



Department of Management Services
Purchasing Division
241 West South Street
Kalamazoo, MI 49007-4796
Phone: 269.337.8020
Fax: 269.337.8500
www.kalamazoo.org
purchasing@kalamazoo.org

MANDATORY PRE-BID MEETING
Wednesday, May 11, 2022 at 10:00 a.m. Local Time
Location: 1415 Harrison St., Kalamazoo, MI 49007 (Conference Room A)

INVITATION FOR BIDS (IFB)

The City of Kalamazoo, Michigan is soliciting sealed bids for:

Project Name: Remote Station Upgrades

Bid Reference #: 91438-004.0

IFB ISSUE DATE: April 28, 2022

BID DUE/OPENING DATE: May 31, 2022 at 3:00 p.m. Local Time

Facsimile Bids Will Not Be Accepted.

MAILING ADDRESS & INSTRUCTIONS

Mail to:

Purchasing Division
241 W. South Street
Kalamazoo, MI 49007

Questions about this IFB should be directed to:

Department Contact: **Tom Koporetz, Process Control Supervisor at**
koporetzt@kalamazoo.org

Include on the Envelope the Project Name and Bid Reference Number. All Envelopes Must Be Sealed.

You are invited to submit a bid for this project. Specifications, terms, conditions and instructions for submitting bids are contained herein. This Invitation for Bids with all pages, documents and attachments contained herein, or subsequently added to and made a part hereof, submitted as a fully and properly executed bid shall constitute the contract between the City and the successful bidder when approved and accepted on behalf of the City by an authorized official or agent of the City. Please review the bid document as soon as possible and note the **DEADLINE FOR QUESTIONS** in the Instructions to Bidders.

All bidders shall complete and return the Bid and Award page(s) and submit all information requested herein in order for a bid to be responsive. The bid document shall be returned in its entirety, in a properly identified and sealed envelope to the Purchasing Division at the above address. **BIDS MUST BE RECEIVED BEFORE THE DUE DATE - LATE BIDS WILL NOT BE CONSIDERED.** The City reserves the right to postpone the bid opening for its own convenience.

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STATEMENT OF NO BID

NOTE: If you DO NOT intend to bid on this commodity or service, please complete and return this form immediately. Your response will assist us in evaluating all responses for this important project and to improve our bid solicitation process.

The Purchasing Division of the City of Kalamazoo wishes to keep its bidders list file up-to-date. If, for any reason you cannot supply the commodity/service noted in this bid solicitation, this form must be completed and returned to remain on the particular bid list for future projects of this type.

If you do not respond to this inquiry within the time set for the bid opening date and time noted, we will assume that you can no longer supply this commodity/service, and your name will be removed from this bid list.

- _____ Specifications too "tight", i.e. geared toward one brand or manufacturer only (explain below).
- _____ Specifications are unclear (explain below).
- _____ We are unable to meet specifications.
- _____ Insufficient time to respond to the Invitation for Bid.
- _____ Our schedule would not permit us to perform.
- _____ We are unable to meet bond requirements.
- _____ We are unable to meet insurance requirements.
- _____ We do not offer this product or service.
- _____ Remove us from your bidders list for this commodity or service.
- _____ Other (specify below).

REMARKS: _____

SIGNED: _____ NAME: _____
(Type or Print)

TITLE: _____ DATE: _____

FIRM NAME: _____
(if any)

ADDRESS: _____
(Street address) (City) (State) (Zip)

PHONE: _____ FAX: _____

EMAIL: _____

**SECTION I
INSTRUCTIONS TO BIDDERS**

1. **EXAMINATION OF BID DOCUMENT**-Before submitting a bid, bidders shall carefully examine the specifications and shall fully inform themselves as to all existing conditions and limitations. The bidder shall indicate in the bid the sum to cover the cost of all items included on the bid form.
2. **PREPARATION OF BID**-The bid shall be legibly prepared in ink or typed. If a unit price or extension already entered by the bidder on the Bid and Award form is to be altered, it shall be crossed out and the new unit price or extension entered above or below and initialed by the bidder with ink. The bid shall be legally signed, and the complete address of the bidder given thereon.

All bids shall be tightly sealed in an envelope plainly marked SEALED BID and identified by project name, bid opening date and time. Bids opened by mistake, due to improper identification, will be so documented and resealed. The Purchasing Division will maintain and guarantee confidentiality of the contents until the specified opening date and time. Bids submitted by Fax machine will not be accepted.

3. **EXPLANATION TO BIDDERS**-Any binding explanation desired by a bidder regarding the meaning or interpretation of the Invitation for Bid (IFB) and attachments must be requested in writing, **at least 5 business days before the bid opening** so a reply may reach all prospective bidders before the submission of bids. Any information given to a prospective bidder concerning the IFB will be furnished to all prospective bidders as an amendment or addendum to the IFB if such information would be prejudicial to uninformed bidders. Receipt of amendments or addenda by a bidder must be acknowledged in the bid by attachment, or by letter or fax received before the time set for opening of bids. Oral explanation or instructions given prior to the opening will not be binding.
4. **CASH DISCOUNTS**-Discount offered for payment of less than thirty (30) days will not be considered in evaluating bids for award. Offered discounts of less than thirty (30) days will be taken if payment is made within the discount period, even though not considered in evaluation of the bid.
5. **WITHDRAWAL OF BIDS**-Bids may be withdrawn in person by a bidder or authorized representative, provided their identity is made known and a receipt is signed for the bid, but only if the withdrawal is made prior to the exact time set for receipt of bid. No bid may be withdrawn for at least ninety (90) days after bid opening.
6. **ALTERNATE BIDS**-bidders are cautioned that any alternate bid, unless specifically requested or any changes, insertions or omissions to the terms and conditions, specifications or any other requirement of this IFB may be considered non-responsive, and at the option of the City, result in rejection of the alternate bid.
7. **LATE BIDS**-Any bid received at the office designated herein after the exact time specified for receipt will not be considered. (Note: The City reserves the right to consider bids that have been determined by the City to be received late due to mishandling by the City after receipt of the bid and no award has been made.)
8. **UNIT PRICES**-If there is a discrepancy between unit prices and their extension, unit prices shall prevail.

SECTION II
BID AND AWARD

The undersigned having become thoroughly familiar with all of the bid/contract documents incorporated herein, the project site and the location conditions affecting the work, hereby proposes to perform everything required to be performed in strict conformity with the requirements of these documents, and to provide and furnish all the equipment, labor and materials necessary to complete in a professional manner the furnishing and installing of all of the following, meeting or exceeding the specifications as set forth herein for the prices as stated below.

SEWAGE LIFT STATIONS ELECTRICAL & CONTROLS UPGRADES

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Augusta – Webster Lift Station	1	LS		
2	Climax Rd. Lift Station	1	LS		
3	L Ave Lift Station	1	LS		
4	Winding Way Lift Station	1	LS		
5	Woods Lake Lift Station	1	LS		
TOTAL BID FOR SEWAGE LIFT STATIONS ELECTRICAL & CONTROLS UPGRADES:					

REMOTE SITE GENERATORS

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Edgemoor Tank				
	All work shown & specified	1	LS		
	Allowance	1	LS		\$1000
2	Gull Road Tank				
	All work shown & specified	1	LS		
	Allowance	1	LS		\$2,500
3	Parchment Tank				
	All work shown & specified	1	LS		
	Allowance	1	LS		\$1000
4	Beech Tank				
	All work shown & specified	1	LS		
	Allowance	1	LS		\$20,000
5	Siesta Tank				
	All work shown & specified	1	LS		
	Allowance	1	LS		\$35,000
6	Mt. Olivet Tank				
	All work shown & specified	1	LS		
	Allowance	1	LS		\$8,000
7	Blakeslee Tank				
	All work shown & specified	1	LS		
	Allowance	1	LS		\$1000
8	Station No. 11				
	All work shown & specified	1	LS		
	Allowance	1	LS		\$30,000
9	Station No. 4				
	All work shown & specified	1	LS		
10	Station No. 31				
	All work shown & specified	1	LS		

11	Station No. 39				
	Allowance	1	LS		\$100,000
TOTAL BID FOR REMOTE SITE GENERATORS:					

METERING STATION CONTROLS UPGRADES

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Allnex Metering Station	1	LS		
2	Bell's Brewery Metering Station	1	LS		
3	Cooper Metering Station	1	LS		
4	Graphics Packaging Metering Station	1	LS		
5	Mattawan Metering Station	1	LS		
6	Meredith Metering Station	1	LS		
7	Parchment Metering Station	1	LS		
8	Pfizer Metering Station	1	LS		
9	Portage Creek Metering Station	1	LS		
10	South County Metering Station	1	LS		
11	Vicksburg Metering Station	1	LS		
TOTAL BID FOR METERING STATION CONTROLS UPGRADES:					

PROJECT GRAND TOTAL \$ _____

Bidder shall provide all of the information as requested herein with their bid. **Failure to do so and/or failure to provide post-bid requested information may be cause for rejecting the bid as non-responsive.**

Work shall start after receipt by Contractor of Notice to Proceed and shall be completed within 600 calendar days.

Bidder/Contractor has examined and carefully studied the bidding documents and attachments, and acknowledges receipt of the following addenda:

Addendum No: _____

Dated: _____

The City encourages the use of local labor in fulfilling the requirements of this contract.

This contract shall be governed by the laws of the State of Michigan.

By my signature below, I certify that the firm bidding on this contract, when making hiring decisions, does not use a past criminal conviction as a bar to or preclude a person with a criminal conviction from being considered for employment with the bidding firm unless otherwise precluded by federal or state law. I further certify that I have read and agree to be bound by the provisions of the City's Non-Discrimination Clause found in Appendix A as updated by City Ordinance 1856.

Signed: _____ Name: _____

Title: _____

CITY OF KALAMAZOO EX-OFFENDER POLICY CHECKLIST

As part of the City’s commitment to reducing unacceptable poverty, encouraging rehabilitation, reducing recidivism and strengthening families in Kalamazoo, the City has updated its Purchasing Policy to ensure that firms with whom the City does business share in this commitment by utilizing hiring practices that do not unfairly deny people with arrest and conviction records gainful employment. *(Important: This requirement also extends to any subcontractors the bidder intends to use to fulfill the contract for goods or services being sought from the City.)*

Part I: Proof that the bidder does not inquire about an individual’s past arrest or criminal history on the bidders employment application form

- Attach a copy of the current application for employment being used by the bidder

Part II: Certification that the bidder does not use an individual’s past arrest or criminal history to unlawfully discriminate against them by checking *one or more* of the following:

- That pursuant to federal or state law bidder is precluded from hiring persons with certain criminal records from holding particular positions or engaging in certain occupations by providing a cite to the applicable statute or regulation; if checking this box, provide a citation to the applicable statute or rule upon which the bidder is relying:_____
- That bidder conducts criminal history background checks only as necessary, and only after making a conditional offer of employment; that any withdrawal of an offer of employment to an individual because of a past criminal history is job-related and consistent with business necessity after the individual has been provided an individualized assessment opportunity to review and challenge or supplement the history of past criminal conduct being relied upon by the bidder;
- That the use by bidder of criminal history background checks complies with the U.S. Equal Employment Opportunity Commission’s Enforcement Guidance on the Consideration of Arrest and Conviction Records in Employment Decisions and that the bidder has not had a determination rendered against it in past 7 years that it discriminated against a person through the use of an individual’s arrest or criminal history

I CERTIFY THAT THE ABOVE STATEMENTS ARE TRUE.

Date

Signature

Printed Name

Position

CITY OF KALAMAZOO
LOCAL PREFERENCE POLICY AND CERTIFICATION

The lowest responsive Kalamazoo County bidder whose bid is not low but falls within 2% of the lowest responsive bid is afforded the opportunity to become the successful bidder if it agrees to reduce its bid to match the lowest responsive bid. The City of Kalamazoo is the sole determiner whether a bidder is responsible, qualifies as a Kalamazoo County bidder, and if its bid is responsive to the City’s specifications, terms and conditions.

If the lowest Kalamazoo County bidder chooses not to match the lowest bid, the next lowest responsive Kalamazoo County bidder whose bid falls within 2% of the lowest bid, is given the opportunity to match the lowest responsive bid.

To qualify as a Kalamazoo County bidder, the bidder must meet both the following criteria:

1. Have a physical presence in Kalamazoo County by maintaining a permanent office, factory or other facility in Kalamazoo County with employees working in Kalamazoo County.
2. Have paid real or personal property taxes related to said business to the City of Kalamazoo, County of Kalamazoo or other municipal corporation within Kalamazoo County in the previous tax year, except that a non-profit entity need not meet this requirement.

This local preference policy applies only to purchases for materials, supplies, capital outlay, and services for maintenance, repair or operation of City facilities that are over \$25,000. If more than 50% of the contract is sub-contracted to firms located outside of Kalamazoo County that bid does not qualify for the local preference policy outlined above. The local preference policy will not apply if prohibited by law. The Purchasing Agent has the authority to finally determine if the bidder qualifies as a Kalamazoo County bidder as set forth herein. The Purchasing Agent may take into account the permanency of the business in Kalamazoo, and whether the business appears to be claiming to be a Kalamazoo County business solely or primarily to qualify as a Kalamazoo County business under this Resolution, and any other material factors.

CERTIFICATION

If you qualify as a Kalamazoo County bidder and wish to be considered for the local preference provisions as provided above please certify that fact by providing the information requested below and attesting to its accuracy.

Firm Name: _____

Street Address of Business: _____

City, State, and Zip Code: _____

Number of employees working in Kalamazoo County: _____

Name the city or township to which business real and/or personal property taxes are paid or provide non-profit status: _____

The above information is accurate:

Signature: _____ Date: _____

Title: _____

SUB-CONTRACTING INFORMATION

Using the table below provide information regarding the sub-contractors that will be working to fulfill the requirements of this contract. Submit as complete a list as possible at the time of your bid. You will have two business days after the bid opening to update the list as needed. The information provided will be used for evaluating your bid and to assist in determining if you qualify as a Kalamazoo County Bidder.

INSTRUCTIONS:

Nature of Contract - State a brief description of the work or product that will be provided.

BIDDER – Provide the percentage of services or construction activity that will be provided by your firm.

Subcontractors:

- Provide the Name and Address for each subcontractor providing services or construction activities for this contract.
- Indicate with **YES** or **NO** under the “Local?” box if they qualify as a “Kalamazoo County bidder” (see local preference certification page)
- Provide the percentage for the dollar amount of the contract work they will be performing.

If there are not enough lines in the table below make additional copies as needed.

Nature of Contract:		
Subcontractor Name/Address	Local?	% Of Total Contract
<i>BIDDER</i>		

Does this List of Subcontractors need to be updated after the bid opening? **Yes** ___ **No** ___

REFERENCE QUESTIONNAIRE

Please answer the following questions completely.

1. Firm name: _____
2. Established: Year _____ Number of Employees: _____
3. Type of organization:
 - a. Individual: _____
 - b. Partnership: _____
 - c. Corporation: _____
 - d. Other: _____
4. Former firm name(s) if any, and year(s) in business:

5. Include at least 3 references of contracts for similar work performed over the last five (5) years. Include: owner, contact person and phone number and description of work performed.
 - 5.1 Company Name: _____
Address: _____
Phone: _____
Contact: _____
Type of work or contract: _____
 - 5.2 Company Name: _____
Address: _____
Phone: _____
Contact: _____
Type of work or contract: _____
 - 5.3 Company Name: _____
Address: _____
Phone: _____
Contact: _____
Type of work or contract: _____

I hereby certify that all of the information provided is true and answered to the best of my ability.

Signed: _____ Name: _____
(type or print)

Title: _____ Date: _____

I hereby state that all of the information I have provided is true, accurate and complete. I hereby state that I have the authority to submit this bid which will become a binding contract if accepted by the City of Kalamazoo. I hereby state that I have not communicated with nor otherwise colluded with any other bidder, nor have I made any agreement with nor offered/accepted anything of value to/from an official or employee of the City of Kalamazoo that would tend to destroy or hinder free competition.

The firm's identification information provided will be used by the City for purchase orders, payment and other contractual purposes. If the contractual relationship is with, or the payment made to, another firm please provide a complete explanation on your letterhead and attach to your bid. Please provide for accounts payable purposes:

Tax Identification Number (Federal ID): _____

Remittance Address: _____

Financial Contact Name: _____ Financial Contact Phone Number: _____

Financial Contact Email Address: _____

I hereby state that I have read, understand and agree to be bound by all terms and conditions of this bid document.

SIGNED: _____ NAME: _____
(Type or Print)

TITLE: _____ DATE: _____

FIRM NAME: _____
(if any)

ADDRESS: _____
(Street address) (City) (State) (Zip)

PHONE: _____ FAX: _____

EMAIL ADDRESS: _____

FOR CITY USE ONLY - DO NOT WRITE BELOW

NOTE: This blanket addendum is for informational purposes only and does not need to be acknowledged by bidders in their submission.

