating to instrumentation and control devices shall be referenced by instrument tag number, as defined in Drawings, Exhibits E and F, listed on submittal documents.

B. Product Data: Manufacturer's data or specification sheets for instrumentation and control devices showing design parameters, equipment catalog designations, calibration range, and clearly identifying options provided.

C. Shop Drawings: Certified outline, installation, and wiring interconnection drawings for equipment and accessories provided. Wiring interconnection drawings shall define terminal numbers and functions for interface with other instruments and equipment.

D. Closeout submittals:
1. Operation and maintenance manuals:
a. Complete instruction manuals and parts lists covering installation, operation, wiring interconnections, and maintenance of equipment.
b. Control loop diagrams for instrument and control devices wired or tubed to control system enclosures. Diagrams shall be in accordance with minimum requirements of ANSI/ISA S5.4. Control loop diagrams shall also include manufacturer, model number, and calibrated range; setpoint values for alarm and shutdown devices; equipment numbers for racks, panels, and

junction boxes; exact location of device including column, row, and elevation; and control of solenoid valve fail-safe operation. Assign tag number oriented cable, wire, and tube numbers.

c. Schematic drawings for motor or relay-based control logic. Show color of wire, all termination points, terminal numbers, cable and wire numbers. Assign cable and wire numbers for external panel wiring. Cable and wire numbers shall be tag number oriented.

2. Record Documents:
   a. "As-built" control loop diagrams and schematic drawings as defined above.
   b. Instrumentation calibration and commissioning reports as defined in Section 40 81 00.

1.04 QUALITY ASSURANCE

A. Provide instruments from same manufacturer and of same model series when multiple units of same item are required.

B. Instruments, control devices, and accessories shall be free of mercury and asbestos.

C. Use plant instrument air source pressure or furnish pressure regulator with filter and output gage.

D. Furnish new and unused instrumentation and control devices.

E. Provide linkages, mounting accessories, etc. necessary to place device into service.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package for delivery, store and handle per manufacturers' recommendations.

1.06 MAINTENANCE

A. Provide 1-year supply of spare parts as recommended by equipment manufacturer as part of initial installation.

PART 2 PRODUCTS

2.01 INSTRUMENTS

A. Refer to Exhibit E - Instrument Index for device listings and contractual responsibilities. Spec. No. column defines specification section responsibility. Instruments referencing an Instrument Data Sheet number belong to this section.

B. Refer to Exhibit F - Instrument Data Sheets for instrument specification requirements and acceptable manufacturers.

2.02 INSTRUMENT IDENTIFICATION

A. Each instrument and control device shall have a tag permanently attached to case with following applicable information:
   1. Tag number.
   2. Manufacturer's name.
   3. Model number.
   4. Serial number.
   5. Operating range.
   6. Calibration setting/range.
   7. Power rating.

B. Each control valve and actuator shall have stainless steel nameplate, permanently fastened to valve body or actuator with following as applicable:
   1. Manufacturer's name, model number, and serial number.

2. Valve action on air failure.
3. Operating range and bench setting.
4. Body and trim size.
5. Body and trim materials.
6. Body and flange rating.
7. Type of packing and lubricant.
8. Flow arrow indicating direction of flow.
9. Tag number.

C. Factory configure, program, and setup of smart instruments and control devices to include following information from Instrument Index.
1. Tag number.
2. Service description.
3. Calibrated range.
4. Engineering units.

2.03 FLOW METERS

A. Submit certified calculation sheets verifying meter selection for operating conditions at minimum and maximum flow rate.

2.04 TEMPERATURE MEASUREMENT

A. Thermocouples: ISA SP1.1.

B. RTDs: ISA SP1.3.

C. Temperature gages: ISA SP1.4 and SP1.6.

D. Thermowells:
1. Standard industry application and dimensional standards.
2. Verify stress analysis calculations in accordance with ANSI/ASME PTC-19.3, Part 3, for operating conditions to demonstrate thermowell shall not exceed material stress limitations.

2.05 CONTROL VALVES

A. Furnish control valves and accessories as complete assembly with control tubing, fittings, and interconnection wiring.

B. Verify control valve sizing in accordance with ISA S75.01, as follows:
1. Minimum flow: Greater than 10% valve travel.
2. Normal flow: Approximately 50% to 70% valve travel.
3. Maximum flow: Approximately 90% valve travel.

C. Verify predicted sound pressure level using ISA S75.17/IEC 534-8-3.
1. Control valve body outlet velocity shall not exceed mach 0.3.
2. Predicted sound pressure shall not exceed specified level.
3. Provide recommendations for mitigation of problem.

PART 3 EXECUTION

END OF SECTION

1) T.J. Mergen

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Programmable automation controller system hardware including process controllers, communications interface modules, Input/Output (I/O) modules, power supplies, chassis, and associated hardware.

1.02 RELATED REQUIREMENTS

A. Section 40 81 00 – Commissioning of Process Systems

B. Section 40 90 13 – Digital Process Control Computers.

C. Section 40 95 13 – Process Control Panels and Hardware.

D. Section 40 96 00 – General Programming and Configuration.

1.03 SUBMITTALS

A. Submit information as indicated in table in accordance with Section 01 33 00:
1. Submittal shall clearly identify each item by instrument tag number or specification section number and paragraph, part or catalog number and options or accessories provided.

Item	Description	Purpose	Time of Submittal (maximum calendar days after notice of award unless noted otherwise)	Submit To
PRODUCT DATA				
	Manufacturer's data or specification sheets designating part or catalog number as well as proposed options for each unique device furnished, including, but not limited to:			
1	Processors including memory modules.	R	28 days	E
2	Communications modules, Ethernet.	R	28 days	E
3	Analog input modules, non-isolated 4-20 mA.	R	28 days	E
4	Analog input modules, isolated 4-20 mA.	R	28 days	E
5	Analog output modules, 4-20 mA.	R	28 days	E
6	Discrete input modules, non-isolated 120-volt ac.	R	28 days	E
7	Discrete output modules, non-isolated relay 120-volt ac.	R	28 days	E
8	Power supplies, processors.	R	28 days	E
9	Power supplies, I/O interfaces.	R	28 days	E
10	Chassis, processors.	R	28 days	E
11	Chassis, I/O interfaces.	R	28 days	E
12	Software, Human Machine Interface	R	28 days	E
13	Software, Data Historian	R	28 days	E
14	Software, Development	R	28 days	E
MANUFACTURER'S INSTRUCTIONS				
	Operation, Installation, and Maintenance Manuals including certified outline drawings, wiring diagrams, and grounding requirements for each unique device or accessory furnished.	FIO	14 days, prior to installation.	E

1.04 QUALITY ASSURANCE

A. Design, construct, and test in conformance to NEMA ICS 1, ICS 2, and ICS 3.

B. Input/Output performance requirements:
   1. I/O point cards shall utilize optical or other isolation techniques to protect system against damage due to voltage spikes.
   2. I/O cards shall have common mode voltage rejection of 500 volts, except relay outputs which shall be 250 volts ac.
   3. Accuracy of analog I/O throughout entire system shall be not less than 0.1% of full scale.
   4. Analog inputs shall have a common-mode rejection ratio of 100 dB and differential rejection ration of 30 dB at line frequency and harmonics to ensure proper plant noise elimination.

1.05 DELIVERY, HANDLING, AND STORAGE

A. Delivery, storage, and protection shall be in accordance with manufacturer's recommended procedures.

B. Accept products on site in factory containers and verify damage.

C. Store products in clean, dry area. Maintain temperature in accordance with NEMA ICS 1.

1.06 EXISTING ENVIRONMENTAL CONDITIONS

A. Control room:
   1. Temperature ranges, °F: 60 to 90.
   2. Humidity, %: 10 to 90, noncondensing.

B. Field indoors:
   1. Temperature ranges, °F: 50 to 100.
   2. Humidity, %: 10 to 90, noncondensing

C. Area classification: Nonhazardous.

1.07 WARRANTY

A. Vendor's warranty shall not begin until final acceptance of system by Owner.

1.08 MAINTENANCE

A. Furnish 1 uninstalled spare for every 5 (or portion thereof) processors, power supplies, boards, modules, assemblies, and cables for PAC system.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Allen Bradley “ControLogix”.

B. Emerson Process Management “Delta-V”.

C. General Electric Fanuc “PAC Systems RX3i”.

2.02 SYSTEM OVERVIEW

A. Network summary:
   1. PAC panel: Located in control room containing non-redundant PAC processor.
   2. Remote I/O panels:

a. Remote I/O Panel 1: Located on operating floor. Contains remote I/O for:
   1) Boiler No. 1
   2) Feedwater Pumps 1A through 1C
   3) Deaerator No. 1
   4) Condesate Transfer Pumps 1A through 1C
   5) Condensate Tank No. 1
b. Remote I/O Panel 2: Located on operating floor. Contains remote I/O for:
   1) Boiler No. 2
   2) Boiler No. 3
   3) Feedwater Pumps 2A through 2C
   4) Deaerator No. 2
   5) Condesate Transfer Pumps 2A through 2C
   6) Condensate Tank No. 2

3. Refer to Drawings for Network Overview Diagram.

B. I/O partitioning including spare quantities:
1. Input/Output List identifies I/O points by tag number, service description, remote I/O chassis assignment, and signal type.
2. Contractor shall partition I/O to select and layout I/O modules in accordance with following:
   a. Complimentary I/O not acceptable.
   b. Assign I/O points to prevent de-energizing multiple units of like equipment in event of single I/O module failure. For example:
      1) I/O points from multiple condensate transfer pumps shall not reside on same module.
      2) I/O points from multiple feedwater pumps shall not reside on same module.
      3) I/O points from condensate transfer and feedwater pumps may reside on same module.
   c. Furnish spare quantities and space for future expansion:
      1) Minimum of 20% spare installed input/output points of each type in each Remote I/O chassis.
      2) Minimum of 20% space for future expansion in each Remote I/O chassis.

C. System shall provide following capabilities:
1. Field instrumentation wiring terminations, instrument signal input/output for system, monitor and control functions, and self-diagnostics.
2. Ability to expand control equipment, i.e. add controllers and remote I/O panels. Control equipment shall be computer-compatible, but shall not require computer for data communication device expansion.

D. Data communication system shall be capable of supporting both copper and fiber-optic media for processors, remote I/O, third party system interfaces, operator workstations, engineering workstations, and data historians, and local Human-Machine Interfaces (HMIs).

E. System hardware shall have sufficient data protection to prevent erroneous data communication during power-up or power-down.

F. Power supply: 120 volts ac, single-phase, 60 Hz.

G. Manufacturer shall have application training and customer assistance services available.

H. Major assemblies, subassemblies, circuit card, and devices shall be permanently marked with manufacturer's part or identification number.

I. Controller system shall be of modular design with plug-in processing unit, input/output frames or assemblies, and plug-in peripherals. Components shall be serviced and supported by same company.

J. Label I/O card strips with English descriptions.

K. Provide CDs for use with programming panel.

2.03 PAC HARDWARE

A. General:
   1. Input / Output (I/O) modules consist I/O card, personality modules (as applicable), and termination equipment including point fusing and signal conditioning.
   2. I/O modules shall:
      a. Be modular in construction and compact in design.
      b. Support hot swapping without upset to system or controls.
      c. Allow replacement of I/O modules including personality modules without:
         1) De-energizing power for chassis.
         2) Removing field wiring (swing arm assemblies are permissible.)
         3) Tools.
      d. Furnish means for module identity, revision, and serial number to be obtained through communications with PAC processor.
      e. Be assigned to selected slots on I/O bus, with bus cycle time of less than 32 microseconds and with bus error checking.
   3. Basis of specification: Allen Bradley, ControLogix platform.

B. Power supplies:
   1. System (PAC) panel:
      a. Redundancy: None (Simplex).
      b. Input source: 120-volt ac.
      c. Rating: 10-amps.
      d. Manufacturer: Allen-Bradley.
      e. Power supply model: 1756-PA72.
   2. Remote I/O panels:
      a. Redundancy: Redundant.
      b. Input source: 120-volt ac.
      c. Rating: 13-amps.
      d. Manufacturer: Allen-Bradley
      e. Power Supply Model: 1756-PB75R.

C. Chassis:
   1. System (PAC) panel:
      a. Size: 7-slot, minimum.
      b. Adapter module: None.
      c. Manufacturer: Allen-Bradley
      d. Model:
         1) Chassis: 1756-A7.
         2) Adapter Module: None.
   2. Remote I/O panels:
      a. Size: As required to meet spare and space requirements.
      b. Adapter module: Furnish separate module for each I/O rack.
      c. Manufacturer: Allen-Bradley.
      d. Model:
         1) Chassis: 1756-A* Series.
         2) Adapter module: 1756-PSCA2.

D. Processors:
   1. Series: ControLogix.
   2. Processor: 6-Series process with latest firmware version.
   3. Memory: 64-Mb CompactFlash memory.
   4. Redundancy: None (Simplex processors).
   5. Redundancy modules: None.
   6. Redundancy cables: None.
   7. Manufacturer: Allen-Bradley.
   8. Model:
      a. Processor: 1756-L64.
      b. CompactFlash: 1784-CF64.
      c. Redundancy modules: None.
      d. Redundancy cables: None.

E. Communications equipment.
   1. Root switches, fan-out switches, media converters.
   2. Manufacturer: Cisco.

F. Communication interfaces:
   1. Operator interface network:
      a. Protocol: EtherNet.
      b. Version: Enhanced (Version 2) communications.
      c. Redundancy: None (Simplex communications).
      d. Manufacturer: Allen-Bradley.
      e. Model: 1756- EN2T.
   2. Control network:
      a. Protocol: ControlNet.
      b. Version: Enhanced (Version 2) communications.
      c. Redundancy: Redundant media.
      d. Manufacturer: Allen-Bradley.
      e. Model: 1756- CN2R.
   3. BMS Interface:
      a. Protocol: RS485.
      b. Communication (Between E300 and PAC): ModBus via RS485 Multi-Drop Link.

G. Analog input, isolated, modules.
   1. Channels: 8 per card.
   2. Resolution: 16-bits, minimum.
   3. Voltage: 24-volt dc.
   4. Range: 4 to 20 mA.
   5. Hart enabled.
   6. Load impedance: 0 - 750 ohms, minimum.
   7. Power Dissipation: 4.01 Watts, maximum.
   8. Manufacturer: Allen-Bradley.
   9. Model:
      a. Module: 1756-IF8H.
      b. Terminal block housing: 1756-TBCH.
      c. Termination unit: 1492-IFM series, Contractor to select model.

H. Analog output modules:
   1. Channels: 8 per card.
   2. Resolution: 15-bits, minimum.
   3. Voltage: 24-volt dc.
   4. Range: 4 to 20 mA.
   5. Hart enabled.
   6. Power dissipation: 4.92 watts, maximum.
   7. Manufacturer: Allen-Bradley.
   8. Model:
      a. Module: 1756-OF8H.
      b. Terminal block housing: 1756-TBNH.
      c. Termination unit: 1492-IFM series, Contractor to select model.

I. Digital input, isolated, modules:
   1. Channels: 16 individually isolated per card.
   2. Voltage category: 120-volt ac.
   3. Operating voltage range: 74 to 132-volt ac.
   4. On-state current input: 5 mA @ 74-volts ac, minimum to 13 mA @ 132-volt ac.
   5. Power dissipation: 5.8 watts, maximum.
   6. Termination unit: Individually fused with replaceable fuses and blown fuse indicators.
   7. Manufacturer: Allen-Bradley.
   8. Model:
      a. Module: 1756-IA16I.
      b. Terminal block housing: 1756-TBNH.

c. Termination unit: 1492-IFM series, Contractor to select model.

J. Digital output, isolated, modules.
1. Channels: 16 individually isolated per card.
2. Voltage category: 120-volt ac.
3. Operating voltage range: 74 to 132-volt ac.
4. Output current input: 2A @ 30-degrees C to 1A @ 60-degrees C.
5. Power Dissipation: 5.5 Watts, maximum.
6. Termination unit: Individually fused with replaceable fuses and blown fuse indicators.
7. Manufacturer: Allen-Bradley.
8. Model:
   a. Module: 1756-IA16I.
   b. Terminal Block Housing: 1756-TBNH.
   c. Termination Unit: 1492-IFM series, Contractor to select model.

2.04 SOFTWARE

A. Human-Machine Interface software:
1. Select software license to meet requirements of system description, operator interface requirements, plus minimum of 20% spare point tags of each type and 20% spare screens (displays).
2. Number of licenses: Two.
3. Data Manufacturer: Rockwell Automation.
4. Model: RSView32.

B. Historian software:
1. Select software license to meet requirements of system description, operator interface requirements, plus minimum of 20% spare point tags of each.
2. Number of licenses: One.
3. Manufacturer: Rockwell Automation.
4. Model: RSView.

C. Development software:
1. PAC, Human-Machine Interface, and Data Historian Development.
2. Number of licenses: One.
3. Manufacturer: Rockwell Automation.
4. Model: RSView Studio.

2.05 BURNER MANAGEMENT SYSTEM

A. Expansion Module
1. Provide expansion modules for existing burner management systemsfor Boilers No. 1, 2, and 3, if needed (installed).
2. Existing Burner Management System: Fireye E110.
3. BMS Expansion Module: Fireye E300.
4. Communication (between existing E110 and E300): E350 Ribbon Cable.

PART 3 EXECUTION

A. NOT USED

END OF SECTION

1) T.J. Mergen

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Control panels and enclosures completely assembled with instruments and electrical controls mounted and wired for manufacturer's packaged equipment.

B. Mount and wire programmable logic controller, remote I/O panels, and graphic operator interface as specified in Section 40 94 43 in selected panels and enclosures.

1.02 SITE CONDITIONS

A. Indoor applications:
1. Temperature: 50 to 110ºF.
2. Humidity: 10 to 90%.

B. None of equipment covered by this specification requires hazardous rating.

C. Electrical power source: 120-volts ac, 60 Hz.

1.03 SUBMITTALS

A. Shop Drawings:
1. Exterior panel layout drawings:
   a. Show panel elevations including front, back and both sides.
   b. Identify panel dimensions, nameplates, panel component locations, and wire routing including panel entrance/exit locations for each enclosure provided.
   c. Include list of nameplate legends and sizes for panel-mounted equipment.
2. Interior panel and sub-panel layout drawings:
   a. Show panel elevations including front, back and both sides. Identify panel dimensions, nameplates, panel component locations, and wire routing including panel entrance/exit locations for each enclosure provided.
   b. Locations and identification of terminal blocks.
   c. Locations and identification of all PLC equipment mounted within: controllers, power supplies, carriers, I/O modules, network fan-out switches, copper/fiber-optic media converters, fiber-optic patch panels and other communications equipment and transient voltage suppression systems (TVSS).
   d. Locations and identification of all control panel power distribution equipment mounted within: 120 volts ac UPS circuits, 24 volts dc instrument circuits, circuit breakers and fuses, any additional power supplies and TVSS's.
   e. Exterior panel wiring interface termination diagrams. Clearly differentiate between internal and field wiring.

B. Quality assurance data:
1. Control panel and enclosures:
   a. Schematics and wiring diagrams identifying terminals, circuits, color of wire, and cable/wire numbers. Cable and wire numbers for external wiring will be assigned by electrical contractor. Cable, wire, and terminal numbers for panels shall be assigned by panel provider. Cable, wire, and terminal numbers shall be instrument tag number oriented. Coordinate with electrical contractor to avoid duplication of wire and terminal numbers.
   b. Provide heat gain calculations for each panel/enclosure with all components energized and in operation. Calculations shall be based on ambient temperatures defined within specifications and with exterior panels in full exposure to sun. Provide adequate cooling for any panel in which internal cabinet operating temperature exceeds rating of any component mounted within enclosure.

2. Panel-mounted instruments: Tabulation of equipment including accessories listed separately where not assembled with equipment item. Tabulation shall include item number, service equipment description, or identification, part or catalog number and other information helpful to installation of equipment and coordination of Project.
3. Configurable controller, for information only: Listing of logical configuration of controller.

C. Closeout submittals:
1. Operation and maintenance manual.
   a. Complete instruction manuals and parts lists covering installation, operation, and maintenance of panel-mounted devices. Manuals shall include interface drawings defining terminal numbers and functions for interface with other instruments and equipment.
   b. Schematic and wiring diagrams for each panel/enclosure. Show color of wire, termination points, terminal numbers, cable and wire numbers.
2. Record Documents: "As-built" schematics and wiring diagrams defining terminals, cables, and wire numbers as defined above.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Ship control panels as recommended by control panel/enclosure manufacturer.

B. Provide removable eye bolt lifting lugs for large panels and suitable skids for safe handling.

C. Remove rack-mounted instruments, controllers, recorders, and indicators that could be damaged by shipment and package in original shipping cartons.

1.05 MAINTENANCE

A. Panel manufacturer shall supply separately packaged spare parts of following items:
1. Fuses: 100% of each rating furnished with control equipment and used internally within the panel/enclosure for circuit protection including, but not limited to, miscellaneous fuses on controllers, recorders, and indicators. Minimum of one standard package.
2. Indicating lamps: 10% of each type furnished with control equipment. Minimum of one standard package.
3. Relays: 10% of each type furnished with panel/enclosure. Minimum of one.

PART 2 PRODUCTS

2.01 FABRICATION

A. Size: Sufficient to house terminal blocks, wireways, power supplies, racks, chassis, and instruments required for each application. Provide 25% additional space for future expansion.

B. Oil-resistant gasket attached with oil-resistant adhesive.

C. Provide each panel/enclosure with industrial corrosion inhibitor emitters of sufficient size and quantity to protect contents of enclosure size selected. Emitters shall contain additional red metal inhibitors to protect brass and copper material in addition to ferrous metals.

D. Provide adequate cooling by means of air conditioners, pneumatic vortex coolers, blowers, exhaust fans, or sun shade, as necessary, for any panel in which internal cabinet operating temperature exceeds rating of any component mounted within enclosure. Thermostat shall be used to control internal temperature.

E. Provide adequate heating by means of electric heater and thermostat for panel in which internal cabinet temperatures may fall below operating temperatures of component mounted within enclosure.

F. Provide "data pockets" for Drawing storage on inside face of panel.

G. Subpanels: Provide for full surface mounting of terminal blocks, wireways, power supplies, racks, chassis, and instruments.

H. Free-standing panels:
1. Panels shall mount on 3" concrete pad.
2. Construct control panel in accordance with manufacturer's standard, subject to Engineer's review.
3. Control panel shall be self-supporting with angle iron or plate framework as necessary to obtain proper stiffness and support.
4. Fabricate control panel of 12-gage carbon steel plate with all-welded construction throughout. Welds shall be ground smooth, corners shall be rounded, and weld spatter cleaned. Corner construction shall be minimum of 1/8" inside radius. Control panel construction shall meet NEMA 12 standards, unless otherwise indicated.
5. Surface of control panel shall be free from mars and defects. Finished panel surfaces shall be flat within 1/16" in 6'-0" and be smooth with rounded edges. Finished panel surfaces shall be 3/16" thick. Instrument cutouts and drilling shall be straight and true.
6. Provide 10-gage full height *rear* *front* access doors. Access doors shall have triple-point latch, stainless steel handle and lock, full length stainless steel "piano" type hinge, and sponge rubber gaskets. Door shall be supplied with devices to hold door in 105° position when fully opened.
7. Provide lower, full-width, rectangular subpanel for *surface mounting of programmable controller,* other surface-mounted instruments, wiring troughs, and terminals strips.
8. Provide full-length, side-mounted subpanels for installation of terminal strips.
9. Base of control panel shall be adequately reinforced to permit anchoring to concrete pad.

10. Purge control panel to protect instruments from corrosive vapors. Air purge rotameter and needle valve shall be furnished, installed and mounted on outside of panels. Purging devices shall be considered as part of control panel package. Provide other devices necessary for proper operation.
11. Supply 4 identical master keys which will operate all locks of *each* control panel.

I. Manufacturer: Control Engineering Company, Hoffman Engineering Company, or equal.

2.02 PANEL-MOUNTED INSTRUMENTATION

A. Control Relays:
1. Function: General logic hardware interlocks.
   a. Type: Plug-in.
   b. Construction: Continuous duty.
   c. Coil voltage: 120-volt ac, 60 Hz.
   d. Switch configuration: 3-SPDT.
   e. Indication: Mechanical or LED to indicate energized relay.
   f. Switch rating: 10 amperes at coil voltage.
   g. Mounting: Socket for DIN-rail mounting.
   h. Manufacturer: Allen Bradley, Type HA, or equal.
2. Function: Interposing relay for PAC output.
   a. Type: Plug-in.
   b. Construction: Continuous duty.
   c. Coil voltage: 120-volt ac, 60 Hz.
   d. Switch configuration: 2-SPDT.
   e. Indication: Mechanical or LED to indicate energized relay.
   f. Switch rating: 5 amperes at coil voltage.
   g. Mounting: Socket for DIN-rail mounting
   h. Manufacturer: Allen Bradley, Type HK or equal.

B. Selector switches:
1. Type: Nonilluminated, transformer-type, 120-volt ac, 60 Hz.
2. Configuration: 3-position, maintained contact.
3. Contact rating: 10 amperes at 120-volts ac, 60 Hz.

4. Legend plates: As shown on Drawings and subject to Owner's review .

5. Manufacturer: Allen-Bradley, Series 800T or equal.

C. Pilot lights:
1. Type: Push-to-test.
2. Input: Transformer-type, 120-volt ac, 60 Hz.
3. Lens color:
   a. Green: Pump running.
4. Legend plates: As shown on Drawings.
5. Manufacturer: Allen-Bradley, Series 800T, or equal.

D. Provide 1 or more 24-volt dc power supply, as necessary, within each panel to power field transmitters and PAC I/O. Amperage shall be 200% of required capacity.

2.03 FACTORY WIRING

A. Provide complete factory wiring of control cabinet and equipment mounted thereon.

B. Provide separate circuits from power distribution panel for:
1. PAC system, operator graphical interface, communication devices.
2. Instrumentation and control devices.
3. Lighting and service outlets.

C. Install continuous wire from terminal to terminal, splices will not be acceptable.

D. Wire and cable:
1. Analog signal cable:
   a. Configuration: Twisted pair, shielded, and jacketed.
   b. Insulation: 300-volt, 60ºC, PVC, color-coded to permit identification of each conductor.
   c. Conductors: Stranded copper, 18 AWG.
   d. Shield: Metallized foil or tinned copper braid providing 100% coverage against noise together with 20 AWG stranded tinned drain wire.
2. Power wire:
   a. Rating: 600-volt, 90ºC, PVC insulation/jacket, Type MTW.
   b. Conductors: Stranded copper, 12 AWG.
3. Discrete signal wire:
   a. Rating: 600-volt, 90EC, PVC insulation/jacket, Type MTW.
   b. Conductors: Stranded copper, 18 AWG.
4. Power and discrete signal wire insulation color:
   a. BLK: Line voltage.
   b. BRN: Line voltage/fused.
   c. RED: 120-volt control ac.
   d. ORG: 24-volt control ac.
   e. YEL: Caution/may be live from remote power source.
   f. GRN: Ground.
   g. BLU: Dc negative.
   h. VIO: Dc positive.
   i. WHT: Neutral at GND potential.

E. Group and route wire/cables from terminal blocks to panel-mounted instruments in separate wireways as follows:
1. Low-voltage/low current dc analog signals (30-volts/50 mA or lower).
2. High-voltage dc alarm signals (48-volts or greater).
3. Low-voltage ac control signals (120-volts or lower).
4. High-voltage ac power signals (greater than 120-volts).

F. Wiring interfaces:
   1. External connections:
      a. Install dedicated terminal strips for analog, discrete, and power signals.
      b. Provide manufacturer's standard connectors for communications, digital data, and multiplexed signals.
      c. Provide surge suppressor terminal blocks for analog and discrete signals that leave building structure:
         1) Analog signal blocks: Voltage rating 24-volt ac/dc; Allen Bradley 1492-HM2K024 Series, or equal.
         2) Discrete signal blocks: Voltage rating 120-volt ac/dc; Allen Bradley 1492-HM2K120 Series, or equal.
   2. Provide separate terminal strips and wireways for 120-volt ac and 24-volt dc circuits.
   3. Terminal block requirements:
      a. Type: High-density.
      b. Voltage: 600-volt.
      c. Wire range: 30 AWG to 12 AWG.
      d. Termination: Screw clamp compression with pressure plate.
      e. Mounting: Rail-mounted with end anchors and barriers.
      f. Spare: Provide greater amount of 20% or 6 terminals per terminal strip
      g. Manufacturer: Allen Bradley 1492-H1, or equal.
   4. Terminate maximum of 2 wires on single connect point.
   5. Wire PLC network communication cables point-to-point rather than terminating on interposing terminal blocks.
   6. Install power distribution blocks to parallel feed to power control devices. Parallel wiring from instrument to instrument not acceptable.
   7. Provide plug-in strip for ac supply power to devices requiring ac power via power cord.
   8. Circuit protection:
      a. Install individual circuit breakers for protection of control panel power supply circuits as identified above. Allen Bradley 1492CB1G Series, or equal.
      b. Group circuit breakers on separate terminal strip away from low-voltage instrumentation circuitry.
      c. Provide fuses or circuit breakers for protection of individual instrumentation circuits. Instrumentation circuits for field-mounted instruments may be combined in logical groupings of no more than 10 devices/signals.
         1) Fuses: Allen Bradley 1492-H6 Series, or equal.
         2) Circuit breakers: Allen Bradley 1492-GH Series, or equal.
   9. Provide 8 AWG internal copper grounding bus for ground connections.

G. Wire tags:
   1. Type: Embossed, heat-shrink tubing. Fiber tape tagging not acceptable.
   2. Color: White.
   3. Identify both ends of wires and/or cables with permanent wire marker.

H. Service equipment:
   1. Fluorescent lighting fixtures of sufficient size and quantity to provide 30 to 50 foot-candles of illumination within panel. Wire to UL-approved switch mounted inside panel.
   2. Duplex, 120-volt ac, 3-wire grounded type convenience outlets. Provide 1 duplex receptacle per 12 sq ft of subpanel area. Service outlets shall be powered from separate voltage source than instrumentation and PAC equipment, as defined above.

2.04 NAMEPLATES

A. Provide permanent nameplates for devices mounted on or within panels. Provide separate nameplates. Standard nameplates included with instruments not acceptable. Plastic tape labeling not acceptable.

B. Type: Instrument nameplates shall be fabricated of laminated plastic, not less than 1/16" thick white Bakelite engraving stock with black core.

C. Size: Outside panel surface shall be 1" x 2", minimum.

D. Lettering: Engraved, approximately 3/16" high, minimum, subject to Engineer's review.

E. Attach nameplates with heat-resistive, waterproof adhesive.

2.05 PAINTING AND FINISHING

A. Surfaces shall be commercial blast cleaned in accordance with SSPC SP6.

B. After preparation of surfaces, pits or indentations shall be filled with a 100% solid catalyzed epoxy putty compound.

C. After hardening of putty filler, filled areas shall be sanded smooth. Entire exterior surface shall be smooth and uniform to receive paint.

D. Manufacturer's standard interior and exterior paint shall be acceptable as primer coat.

E. Prepare interior and exterior surfaces for finish coat of paint in accordance with manufacturer's instructions.

F. Color:
1. Interior and subpanels: White.
2. Exterior:
   a. Indoor panels: Slate gray.

G. Spray-apply paints to produce smooth, uniform coat, free of defects. SSPC PA-1 shall apply.

H. Each coat shall be properly cured according to manufacturer's instructions before application of succeeding coats.

2.06 SOURCE QUALITY CONTROL

A. Contractor shall be responsible for hardware provided and shall notify Owner, in writing, when panel and enclosure control systems are considered complete, in good operating condition, and ready for performance testing.

B. Factory performance tests:
1. Contractor shall perform testing and inspection prior to shipment of control equipment at Contractor's manufacturing facility.
2. Contractor testing in preparation for inspection shall include, but not be limited to following:
   a. Confirm point-to-point wiring by continuity tests with written checklist indicating satisfactory results after final assembly and wiring.
   b. Energize control circuits, simulate analog and discrete signals.
   c. Verify hand switches, pushbuttons, and pilot light operations.
   d. Check control circuits for proper sequence of operation and interlocking functions.
   e. Test instruments over full operational range. Prove instruments to be within published specifications and accuracy. Instruments shall be tested individually and where applicable, as a system. Testing shall be by simulated field signals.
3. If equipment or system fails to perform properly, Contractor shall make necessary corrections, including replacement, at no cost to Owner as follows:
   a. Correct wiring changes including changing terminal block and/or wire tags.
   b. Document all changes on Project Report Documents.
   c. Retest equipment verifying deficiencies are corrected.

4. At completion of testing, Contractor shall notify Engineer of completion of testing and readiness for inspection.

C. Inspection:
1. Contractor shall notify Engineer, in writing, 10 days prior to completion of control panels/enclosures final testing. At their option, Owner and Engineer may witness final factory inspection.
2. Contractor shall coordinate between all concerned parties and establish schedule for inspection. Give minimum 10-day notice to all parties.
3. Written test procedures shall be submitted prior to witness testing. Procedures shall be used for final testing.
4. Upon satisfactory completion of testing, final inspection will be made by Engineer.
5. If system fails to perform properly, Contractor shall make necessary changes and adjustments to equipment at no cost to Owner as defined above, and notify Engineer when ready for reinspection.
6. Reinspection schedule shall be same as initial inspection procedures.
7. If inspection is substantially correct but with minor defects, Contractor shall verify deficiencies are corrected in writing to Engineer without need for additional witness testing.

D. Testing costs:
1. Costs of conducting tests, except for following, shall be borne by Contractor.
   a. Owner and Engineer's costs associated with factory performance test, not exceeding 1 round trip to Contractor's manufacturing facility and 3-days per person for total of 2 persons.
   b. Owner and Engineer's costs associated with field performance tests not exceeding 60-day field performance period.
2. Owner and Engineer will each render bill to be paid by Contractor covering costs incurred by retesting or supplemental testing exceeding limits noted herein.
3. Billings to Contractor for Owner and Engineer's cost for retesting and supplemental testing exceeding limits noted herein shall be paid directly to Owner or Engineer, as appropriate, within 30 calendar days from receipt BY Contractor. Contractor's failure to pay such billings shall be cause for withholding final payment in amount equal to such costs.
4. Engineer's costs, when applicable, will be determined at Engineer's current per diem rates, plus direct expenses.

PART 3 EXECUTION

3.01 INSTALLATION

A. Mount controls panels as shown on Drawings and/or where approved by Owner's representative.

B. Mount rigidly supported, level and plumb, and in such manner as to provide accessibility; protection from damage; isolation from heat, shock, and vibration; and freedom from interference with other equipment, piping, and electrical work.

C. Do not install equipment until adjacent heavy construction work has been completed to extent that damage will be unlikely to installation by such construction work.

D. Install in accordance with manufacturer's recommendations.

3.02 PANEL SCHEDULE

Panel Name	Location	Responsible Section
Programmable Logic Controller Panel	Control Room	40 95 13
Remote I/O Panel No. 1	Lower Level	40 95 13
Remote I/O Panel No. 2	Lower Level	40 95 13

END OF SECTION

1) T.J. Mergen

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Programming, developing graphic screens, reports, alarms, trends, energy management, and archiving of process data, services of Service Engineer, and training of Owner's staff in maintenance and operation of Programmable Automation Controller (PAC).

B. System integration including PAC design, programming, developing graphic screens, reports, alarms, trends, and archiving.

PART 2 PRODUCTS

2.01 INPUT/OUTPUT POINTS

A. Refer to Exhibit D for listing of hardwire point tags including tag number, service description, engineering range, signal type, and panel assignment.

B. Configuration:
   1. Use Owner's I/O tagging system for all I/O.
   2. Partition hardwired I/O such that:
      a. Carrier failure does not affect more than one type of similar equipment.
      b. I/O module failure does not affect more than one type of similar equipment.
   3. Establish data acquisition communications interfaces:
      a. Develop PAC communications interfaces for Burner Management System equipment including coordinating Owner identified Input/Output points with manufacturer's address map, configuring, programming, developing graphic screens, alarm screens, trending, archiving, reporting, and testing software.
      b. Determine address locations for Owner identified input/output points by using address maps furnished by equipment vendors.
      c. Communication interfaces to include:
         1) Boiler No. 1 burner management system.
         2) Boiler No. 2 burner management system.
         3) Boiler No. 3 burner management system.

2.02 PROGRAMMING

A. Develop PAC I/O tag list:
   1. Field instruments.
   2. Control valves.
   3. Supervisory control of boilers and associated systems.

B. Use Owner's tag numbering system:
   1. Use Owner's point tag numbering system for identifying hardwire and digital communications interfaces point tags.
   2. Assign tags to virtual points developed within PAC program as necessary to meet operator interface requirements in accordance with Owner's point tag numbering system.
   3. Maintain Owner's point tag number from field device throughout PAC program and operator interface including alarming, archiving, displaying, and reporting.

C. Program processor control strategies using only IEC 1311-3 programming languages:
   1. Ladder Diagram (LD).
   2. Structured Text (ST).
   3. Instruction List (IL).

