

Engr Work Order No: 9184

PLAINTIFF'S EXHIBIT

DOW-2413

DOW CHEMICAL U.S.A.
TEXAS OPERATIONS
FREEPORT, TEXAS

JOB SPECIFICATIONS

M101-1082B64 (7701889-P013)

B-300 RIVERWATER PUMP ADDITION

PLANT 8

BLOCK B-300

MARCH 15, 1991

ST0406553

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APPROVED: _____
PROJECT ENGINEER

MANUFACTURING REPRESENTATIVE

ST0406553

MARCH 15, 1991
JOB SPECIFICATIONS
M101-1082B64

MIKE SIMS
DOW CHEMICAL U.S.A.
FREEPORT, TEXAS

1. BID INFORMATION

NOTE: The Bidders shall submit any questions through Purchasing via Fax or written. Purchasing will then obtain the answer from the Project Engineer and send it to all bidders at the same time, thus insuring fair and equitable treatment.

1.1 Submit a lump-sum proposal to furnish all supervision, labor, materials (except Owner-furnished), tools and equipment to perform the work for the Plant B, B-300 Block of the U.S. area of The Dow Chemical Company, Freeport, Texas, ("Owner") as shown and noted on the drawings listed below and as specified herein. The scope of work involves:

The work specifically covered includes but is not limited to the following:

Concrete and Grouting	Painting
Demolition	Piping
Electrical	Structural Steel
Equipment Installation	
Grounding	
Hauling	

1.1.1 The proposal shall be based on all work being performed on a straight-time basis.

1.1.1.1 Hours of work shall be 7:30 a.m. to 4:00 p.m. Monday through Friday (except for Dow holidays). Any exceptions must have prior approval of the Owner's Representative.

1.1.1.2 The bidder shall state the number of days and hours that constitute his normal work week, if different from above.

1.1.1.3 The timing of this project is important and must be completed by May 20, 1991. Bidders shall be prepared to man the job site to ensure completion by this date. The following is a timeline for work to be done on this project:

a) Between the contract award date and May 13, 1991 all work other than making piping and electrical tie-ins must be completed.

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b) Between May 13, 1991 and May 20, 1991 the rest of the project is to be completed. This work will require a scheduled plant shutdown. Dow will inform the Contractor of the shutdown date a minimum of two (2) days before it is to occur. Work occurring during the shutdown needs to be planned so that there will be a minimum plant outage.

1.1.2 If Dow requires work beyond the scope shown in the bid documents, the cost of such change shall be negotiated with the Contractor before the work is done.

1.1.3 If overtime is requested by the Owner, Dow will reimburse the Contractor for wage premium in accordance with Paragraph 4.02 of the contract.

1.1.4 The successful bidder shall break out of his bid the cost of any demolition.

1.1.5 All Contractor-furnished equipment and materials shall be new and free of defects.

1.1.6 The successful bidder shall submit a plan of construction showing, in useful detail and time scale, how he intends to perform the work within the time specified. The plan shall indicate restraints imposed by Contractor-furnished components, and Contractor activities, other Contractors and Dow-furnished components. The plan shall be delivered to the Owner's Representative within 10 days from date of contract.

1.1.7 A job site visit for bidders will be held during the bid period, at which time the following will be discussed:

1.1.7.1 Location of the Contractor parking area, temporary construction office building location, storage area for material and equipment, location and availability of Owner-furnished utilities, and area where safe work permit is not required for cutting and welding operations.

1.1.7.2 The following utilities may be used by the Contractor and will be identified at the job site visit:

120V receptacles
Telephone
River water

1.1.7.2.1 The Contractor shall furnish and install, at his own expense, any necessary distribution facilities from the point of attachment to the Owner's existing facility. The Contractor shall also maintain in a safe operating condition, and remove at the completion of the contract, or earlier if so directed by the Owner's Representative.

1.1.8 If the Contractor's bid is successful, the job will be awarded under Dow Texas Operations "Construction Contract" form of agreement, a copy of which is available from the Owner.

1.1.9 It shall be the Contractor's responsibility to provide adequate storage facilities on the job site for all materials. This shall include weather protection where required, and necessary cribbing to keep materials out of mud and protect them against inclement weather. All handling, receiving and unloading shall be done by the Contractor. Material shall be stored in a neat and orderly manner.

1.1.10 The Contractor shall separate excess and/or unsuitable material resulting from his operations into the following categories:

1.1.10.1 Metal.

1.1.10.2 Lumber.

1.1.10.3 Other trash.

1.1.10.4 All metal shall be cut in lengths (max. of 20') to fit into a dempster.

1.1.10.5 All rebar and anchor bolts must be cut flush with the concrete rubble.

1.1.10.6 The Contractor must acquire a permit number from the Owner's Representative prior to dumping material.

1.1.10.7 Disposition of excess, salvageable items, and/or unsuitable material by the Contractor shall be as follows:

1.1.10.7.1 The metal shall be hauled to a dempster within B-300 Block.

1.1.10.7.2 Lumber shall be hauled to a dempster within B-300 Block.

1.1.10.7.3 Other trash shall be hauled to a dempster within B-300 Block.

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1.1.10.7.4 Concrete, paint skimmings and solvents shall be hauled to B-5100 Block and unloaded. This is approximately 3 miles from the job site.