COVID-19 ADDENDUM #2

January 1, 2022

TO: ALL Prospective Bidders
PROJECT: ALL Upcoming Projects

The purpose of this addendum is to clarify and/or modify the sealed bid delivery and bid opening process for all upcoming projects. All work affected is subject to all applicable terms and conditions of the Bidding and Contract Documents.

1. UPDATE TO SEALED BID DELIVERY AND BID OPENING POLICY:

Effective immediately and continuing until further notice, the City of Kalamazoo will return to IN-PERSON bid openings following City Hall guidelines, including Mask Mandate.

BIDS MUST BE RECEIVED BEFORE THE DUE DATE AND TIME – LATE BIDS WILL NOT BE CONSIDERED.

Bidders can submit sealed bids in one of the following ways:

- **Mail your bid**, to be received before the bid due date and time indicated in the bid document, to the City of Kalamazoo at the following address:

City of Kalamazoo
Purchasing Division
241 West South Street
Kalamazoo, MI 49007

- **Deliver your bid to the Treasurer’s Office Payment Drop Box** located in the northwest corner of City Hall before the bid due date and time indicated in the bid document.
- **Deliver your bid to City Hall In Person before** the bid due date and time indicated in the bid document.

All bids shall be tightly sealed in an envelope plainly marked SEALED BID and identified by project name, bid opening date and time. Bids opened by mistake, due to improper identification, will be so documented and resealed. The Purchasing Division will maintain and guarantee confidentiality of the contents until the specified opening date and time. Bids submitted by fax machine or email will not be accepted.

The Purchasing Division will post bid tabulations to the City of Kalamazoo website within 24 hours after the bid opening date and time at: <https://www.kalamazoocity.org/bidopportunities>.

Questions regarding this sealed bid delivery and bid opening policy change related to the COVID-19 virus should be directed to the City of Kalamazoo at (269) 337-8020.

Sincerely,



Michelle Emig
Purchasing Division Manager

SECTION III
CITY OF KALAMAZOO
INDEMNITY AND INSURANCE

Contractor, or any of their subcontractors, shall not commence work under this contract until they have obtained the insurance required under this paragraph, and shall keep such insurance in force during the entire life of this contract. All coverage shall be with insurance companies licensed and admitted to do business in the State of Michigan and acceptable to the City of Kalamazoo within ten (10) days of the Notice of Award. The requirements below should not be interpreted to limit the liability of the Contractor. All deductibles and SIR's are the responsibility of the Contractor.

The Contractor shall procure and maintain the following insurance coverage:

Workers' Compensation Insurance including Employers' Liability Coverage, in accordance with all applicable statutes of the State of Michigan.

Commercial General Liability Insurance on an "Occurrence Basis" with limits of liability not less than \$1,000,000 per occurrence and aggregate. Coverage shall include the following extensions: (A) Contractual Liability; (B) Products and Completed Operations; (C) Independent Contractors Coverage; (D) Broad Form General Liability Extensions or equivalent, if not already included and (E) XCU coverage if the nature of the contract requires XC or U work.

Automobile Liability in accordance with all applicable statutes of the State of Michigan, with limits of liability not less than \$1,000,000 per occurrence, combined single limit for Bodily Injury, and Property Damage. Coverage shall include all owned vehicles, all non-owned vehicles, and all hired vehicles.

Additional Insured: Commercial General Liability and Automobile Liability, as described above, shall include an endorsement stating that the following shall be *Additional Insureds*: The City of Kalamazoo, all elected and appointed officials, all employees and volunteers, all boards, commissions, and/or authorities and board members, including employees and volunteers thereof. It is understood and agreed that by naming the City of Kalamazoo as additional insured, coverage afforded is considered to be primary and any other insurance the City of Kalamazoo may have in effect shall be considered secondary and/or excess.

To the fullest extent permitted by law the Contractor agrees to pay on behalf of, indemnify, and hold harmless the City of Kalamazoo, its elected and appointed officials, and employees against any claims, demands, suits, or loss, including all costs connected therewith, and for any damages which may be asserted, claimed, or recovered against or from the City of Kalamazoo, by reason of personal injury, including bodily injury or death and/or property damage, including loss of use thereof, caused in whole or part by any negligent act or omission by the Contractor, its employees, agents, or officers which arises out of, or is in any way connected or associated with, this contract.

Cancellation Notice: All policies, as described above, shall include an endorsement stating that it is understood and agreed that thirty (30) days, or ten (10) days for non-payment of premium, Advance Written Notice of Cancellation, Non-Renewal, Reduction, and/or Material Change shall be sent to: City of Kalamazoo, Purchasing Division, 241 W. South Street, Kalamazoo, MI 49007.

Proof of Insurance Coverage: The Contractor shall provide the City of Kalamazoo at the time that the contracts are returned by him/her for execution, or within 10 days of Notice of Award, whichever is earlier, a Certificate of Insurance as well as the required endorsements. In lieu of required endorsements, if applicable, a copy of the policy sections where coverage is provided for additional insured and cancellation notice would be acceptable. Copies or certified copies of all policies mentioned above shall be furnished, if so requested.

INDEMNITY AND INSURANCE
Continued

If any of the above coverages expire during the term of this contract, the Contractor shall deliver renewal certificates and/or policies to City of Kalamazoo at least ten (10) days prior to the expiration date.

Scope of Coverage: The above requirements and conditions shall not be interpreted to limit the liability of the Contractor under this Contract, but shall be interpreted to provide the greatest benefit to the City and its officers and employees. The above listed coverages shall protect the Contractor, its employees, agents, representatives and subcontractors against claims arising out of the work performed. It shall be the Contractor's responsibility to provide similar insurance for each subcontractor or to provide evidence that each subcontractor carries such insurance in like amount prior to the time such subcontractor proceeds to perform under the contract.

SECTION IV
SPECIAL REQUIREMENTS

1. BID BOND/GUARANTEE

The bid must be accompanied by a bid bond which shall not be less than five (5%) percent of the total amount of the bid. No bid will be considered unless it is accompanied by the required guarantee. The bid guarantee shall ensure the execution of the bid and award, and the furnishing of a performance bond and a labor and material bond (A and B below) by the successful bidder. (Contractors Note: A cashier's or certified check in lieu of a bid bond is **NOT** acceptable.)

A. PERFORMANCE BOND

A performance bond shall be furnished in the full amount of the contract ensuring the City of faithful performance of all the provisions of the contract, and the satisfactory performance of any equipment required hereunder. The bond shall also ensure the City against defective workmanship and/or materials.

B. LABOR AND MATERIAL (PAYMENT) BOND

A labor and material (payment) bond shall be furnished for the period covered by the contract, in the full amount of the contract for the protection of labor and material suppliers and sub-contractors.

Bonds shall be secured by a guaranty or a surety company listed in the latest issue of the U.S. Treasury, circular 570, and licensed to do business in the State of Michigan, and written in favor of the City of Kalamazoo. The amount of such bonds shall be within the maximum amount specified for such company in said circular 570. The bonds shall be accompanied by a power of attorney showing authority of the bonding agent to sign such bonds on behalf of the guaranty or surety company. The cost of the bonds shall be borne by the Contractor.

Failure of the Contractor to supply the required bonds within ten (10) days after Notice of Award, or within such extended period as the Purchasing Agent may agree to, shall constitute a default and the City of Kalamazoo may either award this contract to the next lowest bidder or re-advertise for bids and may charge against the Contractor for the difference between the amount of the bid and the amount for which a contract for the work is subsequently executed, irrespective of whether the amount thus due exceeds the amount of the bid bond. If a more favorable bid is received by re-advertising, the defaulting bidder shall have no claim against the City of Kalamazoo for a refund.

2. WAIVERS OF LIEN

Upon completion of all work and request for final payment, the Contractor shall furnish a 100% waiver of lien from each supplier and sub-contractor covering all items of the work. Failure to supply waivers of lien for the entire job upon completion and final payment request will be considered grounds for withholding final payment.

3. SUBCONTRACTORS

- A. Contractors shall state on the Bid and Award page any and all subcontractors to be associated with their bid, including the type work to be performed. Any and all subcontractors shall be bound by all of the terms, conditions and requirements of the contract; however, the prime contractor shall be responsible for the performance of the total work requirements.
- B. The Contractor shall cooperate with the City of Kalamazoo in meeting its commitments and goals with regard to maximum utilization of minority and women business enterprise, and shall use its best efforts to ensure that minority and women business enterprises have maximum practicable opportunity to compete for subcontract work under this agreement.

4. PREVAILING WAGES

The successful bidder will be required to comply with Section 2-125 of the Code of Ordinances of the City of Kalamazoo regarding prevailing wages and Appendix B attached, incorporated herein by reference. Special note: This provision applies only to projects in excess of \$100,000 for City (\$2,000 federal) funded projects.

The City's requirements as it relates to prevailing wages includes a meeting with the City's Purchasing Division **prior** to work and payroll and work monitoring during the duration of the contract. Please contact Purchasing at (269) 337-8020 if you have any questions regarding Davis-Bacon provisions.

SECTION V
GENERAL PROVISIONS

1. INTENT

It is the intent of these plans and specifications to provide for a contractor who shall provide all labor, materials, tools and equipment necessary to perform in a professional manner for **Remote Station Upgrades** as described in the specifications and bid document.

2. SCOPE OF WORK

This contract includes, but is not limited to: All work as shown on the drawings and described in the specifications for the Sewage Lift Stations Electrical & Controls Upgrades, Remote Site Generators, Metering Stations Controls Upgrades, and associated work.

The bidder shall furnish all labor, supervision, supplies, tools, equipment and other means necessary or proper for performing and completing the work. The bidder shall be responsible for the cleaning up of the job site and shall repair or restore all structures and property that may be damaged or disturbed during performance of the work to the satisfaction of the Public Services Department for the City of Kalamazoo.

3. QUANTITIES

The quantities shown or indicated on the plans are only estimated. Payment will be made based upon unit pricing of quantities installed.

4. UNIT PRICING

The unit price, including its pro-rata share of overhead, multiplied by the quantity shown shall represent the total bid and shall be held firm for the life of this contract. Any bid not conforming to this requirement may be rejected as non-responsive.

5. INSPECTION OF WORK

The City may maintain inspectors on the job who shall at all times have access to work.

6. INSPECTION OF SITE

Each bidder shall visit the site of the proposed work and fully acquaint himself/herself with the existing conditions relating to construction and labor, and shall fully inform himself/herself as to the facilities involved and the difficulties and restrictions attending the performance of this contract. The bidder shall thoroughly examine and become familiar with the drawings, specifications and all other bid/contract documents. The Contractor, by the execution of this contract, shall in no way be relieved of any obligation under it due to his/her failure to receive or examine any form or legal instrument, or to visit the site and acquaint himself/herself with the conditions there existing. No allowance shall be made subsequently in this connection in behalf of the Contractor for any negligence of his/her part. For inspection call the Public Services Department, Water Resources Division.

7. INSPECTION AND TESTING

The Contractor shall give the Project Manager timely notice of readiness of the work for all required inspections, tests or approvals, and shall cooperate with inspections and testing personnel to facilitate required inspections or tests. The City will provide for materials and construction testing including but not limited to compaction of subbase and backfill material, concrete testing and asphalt

testing. The cost of said testing shall be borne by the City. Verification that testing required by the contract has been completed on one phase of the project prior to proceeding to the next phase is the responsibility of the Contractor. In the event that the project has proceeded without required testing, the Contractor shall insure that the required testing is obtained retroactively and shall provide access for testing as necessary at his/her sole expense.

8. MATERIALS INSPECTION AND RESPONSIBILITY

8.1 The Project Manager shall have the right to inspect any materials to be used in carrying out the terms of the contract.

8.2 The City does not assume any responsibility for the contracted quality and standard of all materials, equipment, components or completed work furnished under this contract.

8.3 Any materials, equipment, components or completed work which does not comply with contract specifications, MDOT, or State codes may be rejected by the City, and shall be replaced by the Contractor at no cost to the City.

8.4 Any materials, equipment or components rejected shall be removed within a reasonable period of time from the premises of the City at the entire expense of the Contractor after notice has been given by the City to the Contractor that such materials, equipment or components have been rejected.

9. LAYING OUT WORK

Before submitting a bid the Contractor shall verify all measurements and shall be responsible for the correctness of same. No extra charge or compensation will be allowed on account of differences between actual dimensions and the measurements indicated on the drawings. Any difference that may be found shall be submitted to the City Engineer for consideration before proceeding. The City Engineer will provide staking for the project.

10. SUPERVISION

The Contractor shall employ an experienced superintendent or foreperson on the job at all times.

11. TEMPORARY UTILITIES

11.1 Temporary or construction water will NOT be available on the sites. The Contractor must provide for drinking water.

11.2 Temporary toilets: To be supplied by the Contractor as may be necessary.

12. SITE SECURITY

The Contractor shall be responsible for job site security of all materials and tools provided by him/her and no claim for loss or damage will be considered by the City.

13. TARDINESS

Construction delays resulting from tardiness on the part of the Contractor will be reviewed by the City in the event of any request for contract extension by the Contractor.

14. PROGRESS SCHEDULE

- 14.1 After receipt of Notice to Proceed, work shall start within 10 days unless otherwise agreed to by the Project Manager.
- 14.2 **Work shall start after receipt by Contractor of Notice to Proceed and shall be completed within 600 calendar days.**
- 14.3 Work of a similar nature may be added to this contract if agreed to by the City and the Contractor. In the event that work is added, the progress schedule for the work will remain unchanged. Any contract time added for additional work will be applied to that additional work only, and cannot be added to items in the original contract. Any work done on the items in the original contract past the number of working days stated herein will be subject to liquidated damages regardless of any work that may be added at a later date.
- 14.4 The Contractor will be required to meet with the Public Services representatives to work out detailed progress schedule. The schedule for this meeting will be within two weeks after contract award has been made.
- 14.5 The named sub-contractor(s) for all items shall also be present at the scheduled meeting and they will be required to sign the Progress Schedule to indicate their approval of the scheduled dates of work set forth in the Progress Schedule.
- 14.6 The Progress Schedule shall include, as a minimum, the starting and completion dates for major items, and where specified in the bid document the date the project is to be opened to traffic as well as the final project completion date specified in the bid documents. The Progress Schedule shall be coordinated with all aspects of the work occurring at the site.
- 14.7 Failure on the part of the Contractor to carry out the provisions of the Progress Schedule as established may be considered sufficient cause to prevent bidding future projects until a satisfactory rate of progress is again established.
- 14.8 The starting date and the contract time to the completion date for this project may be adjusted by Public Services without imposing liquidated damages upon the receipt of satisfactory documented evidence that unforeseen delayed delivery of critical materials will prevent the orderly prosecution the work.
- 14.9 Section 501.03.I.2, Seasonal Limitations, is amended as follows: Seasonal limits for placing HMA mixtures in the City of Kalamazoo will be April 15 through November 15. No HMA paving will be allowed outside of these dates unless approved by the Engineer.

15. CONSTRUCTION SCHEDULE AND COORDINATION

- 15.1 The Contractor shall supply the City with an agreeable construction schedule before commencing work on this contract. This schedule shall detail beginning and completion dates for each major component of the project.
- 15.2 The Contractor shall coordinate and cooperate with all other contractors who may be working on the site in order to allow for the orderly progress of work being done.
- 15.3 The Contractor is required to keep the Project Manager fully informed of any proposed work which will tend to interfere with the existing operations at the site.
- 15.4 The Contractor shall schedule all work to accommodate the City's schedule. In the event Contractor's schedule falls on weekends, nights or overtime work is required, no additional compensation will be allowed. All work shall be part of this contract without regard to when it is done.

16. CONTRACTOR COORDINATION

- 16.1 The Contractor shall make every effort to coordinate every aspect of his work with that of other contractors on the site to assure an efficiently managed and proper installation. Special attention shall be given by the site contractor to the coordination with the playground equipment installation contractor and vice versa.
- 16.2 Consideration shall be given to timing of construction, maintaining adequate construction access, and construction staging. Any costs associated with this coordination shall be included in the contract.

17. COORDINATING CLAUSE

The Contractor's attention is called to Article 104.08 of the MDOT 2012 Standard Specifications for Construction entitled "Cooperation by Contractor."

18. ADDITIONS

- 18.1 Any modification to the contract shall be subject to prior approval by the Purchasing Agent. City Commission approval may also be required.
- 18.2 Prices for additional work required are not requested in the itemized listing contained herein for the base project. Should additional work be authorized, compensation shall be made on the basis of price or prices to be mutually agreed upon. Such additional work shall not begin until a Change Order has been approved.