2.03 OPERATOR INTERFACE

A. Develop PAC operator interface including:
   1. System tag database.
   2. System security.
   3. Operator process control displays.
   4. Alarm screens and alarm history displays.
   5. Alarm classes, priorities, and help files.
   6. Data archives.
   7. Real-time and historical trend displays.
   8. Energy management summaries.

B. Displays:
   1. Develop operator displays including:
      a. System overviews.
      b. Screen navigation buttons and prompts.
      c. Real-time trends: operator configurable with capability of tracking minimum of 8 concurrent parameters.
      d. Historical trends: operator configurable with capability of tracking minimum of 8 concurrent parameters.
      e. Active alarm summaries: operator configurable with capability to develop custom alarm groups.
      f. Alarm history.
   2. Contractor shall develop displays with guidance and review of Owner.
   3. Owner will use displays during field performance testing. Contractor shall include 40-hours of time during field performance testing for updating displays.
   4. Use standard screen templates to provide consistent look and feel for all displays.
   5. Use standard graphic libraries including:
      a. Static objects.
      b. Smart objects.

C. System security: Develop system security hierarchy including
   1. User accounts: Establish user account classes.
   2. Privilege levels: Develop privilege for user account classes.
   3. Assign default passwords for each user account.

D. Alarm management:
   1. Develop alarm and priorities.
   2. Establish alarm classes.
   3. Develop alarm help files.
   4. Assign alarm priorities, alarm class, and alarm help file to each alarm point.

E. Reports:
   1. Contractor shall develop reports with guidance and review of Owner.
   2. , and alarm/event log reports.
   3. Develop daily, weekly, monthly and annual reports.
   4. Allow report time frames to be determined by user.

F. Energy management:
   1. System status: Provide Energy Management summaries for heating plant and individual boiler direct feedback on current or historic state of utility infrastructure, including:
      a. Modeling and simulation of energy/utility systems
      b. Generating total-site system views
      c. Generating energy/utility indices
      d. Generating site energy/utility cost distribution
      e. Monitoring of system and equipment efficiencies
      f. Flagging potential operations improvement opportunities

2. Scenarios: Provides modeling capability for user to evaluate different improvement strategies (operational and structural) through:
   a. “What-if scenarios” to evaluate effect of changes using actual operation data over period of time.
   b. Changeable key operating parameters for evaluating feasibility and economic impacts of operating changes.
   c. Changeable key external factors like market pricing parameters or regulatory limits for evaluating impacts on economic performance.
   d. Changeable equipment parameters and configurations for evaluating impacts of hardware upgrades or plant expansions.
   e. Changeable equipment condition parameters:
      1) For investigating effect of equipment deterioration or equipment maintenance;
      2) To improve accuracy of predictions of overall system performance.

G. Systems models:
   1. Natural gas.
   2. Electrical power.
   3. Steam and condensate.

2.04 COMMUNICATIONS SETUP AND CONFIGURATION

A. Implement LAN communications such that failure of any switch or module will not cause loss of communications beyond that switch or module.

B. Coordinate assignment of network IP addresses with Owner.

C. Develop and modify Virtual Local Area Networks with Owner.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Following field performance tests shall be conducted:
   1. Visual check will be performed to ensure correct equipment.
   2. Owner's configuration and base level programs shall be loaded. Complete loop functional check shall be performed. Input signal shall be applied to each loop, and when applicable, output measured. Input/output values will be compared to displayed graphic values.
   3. Configuration displayed on operator workstations will be verified.
   4. Upon completion of satisfactory inspection, configuration and base level programs shall be recorded on machine-readable storage media for reloading at job site.

B. 24-hour per day reliability test shall be conducted.
   1. Duration: 30 consecutive days.
   2. Any excess downtime beyond reliability performance criteria specified in article "Performance Criteria and Tests" will result in 30 days guarantee period starting anew upon return to uptime.
   3. Any downtime not fault of process control equipment hardware and software will not cause guarantee period to start anew. Upon return to uptime, count of consecutive days will continue less days, or parts of days, of such downtime.
   4. First occurrence of any hardware or software component failure that is successfully repaired by Owner's personnel within 2 hours from start of occurrence shall not be included in determination of reliability performance. Subsequent similar failures or failures not meeting preceding criteria will be included in determination of reliability performance.
   5. Third similar occurrence of any hardware or software component failure meeting above criteria will result in guarantee period starting anew.
   6. Reliability will be computed by dividing uptime by the sum of uptime and downtime. Owner and Design Professional will maintain appropriate daily records of operation during field performance

test period to compute reliability. Uptime and downtime will be measured in hours and whole minutes.

C. Hardware and software shall meet reliability test requirements within 60 days after initial date when reliability tests are started.

END OF SECTION

1) T.J. Mergen

Exhibit A.1

System Description Overview

Introduction

The objective of this exhibit is to provide the functional requirements for the Heat Plant Control and Feedwater/Condensate Transfer Pump Upgrade Process Automation Control System (PACS), which includes being cost effective, reliable, straightforward to implement, easy to maintain, and expandable to other future plant equipment and other campus locations.

This document is intended to augment Drawings and Specifications.

- Section 01 43 33 – Manufacturer's Field Services: Lists requirements for on-site services.
- Section 01 78 23 – Operating and Maintenance Manuals: Lists requirements for Control System O&M Manuals.
- Section 40 81 00 – Commissioning of Process Systems: Lists requirements and responsibilities for system commissioning and field performance testing.
- Section 40 90 13 – Digital Process Control Computers: Identifies requirements for operator workstation, and data historian/engineering workstation.
- Section 40 94 43 – Process Automation Controllers: Identifies hardware requirements for process controllers, network switches, and bulk power supplies.
- Section 40 95 13 – Process Control Panel and Hardware: Identifies requirements for control system processor and HMI cabinets.
- Section 40 96 00 – General Programming and Configuration: Defines design, programming, and configuration requirements for control panels, process controllers, operator interface, and data historian.

- Exhibit A – System Description: Defines process control logic requirements.
- Exhibit D – Input/Output Listing: Lists hardwire and virtual I/O points.
- Exhibit E – Instrument Index: Lists new field instrument devices.
- Process Flow Diagrams: Shows the relationship of the equipment and the associated flow parameters.
- Piping and Instrumentation Diagrams: Shows the relationship of the equipment, piping, and instrumentation.
- Network Overview Diagrams: Shows the conceptual control system hardware and communications methodology.
- Electrical One-Line Diagrams: Shows the relationship of the switchgear, transformers, motor control centers, variable frequency drives, and local motor starters.

Existing Heat Plant

Weber State University Heat Plant was originally constructed in the early 1950's and has gone through several major remodels. The last remodel recently completed this past year included removing Boilers No. 1 and 2 and replacing them with a new Boiler No. 1. Boilers No. 3 and 4 were installed in 1971 and 1994, respectively, and will be renamed Boilers No. 2 and 3 as part of this project. Boiler No. 1 will be used primarily for summer loads while Boilers No. 2 and 3 are utilized to meet peak steam demands during winter months. Boiler No. 2 has the capability to turn down enough to meet current summer loads and will be used during transitional periods (spring and autumn).

Figure A.1-1 Existing Heat Plant Boilers

Boiler Designation	Manufacturer	Fuel Type	Capacity (lb/hr)	Installation Date
B-1	Babcock & Wilcox	Natural Gas/Fuel Oil	30,000	2009
B-2	Tampella	Natural Gas/Fuel Oil	37,000	1994
B-3	Keeler	Natural Gas/Fuel Oil	45,000	1971
Total Heat Plant Capacity			**112,000**	

Source: Stanley Consultants

Each boiler has flue gas economizers which are used to preheat the boiler feedwater entering the boiler. The economizer for Boiler No. 2 has had water hammer problems in the past and is currently not in operation. Three-way control valves will be added to eliminate potential problems with condensing or "raining" in the stack due to low flue gas temperatures in the stack at low boiler loads. The Heat Plant has redundant condensate return and boiler feedwater systems. The condensate transfer pumps and boiler feedwater pumps will all be new constant feed pumps.

Table A.1-2 Heat Plant Ancillary Equipment

Equipment Designation	Description	Capacity	Installation Date
ECO-1	Boiler No. 1 Economizer	30,000 pph	2009
ECO-2	Boiler No. 2 Economizer	Not In Operation	1984
ECO-3	Boiler No. 3 Economizer	55,000 pph	1994
CT-1	Condensate Tank No. 1	2,850 gal	1971
CT-2	Condensate Tank No. 2	6,000 gal	1994
CTP-1A	Condensate Transfer Pump No. 1A	85 gpm @100'	New
CTP-1B	Condensate Transfer Pump No. 1B	85 gpm @100'	New
CTP-2A	Condensate Transfer Pump No. 2A	85 gpm @100'	New
CTP-2B	Condensate Transfer Pump No. 2B	85 gpm @100'	New
DA-1	Deaerator No. 1	80,000 pph 1,960 gal	1971
DA-2	Deaerator No. 2	80,000 pph 1,600 gal	1994
FWP-1A	Feedwater Pump No. 1A	85 gpm @350'	New
FWP-1B	Feedwater Pump No. 1B	85 gpm @350'	New
FWP-1C	Feedwater Pump No. 1C	85 gpm @350'	New
FWP-2A	Feedwater Pump No. 2A	85 gpm @350'	New
FWP-2B	Feedwater Pump No. 2B	85 gpm @350'	New
FWP-2C	Feedwater Pump No. 2C	85 gpm @350'	New

Source: Stanley Consultants

Existing Heat Load

The Heat Plant provides steam to buildings for building heating and domestic heating water needs via two utility tunnels (East and South Tunnels) with minimal direct buried steam and condensate distribution lines (less than 20 feet). Saturated steam leaves the Heat Plant at approximately 100 psig, but is capable of increasing to 125 psig should additional capacity be required. The existing peak steam demand to campus is approximately 54,100 pph and is projected to grow to 64,500 pph in the next 20 years. Conversely, the summer load is estimated to be 10,900 pph.

Process Control System

Heat Plant Controls and Feedwater and Condensate Transfer Pumps Upgrade project establishes a new Process Control System for monitoring and controlling Boilers No. 1, 2, and 3, as well as ancillary equipment. This system is an industrial-grade control system that provides reliable operation at a cost effective price while being straightforward to implement, easy to maintain, and expandable in the future. This system is intended to allow transparent and seamless control of the Heat Plant from new operator workstations and Remote I/O Panel HMI screens. The operator workstation is located in the control room, the data historian/engineering workstation in the adjacent IT room, and the Remote I/O Panel HMI screens on the Operating Floor.

The Process Control System utilizes Process Automation Controllers (PAC) to monitor field instruments, execute control algorithms, and regulate final control elements. These controllers will consist of processors and power supplies, and Input/Output (I/O) interfaces. I/O points will be assigned to baseplates and modules within field processors to maintain segregation of systems.

The Process Control System remotely monitors operation through digital communication interface between the Remote I/O Panels. The basis is to have each Remote I/O Panel equipped with an Allen Bradley ControLogix Programmable Logic Controller (PLC) and Allen Bradley PanelView flat panel with Rockwell Automation RSView ME operator interface software. The Remote I/O Panel will operate the boiler(s) including condensate transfer pumps, feedwater pumps, and auxiliaries.

PAC Panel

The system will consist of the following equipment:

- Control Room:
  - Modular Ethernet Switch
  - Operator Workstation
  - Laser Printer
- IT Room (Adjacent to Control Room)
  - Data Historian/Engineering Workstation.

Remote I/O Panel No. 1

The system will consist of the following equipment:

- Modular Ethernet Switch
- HMI
- Process I/O 1:
  - Controller:
    - Boiler No. 1
    - Condensate Tank No. 1
    - Condensate Transfer Pumps No. 1A and B
    - Deaerator No. 1

    - Feedwater Pumps No. 1A thru C
  - Remote I/O Interfaces (RIO):
    - Analog Remote I/O interface.
    - Discrete Remote I/O interface.

Remote I/O Panel No. 2

The system will consist of the following equipment:

- Modular Ethernet Switch
- HMI
- Process I/O 2:
  - Controller:
    - Boiler No. 2
  - Remote I/O Interfaces (RIO):
    - Analog Remote I/O interface.
    - Discrete Remote I/O interface.
- Process I/O 3:
  - Controller:
    - Boiler No. 3
    - Condensate Tank No. 2
    - Condensate Transfer Pumps No. 2A and B
    - Deaerator No. 2
    - Feedwater Pumps No. 2A thru C
  - Remote I/O Interfaces (RIO):
    - Analog Remote I/O interface.
    - Discrete Remote I/O interface.

Exhibit A.2

System Description Configuration Standards

Introduction

This section defines the common configuration standards for the Heat Plant Control and Feedwater/Condensate Transfer Pump Upgrade Process Automation Control System (PACS), including general requirements, I/O and programming.

General

The process control system will be comprised of a distributed network of process automation controllers. Each controller is assigned specific functions within the facility. Depending on the required functions, a controller can have signal selection logic, PID control logic, constant speed motor control logic, and open-close and modulating valve control logic functions.

Point tags for hardwire and digital communications interfaces are identified in Exhibits D.

Tag Numbering Scheme

Utilize the point tag numbering system for identifying hardwire and digital communications interfaces point tags. Assign tags to virtual points developed within PAC program and as necessary to meet operator interface requirements such as alarm points, PID controller interface points, and calculations, in accordance with the project point tag numbering system. Maintain the project point tag number from field device throughout PAC program and operator interface including alarming, archiving, displaying, and reporting. Add a suffix or extension (.xxxx) when tagging virtual points associated with hardwire and digital communications interfaces point tags, if software allows.

Input/Output Signals

This article discusses the I/O signal definitions utilized on the project. Refer to Exhibit D - Input/Output Listings for a listing of the I/O points added to the control system during this project. This list provides the I/O point tag number, point descriptions, signal definition, and software functions

of typical equipment. Signal definitions define the point tags signal type such as “4 – 20 mA”, signal voltage such as “24-volts dc”, and signal origin such as “Panel”.

Analog Input Signals

Analog input signals utilize 4-20 mA signals to represent the value of a process measurement such as pressure, flow, or temperature. The 24-volt power for the signals can originate either from the marshalling panel (two-wire device) or the device itself (four-wire device). I/O points with origins identified as “Panel” on the I/O Lists are two-wire devices that require the signal source voltage from the marshalling panels. These signals can be connected to non-isolated input modules since the source voltage is common to all two-wire devices. Fused terminal blocks with blown fuse indicators are used to provide point to point isolation between points. I/O points with origins identified as “Field” on the I/O Lists are four-wire devices that will furnish the source voltage for the signal. These signals are connected to isolated inputs modules since the voltage sources vary from point to point. Field devices that are HART enabled also superimpose a digital communications signal along with the analog signal.

Analog Output Signals

Analog output signals utilize 4-20 mA signals to represent the controlled output value to a modulating control device such as control valve or speed setpoint to a VFD. The power for this signal originates at the marshalling panel. Fused terminal blocks with blown fuse indicators are used to provide point to point isolation between points. Analog Output signals are used to modulate control valves, control the speed of a variable speed motor, or to adjust the pressure setpoint.

Discrete Input Signals

Discrete input signals are initiated from a field contact closure and are 120-volt ac. The power for this signal originates in the marshalling panel. These signals can be connected to non-isolated input modules since the source voltage is common to all discrete inputs. Fused terminal blocks with blown fuse indicators are used to provide point to point isolation between points. Discrete input signals are used to communicate the status of an alarm or position of a switch or field contact to the control system.

Discrete Output Signals

Discrete output signals are initiated from the I/O panel and operate at 120-volt ac. The power for this signal may originate from the marshalling panel or the field. Triac output modules with common output points are factory wired to relay termination units. Each Form-C relay is rated for 8 amps at 120-volts ac. Motor control logic such as pumps, fans, and motor operated control valves utilize source (wetting) voltage from the motor starter and are listed as “Field” in the origin field of the I/O list. Solenoid valves use source (wetting) voltage from the marshalling panel and are listed as “Panel” in the origin field of the I/O list. Power is distributed to “Panel” sourced signals through fused terminal blocks with blown fuse indicators to provide point to point isolation between points. Discrete Output signals are used to start or stop motors, or open or close valves from the control system.

Digital Communication Interfaces

Digital communications interfaces are used to transport large groups of data from third party devices to the control system, using an open system communications protocol. Ethernet Global Data (EGD) and Modbus are communication protocols often employed in industrial settings. The

data can then be interpreted and used at the controller as well as subsequently at process control system servers.

Table A.2-1 Third Party Communication

Third Party Device	Protocol
Remote I/O Panels	AB Ethernet
Burner Management System	Modbus RS485

Control Logic

This section defines the configuration requirements for standard control logic functions utilized throughout the strategies.

Operating Modes

The Process Control System is configured for two operating modes: Advisory and Remote Manual.

In an Advisory Mode, the control system prompts the user to start and stops boilers as well as associated equipment by monitoring campus steam demand, electrical usage, plant generation, and ambient conditions. The order in which equipment is energized or de-energized can be based upon a fixed sequence or determined by the user.

In a Remote Manual mode, the user determines when and which equipment such as boilers, pumps, condensate tanks, and deaerators are to operate without prompting from the control system.

Transmitter Failure Alarm

The Process Control System monitors each analog input point and issues a transmitter failure when the input amperage is less than 3.8 mA for non temperature measurements. The system issues a transmitter failure when the input amperage is less than 4 mA for temperature measurement since temperature transmitters downscale on loss of temperature element. Point tags for transmitter failure alarms shall include an “A” as a suffix to the transmitters ISA descriptor.

Signal Selection Logic

Signal selection control logic determines the process variable for a software controller in applications where redundant transmitters are employed.

Middle Select Logic

Middle select control logic determines the process variable to the software controller, where more than one transmitter is installed. Each middle select control block consists of three process transmitters; middle select logic; a software selector function; deviation, high and low alarms. This logic compares the value of the process transmitters to determine the middle signal. A software selector function allows the user to choose between each process transmitters and the middle selected signal. During normal operation, the middle signal is selected as the output of the block.

This logic compares each process value with the middle selected signal for deviations. If the logic detects a deviation of 5 percent or greater for one transmitter, the system alarms the user that the transmitter is out of calibration. If the logic shows 5 percent deviations or greater for

all transmitters, the system transfers the software controller to remote manual and alarms the user.

Motor Control Logic

The following descriptions identify local and remote control requirements for each type of motor listed. Local control requirements are provided by the general contractor including variable frequency drives, reduced voltage solid state starters, motor control centers, and local hand stations.

Local Switch Functions	Definition
Auto	Switch position (maintained contact) that allows operation of motor from a control logic local to the switch without user intervention. For example, sump pumps when placed in Auto are operated by level switches local to the pump.
Close	Pushbutton (momentary contact) that closes motor operated valve when actuated by user.
Hand	Switch position (maintained contact) that initiates operation of a motor without needing to utilize other control devices such as start or stop pushbuttons. When switch is in Hand position, motor cannot be stopped from Process Control System.
Local	Switch position (maintained contact) that allows operation of motor from other local control devices such as start or stop pushbuttons. When switch is in Local position, motor cannot be operated from Process Control System.
Off	Switch position (maintained contact) that prevents operation of motor from any location. When switch is in off position, motor cannot be started by local pushbuttons or from the Process Control System.
Open	Pushbutton (momentary contact) that opens motor operated valve when actuated by user.
Remote	Switch position (maintained contact) that allows operation of motor from a remote location such as the Process Control System. For example, condenser water pumps when placed in Remote are controlled from the Process Control System. This remote control can either be Remote-Manual (user controls pump operation) or Automatic (control logic dictates pump operation).
Start	Pushbutton (momentary contact) that energizes motor when actuated by user.
Stop	Pushbutton (momentary contact) that energizes motor when actuated by user.
Operating Modes	**Definition**
Remote Manual	User controls motor operation from Process Control System
Automatic	Process Control System logic controls motor operation without user intervention.
Output Signals	**Definition**
Run Command	Discrete output signal using Normally Open, maintained contact that electrically closes to energize motor.
Start Command	Discrete output signal using Normally Open, momentary contact that electrically closes to energize motor. Use with Stop Command.
Stop Command	Discrete output signal using Normally Close, momentary contact that electrically opens to de-energize motor. Use with Start Command.

Additionally, these descriptions define requirements for field interlocks, trip interlocks, and start permissive requirements. Field interlocks are hardwired logic that prevents operation of the motor regardless of whether the motor is being controlled locally or from the Process Control System. Trip interlocks are software events, that de-energize effected equipment and alarms the user from the Process Control System. Start permissive requirements are conditions that must be met prior to energizing effective equipment from the Process Control System.

Constant Speed Pump Control

The Process Control System remotely controls a number of miscellaneous pumps throughout the plant. These pumps are powered from Motor Control Center mounted non-reversing, constant speed starters. The pumps are controlled locally from Motor Control Center or remotely from the Process Control System.

No field interlock conditions prevent pump operation, unless noted otherwise in later sections. Motor starters are equipped with maintain contact selector switches and Process Control System discrete output Run Commands are maintained contacts. Therefore, pumps operating prior to the power failure will re-energize without intervention from the user when power is restored.

Each non-reversing, constant speed starter compartment is equipped with a current switch that the Process Control System monitors. This current switch signal is used to determine pump run status. When the current switch and an auxiliary motor starter contact are electrically closed, the Process Control System shows that the pump is “Running”.

Each Motor Control Center compartment is equipped with Hand-Off-Remote selector switch, and Run-Off pilot lights. When the Hand-Off-Remote switch is “Hand”, the pump operates without intervention of the Process Control System. Typically, the Hand-Off-Remote selector switch remains in the “Remote” position and the pump is controlled remotely through the Process Control System. Control, alarm, and status conditions are hardwired to the Process Control System.

The user controls pump operation through a control display from the Process Control System operator workstations when the non-reversing, constant speed starter is in “Remote”. Control displays furnish the user the functions required to remotely operate the pump. These displays consists of Automatic, Remote-Manual, Start, Stop, and Reset functions as well as indication that the pump is running, in automatic mode, in remote-manual mode, has failed-to-start, and requires reset to operate.

The user determines whether the pump is in “Automatic” or “Remote-Manual” modes. Control logic provides bumpless transitions between “Automatic” or “Remote-Manual” modes. In either “Automatic” or “Remote-Manual”, the system provides remote operation of the pump through a maintained Run discrete output signal. The Process Control System initializes the display in the “Remote-Manual” mode and in de-energized state.

When the display is in “Remote-Manual”, the user controls pump operation through the Start and Stop functions, without interference from automatic control logic. With the display in “Automatic”, pump operation is controlled through Process Control System control logic defined in later sections.

When operating from the Process Control System, if the motor run status feedback is not received within 10 seconds (adjustable at startup) after the initiation of the Start command, the Process Control System generates a "Failed to Start" alarm, places the control display in "Remote-Manual", and issues a "Stop" command to the motor starter. The user resets any of these failure conditions from the pump control display by initiating the "Reset" function.

Open-Close Motor-Operated Valve Control Logic

The Process Control System remotely controls a number of motor operated, open-close isolation valves throughout the plant. These valves are powered from reversing motor starters integral to the valve actuator. The valves are controlled locally from valve actuator or remotely from the Process Control System.

No field interlock conditions prevent valve operation, unless noted otherwise in later sections. Additionally, hardwire and software control logic is designed to fail the valve in place on power failure and require remote manual intervention to change valve position after power is reestablished.

Each valve actuator is equipped with Local-Off-Remote selector switch, and Open-Stop-Close pushbuttons, and Open-Close pilot lights. When the Local-Off-Remote switch is "Local", the valve is controlled from the valve actuator without intervention of the Process Control System. The valve is controlled by actuator mounted Open-Stop-Close pushbuttons. Typically, the Local-Off-Remote selector switch remains in the "Remote" position and the valve is controlled remotely through the Process Control System. Control and status conditions are hardwired to the Process Control System.

The user controls valve operation through a control display station from the Process Control System operator workstations when the Local-Off-Remote switch is in "Remote". Control displays furnish the user the functions required to remotely operate the valve. These displays consists of Automatic, Remote-Manual, Open, Close, and Reset functions as well as indication that the valve is open, is closed, in transition, in automatic mode, in remote-manual mode, has failed, and requires reset to operate.

The user determines whether the valve is in "Automatic" or "Remote-Manual" modes. Control logic provides bumpless transitions between "Automatic" or "Remote-Manual" modes. In either "Automatic" or "Remote-Manual", the system provides remote operation of the valve through a maintained open and close discrete output signals. The Process Control System initializes the display in the "Remote-Manual" mode and in closed state, unless noted otherwise.

When the display is in "Remote-Manual", the user controls valve operation through the Open and Close functions, without interference from automatic control logic. With the display in "Automatic", valve operation is controlled through Process Control System control logic defined in later sections.

The Process Control System monitors Valve Open Status and Valve Close Status. These signals are wired to be electrically open when the valve reaches the desired position. The Process Control System shows the valve in transit when both open and close status points are

electrically closed and issues an alarm if both open and close positions are electrically open simultaneously.

When operating remotely, if the valve open status feedback is not received within 20 seconds (adjustable at startup) after the initiation of the Open command or if the valve close status feedback is not received within 20 seconds (adjustable at startup) after the initiation of the Close command, the Process Control System generates a "Failed" alarm, places the software control station in "Remote-Manual", and de-energizes the Open or Close commands to the reversing starter. The user resets the failure condition from the software control station by depressing the software "Reset" function.

Modulating Motor-Operated Valve Control Logic

The Process Control System remotely controls a number of motor operated, modulating control valves throughout the plant. These valves are powered from reversing motor starters integral to the valve actuator. These valves are controlled locally from valve actuator or remotely from the Process Control System.

No field interlock conditions prevent valve operation, unless noted otherwise in later sections. Additionally, hardwire and software control logic is designed to fail the valve in place on power failure and require remote manual intervention to change valve position after power is reestablished.

Each valve actuator is equipped with Local-Off-Remote selector switch, and Open-Stop-Close pushbuttons, and Open-Close pilot lights. When the Local-Off-Remote switch is "Local", the valve is controlled from the valve actuator without intervention of the Process Control System. The valve is controlled by actuator mounted Open-Stop-Close pushbuttons. Typically, the Local-Off-Remote selector switch remains in the "Remote" position and the valve is controlled remotely through the Process Control System. Control and status conditions are hardwired to the Process Control System.

The user controls valve operation through a control display station from the Process Control System operator workstations when the Local-Off-Remote switch is in "Remote". Control displays furnish the user the functions required to remotely operate the valve. This display consists of a software controller with Proportional-Integral-Derivative (PID) control algorithm and an auto-manual station. With the station in Manual, the user directly determines the value of the controlled output (CO) signal and the controller is disabled to prevent windup. With the station in Auto, the controller generates an output signal to minimize the difference (error) between the process variable (PV) and setpoint (SP). The controller provides bumpless transitions between the auto and remote manual positions.

The user determines whether the valve is in "Automatic" or "Remote-Manual" modes. Control logic provides bumpless transitions between "Automatic" or "Remote-Manual" modes. In either "Automatic" or "Remote-Manual", the system provides remote operation of the valve through an analog output signal. The Process Control System initializes the display in the "Remote-Manual" mode and valve output signal at zero.

When the display is in "Remote-Manual", the user controls valve operation without interference from automatic control logic. The user adjusts valve position by either entering a position value (0 – 100%) or using position increase/decrease functions.

With the display in "Automatic", valve operation is controlled through Process Control System control logic defined in later sections. The user adjusts the controller setpoint by either entering a setpoint value or using setpoint increase/decrease functions.

Controller Logic

PID Controller with Analog Output. Each software controller consists of a Proportional-Integral-Derivative (PID) control algorithm and an auto-manual station. With the station in Manual, the user directly determines the value of the controller output signal and the controller is disabled to prevent windup. With the station in Auto, the controller generates an output signal (CO) to minimize the difference (error) between the process variable (PV) and setpoint (SP). The controller provides bumpless transitions between the auto and remote manual positions.

During automatic control, a direct acting controller increases the output signal when the process variable is greater than setpoint. Conversely, a reverse acting controller decreases the output signal when the process variable is greater than setpoint.

PID Controller with Discrete Outputs. Each software controller consists of a Proportional-Integral-Derivative (PID) control algorithm and an auto-manual station. With the station in Manual, the user directly determines the value of the controller output signal and the controller is disabled to prevent windup. With the station in Auto, the controller generates an output signal (CO) to minimize the difference (error) between the process variable (PV) and setpoint (SP). The controller provides bumpless transitions between the auto and remote manual positions.

During automatic control, a direct acting controller increases the output signal when the process variable is greater than setpoint. Conversely, a reverse acting controller decreases the output signal when the process variable is greater than setpoint.

Calculations

This section defines standard calculations to be utilized throughout the process control strategies.

Runtime Totalizers

Runtime totalizers calculate the run times for each individual condensate transfer pumps and boiler feedwater pumps. It is totalized and reset on a daily, monthly, and yearly basis.

Equipment	Description
CTP-1A	Condensate Transfer Pump No. 1A
CTP-1B	Condensate Transfer Pump No. 1B
CTP-2A	Condensate Transfer Pump No. 2A
CTP-2B	Condensate Transfer Pump No. 2B
FWP-1A	Boiler Feedwater Pump No. 1A
FWP-1B	Boiler Feedwater Pump No. 1B

FWP-1C	Boiler Feedwater Pump No. 1C
FWP-2A	Boiler Feedwater Pump No. 2A
FWP-2B	Boiler Feedwater Pump No. 2B
FWP-2C	Boiler Feedwater Pump No. 2C

Exhibit A.3

System Description

Introduction

Heat Plant Control and Feedwater/Condensate Transfer Pump Upgrade consists of the replacement of all condensate transfer pumps and boiler feedwater pumps; and migration of combustion controls from single loop controllers to a new Process Automation Control System (PACS).

The descriptions will identify how the User will interact with the Process Control System. User is defined as heating plant staff responsible for operating the system. Process Control System is used to define functions and actions that the system performs in response to User intervention or control logic functions.

Plant Master Controller

The Plant Master balances Heat Plant steam production with campus steam demand. To achieve this balance, the Plant Demand signal is generated by monitoring the main steam header pressure. This signal is distributed to each boiler.

The Plant Master Controller (PIC-0000) generates the Plant Demand signal which is used as the process variable for each boiler master bias station. This reverse acting controller utilizes median select control logic by monitoring the three steam header pressure transmitters (PI-0001, PI-0002, and PI-0003) for the process variable. The controller transfers the Plant Demand output signal to each boiler master bias station. Provide the ability to Enable or Disable each of the three steam header pressure transmitter signals. Provide a warning to the operator if any of the three pressure signals do not match the other two signals.

Boiler Master Controllers

The Boiler Master modulates the Boiler steam production with the signal from the Plant Master. The Boiler Master Stations are auto-manual with biasing stations. In Manual, the operator selects the boiler demand signal (firing rate).

Boiler No. 1

In Auto, the Boiler Master uses an operator biased (HSC-0100) Plant Demand signal (XI-0100) as the boiler demand signal. During normal operation, this mode provides automatic adjustment of the boiler to meet steam demand.

Boiler No. 2

In Auto, the Boiler Master uses an operator biased (HSC-0200) Plant Demand (XI-0200) as the boiler demand signal. During normal operation, this mode provides automatic adjustment of the boiler to meet steam demand.

Boiler No. 3

In Auto, the Boiler Master uses an operator biased (HSC-0300) Plant Demand signal (XI-0300) as the boiler demand signal. During normal operation, this mode provides automatic adjustment of the boiler to meet steam demand.

Boiler Drum Level Controllers

The steam drum level controllers employ two-element control scheme to balance feedwater input with steam output to maintain the normal water level in the steam drum.

Boiler No. 1

The Drum Level Controller (LIC-1100) generates the drum level error signal. This reverse acting controller uses median select logic by monitoring the two Drum Level Transmitters (LI-1101 and LI-1102) for the process variable while the operator determines setpoint. Provide the ability to Enable or Disable independently each of the two level transmitter signals. Provide a warning to the operator if two level signals do not match.

The Feedwater Controller (FIC-1100) regulates the Feedwater Control Valve (FCV-1111). This reverse acting controller uses the sum of the drum level error signal and Feedwater Flow Rate (FI-1101) as process variable and the steam flow rate as setpoint.

Boiler No. 2

The Drum Level Controller (LIC-1200) generates the drum level error signal. This reverse acting controller uses median select logic by monitoring the two Drum Level Transmitters (LI-1201 and LI-1202) for the process variable while the operator determines setpoint. Provide the ability to Enable or Disable each of the two level transmitter signals. Provide a warning to the operator if two level signals do not match.

The Feedwater Controller (FIC-1200) regulates the Feedwater Control Valve (FCV-1211). This reverse acting controller uses the sum of the drum level error signal and Feedwater Flow Rate (FI-1201) as process variable and the steam flow rate as setpoint. Steam flow compensation is performed in multi-variable flow transmitter.

Boiler No. 3

The Drum Level Controller (LIC-1300) generates the drum level error signal. This reverse acting controller uses median select logic by monitoring the two Drum Level Transmitters (LI-1301 and LI-1302) for the process variable while the operator determines setpoint. Provide the ability to Enable or Disable each of the two level transmitter signals. Provide a warning to the operator if two level signals do not match.

The Feedwater Controller (FIC-1300) regulates the Feedwater Control Valve (FCV-1311). This reverse acting controller uses the sum of the drum level error signal and Feedwater Flow Rate (FI-1301) as process variable and the steam flow rate as setpoint.

Oxygen Trim Boiler 1

The Oxygen Trim Controller (AIC-001) adjusts the FD Fan VFD (ACV-001) to improve boiler efficiency by limiting the amount of excess air injected into the combustion chamber. This reverse acting controller utilizes the Flue Gas Oxygen Measurement (AI-001) as process variable. The oxygen trim setpoint is a function of the units steam flow rate for each fuel as determined during the boiler capacity tests. Control logic selects the oxygen trim setpoint based upon the units steam flow rate for the fuel being fired. This selected setpoint is biased by the operator with a maximum adjustment limited to ±10 percent.

The control logic will automatically disable the oxygen trim logic upon purge and low fire signals from the Burner Management System, a faulty oxygen measurement (out of range), or an operator initiation (Manual return to the Enable Mode).

Oxygen Trim Boiler 2

The Oxygen Trim Controller (AIC-002) adjusts the FD Fan VFD (ACV-002) to improve boiler efficiency by limiting the amount of excess air injected into the combustion chamber. This reverse acting controller utilizes the Flue Gas Oxygen Measurement (AI-002) as process variable. The oxygen trim setpoint is a function of the units steam flow rate for each fuel as determined during the boiler capacity tests. Control logic selects the oxygen trim setpoint based upon the units steam flow rate for the fuel being fired. This selected setpoint is biased by the operator with a maximum adjustment limited to ±10 percent.

The control logic will automatically disable the oxygen trim logic upon purge and low fire signals from the Burner Management System, a faulty oxygen measurement (out of range), or an operator initiation (Manual return to the Enable Mode).

Oxygen Trim Boiler 3

The Oxygen Trim Controller (AIC-003) adjusts the FD Fan VFD (ACV-003) to improve boiler efficiency by limiting the amount of excess air injected into the combustion chamber. This reverse acting controller utilizes the Flue Gas Oxygen Measurement (AI-003) as process variable. The oxygen trim setpoint is a function of the units steam flow rate for each fuel as determined during the boiler capacity tests. Control logic selects the oxygen trim setpoint based upon the units steam flow rate for the fuel being fired. This selected setpoint is biased by the operator with a maximum adjustment limited to ±10 percent.

The control logic will automatically disable the oxygen trim logic upon purge and low fire signals from the Burner Management System, a faulty oxygen measurement (out of range), or an operator initiation (Manual return to the Enable Mode).

Condensate Level Controllers

Condensate Tank No. 1

The Condensate No. 1 Level Controller (LIC-3181) modulates the Condensate No. 1 Flow Control Valve () to maintain condensate tank level. This reverse acting controller uses the Condensate Tank No. 1 Level based on the average select logic of Transmitters (LI-3181A and LI-3181B) for the process variable while the operator determines the setpoint. The operator shall have the ability to select a single transmitter as the process variable.

On increased demand when level control valve () cannot maintain level, control output to hold Level Control Valve () set point and modulate Level Control Valve ().

As demand decrease below minimum control on valve (), close valve and control () to maintain set point.

Condensate Tank No. 2

The Condensate No. 2 Level Controller (LIC-3281) modulates the Condensate No. 2 Flow Control Valve () to maintain condensate tank level. This reverse acting controller uses the Condensate Tank No. 1 Level based on the average select logic of Transmitters (LI-3281A and LI-3281B) for the process variable while the operator determines the setpoint. The operator shall have the ability to select a single transmitter as the process variable.

On increased demand when level control valve () cannot maintain level, control output to hold Level Control Valve () set point and modulate Level Control Valve ().

As demand decrease below minimum control on valve (), close valve and control () to maintain set point.

Deaerator Level Controllers

Deaerator No. 1

The Deaerator No. 1 Level Controller (LIC-2111) modulates the Deaerator No. 1 Level Control Valve (LCV-2181) to maintain deaerator level. This reverse acting controller uses the Deaerator No. 1 Level based on the average select logic of Transmitters (LI-2111A and LI-2111B) for the process variable while the operator determines the setpoint. The operator shall have the ability to select a single transmitter as the process variable.