1.1.10.7.5 All of the above material should not be unloaded until clearance and designated location is given by the Dow representative of that block.

1.1.10.8 The Contractor shall accumulate excess and/or unsuitable material on a daily basis so the job area is maintained in a clean orderly condition. Flammable material containers shall be covered at all times.

1.1.11 The Contractor shall be responsible for furnishing his own construction office, change rooms, lunch rooms, tool rooms, fabrication and material storage facilities, drinking water and sanitary facilities which must be portable chemical type.

1.1.11.1 All temporary buildings supplied by the Contractor must be tied down per Dow Engineering Specification 33-250. Contractor must obtain excavation permit for screw anchor installation.

1.1.11.2 All Contractor-furnished facilities shall be removed at completion of the job.

1.1.11.3 All comfort heaters required during construction shall be Contractor-furnished. Heating units shall be approved by the Owner's Representative.

1.1.12 The Contractor is advised that other Contractors will be working at the job site during the same period he is performing the work included in this contract.

1.1.13 Should the Contractor, as a result of his operations, disturb any areas not included in his scope of work, he shall restore them to their original state insofar as is practical, at his own expense.

1.1.14 The Contractor shall furnish to the Owner's Representative within two weeks after receipt of material, two copies of mill test reports, vendor's certification papers, or certified laboratory reports on Contractor-furnished pipe.

1.2 Drawings & Specifications

1.2.1 The Dow Standards and/or Engineering Specifications referenced in these drawings and job specifications shall be the current edition in effect at the date of this specification.

1.2.2 A complete set of marked-up "as built" drawings are to be maintained by the Contractor during the job. Upon job completion these drawings are to be turned over to the Project Engineer.

1.2.3 Drawing List:

Civil/Structural Drawings

B3-1-1082B64
B3-2-1082B64

Piping plan/section drawings

B4-1-1082B64

Piping isometric drawings

LTW-30-24"-B
LTW-33-20"-B
LTW-37-2"-B
LTW-42-6"-B
LTW-43-2"-B
RW-1A-12"-B

General Mechanical drawings

B5-1-1082B64 (Vendor drawing of P-309D,

Electrical/grounding drawings

B7-1-1082B64	Cover Sheet
B6-F216-1009 REV A	JB Dwgs. for Stop-Start Relays
B6-F216A-1009 REV A	Connections
B6-F216B-1009	JB Door Wiring
B7-2A-1082B64	Grounding Plan
B7-2B-1082B64	Equipment & Cable Plan
B7-2C-1082B64	Cable Tray & Conduit Plan
B7-4-1082B64	Details
B7-4A-1082B64	Details
B7-5-1082B64	Auto Run Indication Connections
B7-5A-1082B64	Current Transducer Connection
B7-5B-1082B64	Handswitch Connections
B7-7002-1082B64 REV A	2400 V Motor Starter Schematic
B7-7002A-1082B64 REV A	2400 V Transformer FDR Schematic
B7-7002B-1082B64 REV A	Motor Starter Schematic
B7-1005-7088	5 KV 1/C 3M Cold Shrink Termination
B7-B307-1000T REV A	Electrical One Line Diagram

Dow Electrical Engineering Practices:

T7D-0001-00	Recommended Electrical Equipment List
T7D-0009-00	General Electrical Specification
T7C-0101-00	Grounding
T7E-0111-01	Ground Resistance Acceptance Testing
T7E-0111-02	Ground Resistance Acceptance Testing Detail
T7D-0301-00	Recommended Electrical Equipment List for Conduit and Cable Tray
T7C-0302-00	Rigid Steel Conduit
T7D-0303-00	Cable Tray Systems - FRP

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1.2.4 Dow Piping Specifications: "B"

1.3 Work Done By Others

1.3.1 Vertical and horizontal control points from which the Contractor shall lay out the work have been established and are shown on Drawing B3-1-1082B64.

1.3.2 The following work will be done by others and is not a part of this contract:

1.3.2.1 All instrumentation work.

1.3.2.2 Lubrication of equipment.

1.3.2.3 The installation of the 2300V 600 HP motor, for pump P-309D and the connection of the power and control cables to the motor's stator leads and low voltage terminal strips.

1.3.2.4 Installation of lugs and termination kits on the 2300V motor feeder AT THE MOTOR END.

1.4 Owner-Furnished Material

1.4.1 Owner-furnished material will be available to the Contractor at the E&CS warehouse/storage yard, B-10601. The Owner's Representative or his designated representative shall release the Owner-furnished material to the Contractor when required.

1.4.2 All required handling, loading, hauling and unloading of Owner-furnished material shall be done by the Contractor.

1.4.3 All surplus Owner-furnished and removed material shall be reported to the Owner's Representative at the job site and returned to B-300.

1.4.4 Owner-furnished material lost or damaged after receipt of same by the Contractor shall be repaired or replaced by the Contractor.