19. MAINTAINING TRAFFIC

- 19.1 This work shall be in accordance with the requirements of Section 812 of the MDOT Standard Specifications for Construction, the Maintaining Traffic special provision, and as specified herein. The Contractor is advised that the current Michigan Manual of Uniform Traffic Control Devices (MMUTCD) is hereby established as governing all work in connection with traffic control devices, barricade lighting, etc. required on this project.
- 19.2 The Contractor shall furnish, erect, maintain and, upon completion of the work, remove all traffic control devices and barricade lights within the project and around the perimeter of the project for the safety and protection of through and local traffic. This includes, but is not limited to: Advance, regulatory and warning signs; barricades and channeling devices at intersecting streets on which traffic is to be maintained; barricades at the ends of the project and at right-of-way lines for intersecting streets which are to be closed with the first usable street on each side of the project. Traffic regulators, where required by the Engineer, are included.
- 19.3 Where the existing pavement or partial widths of new pavement are to be utilized for the maintenance of through and local traffic, *Channelizing device, 42 inch* will be required at 50' intervals or as directed by the Engineer for channeling and directing traffic through the construction area.
- 19.4 Through traffic shall be maintained utilizing sidewalk closures with detours and traffic shifts per MDOT traffic and safety details.

- 19.5 Protection of all pedestrian traffic shall be maintained at all times in accordance with the MMUTCD. Type II barricades and sidewalk detour signs shall be used in accordance with the MMUTCD.
- 19.6 Payment for furnishing and operating all temporary traffic control devices and traffic regulators shall be paid as a lump sum fee for the item “Traffic Maintenance and Control” and shall include all the temporary traffic control measures on all road segments.
- 19.7 Under Article 812.04.D "Operated Pay Items" the term ‘Relocating’ shall include the relocating of the item from any street covered by the contract to any other street covered by the contract.
- 19.8 No work shall be allowed on the following dates:
- | | |
|----------|------------------------|
| 4/15/22 | Good Friday |
| 5/30/22 | Memorial Day Holiday |
| 6/19/22 | Juneteenth |
| 7/4/22 | Fourth of July Holiday |
| 9/5/22 | Labor Day Holiday |
| 11/11/22 | Veteran’s Day |
| 11/24/22 | Thanksgiving |
| 12/25/22 | Christmas |
| 1/1/23 | New Year’s Day |
- 19.9 Milled surfaces will not be allowed on travel lanes for longer than 24 hours unless approved by the Project Manager. Any traffic surface within the construction area containing a drop off at the edge of a pavement greater than two (2) inches shall not be allowed to be opened to the public. Any areas not conforming to the road levelness and profile shall be signed appropriately in accordance with the MMUTCD and best management practices.

Special Restrictions: Access to frontage properties shall be maintained as much as practical. Emergency access shall be maintained at all times. The Contractor shall maintain two-way traffic with flag control as needed when the road is restricted to only one traffic lane.

20. LIQUIDATED DAMAGES

Liquidated damages, if applicable, shall be \$500.00 a day regardless of contract size.

21. REMOVAL OF RUBBISH

The Contractor shall daily remove all rubbish and accumulated materials due to his/her construction.

22. SITE ACCESS

The City will provide fair and reasonable access to the job site within the working schedules of both parties.

23. GUARANTEE

The Contractor shall guarantee all of his/her work for a period of two (2) years following the date of final acceptance of the completed work and shall repair, replace or make good any materials or work which fail to function or perform or be found defective, without cost to the City.

24. SAFETY

The Contractor shall comply with all applicable OSHA and MIOSHA regulations.

25. PAY ESTIMATES

The Contractor shall be responsible for the generation of invoices for payment. Payment will be generated by the City based upon an approved invoice. Recommended frequency of payment is monthly, however, frequency of payment will not exceed bi-weekly.

26. PRODUCT/SYSTEM SUBSTITUTIONS

Submit a written request, to be received not later than 10 days prior to scheduled bid opening, for Substitution of any Product not named. If no substitutions are submitted, it will be reasonably concluded by the Owner that the specified product will be incorporated into the Work and the Bidder will be committed to supplying the specified product.

26.1 Describe in detail any variance to the Product specified. All proposed substitution for specified items shall be substantially the same size (height, length, width, diameter, etc.), type, color, construction quality and shall meet the design intent to be considered for substitution for the Product specified.

26.2 Document each request with complete data substantiating compliance of proposed Substitution with Product specified including written certification that Product conforms to or exceeds all requirements of the Product specified.

26.3 Document all coordination information, including a list of changes or modifications needed to the Contract Documents or other parts of the Work and to construction performed by the Owner and Separate Contractors that will become necessary to accommodate the proposed substitution.

26.4 Provide name, address and telephone number of manufacturer's authorized representative.

26.5 Submit three copies of all documents for each request for Substitution for consideration.

26.6 Approval of the Substitution request, if given, will be in the form of an addendum issued prior to scheduled opening date and hour at local time.

27. SAMPLES AND DEMONSTRATIONS

Evidence in the form of samples may be requested. Such samples are to be furnished after the date of bid opening only upon request of The City unless otherwise stated in the bid proposal. If samples should be requested, such samples must be received by The City no later than seven (7) days after formal request is made. When required, The City may request full demonstrations of any unit(s) bid prior to the award of any contract. Samples, when requested, must be furnished free of expense to The City and if not used in testing or destroyed, will upon request within thirty (30) days of bid award be returned at the bidder's request.

28. ACCEPTANCE OF MATERIAL

The material delivered under this proposal shall remain the property of the seller until a physical inspection and actual usage of the material and/or services is made and thereafter accepted to the satisfaction of The City and must comply with the terms herein, and be full in accord with specifications and of the highest quality. In the event the material and/or service supplied to The City is found to be defective or does not conform to specifications, The City reserves the right to cancel the order upon written notice to the seller and return the product to seller at the seller's expense.

29. VARIATIONS TO SPECIFICATIONS

For purposes of evaluation, the bidder **MUST** indicate any variances from our specifications, terms and/or conditions, no matter how slight. If variations are not stated in the proposal, it will be assumed that the product or service fully complies with our specifications, terms and conditions.

30. SAFETY STANDARDS

The bidder warrants that the products supplied to The City conform in all respects to the standards set forth in the Occupational Safety and Health Act of 1970 and its amendments and the failure to comply with this condition will be considered a breach of contract.

31. MANUFACTURER'S CERTIFICATION

The City reserves the right to request from bidders separate manufacturer certification of all statements made in the bid.

32. PROTECTION OF WORK

The Contractor shall maintain adequate protection of all his/her work from damage and shall protect all public and private abutting property from injury or loss arising in connection with this contract.

33. PROTECTION OF PROPERTY

33.1 The Contractor shall confine his/her equipment and operations to those areas of the work site necessary for the completion of the work, or as authorized by the Project Manager. The Contractor shall protect and preserve from damage any facilities, utilities or features including trees, shrubs and turf which are not required to be disturbed by the requirements of the work.

33.2 The Contractor shall be responsible to determine the location of and to protect from damage any utilities or other improvements.

34. PROJECT MANAGER'S STATUS

The City Process Control Supervisor or his duly authorized representative shall be the City's Project Manager and shall have the duties and responsibilities as provided in the contract.

The Project Manager shall have the authority to reject any work or materials which do not conform to the contract and to decide questions or interpretations which may arise from the contract documents.

The Contractor shall immediately report to the Project Manager any questionable or obvious error or omission which may be apparent in the contract documents and shall not proceed with work until the Project Manager has resolved the error or omission.

35. WORK HOURS

All work shall be done between the hours of 7 am to 7 pm (Monday – Saturday). Work done outside of these times will be at the discretion of the Project Manager.

No work shall be done on Sunday, unless otherwise approved by the Project Manager in writing.

The Contractor shall conduct their work in such a manner that no excavations are left open overnight. If this is not possible, the Contractor shall provide and install a temporary fence to protect the excavation, at the Contractor's expense.

36. UNDERGROUND UTILITIES

For protection of underground utilities, the Contractor shall dial Miss Dig at 1-800-482-7171 a minimum of 72 hours prior to excavating in the vicinity of utility lines. All "Miss Dig" participating members will thus be routinely notified. This does not relieve the Contractor of notifying utility owners who may not be part of the "Miss Dig" alert system.

37. BASIS FOR PAYMENT

Payment shall be based on the bid unit price for each work item and the approved constructed quantity for that work item. Due to potential differences in conditions between the plans and the field, final as built quantities may be different than contained in the bid document. The City does not guarantee quantities and will pay only for "as built" quantities approved by the Project Manager or his representative. Quantities in excess of those approved shall be at the Contractor's own expense, the City will not be responsible for any excess quantities not approved. Should an item of work have to be redone, such as replacing new walk because the Contractor failed to adequately protect the wet concrete from rain or pedestrian or vehicular damage, such work shall be replaced at the Contractor's expense. Should changes in design result in the Project Manager directing the removal and reinstallation of already completed work prior to final completion and acceptance of the project, such removal and installation shall be paid for based on as-bid unit prices and the quantities removed and installed.

38. PAYMENT TO CONTRACTOR

The Project Manager will be responsible for approving all measured quantities of work. Once measured quantities are approved, the Contractor shall submit a pay invoice to the City of Kalamazoo Attn: Accounts Payable at 241 West South Street, Kalamazoo MI, 49007. The contractor is required to meet with the Project Manager to verify final constructed quantities within 60 days of project completion. In the event of a disagreement the Project Manager's measured quantities shall be considered final.

39. **MANDATORY PRE-BID MEETING**

All prospective contractors and subcontractors are invited to attend a MANDATORY Pre-Bid Meeting with representatives from the City of Kalamazoo on **Wednesday, May 11, 2022 at 10:00 a.m. Local Time**. The meeting will be held at 1415 Harrison Street, Kalamazoo, MI 49007, Building #1, Conference Room A. **All prospective contractors attending the meeting MUST sign the pre-bid meeting attendance list to be eligible to bid on this project.**

This Mandatory Pre-Bid Meeting will be longer than is typical for this type of meeting. Public Services will endeavor to provide all of the information necessary to properly bid this project at the meeting, which will hopefully make site visits unnecessary, given the number of sites. **If there is information for properly bidding this project that you will need covered at the meeting, please contact Tom Koporetz at koporetzt@kalamazoocity.org by Friday, May 6, 2022 at 3:00 p.m.**

40. **QUESTIONS**

Bidders shall address questions regarding the specifications to Tom Koporetz, Process Control Supervisor at koporetzt@kalamazoocity.org. (This does not relieve the requirements of Page 1, Item 3.) Questions regarding terms, conditions and other related bid requirements may be addressed to Craig Hull, Buyer at purchasing@kalamazoocity.org.

SECTION VI
TERMS AND CONDITIONS

1. AWARD OF CONTRACT

- A. This contract will be awarded to that responsible bidder whose bid, conforming to this solicitation, will be most advantageous to the City, price and other factors considered. The City reserves the right to accept or reject any or all bids and waive informalities and minor irregularities in bids received. Other factors include, as an example but not limited to, delivery time, conformance to specifications, incidental costs such as demurrage and deposits, etc.

Notification of award will be in writing by the Purchasing Manager. Upon notification, the Contractor shall submit to the Purchasing Division all required insurance certificates (if required) and such other documentation as may be requested or required hereunder. Upon their receipt and subsequent approval by the City, the Purchasing Manager will forward to the Contractor a written **NOTICE TO PROCEED**. Work shall **NOT** be started until such **NOTICE TO PROCEED** is received by the Contractor.

- B. Unilateral changes in bid prices by the bidder shall not be allowed. However, the City, at its sole option, reserves the right to negotiate with bidders in the event of, but not limited to:
- 1) No bids received;
 - 2) A single bid being received; or
 - 3) Prices quoted are over budget and/or unreasonable.

2. COMPLETE CONTRACT

This bid document together with its addenda, amendments, attachments and modifications, when executed, becomes the complete contract between the parties hereto, and no verbal or oral promises or representations made in conjunction with the negotiation of this contract shall be binding on either party.

3. SUBCONTRACTORS – NON-ASSIGNMENT

Bidders shall state in writing any and all sub-contractors to be associated with this bid, including the type of work to be performed. The Contractor shall cooperate with the City of Kalamazoo in meeting its commitments and goals with regard to maximum utilization of minority and women-owned business enterprises.

The Contractor hereby agrees and understands that the contract resulting from this solicitation shall not be transferred, assigned or sublet without prior written consent of the City of Kalamazoo.

4. TAXES

The City of Kalamazoo is exempt from all federal excise tax and state sales and use taxes.

5. INVOICING

All original invoice(s) will be sent to the Financial Services Division, 241 W. South Street, Kalamazoo, MI 49007 or via email at apinvoice@kalamazoo-city.org. The Finance Division processes payments after receipt of an original invoice from the Contractor and approval by the department. The City of Kalamazoo's policy is to pay invoice(s) within 30 days from the receipt of the original invoice, if the services or supplies are satisfactory and the proper paperwork and procedures have been followed. **In order to guarantee payment to the vendor on a timely basis, the vendor needs to receive a purchase order number before supplying the City of Kalamazoo with goods or services.** All original, and copies of original invoice(s), will clearly state which purchase order they are being billed against.

The City of Kalamazoo is a government municipality and therefore is tax exempt from all sales tax.

The vendor is responsible for supplying the Finance Division with a copy of their W9 if they are providing a service to the City of Kalamazoo.

6. PAYMENTS

Upon issuance of certificates of Payment by the Architect/Engineer for labor and material incorporated in the work and the materials suitably stored at the site payment shall be made up to ninety (90%) percent of the value thereof.

When the cumulative total of payment is equal to fifty (50%) percent of the contract sum, subsequent payments will be made in the full amount for labor and material certified by the Architect/Engineer.

The amount retained shall be held until final acceptance of the work, receipt of all payrolls, releases, and waiver of liens.

7. CHANGES AND/OR CONTRACT MODIFICATIONS

The City reserves the right to increase or decrease quantities, service or requirements, or make any changes necessary at any time during the term of this contract, or any negotiated extension thereof. Price adjustments due to any of the foregoing changes shall be negotiated and mutually agreed upon by the Contractor and the City.

Changes of any nature after contract award which reflect an increase or decrease in requirements or costs shall not be permitted without prior approval by the Purchasing Agent. City Commission approval may also be required.

ANY CHANGES PERFORMED IN ADVANCE OF PURCHASING AGENT APPROVAL, MAY BE SUBJECT TO DENIAL AND NON-PAYMENT.

8. LAWS, ORDINANCES AND REGULATIONS

The Contractor shall keep himself/herself fully informed of all local, state and federal laws, ordinances and regulations in any manner affecting those engaged or employed in the work and the equipment used. Contractor and/or employees shall, at all times, serve and comply with such laws, ordinances and regulations.

Any permits, licenses, certificates or fees required for the performance of the work shall be obtained and paid for by the Contractor.

This contract shall be governed by the laws of the State of Michigan.

9. RIGHT TO AUDIT

The City or its designee shall be entitled to audit all of the Contractor's records, and shall be allowed to interview any of the Contractor's employees, throughout the term of this contract and for a period of three years after final payment or longer if required by law to the extent necessary to adequately permit evaluation and verification of:

- A. Contractor compliance with contract requirements,
- B. Compliance with provisions for pricing change orders, invoices or claims submitted by the Contractor or any of his payees.

10. HOLD HARMLESS

If the negligent acts or omissions of the Contractor/Vendor or its employees, agents or officers, cause injury to person or property, the Contractor/Vendor shall indemnify and save harmless the City of Kalamazoo, its agents, officials, and employees against all claims, judgments, losses, damages, demands, and payments of any kind to persons or property to the extent occasioned from any claim or demand arising therefrom.

11. DEFAULT

The City may at any time, by written notice to the Contractor, terminate this contract and the Contractor's right to proceed with the work, for just cause, which shall include, but is not limited to the following:

- A. Failure to provide insurance and bonds (when called for), in the exact amounts and within the time specified or any extension thereof.
- B. Failure to make delivery of the supplies, or to perform the services within the time specified herein, or any extension thereof.
- C. The unauthorized substitution of articles for those bid and specified.
- D. Failure to make progress if such failure endangers performance of the contract in accordance with its terms.
- E. Failure to perform in compliance with any provision of the contract.

DEFAULT (cont.)

- F. Standard of Performance - Contractor guarantees the performance of the commodities, goods or services rendered herein in accordance with the accepted standards of the industry or industries concerned herein, except that if this specification calls for higher standards, then such higher standards shall be provided.

Upon notice by the City of Contractor's failure to comply with such standards or to otherwise be in default of this contract in any manner following the Notice to Proceed, Contractor shall immediately remedy said defective performance in a manner acceptable to the City. Should Contractor fail to immediately correct said defective performance, said failure shall be considered a breach of this contract and grounds for termination of the same by the City.

In the event of any breach of this contract by Contractor, Contractor shall pay any cost to the City caused by said breach including but not limited to the replacement cost of such goods or services with another Contractor.

The City reserves the right to withhold any or all payments until any defects in performance have been satisfactorily corrected.

In the event the Contractor is in breach of this contract in any manner, and such breach has not been satisfactorily corrected, the City may bar the Contractor from being awarded any future City contracts.

- G. All remedies available to the City herein are cumulative and the election of one remedy by the City shall not be a waiver of any other remedy available to the City.