On increased demand when level control valve (LCV-2181) cannot maintain level, control output to hold Level Control Valve (LCV-2181) at 100% valve position and modulate Level Control Valve (LCV-2182) to maintain level set point.

As demand decrease below minimum control on valve (LCV-2182), close valve and control LCV-2181 to maintain set point.

Deaerator No. 2

The Deaerator No. 2 Level Controller (LIC-2211) modulates the Deaerator No. 1 Level Control Valve (LCV-2281) to maintain deaerator level. This reverse acting controller uses the Deaerator No. 2 Level based on the average select logic of Transmitters (LI-2211A and LI-2211B) for the process variable while the operator determines the setpoint. The operator shall have the ability to select a single transmitter as the process variable.

On increased demand when level control valve (LCV-2281) cannot maintain level, control output to hold Level Control Valve (LCV-2281) at 100% valve position and modulate Level Control Valve (LCV-2282) to maintain level set point.

As demand decrease below minimum control on valve (LCV-2281), close valve and control LCV-2182 to maintain set point.

Make Up Water Controllers

The Deaerator receives condensate and adds make up water to maintain deaerator level.

Boiler Feedwater Pressure Controllers

Three pumps transfer boiler feedwater from each deaerator to the feedwater header. During normal operation, either Deaerator No. 1 or 2 are the source of feedwater for the pump. Operator to select which system is in service.

Boiler Feed Pump Controller

Boiler Feed Pumps 1A, 1B and 1C shall not be permitted to start or run while Deaerator No. 1 Level at low-low set point.

Boiler Feed Pumps 2A, 2B and 2C shall not be permitted to start or run while Deaerator No. 2 Level at low-low set point.

Condensate Pump Controller

Condensate Pumps 1A, 1B and 1C shall not be permitted to start or run while Condensate Tank No. 1 Level at low-low set point.

Condensate Pumps 2A, 2B and 2C shall not be permitted to start or run while Condensate Tank No. 2 Level at low-low set point.

Exhibit A.4

System Description
Displays and Data Archiving

Displays

Introduction

The following guidelines explain the design standards used for developing the Process Control System (PCS) displays including general requirements, standards libraries, color schemes, display types, and summary of displays for the Heat Plant Control and Feedwater/Condensate Transfer Pump Upgrade Process Automation Control System (PACS).

Displays are screen images including process overviews; control graphics; informative tables; Controls such as PID (faceplates) controllers and motor control stations; real time trends; alarm summaries; report selections; and help files which allow the operator to remotely monitor and control the process activities.

Designing the displays with human factors in mind will help the operator respond faster during upsets to the process and reduce eyestrain. These factors include providing a high contrast between alarm colors and operator display colors, as well as developing easy and logical access to control graphics. Control graphic displays shall be easy to find, with minimum movement or keystrokes, and vital information about the process will be easily understood with a single glance. The total quantity of displays provided shall be sufficient to conveniently operate and monitor all plant systems. The Contractor is accountable for these human factors when developing a video screen-based operator interface.

Displays shall be based on the PFDs, P&IDs, Electrical One-Line Diagrams, and Network Overview Diagrams. Only objects directly related to the process shall be shown. Unrelated lines, valves, block/isolation valves, etc., shall not be shown unless required for clarity in operation.

While displays shall be based on the guidelines outlined in this section, the Contractor may submit, for review, modified guidelines and schemes based on the Contractor's experience and standards. However, the Owner must review and approve all deviations and additions to these guidelines. Additionally, all displays defined herein shall be provided, regardless of format.

General Requirements

All displays shall be designed to avoid clutter. Information displayed on each Control display shall be limited to what the operator needs to know for process control tasks. Any secondary information, which is deemed useful to the operator, shall be displayed through Controls or secondary displays.

Display Hierarchy

The display hierarchy is the menu system the will aid the operator in navigating through the displays. It shall be possible to move between related displays and displays of different detail levels or of the same detail level with a maximum of two operator actions.

A tree hierarchy shall be utilized for paging between displays. A plant overview display shall be the base of the tree showing the various plant systems. A level of primary displays shall branch off of the base detailing the individual systems. Each branch shall have as many branches and sub-branches as necessary to breakdown the system to manageable control displays. It shall be possible to cycle through a predefined series of displays with a maximum of one operator action.

Operators shall be able to easily access specific displays by pressing dedicated function keys or display targets, selecting from a list of displays in directories or menus, or by typing display names.

Contractor shall develop display hierarchy and paging scheme.

Display Refresh Capability

Displays that show real time data shall be automatically and continually refreshed or updated. Analog values shall be updated at a maximum of 1 second intervals. Discrete values shall be updated by exception, upon changing states. Display refreshments or updates shall not require operator initiation.

Analog Values

The values with engineering units shall be displayed directly above the process line it is associated with. For vertical lines, or if other constraints require the text to be placed adjacent to a vertical line, the text shall appear directly to the left of the process line. Process values associated with equipment (tank levels, etc.), shall be shown directly adjacent to the equipment symbol.

Precision of analog values shall be limited to what the operator needs to know for the given application. Contractor shall implement the following default precision when developing displays. Owner reserves the right to modify precision of group or individual points.

Measurement	Units	Precision
Pressure	psi	Tenth of unit
Differential Pressure	psi / "h2o	Tenth of unit
Flow, Liquid	gpm	Whole unit
Level	" w.c.	Tenth of unit
Temperature	ºF	Tenth of unit
pH	-	Tenth of unit
Conductivity	µS/cm	Whole unit
Humidity	%	Tenth of unit
Speed	%	Tenth of unit
Controller outputs	%	Tenth of unit
Thermal Energy	Btu/hr	Whole unit
Electrical Current	Amp	Tenth of unit
Electrical Voltage, < 600 volts	Volts	Tenth of unit
Boiler Efficiency	%	Tenth of unit

Invalid Values

Special symbols shall be used to indicate that a value is invalid. When input signals are flagged as invalid or bad quality by the field processor, the value color shall be changed to magenta and value area shall be replaced with "#". The display shall not show the incorrect value.

Standard Libraries

The Contractor shall develop standard object libraries to aid display development and achieve consistency between displays. These libraries house master static and smart (dynamic) objects. Smart objects have imbedded links (database connections) while static objects are not linked. When dynamic objects are altered, all instances of the object on all displays are updated. Smart objects will be employed when the object is used for control or shown on two or more displays.

Symbol shapes and sizes will be standardized throughout the displays to maintain consistency. Any custom symbols required to implement the specified control functions shall be created during development and stored in the standards library.

Static Objects Library

Static objects can be process lines or shapes representing process equipment. These objects require the developer to expand the object and fill in the animation detail on an object by object basis. The objects, once placed on a display, do not change with changing process conditions. Static process lines, pumps and valves will be a fixed color assigned to a particular process. Static text is simply a text string whose contents remain fixed. Static text is normally used for informational purposes only. It may be used to direct operators to additional displays, advise of the meaning of dynamic information, or further clarify other display objects.

The Contractor, at minimum, shall develop library of following static objects.

- Display Boxes
- Ducts
- Icons
- Message Displays
- Title Bars

Smart Objects Library

Dynamic objects are symbols, shapes, or lines that are linked to the process database allowing color changes based on changes in process values and conditions. Control objects change based on the direct action of the operator or as a result of discrete changes to monitored process variables.

Dynamic text contains numeric values that change with process conditions and give the operator key process information. Tank levels will be indicated by a bar graph within the tank and will change height to represent changes in the tank level. Dynamic control objects are symbols, shapes, or lines that change color based on changes in process values and conditions.

Smart objects pop up a dialog box when placed on the display and provide edit boxes, combo boxes and variable browse buttons to configure the object.

The Contractor, at minimum, shall develop library of following smart objects.

Smart Object Library	
Devices	**Controls**
Valve, Modulating	Control Station Modulating Valve
Valve, Open-Close	Control Station Open-Close Valve
Fan, Variable Speed	Control Station Fan VFD
Pump, Constant Speed	Control Station Constant Speed
	Controller PID Faceplate

Display Standards

The Contractor shall utilize the following standards in developing standard library objects and displays. The colors associated with specific process lines shall be consistent between all displays.

Process System Color	Static Color	Dynamic Color Dark Lines In Service Light Lines Out of Service
Process/Make-up Water	Green	Green
Heating Water	Purple	Purple
High Pressure Steam	Red	Red
Low Pressure Steam	Orange	Orange
Condensate	Grey	Grey
Compressed/Instrument Air	Grey	Grey
Medium Voltage (13.8 kV)	Red	Red
Medium Voltage (4160 V)	Orange	Orange
Low Voltage (< 600 V)	Yellow	Yellow

Objects	Static Color	Dynamic Color		
		On	Fault	Off
Equipment	Process System Color	Red	Yellow	Green
Future Equipment	Grey	-	-	-
Pumps	Process System Color	Red	Yellow	Green
Fans	Process System Color	Red	Yellow	Green

Objects	Static Color	Dynamic Color

		Closed	Trip	Open
Breakers	Process System Color	Red	Yellow	Green

Objects	Static Color	Dynamic Color		
		Open	In-Transit	Closed
Valves (Open-Closed)	Process System Color	Red	Flashing Yellow	Green

Objects	Static Color	Dynamic Color Over Black Background		
		High-High Low-Low	High Low	Normal
Level Bar Graph	Cyan	Red	Yellow	Cyan

Overviews and Control Displays			
Background	Beige		
Display Titles	Black on grey		
Text	Black on beige		
Process Variables – Value	White on black back ground		
Process Variables – Units	Black		
Setpoints – Value	White on black back ground		
Setpoints – Units	Black		
Control Output – Value	White on black back ground		
Control Output – Units	Black		
Invalid Value	Magenta (Use "#" symbol in data field when data invalid.)		
Change Page Pushbutton	Black text on grey background		
Login Pushbutton	White text on blue background		
Print Display Pushbutton	White test on red background		
	Active, Unacknowledged	**Active, Acknowledged**	**Not Active**
Alarm Conditions	Flashing Yellow	Solid Yellow	Hidden
Trip Conditions	Flashing Red	Solid Red	Hidden

Alarm Summary Display			
Background	Black		
Display Titles	Black on grey		
Text	Black on grey		
Change Display Pushbutton	Black text on grey background		
Login Pushbutton	White text on blue background		
Print Display Pushbutton	White test on red background		
	Active, Unacknowledged	**Active, Acknowledged**	**Not Active, Unack.**
Advisory Alarm Condition	Flashing Yellow	Solid Yellow	Flashing Green
Important Alarm Condition	Flashing Yellow	Solid Yellow	Flashing Green
Critical (Trip) Condition	Flashing Red	Solid Red	Flashing Green

Motor and Valve Control	
Background	Grey
Display Titles	Black on grey
Text	Black on grey
Start or Open Station	Black text on grey background
Stop or Close Station	Black text on grey background
Run or Open Status	Red
Stop or Close Status	Green

In-Transit Status	Flashing yellow
Failed Status	Red text on white background
Alarm Status	Yellow text on black background
Faceplate (PID) Control	
Background	Grey
Display Titles	Black on grey
Text	Black on grey
Process Variables – Graph	Yellow (Vertical Bar)
Process Variables – Value	Yellow
Process Variables – Units	Yellow
Setpoints – Graph	White (Vertical Bar)
Setpoints – Value	White
Setpoints – Units	White
Control Output – Graph	Blue (Horizontal Bar)
Control Output – Value	Blue
Control Output – Units	Blue
Auto-Manual Station	Black text on grey background
Increase-Decrease Station	Black text on grey background
Data Entry Fields	Black text on grey background

Display Development

Process control displays are organized so information flows from general to specific. The displays can be animated and colored to indicate when machinery is running, off, in alarm, or communications have been lost. The linking of displays provides a seamless flow of information.

The operator will monitor and control plant operations from the control system displays. Therefore, displays will be designed to avoid clutter and limited to what the operator needs to know for process control. Secondary information, which is deemed useful to the operator, will be displayed through Controls or secondary displays.

Standard Display Layout

Certain areas of every display shall be dedicated for common information and control functions to enhance mobility between and operability of each display. The standard display layout provides a consistent look and feel for all displays. The following information will be furnished in the same location on every display.

Title Block: Each display will contain a title block field including display title, current date, current time, active user account, and login station.

Navigation Block: Each display will contain a navigation block reserved for paging between the current display and related displays such as overviews, graphics, trends, and report displays.

Alarm Summary Block: Each display will contain an alarm summary block with space to show 5 alarm conditions, acknowledge pushbutton, alarm help pushbutton, and pushbutton to change view to detailed alarm page.

Common Display Keys: The keyboard keys of Help, Next Page, Previous Page, and Escape shall be defined to perform the same type of function on all displays:

- **Help:** Shows permissives associated with the control functions on the display. "Help" shall default to the standard help display if not configured.
- **Next Page:** Toggles to the next similar display related to the display (same layer movement).
- **Previous Page:** Toggles to the previous similar display related to the display (same layer movement).
- **Escape:** Moves up one layer in the display heirarchy.

Overview Displays

Overview displays present a general overview of the plant or entire systems within the plant and are typically view-only displays. These displays show the interconnections of key process equipment and piping in a schematic relationship. Similarly, overview displays show the interconnections of key electrical equipment, such as breakers, switches, and transformers, and interconnecting electrical buses or cables. These displays have links to associated graphic, trend, reports, and detailed alarm displays. Project Process Flow Diagram (PFDs) and Overall Electrical One-Line Diagrams often furnish the starting point for develop of overview displays.

Graphic Displays

Graphic displays detail a specific or portion of a specific process. The operator uses graphic displays to monitor and control process equipment. These displays have links to associated overview, Controls, trend, reports, and detailed alarm displays. Project Piping and Instrumentation Diagrams (P&IDs) and system Electrical One-Line Diagrams often furnish the starting point for develop of overview displays.

Control Displays

Control displays include faceplates (PID) controllers and control stations for pumps, fans, and valves. These displays allow operators to change operating modes (automatic-manual), adjust setpoints, adjust controlled output signals, start or stop motors, and open or close valves. Controller faceplates include Auto-Manual stations, process variable, setpoint, and controlled output signals. Control displays are typically a subset of graphic displays. These displays are standard smart objects that displayed with a unique border color when not active, switching to another distinct border color when selected. The developer assigns Control locations on displays such that pertinent information on the graphic display is not covered or blocked by the Control.

Single Controls will be utilized for control and indication of multi-state devices. For example, a motor operated valve shall indicate open, closed, intermediate position, and fault.

Faceplates (PID) Control

Faceplate (PID) Controls show dynamic process and status information for a process control loop. These Controls shall allow the operator to:

- Change between Automatic and Manual control modes.
- Adjust process setpoint when in Automatic mode.

- Adjust controlled output signal when in Manual mode.

Faceplate (PID) Controls will display the following information as applicable:

- Tag ID.
- Tag descriptor.
- Process input, setpoint, and output values displayed numerically with Buyer's Representative units.
- Process input, setpoint, and output in bar graph representation.
- Auto/manual mode and remote/local setpoint status
- Visual indication for alarm status
- Symbolic and alphanumeric indication of discrete states both for two state devices and multi-state devices

Tabular Displays

Tabular displays, as the name implies, are tables of information allowing the operator to monitor process data. These displays have links to associated overview, graphics, Controls, trend, report, and detailed alarm displays.

Trend Displays

Trend displays are a combination of real-time and historical displays. These displays have links to associated overview, Controls, trend, reports, and detailed alarm displays. These displays will be developed to view process data related to the graphic display with similar name. However, the user may alter the points being trended when the display is active. The display will revert to the default point original points upon reopening the display. These displays have links to associated overview, graphic, tabulate, reports, and detailed alarm displays.

Additionally, users may develop ad-hoc Quick Trends. Quick Trends allow users to custom configure a trend and the save that configuration for later use. Quick Trends will be shared by all or setup for User Account access.

Report Displays

The report display allows the user to select standard reports to view or print as well as adjuct filters and time periods for reporting. This display has links to associated overview, graphic, tabular, trend, and detailed alarm displays.

Detailed Alarm Displays

Detailed alarm displays show the critical, important, and advisory alarms. These displays will show alarm point tag, point description, time stamp, and date stamp as well as include acknowledge pushbutton and alarm help pushbutton. The user will be able to sort or filter alarm conditions by alarm priority, alarm class, and time period. Real-time and historical alarm conditions will be available from the detailed alarm display. These displays have links to associated overview, graphic, tabular, trend, and report displays.

Diagnostic Displays

Diagnostic displays help maintenance and engineering personnel diagnose faults in the system and communications paths. These displays show the operational status of the process control system including component communication parameters such as on-line, off-line, failed, primary failed, and backup failed. Diagnostic displays will indicate the results of self-diagnostic tests. Failure diagnosis will be sufficiently specific to indicate which cards, modules, or devices are at fault. These displays will also show errors in communications. Diagnostic displays have links to associated graphic, trend, reports, and alarm summary displays.

Summary of Required Displays

The Contractor shall develop a hierarchy of displays to be implemented. Overview and graphic displays will contain both new and future equipment. Static symbols shall be utilized for future process lines and equipment as well as space shall be reserved for associated future data fields.

The following displays are conceptual and are intended as a starting point for the Contractor's display development process. Entry and interaction of displays (overviews, summaries, loops, groups, graphics, etc.) with control units shall be responsibility of Contractor. Contractor shall develop displays with guidance and review of Buyer. Buyer will utilize displays during field performance testing. Contractor shall include 40-hours of time during field performance testing for updating displays.

Contractor, at a minimum, shall provide the following displays:

Rev	Name	Type	Comments
A	Display List	Overview	
A	Plant Overview	Overview	
A	Plant Overview	Tabular	
A	Plant Performance Summary	Tabular	
A	Steam System	Graphic	
A	Steam System Trends	Trend	
A	Boiler No. 1	Graphic	
A	Boiler No. 2	Graphic	
A	Boiler No. 3	Graphic	
A	Condensate Tank No. 1	Graphic	
A	Condensate Transfer Pumps No. 1A and 1B	Graphic	
A	Deaerator No. 1	Graphic	
A	Boiler Feedwater Pumps No. 1A, 1B, and 1C	Graphic	
A	Condensate Tank No. 2	Graphic	
A	Condensate Transfer Pumps No. 2A and 2B	Graphic	
A	Deaerator No. 2	Graphic	
A	Boiler Feedwater Pumps No. 2A, 2B, and 2C	Graphic	
A	Faceplate (PID) Controller	Control	
A	Constant Speed Pump Control Station	Control	
A	Trend	Trend	
A	Process Control System	Overview	
A	Control System Status	Diagnostics	
A	Detailed Alarm Page	Alarm	
A	Report Selection	Report	

Data Archiving

Introduction

The following guidelines explain the design standards used for developing the Process Automation Control System (PACS) data archiving including collection types and frequencies for the Heat Plant Control and Feedwater/Condensate Transfer Pump Upgrade.

Archival files will be manually stored on a read/write CD-ROM drive at the site on a time period defined by plant procedures; monthly, quarterly, yearly.

Data Archiving Points

Contractor shall implement the data historian with the following default collection types and frequencies, unless noted otherwise. Owner reserves the right to modify default collection types and frequencies of group or individual points.

Measurement	Units	Type	Frequency	Bandwidth
Pressure	psi	Time	1 Minute	3% Range
Differential Pressure	psi	Time	1 Minute	3% Range
Flow, Liquid	gpm	Time	1 Minute	3% Range
Level	“ w.c.	Time	1 Minute	3% Range
Temperature	ºF	Time	1 Minute	3% Range
pH	-	Time	1 Minute	3% Range
Conductivity	µ-siemen/cm	Time	1 Minute	3% Range
Refrigerant	ppm	Time	1 Minute	3% Range
Humidity	%	Time	1 Minute	3% Range
Speed	%	Time	1 Minute	3% Range
Controller outputs	%	Time	1 Minute	3% Range
Thermal Energy	Tons	Time	1 Minute	3% Range
User Login		Event	Upon Change	
Setpoints		Event	Upon Change	
Control Mode (Auto – Manual)		Event	Upon Change	
Alarm Condition		Event	Upon Change	
Alarm Condition Acknowledgement		Event	Upon Acknowledge	

Exhibit - D

Input/Output Listing

No duplication or disclosure of this data is permitted except to parties who have executed appropriate secrecy agreements.

Organization

Each I/O list contains point descriptions, signal information, and software functions for the process points. These lists have been sorted numerically by I/O point tag number.

I/O List Layout

Included on each I/O List is the following general information:

Title: Located in the center top of each sheet, the title defines the I/O Rack Location, project name, client, and location for each I/O List.

Issue Date: Located in the upper right-hand corner, the issue date indicates the date the I/O List is issued and the revision indicates the current revision at date printed.

General: Located in the footer, the general information lists the date printed, Stanley Consultants project number, and page number for each page of the I/O List.

The definitions of the I/O Lists columns are as follows:

REV.: Indicates the current revision of the I/O point.
- **ADD -** I/O Point Added to Contract in this Revision.
- **DEL** - I/O Point Deleted from Contract.

TAG NO.: Defines the unique alphanumeric identifier of the input/output point. Refer to the Instrumentation Identification on the General Legend drawing.

P&ID NO.: Indicates the Process and Instrumentation Diagram on which the I/O point appears.

SERVICE DESCRIPTION: Describes the I/O points service function.

RANGE/SETTING: Lists the I/O points calibrated range in engineering units.

SIGNAL: Defines the I/O points signal type, voltage, and origin. For signal origin, Panel indicates the point is powered from the Distributed Control System (DCS) and Field indicates the point is powered external from the DCS.

I/O TYPE: Identifies the I/O points as analog or discrete and input or output relative to the DCS.

HARDWIRE	SERIAL
AI - Analog Input.	**VAI** - Analog Input.
AO - Analog Output.	**VAO** - Analog Output.
DI - Discrete Input.	**VDI** - Discrete Input.
DO - Discrete Output.	**VDO** - Discrete Output.
SOE – Sequence of Elements	**VSOE** – Sequence of Elements

I/O STATUS: Defines the status of the I/O point into one of the following categories:
- **NEW -** I/O point is new and connected by Contractor.
- **EXIST -** I/O point exists.
- **FUTURE -** I/O/ point is to be connected in future contracts.

SOFTWARE FUNCTION: States the I/O point software function as follows (The I/O point software function is defined by the character notation in each category.):
- **ALM** - Alarm. (Alarm type as follows)
  - **A** - Discrete I/O Alarm.
  - **B** - Both High and Low Alarm Based on Analog Value.
  - **H** - High Alarm Based on Analog Value.
  - **L** - Low Alarm Based on Analog Value.
- **CNL** - Control.
- **IND** - Indicate.
- **TOT** - Totalize.
- **SQR** - Square Root Extraction.
- **STA** - Status.
- **TRD** - Trend.
- **SOE** - Sequence of Events Point.

COMMENTS - Indicates contact action and special software functional requirements.

No duplication or disclosure of this data is permitted except to parties who have executed appropriate secrecy agreements.

REV	TAG NO. P&ID NO.	SERVICE DESCRIPTION	RANGE / SETTING	SIGNAL: ORIGIN SOURCE DESTINATION	SIGNAL: TYPE VOLTAGE POWERED	I/O TYPE STATUS SERVICE	SOFTWARE FUNCTIONS ALM	CTL	IND	TOT	SQR	STA	TRD	SOE	COMMENTS
0	01-AI-6163 PI1	EXISTING BOILER 1 FLUE GAS - OXYGEN	0-25 %		4 - 20 mA 24 Volt dc Field	AI N	H	-	I	-	-	-	T	-	COORDINATE SIGNAL POWER WITH DEVICE SUPPLIED
0	01-CI-1121 PI1	EXISTING BOILER 1 BLOWDOWN - CONDUCTIVITY	0-2000 mSIEMEN/cm		4 - 20 mA 24 Volt dc Field	AI N	H	-	I	-	-	-	-	-	
0	01-FC-1111 PI1	EXISTING BOILER 1 FEEDWATER - FLOW CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	-	-	-	COORDINATE SIGNAL POWER WITH DEVICE SUPPLIED
0	01-FC-1151 PI1	EXISTING BOILER 1 JACKSHAFT - FLOW CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	-	-	-	COORDINATE SIGNAL POWER WITH DEVICE SUPPLIED
0	01-FI-1101 PI1	EXISTING BOILER 1 STEAM - FLOW	0-40000 LB/HR		4 - 20 mA 24 Volt dc Panel	AI N	-	C	I	-	-	-	-	-	
0	01-FI-1131 PI1	EXISTING BOILER 1 NATURAL GAS MAIN - FLOW	0-50000 SCFH		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	T	-	
0	01-LT-1101 PI1	EXISTING BOILER 1 STEAM - DRUM LEVEL	0-4 FEET		4 - 20 mA 24 Volt dc Panel	AI N	B	C	I	-	-	-	T	-	COORDINATE RANGE W/TAPS ON STEAM DRUM
0	01-LT-1102 PI1	EXISTING BOILER 1 STEAM - DRUM LEVEL	0-4 FEET		4 - 20 mA 24 Volt dc Panel	AI N	B	C	I	-	-	-	T	-	COORDINATE RANGE W/TAPS ON STEAM DRUM
0	01-NAA-1152 PI1	EXISTING BOILER 1 FD FAN VFD FAULT ALARM	NORMAL-ALARM		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	A	-	I	-	-	-	-	-	
0	01-NSA-1111 PI1	EXISTING BOILER 1 FEEDWATER - FLOW CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	S	-	-	
0	01-NSA-1151 PI1	EXISTING BOILER 1 JACKSHAFT - FLOW CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	S	-	-	
0	01-NSA-6121 PI1	EXISTING BOILER 1 FEEDWATER - TEMP CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	S	-	-	
0	01-PI-1101 PI1	EXISTING BOILER 1 STEAM - DRUM PRESSURE	0-150 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	C	I	-	-	-	T	-	
0	01-PI-1131 PI1	EXISTING BOILER 1 NATURAL GAS MAIN - PRESSURE	0-15 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE TO MATCH EXIST DEVICE
0	01-PI-1141 PI1	EXISTING BOILER 1 FUEL OIL - PRESSURE	0-30 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE TO MATCH EXIST DEVICE

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REV	TAG NO. P&ID NO.	SERVICE DESCRIPTION	RANGE / SETTING	SIGNAL: ORIGIN SOURCE DESTINATION	SIGNAL: TYPE VOLTAGE POWERED	I/O TYPE STATUS SERVICE	SOFTWARE FUNCTIONS ALM	CTL	IND	TOT	SQR	STA	TRD	SOE	COMMENTS
0	01-PI-1150 PI1	EXISTING BOILER 1 FURNACE - PRESSURE	0-20 " WC		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE TO MATCH EXIST DEVICE
0	01-PI-6111 PI1	EXISTING BOILER 1 FEEDWATER, ECON INLET - PRESSURE	0-300 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	-	-	
0	01-PI-6112 PI1	EXISTING BOILER 1 FEEDWATER, ECON OUTLET - PRESSURE	0-300 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	-	-	
0	01-SIC-1152 PI1	EXISTING BOILER 1 FD FAN VFD SPEED CONTROL (O2 TRIM)	90-100 %		4 - 20 mA 24 Volt dc Panel	AO N	-	C	I	-	-	-	-	-	COORDINATE SIGNAL POWER WITH VFD SUPPLIED
0	01-SIZ-1152 PI1	EXISTING BOILER 1 FD FAN VFD SPEED FEEDBACK	0-60 Hz		4 - 20 mA 24 Volt dc Panel	AI N	-	-	I	-	-	-	T	-	
0	01-TC-6111 PI1	EXISTING BOILER 1 FEEDWATER - TEMP CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	-	-	-	COORDINATE SIGNAL POWER WITH DEVICE SUPPLIED
0	01-TI-6161 PI1	EXISTING BOILER 1 FLUE GAS - ECONOMIZER INLET TEMP	50-300 °F		4 - 20 mA 24 Volt dc Panel	AI N	H	-	I	-	-	-	T	-	
0	01-TI-6162 PI1	EXISTING BOILER 1 FLUE GAS - ECONOMIZER OUTLET TEMP	50-300 °F		4 - 20 mA 24 Volt dc Panel	AI N	H	-	I	-	-	-	T	-	
0	01-XSL-1199 PI1	EXISTING BOILER 1 BMS - LOW FIRE CMD	NOT LOW FIRE-LOW FIRE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	-	-	-	
0	01-XSM-1199 PI1	EXISTING BOILER 1 BMS - RELEASE & MODULATE CMD	NOT REL-REL & MODULATE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	-	-	-	
0	01-XSP-1199 PI1	EXISTING BOILER 1 BMS - PURGE CMD	NOT PURGE-PURGE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	-	-	-	
0	01-ZI-1111 PI1	EXISTING BOILER 1 FEEDWATER - FLOW CNTRL VALVE POS	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	COORDINATE SIGNAL POWER WITH DEVICE SUPPLIED
0	01-ZI-1151 PI1	EXISTING BOILER 1 JACKSHAFT - FLOW CNTRL POS	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	COORDINATE SIGNAL POWER WITH DEVICE SUPPLIED
0	01-ZI-6111 PI1	EXISTING BOILER 1 FEEDWATER - TEMP CNTRL VALVE POS	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	COORDINATE SIGNAL POWER WITH DEVICE SUPPLIED
0	01-AI-6263 PI2	EXISTING BOILER 2 FLUE GAS - OXYGEN	0-25 %		4 - 20 mA 24 Volt dc Field	AI N	H	-	I	-	-	-	T	-	COORDINATE SIGNAL POWER WITH DEVICE SUPPLIED

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0	01-CI-1221 PI2	EXISTING BOILER 2 BLOWDOWN - CONDUCTIVITY	0-2000 mSIEMEN/cm		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	
0	01-FC-1211 PI2	EXISTING BOILER 2 FEEDWATER - FLOW CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	-	-	-	
0	01-FC-1251 PI2	EXISTING BOILER 2 JACKSHAFT - FLOW CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	-	-	-	
0	01-FI-1201 PI2	EXISTING BOILER 2 STEAM - FLOW	0-50000 LB/HR		4 - 20 mA 24 Volt dc Panel	AI N	-	-	I	-	R	-	T	-	
0	01-FI-1231 PI2	EXISTING BOILER 2 NATURAL GAS MAIN - FLOW	0-62500 SCFH		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	R	-	T	-	
0	01-LT-1201 PI2	EXISTING BOILER 2 STEAM - DRUM LEVEL	0-4 FEET		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE W/ TAPS ON STEAM DRUM
0	01-LT-1202 PI2	EXISTING BOILER 2 STEAM - DRUM LEVEL	0-4 FEET		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE W/ TAPS ON STEAM DRUM
0	01-NAA-1252 PI2	EXISTING BOILER 2 FD FAN VFD FAULT ALARM	NORMAL-ALARM		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	A	-	I	-	-	-	-	-	
0	01-NSA-1211 PI2	EXISTING BOILER 2 FEEDWATER - FLOW CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-1251 PI2	EXISTING BOILER 2 JACKSHAFT - FLOW CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-6211 PI2	EXISTING BOILER 2 FEEDWATER - FLOW CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-PI-1201 PI2	EXISTING BOILER 2 STEAM - DRUM PRESSURE	0-150 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	C	I	-	-	-	T	-	
0	01-PI-1231 PI2	EXISTING BOILER 2 NATURAL GAS MAIN - PRESSURE	0-15 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE TO MATCH EXISTING DEVICE
0	01-PI-1241 PI2	EXISTING BOILER 2 FUEL OIL - PRESSURE	0-30 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE TO MATCH EXISTING DEVICE
0	01-PI-1250 PI2	EXISTING BOILER 2 FURNACE - PRESSURE	0-20 " WC		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE TO MATCH EXISTING DEVICE

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0	01-PI-6211 PI2	EXISTING BOILER 2 FEEDWATER, ECON INLET - PRESSURE	0-300 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	-	-	
0	01-PI-6212 PI2	EXISTING BOILER 2 FEEDWATER, ECON OUTLET - PRESSURE	0-300 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	-	-	
0	01-SIC-1252 PI2	EXISTING BOILER 2 SD FAN VFD SPEED CONTROL (O2 TRIM)	90-100 %		4 - 20 mA 24 Volt dc Panel	AO N	-	C	I	-	-	-	-	-	COORDINATE SIGNAL POWER WITH VFD SUPPLIED
0	01-SIZ-1252 PI2	EXISTING BOILER 2 FD FAN VFD SPEED FEEDBACK	0-60 Hz		4 - 20 mA 24 Volt dc Panel	AI N	-	-	I	-	-	-	T	-	
0	01-TC-6211 PI2	EXISTING BOILER 2 FEEDWATER - TEMP CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	-	-	-	
0	01-TI-6261 PI2	EXISTING BOILER 2 FLUE GAS - ECONOMIZER INLET TEMP	50-300 °F		4 - 20 mA 24 Volt dc Panel	AI N	H	-	I	-	-	-	T	-	
0	01-TI-6262 PI2	EXISTING BOILER 2 FLUE GAS - ECONOMIZER OUTLET TEMP	50-300 °F		4 - 20 mA 24 Volt dc Panel	AI N	H	-	I	-	-	-	T	-	
0	01-XSL-1299 PI2	EXISTING BOILER 2 BMS - LOW FIRE CMD	NOT LOW FIRE-LOW FIRE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	-	-	-	
0	01-XSM-1299 PI2	EXISTING BOILER 2 BMS - RELEASE & MODULATE CMD	NOT REL-RELEASE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	-	-	-	
0	01-XSP-1299 PI2	EXISTING BOILER 2 BMS - PURGE CMD	NOT PURGE-PURGE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	-	-	-	
0	01-ZI-1211 PI2	EXISTING BOILER 2 FEEDWATER - FLOW CNTRL VALVE POS	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	
0	01-ZI-1251 PI2	EXISTING BOILER 2 JACKSHAFT - FLOW CNTRL POS	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	
0	01-ZI-6211 PI2	EXISTING BOILER 2 FEEDWATER - TEMP CNTRL VALVE POS	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	
0	01-AI-6363 PI3	EXISTING BOILER 3 FLUE GAS - OXYGEN	0-25 %		4 - 20 mA 24 Volt dc Field	AI N	H	-	I	-	-	-	T	-	COORDINATE SIGNAL POWER WITH DEVICE SUPPLIED
0	01-CI-1321 PI3	EXISTING BOILER 3 BLOWDOWN - CONDUCTIVITY	0-2000 mSIEMEN/cm		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	

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0	01-FC-1311 PI3	EXISTING BOILER 3 FEEDWATER - FLOW CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	-	-	-	
0	01-FC-1351 PI3	EXISTING BOILER 3 JACKSHAFT - FLOW CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	-	-	-	
0	01-FI-1301 PI3	EXISTING BOILER 3 STEAM - FLOW	0-60000 LB/HR		4 - 20 mA 24 Volt dc Panel	AI N	-	-	I	-	R	-	T	-	
0	01-FI-1331 PI3	EXISTING BOILER 3 NATURAL GAS MAIN - FLOW	0-75000 SCFH		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	R	-	T	-	
0	01-LT-1301 PI3	EXISTING BOILER 3 STEAM - DRUM LEVEL	0-4 FEET		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE W/TAPS ON STEAM DRUM
0	01-LT-1302 PI3	EXISTING BOILER 3 STEAM - DRUM LEVEL	0-4 FEET		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE W/TAPS ON STEAM DRUM
0	01-NAA-1352 PI3	EXISTING BOILER 3 FD FAN VFD FAULT ALARM	NORMAL-ALARM		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	A	-	I	-	-	-	-	-	
0	01-NSA-1311 PI3	EXISTING BOILER 3 FEEDWATER - FLOW CNTRL AUTO STATUS	HAND-OFF AUTO		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-1351 PI3	EXISTING BOILER 3 JACKSHAFT - FLOW CNTRL AUTO STATUS	HAND-OFF AUTO		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-6311 PI3	EXISTING BOILER 3 FEEDWATER - FLOW CNTRL AUTO STATUS	HAND-OFF AUTO		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-PI-1301 PI3	EXISTING BOILER 3 STEAM - DRUM PRESSURE	0-150 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	
0	01-PI-1331 PI3	EXISTING BOILER 3 NATURAL GAS MAIN - PRESSURE	0-15 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE TO MATCH EXISTING DEVICE
0	01-PI-1341 PI3	EXISTING BOILER 3 FUEL OIL - PRESSURE	0-30 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE TO MATCH EXISTING DEVICE
0	01-PI-1350 PI3	EXISTING BOILER 3 FURNACE - PRESSURE	0-20 " WC		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE TO MATCH EXISTING DEVICE
0	01-PI-6311 PI3	EXISTING BOILER 3 FEEDWATER, ECON INLET - PRESSURE	0-300 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	-	-	