1.4.5 The following material will be Owner-furnished:

1.4.5.1 Dow will furnish all instrumentation.

1.4.5.2 Dow will furnish the following valves (Pipe Spec "B"):

<u>Quantity</u>	<u>Description</u>	<u>P.O. #</u>
(1)	20" V-794	7691175-P006
(1)	20" V-944	7691175-P006
(1)	24" V-944	7691175-P006

1.4.5.3 Dow will furnish the following equipment:

<u>Name</u>	<u>Weight</u>	<u>P.O. #</u>
EJ-309D	Approx. 5 lbs	7690454-P014
P-309D	Pump and base plate = 4450 lbs	7690457-P014

Total = 4,450 lbs

Owner-furnished electrical equipment:

<u>Qty.</u>	<u>Units</u>	<u>Desc.</u>	<u>P.O.#</u>
240	ft.	600V, #18 awg, 12 triad instrument wire	7703388-P070
720	ft.	5KV #1/0 awg power cable (on one reel)	7703388-P070
220	ft.	24" wide cable tray w/ divider	7703385-P070
3	ea.	24" wide 90 deg turn w/div	"
26	ea.	Splice plate	"
13	ea.	Silicon-bronze nut/bolt /washer sets (16 bolts/ set)	"
6	ea.	3M #5622K 5KV termination kit	7703386-P070
1	ea.	3M #5323 5KV motor lead kit	7703386-P070

NOTE: Only 3 of the 6 termination kits will be used on this contract. The Contractor shall return the remaining 3 termination kits and the motor lead kit to the Contract Administrator who shall send them to Mick Bayer (X-7911, OC-401).

4	ea.	HOA selector switch	7703387-P070
1	lot	5KV motor control center	38044007001-P005

1.4.6 Vendor drawings of Owner-furnished material will be made available to the bidders upon request.

1.4.6.1 Vendor drawing of EJ-309D is included in these specifications.

1.4.7 The weights of Owner-furnished material given in the specifications or on the drawings represent the Owner's best available information. It shall be the Contractor's responsibility to verify all weights and provide adequate rigging and hoisting equipment to safely handle all equipment. All weight evidence, such as shipping weights, scale weight tickets, calculated figures, or vendor weights will be made available for this purpose. Any extra work necessary to verify Owner-furnished equipment weights will be handled as an extra to the contract with prior authorization from the Owner's Representative.

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2. SPECIAL CONDITIONS COMMON TO B-300

2.1 All Contractor employees will be required to attend the Contractor Safety Council Indoctrination Program, if proof of attendance is not current. There will also be a block or unit safety orientation prior to beginning work and will require approximately 30 minutes. The Owner's Representative will be given one day advanced notice when the orientation is required.

2.1.1 Strict compliance with all Dow and OSHA Safety Rules, Guidelines, Standards, and Policies is mandatory.

2.1.2 All Contractors and sub-contractor personnel shall be familiar with and shall comply with the rules and procedures in the Safety and Loss Prevention Manual for Contractors issued by Dow Chemical U.S.A., Texas Operations, latest edition.

2.1.3 All Contractor and sub-contractor personnel shall be familiar with and comply with the safety rules and policies of the block or unit. Copies of the safety rules and policies will be furnished during the bidding period. The successful bidder shall return all copies at the completion of this contract to the Owner's Representative. All other bidders shall return all copies to the Owner's Representative as soon as this contract is awarded.

2.1.4 A block sticker will be issued and must be affixed to the hard hats of Contractor personnel.

2.1.5 The Contractor shall keep the site in a neat and clean condition at all times.

2.1.6 Barricades will be erected and maintained by the Contractor to protect personnel and will be placed at the discretion of the Owner's Representative.

2.2 The job site is located in an area designated as hazardous. Daily Safe Work Permits will be required, and may be obtained from B-300, Ernie Schreiber, B-300 Building, Phone 238-7842.

2.2.1 Separate safe work permits are required for:

- a) Welding, cutting or open flame operation.
- b) Spark-producing (non-welding) work.
- c) Critical lifts.
- d) Hot work on electrical circuits.
- e) Excavation

2.2.2 The Contractor shall return completed Safe Work Permits to the Control Center at the end of work each day, or when job is complete. Control Room B-300

2.3 Smoking within the jobsite will not be permitted.

2.3.1 Smoking shall be confined to an area which will be designated at the time of the job site visit.

2.3.2 Smoking on roadways and in vehicles between plant gate and jobsite will not be permitted.

2.4 Safety equipment required:

Hard Hat, Side Shield Safety Glasses, Mouth Bit Respirator (American Optical R-97 with R-722 cartridge or other NIOSH approved).

2.4.1 Respirator cartridge is to be dated with employee name and changed every 6 (six) months or after each use.

2.4.2 Contractor-furnished safety harness will be required when working in elevated positions more than 3' off the ground.

2.4.3 Eye protection for using cutting torch or acetylene welding will be required. No one should perform these operations without wearing cutting glasses with shaded lenses.

2.4.4 All cutting torches must be provided with back flow check valves on both the oxygen and acetylene hoses.

2.4.5 As a minimum, welders must wear side shield safety glasses under their welding helmets while welding or slagging. If helmets are raised for more than a quick inspection of the weld, monogoggles must be worn if work is in a designated monogoggle area.

2.5 The Contractor is to confine his people to the work area, access areas and designated break areas. The Contractor employees are not to wander through the plant.

2.6 Fire lanes, access roads, safety showers, stairways and ladders shall not be blocked by the Contractor's equipment after working hours. During working hours, the Contractor must be able to clear fire lanes, access roads, safety showers, stairways and ladders at any time. They shall not be modified during construction.