12. TERMINATION OF CONTRACT

The City may, at any time and without cause, suspend the work of this contract for a period of not more than ninety days after providing notice in writing to the Contractor. The Contractor shall be allowed an adjustment in the contract price or an extension of the contract times, or both, directly attributable to the suspension if Contractor makes an approved claim.

The City may, without prejudice to any other right or remedy of the City, and with or without cause, terminate the contract by giving seven days written notice to the Contractor. In such case the Contractor shall be paid, without duplication, for the following items:

- A. Completed and acceptable work executed in accordance with the contract documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such work;
- B. Expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials or equipment as required by the contract documents in connection with uncompleted work, plus fair and reasonable sums for overhead and profit on such expenses;
- C. All documented claims, costs, losses and damages incurred in settlement of terminated contracts with Subcontractors, Suppliers and others; and
- D. Reasonable expenses directly attributable to termination.

The Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

13. INDEPENDENT CONTRACTOR

At all times, the Contractor, any of his/her employees, or his/her sub-contractors and their subsequent employees shall be considered independent contractors and not as City employees. The Contractor shall exercise all supervisory control and general control over all workers' duties, payment of wages to Contractor's employees and the right to hire, fire and discipline their employees and workers. As an independent contractor, payment under this contract shall not be subject to any withholding for tax, social security or other purposes, nor shall the Contractor or his/her employees be entitled to sick leave, pension benefit, vacation, medical benefits, life insurance or workers' unemployment compensation or the like.

14. PROJECT SUPERVISOR

The Contractor shall employ an individual to act as Project Supervisor. The Project Supervisor shall be available to the Contractor's workers and the Project Manager at all times by use of a mobile phone, beeper or other reliable means. The Project Supervisor shall prepare daily work plans for the employees, monitor employee performance, attendance and punctuality; and work closely with the City's Project Manager in assuring contract compliance.

15. MEETINGS

The Contractor and/or Project Supervisor shall be available to meet with the Department Head or Project Manager at a mutually agreeable time to discuss problems, issues or concerns relative to the contract. Either party may call a meeting at any time. When such a request for a meeting is made, the meeting date shall, in no case exceed five (5) working days after the request; and, if in the sole opinion of the Department Head, the severity of the circumstance warrants, no more than one (1) working day.

16. INSPECTION OF WORK SITE

Before submitting bids or quotes for work, the Contractor shall be responsible for examining the work site and satisfying himself/herself as to the existing conditions under which he/she will be obligated to operate, or that in any way affects the work under this contract. No allowance shall be made subsequently, in behalf of the Contractor, for any negligence on his/her part.

17. CONTRACT PERIOD, EXTENSIONS, CANCELLATION

- A. The contract shall be in effect for the term stated in the specifications.
- B. The City may opt to extend this contract upon mutual agreement of both parties. The number of extensions shall be limited to that stated in the specifications.
- C. The City may, from time to time, find it necessary to continue this contract on a month-to-month basis only, not to exceed a six (6) month period. Such month-to-month extended periods shall be by mutual agreement of both parties, with all provisions of the original contract or any extension thereof remaining in full force and effect.
- D. All contracts, extensions and cost increases are subject to availability of funds and the approval of the City Commission (if required).

CONTRACT PERIOD, EXTENSIONS, CANCELLATION (*cont.*)

- E. The City reserves the right to cancel the contract due to non-appropriation of funds by the City with thirty (30) days written notice.
- F. Either party may terminate the contract (or any extension thereof) without cause at the end of any twelve (12) month term by giving written notice of such intent at least 60 days prior to the end of said twelve (12) month term.
- G. All notices are in effect commencing with the date of mailing. Written notices may be delivered in person or sent by First Class mail; faxed or emailed to the last known address.
- H. If cancellation is for default of contract due to non-performance, the contract may be canceled at any time (see Item 11, DEFAULT)

APPENDIX A
NON-DISCRIMINATION CLAUSE FOR ALL CITY OF KALAMAZOO CONTRACTS

The Contractor agrees to comply with the Federal Civil Rights Act of 1964 as amended; the Federal Civil Rights Act of 1991 as amended; the Americans With Disabilities Act of 1990 as amended; the Elliott-Larson Civil Rights Act, Act. No. 453, Public Act of 1976 as amended; the Michigan Handicappers Civil Rights Act, Act No. 220, Public Act of 1976 as amended, City Ordinance 1856 and all other applicable Federal and State laws. The Contractor agrees as follows:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, national origin, sex, age, height, weight, marital status, physical or mental disability, family status, sexual orientation or gender identity that is unrelated to the individual's ability to perform the duties of the particular job or position. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer, recruitment advertising, layoff or termination; rates of pay or other forms of compensations; and selection for training, including apprenticeship.
2. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, national origin, sex, age, height, weight, marital status, physical or mental disability family status, sexual orientation or gender identity that is unrelated to the individual's ability to perform the duties of the particular job or position.
3. If requested by the City, the Contractor shall furnish information regarding practices, policies and programs and employment statistics for the Contractor and subcontractors. The Contractor and subcontractors shall permit access to all books, records and accounts regarding employment practices by agents and representatives of the City duly charged with investigative duties to assure compliance with this clause.
4. Breach of the covenants herein may be regarded as a material breach of the contract or purchasing agreement as provided in the Elliott-Larsen Civil Rights Act and City Ordinance 1856.
5. The Contractor will include or incorporate by reference the provisions of the foregoing paragraphs 1 through 4 in every subcontract or purchase order unless exempted by the rules, regulations or orders of the Michigan Civil Rights Commission* and will provide in every subcontract or purchase order that said provision will be binding upon each subcontractor or seller.
6. The Contractor will not preclude a person with a criminal conviction from being considered for employment unless otherwise precluded by federal or state law. (for contracts over \$25,000)

The Elliott-Larson Civil Rights Act, Sec. 202 of Act. No. 453 of 1976 reads in part as follows:

Sec. 202. (1) An employer shall not:

- (a) Fail or refuse to hire, or recruit, or discharge or otherwise discriminate against an individual with respect to employment, compensation, or a term condition or privilege of employment because of religion, race, color, national origin, age, sex, height, weight or marital status.
- (b) Limit, segregate or classify an employee or applicant for employment in a way which deprives or tends to deprive the employee or applicant of an employment opportunity or otherwise adversely affects the status of an employee or applicant because of religion, race, color, national origin, age, sex, height, weight or marital status.
- (c) Segregate, classify or otherwise discriminate against a person on the basis of sex with respect to a term, condition or privilege of employment, including a benefit plan or system.

* Except for contracts entered into with parties employing less than three employees.

APPENDIX B - PREVAILING WAGES

Prevailing wages are applicable to this contract, therefore, rates will apply as follows:

- (XX) Project is funded by City of Kalamazoo monies and is estimated to be in excess of \$100,000.00. The applicable prevailing wage rates are attached.

Specifications for projects in which the City of Kalamazoo is party for construction, alterations and/or repair including painting and decorating of public buildings or public works in or for the City of Kalamazoo and which requires or involves the employment of mechanics and/or laborers shall contain the following provisions stating the minimum wages to be paid the various classes of laborers and mechanics for the project. Prevailing wage rates determined by the U.S. Department of Labor under Davis Bacon and related acts will be used for City of Kalamazoo construction projects.

By the incorporation of prevailing wage rates within this specification, the City of Kalamazoo stipulates that:

- ✓ Contractor or his/her subcontractor shall pay all mechanics and laborers employed directly upon the site of the work, unconditionally and not less than once a week and without subsequent deduction or rebate on any account the full amount, accrued at the time of payment, computed at wage rates as incorporated herein regardless of any contractual relationship which may be alleged to exist between the contractor or subcontractor and such laborers and mechanics;
- ✓ The scale of wages to be paid shall be posted by the contractor in a prominent and easily accessible place at the site of the work;
- ✓ The Prime Contractor and all subcontractors shall submit weekly certified payrolls documenting the hours worked and wages paid by work classification. **NOTE: Contactor shall not include Social Security numbers of employees on certified payrolls.**
- ✓ There may be withheld from the contractor's accrued payments the amount considered necessary by the City's Contracting Official to pay to laborers and mechanics employed by the contractor or any subcontractor on the work for the difference between the rates of wages required by the contract and the rates of wages received by such laborers and mechanics except those amounts properly deducted or refunded pursuant to the terms of the Davis-Bacon Act (USC, Title 40, Sec. 276a) and interpretations thereof.

Special Note: The City's requirements as it relates to prevailing wages **includes a meeting with the City's Purchasing Agent prior to starting work and the submission of weekly certified payrolls by prime contractors and all subcontractors.** The City will monitor certified payrolls, work progress, and conduct interviews with the mechanics and labors employed directly upon the site during the duration of the contract Please contact the Purchasing Department at (269) 337-8020 if you have any questions regarding prevailing wage provision.

The overtime pay to which a laborer or mechanic is entitled under this contract shall be that overtime pay to which he/she is entitled by any agreement made with the contractor or subcontractor or by any applicable provision of law; but in no event shall such amount be less than the prevailing wage in the Kalamazoo community for such overtime.

Revised 4-08



PREVAILING WAGE RATES

REMOTE STATION UPGRADES

Bid Reference #: 91438-004.0

April 2022

"General Decision Number: MI20220087 04/01/2022

Superseded General Decision Number: MI20210087

State: Michigan

Construction Type: Building

County: Kalamazoo County in Michigan.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

<p>If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:</p>	<ul style="list-style-type: none"> . Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$15.00 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2022.
<p>If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:</p>	<ul style="list-style-type: none"> . Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$11.25 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2022.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Modification Number	Publication Date
0	01/07/2022
1	02/18/2022

2 02/25/2022
 3 04/01/2022

ASBE0047-002 07/01/2021

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR.....	\$ 33.77	18.18

BOIL0169-001 01/01/2021

	Rates	Fringes
BOILERMAKER.....	\$ 35.95	34.52

BRMI0009-031 08/01/2020

	Rates	Fringes
BRICKLAYER.....	\$ 31.01	20.36
TILE FINISHER.....	\$ 23.17	13.79
TILE SETTER.....	\$ 24.23	15.56

CARP0525-013 06/01/2021

	Rates	Fringes
CARPENTER (Including Acoustical Ceiling Installation, Drywall Hanging, Form Work, Metal Stud Installation & Scaffold Builder).....	\$ 25.94	20.59

CARP1102-001 06/01/2019

	Rates	Fringes
MILLWRIGHT.....	\$ 28.59	24.79

ELEC0131-001 06/01/2021

	Rates	Fringes
ELECTRICIAN Excludes Low Voltage Wiring.	\$ 36.61	7.95+27%

ENGI0324-002 06/01/2021

	Rates	Fringes
OPERATOR: Power Equipment		
GROUP 1.....	\$ 42.38	24.85
GROUP 2.....	\$ 39.08	24.85
GROUP 3.....	\$ 36.43	24.85
GROUP 4.....	\$ 34.72	24.85
GROUP 5.....	\$ 34.72	24.85
GROUP 6.....	\$ 28.86	24.85
GROUP 7.....	\$ 26.38	24.85

FOOTNOTES:

Crane operator with main boom and jib 300' or longer: \$1.50 per hour above the group 1 rate.

Crane operator with main boom and jib 400' or longer: \$3.00 per hour above the group 1 rate.

PAID HOLIDAYS: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Crane operator with main boom and jib 400', 300', or 220' or longer.

GROUP 2: Crane operator with main boom and jib 140' or longer, tower crane, gantry crane, whirley derrick

GROUP 3: Backhoe/Excavator/Trackhoe; Crane; Concrete Pump; Grader/Blade; Highlift; Hoist; Loader; Roller; Scraper; Stiff Leg Derrick; Trencher

GROUP 4: Bobcat/Skid Loader; Broom/Sweeper; Fork Truck (over 20' lift)

GROUP 5: Boom Truck (non-swinging)

GROUP 6: Fork Truck (20' lift and under for masonry work)

GROUP 7: Oiler

IRON0340-002 06/19/2017

	Rates	Fringes
IRONWORKER, REINFORCING AND STRUCTURAL.....	\$ 24.43	24.67

LABO0355-022 06/01/2021

	Rates	Fringes
LABORER Common or General; Grade Checker; Mason Tender - Brick; Mason Tender - Cement/Concrete; Sandblaster.....	\$ 24.90	12.95
Pipelayer.....	\$ 20.34	12.85

PAIN0312-002 06/01/2020

	Rates	Fringes
PAINTER: Brush and Roller.....	\$ 23.74	13.35
PAINTER: Drywall Finishing/Taping.....	\$ 23.74	13.35
PAINTER: Spray.....	\$ 25.22	13.47

PLAS0016-003 04/01/2014

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 22.31	12.83

PLUM0357-001 07/01/2020

Excluding Fort Custer

	Rates	Fringes
PIPEFITTER, Includes HVAC Pipe and Unit Installation.....	\$ 35.20	22.35
PLUMBER, Excludes HVAC Pipe and Unit Installation.....	\$ 35.20	22.35

ROOF0070-002 06/01/2021

	Rates	Fringes
ROOFER.....	\$ 29.09	16.53

* SFMI0669-001 04/01/2022

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers).....	\$ 38.69	24.66

SHEE0007-010 05/01/2018

	Rates	Fringes
SHEET METAL WORKER (HVAC Duct Installation Only).....	\$ 32.61	19.66

* SUMI2011-012 02/01/2011

	Rates	Fringes
IRONWORKER, ORNAMENTAL.....	\$ 18.48	7.93
LABORER: Landscape & Irrigation.....	\$ 10.38 **	0.50
OPERATOR: Bulldozer.....	\$ 19.68	6.64
OPERATOR: Tractor.....	\$ 19.10	8.48
SHEET METAL WORKER, Excludes HVAC Duct and Unit Installation.....	\$ 23.59	5.66
TRUCK DRIVER: Dump Truck.....	\$ 17.26	11.42
TRUCK DRIVER: Lowboy Truck.....	\$ 14.50 **	0.44
TRUCK DRIVER: Tractor Haul Truck.....	\$ 13.57 **	1.18

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher
minimum wage under Executive Order 14026 (\$15.00) or 13658
(\$11.25). Please see the Note at the top of the wage
determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave
for Federal Contractors applies to all contracts subject to the

Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the E0, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the E0 is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average

calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator

U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

=====

END OF GENERAL DECISIO"



PROJECT MANUAL

REMOTE STATION UPGRADES

Bid Reference #: 91438-004.0

CITY OF KALAMAZOO DEPARTMENT OF PUBLIC SERVICES

Copy No.



REMOTE STATION UPGRADES

Contract No. 200-19743-21003

Project Manual

Prepared by:



TETRA TECH

March 2022

**CITY OF KALAMAZOO MICHIGAN
REMOTE STATION UPGRADES**

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DIVISION 0

BIDDING AND CONTRACT REQUIREMENTS

Performance Bond

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Address of Principal Place
of Business):

OWNER (Name and Address):

CONTRACT

Date:

Amount:

Description (Name and Location):

BOND

Date (Not earlier than Contract Date):

Amount:

Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent or representative.

CONTRACTOR AS PRINCIPAL

Company: _____ (Corp. Seal)

Signature: _____

Name and Title:

SURETY

Company: _____ (Corp. Seal)

Signature: _____

Name and Title:

(Attach Power of Attorney)

(Space is provided below for signatures of additional parties, if required.)

CONTRACTOR AS PRINCIPAL

Company: _____ (Corp. Seal)

Signature: _____

Name and Title:

SURETY

Company: _____ (Corp. Seal)

Signature: _____

Name and Title:

EJCDC No. 1910-28-A (1996 Edition)

Originally prepared through the joint efforts of the Surety Association of America, Engineers Joint Contract Documents Committee, the Associated General Contractors of America, and the American Institute of Architects.

(FOR INFORMATION ONLY--Name, Address and Telephone)

AGENT or BROKER: _____ OWNER'S REPRESENTATIVE (Engineer or other party): _____

1. The CONTRACTOR and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Contract, which is incorporated herein by reference.

2. If the CONTRACTOR performs the Contract, the Surety and the CONTRACTOR have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.