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0	01-PI-6312 PI3	EXISTING BOILER 3 FEEDWATER, ECON OUTLET - PRESSURE	0-300 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	-	-	
0	01-SIC-1352 PI3	EXISTING BOILER 3 FD FAN VFD SPEED CONTROL (O2 TRIM)	90-100 %		4 - 20 mA 24 Volt dc Panel	AO N	-	C	I	-	-	-	-	-	
0	01-SIZ-1352 PI3	EXISTING BOILER 3 FD FAN VFD SPEED FEEDBACK	0-60 Hz		4 - 20 mA 24 Volt dc Panel	AI N	-	-	I	-	-	-	T	-	
0	01-TC-6311 PI3	EXISTING BOILER 3 ECONOMIZER BYPASS - TEMP CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	-	-	-	
0	01-TI-6361 PI3	EXISTING BOILER 3 FLUE GAS - ECONOMIZER INLET TEMP	50-300 °F		4 - 20 mA 24 Volt dc Panel	AI N	H	-	I	-	-	-	T	-	
0	01-TI-6362 PI3	EXISTING BOILER 3 FLUE GAS - ECONOMIZER OUTLET TEMP	50-300 °F		4 - 20 mA 24 Volt dc Panel	AI N	H	-	I	-	-	-	T	-	
0	01-XSL-1399 PI3	EXISTING BOILER 3 BMS - LOW FIRE CMD	NOT LOW FIRE-LOW FIRE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	-	-	-	
0	01-XSM-1399 PI3	EXISTING BOILER 3 BMS - RELEASE & MODULATE CMD	NOT REL-REL & MODULATE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	-	-	-	
0	01-XSP-1399 PI3	EXISTING BOILER 3 BMS - PURGE CMD	NOT PURGE-PURGE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	-	-	-	
0	01-ZI-1311 PI3	EXISTING BOILER 3 FEEDWATER - FLOW CNTRL VALVE POS	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	
0	01-ZI-1351 PI3	EXISTING BOILER 3 JACKSHAFT - FLOW CNTRL POS	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	
0	01-ZI-6311 PI3	EXISTING BOILER 3 FEEDWATER - TEMP CNTRL VALVE POS	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	
0	01-FC-3181 PI4	EXISTING CONDENSATE TANK 1 CONDENSATE - FLOW CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	-	-	-	
0	01-LSH-3181 PI4	EXISTING CONDENSATE TANK 1 CONDENSATE - LEVEL HIGH	HIGH-NOT HIGH		N.C., Main. 120 Volt ac Panel	DI N Balance of Plant	A	-	I	-	-	-	-	-	
0	01-LSL-3181 PI4	EXISTING CONDENSATE TANK 1 CONDENSATE - LEVEL LOW	LOW-NOT LOW		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	A	-	I	-	-	-	-	-	

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0	01-LT-3181A PI4	EXISTING CONDENSATE TANK 1 CONDENSATE - LEVEL	0-11 FEET		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	
0	01-LT-3181B PI4	EXISTING CONDENSATE TANK 1 CONDENSATE - LEVEL	0-11 FEET		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	
0	01-NS-4181 PI4	EXISTING CONDENSATE TRANSFER PUMP 1A RUN STATUS	RUNNING-NOT RUNNING		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	-	-	-	
0	01-NS-4182 PI4	EXISTING CONDENSATE TRANSFER PUMP 1B RUN STATUS	RUNNING-NOT RUNNING		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	-	-	-	
0	01-NS-4183 PI4	EXISTING CONDENSATE TRANSFER PUMP 1C RUN STATUS	RUNNING-NOT RUNNING		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	-	-	-	
0	01-NSA-3181 PI4	EXISTING CONDENSATE TANK 1 CONDENSATE - FLOW CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-4181 PI4	EXISTING CONDENSATE TRANSFER PUMP 1A REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-4182 PI4	EXISTING CONDENSATE TRANSFER PUMP 1B REMOTE STATUS	HAND-OFF REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-4183 PI4	EXISTING CONDENSATE TRANSFER PUMP 1C REMOTE STATUS	HAND-OFF REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XSS-4181 PI4	EXISTING CONDENSATE TRANSFER PUMP 1A START COMMAND	NOT START-START		N.O., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XSS-4182 PI4	EXISTING CONDENSATE TRANSFER PUMP 1B START COMMAND	NOT START-START		N.O., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XSS-4183 PI4	EXISTING CONDENSATE TRANSFER PUMP 1C START COMMAND	NOT START-START		N.O., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XST-4181 PI4	EXISTING CONDENSATE TRANSFER PUMP 1A STOP COMMAND	NOT STOP-STOP		N.C., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XST-4182 PI4	EXISTING CONDENSATE TRANSFER PUMP 1B STOP COMMAND	NOT STOP-STOP		N.C., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XST-4183 PI4	EXISTING CONDENSATE TRANSFER PUMP 1B STOP COMMAND	NOT STOP-STOP		N.C., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	

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REV	TAG NO. P&ID NO.	SERVICE DESCRIPTION	RANGE / SETTING	SIGNAL: ORIGIN SOURCE DESTINATION	SIGNAL: TYPE VOLTAGE POWERED	I/O TYPE STATUS SERVICE	SOFTWARE FUNCTIONS ALM	CTL	IND	TOT	SQR	STA	TRD	SOE	COMMENTS
0	01-ZSC-3181 PI4	EXISTING CONDENSATE TANK 1 CONDENSATE RETURN - VALVE CLOSED POS	NOT CLOSED-CLOSED		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	S	-	-	
0	01-ZSO-3181 PI4	EXISTING CONDENSATE TANK 1 CONDENSATE RETURN - VALVE OPEN POS	NOT OPEN-OPEN		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	S	-	-	
0	01-FCV-2191 PI5	EXISTING DEAERATOR 1 MAKE UP WATER - FLOW CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	-	-	-	
0	01-LCV-2181 PI5	EXISTING DEAERATOR 1 CONDENSATE - LEVEL CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	S	-	-	
0	01-LCV-2182 PI5	EXISTING DEAERATOR 1 CONDENSATE - LEVEL CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	S	-	-	
0	01-LIT-2111B PI5	EXISTING DEAERATOR 1 DEAERATOR - LEVEL	0-11 FEET		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	
0	01-LSH-2111 PI5	EXISTING DEAERATOR 1 CONDENSATE - LEVEL HIGH	HIGH-NOT HIGH		N.C., Main. 120 Volt ac Panel	DI N Balance of Plant	A	-	I	-	-	-	-	-	
0	01-LSL-2111 PI5	EXISTING DEAERATOR 1 FEEDWATER - LEVEL LOW	LOW-NOT LOW		N.C., Main. 120 Volt ac Panel	DI N Balance of Plant	A	-	I	-	-	-	-	-	
0	01-LT-2111A PI5	EXISTING DEAERATOR 1 DEAERATOR - LEVEL	0-11 FEET		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	
0	01-NS-5111 PI5	EXIST DEAERATOR FEED WATER PUMP 1A RUN STATUS	RUNNING-NOT RUNNING		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	-	-	-	
0	01-NS-5112 PI5	EXIST DEAERATOR FEED WATER PUMP 1B RUN STATUS	RUNNING-NOT RUNNING		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	-	-	-	
0	01-NS-5113 PI5	EXIST DEAERATOR FEED WATER PUMP 1C RUN STATUS	RUNNING-NOT RUNNING		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	-	-	-	
0	01-NSA-2181 PI5	EXISTING DEAERATOR 1 CONDENSATE - LEVEL CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-2182 PI5	EXISTING DEAERATOR 1 CONDENSATE - LEVEL CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-2191 PI5	EXISTING MAKE UP WATER MAKE UP WTR - FLOW CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	

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REV	TAG NO. P&ID NO.	SERVICE DESCRIPTION	RANGE / SETTING	SIGNAL: ORIGIN SOURCE DESTINATION	SIGNAL: TYPE VOLTAGE POWERED	I/O TYPE STATUS SERVICE	SOFTWARE FUNCTIONS ALM	CTL	IND	TOT	SQR	STA	TRD	SOE	COMMENTS
0	01-NSA-5111 PI5	EXIST DEAERATOR FEEDWATER PUMP 1A FEEDWATER - PUMP CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-5112 PI5	EXIST DEAERATOR FEEDWATER PUMP 1B FEEDWATER - PUMP CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-5113 PI5	EXIST DEAERATOR FEEDWATER PUMP 1C FEEDWATER - PUMP CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-PI-5110 PI5	EXISTING DEAERATOR 1 FEEDWATER - PRESSURE	0-200 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE TO MATCH EXISTING DEVICE
0	01-XSS-5111 PI5	EXIST DEAERATOR FEED WATER PUMP 1A START COMMAND	NOT START-START		N.O., Main. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XSS-5112 PI5	EXIST DEAERATOR FEED WATER PUMP 1B START COMMAND	NOT START-START		N.O., Main. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XSS-5113 PI5	EXIST DEAERATOR FEED WATER PUMP 1C START COMMAND	NOT START-START		N.O., Main. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XST-5111 PI5	EXIST DEAERATOR FEED WATER PUMP 1A STOP COMMAND	NOT STOP-STOP		N.O., Mom. 120 Volt ac Field	N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XST-5112 PI5	EXIST DEAERATOR FEED WATER PUMP 1B STOP COMMAND	NOT STOP-STOP		N.O., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XST-5113 PI5	EXIST DEAERATOR FEED WATER PUMP 1C STOP COMMAND	NOT STOP-STOP		N.O., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-ZI-2181 PI5	EXISTING DEAERATOR 1 CONDENSATE - LEVEL CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	
0	01-ZI-2182 PI5	EXISTING DEAERATOR 1 CONDENSATE - LEVEL CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	
0	01-ZI-2191 PI5	EXISTING DEAERATOR 1 MAKE UP WATER - FLOW CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	
0	01-FC-3281 PI6	EXISTING CONDENSATE TANK 2 CONDENSATE - FLOW CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	-	-	-	
0	01-FC-3291 PI6	EXISTING CONDENSATE TANK 2 MAKE UP WATER - FLOW CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	-	-	-	

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REV	TAG NO. P&ID NO.	SERVICE DESCRIPTION	RANGE / SETTING	SIGNAL: ORIGIN SOURCE DESTINATION	SIGNAL: TYPE VOLTAGE POWERED	I/O TYPE STATUS SERVICE	SOFTWARE FUNCTIONS ALM	CTL	IND	TOT	SQR	STA	TRD	SOE	COMMENTS
0	01-LSH-3281 PI6	EXISTING CONDENSATE TANK 2 CONDENSATE - LEVEL HIGH	HIGH-NOT HIGH		N.C., Main. 120 Volt ac Panel	DI N Balance of Plant	A	-	I	-	-	-	-	-	
0	01-LSL-3281 PI6	EXISTING CONDENSATE TANK 2 CONDENSATE - LEVEL LOW	LOW-NOT LOW		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	A	-	I	-	-	-	-	-	
0	01-LT-3281A PI6	EXISTING CONDENSATE TANK 2 CONDENSATE - LEVEL	0-11 FEET		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	
0	01-LT-3281B PI6	EXISTING CONDENSATE TANK 2 CONDENSATE - LEVEL	0-11 FEET		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	
0	01-NS-4281 PI6	EXISTING CONDENSATE TRANSFER PUMP 2A RUN STATUS	RUNNING-NOT RUNNING		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	-	-	-	
0	01-NS-4282 PI6	EXISTING CONDENSATE TRANSFER PUMP 2B RUN STATUS	RUNNING-NOT RUNNING		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	-	-	-	
0	01-NS-4283 PI6	EXISTING CONDENSATE TRANSFER PUMP 2C RUN STATUS	RUNNING-NOT RUNNING		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	-	-	-	
0	01-NSA-3281 PI6	EXISTING CONDENSATE TANK 2 CONDENSATE - FLOW CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-3291 PI6	EXISTING CONDENSATE TANK 2 MAKE UP WATER - FLOW REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-4281 PI6	EXISTING CONDENSATE TRANSFER PUMP 2A CONDENSATE - PUMP REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-4282 PI6	EXISTING CONDENSATE TRANSFER PUMP 2B CONDENSATE - PUMP REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-4283 PI6	EXISTING CONDENSATE TRANSFER PUMP 2C CONDENSATE - PUMP REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XSS-4281 PI6	EXISTING CONDENSATE TRANSFER PUMP 2A START COMMAND	NOT START-START		N.O., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XSS-4282 PI6	EXISTING CONDENSATE TRANSFER PUMP 2B START COMMAND	NOT START-START		N.O., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XSS-4283 PI6	EXISTING CONDENSATE TRANSFER PUMP 2C START COMMAND	NOT START-START		N.O., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	

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REV	TAG NO. P&ID NO.	SERVICE DESCRIPTION	RANGE / SETTING	SIGNAL: ORIGIN SOURCE DESTINATION	SIGNAL: TYPE VOLTAGE POWERED	I/O TYPE STATUS SERVICE	SOFTWARE FUNCTIONS ALM	CTL	IND	TOT	SQR	STA	TRD	SOE	COMMENTS
0	01-XST-4281 PI6	EXISTING CONDENSATE TRANSFER PUMP 2A STOP COMMAND	NOT STOP-STOP		N.O., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XST-4282 PI6	EXISTING CONDENSATE TRANSFER PUMP 2B STOP COMMAND	NOT STOP-STOP		N.O., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XST-4283 PI6	EXISTING CONDENSATE TRANSFER PUMP 2C STOP COMMAND	NOT STOP-STOP		N.O., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-ZI-3291 PI6	EXISTING CONDENSATE TANK 2 MAKE UP WATER - FLOW CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	
0	01-ZSC-3281 PI6	EXISTING CONDENSATE TANK 2 CONDENSATE RETURN - VALVE CLOSED POS	NOT CLOSED-CLOSED		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	-	-	-	S	-	-	
0	01-ZSO-3281 PI6	EXISTING CONDENSATE TANK 2 CONDENSATE RETURN - VALVE OPEN POS	NOT OPEN-OPEN		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	-	-	-	S	-	-	
0	01-FCV-2291 PI7	EXISTING DEAERATOR 2 MAKE UP WATER - FLOW CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	I	-	-	-	-	-	
0	01-LCV-2281 PI7	EXISTING DEAERATOR 2 MAKE UP WATER - LEVEL CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	-	-	-	S	-	-	
0	01-LCV-2282 PI7	EXISTING DEAERATOR 2 MAKE UP WATER - LEVEL CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AO N	-	C	-	-	-	S	-	-	
0	01-LSH-2211 PI7	EXISTING DEAERATOR 2 FEEDWATER - LEVEL HIGH	HIGH-NOT HIGH		N.C., Main. 120 Volt ac Panel	DI N Balance of Plant	A	-	I	-	-	-	-	-	
0	01-LSL-2211 PI7	EXISTING DEAERATOR 2 FEEDWATER - LEVEL LOW	LOW-NOT LOW		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	A	-	I	-	-	-	-	-	
0	01-LT-2211A PI7	EXISTING DEAERATOR 2 DEAERATOR - LEVEL	0-11 FEET		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	
0	01-LT-2211B PI7	EXISTING DEAERATOR 2 DEAERATOR - LEVEL	0-11 FEET		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	
0	01-NS-5211 PI7	EXIST DEAERATOR FEED WATER PUMP 2A RUN STATUS	RUNNING-NOT RUNNING		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	-	-	-	
0	01-NS-5212 PI7	EXIST DEAERATOR FEED WATER PUMP 2B RUN STATUS	RUNNING-NOT RUNNING		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	-	-	-	

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REV	TAG NO. P&ID NO.	SERVICE DESCRIPTION	RANGE / SETTING	SIGNAL: ORIGIN SOURCE DESTINATION	SIGNAL: TYPE VOLTAGE POWERED	I/O TYPE STATUS SERVICE	SOFTWARE FUNCTIONS ALM	CTL	IND	TOT	SQR	STA	TRD	SOE	COMMENTS
0	01-NS-5213 PI7	EXIST DEAERATOR FEED WATER PUMP 2C RUN STATUS	RUNNING-NOT RUNNING		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	-	I	-	-	-	-	-	
0	01-NSA-2281 PI7	EXISTING DEAERATOR 2 CONDENSATE - LEVEL CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-2282 PI7	EXISTING DEAERATOR 2 CONDENSATE - LEVEL CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-2291 PI7	EXISTING DEAERATOR 2 MAKE UP WTR - FLOW CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-5211 PI7	EXIST DEAERATOR FEEDWATER PUMP 2A CONDENSATE - PUMP CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-5212 PI7	EXIST DEAERATOR FEEDWATER PUMP 2B CONDENSATE - PUMP CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-NSA-5213 PI7	EXIST DEAERATOR FEEDWATER PUMP 2C CONDENSATE - PUMP CNTRL REMOTE STATUS	LOCAL-REMOTE		N.O., Main. 120 Volt ac Panel	DI N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-PI-5210 PI7	EXISTING DEAERATOR 2 FEEDWATER - PRESSURE	0-200 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	-	I	-	-	-	T	-	COORDINATE RANGE TO MATCH EXISTING DEVICE
0	01-XSS-5211 PI7	EXIST DEAERATOR FEED WATER PUMP 2A START COMMAND	NOT START-START		N.O., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XSS-5212 PI7	EXIST DEAERATOR FEED WATER PUMP 2B START COMMAND	NOT START-START		N.O., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XSS-5213 PI7	EXIST DEAERATOR FEED WATER PUMP 2C START COMMAND	NOT START-START		N.O., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XST-5211 PI7	EXIST DEAERATOR FEED WATER PUMP 2A STOP COMMAND	NOT STOP-STOP		N.C., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XST-5212 PI7	EXIST DEAERATOR FEED WATER PUMP 2B STOP COMMAND	NOT STOP-STOP		N.C., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-XST-5213 PI7	EXIST DEAERATOR FEED WATER PUMP 2C STOP COMMAND	NOT STOP-STOP		N.C., Mom. 120 Volt ac Field	DO N Balance of Plant	-	C	I	-	-	S	-	-	
0	01-ZI-2281 PI7	EXISTING DEAERATOR 2 CONDENSATE - LEVEL CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	

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REV	TAG NO. P&ID NO.	SERVICE DESCRIPTION	RANGE / SETTING	SIGNAL: ORIGIN SOURCE DESTINATION	SIGNAL: TYPE VOLTAGE POWERED	I/O TYPE STATUS SERVICE	SOFTWARE FUNCTIONS ALM	CTL	IND	TOT	SQR	STA	TRD	SOE	COMMENTS
0	01-ZI-2282 PI7	EXISTING DEAERATOR 2 CONDENSATE - LEVEL CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	
0	01-ZI-2291 PI7	EXISTING DEAERATOR 2 MAKE UP WATER - FLOW CNTRL	0-100 %		4 - 20 mA 24 Volt dc Field	AI N	-	-	I	-	-	-	-	-	
0	01-FI-0001 PI8	MAIN STEAM FLOW	0-100000 LB/HR		4 - 20 mA 24 Volt dc Panel	AI N	-	C	I	-	-	-	T	-	
0	01-PI-0001 PI8	MAIN STEAM HEADER STEAM - PRESSURE A	0-150 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	C	I	-	-	-	T	-	
0	01-PI-0002 PI8	MAIN STEAM HEADER STEAM - PRESSURE B	0-150 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	C	I	-	-	-	T	-	
0	01-PI-0003 PI8	MAIN STEAM HEADER STEAM - PRESSURE C	0-150 PSIG		4 - 20 mA 24 Volt dc Panel	AI N	B	C	I	-	-	-	T	-	

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Exhibit - E

Instrument Index Listing

Organization
The Instrument Index contains field device descriptions and an estimate of the installation responsibilities for instrumentation and control devices. Contractor is responsible for determining the actual installation requirements of each device. The Instrument Index is sorted numerically by equipment number, loop number, and then by prefix.

Instrument Index Layout
Included on the Instrument Index is the following general information:

Title — Located in the center top of each sheet, the title defines the project name, client, and location.
Issue Date — Located in the upper right-hand corner, the issue date indicates the date the Instrument Index is issued and the revision indicates the current revision of the Instrument Index at the date printed.
General — Located at the bottom of each sheet. The general information lists the page number, date printed and project number for each page of the Instrument Index.

The definitions of the Instrument Index columns are as follows:

REV.: Indicates the current revision of the field device.

ADD.: Device added to Contract in this Revision.
DEL.: Device deleted from Contract.

TAG NO.: Defines the unique alphanumeric identifier of the device. Refer to the Instrumentation Identification on the General Legend and Notes drawings.

DATASHEET: Indicates the Stanley Consultants' technical specification number or instrument data sheet number for the device. This column is blank if the device is existing or prepurchased by Owner.

SERVICE DESCRIPTION: - Describes the device's service function and type.

MANUFACTURER: - Specifies the manufacturer of the device.

MODEL NO.: - Specifies the model number of the device.

RANGE: - Lists the device's calibrated range in engineering units.

P&ID NO.: - Indicates the Piping and Instrumentation Diagram on which the device appears.

PLAN: - Indicates the Plan Drawing on which the device appears.

INSTL DTL.: - Indicates the Installation Detail for the device.

INSTALLATION OVERVIEW: Presents an overview for the purchase and installation of field instrumentation. This section is subdivided into the following categories:

FUR Furnished.
MNT Installed.
POW Electrical power connection.
CON Low-voltage ac control signal (120-volt ac or less).
INS Low-voltage dc instrumentation and control signals.
COM Communications.
AIR Instrument air connection.
IMP Impulse tubing connection or resides in process line.
CAL Calibrated.

C Contractor
O By Owner.
X Existing.
- Not applicable for the device.

COMMENTS Indicates special installation requirements for a device, or information for clarification.

Stanley Consultants INC.

EXHIBIT E - INSTRUMENT INDEX
WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/ CONDENSATE PUMP UPGRADE
OGDEN, UTAH

ISSUE DATE 28-Jan-10
REVISION NO: 0

REV	TAG NO DATASHEET	SERVICE DESCRIPTION	MANUFACTURER MODEL NO RANGE	P&ID NO PLAN INST DTL	INSTALLATION REQUIREMENTS FUR	MNT	PWR	CON	INS	COM	AIR	IMP	CAL	ACCESSORIES	COMMENTS
0	01-FT-1101 006.00	EXISTING BOILER 1 STEAM - FLOW FLOW TRANSMITTER	Rosemount 3095MV 0 - 40,000 LB/HR	PI1	C	C	-	-	C	-	-	C	C		
0	01-FE-1101 121.11	EXISTING BOILER 1 STEAM - FLOW FLOW ELEMENT	McCrometer VW06 0 - 40,000 LB/HR	PI1	C	C	-	-	-	-	-	-	C		
0	01-LIT-1102 216.00	EXISTING BOILER 1 STEAM - DRUM LEVEL LEVEL INDICATING TRANSMITTER	Rosemount 3051 0 - 4 FEET	PI1	C	C	-	-	C	-	-	C	C		
0	01-AE-6163 409.01	EXISTING BOILER 1 FLUE GAS - OXYGEN ANALYZER ELEMENT	Yokogawa ZR402G** / ZR22G 0 - 100 %	PI1	C	C	C	-	-	-	-	-	C		
0	01-AIT-6163 409.01	EXISTING BOILER 1 FLUE GAS - OXYGEN ANALYZER INDICATING TRANSMITTER	Yokogawa ZR402G** / ZR22G 0 - 100 %	PI1	C	C	-	-	C	-	-	-	C		
0	01-TCV-6111 502.00	EXISTING BOILER 1 ECONOMIZER BYPASS - TEMP CONTROL TEMPERATURE CONTROL VALVE (MODULATING)	Fisher YS 0 - 100 %	PI1	C	C	C	C	C	-	-	-	C	01-ZT-6111	
0	01-BY-1151 591.02	EXISTING BOILER 1 JACKSHAFT - CONTROL JACKSHAFT ACTUATOR	Rotork Process Controls SM1730 0 - 100 %	PI1	C	C	C	C	C	-	C	C	C	01-ZT-1151 01-JY-1151	
0	01-FY-1111 592.01	EXISTING BOILER 1 FEEDWATER - FLOW CONTROL FLOW CONTROL VALVE POSITIONER	Limitorque L-120 0 - 100 %	PI1	C	C	-	-	-	-	-	C	C	01-ZT-1111	INSTALL ON EXISTING 01-FCV-1111
0	01-FT-1201 006.00	EXISTING BOILER 2 STEAM - FLOW FLOW TRANSMITTER	Rosemount 3095MV 0 - 45,000 LB/HR	PI2	C	C	-	-	C	-	-	C	C		
0	01-PT-1250 021.00	EXISTING BOILER 2 FURNACE - PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 20 " H2O	PI2	C	C	-	-	C	-	-	C	C		
0	01-PT-1241 021.02	EXISTING BOILER 2 FUEL OIL - PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 30 PSIG	PI2	C	C	-	-	C	-	-	C	C		
0	01-PT-1201 021.03	EXISTING BOILER 2 STEAM - DRUM PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 150 PSIG	PI2	C	C	-	-	C	-	-	C	C		
0	01-PT-1231 021.03	EXISTING BOILER 2 NATURAL GAS MAIN - PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 30 PSIG	PI2	C	C	-	-	C	-	-	C	C		
0	01-PT-6211 021.03	EXISTING BOILER 2 FEEDWATER ECONOMIZER INLET PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 300 PSIG	PI2	C	C	-	-	C	-	-	C	C		
0	01-PT-6212 021.03	EXISTING BOILER 2 FEEDWATER ECONOMIZER OUTLET PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 300 PSIG	PI2	C	C	-	-	C	-	-	C	C		

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0	01-FE-1201 121.11	EXISTING BOILER 2 STEAM - FLOW FLOW ELEMENT	McCrometer VW06 0 - 45,000 LB/HR	PI2	C	C	-	-	-	-	-	-	C		
0	01-FE-1231 159.01	EXISTING BOILER 2 NATURAL GAS MAIN - FLOW FLOW ELEMENT	Sage Prime SIP SERIES 0 - 62,500 SCFH	PI2	C	C	-	-	-	-	-	-	C		
0	01-FIT-1231 159.01	EXISTING BOILER 2 NATURAL GAS MAIN - FLOW FLOW INDICATING TRANSMITTER	Sage Prime SIP SERIES 0 - 62,500 SCFH	PI2	C	C	C	-	C	-	-	C	C		
0	01-LIT-1202 216.00	EXISTING BOILER 2 STEAM - DRUM LEVEL LEVEL INDICATING TRANSMITTER	Rosemount 3051 0 - 4 FEET	PI2	C	C	-	-	C	-	-	C	C		
0	01-LIT-1201 216.00	EXISTING BOILER 2 STEAM - DRUM LEVEL LEVEL INDICATING TRANSMITTER	Rosemount 3051 0 - 4 FEET	PI2	C	C	-	-	C	-	-	C	C		
0	01-TT-6262 301.00	EXISTING BOILER 2 FLUE GAS - ECONOMIZER OUTLET TEMP TEMPERATURE TRANSMITTER	Rosemount 3244 50 - 300 °F	PI2	C	C	-	-	C	-	-	-	C		
0	01-TT-6261 301.00	EXISTING BOILER 2 FLUE GAS - ECONOMIZER INLET TEMP TEMPERATURE TRANSMITTER	Rosemount 3244 50 - 300 °F	PI2	C	C	-	-	C	-	-	-	C		
0	01-AIT-6263 409.01	EXISTING BOILER 2 FLUE GAS - OXYGEN ANALYZER INDICATING TRANSMITTER	Yokogawa ZR402G** / ZR22G 0 - 100 %	PI2	C	C	-	-	C	-	-	-	C		
0	01-AE-6263 409.01	EXISTING BOILER 2 FLUE GAS - OXYGEN ANALYZER ELEMENT	Yokogawa ZR402G** / ZR22G 0 - 100 %	PI2	C	C	C	-	-	-	-	-	C		
0	01-FCV-1211 501.00	EXISTING BOILER 2 FEEDWATER - FLOW CONTROL FLOW CONTROL VALVE (MODULATING)	Fisher ED 0 - 100 %	PI2	C	C	C	C	C	-	-	-	C	01-ZT-1211	
0	01-TCV-6211 502.00	EXISTING BOILER 2 ECONOMIZER BYPASS - TEMP CONTROL TEMPERATURE CONTROL VALVE (MODULATING)	Fisher YS 0 - 100 %	PI2	C	C	C	C	C	-	-	-	C	01-ZT-6211	
0	01-BY-1251 591.02	EXISTING BOILER 2 JACKSHAFT - CONTROL JACKSHAFT ACTUATOR	Rotork Process Controls SM1730 0 - 100 %	PI2	C	C	C	C	C	-	C	C	C	01-ZT-1251 01-JY-1251	
0	01-FT-1301 006.00	EXISTING BOILER 3 STEAM - FLOW FLOW TRANSMITTER	Rosemount 3095MV 0 - 60,000 LB/HR	PI3	C	C	-	-	C	-	-	C	C		
0	01-PT-1350 021.00	EXISTING BOILER 3 FURNACE - PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 20 " H2O	PI3	C	C	-	-	C	-	-	C	C		
0	01-PT-1341 021.02	EXISTING BOILER 3 FUEL OIL - PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 30 PSIG	PI3	C	C	-	-	C	-	-	C	C		

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0	01-PT-1301 021.03	EXISTING BOILER 3 STEAM - DRUM PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 150 PSIG	PI3	C	C	-	-	C	-	-	C	C		
0	01-PT-6311 021.03	EXISTING BOILER 3 FEEDWATER ECONOMIZER OUTLET PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 300 PSIG	PI3	C	C	-	-	C	-	-	C	C		
0	01-PT-1331 021.03	EXISTING BOILER 3 NATURAL GAS MAIN - PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 30 PSIG	PI3	C	C	-	-	C	-	-	C	C		
0	01-PT-6312 021.03	EXISTING BOILER 3 FEEDWATER ECONOMIZER OUTLET PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 300 PSIG	PI3	C	C	-	-	C	-	-	C	C		
0	01-FE-1301 121.11	EXISTING BOILER 3 STEAM - FLOW FLOW ELEMENT	McCrometer VW06 0 - 60,000 LB/HR	PI3	C	C	-	-	-	-	-	-	C		
0	01-FE-1331 159.01	EXISTING BOILER 3 NATURAL GAS MAIN - FLOW FLOW ELEMENT	Sage Prime SIP SERIES 0 - 62,500 SCFH	PI3	C	C	-	-	-	-	-	-	C		
0	01-FIT-1331 159.01	EXISTING BOILER 3 NATURAL GAS MAIN - FLOW FLOW INDICATING TRANSMITTER	Sage Prime SIP SERIES 0 - 62,500 SCFH	PI3	C	C	C	-	C	-	-	C	C		
0	01-LIT-1301 216.00	EXISTING BOILER 3 STEAM - DRUM LEVEL LEVEL INDICATING TRANSMITTER	Rosemount 3051 0 - 4 FEET	PI3	C	C	-	-	C	-	-	C	C		
0	01-LIT-1302 216.00	EXISTING BOILER 3 STEAM - DRUM LEVEL LEVEL INDICATING TRANSMITTER	Rosemount 3051 0 - 4 FEET	PI3	C	C	-	-	C	-	-	C	C		
0	01-TT-6361 301.00	EXISTING BOILER 3 FLUE GAS - ECONOMIZER INLET TEMP TEMPERATURE TRANSMITTER	Rosemount 3244 50 - 300 °F	PI3	C	C	-	-	C	-	-	-	C		
0	01-TT-6362 301.00	EXISTING BOILER 3 FLUE GAS - ECONOMIZER OUTLET TEMP TEMPERATURE TRANSMITTER	Rosemount 3244 50 - 300 °F	PI3	C	C	-	-	C	-	-	-	C		
0	01-AE-6363 409.01	EXISTING BOILER 3 FLUE GAS - OXYGEN ANALYZER ELEMENT	Yokogawa ZR402G** / ZR22G 0 - 100 %	PI3	C	C	C	-	-	-	-	-	C		
0	01-AIT-6363 409.01	EXISTING BOILER 3 FLUE GAS - OXYGEN ANALYZER INDICATING TRANSMITTER	Yokogawa ZR402G** / ZR22G 0 - 100 %	PI3	C	C	-	-	C	-	-	-	C		
0	01-FCV-1311 501.00	EXISTING BOILER 3 FEEDWATER - FLOW CONTROL FLOW CONTROL VALVE (MODULATING)	Fisher ED 0 - 100 %	PI3	C	C	C	C	C	-	-	-	C	01-ZT-1311	
0	01-TCV-6311 502.00	EXISTING BOILER 3 ECONOMIZER BYPASS - TEMP CONTROL TEMPERATURE CONTROL VALVE (MODULATING)	Fisher YS 0 - 100 %	PI3	C	C	C	C	C	-	-	-	C	01-ZT-6311	

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0	01-BY-1351 591.02	EXISTING BOILER 3 JACKSHAFT - CONTROL JACKSHAFT ACTUATOR	Rotork Process Controls SM1730 0 - 100 %	PI3	C	C	C	C	C	-	C	C	C	01-ZT-1351 01-JY-1351	
0	01-PI-4183 090.00	EXISTING CONDENSATE TANK 1 TRANSFER TANK PUMP CTP-1C - PRESSURE PRESSURE INDICATOR	Ashcroft 1279 0 - 100 PSIG	PI4	C	C	-	-	-	-	-	C	C		
0	01-PI-4181 090.00	EXISTING CONDENSATE TANK 1 TRANSFER TANK PUMP CTP-1A - PRESSURE PRESSURE INDICATOR	Ashcroft 1279 0 - 100 PSIG	PI4	C	C	-	-	-	-	-	C	C		
0	01-PI-4182 090.00	EXISTING CONDENSATE TANK 1 TRANSFER TANK PUMP CTP-1B - PRESSURE PRESSURE INDICATOR	Ashcroft 1279 0 - 100 PSIG	PI4	C	C	-	-	-	-	-	C	C		
0	01-LG-3181 276.02	EXISTING CONDENSATE TANK 1 CONDENSATE - LEVEL LEVEL GAUGE	Magnetrol AURORA	PI4	C	C	-	-	-	-	-	-	C		
0	01-LSH-3181 276.02	EXISTING CONDENSATE TANK 1 CONDENSATE - LEVEL HIGH LEVEL SWITCH HIGH	Magnetrol AURORA NOT HIGH - HIGH	PI4	C	C	-	C	-	-	-	-	C		
0	01-LIT-3181A 276.02	EXISTING CONDENSATE TANK 1 CONDENSATE - LEVEL LEVEL INDICATING TRANSMITTER	Magnetrol AURORA 0 - 11 FEET	PI4	C	C	-	-	C	-	-	-	C		
0	01-LSL-3181 276.02	EXISTING CONDENSATE TANK 1 CONDENSATE - LEVEL LOW LEVEL SWITCH LOW	Magnetrol AURORA NOT LOW - LOW	PI4	C	C	-	C	-	-	-	-	C		
0	01-LIT-3181B 276.03	EXISTING CONDENSATE TANK 1 CONDENSATE - LEVEL LEVEL INDICATING TRANSMITTER	Magnetrol _____ 0 - 11 FEET	PI4	C	C	-	-	C	-	-	-	C		
0	01-HS-4183 40 95 13	EXISTING CONDENSATE TANK 1 CONDENSATE - PUMP CNTRL HAND SWITCH	- - - HAND - OFF REMOTE	PI4	C	C	-	C	-	-	-	-	C		
0	01-HS-4182 40 95 13	EXISTING CONDENSATE TANK 1 CONDENSATE - PUMP CNTRL HAND SWITCH	- - - HAND - OFF REMOTE	PI4	C	C	-	C	-	-	-	-	C		
0	01-HS-4181 40 95 13	EXISTING CONDENSATE TANK 1 CONDENSATE - PUMP CNTRL HAND SWITCH	- - - HAND - OFF REMOTE	PI4	C	C	-	C	-	-	-	-	C		
0	01-FV-3181 501.22	CONDENSATE TANK CONDENSATE RETURN - FLOW FLOW ON/OFF VALVE OR SOLENOID VALVE	Fisher ED 0 - 100 %	PI4	C	C	C	C	C	C	C	-	C	01-ZSO-3181 01-ZSC-3181	
0	01-PRV-4180 561.00	EXISTING CONDENSATE TANK 1 REGULATOR VALVE - PRESSURE PRESSURE RELIEF/REGULATING VALVE	Fisher 95H 0 - 45 PSIG	PI4	C	C	-	-	-	-	-	-	C		
0	01-PT-5110 021.03	EXISTING DEAERATOR 1 FEEDWATER - PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 200 PSIG	PI5	C	C	-	-	C	-	-	C	C		