2.7 The Contractor is not, under any circumstances, to use firewater from fire hydrants and/or fire monitors except to put out fires or for other emergencies.

2.8 Protective Enclosures for Welding:

2.8.1 All welding, burning, grinding or other spark producing operations shall be contained or extinguished as follows:

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2.8.1.1 TYPE C: Sparks will not be allowed to fall through pipeways, on equipment, wire, cable or other apparatus. All sparks must be extinguished by falling into running water on paved areas or into running water on tarpaulins in grassy areas. Above grade, sparks shall fall into running water on tarpaulins placed over piping, equipment, wire, cable or other apparatus.

2.9 A pre-job safety conference will be conducted and the Unit or Contractor pre-job safety check sheet shall be completed prior to starting any field work.

2.9.1 The successful bidder shall hold weekly safety meetings for their personnel and any sub's personnel. A copy of the minutes of the meeting shall be given to the Owner's Representative who may attend the meeting as required.

2.10 A short safety meeting shall be conducted each day by the foreman of each crew on the job prior to commencing work. This meeting will, as a minimum, detail the tasks to be performed that day, emphasizing the possible hazards involved and safe methods to perform those tasks. Reference is hereby made to the "Safety and Loss Prevention Manual for Contractors" for guidance.

2.11 The Contractor shall provide and maintain adequate barricades and warning lights. All barricades shall be marked with a sign or green tag explaining the hazards and the sign or green tag shall be placed where it will be visible from all directions.

2.12 A weekly head count of Contractor personnel will be taken and recorded on forms supplied by the Owner's Representative.

2.13 Parking for Contractor personnel shall be outside the gate. The Contractor shall provide transportation from the gate to the jobsite.

2.13.1 Where parking is allowed within the Unit, cars and trucks must be parked in designated areas and left unlocked with the key in the ignition. This includes company-owned vehicles such as pickups, trucks and heavy equipment.

2.13.2 No gasoline or diesel powered vehicle will be allowed in the Unit without an I.C.E. permit from Unit personnel. Operation of this equipment, including cranes and backhoe machines, under pipeways is prohibited.

2.13.3 Jump starting of heavy equipment is prohibited under any circumstance. When jump starting is required to move heavy equipment, the equipment shall be jumped with a Dow-furnished battery cart. The use of the cart shall be limited for the sole purpose of getting the vehicle to the place it needs to be repaired (new battery or charged battery).

NO MOTOR VEHICLE IS TO BE LEFT VACANT WITH THE ENGINE RUNNING.

2.14 Sandblasting within the jobsite will be permitted only by a Safe Work Permit from the Owner's Representative.

2.15 All cranes shall be inspected as stipulated in paragraph H.6 of the S&LP Manual for Contractors. In addition, a daily safety inspections shall be made during the time the equipment is on the jobsite.

2.16 Scaffold boards are to have painted ends.

2.17 All Contractors, or foremen with total head count of Contractor employees, must sign in and out daily in the B-300 Control Center and notify the area technician before entering an area. Personnel, required by their specific job assignments to wear mouth-nose respirators, Scott air packs or equivalent, or any other device that depends on an unbroken seal between the mask and the face for protection, must be clean shaven on all skin areas under the seal. This rule applies equally for routine and emergency response situations.

2.18 Only synthetic rope such as polypropylene is to be used.

2.19 Wearing of contact lens is prohibited.

2.20 Gloves shall not be worn when using portable grinders.

2.21 Excavations

2.21.1 The successful bidder shall submit a written excavation safety plan to the Owner's Representative prior to the beginning of any excavation work where personnel will enter the excavation. The plan shall describe in detail the systems to be used on all excavations to provide safe working conditions for all personnel. The safety plan shall name the designated competent person. All excavations greater than five (5) feet in depth where personnel will enter shall be in accordance with OSHA Regulation 29 CFR Part 1926, Subpart P, latest issue, as a minimum. Soil Type C shall be assumed unless otherwise noted.

2.21.2 Excavations in which the Owner determines that sheetpile shoring systems are required will be designed and certified by the Owner.

2.22 All contractors' and Subcontractors' personnel shall be trained in the use of Texas Operations Safety Standard M-75, Lockout/Tagout Requirements, Revised 3-5-91.

2.22.1 Any person who places lockout/tagout devices or performs work requiring lockout/tagout shall be trained in the recognition of applicable hazardous energy sources and type magnitude of the energy available in the plant and the methods and means necessary for energy isolation and control. All personnel who meets this criteria will be classified as "Users."

2.22.2 All other persons performing tasks that will not require the placement of lockout/tagout devices or who will not perform work requiring lockout/tagout will be trained in the utilization of restraining devices and Red Danger Tags. All personnel who meet this criteria will be classified as "Non-Users."

2.22.3 All "Users" and "Non-Users" shall be able to speak, read and understand English and be able to sign his/her name.

2.22.4 Retraining for all personnel is required annually.

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3. CIVIL

3.1 The horizontal and vertical control points from which the Contractor is to lay out his work are shown on Drawing B3-1.

3.2 Concrete

3.2.1 Concrete and embedded items shall be in accordance with Dow Engineering Specification 32-010.

3.2.1.1 The concrete shall be Class I with a broom finish.

3.2.1.2 Contractor shall remove laitance.

3.2.2 Grouting shall be in accordance with Dow Engineering Specification 32-410.

3.2.2.1 The type grout shall be Type A.

3.2.2.2 All shimming of equipment and structural steel to proper elevation, as well as the final 1" of grout (as shown on the drawings) is to be done on this contract.