3. If there is no OWNER Default, the Surety's obligation under this Bond shall arise after:

3.1. The OWNER has notified the CONTRACTOR and the Surety at the addresses described in Paragraph 10 below, that the OWNER is considering declaring a CONTRACTOR Default and has requested and attempted to arrange a conference with the CONTRACTOR and the Surety to be held not later than fifteen days after receipt of such notice to discuss methods of performing the Contract. If the OWNER, the CONTRACTOR and the Surety agree, the CONTRACTOR shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive the OWNER's right, if any, subsequently to declare a CONTRACTOR Default; and

3.2. The OWNER has declared a CONTRACTOR Default and formally terminated the CONTRACTOR's right to complete the Contract. Such CONTRACTOR Default shall not be declared earlier than twenty days after the CONTRACTOR and the Surety have received notice as provided in Paragraph 3.1; and

3.3. The OWNER has agreed to pay the Balance of the Contract Price to:

3.3.1. The Surety in accordance with the terms of the Contract;

3.3.2. Another contractor selected pursuant to Paragraph 4.3 to perform the Contract.

4. When the OWNER has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

4.1. Arrange for the CONTRACTOR, with consent of the OWNER, to perform and complete the Contract; or

4.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or

4.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the OWNER for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by the OWNER and the contractor selected with the OWNER's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the Bonds issued on the Contract, and pay to the OWNER the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by the OWNER resulting from the CONTRACTOR Default; or

4.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances;

4.4.1. After investigation, determine the amount for which it may be liable to the OWNER and, as soon as practicable after the amount is determined, tender payment therefor to the OWNER; or

4.4.2. Deny liability in whole or in part and notify the OWNER citing reasons therefor.

5. If the Surety does not proceed as provided in Paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond fifteen days after receipt of an additional written notice from the OWNER to the Surety demanding that the Surety perform its obligations under this Bond, and the OWNER shall be entitled to enforce any remedy available to the OWNER. If the Surety proceeds as provided in Paragraph 4.4, and the OWNER refuses the payment tendered or the Surety has denied liability, in whole or in part, without further notice the OWNER shall be entitled to enforce any remedy available to the OWNER.

6. After the OWNER has terminated the CONTRACTOR's right to complete the Contract, and if the Surety elects to act under Paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of the Surety to the OWNER shall not be greater than those of the CONTRACTOR under the Contract, and the responsibilities of the OWNER to the Surety shall not be greater than those of the OWNER under the Contract. To a limit of the amount of this Bond, but subject to commitment by the OWNER of the Balance of the Contract Price to mitigation of costs and damages on the Contract, the Surety is obligated without duplication for:

6.1. The responsibilities of the CONTRACTOR for correction of defective Work and completion of the Contract;

6.2. Additional legal, design professional and delay costs resulting from the CONTRACTOR's Default, and resulting from the actions or failure to act of the Surety under Paragraph 4; and

6.3. Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of the CONTRACTOR.

7. The Surety shall not be liable to the OWNER or others for obligations of the CONTRACTOR that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the OWNER or its heirs, executors, administrators, or successors.

8. The Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders and other obligations.

9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the Work or part of the Work is located and shall be instituted within two years after CONTRACTOR Default or within two years after the CONTRACTOR ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to the Surety, the OWNER or the CONTRACTOR shall be mailed or delivered to the address shown on the signature page.

11. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the Contract was performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted here from and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

12. Definitions.

12.1. Balance of the Contract Price: The total amount payable by the OWNER to the CONTRACTOR under the Contract after all proper adjustments have been made, including allowance to the CONTRACTOR of any amounts received or to be received by the OWNER in settlement of insurance or other Claims for damages to which the CONTRACTOR is entitled, reduced by all valid and proper payments made to or on behalf of the CONTRACTOR under the Contract.

12.2. Contract: The agreement between the OWNER and the CONTRACTOR identified on the signature page, including all Contract Documents and changes thereto.

12.3. CONTRACTOR Default: Failure of the CONTRACTOR, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.

12.4. OWNER Default: Failure of the OWNER, which has neither been remedied nor waived, to pay the CONTRACTOR as required by the Contract or to perform and complete or comply with the other terms thereof.

(FOR INFORMATION ONLY--Name, Address and Telephone)
AGENT or BROKER: OWNER'S REPRESENTATIVE (Engineer or other party):

PAYMENT BOND

CONTRACTOR (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address):

CONTRACT

Date:
Amount:
Description (Name and Location):

BOND

Date (Not earlier than Contract Date):
Amount:
Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent or representative.

CONTRACTOR AS PRINCIPAL

Company: _____ (Corp. Seal)
Seal)

SURETY

Company: _____ (Corp.

Signature: _____
Name and Title:

Signature: _____
Name and Title:
(Attach Power of Attorney)

(Space is provided below for signatures of additional parties, if required.)

CONTRACTOR AS PRINCIPAL

Company: _____ (Corp. Seal)
Seal)

SURETY

Company: _____ (Corp.

Signature: _____
Name and Title:

Signature: _____
Name and Title:

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in

EJCDC® C-615, Payment Bond

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and American Society of Civil Engineers. All rights reserved

Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond shall arise after the following:
 - 5.1 Claimants who do not have a direct contract with the Contractor,
 - 5.1.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
 - 5.1.2 have sent a Claim to the Surety (at the address described in Paragraph 13).
 - 5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
 - 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
 - 7.2 Pay or arrange for payment of any undisputed amounts.

7.3 The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.
9. Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.
10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.
11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

16.1 **Claim:** A written statement by the Claimant including at a minimum:

1. The name of the Claimant;
2. The name of the person for whom the labor was done, or materials or equipment furnished;
3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
4. A brief description of the labor, materials, or equipment furnished;
5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and
8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2 **Claimant:** An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's

subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3 **Construction Contract:** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4 **Owner Default:** Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5 **Contract Documents:** All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

18. Modifications to this Bond are as follows:

SECTION 00620

APPLICATION FOR PAYMENT CERTIFICATE

CONTRACTOR'S APPLICATION FOR PAYMENT NO. _____

CONTRACTOR: _____ TITLE: _____

OWNER: _____ CONTRACT NO.: _____

Substantial Completion Date: _____ Final Completion Date: _____

Milestone Completion Date: _____

Application is made for payment for the Work shown below, accomplished through the date of _____

1. Original Contract Sum		\$	_____
2. Net Change by Change Order		\$	_____
3. Current Contract Amount (line 1 + line 2)		\$	_____
4. Work Complete (from summary sheet) _____ %		\$	_____
5. Stored Materials (from summary sheet, if applicable)		\$	_____
6. Less _____ % Retainage	\$	_____	
7. Less 10% Retainage - Stored Materials	\$	_____	
8. Total Retainage (line 6 + 7)		\$	_____
9. Amount Due to Date (line 4 + 5 - 8)		\$	_____
10. Less Previous Payments (from summary sheet)		\$	_____
11. Amount Due This Application (line 9-10)		\$	_____

CONTRACTOR's Certification:

The undersigned CONTRACTOR certifies that: (1) all previous progress payments received from OWNER on account of Work done under the Contract referred to above have been applied to discharge in full all obligations of CONTRACTOR incurred in connection with Work covered by prior Applications for Payment; (2) title to all Work, materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to OWNER at time of payment free and clear of all liens, claims, security interest and encumbrances (except such as are covered by Bond acceptable to OWNER indemnifying OWNER against any such lien, claim, security interest or encumbrance); and (3) all Work covered by this Application for Payment is in accordance with the Contract Documents and not *defective* as that term is defined in the Contract Documents.

ATTACHMENTS TO THIS CERTIFICATION:

____ Summary Sheet ____ Change Order Summary ____ Stored Material Summary
____ Other _____

CONTRACTOR:

By: _____ Date: _____

Payment to CONTRACTOR of the amount shown in line 11 above is recommended by ENGINEER, Tetra Tech, Inc.

By: _____ Date: _____

APPROVED: OWNER

By: _____ Date: _____

Change Order Summary

No.	Date	Additions	Deductions
	Subtotals		
Total Change In Contract Price			

Stored Material Summary

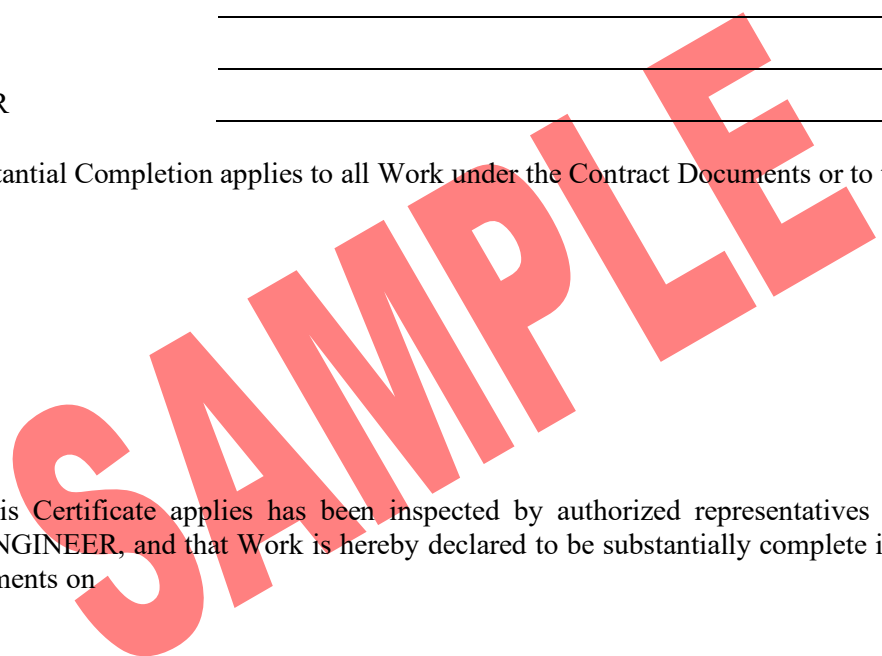
Invoice No.	Stored Material	Material Location	Insurance Certificates on File	Stored Previous		Stored This Month		Incorporated This Month		Materials remaining in storage (\$)
				Date (MO/YR)	Amount (\$)	Date (MO/YR)	Amount (\$)	Date (MO/YR)	Amount (\$)	
		On-Site Off-Site	Yes / No							
		On-Site Off-Site	Yes / No							
		On-Site Off-Site	Yes / No							

SECTION 00626

CERTIFICATE OF SUBSTANTIAL COMPLETION

Contract _____
 Contract No. _____
 Date Issued: _____
 OWNER _____
 CONTRACTOR _____

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof:



The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, and that Work is hereby declared to be substantially complete in accordance with the Contract Documents on _____

DATE OF SUBSTANTIAL COMPLETION

A tentative list of items to be completed or corrected is attached hereto as Attachment No. A. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by CONTRACTOR within _____ days of the above date of Substantial Completion.

The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties and guarantees pending final payment shall be as follows:

OWNER: Shall perform and/or maintain insurances, if any, in accordance with Article 5 of the General Conditions, and allow CONTRACTOR reasonable access to complete or correct items on the tentative list. Additional responsibilities are:

CONTRACTOR: Shall perform and/or maintain Site security, temporary facilities, Bonds and insurances in accordance with Article 5 of the General Conditions, and protect the Work. Additional responsibilities are:

The following documents are attached to and made a part of this Certificate:

Attachment A: Tentative List of Items to be completed prior to Final Payment (Pages 1 to __, inclusive).

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR's obligation to complete the Work in accordance with the Contract Documents.

Executed by ENGINEER on _____
Date

ENGINEER

By: _____
(Authorized Signature)

CONTRACTOR accepts this Certificate of Substantial Completion on _____
Date

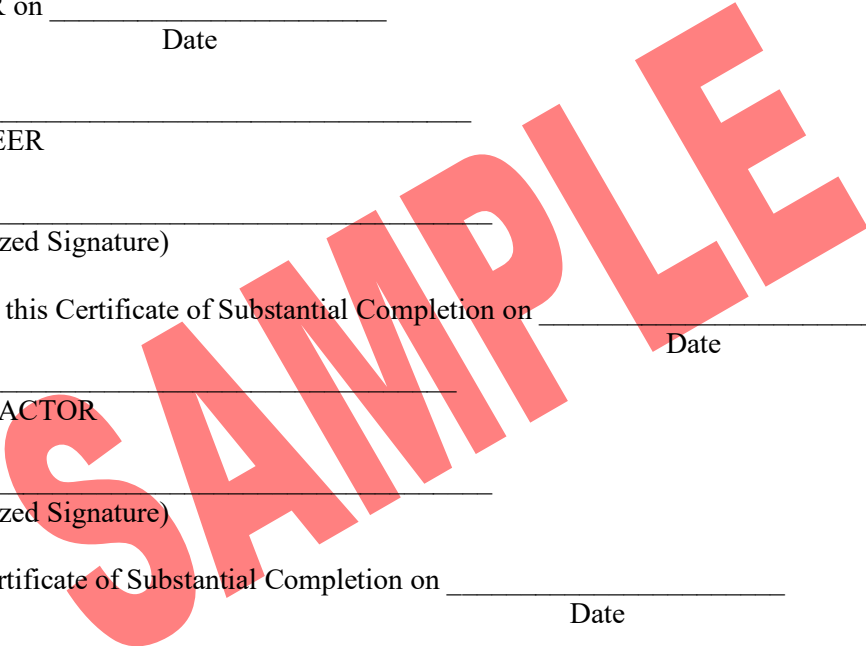
CONTRACTOR

By: _____
(Authorized Signature)

OWNER accepts this Certificate of Substantial Completion on _____
Date

OWNER

By: _____
(Authorized Signature)



SECTION 00627

CERTIFICATE OF FINAL COMPLETION

Contract _____
Contract No. _____
Date Issued: _____
OWNER _____
CONTRACTOR _____

This Certificate of Final Completion applies to all Work under the Contract Documents or to the following specified parts thereof:

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, in accordance with Paragraph 14.06 of the General Conditions, and that Work is hereby declared to be finally complete in accordance with the Contract Documents on

DATE OF FINAL COMPLETION

CONTRACTOR's general warranty and guarantee period commences on _____ and terminates on _____.

CONTRACTOR's special warranty and guarantee are:

_____ warranty and guarantee period commences on _____ and terminates on _____.

_____ warranty and guarantee period commences on _____ and terminates on _____.

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR's obligation to correct defective Work in accordance with the General Conditions of the Contract Documents.

Executed by ENGINEER on _____
Date

ENGINEER

By: _____
(Authorized Signature)

CONTRACTOR accepts this Certificate of Final Completion on _____
Date

CONTRACTOR

By: _____
(Authorized Signature)

OWNER accepts this Certificate of Final Completion on _____
Date

OWNER

By: _____
(Authorized Signature)

SECTION 00931

REQUEST FOR INFORMATION

From: _____ RFI Number: _____

Date: _____

Project: _____

Submitted to: _____
ENGINEER - Tetra Tech, Inc. Contract: _____

Specification Section: _____ Paragraph: _____ Drawing Reference: _____ Detail: _____

Request: _____



Attachments

Signed by: _____

Response: _____

Attachments

Follow-up: Contract Clarification Field Order Work Change Directive .Proposal Request

Signed by: _____ Date: _____
ENGINEER - Tetra Tech, Inc.

Copy: OWNER CONTRACTOR RPR CPM Shop Dwg. File

END OF SECTION

SECTION 00934

PROPOSAL REQUEST

CONTRACTOR: _____ Request Number: _____

Date: _____

Project: _____
From: _____
ENGINEER - Tetra Tech, Inc. Contract: _____

INTENT: This is not a Change Order. This is a request to CONTRACTOR for a detailed price breakdown of proposed changes in the Work. Where Unit Prices are established in the Agreement, they will be used for changes in pay item quantities. Any changes to cost other than those due to quantity changes must be clearly stated.

PROPOSED CHANGES:

REASON:

It is required that the spaces provided for the change in Contract Price, signature and date be filled in and (2) copies returned to ENGINEER. A quotation, showing the Proposal Request number and detailed cost setting forth the breakdown of labor, material, and markup, is to be attached to each copy of the Proposal Request, showing the Contract Price addition, deduction, or no change for this request.

RECOMMENDED BY:

ENGINEER: Tetra Tech, Inc.

CONTRACTOR'S QUOTATION:

Will the Work covered by this Proposal Request require an extension of the Contract Times _____?
If yes, how many calendar days _____?

Proposed Change in Contract Price: Addition Deduction No change in Contract Price
(circle one)
_____ Dollars (\$ _____)

CONTRACTOR

BY _____

DATE _____

Copy: OWNER CONTRACTOR RPR CPM Shop Dwg. File

END OF SECTION

SECTION 00942

FIELD ORDER

CONTRACTOR: _____ F.O. Number: _____

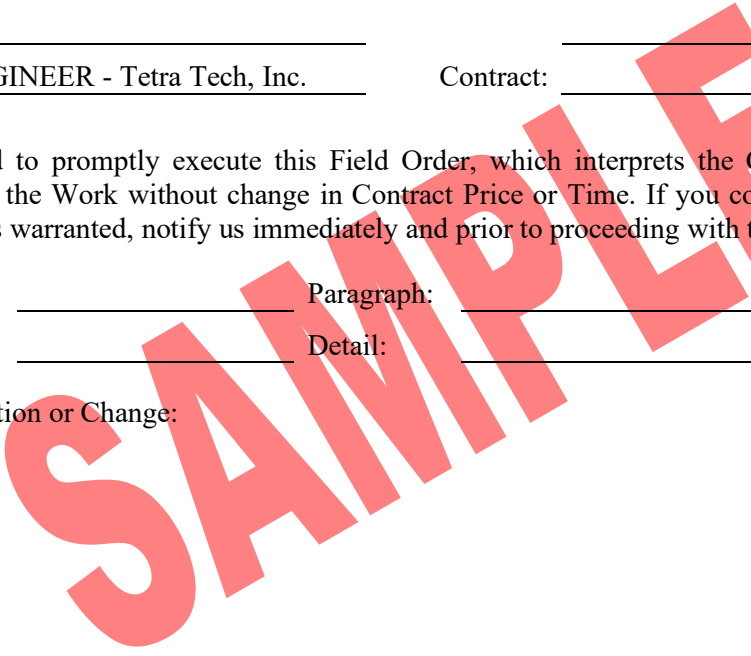
Date: _____

Project: _____
From: _____
ENGINEER - Tetra Tech, Inc. Contract: _____

You are hereby directed to promptly execute this Field Order, which interprets the Contract Documents or orders minor changes in the Work without change in Contract Price or Time. If you consider that a change in Contract Price or Time is warranted, notify us immediately and prior to proceeding with this Work.³

Specification Section: _____ Paragraph: _____
Drawing Reference: _____ Detail: _____

Description of Interpretation or Change: _____



Attachments

Signed by: _____ Date: _____
ENGINEER - Tetra Tech, Inc.