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0	01-PI-5111 090.00	EXISTING DEAERATOR 1 FEED WATER PUMP FWP-1A - PRESSURE PRESSURE INDICATOR	Ashcroft 1279 0 - 300 PSIG	PI5	C	C	-	-	-	-	-	C	C		
0	01-PI-5112 090.00	EXISTING DEAERATOR 1 FEED WATER PUMP FWP-1B - PRESSURE PRESSURE INDICATOR	Ashcroft 1279 0 - 300 PSIG	PI5	C	C	-	-	-	-	-	C	C		
0	01-PI-5113 090.00	EXISTING DEAERATOR 1 FEED WATER PUMP FWP-1C - PRESSURE PRESSURE INDICATOR	Ashcroft 1279 0 - 300 PSIG	PI5	C	C	-	-	-	-	-	C	C		
0	01-PI-5110 090.00	EXISTING DEAERATOR 1 FEEDWATER - PRESSURE PRESSURE INDICATOR	Ashcroft 1279 0 - 300 PSIG	PI5	C	C	-	-	-	-	-	C	C		
0	01-LSH-2111 276.02	EXISTING DEAERATOR 1 FEEDWATER - LEVEL HIGH LEVEL SWITCH HIGH	Magnetrol AURORA NOT HIGH - HIGH	PI5	C	C	-	C	-	-	-	-	C		
0	01-LSL-2111 276.02	EXISTING DEAERATOR 1 FEEDWATER - LEVEL LOW LEVEL SWITCH LOW	Magnetrol AURORA NOT LOW - LOW	PI5	C	C	-	C	-	-	-	-	C		
0	01-LIT-2111A 276.02	EXISTING DEAERATOR 1 FEEDWATER - LEVEL LEVEL INDICATING TRANSMITTER	Magnetrol AURORA 0 - 11 FEET	PI5	C	C	-	-	C	-	-	-	C		
0	01-LG-2111 276.02	EXISTING DEAERATOR 1 FEEDWATER - LEVEL LEVEL GAUGE	Magnetrol AURORA -	PI5	C	C	-	-	-	-	-	-	C		
0	01-LIT-2111B 276.03	EXISTING DEAERATOR 1 DEAERATOR - LEVEL LEVEL INDICATING TRANSMITTER	Magnetrol _____ 0 - 11 FEET	PI5	C	C	-	-	C	-	-	-	C		
0	01-TI-5110 391.00	EXISTING DEAERATOR 1 FEEDWATER - TEMPERATURE INDICATION TEMPERATURE INDICATOR	Ashcroft 50EL 50 - 300 °F	PI5	C	C	-	-	-	-	-	-	C		
0	01-HS-5113 40 95 13	EXIST DEAERATOR FEED WATER PUMP 1B FEEDWATER - PRESSURE HAND SWITCH	- - - HAND - OFF REMOTE	PI5	C	C	-	C	-	-	-	-	C		
0	01-HS-5112 40 95 13	EXIST DEAERATOR FEED WATER PUMP 1B FEEDWATER - PRESSURE HAND SWITCH	- - - HAND - OFF REMOTE	PI5	C	C	-	C	-	-	-	-	C		
0	01-HS-5111 40 95 13	EXIST DEAERATOR FEED WATER PUMP 1A FEEDWATER - PRESSURE HAND SWITCH	- - - HAND - OFF REMOTE	PI5	C	C	-	C	-	-	-	-	C		
0	01-LCV-2181 501.21	EXISTING DEAERATOR 1 CONDENSATE - LEVEL CONTROL LEVEL CONTROL VALVE (MODULATING)	Fisher EZ 0 - 100 %	PI5	C	C	C	C	C	-	-	-	C	01-ZT-2181	
0	01-LCV-2182 501.41	EXISTING DEAERATOR 1 CONDENSATE - LEVEL CONTROL LEVEL CONTROL VALVE (MODULATING)	Fisher ET 0 - 100 %	PI5	C	C	C	C	C	-	-	-	C	01-ZT-2182	

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0	01-FCV-2191 531.11	EXISTING DEAERATOR 1 MAKE UP WATER - FLOW CONTROL FLOW CONTROL VALVE (MODULATING)	Fisher V-150 0 - 100 %	PI5	C	C	C	C	C	-	-	-	C	01-ZT-2191	
0	01-PRV-5110 561.01	EXISTING DEAERATOR 1 REGULATOR VALVE - PRESSURE PRESSURE RELIEF/REGULATING VALVE	Fisher 95H 0 - 158 PSIG	PI5	C	C	-	-	-	-	-	-	C		
0	01-PI-4281A 090.00	EXISTING CONDENSATE TANK 2 TRANSFER TANK PUMP CTP-2A - PRESS PRESSURE INDICATOR	Ashcroft 1279 0 - 100 PSIG	PI6	C	C	-	-	-	-	-	C	C		
0	01-PI-4282B 090.00	EXISTING CONDENSATE TANK 2 TRANSFER TANK PUMP CTP-2B - PRESS PRESSURE INDICATOR	Ashcroft 1279 0 - 100 PSIG	PI6	C	C	-	-	-	-	-	C	C		
0	01-PI-4283 090.00	EXISTING CONDENSATE TANK 2 TRANSFER TANK PUMP CTP-2C - PRESS PRESSURE INDICATOR	Ashcroft 1279 0 - 100 PSIG	PI6	C	C	-	-	-	-	-	C	C		
0	01-LIT-3281A 276.02	EXISTING CONDENSATE TANK 2 CONDENSATE - LEVEL LEVEL INDICATING TRANSMITTER	Magnetrol AURORA 0 - 11 FEET	PI6	C	C	-	-	C	-	-	-	C		
0	01-LSH-3281 276.02	EXISTING CONDENSATE TANK 2 CONDENSATE - LEVEL HIGH LEVEL SWITCH HIGH	Magnetrol AURORA NOT HIGH - HIGH	PI6	C	C	-	C	-	-	-	-	C		
0	01-LSL-3281 276.02	EXISTING CONDENSATE TANK 2 CONDENSATE - LEVEL LOW LEVEL SWITCH LOW	Magnetrol AURORA NOT LOW - LOW	PI6	C	C	-	C	-	-	-	-	C		
0	01-LG-3281 276.02	EXISTING CONDENSATE TANK 2 CONDENSATE - LEVEL LEVEL GAUGE	Magnetrol AURORA -	PI6	C	C	-	-	-	-	-	-	C		
0	01-LIT-3281B 276.03	EXISTING CONDENSATE TANK 2 CONDENSATE - LEVEL LEVEL INDICATING TRANSMITTER	Magnetrol _____ 0 - 11 FEET	PI6	C	C	-	-	C	-	-	-	C		
0	01-FCV-3291 501.01	EXISTING CONDENSATE TANK 2 MAKE UP WATER - FLOW CONTROL FLOW CONTROL VALVE (MODULATING)	Fisher ED 0 - 100 %	PI6	C	C	C	C	C	-	-	-	C	01-ZT-3291	
0	01-FV-3281 501.22	EXISTING CONDENSATE TANK 2 CONDENSATE RETURN - FLOW FLOW ON/OFF VALVE OR SOLENOID VALVE	Fisher ED 0 - 100 %	PI6	C	C	C	C	C	-	-	-	C	01-ZSO-3281 01-ZSC-3281	
0	01-PRV-4280 561.00	EXISTING CONDENSATE TANK 2 REGULATOR VALVE - PRESSURE PRESSURE RELIEF/REGULATING VALVE	Fisher 95H 0 - 45 PSIG	PI6	C	C	-	-	-	-	-	-	C		
0	01-PT-5210 021.03	EXISTING DEAERATOR 2 FEEDWATER - PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 200 PSIG	PI7	C	C	-	-	C	-	-	C	C		
0	01-PI-5212 090.00	EXISTING DEAERATOR 2 FEED WATER PUMP FWP-2B PRESSURE PRESSURE INDICATOR	Ashcroft 1279 0 - 300 PSIG	PI7	C	C	-	-	-	-	-	C	C		

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0	01-PI-5213 090.00	EXISTING DEAERATOR 2 FEED WATER PUMP FWP-2C PRESSURE PRESSURE INDICATOR	Ashcroft 1279 0 - 300 PSIG	PI7	C	C	-	-	-	-	-	C	C		
0	01-PI-5211 090.00	EXISTING DEAERATOR 2 FEED WATER PUMP FWP-2A PRESSURE PRESSURE INDICATOR	Ashcroft 1279 0 - 300 PSIG	PI7	C	C	-	-	-	-	-	C	C		
0	01-LIT-2211A 276.02	EXISTING DEAERATOR 2 FEEDWATER - LEVEL LEVEL INDICATING TRANSMITTER	Magnetrol AURORA 0 - 11 FEET	PI7	C	C	-	-	C	-	-	-	C		
0	01-LG-2211 276.02	EXISTING DEAERATOR 2 FEEDWATER - LEVEL LEVEL GAUGE	Magnetrol AURORA	PI7	C	C	-	-	-	-	-	-	C		
0	01-LSL-2211 276.02	EXISTING DEAERATOR 2 FEEDWATER - LEVEL LOW LEVEL SWITCH LOW	Magnetrol AURORA NOT LOW - LOW	PI7	C	C	-	C	-	-	-	-	C		
0	01-LSH-2211 276.02	EXISTING DEAERATOR 2 FEEDWATER - LEVEL HIGH LEVEL SWITCH HIGH	Magnetrol AURORA NOT HIGH - HIGH	PI7	C	C	-	C	-	-	-	-	C		
0	01-LIT-2211B 276.03	EXISTING DEAERATOR 2 DEAERATOR - LEVEL LEVEL INDICATING TRANSMITTER	Magnetrol _____ 0 - 11 FEET	PI7	C	C	-	-	C	-	-	-	C		
0	01-LCV-2281 501.21	EXISTING DEAERATOR 2 CONDENSATE - LEVEL CONTROL LEVEL CONTROL VALVE (MODULATING)	Fisher EZ 0 - 100 %	PI7	C	C	C	C	C	-	-	-	C	01-ZT-2281	
0	01-LCV-2282 501.41	EXISTING DEAERATOR 2 CONDENSATE - LEVEL CONTROL LEVEL CONTROL VALVE (MODULATING)	Fisher ET 0 - 100 %	PI7	C	C	C	C	C	-	-	-	C	01-ZT-2282	
0	01-FCV-2291 531.11	EXISTING DEAERATOR 2 MAKE UP WATER - FLOW CONTROL FLOW CONTROL VALVE (MODULATING)	Fisher V-150 0 - 100 %	PI7	C	C	C	C	C	-	-	-	C	01-ZT-2291	
0	01-PRV-5210 561.01	EXISTING DEAERATOR 2 REGULATOR VALVE - PRESSURE PRESSURE RELIEF/REGULATING VALVE	Fisher 95H 0 - 158 PSIG	PI7	C	C	-	-	-	-	-	-	C		
0	01-FT-0001 006.00	EXISTING BOILER STEAM - FLOW FLOW TRANSMITTER	Rosemount 3095MV 0 - 110,000 LB/HR	PI8	C	C	-	-	C	-	-	C	C		
0	01-PT-0001 021.03	EXISTING BOILER STEAM - PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 150 PSIG	PI8	C	C	-	-	C	-	-	C	C		
0	01-PT-0003 021.03	EXISTING BOILER STEAM - PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 150 PSIG	PI8	C	C	-	-	C	-	-	C	C		
0	01-PT-0002 021.03	EXISTING BOILER STEAM - PRESSURE PRESSURE TRANSMITTER	Rosemount 3051 0 - 150 PSIG	PI8	C	C	-	-	C	-	-	C	C		

Stanley Consultants INC.

EXHIBIT E - INSTRUMENT INDEX
WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/ CONDENSATE PUMP UPGRADE
OGDEN, UTAH

ISSUE DATE 28-Jan-10
REVISION NO: 0

REV	TAG NO DATASHEET	SERVICE DESCRIPTION	MANUFACTURER MODEL NO RANGE	P&ID NO PLAN INST DTL	INSTALLATION REQUIREMENTS FUR	MNT	PWR	CON	INS	COM	AIR	IMP	CAL	ACCESSORIES	COMMENTS
0	01-FE-0001 121.00	EXISTING BOILER STEAM - FLOW FLOW ELEMENT	McCrometer VW12 0 - 100,000 LB/HR	PI8	C	C	-	-	-	-	-	-	C		

Exhibit F

Datasheets

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

MULTI-VARIABLE FLOW TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 006.00 - 01 of 04		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number		01-FT-0001				
	Service Description		EXISTING BOILER STEAM - FLOW				
	P&ID Number		PI8				
	Line No. Or Vessel No.		12"-STM-025				
	Pipe Class Specification						
	Electrical Class | Power Supply		|				
	Calibrate Differential Pressure To		0-110,000 LB/HR				
	Calibrate Static Pressure To						
Process Data	Fluid | Fluid State		STEAM | SUPERHEATED				
	Operating Conditions		Units	Minimum	Normal	Maximum	Design
	Flow Rate		LB/HR	5000	30,000	100,000	110,000
	Inlet Pressure		PSIG	100	100	100	125
	Outlet Pressure		PSIG				
	Temperature		°F	338	338	338	350
	Level						
	Sp Wt	Sp Grav	Mol Wt				
	Viscosity	Sp Heat					
Performance/Material	Type		MULTI-VARIABLE				
	Accuracy		± 0.075% OF SPAN FOR SPANS FROM 1:1 TO 10:1 URL				
	Ambient Temperature		± (0.025% URL + 0.125% SPAN) FOR SPANS FROM 1:1 TO 30:1				
	Stability		± 0.125% URL FOR 5 YEARS FOR ±50°F(28°C) AMBIENT TEMPERATURE CHANGES				
	Temperature Limits		-40 TO 185°F				
	Overrange Protection		3,626 PSIA				
	Differential Pressure Range		0-2.5 to 0-250 IN H2O				
	Lower Range / Upper Range Limits		0" WC / 250" WC				
	Static Pressure Range		0 - 8 TO 0 - 800 PSIG				
	Output Signal		4-20 MA				
	Communications Protocol		HART				
	Flange Type / Flange Material		COPLANAR / 316L SS				
	Drain Vent / Flange Adapters		316L SS / NONE				
	Wetted O-Ring / Non-Wetted O-Ring		GLASS-FILLED PTFE / BUNA-N				
	Fill Fluid		SILICONE				
	Enclosure Matl. / Rating		LOW COPPER ALUMINIUM / IP66- NEMA 4X				
	Mounting		MTG HARDWARE FOR 2" PIPE STAND				
	Process Connection		(2) 1/2"-14 NPT				
	Electrical Connection		1/2"-14 NPT				
	Cable Length / Type						
Options	Flanges						
	Manifold		3-VALVE MANIFOLD				
	Local Indication		YES				
	Manufacturer		Rosemount				
	Model No.		3095MV**				

Notes:

1. COORDINATE WITH FACTORY CERTIFIED CALIBRATION SHEET FROM MCCROMETER (V-CONE).
2. COORDINATE CALIBRATION WITH 01-FE-1101 ON DATASHEET 121.11 PAGE 1.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

MULTI-VARIABLE FLOW TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 006.00 - 02 of 04		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number		01-FT-1101				
	Service Description		EXISTING BOILER 1 STEAM - FLOW				
	P&ID Number		PI1				
	Line No. Or Vessel No.		6"-STM-003				
	Pipe Class Specification						
	Electrical Class | Power Supply		|				
	Calibrate Differential Pressure To		0-40,000 LB/HR				
	Calibrate Static Pressure To						
Process Data	Fluid | Fluid State		STEAM | SUPERHEATED				
	Operating Conditions		Units	Minimum	Normal	Maximum	Design
	Flow Rate		PPH	4000	30,000	40,000	
	Inlet Pressure		PSIG	100	100	125	125
	Outlet Pressure		PSIG				
	Temperature		°F	338	338	338	350
	Level						
	Sp Wt	Sp Grav	Mol Wt				
	Viscosity	Sp Heat					
Performance/Material	Type		MULTI-VARIABLE				
	Accuracy		± 0.075% OF SPAN FOR SPANS FROM 1:1 TO 10:1 URL				
	Ambient Temperature		± (0.025% URL + 0.125% SPAN) FOR SPANS FROM 1:1 TO 30:1				
	Stability		± 0.125% URL FOR 5 YEARS FOR ±50°F(28°C) AMBIENT TEMPERATURE CHANGES				
	Temperature Limits		-40 TO 185°F				
	Overrange Protection		3,626 PSIA				
	Differential Pressure Range		0-2.5 to 0-250 IN H2O				
	Lower Range / Upper Range Limits		0" WC / 250" WC				
	Static Pressure Range		0 - 8 TO 0 - 800 PSIG				
	Output Signal		4-20 MA				
	Communications Protocol		HART				
	Flange Type / Flange Material		COPLANAR / 316L SS				
	Drain Vent / Flange Adapters		316L SS / NONE				
	Wetted O-Ring / Non-Wetted O-Ring		GLASS-FILLED PTFE / BUNA-N				
	Fill Fluid		SILICONE				
	Enclosure Matl. / Rating		LOW COPPER ALUMINIUM / IP66- NEMA 4X				
	Mounting		MTG HARDWARE FOR 2" PIPE STAND				
	Process Connection		(2) 1/2"-14 NPT				
	Electrical Connection		1/2"-14 NPT				
	Cable Length / Type						
Options	Flanges						
	Manifold		3-VALVE MANIFOLD				
	Local Indication		YES				
	Manufacturer		Rosemount				
	Model No.		3095MV**				

Notes:

1. COORDINATE WITH FACTORY CERTIFIED CALIBRATION SHEET FROM MCCROMETER (V-CONE).
2. COORDINATE CALIBRATION WITH 01-FE-0001 ON DATASHEET 121.00 PAGE 1.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

MULTI-VARIABLE FLOW TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 006.00 - 03 of 04		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-FT-1201
	Service Description	EXISTING BOILER 2 STEAM - FLOW
	P&ID Number	PI2
	Line No. Or Vessel No.	6"-STM-020
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Differential Pressure To	0-45,000 LB/HR
	Calibrate Static Pressure To	
Process Data	Fluid | Fluid State	STEAM | SUPERHEATED

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	PPH	3700	37,000	45,000	
Inlet Pressure	PSIG	100	100	125	150
Outlet Pressure	PSIG				
Temperature	°F	338	338	338	350
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	MULTI-VARIABLE
	Accuracy	± 0.075% OF SPAN FOR SPANS FROM 1:1 TO 10:1 URL
	Ambient Temperature	± (0.025% URL + 0.125% SPAN) FOR SPANS FROM 1:1 TO 30:1
	Stability	± 0.125% URL FOR 5 YEARS FOR ±50°F(28°C) AMBIENT TEMPERATURE CHANGES
	Temperature Limits	-40 TO 185°F
	Overrange Protection	3,626 PSIA
	Differential Pressure Range	0-2.5 to 0-250 IN H2O
	Lower Range / Upper Range Limits	0" WC / 250" WC
	Static Pressure Range	0 - 8 TO 0 - 800 PSIG
	Output Signal	4-20 MA
	Communications Protocol	HART
	Flange Type / Flange Material	COPLANAR / 316L SS
	Drain Vent / Flange Adapters	316L SS / NONE
	Wetted O-Ring / Non-Wetted O-Ring	GLASS-FILLED PTFE / BUNA-N
	Fill Fluid	SILICONE
	Enclosure Matl. / Rating	LOW COPPER ALUMINIUM / IP66- NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	(2) 1/2"-14 NPT
	Electrical Connection	1/2"-14 NPT
	Cable Length / Type	
Options	Flanges	
	Manifold	3-VALVE MANIFOLD
	Local Indication	YES
	Manufacturer	Rosemount
	Model No.	3095MV**

Notes:

1. COORDINATE WITH FACTORY CERTIFIED CALIBRATION SHEET FROM MCCROMETER (V-CONE).
2. COORDINATE CALIBRATION WITH 01-FE-1201 ON DATASHEET 121.11 PAGE 2.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

MULTI-VARIABLE FLOW TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 006.00 - 04 of 04		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number		01-FT-1301				
	Service Description		EXISTING BOILER 3 STEAM - FLOW				
	P&ID Number		PI3				
	Line No. Or Vessel No.		6"-STM-009				
	Pipe Class Specification						
	Electrical Class | Power Supply		|				
	Calibrate Differential Pressure To		0-60,000 LB/HR				
	Calibrate Static Pressure To						
Process Data	Fluid | Fluid State		STEAM | SUPERHEATED				
	Operating Conditions		Units	Minimum	Normal	Maximum	Design
	Flow Rate		PPH	4500	45,000	60,000	
	Inlet Pressure		PSIG	100	100	125	125
	Outlet Pressure		PSIG				
	Temperature		°F	338	338	338	350
	Level						
	Sp Wt	Sp Grav	Mol Wt				
	Viscosity	Sp Heat					
Performance/Material	Type		MULTI-VARIABLE				
	Accuracy		± 0.075% OF SPAN FOR SPANS FROM 1:1 TO 10:1 URL				
	Ambient Temperature		± (0.025% URL + 0.125% SPAN) FOR SPANS FROM 1:1 TO 30:1				
	Stability		± 0.125% URL FOR 5 YEARS FOR ±50°F(28°C) AMBIENT TEMPERATURE CHANGES				
	Temperature Limits		-40 TO 185°F				
	Overrange Protection		3,626 PSIA				
	Differential Pressure Range		0-2.5 to 0-250 IN H2O				
	Lower Range / Upper Range Limits		0" WC / 250" WC				
	Static Pressure Range		0 - 8 TO 0 - 800 PSIG				
	Output Signal		4-20 MA				
	Communications Protocol		HART				
	Flange Type / Flange Material		COPLANAR / 316L SS				
	Drain Vent / Flange Adapters		316L SS / NONE				
	Wetted O-Ring / Non-Wetted O-Ring		GLASS-FILLED PTFE / BUNA-N				
	Fill Fluid		SILICONE				
	Enclosure Matl. / Rating		LOW COPPER ALUMINIUM / IP66- NEMA 4X				
	Mounting		MTG HARDWARE FOR 2" PIPE STAND				
	Process Connection		(2) 1/2"-14 NPT				
	Electrical Connection		1/2"-14 NPT				
	Cable Length / Type						
Options	Flanges						
	Manifold		3-VALVE MANIFOLD				
	Local Indication		YES				
	Manufacturer		Rosemount				
	Model No.		3095MV**				

Notes:

1. COORDINATE WITH FACTORY CERTIFIED CALIBRATION SHEET FROM MCCROMETER (V-CONE).
2. COORDINATE CALIBRATION WITH 01-FE-1301 ON DATASHEET 121.11 PAGE 3.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

GAUGE PRESSURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 021.00 - 01 of 02	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-PT-1250
	Service Description	EXISTING BOILER 2 FURNACE - PRESSURE
	P&ID Number	PI2
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-20 " H2O
Process Data	Fluid | Fluid State	AIR | GAS

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate					
Inlet Pressure	" H2O		0.5		
Outlet Pressure	" H2O				
Temperature	°F				
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	GAUGE PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1
	Total Performance	± 0.15% OF SPAN FOR ± 50°F
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI
	Temperature Limits	-40 TO 185°F
	Overrange Protection	3,626 PSIG
	Pressure Range	0 - 2.5" to 250" H20
	Lower Range / Upper Range Limits	-250" H20 / 250" H20
	Output Signal	4-20 mA
	Communications Protocol	HART
	Process Cover Material	
	Sensor Material	
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" - 14 NPT
	Electrical Connection	1/2" - 14 NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	2-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

GAUGE PRESSURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 021.00 - 02 of 02	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS / CHK'D SAW	APPR. TJM

General	Tag Number	01-PT-1350
	Service Description	EXISTING BOILER 3 FURNACE - PRESSURE
	P&ID Number	PI3
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-20 " H2O
Process Data	Fluid | Fluid State	AIR | GAS

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate					
Inlet Pressure	" H2O		0.2		
Outlet Pressure	" H2O				
Temperature	°F				
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	GAUGE PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1
	Total Performance	± 0.15% OF SPAN FOR ± 50°F
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI
	Temperature Limits	-40 TO 185°F
	Overrange Protection	3,626 PSIG
	Pressure Range	0 - 2.5" to 250" H20
	Lower Range / Upper Range Limits	-250" H20 / 250" H20
	Output Signal	4-20 mA
	Communications Protocol	HART
	Process Cover Material	
	Sensor Material	
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" - 14 NPT
	Electrical Connection	1/2" - 14 NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	2-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

GAUGE PRESSURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 021.02 - 01 of 02	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-PT-1241
	Service Description	EXISTING BOILER 2 FUEL OIL - PRESSURE
	P&ID Number	PI2
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-30 PSIG
Process Data	Fluid | Fluid State	FUEL OIL | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate					
Inlet Pressure	PSIG				
Outlet Pressure	PSIG				
Temperature	°F				
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	GAUGE PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1
	Total Performance	± 0.15% OF SPAN FOR ± 50°F
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI
	Temperature Limits	-40 TO 185°F
	Overrange Protection	3,626 PSIG
	Pressure Range	3 to 300 PSI
	Lower Range / Upper Range Limits	.5 PSIA / 300 PSI
	Output Signal	4-20 mA
	Communications Protocol	HART
	Process Cover Material	
	Sensor Material	
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" - 14 NPT
	Electrical Connection	1/2" - 14 NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	2-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

GAUGE PRESSURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 021.02 - 02 of 02		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-PT-1341
	Service Description	EXISTING BOILER 3 FUEL OIL - PRESSURE
	P&ID Number	PI3
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-30 PSIG
Process Data	Fluid | Fluid State	FUEL OIL | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate					
Inlet Pressure	PSIG				
Outlet Pressure	PSIG				
Temperature	°F				
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	GAUGE PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1
	Total Performance	± 0.15% OF SPAN FOR ± 50°F
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI
	Temperature Limits	-40 TO 185°F
	Overrange Protection	3,626 PSIG
	Pressure Range	3 to 300 PSI
	Lower Range / Upper Range Limits	.5 PSIA / 300 PSI
	Output Signal	4-20 mA
	Communications Protocol	HART
	Process Cover Material	
	Sensor Material	
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" - 14 NPT
	Electrical Connection	1/2" - 14 NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	2-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

GAUGE PRESSURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 021.03 - 01 of 13	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS / CHK'D SAW	APPR. TJM

General	Tag Number	01-PT-0001
	Service Description	EXISTING BOILER STEAM - PRESSURE
	P&ID Number	PI8
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-150 PSIG
Process Data	Fluid | Fluid State	STEAM | SUPERHEATED

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	PPH				
Inlet Pressure	PSIG		100		125
Outlet Pressure	PSIG				
Temperature	°F		338		350
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	GAUGE PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1
	Total Performance	± 0.15% OF SPAN FOR ± 50°F
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI
	Temperature Limits	-40 TO 185°F
	Overrange Protection	3,626 PSIG
	Pressure Range	3 to 300 PSI
	Lower Range / Upper Range Limits	.5 PSIA / 300 PSI
	Output Signal	4-20 mA
	Communications Protocol	HART
	Process Cover Material	
	Sensor Material	
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" NPT
	Electrical Connection	1/2" - 14 NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	2-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

GAUGE PRESSURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 021.03 - 02 of 13	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-PT-0002
	Service Description	EXISTING BOILER STEAM - PRESSURE
	P&ID Number	PI8
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-150 PSIG
Process Data	Fluid | Fluid State	STEAM | SUPERHEATED

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	PPH		30,000		
Inlet Pressure	PSIG		100		125
Outlet Pressure	PSIG				
Temperature	°F		338		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	GAUGE PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1
	Total Performance	± 0.15% OF SPAN FOR ± 50°F
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI
	Temperature Limits	-40 TO 185°F
	Overrange Protection	3,626 PSIG
	Pressure Range	3 to 300 PSI
	Lower Range / Upper Range Limits	.5 PSIA / 300 PSI
	Output Signal	4-20 mA
	Communications Protocol	HART
	Process Cover Material	
	Sensor Material	
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" NPT
	Electrical Connection	1/2" - 14 NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	2-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

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HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

GAUGE PRESSURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 021.03 - 03 of 13		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-PT-0003
	Service Description	EXISTING BOILER STEAM - PRESSURE
	P&ID Number	PI8
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-150 PSIG
Process Data	Fluid | Fluid State	STEAM | SUPERHEATED

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	PPH		30,000		
Inlet Pressure	PSIG		100		125
Outlet Pressure	PSIG				
Temperature	°F		338		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	GAUGE PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1
	Total Performance	± 0.15% OF SPAN FOR ± 50°F
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI
	Temperature Limits	-40 TO 185°F
	Overrange Protection	3,626 PSIG
	Pressure Range	3 to 300 PSI
	Lower Range / Upper Range Limits	.5 PSIA / 300 PSI
	Output Signal	4-20 mA
	Communications Protocol	HART
	Process Cover Material	
	Sensor Material	
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" NPT
	Electrical Connection	1/2" - 14 NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	2-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

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HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

GAUGE PRESSURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 021.03 - 04 of 13		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-PT-1201
	Service Description	EXISTING BOILER 2 STEAM - DRUM PRESSURE
	P&ID Number	PI2
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-150 PSIG
Process Data	Fluid | Fluid State	STEAM | SUPERHEATED

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	PPH		37,000		
Inlet Pressure	PSIG		100		125
Outlet Pressure	PSIG				
Temperature	°F		338		350
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	GAUGE PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1
	Total Performance	± 0.15% OF SPAN FOR ± 50°F
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI
	Temperature Limits	-40 TO 185°F
	Overrange Protection	3,626 PSIG
	Pressure Range	3 to 300 PSI
	Lower Range / Upper Range Limits	.5 PSIA / 300 PSI
	Output Signal	4-20 mA
	Communications Protocol	HART
	Process Cover Material	
	Sensor Material	
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" NPT
	Electrical Connection	1/2" - 14 NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	2-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

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CONDENSATE PUMP UPGRADE
OGDEN, UTAH

GAUGE PRESSURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 021.03 - 05 of 13	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS / CHK'D SAW	APPR. TJM

General	Tag Number	01-PT-1231
	Service Description	EXISTING BOILER 2 NATURAL GAS MAIN - PRESSURE
	P&ID Number	PI2
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-30 PSIG
Process Data	Fluid | Fluid State	NATURAL GAS | GAS

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	SCFM				
Inlet Pressure	PSIG		15	17	
Outlet Pressure	PSIG				
Temperature	°F				
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	GAUGE PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1
	Total Performance	± 0.15% OF SPAN FOR ± 50°F
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI
	Temperature Limits	-40 TO 185°F
	Overrange Protection	3,626 PSIG
	Pressure Range	3 to 300 PSI
	Lower Range / Upper Range Limits	.5 PSIA / 300 PSI
	Output Signal	4-20 mA
	Communications Protocol	HART
	Process Cover Material	
	Sensor Material	
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" NPT
	Electrical Connection	1/2" - 14 NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	2-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

GAUGE PRESSURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 021.03 - 06 of 13	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS / CHK'D SAW	APPR. TJM

General	Tag Number	01-PT-1301
	Service Description	EXISTING BOILER 3 STEAM - DRUM PRESSURE
	P&ID Number	PI3
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-150 PSIG
Process Data	Fluid | Fluid State	STEAM | SUPERHEATED

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	PPH				
Inlet Pressure	PSIG		100		125
Outlet Pressure	PSIG				
Temperature	°F		338		350
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	GAUGE PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1
	Total Performance	± 0.15% OF SPAN FOR ± 50°F
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI
	Temperature Limits	-40 TO 185°F
	Overrange Protection	3,626 PSIG
	Pressure Range	3 to 300 PSI
	Lower Range / Upper Range Limits	.5 PSIA / 300 PSI
	Output Signal	4-20 mA
	Communications Protocol	HART
	Process Cover Material	
	Sensor Material	
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" NPT
	Electrical Connection	1/2" - 14 NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	2-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY **HEAT PLANT CONTROLS & FEEDWATER/** **CONDENSATE PUMP UPGRADE** **OGDEN, UTAH**	**GAUGE PRESSURE TRANSMITTER**				SHEET 021.03 - 07 of 13		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number		01-PT-1331				
	Service Description		EXISTING BOILER 3 NATURAL GAS MAIN - PRESSURE				
	P&ID Number		PI3				
	Line No. Or Vessel No.						
	Pipe Class Specification						
	Electrical Class | Power Supply		|				
	Calibrate Range To		0-30 PSIG				
Process Data	Fluid | Fluid State		NATURAL GAS | GAS				
	Operating Conditions		Units	Minimum	Normal	Maximum	Design
	Flow Rate		SCFM				
	Inlet Pressure		PSIG		15	17	
	Outlet Pressure		PSIG				
	Temperature		°F				
	Level						
	Sp Wt	Sp Grav	Mol Wt				
	Viscosity	Sp Heat					
Performance/Material	Type		GAUGE PRESSURE				
	Accuracy		± 0.065% OF SPAN				
	Ambient Temperature Effect		± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1				
	Total Performance		± 0.15% OF SPAN FOR ± 50°F				
	Stability		± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI				
	Temperature Limits		-40 TO 185°F				
	Overrange Protection		3,626 PSIG				
	Pressure Range		3 to 300 PSI				
	Lower Range / Upper Range Limits		.5 PSIA / 300 PSI				
	Output Signal		4-20 mA				
	Communications Protocol		HART				
	Process Cover Material						
	Sensor Material						
	Flange Type / Flange Material		TRADITIONAL / STAINLESS STEEL				
	Drain Vent / Flange Adapters		STAINLESS STEEL / NONE				
	Element Type		HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM				
	Diaphragm / O-Ring		316 STAINLESS STEEL / GLASS-FILLED PTFE				
	Fill Fluid		SILICONE				
	Enclosure Matl. / Rating		POLYURETHANE-COVERED ALUMINUM / NEMA 4X				
	Mounting		MTG HARDWARE FOR 2" PIPE STAND				
	Process Connection		1/2" NPT				
	Electrical Connection		1/2" - 14 NPT				
Options	Flanges		TRADITIONAL MOUNTING FLANGE				
	Manifold		2-VALVE MANIFOLD				
	Local Indicator		YES				
	Remote Diaphragm Seals						
	Manufacturer		Rosemount				
	Model No.		3051**				

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

GAUGE PRESSURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 021.03 - 08 of 13		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-PT-5110				
	Service Description	EXISTING DEAERATOR 1 FEEDWATER - PRESSURE				
	P&ID Number	PI5				
	Line No. Or Vessel No.	4"-FW-000				
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
	Calibrate Range To	0-200 PSIG				
Process Data	Fluid | Fluid State	WATER | LIQUID				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	GPM				
	Inlet Pressure	PSIG		153		
	Outlet Pressure	PSIG				
	Temperature	°F		219		
	Level					
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Performance/Material	Type	GAUGE PRESSURE				
	Accuracy	± 0.065% OF SPAN				
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1				
	Total Performance	± 0.15% OF SPAN FOR ± 50°F				
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI				
	Temperature Limits	-40 TO 185°F				
	Overrange Protection	3,626 PSIG				
	Pressure Range	3 to 300 PSI				
	Lower Range / Upper Range Limits	.5 PSIA / 300 PSI				
	Output Signal	4-20 mA				
	Communications Protocol	HART				
	Process Cover Material					
	Sensor Material					
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL				
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE				
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM				
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE				
	Fill Fluid	SILICONE				
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X				
	Mounting	MTG HARDWARE FOR 2" PIPE STAND				
	Process Connection	1/2" NPT				
	Electrical Connection	1/2" - 14 NPT				
Options	Flanges	TRADITIONAL MOUNTING FLANGE				
	Manifold	2-VALVE MANIFOLD				
	Local Indicator	YES				
	Remote Diaphragm Seals					
	Manufacturer	Rosemount				
	Model No.	3051**				

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY **HEAT PLANT CONTROLS & FEEDWATER/** **CONDENSATE PUMP UPGRADE** **OGDEN, UTAH**	**GAUGE PRESSURE TRANSMITTER**				SHEET 021.03 - 09 of 13		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-PT-5210				
	Service Description	EXISTING DEAERATOR 2 FEEDWATER - PRESSURE				
	P&ID Number	PI7				
	Line No. Or Vessel No.	4"-FW-000				
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
	Calibrate Range To	0-200 PSIG				
Process Data	Fluid | Fluid State	WATER | LIQUID				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	GPM				
	Inlet Pressure	PSIG		153		
	Outlet Pressure	PSIG				
	Temperature	°F		218		
	Level					
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Performance/Material	Type	GAUGE PRESSURE				
	Accuracy	± 0.065% OF SPAN				
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1				
	Total Performance	± 0.15% OF SPAN FOR ± 50°F				
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI				
	Temperature Limits	-40 TO 185°F				
	Overrange Protection	3,626 PSIG				
	Pressure Range	3 to 300 PSI				
	Lower Range / Upper Range Limits	.5 PSIA / 300 PSI				
	Output Signal	4-20 mA				
	Communications Protocol	HART				
	Process Cover Material					
	Sensor Material					
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL				
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE				
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM				
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE				
	Fill Fluid	SILICONE				
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X				
	Mounting	MTG HARDWARE FOR 2" PIPE STAND				
	Process Connection	1/2" NPT				
	Electrical Connection	1/2" - 14 NPT				
Options	Flanges	TRADITIONAL MOUNTING FLANGE				
	Manifold	2-VALVE MANIFOLD				
	Local Indicator	YES				
	Remote Diaphragm Seals					
	Manufacturer	Rosemount				
	Model No.	3051**				