3.2.2.3 See Drawings B4-1-1082B54 for notes concerning the grouting of P-309D.

3.3 Structural steel shall be in accordance with Dow Spec 38-010.

3.3.1 Steel shall be hot dip galvanized after fabrication.

3.4 Excavation

3.4.1 Excavation shall be in accordance with Dow Engineering Specification 21-100.

3.5 The type fill material shall be sandy clay.

3.6 See the Special Conditions section of this specification for other information concerning excavations.

3.7 All excavation work shall be done by hand. No machine excavation allowed.

4. PIPING

4.1 The term "piping", as used herein and on the piping drawings, is intended to include pipe, valves, fittings, strainers, traps, support elements, and other appurtenances.

4.1.1 Piping shall be fabricated and installed per Dow Engineering Specification 47-110.

4.2 Piping shall be tested as noted on Drawing B4-1-1082B64.

4.3 The welding procedure and technique shall be the responsibility of the Contractor, and shall be submitted to Owner's Representative for approval before any welding is performed. Welding procedures and techniques, unless otherwise specified, shall be optional with the Contractor within code limitations.

4.4 All welders shall be qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. Welder qualification records will be submitted to Dow prior to any welding.

4.5 The Contractor shall not install any flanges other than those shown on the piping drawings without permission from the Owner's Representative's.

4.6 Screwed nipples shall be as specified in the piping specs and complying with the following:

4.6.1 Do not use all-thread or close nipples.

4.6.2 Nipples on insulated lines shall be a minimum of 3" long.

4.6.3 All nipples shall be Schedule 80 minimum.

4.7 The Contractor shall lubricate valve bushings and stems. The Contractor shall also lubricate and tighten valve packing gland bolts.

4.8 On piping isometric detail drawings the bill of materials and pipe cut lengths are assumed to be correct; however; these items are "not guaranteed" and are to be used for estimating purposes "only." The "hard copy" of the piping specification is to be used to determine all valves and piping materials, except for items which are specifically noted on the piping drawings as an exception to the piping specification.

4.9 Piping general notes appear on Drawing B4-1-1082B64.

4.10 Plant water for testing and general construction purposes will be made available to the Contractor without cost but it will be his responsibility to furnish his own distribution facilities and remove them at job completion.

4.10.1 After testing, leaks and other defects detected after piping is placed in service, shall be repaired by the Contractor at no additional cost to the Owner. Before making repair, contact Owner's Representative to ascertain line is safe.

4.11 New gaskets shall be used for every flanged joint unless such assembly is intended solely for fit-up.

4.12 The specified bolt thread lubricant shall be applied to the full length of the threads.

4.13 Burned or otherwise damaged galvanized surfaces shall be repaired in accordance with Dow Engineering Specification 57-271.

4.14 Exposed threads on galvanized pipe connections shall be coated in accordance with Dow Engineering Specification 57-271 on the same day the connection is made.

4.15 Protect flange faces and pipe threads during storage and erection. flange faces and piping shall be clean and free from foreign matter before assembly.

4.16 Miscellaneous

4.16.1 Tie-in connections to existing piping or equipment shall be made on this contract. These connections are identified on the drawings at tie points and noted:

I.E. TP-1.

4.16.1.1 Field check and correct dimensions and elevations of tie points before fabricating pipe that connects to these tie points. The dimensions are approximate and are sufficient for bidding purposes only.

4.17 Remove existing blind flanges or weld caps at tie points as necessary.

4.18 All piping tie-ins require a permit.

4.19 When/if existing Asbestos gaskets are encountered while making piping tie-ins at flanged connections, the following action shall be taken:

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4.19.1 If the gasket freely comes loose from it's mating surfaces it shall be removed by the Contractor, placed in a plastic bag, and given to the Owner's Representative for disposal.

4.19.2 If the gasket is stuck to the mating surfaces, or during gasket removal a portion of the gasket sticks to a mating surface, the Contractor is to notify the Owner's Representative who will in turn notify the Manufacturing Representative who will obtain trained personnel to remove the gasket material and dispose of it.

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5. EQUIPMENT

5.1 Contractor shall inspect all equipment when received and notify the Owner's Representative in writing of any shortages or damaged equipment. Thereafter, the completeness and condition of equipment shall be the Contractor's responsibility.

5.2 Approximate weight of equipment is noted in the Owner-furnished material section of this specification. However, it shall be the Contractor's responsibility to verify weight prior to handling equipment.

5.3 Equipment Setting

5.3.1 Mechanical equipment shall be installed in accordance with Dow Engineering Specification 55-200.

5.3.2 Experienced personnel and adequate handling equipment shall be used for setting equipment.

5.3.3 Elevations and center lines of equipment shall be set using the control point shown on Drawing B3-1-1082B64.

5.3.4 Equipment shall be set level, true to line, at correct elevation and in proper orientation as shown and noted on the installation drawings noted on equipment schedules and as specified herein.