Copy: OWNER CONTRACTOR RPR CPM Shop Dwg. File

END OF SECTION

SECTION 00943

WORK CHANGE DIRECTIVE

CONTRACTOR: _____ W.C.D. Number: _____
 _____ Date: _____
 _____ Project: _____
 From: _____
 _____ Contract: _____
 ENGINEER - Tetra Tech, Inc.

To prevent a possible delay in the Work you are directed to proceed with the following changes:

Reason:

The Contract Price and/or Contract Times will be adjusted by a future Change Order based on:

- _____ Extension of Unit Prices as indicated in Agreement.
- _____ Actual time and material costs plus OH&P.
- _____ Actual time and material costs plus OH&P, not to exceed. \$ _____
- _____ An agreed sum to be added. \$ _____
- _____ An agreed sum to be deducted. \$ _____
- _____ No change in Contract Price.
- _____ No change in Contract Time.

A detailed breakdown _____ is needed.
_____ has been received.

ENGINEER: Tetra Tech, Inc. _____

Recommended by: _____ Date _____

CONTRACTOR: _____

Accepted by: _____ Date _____

OWNER: _____

Approved by: _____ Date _____

Copy: OWNER CONTRACTOR RPR CPM Shop Dwg. File

SECTION 00943

WORK CHANGE DIRECTIVE - SUBSTITUTION

CONTRACTOR: _____ W.C.D. Number: _____
 _____ Date: _____
 _____ Project: _____
 From: _____
 _____ Contract: _____
 ENGINEER - Tetra Tech, Inc.

CONTRACTOR has submitted the following material or equipment to ENGINEER for review as a Substitute item in accordance with Paragraph 6.05 of the General Conditions and as supplemented by the Supplementary Conditions.

Opinion of probable ENGINEER's costs for Substitution Review:
 Minimum review fee \$200
 Hours to review _____ hours at \$120 per hour \$_____
 Opinion of Probable costs for Substitute review \$_____

The Contract Price and/or Contract Times will be adjusted by a future Change Order based on:
 _____ Actual time and material costs to be deducted

ENGINEER will notify CONTRACTOR if review hours are to exceed those listed above.

Section 01630, Substitution Request Application _____ is needed.
 _____ has been received.

ENGINEER: Tetra Tech, Inc. _____

Recommended by: _____ Date _____

CONTRACTOR: _____

Accepted by: _____ Date _____

OWNER: _____

Approved by: _____ Date _____

Copy: OWNER CONTRACTOR RPR CPM Shop Dwg. File

END OF SECTION

SECTION 00946

CHANGE ORDER

CONTRACTOR: _____ C.O. Number: _____
 _____ Date: _____
 _____ Project: _____

 OWNER: _____ Contract: _____

**TO THE CONTRACTOR NAMED ABOVE:
 Under the terms of this Agreement, and upon acceptance of CONTRACTOR and approval of OWNER,
 ENGINEER recommends the following changes to the Agreement:**

No.	Description	Add/ Deduct	Amount
			\$
			\$
			\$
	TOTAL THIS CHANGE ORDER		\$

REASON FOR CHANGE:

Current Contract Price	\$ _____
This Change Order Add/Deduct	\$ _____
Revised Contract Price	\$ _____
Current Substantial Completion Date	_____
Current Final Completion Date	_____
Contract Time Extension	_____ Days
Revised Substantial Completion Date	_____
Revised Final Completion Date	_____

The above is agreed to as full and complete compensation for the Work listed in this Change Order.

RECOMMENDED BY: Tetra Tech, Inc.

_____ DATE _____

ACCEPTED BY: CONTRACTOR: _____

_____ DATE _____

APPROVED BY: OWNER: _____

_____ DATE _____

Copy: OWNER CONTRACTOR RPR CPM Shop Dwg. File

END OF SECTION

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01005

PROJECT REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. The Work to be done consists of the furnishing of all labor, materials, and equipment, and the performance of all Work included in this Contract. The summary of the Work is presented in Section 01110: Summary of Work.
2. Work Included:
 - a. The Contractor shall furnish all labor, superintendence, materials, power, light, heat, fuel, water, tools, appliances, equipment, supplies, and means of construction necessary for proper performance and completion of the Work. The Contractor shall obtain and pay for all necessary construction permits except as provided for in Section 01065 – Permits and Fees. The Contractor shall perform and complete the Work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the Engineer, and in strict accordance with the Contract Documents. The Contractor shall clean up the Work and maintain it during and after construction, until accepted, and shall do all Work and pay all costs incidental thereto. He shall repair or restore all structures and property that may be damaged or disturbed during performance of the Work.
 - b. The cost of incidental work described in these Project Requirements, for which there are no specific Contract Items, shall be considered as part of the general cost of doing the Work and shall be included in the prices for the various Contract Items. No additional payment will be made therefore.
 - c. The Contractor shall provide and maintain tools and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the Work required by this Contract. Only equipment of established reputation and proven efficiency shall be used. The Contractor shall be solely responsible for the adequacy of his workmanship, materials, and equipment, prior approval of the Engineer notwithstanding.
3. Public Utility Installations and Structures:
 - a. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, vaults, manholes, and all other appurtenances and facilities pertaining thereto whether owned or controlled by the Owner, other governmental bodies, or privately owned by individuals, firms, or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage, water, or other public or private property which may be affected by the Work shall be deemed included hereunder.
 - b. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition, and extent of all such installations and structures as may be encountered and as may affect the construction operations.
 - c. The Contractor shall protect all public utility installations and structures from damage during the Work. Access across any buried public utility installation or structure shall be made to avoid any damage to these facilities. All required protective devices and construction shall be provided by the Contractor at his expense. All existing public utilities

damaged by the Contractor shall be repaired by the Contractor, at his expense. No separate payment shall be made for such protection or repairs to public utility installations or structures.

- d. Public utility installations or structures owned or controlled by the Owner or other governmental body which are shown on the Drawings to be removed, relocated, replaced, or rebuilt by the Contractor shall be considered as a part of the general cost of doing the Work and shall be included in the prices bid for the various Contract Items. No separate payment shall be made therefore.
- e. Where public utility installations or structures owned or controlled by the Owner or other governmental body are encountered during the course of the Work, and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the Engineer, removal, relocation, replacement, or rebuilding is necessary to complete the Work under this Contract, such Work shall be accomplished by the utility having jurisdiction, or such Work may be ordered, in writing by the Engineer, for the Contractor to accomplish. If such work is accomplished by the utility having jurisdiction it will be carried out expeditiously, and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement, or rebuilding as required. If such work is accomplished by the Contractor, it will be paid for as extra work as provided in the Agreement.
- f. The Contractor shall, at all times in performance of the Work, employ acceptable methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage, or destruction of public utility installations and structures; and shall, at all times in the performance of the Work, avoid unnecessary interference with, or interruption of, public utility services, and shall cooperate fully with the owners thereof to that end.
- g. The maintenance, repair, removal, relocation, or rebuilding of public utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the owners of such utilities.

1.02 DRAWINGS AND PROJECT MANUAL

- A. Drawings: When obtaining data and information from the Drawings, figures shall be used in preference to scaled dimensions, and large-scale drawings in preference to small-scale drawings.
- B. Supplementary Drawings:
 1. When, in the opinion of the Engineer, it becomes necessary to explain more fully the Work to be done or to illustrate the Work further or to show any changes which may be required, drawings known as Supplementary Drawings, with specifications pertaining thereto, will be prepared by the Engineer, and the Contractor will be furnished one (1) complete set of reproducible drawings (24 inches by 36 inches) and one (1) reproducible copy of the specifications.
 2. The Supplementary Drawings shall be binding upon the Contractor with the same force as the Contract Drawings. Where such Supplementary Drawings require either less or more than the estimated quantities of Work, credit to the Owner or compensation therefore to the Contractor shall be subject to the terms of the Agreement.
- C. Contractor to Check Drawings and Data:
 1. The Contractor shall verify all dimensions, quantities, and details shown on the Drawings, Supplementary Drawings, Schedules, Specifications, or other data received from the Engineer, and shall notify him of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts, or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction, or improper operation resulting therefrom, nor from rectifying such conditions at his own expense. He will not be allowed to

take advantage of any errors or omissions, as full instructions will be furnished by the Engineer, should such errors or omissions be discovered.

2. All schedules are given for the convenience of the Engineer and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in work to be done under the Contract.

D. Specifications: The Technical Specifications consist of three (3) parts: General, Products, and Execution. The General part of a Specification contains General Requirements which govern the Work. The Products and Execution parts modify and supplement the General Requirements by detailed requirements for the Work and shall always govern whenever there appears to be a conflict.

E. Intent:

1. All Work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Drawings or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the Work, is required and shall be performed by the Contractor as though it were specifically delineated or described.
2. The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, the interpretation of these Specifications shall be made upon that basis.

1.03 MATERIALS AND EQUIPMENT

A. Manufacturer:

1. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request and at the Engineer's option, that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.
2. Any two (2) or more pieces of material or equipment of the same kind, type, or classification, and being used for identical types of service, shall be made by the same manufacturer.

B. Delivery:

1. The Contractor shall deliver materials in ample quantities to ensure the most speedy and uninterrupted progress of the Work so as to complete the Work within the allotted time.
2. The Contractor shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the work of any related Contractor.

C. Tools and Accessories:

1. The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind, or size of equipment, one (1) complete set of suitably marked high grade special tools and appliances which may be needed to adjust, operate, maintain, or repair the equipment. Such tools and appliances shall be furnished in approved painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.
2. Spare parts shall be furnished as specified herein and as recommended by the manufacturer necessary for the operation of the equipment, not including materials required for routine maintenance.

3. Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight, and principal rate data.

D. Service of Manufacturer's Engineer:

1. The Contract Prices for equipment shall include the cost of furnishing a competent and experienced engineer or superintendent who shall represent the manufacturer and shall assist the Contractor, when required, to install, adjust, test, and place in operation, the equipment in conformity with the Contract Documents.
2. After the equipment is placed in permanent operation by the Owner, such engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the Owner in the proper operation and maintenance of such equipment.

1.04 INSPECTION AND TESTING

A. General:

1. For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests, and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Five (5) copies of the reports shall be submitted, and authoritative certification thereof must be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment.
2. If, in the making of any test of any material or equipment, it is ascertained by the Engineer that the material or equipment does not comply with the Contract Documents, the Contractor will be notified thereof, and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the Work and replace it with acceptable material, without cost to the Owner.
3. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with the recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.
4. The Contractor shall be fully responsible for the proper operation of equipment during testing and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

B. Costs:

1. All costs for inspections required under the Building Permit shall be provided by the Contractor, unless otherwise expressly specified.
2. The cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents shall be borne by the Contractor, and such costs shall be deemed to be included in the Contract Price.
3. Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the Owner for compliance. The Contractor shall reimburse the Owner for the expenditures incurred in making such tests of materials and equipment which are rejected for non-compliance.

C. Certificate of Manufacture:

1. Contractor shall furnish to Engineer authoritative evidence in the form of a certificate of manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents.

2. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

D. Shop Tests:

1. Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function, or special requirements are specified shall be tested in the shop of the maker in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. Shop tests where specified shall be witnessed by the Engineer.
2. Five (5) copies of the manufacturer's actual test data and interpreted results thereof, accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company and/or independent laboratory, shall be submitted to the Engineer for approval.
3. The cost of shop tests, travel expenses of the Engineer, and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.

E. Start-up Tests:

1. As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make start-up tests of equipment.
2. If the start-up tests disclose any equipment furnished under this Contract which does not comply with the requirements of the Contract Documents, the Contractor shall, prior to demonstration tests, make all changes, adjustments, and replacements required. The furnishing Contractor shall assist in the start-up tests as applicable.

F. Demonstration Tests:

1. Prior to Contractor's request for a Substantial Completion inspection, all equipment and piping installed under this Contract shall be subjected to demonstration tests as specified or required to prove compliance with the Contract Documents.
2. The Contractor shall furnish labor, fuel, energy, water, and all other materials, equipment, and instruments necessary for all demonstration tests, at no additional cost to the Owner. Contractor shall assist in the demonstration tests as applicable.

1.05 LINES AND GRADES

A. Grade:

1. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings, or as given by the Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.
2. The Engineer will establish benchmarks and baseline controlling points. Reference marks for lines and grades as the Work progresses will be located by the Contractor to cause as little inconvenience to the prosecution of the Work as possible. The Contractor shall so place excavation and other materials as to cause no inconvenience in the use of the reference marks provided. He shall remove any obstructions placed by him contrary to this provision.

B. Surveys:

1. The Contractor shall furnish and maintain, at his own expense, stakes and other such materials.
2. The Contractor shall check such reference marks by such means as he may deem necessary and, before using them, shall call the Engineer's attention to any inaccuracies.

3. The Contractor shall, at his own expense, establish all working or construction lines and grades as required from the reference marks set by the Engineer, and shall be solely responsible for the accuracy thereof. He shall, however, be subject to the check and review by the Engineer.

C. Safeguarding Marks:

1. The Contractor shall safeguard all points, stakes, grade marks, monuments, and bench marks made or established on the Work, bear the cost of re-establishing them if disturbed, and bear the entire expense of rectifying work improperly installed due to not maintaining or protecting or to removing without authorization such established points, stakes, and marks.
2. The Contractor shall safeguard all existing and known property corners, monuments, and marks adjacent to but not related to the Work and shall bear the cost of re-establishing them if disturbed or destroyed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01065

PERMITS AND FEES

PART 1 -- GENERAL

- A. The Contractor shall secure and pay for all permits and licenses related to his work, including but not limited to, any necessary construction permits.
- B. The Contractor shall procure all necessary permits and licenses, pay all charges and fees, and give all notices necessary and incidental to the due and lawful prosecution of the work. The Contractor shall determine what permits are required for construction of the Work and procure them.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 01070

STANDARDS AND ABBREVIATIONS

PART 1 - GENERAL

1.01 STANDARDS AND ABBREVIATIONS

- A. Referenced Standards: Any reference to published specifications or standards of any organization or association shall comply with the requirements of the specification or standard which is current on the date of Advertisement for Bids. In case of a conflict between the referenced specifications or standards, the one having the more stringent requirements shall govern.
- B. Reference in the specifications to MDOT Standards shall mean the “MDOT 2012 Standard Specifications for Construction”.
- C. In case of conflict between the referenced specifications or standards and the Contract Documents, the Contract Documents shall govern.
- D. Abbreviations:

AA	Aluminum Association
AAA	American Arbitration Association
AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturers Association
AASHTO	The American Association of State Highway and Transportation Officials
ABA	American Bar Association
ABMA	American Boiler Manufacturers Association
ABPA	Acoustical and Board Products Association
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies
AFBMA	Anti-Friction Bearing Manufacturers Association
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AGC	Associated General Contractors of America
AGMA	American Gear Manufacturers Association
AHA	American Hardboard Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AIA	American Insurance Association
AIEE	American Institute of Electrical Engineers (Now IEEE)
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standard Institute
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association

AREA	American Railway Engineering Association
ARI	American Refrigeration Institute
ASA	American Standards Association (Now ANSI)
ASAHC	American Society of Architectural Hardware Consultants
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSCBC	American Standard Safety Code for Building Construction
ASSHTO	American Association of State Highway Transportation Officials
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWPB	American Wood Preservers Bureau
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Institute of America (formerly SCPI)
CDA	Copper Development Association
CFR	Code of Federal Regulations
CFS	Cubic Feet Per Second
CISPI	Cast Iron Soil Pipe Institute
CMAA	Crane Manufacturers Association of America
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard
CSA	Canadian Standards Association
DHI	Door and Hardware Institute
DIPRA	Ductile Iron Pipe Research Association
DOT Spec	Standard Specification for Road and Bridge Construction Florida Department of Transportation
E/A	Engineer and/or Architect
EDA	Economic Development Association
EEI	Edison Electric Institute
EPA	Environmental Protection Agency
FCI	Fluid Control Institute
Fed Spec	Federal Specification
FM	Factory Mutual Engineering and Research
FPS	Feet Per Second
FS	Federal Standards
GPM	Gallons Per Minute
HMI	Hoist Manufacturers Institute
HI	Hydraulic Institute
HP	Horsepower
HSBII	Hartford Steam Boiler Inspection and Insurance Co.
ID	Inside Diameter
IEEE	Institute of Electrical and Electronic Engineers
IFI	Industrial Fasteners Institute
IPCEA	Insulated Power Cable Engineers Association
IPS	Iron Pipe Size
ISA	Instrument Society of America