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY **HEAT PLANT CONTROLS & FEEDWATER/** **CONDENSATE PUMP UPGRADE** **OGDEN, UTAH**	**GAUGE PRESSURE TRANSMITTER**				SHEET 021.03 - 10 of 13		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-PT-6211				
	Service Description	EXISTING BOILER 2 FEEDWATER ECONOMIZER INLET PRESSURE				
	P&ID Number	PI2				
	Line No. Or Vessel No.					
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
	Calibrate Range To	0-300 PSIG				
Process Data	Fluid | Fluid State	WATER | LIQUID				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	GPM				
	Inlet Pressure	PSIG		120		
	Outlet Pressure	PSIG				
	Temperature	°F		180		
	Level					
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Performance/Material	Type	GAUGE PRESSURE				
	Accuracy	± 0.065% OF SPAN				
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1				
	Total Performance	± 0.15% OF SPAN FOR ± 50°F				
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI				
	Temperature Limits	-40 TO 185°F				
	Overrange Protection	3,626 PSIG				
	Pressure Range	3 to 300 PSI				
	Lower Range / Upper Range Limits	.5 PSIA / 300 PSI				
	Output Signal	4-20 mA				
	Communications Protocol	HART				
	Process Cover Material					
	Sensor Material					
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL				
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE				
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM				
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE				
	Fill Fluid	SILICONE				
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X				
	Mounting	MTG HARDWARE FOR 2" PIPE STAND				
	Process Connection	1/2" NPT				
	Electrical Connection	1/2" - 14 NPT				
Options	Flanges	TRADITIONAL MOUNTING FLANGE				
	Manifold	2-VALVE MANIFOLD				
	Local Indicator	YES				
	Remote Diaphragm Seals					
	Manufacturer	Rosemount				
	Model No.	3051**				

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY **HEAT PLANT CONTROLS & FEEDWATER/** **CONDENSATE PUMP UPGRADE** **OGDEN, UTAH**	**GAUGE PRESSURE TRANSMITTER**				SHEET 021.03 - 11 of 13		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-PT-6212				
	Service Description	EXISTING BOILER 2 FEEDWATER ECONOMIZER OUTLET PRESSURE				
	P&ID Number	PI2				
	Line No. Or Vessel No.					
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
	Calibrate Range To	0-300 PSIG				
Process Data	Fluid | Fluid State	WATER | LIQUID				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	GPM				
	Inlet Pressure	PSIG		120		
	Outlet Pressure	PSIG				
	Temperature	°F		180		
	Level					
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Performance/Material	Type	GAUGE PRESSURE				
	Accuracy	± 0.065% OF SPAN				
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1				
	Total Performance	± 0.15% OF SPAN FOR ± 50°F				
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI				
	Temperature Limits	-40 TO 185°F				
	Overrange Protection	3,626 PSIG				
	Pressure Range	3 to 300 PSI				
	Lower Range / Upper Range Limits	.5 PSIA / 300 PSI				
	Output Signal	4-20 mA				
	Communications Protocol	HART				
	Process Cover Material					
	Sensor Material					
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL				
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE				
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM				
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE				
	Fill Fluid	SILICONE				
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X				
	Mounting	MTG HARDWARE FOR 2" PIPE STAND				
	Process Connection	1/2" NPT				
	Electrical Connection	1/2" - 14 NPT				
Options	Flanges	TRADITIONAL MOUNTING FLANGE				
	Manifold	2-VALVE MANIFOLD				
	Local Indicator	YES				
	Remote Diaphragm Seals					
	Manufacturer	Rosemount				
	Model No.	3051**				

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY **HEAT PLANT CONTROLS & FEEDWATER/** **CONDENSATE PUMP UPGRADE** **OGDEN, UTAH**	**GAUGE PRESSURE TRANSMITTER**				SHEET 021.03 - 12 of 13		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-PT-6311				
	Service Description	EXISTING BOILER 3 FEEDWATER ECONOMIZER OUTLET PRESSURE				
	P&ID Number	PI3				
	Line No. Or Vessel No.					
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
	Calibrate Range To	0-300 PSIG				
Process Data	Fluid | Fluid State	WATER | LIQUID				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	GPM				
	Inlet Pressure	PSIG		120		
	Outlet Pressure	PSIG				
	Temperature	°F		180		
	Level					
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Performance/Material	Type	GAUGE PRESSURE				
	Accuracy	± 0.065% OF SPAN				
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1				
	Total Performance	± 0.15% OF SPAN FOR ± 50°F				
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI				
	Temperature Limits	-40 TO 185°F				
	Overrange Protection	3,626 PSIG				
	Pressure Range	3 to 300 PSI				
	Lower Range / Upper Range Limits	.5 PSIA / 300 PSI				
	Output Signal	4-20 mA				
	Communications Protocol	HART				
	Process Cover Material					
	Sensor Material					
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL				
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE				
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM				
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE				
	Fill Fluid	SILICONE				
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X				
	Mounting	MTG HARDWARE FOR 2" PIPE STAND				
	Process Connection	1/2" NPT				
	Electrical Connection	1/2" - 14 NPT				
Options	Flanges	TRADITIONAL MOUNTING FLANGE				
	Manifold	2-VALVE MANIFOLD				
	Local Indicator	YES				
	Remote Diaphragm Seals					
	Manufacturer	Rosemount				
	Model No.	3051**				

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY **HEAT PLANT CONTROLS & FEEDWATER/** **CONDENSATE PUMP UPGRADE** **OGDEN, UTAH**	**GAUGE PRESSURE TRANSMITTER**				SHEET 021.03 - 13 of 13		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-PT-6312				
	Service Description	EXISTING BOILER 3 FEEDWATER ECONOMIZER OUTLET PRESSURE				
	P&ID Number	PI3				
	Line No. Or Vessel No.					
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
	Calibrate Range To	0-300 PSIG				
Process Data	Fluid | Fluid State	WATER | LIQUID				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	GPM				
	Inlet Pressure	PSIG		120		
	Outlet Pressure	PSIG				
	Temperature	°F		180		
	Level					
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Performance/Material	Type	GAUGE PRESSURE				
	Accuracy	± 0.065% OF SPAN				
	Ambient Temperature Effect	± (0.0125% URL + 0.0625% OF SPAN) FROM 1:1 to 5:1				
	Total Performance	± 0.15% OF SPAN FOR ± 50°F				
	Stability	± .125% URL FOR 60 MONTHS FOR ± 50°F, AND UP TO 1,000 PSI				
	Temperature Limits	-40 TO 185°F				
	Overrange Protection	3,626 PSIG				
	Pressure Range	3 to 300 PSI				
	Lower Range / Upper Range Limits	.5 PSIA / 300 PSI				
	Output Signal	4-20 mA				
	Communications Protocol	HART				
	Process Cover Material					
	Sensor Material					
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL				
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE				
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM				
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE				
	Fill Fluid	SILICONE				
	Enclosure Matl. / Rating	POLYURETHANE-COVERED ALUMINUM / NEMA 4X				
	Mounting	MTG HARDWARE FOR 2" PIPE STAND				
	Process Connection	1/2" NPT				
	Electrical Connection	1/2" - 14 NPT				
Options	Flanges	TRADITIONAL MOUNTING FLANGE				
	Manifold	2-VALVE MANIFOLD				
	Local Indicator	YES				
	Remote Diaphragm Seals					
	Manufacturer	Rosemount				
	Model No.	3051**				

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

PRESSURE GAUGE

NO.	BY	DATE	DESCRIPTION

SHEET 090.00 - 01 of 13	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-PI-4181
	Service Description	EXISTING CONDENSATE TANK 1 TRANSFER TANK PUMP CTP-1A - PRESSURE
	P&ID Number	PI4
	Line No. Or Vessel No.	3"-CR-000
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-100 PSIG
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		45		
Outlet Pressure	PSIG				
Temperature	°F		175		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Instrument	Type	DIRECT READING
	Mounting	LOCAL
	Dial	4-1/2"
	Color	BLACK ON WHITE
	Case	BLACK PHENOLIC
	Ring	THREADED REINFORCED BLACK POLYPROPYLENE
	Blowout Protection	PRESSURE RELIEVING BACK
	Lens	GLASS
	Accuracy	±0.5% FULL SCALE
	Pressure Element	BOURDON TUBE
	Element Material	316SS
	Socket Material	316SS
	Connection	1/2" NPT, LOWER
	Movement	STANDARD
Options	Diaphragm Seal	NONE
	Snubber	NONE
	Siphon	NONE
	Plus! Performance	YES
	Isolation	2 VALVES FOR BLOCK & BLEED SYSTEM
	Manufacturer	Ashcroft
	Model No.	1279**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY **HEAT PLANT CONTROLS & FEEDWATER/** **CONDENSATE PUMP UPGRADE** **OGDEN, UTAH**	**PRESSURE GAUGE**				SHEET 090.00 - 02 of 13		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-PI-4182				
	Service Description	EXISTING CONDENSATE TANK 1 TRANSFER TANK PUMP CTP-1B - PRESSURE				
	P&ID Number	PI4				
	Line No. Or Vessel No.					
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
	Range	0-100 PSIG				
Process Data	Fluid | Fluid State	WATER | LIQUID				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	GPM				
	Inlet Pressure	PSIG		45		
	Outlet Pressure	PSIG				
	Temperature	°F		175		
	Level					
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Instrument	Type	DIRECT READING				
	Mounting	LOCAL				
	Dial	4-1/2"				
	Color	BLACK ON WHITE				
	Case	BLACK PHENOLIC				
	Ring	THREADED REINFORCED BLACK POLYPROPYLENE				
	Blowout Protection	PRESSURE RELIEVING BACK				
	Lens	GLASS				
	Accuracy	±0.5% FULL SCALE				
	Pressure Element	BOURDON TUBE				
	Element Material	316SS				
	Socket Material	316SS				
	Connection	1/2" NPT, LOWER				
	Movement	STANDARD				
Options	Diaphragm Seal	NONE				
	Snubber	NONE				
	Siphon	NONE				
	Plus! Performance	YES				
	Isolation	2 VALVES FOR BLOCK & BLEED SYSTEM				
	Manufacturer	Ashcroft				
	Model No.	1279**				

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

PRESSURE GAUGE

NO.	BY	DATE	DESCRIPTION

SHEET 090.00 - 03 of 13	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-PI-4183
	Service Description	EXISTING CONDENSATE TANK 1 TRANSFER TANK PUMP CTP-1C - PRESSURE
	P&ID Number	PI4
	Line No. Or Vessel No.	3"-CR-000
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-100 PSIG
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		45		
Outlet Pressure	PSIG				
Temperature	°F		175		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Instrument	Type	DIRECT READING
	Mounting	LOCAL
	Dial	4-1/2"
	Color	BLACK ON WHITE
	Case	BLACK PHENOLIC
	Ring	THREADED REINFORCED BLACK POLYPROPYLENE
	Blowout Protection	PRESSURE RELIEVING BACK
	Lens	GLASS
	Accuracy	±0.5% FULL SCALE
	Pressure Element	BOURDON TUBE
	Element Material	316SS
	Socket Material	316SS
	Connection	1/2" NPT, LOWER
	Movement	STANDARD
Options	Diaphragm Seal	NONE
	Snubber	NONE
	Siphon	NONE
	Plus! Performance	YES
	Isolation	2 VALVES FOR BLOCK & BLEED SYSTEM
	Manufacturer	Ashcroft
	Model No.	1279**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

PRESSURE GAUGE

NO.	BY	DATE	DESCRIPTION

SHEET 090.00 - 04 of 13	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-PI-4281A
	Service Description	EXISTING CONDENSATE TANK 2 TRANSFER TANK PUMP CTP-2A - PRESS
	P&ID Number	PI6
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-100 PSIG
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		45		
Outlet Pressure	PSIG				
Temperature	°F		175		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Instrument	Type	DIRECT READING
	Mounting	LOCAL
	Dial	4-1/2"
	Color	BLACK ON WHITE
	Case	BLACK PHENOLIC
	Ring	THREADED REINFORCED BLACK POLYPROPYLENE
	Blowout Protection	PRESSURE RELIEVING BACK
	Lens	GLASS
	Accuracy	±0.5% FULL SCALE
	Pressure Element	BOURDON TUBE
	Element Material	316SS
	Socket Material	316SS
	Connection	1/2" NPT, LOWER
	Movement	STANDARD
Options	Diaphragm Seal	NONE
	Snubber	NONE
	Siphon	NONE
	Plus! Performance	YES
	Isolation	2 VALVES FOR BLOCK & BLEED SYSTEM
	Manufacturer	Ashcroft
	Model No.	1279**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

PRESSURE GAUGE

NO.	BY	DATE	DESCRIPTION

SHEET 090.00 - 05 of 13		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-PI-4282B
	Service Description	EXISTING CONDENSATE TANK 2 TRANSFER TANK PUMP CTP-2B - PRESS
	P&ID Number	PI6
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-100 PSIG
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		45		
Outlet Pressure	PSIG				
Temperature	°F		175		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Instrument	Type	DIRECT READING
	Mounting	LOCAL
	Dial	4-1/2"
	Color	BLACK ON WHITE
	Case	BLACK PHENOLIC
	Ring	THREADED REINFORCED BLACK POLYPROPYLENE
	Blowout Protection	PRESSURE RELIEVING BACK
	Lens	GLASS
	Accuracy	±0.5% FULL SCALE
	Pressure Element	BOURDON TUBE
	Element Material	316SS
	Socket Material	316SS
	Connection	1/2" NPT, LOWER
	Movement	STANDARD
Options	Diaphragm Seal	NONE
	Snubber	NONE
	Siphon	NONE
	Plus! Performance	YES
	Isolation	2 VALVES FOR BLOCK & BLEED SYSTEM
	Manufacturer	Ashcroft
	Model No.	1279**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

PRESSURE GAUGE

NO.	BY	DATE	DESCRIPTION

SHEET 090.00 - 06 of 13	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-PI-4283
	Service Description	EXISTING CONDENSATE TANK 2 TRANSFER TANK PUMP CTP-2C - PRESS
	P&ID Number	PI6
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-100 PSIG
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		45		
Outlet Pressure	PSIG				
Temperature	°F		175		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Instrument	Type	DIRECT READING
	Mounting	LOCAL
	Dial	4-1/2"
	Color	BLACK ON WHITE
	Case	BLACK PHENOLIC
	Ring	THREADED REINFORCED BLACK POLYPROPYLENE
	Blowout Protection	PRESSURE RELIEVING BACK
	Lens	GLASS
	Accuracy	±0.5% FULL SCALE
	Pressure Element	BOURDON TUBE
	Element Material	316SS
	Socket Material	316SS
	Connection	1/2" NPT, LOWER
	Movement	STANDARD
Options	Diaphragm Seal	NONE
	Snubber	NONE
	Siphon	NONE
	Plus! Performance	YES
	Isolation	2 VALVES FOR BLOCK & BLEED SYSTEM
	Manufacturer	Ashcroft
	Model No.	1279**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

PRESSURE GAUGE

NO.	BY	DATE	DESCRIPTION

SHEET 090.00 - 07 of 13	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-PI-5110
	Service Description	EXISTING DEAERATOR 1 FEEDWATER - PRESSURE
	P&ID Number	PI5
	Line No. Or Vessel No.	4"-FW-000
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-300 PSIG
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		153		
Outlet Pressure	PSIG				
Temperature	°F		219		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Instrument	Type	DIRECT READING
	Mounting	LOCAL
	Dial	4-1/2"
	Color	BLACK ON WHITE
	Case	BLACK PHENOLIC
	Ring	THREADED REINFORCED BLACK POLYPROPYLENE
	Blowout Protection	PRESSURE RELIEVING BACK
	Lens	GLASS
	Accuracy	±0.5% FULL SCALE
	Pressure Element	BOURDON TUBE
	Element Material	316SS
	Socket Material	316SS
	Connection	1/2" NPT, LOWER
	Movement	STANDARD
Options	Diaphragm Seal	NONE
	Snubber	NONE
	Siphon	NONE
	Plus! Performance	YES
	Isolation	2 VALVES FOR BLOCK & BLEED SYSTEM
	Manufacturer	Ashcroft
	Model No.	1279**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

PRESSURE GAUGE

NO.	BY	DATE	DESCRIPTION

SHEET 090.00 - 08 of 13		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-PI-5111
	Service Description	EXISTING DEAERATOR 1 FEED WATER PUMP FWP-1A - PRESSURE
	P&ID Number	PI5
	Line No. Or Vessel No.	4"-FW-000
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-300 PSIG
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		153		
Outlet Pressure	PSIG				
Temperature	°F		219		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Instrument	Type	DIRECT READING
	Mounting	LOCAL
	Dial	4-1/2"
	Color	BLACK ON WHITE
	Case	BLACK PHENOLIC
	Ring	THREADED REINFORCED BLACK POLYPROPYLENE
	Blowout Protection	PRESSURE RELIEVING BACK
	Lens	GLASS
	Accuracy	±0.5% FULL SCALE
	Pressure Element	BOURDON TUBE
	Element Material	316SS
	Socket Material	316SS
	Connection	1/2" NPT, LOWER
	Movement	STANDARD
Options	Diaphragm Seal	NONE
	Snubber	NONE
	Siphon	NONE
	Plus! Performance	YES
	Isolation	2 VALVES FOR BLOCK & BLEED SYSTEM
	Manufacturer	Ashcroft
	Model No.	1279**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

PRESSURE GAUGE

NO.	BY	DATE	DESCRIPTION

SHEET 090.00 - 09 of 13	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-PI-5112
	Service Description	EXISTING DEAERATOR 1 FEED WATER PUMP FWP-1B - PRESSURE
	P&ID Number	PI5
	Line No. Or Vessel No.	3"-FW-000
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-300 PSIG
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		153		
Outlet Pressure	PSIG				
Temperature	°F		219		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Instrument	Type	DIRECT READING
	Mounting	LOCAL
	Dial	4-1/2"
	Color	BLACK ON WHITE
	Case	BLACK PHENOLIC
	Ring	THREADED REINFORCED BLACK POLYPROPYLENE
	Blowout Protection	PRESSURE RELIEVING BACK
	Lens	GLASS
	Accuracy	±0.5% FULL SCALE
	Pressure Element	BOURDON TUBE
	Element Material	316SS
	Socket Material	316SS
	Connection	1/2" NPT, LOWER
	Movement	STANDARD
Options	Diaphragm Seal	NONE
	Snubber	NONE
	Siphon	NONE
	Plus! Performance	YES
	Isolation	2 VALVES FOR BLOCK & BLEED SYSTEM
	Manufacturer	Ashcroft
	Model No.	1279**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

PRESSURE GAUGE

NO.	BY	DATE	DESCRIPTION

SHEET 090.00 - 10 of 13	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-PI-5113
	Service Description	EXISTING DEAERATOR 1 FEED WATER PUMP FWP-1C - PRESSURE
	P&ID Number	PI5
	Line No. Or Vessel No.	3"-FW-000
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-300 PSIG
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		153		
Outlet Pressure	PSIG				
Temperature	°F		219		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Instrument	Type	DIRECT READING
	Mounting	LOCAL
	Dial	4-1/2"
	Color	BLACK ON WHITE
	Case	BLACK PHENOLIC
	Ring	THREADED REINFORCED BLACK POLYPROPYLENE
	Blowout Protection	PRESSURE RELIEVING BACK
	Lens	GLASS
	Accuracy	±0.5% FULL SCALE
	Pressure Element	BOURDON TUBE
	Element Material	316SS
	Socket Material	316SS
	Connection	1/2" NPT, LOWER
	Movement	STANDARD
Options	Diaphragm Seal	NONE
	Snubber	NONE
	Siphon	NONE
	Plus! Performance	YES
	Isolation	2 VALVES FOR BLOCK & BLEED SYSTEM
	Manufacturer	Ashcroft
	Model No.	1279**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

PRESSURE GAUGE

NO.	BY	DATE	DESCRIPTION

SHEET 090.00 - 11 of 13		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-PI-5211
	Service Description	EXISTING DEAERATOR 2 FEED WATER PUMP FWP-2A PRESSURE
	P&ID Number	PI7
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-300 PSIG
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		153		
Outlet Pressure	PSIG				
Temperature	°F		218		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Instrument	Type	DIRECT READING
	Mounting	LOCAL
	Dial	4-1/2"
	Color	BLACK ON WHITE
	Case	BLACK PHENOLIC
	Ring	THREADED REINFORCED BLACK POLYPROPYLENE
	Blowout Protection	PRESSURE RELIEVING BACK
	Lens	GLASS
	Accuracy	±0.5% FULL SCALE
	Pressure Element	BOURDON TUBE
	Element Material	316SS
	Socket Material	316SS
	Connection	1/2" NPT, LOWER
	Movement	STANDARD
Options	Diaphragm Seal	NONE
	Snubber	NONE
	Siphon	NONE
	Plus! Performance	YES
	Isolation	2 VALVES FOR BLOCK & BLEED SYSTEM
	Manufacturer	Ashcroft
	Model No.	1279**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
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CONDENSATE PUMP UPGRADE
OGDEN, UTAH

PRESSURE GAUGE

NO.	BY	DATE	DESCRIPTION

SHEET 090.00 - 12 of 13	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-PI-5212
	Service Description	EXISTING DEAERATOR 2 FEED WATER PUMP FWP-2B PRESSURE
	P&ID Number	PI7
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-300 PSIG
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		153		
Outlet Pressure	PSIG				
Temperature	°F		218		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Instrument	Type	DIRECT READING
	Mounting	LOCAL
	Dial	4-1/2"
	Color	BLACK ON WHITE
	Case	BLACK PHENOLIC
	Ring	THREADED REINFORCED BLACK POLYPROPYLENE
	Blowout Protection	PRESSURE RELIEVING BACK
	Lens	GLASS
	Accuracy	±0.5% FULL SCALE
	Pressure Element	BOURDON TUBE
	Element Material	316SS
	Socket Material	316SS
	Connection	1/2" NPT, LOWER
	Movement	STANDARD
Options	Diaphragm Seal	NONE
	Snubber	NONE
	Siphon	NONE
	Plus! Performance	YES
	Isolation	2 VALVES FOR BLOCK & BLEED SYSTEM
	Manufacturer	Ashcroft
	Model No.	1279**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

PRESSURE GAUGE

NO.	BY	DATE	DESCRIPTION

SHEET 090.00 - 13 of 13	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-PI-5213
	Service Description	EXISTING DEAERATOR 2 FEED WATER PUMP FWP-2C PRESSURE
	P&ID Number	PI7
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-300 PSIG
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		153		
Outlet Pressure	PSIG				
Temperature	°F		218		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Instrument	Type	DIRECT READING
	Mounting	LOCAL
	Dial	4-1/2"
	Color	BLACK ON WHITE
	Case	BLACK PHENOLIC
	Ring	THREADED REINFORCED BLACK POLYPROPYLENE
	Blowout Protection	PRESSURE RELIEVING BACK
	Lens	GLASS
	Accuracy	±0.5% FULL SCALE
	Pressure Element	BOURDON TUBE
	Element Material	316SS
	Socket Material	316SS
	Connection	1/2" NPT, LOWER
	Movement	STANDARD
Options	Diaphragm Seal	NONE
	Snubber	NONE
	Siphon	NONE
	Plus! Performance	YES
	Isolation	2 VALVES FOR BLOCK & BLEED SYSTEM
	Manufacturer	Ashcroft
	Model No.	1279**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

V-CONE FLOW ELEMENT

NO.	BY	DATE	DESCRIPTION

SHEET 121.00 - 01 of 01	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-FE-0001
	Service Description	EXISTING BOILER STEAM - FLOW
	P&ID Number	PI8
	Line No. Or Vessel No.	12"-STM-027
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-100,000 LB/HR
Process Data	Fluid | Fluid State	STEAM | SUPERHEATED

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	PPH	5000	30,000	100,000	110,000
Inlet Pressure	PSIG	100	100	100	125
Outlet Pressure	PSIG				
Temperature	°F	338	338	338	350
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Unit	Type	IN-LINE V-CONE (DIFFERENTIAL PRESSURE)
	Unit and Flange Material	CARBON STEEL
	Cone Material	304SS
	Fittings	SOCKET-WELD
	End Connection	RF WELD-NECK FLANGE
	Rating	ANSI CLASS 300
	Location of Element	HORIZONTAL PIPING
	Accuracy	UP TO ±0.5% OF RATE
	Repeatability	±0.1%
	Coatings	
	Flow Direction	HORIZONTAL
	Element Length	**
	Turndown	20:1
	Beta Ratio	0.5500**
Options	Manifold	- - -
	DP Transmitter	- - -
	Flow Computer	- - -
	Manufacturer	McCrometer
	Model No.	VW12**

Notes:

1. REFER TO 01-FT-0001 ON DATASHEET 006.00 PAGE 1 FOR TRANSMITTER.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY **HEAT PLANT CONTROLS & FEEDWATER/** **CONDENSATE PUMP UPGRADE** **OGDEN, UTAH**	**V-CONE FLOW ELEMENT**				SHEET 121.11 - 01 of 03		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-FE-1101				
	Service Description	EXISTING BOILER 1 STEAM - FLOW				
	P&ID Number	PI1				
	Line No. Or Vessel No.	6"-STM-003				
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
	Range	0-40,000 LB/HR				
Process Data	Fluid | Fluid State	STEAM | SUPERHEATED				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	PPH	4,000	30,000	40,000	
	Inlet Pressure	PSIG	100	100	125	125
	Outlet Pressure	PSIG				
	Temperature	°F	338	338	338	350
	Level					
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Unit	Type	IN-LINE V-CONE (DIFFERENTIAL PRESSURE)				
	Unit and Flange Material	CARBON STEEL				
	Cone Material	304SS				
	Fittings	SOCKET-WELD				
	End Connection	RF WELD-NECK FLANGE				
	Rating	ANSI CLASS 300				
	Location of Element	HORIZONTAL PIPING				
	Accuracy	UP TO ±0.5% OF RATE				
	Repeatability	±0.1%				
	Coatings					
	Flow Direction	HORIZONTAL				
	Element Length	**				
	Turndown	10:1				
	Beta Ratio	0.8000**				
Options	Manifold	- - -				
	DP Transmitter	- - -				
	Flow Computer	- - -				
	Manufacturer	McCrometer				
	Model No.	VW06**				

Notes:

1. REFER TO 01-FT-1101 ON DATASHEET 006.00 PAGE 2 FOR TRANSMITTER.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY **HEAT PLANT CONTROLS & FEEDWATER/** **CONDENSATE PUMP UPGRADE** **OGDEN, UTAH**	**V-CONE FLOW ELEMENT**				SHEET 121.11 - 02 of 03		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-FE-1201				
	Service Description	EXISTING BOILER 2 STEAM - FLOW				
	P&ID Number	PI2				
	Line No. Or Vessel No.	6"-STM-020				
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
	Range	0-45,000 LB/HR				
Process Data	Fluid | Fluid State	STEAM | SUPERHEATED				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	PPH	3700	37,000	45,000	
	Inlet Pressure	PSIG	100	100	125	150
	Outlet Pressure	PSIG				
	Temperature	°F	338	338	338	350
	Level					
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Unit	Type	IN-LINE V-CONE (DIFFERENTIAL PRESSURE)				
	Unit and Flange Material	CARBON STEEL				
	Cone Material	304SS				
	Fittings	SOCKET-WELD				
	End Connection	RF WELD-NECK FLANGE				
	Rating	ANSI CLASS 300				
	Location of Element	HORIZONTAL PIPING				
	Accuracy	UP TO ±0.5% OF RATE				
	Repeatability	±0.1%				
	Coatings					
	Flow Direction	HORIZONTAL				
	Element Length	**				
	Turndown	10:1				
	Beta Ratio	0.8000**				
Options	Manifold	- - -				
	DP Transmitter	- - -				
	Flow Computer	- - -				
	Manufacturer	McCrometer				
	Model No.	VW06**				

Notes:

1. REFER TO 01-FT-1201 ON DATASHEET 006.00 PAGE 3 FOR TRANSMITTER.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

V-CONE FLOW ELEMENT

NO.	BY	DATE	DESCRIPTION

SHEET 121.11 - 03 of 03	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-FE-1301
	Service Description	EXISTING BOILER 3 STEAM - FLOW
	P&ID Number	PI3
	Line No. Or Vessel No.	6"-STM-009
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-60,000 LB/HR
Process Data	Fluid | Fluid State	STEAM | SUPERHEATED

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	PPH	4,500	45,000	60,000	
Inlet Pressure	PSIG	100	100	125	125
Outlet Pressure	PSIG				
Temperature	°F	338	338	338	350
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Unit	Type	IN-LINE V-CONE (DIFFERENTIAL PRESSURE)
	Unit and Flange Material	CARBON STEEL
	Cone Material	304SS
	Fittings	SOCKET-WELD
	End Connection	RF WELD-NECK FLANGE
	Rating	ANSI CLASS 300
	Location of Element	HORIZONTAL PIPING
	Accuracy	UP TO ±0.5% OF RATE
	Repeatability	±0.1%
	Coatings	
	Flow Direction	HORIZONTAL
	Element Length	**
	Turndown	10:1
	Beta Ratio	0.8000**
Options	Manifold	- - -
	DP Transmitter	- - -
	Flow Computer	- - -
	Manufacturer	McCrometer
	Model No.	VW06**

Notes:

1. REFER TO 01-FT-1301 ON DATASHEET 006.00 PAGE 4 FOR TRANSMITTER.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

FLOW ELEMENT (THERMAL MASS)

NO.	BY	DATE	DESCRIPTION

SHEET 159.01 - 01 of 02	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-FIT-1231 / 01-FE-1231
	Service Description	EXISTING BOILER 2 NATURAL GAS MAIN - FLOW
	P&ID Number	PI2
	Line No. Or Vessel No.	2 1/2"-NG-003
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-62,500 SCFH
Process Data	Fluid | Fluid State	NATURAL GAS | GAS

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	SCFH	5,000	50,000	62,500	
Inlet Pressure	PSIG	5	15	17	50
Outlet Pressure	PSIG				
Temperature	°F	AMB	AMB	AMB	AMB
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Unit	Type	THERMAL DISPERSION
	Style	INSERTION
	Material	316 STAINLESS STEEL
	Probe Diameter	1/2" TUBE (STANDARD)
	Flow Element Range	100 to 1100 SCFM
	Temperature Range	-40 to 200 °F
	Response Time	1 SECONDS
	Accuracy	±1.0% OF READING +0.5% OF FULL SCALE OVER 100:1 TURN DOWN
	Repeatability	±0.2% OF FULL SCALE
	Pressure Rating	500 PSIG
	Enclosure	RUGGED WINDOWED DUAL COMPARTMENT W/LOCAL DISPLAY
	Enclosure Classification	NEMA 4X
	Resolution	UP TO 1000:1
Electrical	Power Required	24 VDC, 115 VAC/230 VAC, 60HZ
	Output	4-20 mA
Options	Approvals	NONE
	Tag Material	STAINLESS STEEL
	Mounting	INSERTION MOUNTING HARDWARE W/ISOLATION VALVE
	Manufacturer	Sage Prime
	Model No.	SIP SERIES**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

FLOW ELEMENT (THERMAL MASS)

NO.	BY	DATE	DESCRIPTION

SHEET 159.01 - 02 of 02	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS / CHK'D SAW	APPR. TJM

General	Tag Number	01-FIT-1331 / 01-FE-1331
	Service Description	EXISTING BOILER 3 NATURAL GAS MAIN - FLOW
	P&ID Number	PI3
	Line No. Or Vessel No.	2 1/2"-NG-005
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	0-62,500 SCFH
Process Data	Fluid | Fluid State	NATURAL GAS | GAS

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	SCFH	5,000	50,000	75,000	
Inlet Pressure	PSIG	5	15	17	50
Outlet Pressure	PSIG				
Temperature	°F	AMB	AMB	AMB	AMB
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Unit	Type	THERMAL DISPERSION
	Style	INSERTION
	Material	316 STAINLESS STEEL
	Probe Diameter	1/2" TUBE (STANDARD)
	Flow Element Range	100 to 1100 SCFM
	Temperature Range	-40 to 200 °F
	Response Time	1 SECONDS
	Accuracy	±1.0% OF READING +0.5% OF FULL SCALE OVER 100:1 TURN DOWN
	Repeatability	±0.2% OF FULL SCALE
	Pressure Rating	500 PSIG
	Enclosure	RUGGED WINDOWED DUAL COMPARTMENT W/LOCAL DISPLAY
	Enclosure Classification	NEMA 4X
	Resolution	UP TO 1000:1
Electrical	Power Required	24 VDC, 115 VAC/230 VAC, 60HZ
	Output	4-20 mA
Options	Approvals	NONE
	Tag Material	STAINLESS STEEL
	Mounting	INSERTION MOUNTING HARDWARE W/ISOLATION VALVE
	Manufacturer	Sage Prime
	Model No.	SIP SERIES**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

LEVEL TRANSMITTER (DIFFERENTIAL)

NO.	BY	DATE	DESCRIPTION

SHEET 216.00 - 01 of 05		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-LIT-1102
	Service Description	EXISTING BOILER 1 STEAM - DRUM LEVEL
	P&ID Number	PI1
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-4 FEET
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		100		125
Outlet Pressure	PSIG				
Temperature	°F		338		350
Level	FT	0		4	

Sp Wt	Sp Grav	Mol Wt			
Viscosity	Sp Heat				

Performance/Material	Type	DIFFERENTIAL PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± 0.0125% URL + 0.0625% OF SPAN FROM 1:1 TO 5:1
	Total Performance	± 0.15% OF SPAN
	Stability	± 0.125% URL FOR 60 MONTHS
	Temperature Limits	-40 TO 185 °F
	Overrange Protection	3626 PSIG
	Pressure Range	-250 to 250" H2O
	Lower Range Limit	-250" H2O
	Upper Range Limit	250" H2O
	Output Signal	4-20mA
	Communications Protocol	HART
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Material	POLYURENTHANE-COVERED ALUMINUM
	Enclosure Rating	NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" - 14NPT
	Electrical Connection	1/2" - 14NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	3-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

LEVEL TRANSMITTER (DIFFERENTIAL)

NO.	BY	DATE	DESCRIPTION

SHEET 216.00 - 02 of 05		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-LIT-1201
	Service Description	EXISTING BOILER 2 STEAM - DRUM LEVEL
	P&ID Number	PI2
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-4 FEET
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		100		150
Outlet Pressure	PSIG				
Temperature	°F		338		350
Level	FT	0		4	

Sp Wt	Sp Grav	Mol Wt			
Viscosity	Sp Heat				

Performance/Material	Type	DIFFERENTIAL PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± 0.0125% URL + 0.0625% OF SPAN FROM 1:1 TO 5:1
	Total Performance	± 0.15% OF SPAN
	Stability	± 0.125% URL FOR 60 MONTHS
	Temperature Limits	-40 TO 185 °F
	Overrange Protection	3626 PSIG
	Pressure Range	-250 to 250" H2O
	Lower Range Limit	-250" H2O
	Upper Range Limit	250" H2O
	Output Signal	4-20mA
	Communications Protocol	HART
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Material	POLYURENTHANE-COVERED ALUMINUM
	Enclosure Rating	NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" - 14NPT
	Electrical Connection	1/2" - 14NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	3-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

LEVEL TRANSMITTER (DIFFERENTIAL)

NO.	BY	DATE	DESCRIPTION

SHEET 216.00 - 03 of 05		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-LIT-1202
	Service Description	EXISTING BOILER 2 STEAM - DRUM LEVEL
	P&ID Number	PI2
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-4 FEET
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		100		150
Outlet Pressure	PSIG				
Temperature	°F		338		350
Level	FT	0		4	

Sp Wt	Sp Grav	Mol Wt			
Viscosity	Sp Heat				

Performance/Material	Type	DIFFERENTIAL PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± 0.0125% URL + 0.0625% OF SPAN FROM 1:1 TO 5:1
	Total Performance	± 0.15% OF SPAN
	Stability	± 0.125% URL FOR 60 MONTHS
	Temperature Limits	-40 TO 185 °F
	Overrange Protection	3626 PSIG
	Pressure Range	-250 to 250" H2O
	Lower Range Limit	-250" H2O
	Upper Range Limit	250" H2O
	Output Signal	4-20mA
	Communications Protocol	HART
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Material	POLYURENTHANE-COVERED ALUMINUM
	Enclosure Rating	NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" - 14NPT
	Electrical Connection	1/2" - 14NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	3-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

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CONDENSATE PUMP UPGRADE
OGDEN, UTAH

LEVEL TRANSMITTER (DIFFERENTIAL)

NO.	BY	DATE	DESCRIPTION

SHEET 216.00 - 04 of 05	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-LIT-1301
	Service Description	EXISTING BOILER 3 STEAM - DRUM LEVEL
	P&ID Number	PI3
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-4 FEET
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		100		125
Outlet Pressure	PSIG				
Temperature	°F		338		350
Level	FT	0		4	

Sp Wt	Sp Grav	Mol Wt			
Viscosity	Sp Heat				

Performance/Material	Type	DIFFERENTIAL PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± 0.0125% URL + 0.0625% OF SPAN FROM 1:1 TO 5:1
	Total Performance	± 0.15% OF SPAN
	Stability	± 0.125% URL FOR 60 MONTHS
	Temperature Limits	-40 TO 185 °F
	Overrange Protection	3626 PSIG
	Pressure Range	-250 to 250" H2O
	Lower Range Limit	-250" H2O
	Upper Range Limit	250" H2O
	Output Signal	4-20mA
	Communications Protocol	HART
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Material	POLYURENTHANE-COVERED ALUMINUM
	Enclosure Rating	NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" - 14NPT
	Electrical Connection	1/2" - 14NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	3-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
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OGDEN, UTAH

LEVEL TRANSMITTER (DIFFERENTIAL)

NO.	BY	DATE	DESCRIPTION

SHEET 216.00 - 05 of 05		
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CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-LIT-1302
	Service Description	EXISTING BOILER 3 STEAM - DRUM LEVEL
	P&ID Number	PI3
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Calibrate Range To	0-4 FEET
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		100		125
Outlet Pressure	PSIG				
Temperature	°F		338		350
Level	FT	0		4	