5.3.5 Mechanical equipment shall be set, leveled, aligned, and inspected with precision tools (steel straight edge, dial indicator, graduated machinist levels, etc.). Specifically, all direct-driven equipment, except as noted below, shall be aligned by the use of a dial indicator. The alignment shall be accomplished prior to making up the piping flanges. After units have been aligned, the piping flange bolts shall be tightened while indicator is still on coupling to see that there is no load or strain placed on the equipment by the piping.

5.3.6 Equipment shall be leveled with shims at each anchor bolt (shim on both sides of each bolt) and at intermediate points as required to prevent distortion of the equipment. Shims shall have square cut edges (not trimmed or sheared) and shall be of varying thicknesses to minimize the number of shims required.

5.3.7 Equipment on concrete: Where metal bases, sole plates, base plates, etc., will be in contact with concrete supports or foundations, carbon steel shims shall be used. If the carbon steel shims are not removed after the grout sets, care shall be taken to totally cover exposed surface areas of the shims with grout.

5.3.8 Shims shall be furnished by the Contractor.

5.3.9 Bolts and guide keys shall be coated with FEL PRO C-5A, or Owner approved equal prior to setting equipment.

5.4 Equipment and vessels to be installed are listed in the Owner-furnished material section of this specification.

5.5 Equipment to be set shall be checked by the Contractor to verify anchor bolt, soleplate, piping, and other equipment locations. This shall be done prior to setting the equipment. The Owner's Representative shall be notified immediately if any location discrepancies or interferences are found.

5.6 Lubrication of equipment will be furnished and installed by the Owner.

5.7 Equipment shall be inspected by the Owner's Representative prior to final piping connection. New gaskets shall be used when final piping connection or cover replacement is made.

5.8 Equipment openings shall be weather protected at all times.

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7. ELECTRICAL

7.1 General

7.1.1 Electrical work shall be in accordance with Dow Engineering Practice T7D-0009-00 and this specification.

7.1.2 The Contractor shall coordinate with the Owner's Representative to ensure any field changes are documented on a master set of drawings. A copy of this set shall be forwarded to the project engineer.

7.2 Materials And Workmanship

7.2.1 All material shall be new and free of defects. Where several approved manufacturers are listed for one type of material, all material of that type shall be from the same manufacturer.

7.2.2 All Contractor-furnished materials and equipment shall be from a manufacturer listed on the RECOMMENDED ELECTRICAL EQUIPMENT LIST, Dow Engineering Practice T7D-0001-00 and T7D-0301-00.

7.3 Classification Of Areas

7.3.1 Area of electrical work is not electrically classified.

7.4 Wire and Cable-Wiring Method

7.4.1 Wire and Cable Specifications shall be in accordance with Dow Engineering Practices:

U7D-0423-01	Dow Code A-1 Grounding Conductor
U7D-0425-00	Dow Code C Multi-conductor, 600V
U7D-0468-01	Dow Code ICI SHLD Pair Trand, 600V

7.4.2 Wire insulation shall be maintained to within 1/8 inch of clamp type terminals or box type connectors.

7.4.3 Not more than two wires shall be installed to one screw terminal or terminal block connection.

7.4.4 Electrical wiring terminating in terminal blocks provided with mechanical clamp connectors shall not be lugged. All other electrical wiring terminations shall be with crimp type compression connectors and lugs.

7.4.5 Crimp type compression connectors shall be crimped with the proper tool using the connector manufacturer's recommended die size.

7.4.6 All lugs shall be ring tongue Burndy type YA-L, YAV, YAV-H. Equivalent T&B or Anderson, heavy duty, 600V terminals are acceptable.

7.4.7 Field wire connections to electrical devices providing screws for electrical terminal connections shall be made using T&B nylon insulated Sta-Kon or Burndy nylon hylugs. Crimping of the terminal shall be made using a T&B or Burndy ratcheting tool that assures a complete positive crimp.

7.4.8 For instrument circuits other than thermocouple extension wire, 120VAC or less, wire terminations shall be made with TB forked tongue, self-insulated grip lugs at all items not provided with a mechanical clamp connector. Crimping of the terminal shall be made using a T&B or Burndy ratcheting tool that assures a complete, positive crimp.

7.4.9 Split bolt connectors shall not be used unless specifically called out on drawings.

7.4.10 Splices and terminations shall be made in accordance with the details shown on the drawings. If no details are shown, the manufacturer's instructions shall be used.

7.4.11 Shielded non-power cable shall have its shields grounded as follows, unless otherwise indicated on the drawings.

7.4.11.1 Single twisted pair or triad with an overall shield:

7.4.11.1.1 When the cable is installed in conduit, which has been grounded at both ends to the power ground, the overall shield shall be terminated and grounded only at one end to the instrument/computer ground, preferably at the power source end.

7.4.11.1.2 For other installations, the overall shield shall be terminated and grounded to the power ground at both ends.

7.4.11.2 Multiple twisted pairs or triads with an overall shield: the overall shield shall be terminated and grounded to the power ground at both ends.

7.4.11.3 Multiple individually shielded twisted pairs or triads with an overall shield: the overall shield shall be terminated and grounded at both ends to the power ground: the individual shields shall be terminated and grounded only at one end to the instrument/computer ground, preferably at the power source end.

7.4.11.4 Jumper the ground shield across each connection point where it is broken by junction boxes, etc.

7.4.12 Shielded power cable shall have a continuous shield through all splices and shall be grounded to the equipment ground at each splice and termination point unless otherwise specified.