MBMA	Metal Building Manufacturers Association
MDEQ	Michigan Department of Environmental Quality
MDOT	Michigan Department of Transportation
MGD	Million Gallons Per Day
MHI	Materials Handling Institute
MMA	Monorail Manufacturers Association
MIOSHA	Michigan Occupational Safety and Health Administration
NAPA	National Asphalt Pavement Association
NBFU	National Board of Fire Underwriters
NBHA	National Builders' Hardware Association
NBS	National Bureau of Standards
NCPI	National Clay Pipe Institute
NCSA	National Crushed Stone Association
NCSPA	National Corrugated Steel Pipe Association
NEC	National Electrical Code
NECA	National Electrical Contractors' Association
NEMA	National Electrical Manufacturers' Association
NFPA	National Fire Protection Association
NLA	National Lime Association
NPC	National Plumbing Code
NPCA	National Precast Concrete Association
NPT	National Pipe Threads
NSC	National Safety Council
NSF	National Sanitation Foundation
OD	Outside Diameter
OSHA	U.S. Department of Labor, Occupational Safety and Health Act
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PS	United States Products Standards
PSI	Pounds per Square Inch
PSIA	Pounds per Square Inch Absolute
PSIG	Pounds per Square Inch Gauge
PTI	Post Tensioning Institute
RPM	Revolutions Per Minute
SAE	Society of Automotive Engineers
SDI	Steel Decks Institute
SJI	Steel Joists Institute
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SSI	Scaffolding and Shoring Institute
SSPC	Steel Structures Painting Council
SSPC	Structural Steel Painting Council
STA	Station (100 feet)
TDH	Total Dynamic Head
TH	Total Head
TPI	Truss Plate Institute
UBC	Uniform Building Code
UL	Underwriter's Laboratories, Inc.
USACE	United States Army Corps of Engineers
USASI or	United States of America Standards Institute

C. Additional abbreviations and symbols are shown on the Drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01110

SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY

- A. The Work to be performed shall consist of furnishing plant, tools, equipment, materials, supplies, and manufactured articles, and furnishing all labor, transportation, and services, including but not limited to fuel, power, water, essential communications, and performing all Work or other operations required in strict accordance with the Drawings and these specifications. The Work shall be complete, and all Work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete and proper construction of the Work in good faith shall be provided by the Contractor as though originally so indicated, at no increase in cost to the City.

- B. The Project is located at various locations around the City of Kalamazoo Michigan, see list of site addresses below. Work is shown on contract drawings which includes three sets of drawings (Remote Generator Upgrades, Remote Sewage Upgrades and Remote Metering Upgrades) and generally consists of:
 1. The Remote Generator Upgrades at each site (excluding station No. 4, Station No. 31 and Station No. 39) along with related automatic transfer switch, electrical and instrumentation work as shown on drawings. The work at Station No. 4 and Station No. 31 includes procurement and replacement of an existing Automatic Transfer Switch and other related work as shown on drawings. The work at Station No. 39 includes procurement of a gas line installation by Consumers Energy using the allowance specified in specification section 01210. Note that the 6th Street tank location utilizes propane (tank) as its energy source where all other stations with a Generator will utilize Natural Gas from Consumers Energy.
 2. The Remote Sewage Upgrades generally consists of programmable logic controller (PLC) replacement, input/output (I/O) replacement including rewiring, electrical upgrades including variable frequency drives, radio communication upgrades including several new direct buried monopole antennas. Related work includes all other work shown on contract remote sewage upgrades drawings.
 3. The Remote Metering Upgrades work is shown on contract drawings and generally consists of programmable logic controller (PLC) replacement, input/output (I/O) replacement including rewiring of existing and new I/O plus network and radio communication upgrades at each location. Related work includes all other work shown on remote metering upgrade contract drawings.

C. Site Locations:

Remote Generator Sites		
	Station Name	Station Address
1	Edgemoor Tank	1313 Edgemoor, Kalamazoo, MI
2	Gull Road Tank	7837 Gull Road, Kalamazoo, MI
3	Parchment Tank	Kindleberger Park Dr., Parchment, MI
4	Beech Tank	5292 Beech Ave., Kalamazoo, MI
5	Siesta Tank	4219 Siesta Street, Kalamazoo, MI
6	Mt. Olivet Tank	2634 Mt.Olivet, Kalamazoo, MI
7	Blakeslee Tank	1600 Blakeslee, Kalamazoo, MI
8	Station No. 11	432 Kendall, Kalamazoo, MI
9	Station No. 4	2000 W. Crosstown, Kalamazoo, MI
10	Station No. 31	745 Prairie Ave., Kalamazoo, MI
11	Station No. 39	8801 E. Miller, Kalamazoo, MI
Remote Sewage Sites		
1	Augusta - Webster Lift Station	120 N. Webster, Augusta MI
2	Climax Rd Lift Station	11523 Climax Rd Galesburg MI
3	L Ave Lift Station	12459 East "L" Ave, Kalamazoo MI
4	Winding Way Lift Station	4510 Winding Way, Kalamazoo MI
5	Woods Lake Lift Station	2830 Oakland Drive, Kalamazoo MI
Remote Metering Sites		
1	Allnex Metering Station	2715 MILLER RD., Kalamazoo MI
2	Bell's Brewery Metering Station	8938 Krum Ave Galesburg, MI
3	Cooper Metering Station	Refer to contract drawings
4	Graphics Packaging Metering Station	1361 N. HARRISON ST., Kalamazoo MI
5	Matawan Metering Station	25th Street north of Estates Court, Mattawan MI
6	Meredith Metering Station	3601 E. KILGORE RD., Kalamazoo MI
7	Parchment Metering Station	511 E. MOSEL, Kalamazoo MI
8	Pfizer Metering Station	3501 Romance Rd., Kalamazoo MI
9	Portage Creek Metering Station	290 E. KILGORE RD., Kalamazoo MI
10	South County Metering Station	5408 TU Ave., Kalamazoo MI
11	Vicksburg Metering Station	1321 SPRUCE ST., Vicksburg, MI

1.02 WORK SEQUENCE

- A. CONTRACTOR shall arrange its Work so that at no time shall it cause unnecessary interruption to the operation of existing facilities. In order to meet the overall objective of this Project, certain elements of the Work must be completed in a particular sequence. It may also be necessary to do certain parts of the Work outside normal working hours. CONTRACTOR shall do this Work at such times and at no additional cost to OWNER. CONTRACTOR shall be completely responsible for

finances and other enforcement imposed upon the facility resulting from inadvertent or unplanned interruptions caused by CONTRACTOR. A suggested sequence of construction is as follows:

1. The CONTRACTOR shall coordinate all onsite work and installation of components with the City of Kalamazoo Process Control Supervisor, Tom Koperetz.
2. Central Station
 - 1) This work shall be scheduled and approved by City two weeks prior to the work being performed. The work shall be performed from 8:00 A.M. until 4:00 P.M.

1.03 CONTRACTOR USE OF PREMISES

- A. Limit use of the premises to construction activities in areas indicated; allow for OWNER occupancy and use by the public. Confine operations to areas within Contract limits indicated. Portions of the Site beyond areas in which construction operations are indicated are not to be disturbed.
- B. Keep driveways and entrances serving the premises clear and available to OWNER, OWNER's employees, and private property owners at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on Site. Areas for CONTRACTOR's trailers, equipment, and material storage, and CONTRACTOR's employee parking shall be as indicated on Drawings or agreed by OWNER prior to the start of construction.

1.04 MISCELLANEOUS PROVISIONS

- A. CONTRACTOR shall notify all Owners of public utilities within the right-of-way or easement for the purpose of establishing the approximate locations of the utilities in accordance with the requirements of Act No. 53 Public Acts of 1974 of the State of Michigan. CONTRACTOR shall notify MISS DIG-Utility Communication System, 1-800-482-7171, three working days prior to starting any excavation with power equipment.
- B. CONTRACTOR shall be responsible for verifying the location of all underground utilities by magnetic or other type instruments before beginning excavation Work.
- C. Time and Sequence of Work: In general, it is the intention and understanding that CONTRACTOR shall have control over the sequence or order of execution of the several parts of the Work to be done under the Contract and over the method of accomplishing the required results, except as some particular sequence or method may be distinctly demanded by the Drawings and Project Manual or by the expressed provisions of the Contract. ENGINEER may, however, make such reasonable requirements as may, in ENGINEER's judgment, be necessary for the proper and effective protection of Work partially or wholly completed, and to these requirements CONTRACTOR shall conform.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 01210

ALLOWANCES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies administrative and procedural requirements for processing Allowances. Selected materials and equipment, and in some cases their installation, are shown and specified in the Contract Documents by Allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. Additional requirements, if necessary, will be issued by Change Order.

1.02 DEFINITIONS

- A. Lump Sum Allowance: A monetary sum that includes, as part of the Contract Price, the associated costs and requirements to complete the specified Allowance.
- B. Unit-cost Allowance: A specified quantity of a product or assembly, as part of the Contract Price, that is to be included in the Work even though the location of the product or assembly is not indicated on Drawings or shown in the specifications.
- C. Contingency Allowance: A monetary sum that, as part of the Contract Price, is to be utilized as directed by OWNER, through a Change Order, to cover minor changes in the Work.
- D. Provisionary Allowance: A monetary sum that, as part of the Contract Price, is to be utilized as directed by OWNER, through a Change Order, to cover minor changes in the Work.

1.03 SUBMITTALS

- A. Submit invoices or delivery slips to indicate actual quantities of materials delivered to the Site for use in fulfillment of each Allowance.

1.04 OWNER'S INSTRUCTIONS

- A. At the earliest feasible date after Contract Award, advise ENGINEER of the date when the final selection and purchase of each product or system described by an Allowance must be completed in order to avoid delay in performance of the Work.
- B. When requested by ENGINEER, obtain Bids for each Allowance for use in making final selections; include recommendations that are relevant to performance of the Work.
- C. Purchase products and systems as selected by ENGINEER from the designated supplier.
- D. Use Allowances only as directed for OWNER's purposes, and only by Change Orders which designate amounts to be charged to the Allowance.

- E. If the actual price for the specified Allowance is more or less than the stated Allowance, the Contract Price shall be adjusted accordingly by Change Order. The adjustment in Contract Price shall be made in accordance with Paragraph 11.02 of the General Conditions.
- F. Change Orders authorizing use of funds from the Contingency or Provisionary Allowances will include CONTRACTOR's related costs and reasonable overhead and profit margins.
- G. At Project closeout, any amounts remaining in Allowances will be credited to OWNER by Change Order.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspect products covered by an Allowance promptly upon delivery for damage or defects.

3.02 PREPARATION

- A. Coordinate materials and their installation for each Allowance with related materials and installations to ensure that each Allowance item is completely integrated and interfaced with related construction activities.

SCHEDULE OF ALLOWANCES

1. Lump sum allowance for payment to Consumers Energy for services associated with installation of new natural gas lines to each site that includes (Beech Tank, Edgemoor Tank, Gull Tank, Mt. Olivet Tank, Parkdale, Prairie, and Siesta). An Allowance of \$198,000 shall be included in the Contract Price for this Work. No mark-ups shall be permitted. Unused monies shall be credited back to Owner at project completion. Allowance monies are broken out per site in the bid form.

END OF SECTION

SECTION 01290

APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies administrative and procedural requirements governing CONTRACTOR's Applications for Payment.
- B. Related Sections:
 - 1. CONTRACTOR's Application for Payment form is included in Section 00620.
 - 2. CONTRACTOR's Construction Schedule and Submittal Schedule are included in Section 01330.

1.02 OWNER'S INSTRUCTIONS

- A. Schedule of Values:
 - 1. Coordinate preparation of Schedule of Values with preparation of CONTRACTOR's Construction Schedule.
 - 2. Correlate line items on Schedule of Values with other required administrative schedules and forms, including:
 - a. CONTRACTOR's Construction Schedule.
 - b. Application for Payment form.
 - c. List of subcontractors.
 - d. Schedule of Allowances.
 - e. Schedule of Alternates.
 - f. List of products.
 - g. List of principal suppliers and fabricators.
 - h. Schedule of Submittals.
 - 3. Submit Schedule of Values to ENGINEER at the earliest feasible date, but in no case later than 7 days before the date scheduled for submittal of the initial Application for Payment.
 - 4. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for Schedule of Values.
 - 5. Identification: Include the following Project identification on Schedule of Values:
 - a. Project name and location.
 - b. Name of ENGINEER.
 - c. Project number.
 - d. CONTRACTOR's name and address.
 - e. Date of submittal.
 - 6. Arrange Schedule of Values in a tabular form with separate rows for each Specification Section and separate columns for each major structure or area of Work.
 - 7. Provide a breakdown of the Contract Price in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
 - 8. Round off amounts to the nearest whole dollar; the total shall equal the Contract Price.
 - 9. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items

- on Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
10. Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually on Applications for Payment. Each item on Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
 11. At CONTRACTOR's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items on Schedule of Values or distributed as general overhead expense.
 12. Update and resubmit Schedule of Values when Change Orders or Work Change Directives result in a change in the Contract Price.
- B. Initial Application for Payment: Administrative actions and submittals that must precede submittal of the first Application for Payment include the following:
1. List of subcontractors.
 2. List of principal suppliers and fabricators.
 3. Schedule of Values.
 4. CONTRACTOR's Construction Schedule (preliminary if not final).
 5. Submittal Schedule (preliminary if not final).
- C. Applications For Payment:
1. Each Application for Payment shall be consistent with previous applications and payments as certified by ENGINEER and paid for by OWNER.
 2. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
 3. The date for each progress payment will be determined at the Pre-Construction Conference. The period of construction Work covered by each Application for Payment is 1 month. Actual start/end dates will be determined at the Pre-Construction Conference.
 4. Use the pay application form included in Section 00620 for Applications for Payment.
 5. Complete every entry on the form, including execution by person authorized to sign legal documents on behalf of CONTRACTOR. Incomplete applications will be returned without action.
 6. Entries shall match data on Schedule of Values and CONTRACTOR's Construction Schedule. Use updated Schedules if revisions have been made.
 7. Include amounts of Change Orders and Work Change Directives issued prior to the last day of the construction period covered by the application.
 8. Submit 3 executed copies of each Application for Payment to ENGINEER; 1 copy shall be complete, including waivers of lien and similar attachments, when required.
 9. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to ENGINEER.
- D. Application for Payment at Substantial Completion:
1. Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for OWNER occupancy of designated portions of the Work.
 2. Administrative actions and submittals that shall proceed or coincide with this application include:
 - a. Warranties (guarantees) and maintenance agreements.
 - b. Maintenance instructions.
 - c. Meter readings.
 - d. Final cleaning.

- e. Final progress photographs.
 - f. List of incomplete Work, recognized as exceptions to ENGINEER'S Certificate of Substantial Completion.
- E. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
- 1. Completion of Project closeout requirements.
 - 2. Completion of items specified for completion after Substantial Completion.
 - 3. Assurance that unsettled claims will be settled.
 - 4. Assurance that Work not complete and accepted will be completed without undue delay.
 - 5. Transmittal of required Project construction records to OWNER.
 - 6. Proof that taxes, fees, and similar obligations have been paid.
 - 7. Removal of surplus materials, rubbish, and similar elements.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 01310

PROJECT COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
 - 1. Coordination of Work under this Contract.
 - 2. Coordination with other Contractors.
 - 3. Administrative and supervisory personnel.
 - 4. Land survey work.
 - 5. Pre-Construction Conference.
 - 6. Pre-Excavation Conference.
 - 7. Progress meetings.
 - 8. General installation provisions.
 - 9. Cleaning and protection.

- B. Related Sections Specified Elsewhere:
 - 1. Requirements for CONTRACTOR's Construction Schedule are included in Section 01330.

1.02 DEFINITIONS

- A. Monument: The term "monument" shall be considered as any object defining the location of a property corner, street location, section line, fractional section line, right-of-way marker, or other delineation of land ownership or division.

1.03 SUBMITTALS

- A. Within 15 days of Notice to Proceed, submit a list of CONTRACTOR's principal staff assignments, including the Superintendent and other personnel in attendance at Site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.

1.04 SCHEDULING

- A. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair. Make adequate provisions to accommodate items scheduled for later installation.

- B. CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at Site in accordance with Laws or Regulations. CONTRACTOR shall train CONTRACTOR's employees on use of these sheets and shall keep a master copy on hand at Site.