Sp Wt	Sp Grav	Mol Wt			
Viscosity	Sp Heat				

Performance/Material	Type	DIFFERENTIAL PRESSURE
	Accuracy	± 0.065% OF SPAN
	Ambient Temperature Effect	± 0.0125% URL + 0.0625% OF SPAN FROM 1:1 TO 5:1
	Total Performance	± 0.15% OF SPAN
	Stability	± 0.125% URL FOR 60 MONTHS
	Temperature Limits	-40 TO 185 °F
	Overrange Protection	3626 PSIG
	Pressure Range	-250 to 250" H2O
	Lower Range Limit	-250" H2O
	Upper Range Limit	250" H2O
	Output Signal	4-20mA
	Communications Protocol	HART
	Flange Type / Flange Material	TRADITIONAL / STAINLESS STEEL
	Drain Vent / Flange Adapters	STAINLESS STEEL / NONE
	Element Type	HIGH ACCURACY CAPACITANCE (RESONANT) DIAPHRAGM
	Diaphragm / O-Ring	316 STAINLESS STEEL / GLASS-FILLED PTFE
	Fill Fluid	SILICONE
	Enclosure Material	POLYURENTHANE-COVERED ALUMINUM
	Enclosure Rating	NEMA 4X
	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Process Connection	1/2" - 14NPT
	Electrical Connection	1/2" - 14NPT
Options	Flanges	TRADITIONAL MOUNTING FLANGE
	Manifold	3-VALVE MANIFOLD
	Local Indicator	YES
	Remote Diaphragm Seals	
	Manufacturer	Rosemount
	Model No.	3051**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

LEVEL (MAGNETOSTRICTIVE)

NO.	BY	DATE	DESCRIPTION

SHEET 276.02 - 01 of 04	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-LG-2111 / 01-LIT-2111A / 01-LSL-2111 / 01-LSH-2111
	Service Description	EXISTING DEAERATOR 1 FEEDWATER - LEVEL
	P&ID Number	PI5
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		5		
Outlet Pressure	PSIG				
Temperature	°F		218		
Level	FT	0		11	
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Type	MAGNETIC LEVEL BLIND CHAMBER
	Chamber Material	304 STAINLESS STEEL
	Mounting Style / Connection Size	SIDE/SIDE / 2" RF SLIP ON FLANGE (NOTE 2)
	Flange Rating / Flange Material	ANSI 150 / 304 STAINLESS STEEL
	Measurement Length "L"	0-11 FT
	Float Chamber / Float Material	3" PIPE WITH VENT AND DRAIN FLANGE / 304 STAINLESS STEEL
	Temperature Range	-320°F to 1000°F
	Pressure Range	FULL VACUUM to 4500 PSIG
Transmitter	Type	GUIDED WAVE RADAR
	Linearity	<0.1% OF PROBE LENGTH OR 0.1" WHICHEVER IS GREATER
	Repeatability	<0.1"
	Communications Protocal	HART
	Output	4-20mA
	Damping	ADJUSTABLE 0 - 10 S
	Ambient Temperature / Operating Press	-40° to 175°F / - - -
	Housing Material / Mounting	CAST ALLUMINUM / INTEGRAL
	Power	24 VDC
Indication/Scale	Indicators	METAL FLAG (RED/WHITE)
	Scale	100% OF SPAN
	Float Type	MAGNETIC FLUX RING
Switch	Quantity	2
	Type	MAGNETICALLY ACTUATED, BI-STABLE CAM DRIVE SNAP ACTION SWITCH
		TWO SPDT 10.1 AMP
	Max Dead Band	±0.75" FLOAT TRAVEL
	Temperature Range	-58°F to 392°F
	Enclosure Rating	NEMA 4X
	Enclosure Material	CAST ALUMINUM
Options	High Temperature Insulation	YES
	Manufacturer	Magnetrol
	Model No.	AURORA**
	Transmitter Model No.	Eclipse 705**

Notes:
1. ACCEPTABLE MANUFACTURER: K-TEK.
2. CONTRACTOR TO VERIFY CONNECTION SIZE WITH EXISTING EQUIPMENT.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
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NO.	BY	DATE	DESCRIPTION

SHEET 276.02 - 02 of 04		
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CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-LG-2211 / 01-LIT-2211A / 01-LSL-2211 / 01-LSH-2211				
	Service Description	EXISTING DEAERATOR 2 FEEDWATER - LEVEL				
	P&ID Number	PI7				
	Line No. Or Vessel No.					
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
Process Data	Fluid | Fluid State	WATER | LIQUID				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	GPM				
	Inlet Pressure	PSIG		5		
	Outlet Pressure	PSIG				
	Temperature	°F		175		
	Level	FT	0		11	
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Body	Type	MAGNETIC LEVEL BLIND CHAMBER				
	Chamber Material	304 STAINLESS STEEL				
	Mounting Style / Connection Size	SIDE/SIDE / 2" RF SLIP ON FLANGE (NOTE 2)				
	Flange Rating / Flange Material	ANSI 150 / 304 STAINLESS STEEL				
	Measurement Length "L"	0-11 FT				
	Float Chamber / Float Material	3" PIPE WITH VENT AND DRAIN FLANGE / 304 STAINLESS STEEL				
	Temperature Range	-320°F to 1000°F				
	Pressure Range	FULL VACUUM to 4500 PSIG				
Transmitter	Type	GUIDED WAVE RADAR				
	Linearity	<0.1% OF PROBE LENGTH OR 0.1" WHICHEVER IS GREATER				
	Repeatability	<0.1"				
	Communications Protocal	HART				
	Output	4-20mA				
	Damping	ADJUSTABLE 0 - 10 S				
	Ambient Temperature / Operating Press	-40° to 175°F / - - -				
	Housing Material / Mounting	CAST ALLUMINUM / INTEGRAL				
	Power	24 VDC				
Indication/Scale	Indicators	METAL FLAG (RED/WHITE)				
	Scale	100% OF SPAN				
	Float Type	MAGNETIC FLUX RING				
Switch	Quantity	2				
	Type	MAGNETICALLY ACTUATED, BI-STABLE CAM DRIVE SNAP ACTION SWITCH				
		TWO SPDT 10.1 AMP				
	Max Dead Band	±0.75" FLOAT TRAVEL				
	Temperature Range	-58°F to 392°F				
	Enclosure Rating	NEMA 4X				
	Enclosure Material	CAST ALUMINUM				
Options	High Temperature Insulation	YES				
	Manufacturer	Magnetrol				
	Model No.	AURORA**				
	Transmitter Model No.	Eclipse 705**				

Notes:
1. ACCEPTABLE MANUFACTURER: K-TEK.
2. CONTRACTOR TO VERIFY CONNECTION SIZE WITH EXISTING EQUIPMENT.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

LEVEL (MAGNETOSTRICTIVE)

NO.	BY	DATE	DESCRIPTION

SHEET 276.02 - 03 of 04		
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SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-LG-3181 / 01-LIT-3181A / 01-LSL-3181 / 01-LSH-3181				
	Service Description	EXISTING CONDENSATE TANK 1 CONDENSATE - LEVEL				
	P&ID Number	PI4				
	Line No. Or Vessel No.					
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
Process Data	Fluid | Fluid State	WATER | LIQUID				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	GPM				
	Inlet Pressure	PSIG		5		
	Outlet Pressure	PSIG				
	Temperature	°F		175		
	Level	FT	0		11	
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Body	Type	MAGNETIC LEVEL BLIND CHAMBER				
	Chamber Material	304 STAINLESS STEEL				
	Mounting Style / Connection Size	SIDE/SIDE / 2" RF SLIP ON FLANGE (NOTE 2)				
	Flange Rating / Flange Material	ANSI 150 / 304 STAINLESS STEEL				
	Measurement Length "L"	0-11 FT				
	Float Chamber / Float Material	3" PIPE WITH VENT AND DRAIN FLANGE / 304 STAINLESS STEEL				
	Temperature Range	-320°F to 1000°F				
	Pressure Range	FULL VACUUM to 4500 PSIG				
Transmitter	Type	GUIDED WAVE RADAR				
	Linearity	<0.1% OF PROBE LENGTH OR 0.1" WHICHEVER IS GREATER				
	Repeatability	<0.1"				
	Communications Protocal	HART				
	Output	4-20mA				
	Damping	ADJUSTABLE 0 - 10 S				
	Ambient Temperature / Operating Press	-40° to 175°F / - - -				
	Housing Material / Mounting	CAST ALLUMINUM / INTEGRAL				
	Power	24 VDC				
Indication/Scale	Indicators	METAL FLAG (RED/WHITE)				
	Scale	100% OF SPAN				
	Float Type	MAGNETIC FLUX RING				
Switch	Quantity	2				
	Type	MAGNETICALLY ACTUATED, BI-STABLE CAM DRIVE SNAP ACTION SWITCH				
		TWO SPDT 10.1 AMP				
	Max Dead Band	±0.75" FLOAT TRAVEL				
	Temperature Range	-58°F to 392°F				
	Enclosure Rating	NEMA 4X				
	Enclosure Material	CAST ALUMINUM				
Options	High Temperature Insulation	YES				
	Manufacturer	Magnetrol				
	Model No.	AURORA**				
	Transmitter Model No.	Eclipse 705**				

Notes:
1. ACCEPTABLE MANUFACTURER: K-TEK.
2. CONTRACTOR TO VERIFY CONNECTION SIZE WITH EXISTING EQUIPMENT.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

LEVEL (MAGNETOSTRICTIVE)

NO.	BY	DATE	DESCRIPTION

SHEET 276.02 - 04 of 04		
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SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-LG-3281 / 01-LIT-3281A / 01-LSL-3281 / 01-LSH-3281				
	Service Description	EXISTING CONDENSATE TANK 2 CONDENSATE - LEVEL				
	P&ID Number	PI6				
	Line No. Or Vessel No.					
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
Process Data	Fluid | Fluid State	WATER | LIQUID				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	GPM				
	Inlet Pressure	PSIG		5		
	Outlet Pressure	PSIG				
	Temperature	°F		175		
	Level	FT	0		11	
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Body	Type	MAGNETIC LEVEL BLIND CHAMBER				
	Chamber Material	304 STAINLESS STEEL				
	Mounting Style / Connection Size	SIDE/SIDE / 2" RF SLIP ON FLANGE (NOTE 2)				
	Flange Rating / Flange Material	ANSI 150 / 304 STAINLESS STEEL				
	Measurement Length "L"	0-11 FT				
	Float Chamber / Float Material	3" PIPE WITH VENT AND DRAIN FLANGE / 304 STAINLESS STEEL				
	Temperature Range	-320°F to 1000°F				
	Pressure Range	FULL VACUUM to 4500 PSIG				
Transmitter	Type	GUIDED WAVE RADAR				
	Linearity	<0.1% OF PROBE LENGTH OR 0.1" WHICHEVER IS GREATER				
	Repeatability	<0.1"				
	Communications Protocal	HART				
	Output	4-20mA				
	Damping	ADJUSTABLE 0 - 10 S				
	Ambient Temperature / Operating Press	-40° to 175°F / - - -				
	Housing Material / Mounting	CAST ALLUMINUM / INTEGRAL				
	Power	24 VDC				
Indication/Scale	Indicators	METAL FLAG (RED/WHITE)				
	Scale	100% OF SPAN				
	Float Type	MAGNETIC FLUX RING				
Switch	Quantity	2				
	Type	MAGNETICALLY ACTUATED, BI-STABLE CAM DRIVE SNAP ACTION SWITCH				
		TWO SPDT 10.1 AMP				
	Max Dead Band	±0.75" FLOAT TRAVEL				
	Temperature Range	-58°F to 392°F				
	Enclosure Rating	NEMA 4X				
	Enclosure Material	CAST ALUMINUM				
Options	High Temperature Insulation	YES				
	Manufacturer	Magnetrol				
	Model No.	AURORA**				
	Transmitter Model No.	Eclipse 705**				

Notes:
1. ACCEPTABLE MANUFACTURER: K-TEK.
2. CONTRACTOR TO VERIFY CONNECTION SIZE WITH EXISTING EQUIPMENT.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
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OGDEN, UTAH

LEVEL (MAGNETOSTRICTIVE)

NO.	BY	DATE	DESCRIPTION

SHEET 276.03 - 01 of 04	
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SCI PROJECT NO. 21937.01.00	
BY JWS / CHK'D SAW	APPR. TJM

General	Tag Number		01-LIT-2111B			
	Service Description		EXISTING DEAERATOR 1 DEAERATOR - LEVEL			
	P&ID Number		PI5			
	Line No. Or Vessel No.					
	Pipe Class Specification					
	Electrical Class | Power Supply		|			
Process Data	Fluid | Fluid State		WATER | LIQUID			
	Operating Conditions		Units	Minimum	Normal	Maximum	Design
	Flow Rate		GPM				
	Inlet Pressure		PSIG		5		
	Outlet Pressure		PSIG				
	Temperature		°F		218		
	Level		FT	0		11	
	Sp Wt / Sp Grav	Mol Wt					
	Viscosity / Sp Heat						
Body	Type		MAGNETIC LEVEL BLIND CHAMBER				
	Chamber Material		304 STAINLESS STEEL				
	Mounting Style / Connection Size		SIDE/SIDE / 2" RF SLIP ON FLANGE (NOTE 2)				
	Flange Rating / Flange Material		ANSI 150 / 304 STAINLESS STEEL				
	Measurement Length "L"		0-11 FT				
	Float Chamber / Float Material		3" WITH VENT AND DRAIN FLANGE / 304 STAINLESS STEEL				
	Temperature Range		-320°F to 1000°F				
	Pressure Range		FULL VACUUM to 4500 PSIG				
Transmitter	Type		GUIDED WAVE RADAR				
	Linearity		<0.1% OF PROBE LENGTH OR 0.1"				
	Repeatability		<0.1"				
	Communications Protocal		HART				
	Output		4-20mA				
	Damping		0 - 45 SECONDS				
	Ambient Temperature / Operating Press		-40° to 175°F / - - -				
	Housing Material / Mounting		CAST ALLUMINUM / INTEGRAL				
	Power		24VDC				
Indication/Scale	None Required						
Switch	None Required						
Options	High Temperature Insulation		YES				
	Manufacturer		Magnetrol				
	Model No.		_____**				
	Transmitter Model No.		Eclipse 705**				

Notes:
1. ACCEPTABLE MANUFACTURER: K-TEK.
2. CONTRACTOR TO VERIFY CONNECTION SIZE WITH EXISTING EQUIPMENT.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
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OGDEN, UTAH

LEVEL (MAGNETOSTRICTIVE)

NO.	BY	DATE	DESCRIPTION

SHEET 276.03 - 02 of 04	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-LIT-2211B
	Service Description	EXISTING DEAERATOR 2 DEAERATOR - LEVEL
	P&ID Number	PI7
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		5		
Outlet Pressure	PSIG				
Temperature	°F		175		
Level	FT	0		11	
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Type	MAGNETIC LEVEL BLIND CHAMBER
	Chamber Material	304 STAINLESS STEEL
	Mounting Style / Connection Size	SIDE/SIDE / 2" RF SLIP ON FLANGE (NOTE 2)
	Flange Rating / Flange Material	ANSI 150 / 304 STAINLESS STEEL
	Measurement Length "L"	0-11 FT
	Float Chamber / Float Material	3" WITH VENT AND DRAIN FLANGE / 304 STAINLESS STEEL
	Temperature Range	-320°F to 1000°F
	Pressure Range	FULL VACUUM to 4500 PSIG
Transmitter	Type	GUIDED WAVE RADAR
	Linearity	<0.1% OF PROBE LENGTH OR 0.1"
	Repeatability	<0.1"
	Communications Protocal	HART
	Output	4-20mA
	Damping	0 - 45 SECONDS
	Ambient Temperature / Operating Press	-40° to 175°F / - - -
	Housing Material / Mounting	CAST ALLUMINUM / INTEGRAL
	Power	24VDC
Indication/Scale	None Required	
Switch	None Required	
Options	High Temperature Insulation	YES
	Manufacturer	Magnetrol
	Model No.	_____**
	Transmitter Model No.	Eclipse 705**

Notes:
1. ACCEPTABLE MANUFACTURER: K-TEK.
2. CONTRACTOR TO VERIFY CONNECTION SIZE WITH EXISTING EQUIPMENT.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

LEVEL (MAGNETOSTRICTIVE)

NO.	BY	DATE	DESCRIPTION

SHEET 276.03 - 03 of 04		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-LIT-3181B
	Service Description	EXISTING CONDENSATE TANK 1 CONDENSATE - LEVEL
	P&ID Number	PI4
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		5		
Outlet Pressure	PSIG				
Temperature	°F		175		
Level	FT	0		11	
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Type	MAGNETIC LEVEL BLIND CHAMBER
	Chamber Material	304 STAINLESS STEEL
	Mounting Style / Connection Size	SIDE/SIDE / 2" RF SLIP ON FLANGE (NOTE 2)
	Flange Rating / Flange Material	ANSI 150 / 304 STAINLESS STEEL
	Measurement Length "L"	0-11 FT
	Float Chamber / Float Material	3" WITH VENT AND DRAIN FLANGE / 304 STAINLESS STEEL
	Temperature Range	-320°F to 1000°F
	Pressure Range	FULL VACUUM to 4500 PSIG
Transmitter	Type	GUIDED WAVE RADAR
	Linearity	<0.1% OF PROBE LENGTH OR 0.1"
	Repeatability	<0.1"
	Communications Protocal	HART
	Output	4-20mA
	Damping	0 - 45 SECONDS
	Ambient Temperature / Operating Press	-40° to 175°F / - - -
	Housing Material / Mounting	CAST ALLUMINUM / INTEGRAL
	Power	24VDC
Indication/Scale	None Required	
Switch	None Required	
Options	High Temperature Insulation	YES
	Manufacturer	Magnetrol
	Model No.	_____**
	Transmitter Model No.	Eclipse 705**

Notes:
1. ACCEPTABLE MANUFACTURER: K-TEK.
2. CONTRACTOR TO VERIFY CONNECTION SIZE WITH EXISTING EQUIPMENT.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

LEVEL (MAGNETOSTRICTIVE)

NO.	BY	DATE	DESCRIPTION

SHEET 276.03 - 04 of 04		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-LIT-3281B				
	Service Description	EXISTING CONDENSATE TANK 2 CONDENSATE - LEVEL				
	P&ID Number	PI6				
	Line No. Or Vessel No.					
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
Process Data	Fluid | Fluid State	WATER | LIQUID				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	GPM				
	Inlet Pressure	PSIG		5		
	Outlet Pressure	PSIG				
	Temperature	°F		175		
	Level	FT	0		11	
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Body	Type	MAGNETIC LEVEL BLIND CHAMBER				
	Chamber Material	304 STAINLESS STEEL				
	Mounting Style / Connection Size	SIDE/SIDE / 2" RF SLIP ON FLANGE (NOTE 2)				
	Flange Rating / Flange Material	ANSI 150 / 304 STAINLESS STEEL				
	Measurement Length "L"	0-11 FT				
	Float Chamber / Float Material	3" WITH VENT AND DRAIN FLANGE / 304 STAINLESS STEEL				
	Temperature Range	-320°F to 1000°F				
	Pressure Range	FULL VACUUM to 4500 PSIG				
Transmitter	Type	GUIDED WAVE RADAR				
	Linearity	<0.1% OF PROBE LENGTH OR 0.1"				
	Repeatability	<0.1"				
	Communications Protocal	HART				
	Output	4-20mA				
	Damping	0 - 45 SECONDS				
	Ambient Temperature / Operating Press	-40° to 175°F / - - -				
	Housing Material / Mounting	CAST ALLUMINUM / INTEGRAL				
	Power	24VDC				
Indication/Scale	None Required					
Switch	None Required					
Options	High Temperature Insulation	YES				
	Manufacturer	Magnetrol				
	Model No.	_____**				
	Transmitter Model No.	Eclipse 705**				

Notes:
1. ACCEPTABLE MANUFACTURER: K-TEK.
2. CONTRACTOR TO VERIFY CONNECTION SIZE WITH EXISTING EQUIPMENT.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

TEMPERATURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 301.00 - 01 of 04	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS / CHK'D SAW	APPR. TJM

General	Tag Number	01-TT-6261
	Service Description	EXISTING BOILER 2 FLUE GAS - ECONOMIZER INLET TEMP
	P&ID Number	PI2
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	50 - 300 °F
Process Data	Fluid | Fluid State	FLUE GAS | GAS

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG				
Outlet Pressure	PSIG				
Temperature	°F		228	250	
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	3-WIRE RTD
	Sensor Type	Pt 100 (ohm= 0.00385)
	Accuracy	± 0.02% OF SPAN
	Stability	± 0.1% READING OR 0.1°C, WHICHEVER IS GREATER, FOR 24 MONTHS
	Temperature Limits	-4 TO 185 °F
	Output Signal	4-20 mA
	Output	LINEAR WITH TEMPERATURE
	Communications Protocol	HART
	Power Supply	24 VDC
	Failure Mode	HIGH
	Electrical Connection	1/2" - 14 NPT
	Housing Material	LOW-COPPER ALUMINUM
	Enclosure Rating	NEMA 4X
Options	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Local Indicator	YES
	Hazardous Locations Certification	NONE
	Configuration Options	NONE
	Manufacturer	Rosemount
	Model No.	3244**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

TEMPERATURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 301.00 - 02 of 04	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-TT-6262
	Service Description	EXISTING BOILER 2 FLUE GAS - ECONOMIZER OUTLET TEMP
	P&ID Number	PI2
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	50 - 300 °F
Process Data	Fluid | Fluid State	FLUE GAS | GAS

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG				
Outlet Pressure	PSIG				
Temperature	°F		228	250	
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	3-WIRE RTD
	Sensor Type	Pt 100 (ohm= 0.00385)
	Accuracy	± 0.02% OF SPAN
	Stability	± 0.1% READING OR 0.1°C, WHICHEVER IS GREATER, FOR 24 MONTHS
	Temperature Limits	-4 TO 185 °F
	Output Signal	4-20 mA
	Output	LINEAR WITH TEMPERATURE
	Communications Protocol	HART
	Power Supply	24 VDC
	Failure Mode	HIGH
	Electrical Connection	1/2" - 14 NPT
	Housing Material	LOW-COPPER ALUMINUM
	Enclosure Rating	NEMA 4X
Options	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Local Indicator	YES
	Hazardous Locations Certification	NONE
	Configuration Options	NONE
	Manufacturer	Rosemount
	Model No.	3244**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

TEMPERATURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 301.00 - 03 of 04	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS / CHK'D SAW	APPR. TJM

General	Tag Number	01-TT-6361
	Service Description	EXISTING BOILER 3 FLUE GAS - ECONOMIZER INLET TEMP
	P&ID Number	PI3
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	50 - 300 °F
Process Data	Fluid | Fluid State	FLUE GAS | GAS

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG				
Outlet Pressure	PSIG				
Temperature	°F		220		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	3-WIRE RTD
	Sensor Type	Pt 100 (ohm= 0.00385)
	Accuracy	± 0.02% OF SPAN
	Stability	± 0.1% READING OR 0.1°C, WHICHEVER IS GREATER, FOR 24 MONTHS
	Temperature Limits	-4 TO 185 °F
	Output Signal	4-20 mA
	Output	LINEAR WITH TEMPERATURE
	Communications Protocol	HART
	Power Supply	24 VDC
	Failure Mode	HIGH
	Electrical Connection	1/2" - 14 NPT
	Housing Material	LOW-COPPER ALUMINUM
	Enclosure Rating	NEMA 4X
Options	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Local Indicator	YES
	Hazardous Locations Certification	NONE
	Configuration Options	NONE
	Manufacturer	Rosemount
	Model No.	3244**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

TEMPERATURE TRANSMITTER

NO.	BY	DATE	DESCRIPTION

SHEET 301.00 - 04 of 04	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS / CHK'D SAW	APPR. TJM

General	Tag Number	01-TT-6362
	Service Description	EXISTING BOILER 3 FLUE GAS - ECONOMIZER OUTLET TEMP
	P&ID Number	PI3
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	50 - 300 °F
Process Data	Fluid | Fluid State	FLUE GAS | GAS

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG				
Outlet Pressure	PSIG				
Temperature	°F		220		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	3-WIRE RTD
	Sensor Type	Pt 100 (ohm= 0.00385)
	Accuracy	± 0.02% OF SPAN
	Stability	± 0.1% READING OR 0.1°C, WHICHEVER IS GREATER, FOR 24 MONTHS
	Temperature Limits	-4 TO 185 °F
	Output Signal	4-20 mA
	Output	LINEAR WITH TEMPERATURE
	Communications Protocol	HART
	Power Supply	24 VDC
	Failure Mode	HIGH
	Electrical Connection	1/2" - 14 NPT
	Housing Material	LOW-COPPER ALUMINUM
	Enclosure Rating	NEMA 4X
Options	Mounting	MTG HARDWARE FOR 2" PIPE STAND
	Local Indicator	YES
	Hazardous Locations Certification	NONE
	Configuration Options	NONE
	Manufacturer	Rosemount
	Model No.	3244**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

TEMPERATURE (GAUGE)

NO.	BY	DATE	DESCRIPTION

SHEET 391.00 - 01 of 01	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS / CHK'D SAW	APPR. TJM

General	Tag Number	01-TI-5110
	Service Description	EXISTING DEAERATOR 1 FEEDWATER - TEMPERATURE INDICATION
	P&ID Number	PI5
	Line No. Or Vessel No.	4"-FW-000
	Pipe Class Specification	
	Electrical Class | Power Supply	|
	Range	50-300 °F
	Bore	.260"
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM				
Inlet Pressure	PSIG		153		
Outlet Pressure	PSIG				
Temperature	°F		218		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	Type	BIMETAL, THERMOMETER
	Mounting	ADJUSTABLE ANGLE (LOCAL)
	Dial	5" MAXIVISION
	Window	POLYCARBONATE
	Accuracy	±1% FULL-SPAN
	Liquid-Filled	SILICONE
	Max Ambient Temperature Range	-40° to 200°F; LIQUID FILLED -40° to 150°F
	Case	304 STAINLESS STEEL
	Stem	THREADED
	Stem Material	304 STAINLESS STEEL
	Stem Thread	1/2" NPT
Well or Tube	Included	YES
	Type	TAPERED SHANK
	Material	304 STAINLESS STEEL
	Internal Thread	1/2" NPSM
	Insertion Length	2"
	Process Connection	THREADED 1/2" NPT
Options	Lagging	NONE
	Cap & Chain	NONE
	Manufacturer	Ashcroft
	Model No.	50EL**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY HEAT PLANT CONTROLS & FEEDWATER/ CONDENSATE PUMP UPGRADE OGDEN, UTAH	ANALYZER (OXYGEN)				SHEET 409.01 - 01 of 03		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-AIT-6163 / 01-AE-6163
	Service Description	EXISTING BOILER 1 FLUE GAS - OXYGEN
	P&ID Number	PI1
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Characteristics	Repeatability	± 0.5% MAX VALUE OF SET RANGE (LESS THAN 0 to 25% RANGE)
	Linearity	± 1% MAX VALUE OF SET RANGE (LESS THAN 0 TO 25% RANGE)
	Drift	BOTH ZERO AND SPAN ±2% MAX VALUE OF SET RANGE /MONTH
	Response Time	90% WITHIN 5 SECONDS
Converter	Model Number	ZR402G**
	Display	LCD DISPLAY 300x240 WITH TOUCH SCREEN
	Power Supply	
	Power Consumption	100 W (ORDINARY USE), MAX. 300 W
	Output Signal	4 - 20 mA DC
	Contact Input	TWO POINTS
	Panel Letter	ENGLISH
	Style Code	
	Digital Communication	HART
	Auto Calibration Output	TWO POINTS
Calibration Equipment	Flow Setting Unit	MODEL NO: ZA8F (INSTRUMENT AIR PROVIDED FOR MANUAL CALIBRATION)
	Tube Connections	1/4" NPT FEMALE
	Air Set	1/4" NPT FEMALE
	Sealed Zero Gas Cylinder	3.4 LITER 0.95 TO 1.0 VOL% O2 REMAINING N2
	Cylinder Pressure Regulator	INLET W22 14 THREADS, OUTLET 1/4" NPT FEMALE
	Case Assembly	INCLUDED
	Check Valve	NO
	Stop Valve	YES
Detector	Model Number	ZR22G**
	Sample Gas Temp.	0 to 700°C
	Smpl Gas Press	-5 to 250 kPa
	Insertion Length	**
	Ambient Temperature	-20°C to 150°C
	Material in Contact with Gas	SUS316, ZIRCONIA, SUS304 (FLANGE)
	Installation	FLANGE MOUNTING
	Flange	ANSI CLASS 150 4 RF SUS304
	Probe Mounting Angle	**
	Connection	1/2" NPT
	Construction	NON-EXPLOSION PROOF JIS C0920/EQUIVALENT TO IP44D
	Terminal Box Case Material	ALLUMINUM ALLOY
	Manufacturer	Yokogawa
	Model No.	ZR402G** / ZR22G**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY HEAT PLANT CONTROLS & FEEDWATER/ CONDENSATE PUMP UPGRADE OGDEN, UTAH	ANALYZER (OXYGEN)				SHEET 409.01 - 02 of 03		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-AIT-6263 / 01-AE-6263
	Service Description	EXISTING BOILER 2 FLUE GAS - OXYGEN
	P&ID Number	PI2
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Characteristics	Repeatability	± 0.5% MAX VALUE OF SET RANGE (LESS THAN 0 to 25% RANGE)
	Linearity	± 1% MAX VALUE OF SET RANGE (LESS THAN 0 TO 25% RANGE)
	Drift	BOTH ZERO AND SPAN ±2% MAX VALUE OF SET RANGE /MONTH
	Response Time	90% WITHIN 5 SECONDS
Converter	Model Number	ZR402G**
	Display	LCD DISPLAY 300x240 WITH TOUCH SCREEN
	Power Supply	
	Power Consumption	100 W (ORDINARY USE), MAX. 300 W
	Output Signal	4 - 20 mA DC
	Contact Input	TWO POINTS
	Panel Letter	ENGLISH
	Style Code	
	Digital Communication	HART
	Auto Calibration Output	TWO POINTS
Calibration Equipment	Flow Setting Unit	MODEL NO: ZA8F (INSTRUMENT AIR PROVIDED FOR MANUAL CALIBRATION)
	Tube Connections	1/4" NPT FEMALE
	Air Set	1/4" NPT FEMALE
	Sealed Zero Gas Cylinder	3.4 LITER 0.95 TO 1.0 VOL% O2 REMAINING N2
	Cylinder Pressure Regulator	INLET W22 14 THREADS, OUTLET 1/4" NPT FEMALE
	Case Assembly	INCLUDED
	Check Valve	NO
	Stop Valve	YES
Detector	Model Number	ZR22G**
	Sample Gas Temp.	0 to 700°C
	Smpl Gas Press	-5 to 250 kPa
	Insertion Length	**
	Ambient Temperature	-20°C to 150°C
	Material in Contact with Gas	SUS316, ZIRCONIA, SUS304 (FLANGE)
	Installation	FLANGE MOUNTING
	Flange	ANSI CLASS 150 4 RF SUS304
	Probe Mounting Angle	**
	Connection	1/2" NPT
	Construction	NON-EXPLOSION PROOF JIS C0920/EQUIVALENT TO IP44D
	Terminal Box Case Material	ALLUMINUM ALLOY
	Manufacturer	Yokogawa
	Model No.	ZR402G** / ZR22G**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY HEAT PLANT CONTROLS & FEEDWATER/ CONDENSATE PUMP UPGRADE OGDEN, UTAH	ANALYZER (OXYGEN)				SHEET 409.01 - 03 of 03		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-AIT-6363 / 01-AE-6363
	Service Description	EXISTING BOILER 3 FLUE GAS - OXYGEN
	P&ID Number	PI3
	Line No. Or Vessel No.	
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Characteristics	Repeatability	± 0.5% MAX VALUE OF SET RANGE (LESS THAN 0 to 25% RANGE)
	Linearity	± 1% MAX VALUE OF SET RANGE (LESS THAN 0 TO 25% RANGE)
	Drift	BOTH ZERO AND SPAN ±2% MAX VALUE OF SET RANGE /MONTH
	Response Time	90% WITHIN 5 SECONDS
Converter	Model Number	ZR402G**
	Display	LCD DISPLAY 300x240 WITH TOUCH SCREEN
	Power Supply	
	Power Consumption	100 W (ORDINARY USE), MAX. 300 W
	Output Signal	4 - 20 mA DC
	Contact Input	TWO POINTS
	Panel Letter	ENGLISH
	Style Code	
	Digital Communication	HART
	Auto Calibration Output	TWO POINTS
Calibration Equipment	Flow Setting Unit	MODEL NO: ZA8F (INSTRUMENT AIR PROVIDED FOR MANUAL CALIBRATION)
	Tube Connections	1/4" NPT FEMALE
	Air Set	1/4" NPT FEMALE
	Sealed Zero Gas Cylinder	3.4 LITER 0.95 TO 1.0 VOL% O2 REMAINING N2
	Cylinder Pressure Regulator	INLET W22 14 THREADS, OUTLET 1/4" NPT FEMALE
	Case Assembly	INCLUDED
	Check Valve	NO
	Stop Valve	YES
Detector	Model Number	ZR22G**
	Sample Gas Temp.	0 to 700°C
	Smpl Gas Press	-5 to 250 kPa
	Insertion Length	**
	Ambient Temperature	-20°C to 150°C
	Material in Contact with Gas	SUS316, ZIRCONIA, SUS304 (FLANGE)
	Installation	FLANGE MOUNTING
	Flange	ANSI CLASS 150 4 RF SUS304
	Probe Mounting Angle	**
	Connection	1/2" NPT
	Construction	NON-EXPLOSION PROOF JIS C0920/EQUIVALENT TO IP44D
	Terminal Box Case Material	ALLUMINUM ALLOY
	Manufacturer	Yokogawa
	Model No.	ZR402G** / ZR22G**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (GLOBE)

NO.	BY	DATE	DESCRIPTION

SHEET 501.00 - 01 of 02		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-FCV-1211
	Accessory Tags	01-ZT-1211
	Service Description	EXISTING BOILER 2 FEEDWATER - FLOW CONTROL
	P&ID Number	PI2
	Line No. Or Vessel No.	2"-FW-005
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM	10	50	81	
Inlet Pressure	PSIG	126	126	126	
Outlet Pressure	PSIG	120	120	120	
Temperature	°F	180	180	180	
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Style	GLOBE
	End Connection	RAISED FACE FLANGE
	Rating	CL150
	Port Size	2 5/16"
	Valve Cv	**
	Body Material / Bonnet Style	WCC STEEL / PLAIN
	Characteristic / Trim Number	EQUAL PERCENTAGE / 1
	Cage Material / Retainer Material	CB7Cu-1 SST /
	Seat Material / Seat Ring Material	/ 416 STAINLESS STEEL
	Plug Material / Stem Material	416 STAINLESS STEEL / 316 STAINLESS STEEL
	Flow Direction	DOWN
	Required Seat Tightness	ANSI CLASS II
	Max Allowable Sound Level (dBA)	< 85 dBA
Actuator	Type	ELECTRIC - CONTINUOUS MODULATING SERVICE
	Push-Down To	CLOSE
	Fail Valve	LAST
	Close At / Open At	** /**
	Handwheel	YES, DE-CLUTCHABLE
	Input Power / Control Power	230 VAC/3 Ph/60 Hz / 120 VAC/1 Ph/60 Hz
	Command Input	4 - 20 mA
	Feedback	4 - 20 mA
	Auto Status	YES, DRY CONTACT RATED 120VAC @ 5 AMPS
Options		
	Manufacturer	Fisher
	Model No.	ED**
	Actuator Manufacturer	Limitorque
	Actuator Model No.	L120**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (GLOBE)

NO.	BY	DATE	DESCRIPTION

SHEET 501.00 - 02 of 02	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-FCV-1311
	Accessory Tags	01-ZT-1311
	Service Description	EXISTING BOILER 3 FEEDWATER - FLOW CONTROL
	P&ID Number	PI3
	Line No. Or Vessel No.	2"-FW-008
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM	10	50	81	
Inlet Pressure	PSIG	126	126	126	
Outlet Pressure	PSIG	120	120	120	
Temperature	°F	180	180	180	
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Style	GLOBE
	End Connection	RAISED FACE FLANGE
	Rating	CL150
	Port Size	2 5/16"
	Valve Cv	**
	Body Material / Bonnet Style	WCC STEEL / PLAIN
	Characteristic / Trim Number	EQUAL PERCENTAGE / 1
	Cage Material / Retainer Material	CB7Cu-1 SST /
	Seat Material / Seat Ring Material	/ 416 STAINLESS STEEL
	Plug Material / Stem Material	416 STAINLESS STEEL / 316 STAINLESS STEEL
	Flow Direction	DOWN
	Required Seat Tightness	ANSI CLASS II
	Max Allowable Sound Level (dBA)	< 85 dBA
Actuator	Type	ELECTRIC - CONTINUOUS MODULATING SERVICE
	Push-Down To	CLOSE
	Fail Valve	LAST
	Close At / Open At	** /**
	Handwheel	YES, DE-CLUTCHABLE
	Input Power / Control Power	230 VAC/3 Ph/60 Hz / 120 VAC/1 Ph/60 Hz
	Command Input	4 - 20 mA
	Feedback	4 - 20 mA
	Auto Status	YES, DRY CONTACT RATED 120VAC @ 5 AMPS
Options		
	Manufacturer	Fisher
	Model No.	ED**
	Actuator Manufacturer	Limitorque
	Actuator Model No.	L120**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (GLOBE)