7.4.13 Continuity and identification of all circuits shall be checked by the Contractor while being witnessed by the Owner's Representative.

7.5 Grounding

7.5.1 All installed equipment and metallic structures shall be grounded to the equipment ground system in accordance with Dow Engineering Practice T7C-0101-00, unless otherwise specified on the drawings.

7.5.2 All galvanized rigid steel and plastic coated rigid steel conduits, either entering cable trays or located underground, shall be grounded in accordance with Dow Engineering Practice T7C-0101-00.

7.5.3 All galvanized rigid steel and plastic coated rigid steel conduits entering a non-metallic junction box shall be grounded together and connected to the back plate with a ground wire, sized in accordance with Dow Engineering Practice T7C-0101-01 for all cases unless otherwise specified on the drawings.

7.6 Conduit

7.6.1 For unclassified and Class 1 Division 2 areas, galvanized rigid steel conduit and enclosures shall be installed in accordance with Dow Engineering Practice T7C-0302-00, unless otherwise noted herein or on the drawings.

7.6.2 Conduit bushings shall be installed for each conduit entering cable trays, junction boxes, or equipment.

7.6.3 The Contractor shall provide insulated conduit bushings or T&B Insuliners for each conduit one inch or larger entering cable trays, junction boxes, or equipment.

7.7 Motor Control, Switchgear, And Power Panels

7.7.1 Owner-furnished motor control centers will have modified NEMA Type B wiring installed, including wiring between all internal control equipment and terminal blocks. The Contractor shall make control connections to terminals and shall extend and connect power wires for the motor directly to the starter lugs.

7.7.2 All bus bar connection joints and splices shall be torqued in accordance with Dow Engineering Practice T7C-0471-01.

7.8 Electrical Testing

7.8.1 General

7.8.1.1 All electrical equipment and installations shall conform to the electrical acceptance tests in accordance with the latest revision of Dow Engineering Practices T7D-0009-00 and U7E-0002-00.

Low Voltage Cable T7E-0411-00

All electrical testing of devices rated greater than 600V shall be conducted under the supervision of the Dow Electrical Acceptance Testing Department and is not part of this contract.

7.8.1.2 All testing equipment shall be Contractor-furnished. Testing equipment and test personnel provided by the Contractor is subject to approval by the Dow Electrical Acceptance Testing department or Owner's Representative.

7.8.1.3 The Testing Personnel shall immediately notify the Owner's Representative about the failure of any material, equipment, or system of a test.

7.8.2 Grounding

7.8.2.1 Grounding tests shall be in accordance with the latest revision of Dow Engineering Practices T7C-0101-00, T7E-0111-01, and T7E-0111-02.

7.8.2.2 All underground connections will require visual inspection and approval by the Owner's Representative before backfilling.

7.8.2.3 Ground rods shall be tested utilizing a ground test megger.

7.8.2.4 Notify the Owner's Representative if the resistance of any ground rod to earth exceeds 5.0 ohms.

7.8.2.5 Pigtaills shall show a resistance of 1.0 ohms or less to ground using a ground test megger.

7.8.3 Instrument and Electronic Cable

7.8.3.1 Individual wires shall be disconnected before testing.

7.8.3.2 Continuity and identification of all single and multiconductor cables and thermocouple wires shall be checked by means of a DC test device using a bell or buzzer to 'ring out' the wires.

7.8.3.3 Polarity, point-to-point continuity, and identification checks of instrument and electronic cable and shield drains shall be performed by the Contractor and witnessed by the Owner's Representative.

7.8.3.4 Phones may only be used for communication between the testers, not for continuity tests.

7.8.4 600 Volt Power, Control, and Lighting Conductors

7.8.4.1 Control circuits shall be tested during construction to assure the circuits perform all the functions for which they are designed.

7.8.4.2 Each power phase shall be tested by using a 1000 volt megger between each conductor and ground, and between each of the phases.

7.8.4.3 Minimum megger reading at ambient temperature shall be 5 megohms.

7.8.5 Medium Voltage Power Cables (General)

7.8.5.1 All power cables shall be given a DC high potential test after all terminal lugs are installed and splices and stress cones are completed, but prior to connection of the cables to the equipment. Note that the cables at the motor end will not have lugs and termination kits installed since the motor will not be there. The DC Hi-Pot tests shall be conducted under the supervision of the Dow Electrical Acceptance Testing Department and is not part of this contract.

7.8.5.2 Before installing the termination kits, the continuity of each cable shield shall be checked by means of a DC test device using a bell or buzzer to 'ring out' the shields.

7.8.5.3 The Contractor shall determine proper phasing of the newly installed cable after energization, at any substation or other load where it may subsequently be paralleled with another feeder. The proposed equipment and procedure to be used must be approved by the Owner's Representative or the Major Manager.

7.8.6 5 and 15 kV Power Cables

7.8.6.1 Test conductor shall be raised to the maximum test voltage in equal step increments and held at each step voltage until the leakage current stabilizes. Record the leakage current at each step. The maximum test voltage shall be held for at least 5 minutes. The DC Hi-Pot test shall be conducted under the supervision of the Dow Electrical Acceptance Testing Department and is not a part of this contract.

<u>Cable Rating</u>	<u>Voltage, kv-DC</u>		
	<u>Initial</u>	<u>Increment</u>	<u>Maximum</u>
5 kV	3	3	24
15 kV	10	5	55

7.8.6.2 All failures during testing due to poor workmanship by the Contractor shall be corrected by the Contractor, at his own expense. The Contractor shall have the respective vendors correct any defective Contractor-furnished materials. Notice of such failures shall be furnished to the Owner's Representative

7.8.6.3 15kV and 5kV insulated cable shall be meggered while on the reel and again after installation. The cable shall be resealed after the first test.

7.8.7 Motor Control Centers (General)

7.8.7.1 Manually operate all starters, breakers, relays, etc., to determine satisfactory mechanical operating condition and that electrical clearances are adequate for service.

7.8.7.2 A visual check shall be made for loose, missing, or broken parts and inadequate clearance.

7.8.7.3 All bus bar connection joints, and splices shall be torqued in accordance with the current revision of Dow Engineering Practice T7C-0471-01.

7.8.7.4 With breakers or switches open and external power cables connected, megger each bus using a 1000 volt megger between each phase and ground while the other two phases are grounded. If the reading is under 2 megohms, contact the Owner's Representative for instructions. This should be done, or repeated, immediately prior to initial energization.

7.8.7.5 Check the operation of all control devices and interlocks with the control circuits properly energized, but with no load cables.

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7.8.8 2400 and 4160 Volt Motor Control Centers

7.8.8.1 A high potential test of 20 kV DC shall be applied to the bus, with disconnecting switches open; circuit breakers and cable REMOVED FROM THE CIRCUIT. Test one phase at a time with the other two phases grounded. The DC Hi-Pot test shall be conducted under the supervision of the Dow Electrical Acceptance Testing Department and is not part of this contract.

7.8.8.2 Contactors shall be tested separately from the bus at the voltage specified by the manufacturer's equipment recommendations. The test voltage will vary by manufacturer and type of equipment (vacuum or SF6). The DC Hi-Pot test shall be conducted under the supervision of the Dow Electrical Acceptance Testing Department and is not part of this contract.

7.8.8.3 The VT'S (PT'S) shall be isolated from the bus before any hypot tests are performed. The VT'S (PT'S) shall be meggered separately at their own VT (PT) voltage rating. The DC Hi-Pot test shall be conducted under the supervision of the Dow Electrical Acceptance Testing Department and is not part of this contract.

7.8.9 Electrical Testing Results

7.8.9.1 All tests made on electrical equipment shall be entered on E&CS Form 503-530 and shall show the following:

7.8.9.1.1 Identity of equipment.

7.8.9.1.2 Date of test.

7.8.9.1.3 Test equipment utilized.

7.8.9.1.4 Paragraph numbers of this specification used as a basis for the test.

7.8.9.1.5 Test results.

7.8.9.1.6 Any corrective action taken to make the equipment pass the test.

7.8.9.1.7 Statement as to what is required for equipment before it is energized or placed in service.

7.8.9.1.8 Note that entry of test result was made on 'white' equipment tag in accordance with Owner's Safety and Loss Prevention Manual for Contractors.

7.8.9.1.9 Name of person or persons making the test.

7.8.9.2 Four (4) copies of all test data and test procedures shall be furnished to the Owner's Representative for distribution as follows:

- (1) Copy - to Owner's Representative.
- (1) Copy - to the Owner.
- (2) Copies - to Maintenance Department.

7.8.10 All questions concerning procedures, methods, or alternate tests shall be referred to the Owner's Representative for clarification or approval.

7.8.11 Drawings - two (2) copies of electrical drawings shall be marked per field changes and furnished to the Owner's Representative for distribution as follows:

- (1) Set - to Owner's Representative (For the Electrical Lead Engineer.
- (1) Set - to Maintenance Department.

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9. PAINTING

9.1 All painting shall be in accordance with Dow Engineering Specifications 57-201 and the following:

9.1.1 Piping shall be painted in accordance with Dow Engineering Specification 57-257.

9.2 P-309D and EJ-309D shall be painted in accordance with Dow Engineering Specification 57-257.

9.3 All damaged galvanizing (including exposed threads on pipe connections and structural steel) shall be repaired in accordance with Dow Engineering Specification 57-271.

9.4 All damaged painted surfaces (pipe, structural steel, equipment, etc.) shall be prepared in accordance with Dow Engineering Specification 57-204 (power tool cleaning--no hand cleaning allowed) and painted according to the coating system that was specified for that item.

9.5 All steel valves shall be painted according to the coating system of the pipe they are in.

9.6 Finish colors shall be light gray.

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10. DEMOLITION

10.1 The Contractor shall keep the site in a neat and clean condition at all times.

10.2 Barricades will be erected and maintained by the Contractor to protect personnel and will be placed at the discretion of the Owner's Representative.

10.3 Fire lanes and access roads shall not be blocked by Contractor's equipment after working hours. During working hours, Contractor must be able to clear fire lanes and access roads at any time.

10.4 Successful bidder will secure the field representative's approval on techniques he is planning to use before proceeding with the work.

10.5 All rigging will comply with Dow's Rigging and Critical Lift Standards; specifically but not limited to Dow's Safety Standard #21.

10.6 Rig booms are to be lowered at night and over weekends.

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