NO.	BY	DATE	DESCRIPTION

SHEET 501.01 - 01 of 01	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS / CHK'D SAW	APPR. TJM

General	Tag Number	01-FCV-3291
	Accessory Tags	01-ZT-3291
	Service Description	EXISTING CONDENSATE TANK 2 MAKE UP WATER - FLOW CONTROL
	P&ID Number	PI6
	Line No. Or Vessel No.	2"-MUW-013
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM	3.5	3.5	3.5	
Inlet Pressure	PSIG	30	60	90	
Outlet Pressure	PSIG	5	5	5	
Temperature	°F	60	60	60	
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Style	GLOBE
	End Connection	RAISED FACE FLANGE
	Rating	CL150
	Size	2"
	Port Size	2 5/16"
	Valve Cv	**
	Body Material / Bonnet Style	WCC STEEL / PLAIN
	Characteristic / Trim Number	EQUAL PERCENTAGE / 1
	Cage Material / Retainer Material	CB7Cu-1 SST /
	Seat Material / Seat Ring Material	/ 416 STAINLESS STEEL
	Plug Material / Stem Material	416 STAINLESS STEEL / 316 STAINLESS STEEL
	Flow Direction	DOWN
	Required Seat Tightness	ANSI CLASS IV
	Max Allowable Sound Level (dBA)	< 85 dBA
Actuator	Type	ELECTRIC - CONTINUOUS MODULATING SERVICE
	Push-Down To	CLOSE
	Fail Valve	LAST
	Close At / Open At	** /**
	Handwheel	YES, DE-CLUTCHABLE
	Input Power / Control Power	230 VAC/3 Ph/60 Hz / 120 VAC/1 Ph/60 Hz
	Command Input	4 - 20 mA
	Feedback	4 - 20 mA
	Auto Status	YES, DRY CONTACT RATED 120VAC @ 5 AMPS
Options		
	Manufacturer	Fisher
	Model No.	ED**
	Actuator Manufacturer	Limitorque
	Actuator Model No.	L120**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (GLOBE)

NO.	BY	DATE	DESCRIPTION

SHEET 501.21 - 01 of 02	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-LCV-2181
	Accessory Tags	01-ZT-2181
	Service Description	EXISTING DEAERATOR 1 CONDENSATE - LEVEL CONTROL
	P&ID Number	PI5
	Line No. Or Vessel No.	1 1/2"-CND-001
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM	10	15	45	
Inlet Pressure	PSIG	20	20	20	
Outlet Pressure	PSIG	4	4	4	
Temperature	°F	180	180	180	
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Style	GLOBE
	End Connection / Rating	RAISED FACE FLANGE / ANSI CL 150
	Size	1 1/2"
	Port Size	1.5"
	Valve Cv / Valve C1/Km	** / **
	Body Material / Bonnet Style	WC CARBON STEEL / PLAIN
	Characteristic / Trim Number	EQUAL PERCENTAGE / 101
	Cage Material / Retainer Material	/ CB7CU-1 SST
	Seat Material / Seat Ring Material	/ 416 STAINLESS STEEL
	Plug Material / Stem Material	416 STAINLESS STEEL / 316 STAINLESS STEEL
	Flow Direction	UP
	Required Seat Tightness	ANSI CLASS IV
	Max. Allowable Sound Level (dBA)	<85 DBA
Actuator	Type	ELECTRIC - CONTINUOUS OPERATION
	Push-Down to	CLOSE
	Fail Position	LAST
	Close At / Open At	** / **
	Handwheel	YES, DE-CLUTCHABLE
	Input Power / Control Power	230 VAC/3 Ph/60 Hz / 120 VAC/1 Ph/60 Hz
	Command Input	4-20mA
	Feedback	4-20mA
	Auto Status	YES, DRY CONTACT RATED 5AMP @ 120VAC
Options		
	Manufacturer	Fisher
	Model No.	EZ**
	Actuator Manufacturer	Limitorque
	Actuator Model No.	L120**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (GLOBE)

NO.	BY	DATE	DESCRIPTION

SHEET 501.21 - 02 of 02	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-LCV-2281
	Accessory Tags	01-ZT-2281
	Service Description	EXISTING DEAERATOR 2 CONDENSATE - LEVEL CONTROL
	P&ID Number	PI7
	Line No. Or Vessel No.	1 1/2"-CND-012
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM	10	15	45	
Inlet Pressure	PSIG	20	20	20	
Outlet Pressure	PSIG	4	4	4	
Temperature	°F	180	180	180	
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Style	GLOBE
	End Connection / Rating	RAISED FACE FLANGE / ANSI CL 150
	Size	1 1/2"
	Port Size	1.5"
	Valve Cv / Valve C1/Km	** / **
	Body Material / Bonnet Style	WC CARBON STEEL / PLAIN
	Characteristic / Trim Number	EQUAL PERCENTAGE / 101
	Cage Material / Retainer Material	/ CB7CU-1 SST
	Seat Material / Seat Ring Material	/ 416 STAINLESS STEEL
	Plug Material / Stem Material	416 STAINLESS STEEL / 316 STAINLESS STEEL
	Flow Direction	UP
	Required Seat Tightness	ANSI CLASS IV
	Max. Allowable Sound Level (dBA)	<85 DBA
Actuator	Type	ELECTRIC - CONTINUOUS OPERATION
	Push-Down to	CLOSE
	Fail Position	LAST
	Close At / Open At	** / **
	Handwheel	YES, DE-CLUTCHABLE
	Input Power / Control Power	230 VAC/3 Ph/60 Hz / 120 VAC/1 Ph/60 Hz
	Command Input	4-20mA
	Feedback	4-20mA
	Auto Status	YES, DRY CONTACT RATED 5AMP @ 120VAC
Options		
	Manufacturer	Fisher
	Model No.	EZ**
	Actuator Manufacturer	Limitorque
	Actuator Model No.	L120**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (GLOBE)

NO.	BY	DATE	DESCRIPTION

SHEET 501.22 - 01 of 02	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-FV-3181
	Accessory Tags	01-ZSO-3181 01-ZSC-3181
	Service Description	CONDENSATE TANK CONDENSATE RETURN - FLOW
	P&ID Number	PI4
	Line No. Or Vessel No.	4"-CND-001
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	|

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM	25	125	150	
Inlet Pressure	PSIG	7	7	7	
Outlet Pressure	PSIG	5	5	5	
Temperature	°F	175	175	175	
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Style	GLOBE
	End Connection / Rating	RAISED FACE FLANGE / CL 150
	Size	4"
	Port Size	**
	Valve Cv / Valve C1/Km	** / **
	Body Material / Bonnet Style	WC CARBON STEEL / PLAIN
	Characteristic / Trim Number	EQUAL PERCENTAGE / 101
	Cage Material / Retainer Material	/ CB7CU-1 SST
	Seat Material / Seat Ring Material	/ 416 STAINLESS STEEL
	Plug Material / Stem Material	416 STAINLESS STEEL / 316 STAINLESS STEEL
	Flow Direction	UP
	Required Seat Tightness	ANSI CLASS IV
	Max. Allowable Sound Level (dBA)	<85 DBA
Actuator	Type	ELECTRIC - CONTINUOUS OPERATION
	Push-Down to	CLOSE
	Fail Position	LAST
	Close At / Open At	** / **
	Handwheel	YES, DE-CLUTCHABLE
	Input Power / Control Power	230 VAC/3 Ph/60 Hz / 120 VAC/1 Ph/60 Hz
	Command Input	4-20mA
	Feedback	4-20mA
	Auto Status	YES, DRY CONTACT RATED 5AMP @ 120VAC
Options		
	Manufacturer	Fisher
	Model No.	ED**
	Actuator Manufacturer	Limitorque
	Actuator Model No.	L120**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (GLOBE)

NO.	BY	DATE	DESCRIPTION

SHEET 501.22 - 02 of 02	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-FV-3281
	Accessory Tags	01-ZSO-3281 01-ZSC-3281
	Service Description	EXISTING CONDENSATE TANK 2 CONDENSATE RETURN - FLOW
	P&ID Number	PI6
	Line No. Or Vessel No.	4"-CND-090
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	|

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM	24	125	175	
Inlet Pressure	PSIG	7	7	7	150
Outlet Pressure	PSIG	5	5	5	
Temperature	°F	175	175	175	350
Level					

Sp Wt	Sp Grav	Mol Wt			
Viscosity	Sp Heat				

Body	Style	GLOBE
	End Connection / Rating	RAISED FACE FLANGE / CL 150
	Size	4"
	Port Size	**
	Valve Cv / Valve C1/Km	** / **
	Body Material / Bonnet Style	WC CARBON STEEL / PLAIN
	Characteristic / Trim Number	EQUAL PERCENTAGE / 101
	Cage Material / Retainer Material	/ CB7CU-1 SST
	Seat Material / Seat Ring Material	/ 416 STAINLESS STEEL
	Plug Material / Stem Material	416 STAINLESS STEEL / 316 STAINLESS STEEL
	Flow Direction	UP
	Required Seat Tightness	ANSI CLASS IV
	Max. Allowable Sound Level (dBA)	<85 DBA
Actuator	Type	ELECTRIC - CONTINUOUS OPERATION
	Push-Down to	CLOSE
	Fail Position	LAST
	Close At / Open At	** / **
	Handwheel	YES, DE-CLUTCHABLE
	Input Power / Control Power	230 VAC/3 Ph/60 Hz / 120 VAC/1 Ph/60 Hz
	Command Input	4-20mA
	Feedback	4-20mA
	Auto Status	YES, DRY CONTACT RATED 5AMP @ 120VAC
Options		
	Manufacturer	Fisher
	Model No.	ED**
	Actuator Manufacturer	Limitorque
	Actuator Model No.	L120**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (GLOBE)

NO.	BY	DATE	DESCRIPTION

SHEET 501.41 - 01 of 02	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-LCV-2182
	Accessory Tags	01-ZT-2182
	Service Description	EXISTING DEAERATOR 1 CONDENSATE - LEVEL CONTROL
	P&ID Number	PI5
	Line No. Or Vessel No.	1 1/2"-CND-004
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM	45	68	90	
Inlet Pressure	PSIG	20	20	20	
Outlet Pressure	PSIG	4	4	4	
Temperature	°F	180	180	180	
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Style	GLOBE
	End Connection / Rating	RAISED FACE FLANGE / ANSI CL 150
	Size	1 1/2"
	Port Size	1.875"
	Valve Cv / Valve C1/Km	** / **
	Body Material / Bonnet Style	WC CARBON STEEL / PLAIN
	Characteristic / Trim Number	EQUAL PERCENTAGE / 1
	Cage Material / Retainer Material	CB7Cu-1 SST /
	Seat Material / Seat Ring Material	/ 416 STAINLESS STEEL
	Plug Material / Stem Material	416 STAINLESS STEEL / 316 STAINLESS STEEL
	Flow Direction	DOWN
	Required Seat Tightness	ANSI CLASS IV
	Max. Allowable Sound Level (dBA)	<85 DBA
Actuator	Type	ELECTRIC - CONTINUOUS OPERATION
	Push-Down to	CLOSE
	Fail Position	LAST
	Close At / Open At	** / **
	Handwheel	YES, DE-CLUTCHABLE
	Input Power / Control Power	230 VAC/3 Ph/60 Hz / 120 VAC/1 Ph/60 Hz
	Command Input	4-20mA
	Feedback	4-20mA
	Auto Status	YES, DRY CONTACT RATED 5AMP @ 120VAC
Options		
	Manufacturer	Fisher
	Model No.	ET**
	Actuator Manufacturer	Limitorque
	Actuator Model No.	L120**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY **HEAT PLANT CONTROLS & FEEDWATER/** **CONDENSATE PUMP UPGRADE** **OGDEN, UTAH**	**VALVE (GLOBE)**				SHEET 501.41 - 02 of 02		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-LCV-2282				
	Accessory Tags	01-ZT-2282				
	Service Description	EXISTING DEAERATOR 2 CONDENSATE - LEVEL CONTROL				
	P&ID Number	PI7				
	Line No. Or Vessel No.	1 1/2"-CND-010				
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
Process Data	Fluid | Fluid State	WATER | LIQUID				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	GPM	45	68	90	
	Inlet Pressure	PSIG	20	20	20	
	Outlet Pressure	PSIG	4	4	4	
	Temperature	°F	180	180	180	
	Level					
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Body	Style	GLOBE				
	End Connection / Rating	RAISED FACE FLANGE / ANSI CL 150				
	Size	1 1/2"				
	Port Size	1.875"				
	Valve Cv / Valve C1/Km	** / **				
	Body Material / Bonnet Style	WC CARBON STEEL / PLAIN				
	Characteristic / Trim Number	EQUAL PERCENTAGE / 1				
	Cage Material / Retainer Material	CB7Cu-1 SST /				
	Seat Material / Seat Ring Material	/ 416 STAINLESS STEEL				
	Plug Material / Stem Material	416 STAINLESS STEEL / 316 STAINLESS STEEL				
	Flow Direction	DOWN				
	Required Seat Tightness	ANSI CLASS IV				
	Max. Allowable Sound Level (dBA)	<85 DBA				
Actuator	Type	ELECTRIC - CONTINUOUS OPERATION				
	Push-Down to	CLOSE				
	Fail Position	LAST				
	Close At / Open At	** / **				
	Handwheel	YES, DE-CLUTCHABLE				
	Input Power / Control Power	230 VAC/3 Ph/60 Hz / 120 VAC/1 Ph/60 Hz				
	Command Input	4-20mA				
	Feedback	4-20mA				
	Auto Status	YES, DRY CONTACT RATED 5AMP @ 120VAC				
Options						
	Manufacturer	Fisher				
	Model No.	ET**				
	Actuator Manufacturer	Limitorque				
	Actuator Model No.	L120**				

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (GLOBE)

NO.	BY	DATE	DESCRIPTION

SHEET 502.00 - 01 of 03	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-TCV-6111
	Accessory Tags	01-ZT-6111
	Service Description	EXISTING BOILER 1 ECONOMIZER BYPASS - TEMP CONTROL
	P&ID Number	PI1
	Line No. Or Vessel No.	2"-FW-001
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM	10	28	66	
Inlet Pressure	PSIG	126	126	126	
Outlet Pressure	PSIG	120	120	120	
Temperature	°F	180	180	180	
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Style	THREE-WAY
	End Connection	RAISED FACE FLANGE
	Rating	CL150
	Port Size	2 5/16"
	Valve Cv	**
	Body Material / Bonnet Style	WC CARBON STEEL / PLAIN
	Characteristic / Trim Number	LINEAR / 1
	Cage Material / Retainer Material	CB7Cu-1 SST /
	Seat Material / Seat Ring Material	** / 416 STAINLESS STEEL
	Plug Material / Stem Material	416 STAINLESS STEEL / 316 STAINLESS STEEL
	Flow Direction	DIVERGING
	Required Seat Tightness	ANSI CLASS IV
	Max Allowable Sound Level (dBA)	< 85 dBA
Actuator	Type	ELECTRIC - CONTINUOUS OPERATION
	Push-Down To	CLOSE BOTTOM PORT
	Fail Position	LAST
	Close At / Open At	** /**
	Handwheel	YES, DE-CLUTCHABLE
	Input Power / Control Power	230 VAC/3 Ph/60 Hz / 120 VAC/1 Ph/60 Hz
	Command Input	4 - 20 mA
	Feedback	4 - 20 mA
	Auto Status	YES, DRY CONTACT RATED 5AMP @ 120 VAC
Options		
	Manufacturer	Fisher
	Model No.	YS**
	Actuator Manufacturer	Limitorque
	Actuator Model No.	L120**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (GLOBE)

NO.	BY	DATE	DESCRIPTION

SHEET 502.00 - 02 of 03	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-TCV-6211
	Accessory Tags	01-ZT-6211
	Service Description	EXISTING BOILER 2 ECONOMIZER BYPASS - TEMP CONTROL
	P&ID Number	PI2
	Line No. Or Vessel No.	2"-FW-005
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM	10	35	81	
Inlet Pressure	PSIG	120	120	120	
Outlet Pressure	PSIG	118	118	118	
Temperature	°F	180	180	180	
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Style	THREE-WAY
	End Connection	RAISED FACE FLANGE
	Rating	CL150
	Port Size	2 5/16"
	Valve Cv	**
	Body Material / Bonnet Style	WC CARBON STEEL / PLAIN
	Characteristic / Trim Number	LINEAR / 1
	Cage Material / Retainer Material	CB7Cu-1 SST /
	Seat Material / Seat Ring Material	** / 416 STAINLESS STEEL
	Plug Material / Stem Material	416 STAINLESS STEEL / 316 STAINLESS STEEL
	Flow Direction	DIVERGING
	Required Seat Tightness	ANSI CLASS IV
	Max Allowable Sound Level (dBA)	< 85 dBA
Actuator	Type	ELECTRIC - CONTINUOUS OPERATION
	Push-Down To	CLOSE BOTTOM PORT
	Fail Position	LAST
	Close At / Open At	** /**
	Handwheel	YES, DE-CLUTCHABLE
	Input Power / Control Power	230 VAC/3 Ph/60 Hz / 120 VAC/1 Ph/60 Hz
	Command Input	4 - 20 mA
	Feedback	4 - 20 mA
	Auto Status	YES, DRY CONTACT RATED 5AMP @ 120 VAC
Options		
	Manufacturer	Fisher
	Model No.	YS**
	Actuator Manufacturer	Limitorque
	Actuator Model No.	L120**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (GLOBE)

NO.	BY	DATE	DESCRIPTION

SHEET 502.00 - 03 of 03	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-TCV-6311
	Accessory Tags	01-ZT-6311
	Service Description	EXISTING BOILER 3 ECONOMIZER BYPASS - TEMP CONTROL
	P&ID Number	PI3
	Line No. Or Vessel No.	2"-FW-008
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM	10	35	81	
Inlet Pressure	PSIG	126	126	126	
Outlet Pressure	PSIG	120	120	120	
Temperature	°F	180	180	180	
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Style	THREE-WAY
	End Connection	RAISED FACE FLANGE
	Rating	CL150
	Port Size	2 5/16"
	Valve Cv	**
	Body Material / Bonnet Style	WC CARBON STEEL / PLAIN
	Characteristic / Trim Number	LINEAR / 1
	Cage Material / Retainer Material	CB7Cu-1 SST /
	Seat Material / Seat Ring Material	** / 416 STAINLESS STEEL
	Plug Material / Stem Material	416 STAINLESS STEEL / 316 STAINLESS STEEL
	Flow Direction	DIVERGING
	Required Seat Tightness	ANSI CLASS IV
	Max Allowable Sound Level (dBA)	< 85 dBA
Actuator	Type	ELECTRIC - CONTINUOUS OPERATION
	Push-Down To	CLOSE BOTTOM PORT
	Fail Position	LAST
	Close At / Open At	** /**
	Handwheel	YES, DE-CLUTCHABLE
	Input Power / Control Power	230 VAC/3 Ph/60 Hz / 120 VAC/1 Ph/60 Hz
	Command Input	4 - 20 mA
	Feedback	4 - 20 mA
	Auto Status	YES, DRY CONTACT RATED 5AMP @ 120 VAC
Options		
	Manufacturer	Fisher
	Model No.	YS**
	Actuator Manufacturer	Limitorque
	Actuator Model No.	L120**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (BALL/PLUG)

NO.	BY	DATE	DESCRIPTION

SHEET 531.11 - 01 of 02		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-FCV-2191
	Accessory Tags	01-ZT-2191
	Service Description	EXISTING DEAERATOR 1 MAKE UP WATER - FLOW CONTROL
	P&ID Number	PI5
	Line No. Or Vessel No.	2"-MUW-001
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM	2.4	72	148	
Inlet Pressure	PSIG	40	40	40	
Outlet Pressure	PSIG	4	4	4	
Temperature	°F	60	60	60	
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Style	VEE-BALL
	End Connection	FLANGED
	Rating	CL150
	Size	2"
	Port Size	FULL
	Valve Cv	**
	Body Material / Bonnet Style	WC CARBON STEEL / NONE
	Characteristic / Trim Number	MODIFIED EQUAL PERCENTAGE / HD METAL
	Bushing Material / Bearing Material	PEEK / PTFE
	Seal Material / Liner Material	CF10SMnN SST /
	Disk Material / Ball Material	CG8M SST / CRPL
	Flow Direction	FORWARD
	Required Seat Tightness	ANSI CLASS IV
	Max Allowable Sound Level (dBA)	< 85 dBA
Actuator	Type	ELECTRIC - CONTINUOUS OPERATION
	Push-Down To	OPEN
	Fail Position	LAST
	Close At / Open At	** /**
	Handwheel	YES, DE-CLUTCHABLE
	Input Power / Control Power	230 VAC/3 Ph/60 Hz / 120 VAC/1 Ph/60 Hz
	Command Input	4 - 20 mA
	Feedback	4 - 20 mA
	Auto Status	YES, DRY CONTACT RATED 5AMP @ 120VAC
Options		
	Manufacturer	Fisher
	Model No.	V-150**
	Actuator Manufacturer	Limitorque
	Actuator Model No.	L120**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (BALL/PLUG)

NO.	BY	DATE	DESCRIPTION

SHEET 531.11 - 02 of 02		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-FCV-2291
	Accessory Tags	01-ZT-2291
	Service Description	EXISTING DEAERATOR 2 MAKE UP WATER - FLOW CONTROL
	P&ID Number	PI7
	Line No. Or Vessel No.	2"-MUW-012
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM	2.4	72	148	
Inlet Pressure	PSIG	40	40	40	
Outlet Pressure	PSIG	4	4	4	
Temperature	°F	60	60	60	
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Body	Style	VEE-BALL
	End Connection	FLANGED
	Rating	CL150
	Size	2"
	Port Size	FULL
	Valve Cv	**
	Body Material / Bonnet Style	WC CARBON STEEL / NONE
	Characteristic / Trim Number	MODIFIED EQUAL PERCENTAGE / HD METAL
	Bushing Material / Bearing Material	PEEK / PTFE
	Seal Material / Liner Material	CF10SMnN SST /
	Disk Material / Ball Material	CG8M SST / CRPL
	Flow Direction	FORWARD
	Required Seat Tightness	ANSI CLASS IV
	Max Allowable Sound Level (dBA)	< 85 dBA
Actuator	Type	ELECTRIC - CONTINUOUS OPERATION
	Push-Down To	OPEN
	Fail Position	LAST
	Close At / Open At	** /**
	Handwheel	YES, DE-CLUTCHABLE
	Input Power / Control Power	230 VAC/3 Ph/60 Hz / 120 VAC/1 Ph/60 Hz
	Command Input	4 - 20 mA
	Feedback	4 - 20 mA
	Auto Status	YES, DRY CONTACT RATED 5AMP @ 120VAC
Options		
	Manufacturer	Fisher
	Model No.	V-150**
	Actuator Manufacturer	Limitorque
	Actuator Model No.	L120**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (REGULATOR)

NO.	BY	DATE	DESCRIPTION

SHEET 561.00 - 01 of 02		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number		01-PRV-4180			
	Service Description		EXISTING CONDENSATE TANK 1 REGULATOR VALVE - PRESSURE			
	P&ID Number		PI4			
	Line No. Or Vessel No.		1 1/2"-CR-000			
	Pipe Class Specification					
	Electrical Class | Power Supply		|			
Process Data	Fluid | Fluid State		WATER | LIQUID			
	Operating Conditions		Units	Minimum	Normal	Maximum	Design
	Flow Rate		GPM		20		
	Inlet Pressure		PSIG		45		
	Outlet Pressure		PSIG		5		
	Temperature		°F		175		
	Level						
	Sp Wt | Sp Grav	Mol Wt				
	Viscosity | Sp Heat					
Performance/Material	End Connection		NPT SCREWED			
	Rating		150#			
	Size		1 1/2"			
	Port Size		STANDARD			
	No. of Ports		1			
	Body Matl.		STEEL			
	Guiding		TOP			
	Characteristic		DIAPHRAGM			
	Seat Material		METAL (STANDARD)			
	Required Seat Tightness		CLASS IV			
	Max. Allowable Sound Level (dBA)		85 DBA			
	Self Contained		YES			
	Diaphragm Matl.		302 STAINLESS STEEL			
	Diaphragm Rating		STANDARD			
	Set Point		45 PSIG			
Options						
	Manufacturer		Fisher			
	Model No.		95H**			

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (REGULATOR)

NO.	BY	DATE	DESCRIPTION

SHEET 561.00 - 02 of 02		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number		01-PRV-4280			
	Service Description		EXISTING CONDENSATE TANK 2 REGULATOR VALVE - PRESSURE			
	P&ID Number		PI6			
	Line No. Or Vessel No.		1 1/2"-CR-000			
	Pipe Class Specification					
	Electrical Class | Power Supply		|			
Process Data	Fluid | Fluid State		WATER | LIQUID			
	Operating Conditions		Units	Minimum	Normal	Maximum	Design
	Flow Rate		GPM		20		
	Inlet Pressure		PSIG		45		
	Outlet Pressure		PSIG		5		
	Temperature		°F		175		
	Level						
	Sp Wt | Sp Grav	Mol Wt				
	Viscosity | Sp Heat					
Performance/Material	End Connection		NPT SCREWED			
	Rating		150#			
	Size		1 1/2"			
	Port Size		STANDARD			
	No. of Ports		1			
	Body Matl.		STEEL			
	Guiding		TOP			
	Characteristic		DIAPHRAGM			
	Seat Material		METAL (STANDARD)			
	Required Seat Tightness		CLASS IV			
	Max. Allowable Sound Level (dBA)		85 DBA			
	Self Contained		YES			
	Diaphragm Matl.		302 STAINLESS STEEL			
	Diaphragm Rating		STANDARD			
	Set Point		45 PSIG			
Options						
	Manufacturer		Fisher			
	Model No.		95H**			

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (REGULATOR)

NO.	BY	DATE	DESCRIPTION

SHEET 561.01 - 01 of 02	
SPEC. NO. 40 91 00	REV. 0
CONTRACT - - -	DATE 01-28-10
SCI PROJECT NO. 21937.01.00	
BY JWS	CHK'D SAW / APPR. TJM

General	Tag Number	01-PRV-5110
	Service Description	EXISTING DEAERATOR 1 REGULATOR VALVE - PRESSURE
	P&ID Number	PI5
	Line No. Or Vessel No.	2"-FW-000
	Pipe Class Specification	
	Electrical Class | Power Supply	|
Process Data	Fluid | Fluid State	WATER | LIQUID

Operating Conditions	Units	Minimum	Normal	Maximum	Design
Flow Rate	GPM		30		
Inlet Pressure	PSIG		158		
Outlet Pressure	PSIG		4		
Temperature	°F		219		
Level					
Sp Wt / Sp Grav / Mol Wt					
Viscosity / Sp Heat					

Performance/Material	End Connection	NPT SCREWED
	Rating	150#
	Size	2"
	Port Size	STANDARD
	No. of Ports	1
	Body Matl.	STEEL
	Guiding	TOP
	Characteristic	DIAPHRAGM
	Seat Matl.	METAL (STANDARD)
	Required Seat Tightness	CLASS IV
	Self Contained	YES
	Diaphragm Matl.	302 STAINLESS STEEL
	Diaphragm Rating	STANDARD
	Set Point	158 PSIG
	Max. Allowable Sound Level (dBA)	85 DBA
Options		
	Manufacturer	Fisher
	Model No.	95H**

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY
HEAT PLANT CONTROLS & FEEDWATER/
CONDENSATE PUMP UPGRADE
OGDEN, UTAH

VALVE (REGULATOR)

NO.	BY	DATE	DESCRIPTION

SHEET 561.01 - 02 of 02		
SPEC. NO. 40 91 00		REV. 0
CONTRACT - - -		DATE 01-28-10
SCI PROJECT NO. 21937.01.00		
BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number		01-PRV-5210			
	Service Description		EXISTING DEAERATOR 2 REGULATOR VALVE - PRESSURE			
	P&ID Number		PI7			
	Line No. Or Vessel No.		2"-FW-000			
	Pipe Class Specification					
	Electrical Class | Power Supply		|			
Process Data	Fluid | Fluid State		WATER | LIQUID			
	Operating Conditions		Units	Minimum	Normal	Maximum	Design
	Flow Rate		GPM		30		
	Inlet Pressure		PSIG		158		
	Outlet Pressure		PSIG		4		
	Temperature		°F		219		
	Level						
	Sp Wt | Sp Grav	Mol Wt				
	Viscosity | Sp Heat					
Performance/Material	End Connection		NPT SCREWED			
	Rating		150#			
	Size		2"			
	Port Size		STANDARD			
	No. of Ports		1			
	Body Matl.		STEEL			
	Guiding		TOP			
	Characteristic		DIAPHRAGM			
	Seat Matl.		METAL (STANDARD)			
	Required Seat Tightness		CLASS IV			
	Self Contained		YES			
	Diaphragm Matl.		302 STAINLESS STEEL			
	Diaphragm Rating		STANDARD			
	Set Point		158 PSIG			
	Max. Allowable Sound Level (dBA)		85 DBA			
Options						
	Manufacturer		Fisher			
	Model No.		95H**			

Notes:

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY **HEAT PLANT CONTROLS & FEEDWATER/** **CONDENSATE PUMP UPGRADE** **OGDEN, UTAH**	**VALVE (ELECTRIC ACTUATOR)**				SHEET 591.02 - 01 of 03		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-BY-1151				
	Accessory Tags	01-ZT-1151 01-JY-1151				
	Service Description	EXISTING BOILER 1 JACKSHAFT - CONTROL				
	P&ID Number	PI1				
	Line No. Or Vessel No.					
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
Process Data	Fluid | Fluid State	|				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	PPH				
	Inlet Pressure	PSIG				
	Outlet Pressure	PSIG				
	Temperature	°F				
	Level					
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Actuator	Type	ELECTRIC - CONTINUOUS MODULATION				
	Duty Cycle	100%				
	Input Power | Control Power	120 Volt/1 Ph/60 Hz | 120 Volt/1 Ph/60 Hz				
	Current (Amps): Run | Stall	0.9 Amps | 1.2 Amps				
	Torque Min.	1080 In. lbs.				
	Speeds For 90°	12 Sec.				
	Command Input	4-20 mA				
	Feedback	4-20 mA				
	Dynamic Braking	YES				
	Loss of Power	LOCK IN PLACE				
	Loss of Command Signal	RUN TO PRESET (CLOSE)				
	Dry Contact Status	AUTO STATUS - DRY CONTACT RATED 120VAC @ 5 AMP				
Options	Drive Arm and Linkage	REPLACES EXISTING BAILEY PNEUMATIC ACTUATOR - FIELD DETERMINED				
	Manufacturer	Rotork Process Controls				
	Model No.	SM1730**				

Notes:

1. ACCEPTABLE ALTERNATE MANUFACTURERS: BAILEY AND HONEYWELL.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY **HEAT PLANT CONTROLS & FEEDWATER/** **CONDENSATE PUMP UPGRADE** **OGDEN, UTAH**	**VALVE (ELECTRIC ACTUATOR)**				SHEET 591.02 - 02 of 03		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-BY-1251				
	Accessory Tags	01-ZT-1251 01-JY-1251				
	Service Description	EXISTING BOILER 2 JACKSHAFT - CONTROL				
	P&ID Number	PI2				
	Line No. Or Vessel No.					
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
Process Data	Fluid | Fluid State	|				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	PPH				
	Inlet Pressure	PSIG				
	Outlet Pressure	PSIG				
	Temperature	°F				
	Level					
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Actuator	Type	ELECTRIC - CONTINUOUS MODULATION				
	Duty Cycle	100%				
	Input Power | Control Power	120 Volt/1 Ph/60 Hz | 120 Volt/1 Ph/60 Hz				
	Current (Amps): Run | Stall	0.9 Amps | 1.2 Amps				
	Torque Min.	1080 In. lbs.				
	Speeds For 90°	12 Sec.				
	Command Input	4-20 mA				
	Feedback	4-20 mA				
	Dynamic Braking	YES				
	Loss of Power	LOCK IN PLACE				
	Loss of Command Signal	RUN TO PRESET (CLOSE)				
	Dry Contact Status	AUTO STATUS - DRY CONTACT RATED 120VAC @ 5 AMP				
Options	Drive Arm and Linkage	REPLACES EXISTING BAILEY PNEUMATIC ACTUATOR - FIELD DETERMINED				
	Manufacturer	Rotork Process Controls				
	Model No.	SM1730**				

Notes:

1. ACCEPTABLE ALTERNATE MANUFACTURERS: BAILEY AND HONEYWELL.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY **HEAT PLANT CONTROLS & FEEDWATER/** **CONDENSATE PUMP UPGRADE** **OGDEN, UTAH**	**VALVE (ELECTRIC ACTUATOR)**				SHEET 591.02 - 03 of 03		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-BY-1351				
	Accessory Tags	01-ZT-1351 01-JY-1351				
	Service Description	EXISTING BOILER 3 JACKSHAFT - CONTROL				
	P&ID Number	PI3				
	Line No. Or Vessel No.					
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
Process Data	Fluid | Fluid State	|				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	PPH				
	Inlet Pressure	PSIG				
	Outlet Pressure	PSIG				
	Temperature	°F				
	Level					
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Actuator	Type	ELECTRIC - CONTINUOUS MODULATION				
	Duty Cycle	100%				
	Input Power | Control Power	120 Volt/1 Ph/60 Hz | 120 Volt/1 Ph/60 Hz				
	Current (Amps): Run | Stall	0.9 Amps | 1.2 Amps				
	Torque Min.	1080 In. lbs.				
	Speeds For 90°	12 Sec.				
	Command Input	4-20 mA				
	Feedback	4-20 mA				
	Dynamic Braking	YES				
	Loss of Power	LOCK IN PLACE				
	Loss of Command Signal	RUN TO PRESET (CLOSE)				
	Dry Contact Status	AUTO STATUS - DRY CONTACT RATED 120VAC @ 5 AMP				
Options	Drive Arm and Linkage	REPLACES EXISTING BAILEY PNEUMATIC ACTUATOR - FIELD DETERMINED				
	Manufacturer	Rotork Process Controls				
	Model No.	SM1730**				

Notes:

1. ACCEPTABLE ALTERNATE MANUFACTURERS: BAILEY AND HONEYWELL.

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.

Stanley Consultants INC.

WEBER STATE UNIVERSITY **HEAT PLANT CONTROLS & FEEDWATER/** **CONDENSATE PUMP UPGRADE** **OGDEN, UTAH**	**VALVE (ELECTRIC ACTUATOR)**				SHEET 592.01 - 01 of 01		
					SPEC. NO. 40 91 00		REV. 0
	NO.	BY	DATE	DESCRIPTION	CONTRACT - - -		DATE 01-28-10
					SCI PROJECT NO. 21937.01.00		
					BY JWS	CHK'D SAW	APPR. TJM

General	Tag Number	01-FY-1111				
	Accessory Tags	01-ZT-1111				
	Service Description	EXISTING BOILER 1 FEEDWATER - FLOW CONTROL				
	P&ID Number	PI1				
	Line No. Or Vessel No.	2"-FW-001				
	Pipe Class Specification					
	Electrical Class | Power Supply	|				
Process Data	Fluid | Fluid State	WATER | LIQUID				
	Operating Conditions	Units	Minimum	Normal	Maximum	Design
	Flow Rate	GPM	10	50	70	
	Inlet Pressure	PSIG	126	130	130	150
	Outlet Pressure	PSIG	119	119	119	
	Temperature	°F	160	200	200	225
	Level					
	Sp Wt | Sp Grav | Mol Wt					
	Viscosity | Sp Heat					
Actuator	Service	CONTINUOUS OPERATION				
	Type	ELECTRIC				
	Travel	1 1/8"				
	Push Down To	CLOSE				
	Supply	ELECTRIC				
	Input Power / Control Power	230 VAC/3 Ph/60 HZ / 120 VAC/1 Ph/60 HZ				
	Fail Position	LAST				
	Handwheel	YES, DE-CLUTCHABLE				
	Input Signal	4-20mA				
	Access Feedback	4-20mA				
	Dry Contact Status	AUTO STATUS - DRY CONTACT RATED 120VAC @ 5AMP				
Options						
	Manufacturer	Limitorque				
	Model No.	L-120**				

Notes:

1. FIELD VERIFY COMPATIBILITY WITH EXISTING FISHER CONTROLS VALVE.
2. ACCEPTABLE ALTERNATE MANUFACTURERS: BAILEY AND ROTORK PROCESS CONTROLS (MV-1500)

** MANUFACTURER TO VERIFY AND COMPLETE MODEL NUMBER BASED UPON SPECIFIED PROCESS DATA, PERFORMANCE AND MATERIALS, AND OPTIONS.