- C. Coordination with Other Contractors:
 - 1. CONTRACTOR shall so conduct CONTRACTOR's operations as not to interfere with or injure the Work of other Contractors or workmen employed on adjoining or related Work, and CONTRACTOR shall promptly make good any injury or damage which may be done to such Work by CONTRACTOR or CONTRACTOR's employees or agents.
 - 2. Should a contract for adjoining Work be awarded to another CONTRACTOR, and should the Work on one of these contracts interfere with that of the other, ENGINEER shall decide which contract shall cease Work for the time being and which shall continue, or whether Work on both contracts shall continue at the same time and in what manner.

- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of schedules.
 - 2. Installation and removal of temporary facilities.
 - 3. Delivery and processing of submittals.
 - 4. Progress meetings.
 - 5. Project closeout activities.

1.05 PRE-CONSTRUCTION CONFERENCE

- A. ENGINEER will schedule a Pre-Construction Conference and organizational meeting at the Site or other convenient location prior to commencement of construction activities to review responsibilities and personnel assignments.

- B. Attendees: OWNER, ENGINEER and ENGINEER's consultants, CONTRACTOR and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

- C. Agenda: Discuss items of significance that could affect progress including such topics as:
 - 1. Tentative Construction Schedule.
 - 2. Critical Work sequencing.
 - 3. Designation of responsible personnel.
 - 4. Procedures for processing field decisions and Change Orders.
 - 5. Procedures for processing Applications for Payment.
 - 6. Distribution of Contract Documents.
 - 7. Submittal of Shop Drawings, product data, and samples.
 - 8. Preparation of Record Documents.
 - 9. Use of the premises.
 - 10. Office, Work, and storage areas.
 - 11. Equipment deliveries and priorities.
 - 12. Safety procedures.
 - 13. First aid.
 - 14. Security.
 - 15. Housekeeping.
 - 16. Working hours.

1.06 PRE-EXCAVATION CONFERENCE

- A. In addition to the Pre-Construction Conference, ENGINEER may also require a Pre-Excavation Conference in relation to the installation of the direct buried antenna towers. CONTRACTOR and

Subcontractors performing excavation Work on Site shall provide written descriptions of their plans for shoring, dewatering, disposal of spoils, protection of existing utilities, and any other particulars of the excavation process, including the technical basis for their selection of the means and methods to be employed. ENGINEER will prepare and distribute minutes.

1.07 PROGRESS MEETINGS

- A. Attendees: In addition to representatives of OWNER and ENGINEER, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.
- B. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
- C. CONTRACTOR's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to CONTRACTOR's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
- D. Reporting: ENGINEER will prepare and distribute copies of minutes of the meeting to each party present and to other parties who should have been present. The minutes will include a brief summary, in narrative form, of progress since the previous meeting and report.
- E. CONTRACTOR shall schedule at least 1 meeting per site (3 total).
- F. Schedule Updating: CONTRACTOR shall revise Construction Schedule after each progress meeting where revisions to Schedule have been made or recognized. Issue revised Schedule no later than 3 days after the progress meeting date to ENGINEER for distribution concurrently with the progress meeting minutes.

PART 2 - PRODUCTS

NOT USED

PART 3 – EXECUTION

3.01 LAND SURVEY WORK

- A. CONTRACTOR Performance:
 - 1. Furnish stakes and such suitable labor and assistance as ENGINEER may require in setting survey work.
 - 2. Be responsible for costs by ENGINEER for providing:
 - a. Additional or replacement staking of original control points established by ENGINEER.
 - b. Replacements of Site benchmarks established by ENGINEER.
 - 3. Verify layout information shown on Drawings, in relation to the property survey and existing benchmarks before proceeding to layout the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

- a. Record benchmark locations, with horizontal and vertical data, on Contract Record Documents.
4. Working from lines and levels established by ENGINEER, establish benchmarks and markers to set lines and levels at each area of Work and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.
5. Benchmarks or control points shall not be changed or relocated without prior written approval by ENGINEER. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grades or locations.
6. Promptly replace lost or destroyed Project control points. Base replacements on the original survey control points.
7. Advise entities engaged in construction activities, of marked lines and levels provided for their use.
8. As construction proceeds, check every major element for line, level and plumb.
9. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes, and invert elevations by instrumentation and similar appropriate means.
10. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels, and control lines and levels required for mechanical and electrical Work.
11. Existing Utilities and Equipment:
 - a. The existence and location of underground and other utilities and construction as shown on Drawings as existing are not guaranteed. Before beginning Site Work, CONTRACTOR shall investigate and verify the existence and location of underground utilities and other construction.
 - b. Furnish information necessary to adjust, move, or relocate existing structures, utility poles, lines, services, or other appurtenances located in or affected by construction. Coordinate with local authorities having jurisdiction.
 - c. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water service piping.

3.02 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

3.03 PIPE LOCATIONS

- A. All pipes shall be located substantially as indicated on the Drawings, but the Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required.

3.04 OPEN EXCAVATIONS

- A. Contractor shall adequately safeguard all open excavations by providing temporary barricades, caution signs, lights, and other means to prevent accidents to persons, and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by workmen. All open excavations shall comply with applicable OSHA Standards.

3.05 TEST PITS

- A. Test pits for the purpose of locating underground pipelines or structures in advance of the construction shall be excavated and backfilled by the Contractor. Test pits shall be backfilled immediately after their purpose has been satisfied and maintained in a manner satisfactory to the Engineer. The costs for such test pits shall be borne by the Contractor.

3.06 CARE AND PROTECTION OF PROPERTY

- A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the Engineer.

3.07 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly constructed work shall be carefully protected from damage in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions damaged shall be reconstructed by the Contractor at no additional expense to the Owner.
- B. Protect all structures in a suitable manner to prevent damage. Should any part of a structure become heaved, cracked or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor at his own expense and to the satisfaction of the Engineer. If, in the final inspection of the work, any defects, faults or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the Contract.
- C. Further, the Contractor shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the Owner.

3.08 MAINTENANCE OF TRAFFIC

- A. Unless permission to close a street is received in writing from the proper authority (County, City, MDOT, etc.), all excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, he shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the Engineer.
- B. Detours around construction will be subject to the approval of the Owner and the Engineer. Where detours are permitted, the Contractor shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured, the Contractor shall expedite construction operations and periods when traffic is being detoured will be strictly controlled by the Owner. All maintenance of traffic plans required for construction shall be approved by the local governmental entity having jurisdiction.
- C. The Contractor shall take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist, or police protection provided for traffic while work is in progress. The Contractor shall be fully responsible for damage or injuries whether or not police protection has been provided.

3.09 PRIVATE LAND

- A. The Contractor shall not enter or occupy private land outside the site, except by written permission of the appropriate Owners. Contractor shall provide Owner a copy of such written permission prior to entering private land.

3.10 COOPERATION WITHIN THIS CONTRACT

- A. The Contractor shall, prior to interrupting a utility service (water, sewer, etc.) for the purpose of making cut-ins to the existing lines or for any other purposes, contact the Owner and make arrangements for the interruption, which will be satisfactory to the Owner.

3.11 COOPERATION WITH OTHER CONTRACTS

- A. This Contract may require a portion of the work to be connected to work done under other contract(s). It will be necessary for the Contractor to plan his work and cooperate with other contractors insofar as possible to prevent any interference and delay.

END OF SECTION

SECTION 01330

SUBMITTALS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals, including, but not necessarily limited to, the following:
 - 1. CONTRACTOR's Construction Schedule.
 - 2. Submittal Schedule.
 - 3. Shop Drawings.
 - 4. Product data.
 - 5. Samples.
 - 6. Progress photographs.
 - 7. Record photographs.

- B. Topics covered elsewhere include, but are not limited to:
 - 1. Permits.
 - 2. Applications for payment.
 - 3. Performance and payment bonds.
 - 4. Insurance certificates.
 - 5. List of subcontractors.

1.02 SUBMITTALS

- A. Bonds and Insurance Certificates shall be submitted to and approved by OWNER and ENGINEER prior to the initiation of any construction on Site.

- B. Permits, Licenses, and Certificates: For OWNER's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents; correspondence and records established in conjunction with compliance with standards; and regulations bearing upon performance of the Work.

1.03 SUBMITTAL PROCEDURES

- A. Coordination:
 - 1. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 - 2. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 3. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - 4. ENGINEER reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- B. Processing:
1. Allow sufficient review time so that installation shall not be delayed as a result of the time required to process submittals, including time for resubmittals.
 2. ENGINEER will review and return submittals with reasonable promptness, or advise CONTRACTOR when a submittal being processed must be delayed for coordination or receipt of additional information by putting the submittal "On Hold" and returning a transmittal identifying the reasons for the delay.
 3. No extension of Contract Time will be authorized because of failure to transmit submittals to ENGINEER sufficiently in advance of the Work to permit processing.
- C. Submittal Preparation:
1. Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
 2. Provide a space approximately 4 inches by 5 inches on the label or beside the title block on submittals not originating from CONTRACTOR to record CONTRACTOR's review and approval markings and the action taken.
 3. Include the following information on the label for processing and recording action taken.
 - a. Project name.
 - b. Date.
 - c. Name and address of ENGINEER.
 - d. Name and address of CONTRACTOR.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
 4. Any markings done by CONTRACTOR shall be done in a color other than red. Red is reserved for ENGINEER's marking.
 5. The number of copies to be submitted will be determined at the pre-construction conference. Reproducibles may be submitted and will be marked and returned to CONTRACTOR. Blue or black line prints shall be submitted in sufficient quantity for distribution to ENGINEER and OWNER recipients.
- D. Submittal Transmittal:
1. Package each submittal appropriately for shipping and handling. This shall include an index either on the transmittal or within the submittal itself. Transmit each submittal from CONTRACTOR to ENGINEER using a transmittal form. Submittals received from sources other than CONTRACTOR will be returned without action. Use separate transmittals for items from different specification sections. Number each submittal consecutively. Resubmittals should have the same number as the original, plus a letter designation for each resubmittal (i.e., 7-A, 7-B, etc.).
 2. Indicate on the transmittal relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include CONTRACTOR's certification that information complies with Contract Document requirements. On resubmittal, all changes shall be clearly identified for ease of review. Resubmittals shall be reviewed for the clearly identified changes only. Any changes not clearly identified will not be reviewed and original submittal shall govern.

1.04 CONSTRUCTION SCHEDULE

A. Bar Chart Schedule:

1. Prepare a fully developed, horizontal bar chart type Construction Schedule. Submit within 30 days of the date established for "Commencement of the Work."
 2. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated on Schedule of Values.
 3. Prepare Schedule on a sheet, or series of sheets, of stable transparency or other reproducible media, of sufficient width to show data for the entire construction period.
 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on Schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
 5. Coordinate Construction Schedule with Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on Schedule to allow time for ENGINEER's procedures necessary for certification of Substantial Completion.
- B. Schedule Updating: Revise Schedule after each meeting or activity where revisions have been recognized or made within 2 weeks following the meeting or activity.

1.05 SUBMITTAL SCHEDULE

- A. After development and acceptance of Construction Schedule, prepare a complete Schedule of Submittals. Submit Schedule within 10 days of the date required for establishment of Construction Schedule.
- B. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products, as well as Construction Schedule.
- C. Prepare Schedule in chronological order; include submittals required during the first 90 days of construction. Provide the following information:
 1. Scheduled date for the first submittal.
 2. Related Section number.
 3. Submittal category.
 4. Name of subcontractor.
 5. Description of the part of the Work covered.
 6. Scheduled date for resubmittal.
 7. Scheduled date ENGINEER's final release or approval.
- D. Following response to initial submittal, print and distribute copies to ENGINEER, OWNER, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
- E. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- F. Schedule Updating: Revise Schedule after each meeting or activity where revisions have been recognized or made within 2 weeks following the meeting or activity.

1.06 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:
 - 1. Dimensions.
 - 2. Identification of products and materials included.
 - 3. Compliance with specified standards.
 - 4. Notation of coordination requirements.
 - 5. Notation of dimensions established by field measurement.
- C. Nameplate data for equipment including electric motors shall be included on Shop Drawings. Electric motor data shall state the manufacturer, horsepower, service factor, voltage, enclosure type, oversize wiring box, etc.
- D. Shop Drawings shall indicate shop painting requirements to include type of paint and manufacturer.
- E. Manufacturer's catalog sheets, brochures, diagrams, illustrations, and other standard descriptive data shall be clearly marked to identify pertinent materials, products, or models. Delete information which is not applicable to the Work by striking or cross-hatching.
- F. Measurements given on Shop Drawings or standard catalog sheets, as established from Contract Drawings and as approved by ENGINEER, shall be followed. When it is necessary to verify field measurements, they shall be checked and established by CONTRACTOR. The field measurements so established shall be followed by CONTRACTOR and by all affected trades.
- G. Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 inches by 11 inches but no larger than 36 inches by 48 inches.
- H. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

1.07 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as Shop Drawings.
- B. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
 - 1. Manufacturer's printed recommendations.
 - 2. Compliance with recognized trade association standards.
 - 3. Compliance with recognized testing agency standards.
 - 4. Application of testing agency labels and seals.

5. Notation of dimensions verified by field measurement.
 6. Notation of coordination requirements.
- C. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

1.08 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
- B. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match ENGINEER's Sample. Include the following:
 1. Generic description of the Sample.
 2. Sample source.
 3. Product name or name of manufacturer.
 4. Compliance with recognized standards.
 5. Availability and delivery time.
- C. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
- D. Where variation in color, pattern, texture, or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3) that show approximate limits of the variations.
- E. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
- F. Preliminary Submittals: Where Samples are for selection of color, pattern, texture, or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
 1. Preliminary submittals will be reviewed and returned with ENGINEER's mark indicating selection and other action.
- G. Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; 1 will be returned marked with the action taken.
- H. Maintain sets of Samples, as returned, at the Site, for quality comparisons throughout the course of construction.
- I. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
- J. Sample sets may be used to obtain final acceptance of the construction associated with each set.

1.09 ENGINEER'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, ENGINEER will review each submittal, mark to indicate action taken, and return promptly.
 - 1. Compliance with specified characteristics is CONTRACTOR's responsibility.
- B. Action Stamp: ENGINEER will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
 - 1. Final Unrestricted Release: Where submittals are marked "No Exceptions Taken," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
 - 2. Final-But-Restricted Release: When submittals are marked "Furnish as Corrected," that part of the Work covered by the submittal may proceed, provided it complies with notation or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
 - 3. Returned for Resubmittal: When submittal is marked "Rejected" or "Revise and Resubmit," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked "Rejected" or "Revise and Resubmit" to be used at Site, or elsewhere where Work is in progress.
 - 4. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Acknowledge Receipt."
 - 5. The approval of ENGINEER shall not relieve CONTRACTOR of responsibility for errors on Drawings or submittals as ENGINEER's checking is intended to cover compliance with Drawings and Specifications and not enter into every detail of the shop work.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 01600

GENERAL EQUIPMENT STIPULATIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. These General Equipment Stipulations apply, in general, to all equipment provided under other Specification Sections. They shall supplement the detailed equipment specifications, but in cases of conflict the equipment specifications shall govern.

1.02 OPERATION AND MAINTENANCE

- A. All equipment suppliers shall submit to ENGINEER, through CONTRACTOR, 4 bound copies and 1 electronic/digital format copy of a manual containing specifications, Drawings, and descriptions of equipment; installation instructions; operation, maintenance, and lubrication manuals; parts lists; emergency instructions; and where applicable, test data with curves, wiring diagrams, PLC programs, VFD configuration, Valve actuator configuration on CD and schematics. This information shall be submitted for each item of equipment furnished under this Contract and shall be specific to the exact equipment models complete with all appurtenances provided. It shall also include detailed, comprehensive directions for all required maintenance activities and for the repair or replacement of all wearing parts. Special attention shall be paid to necessary safety precautions that OWNER's staff should take when operating, maintaining, or repairing the equipment.
 - 1. Bound copies of O&M Manuals shall be in addition to any instructions shipped with the equipment and shall be submitted only after ENGINEER has given final approval of Shop Drawings. All manuals shall be submitted to ENGINEER following final Shop Drawing approval and prior to the date of shipment of the equipment to the Site. Organize operation and maintenance manuals into suitable sets of manageable size, organized by section or process, as directed by ENGINEER. Bind properly indexed data in heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Appropriate identification shall be noted on the front and spine of each binder.
 - 2. Electronic Copy of O&M Manuals: Each equipment O&M manual shall be provided with an electronic disk, matching the content of the final approved printed O&M Manual. The information shall be saved in a single ".pdf" file, with bookmarks for each chapter, section, appendices, etc., as well as each piece of equipment. Where numerous pieces of equipment may be addressed within a section, a second tier of bookmarks shall be provided to allow quick access to each piece of equipment or key piece of information.
 - 3. "Sample" Table of Contents:

Bookmarks

- Table of Contents
- Section 1 - Approved Shop Drawings
- Section 2 - Installation Instructions and Parts Identification
- Section 3 - Operations and Maintenance Information
- Section 4 - Troubleshooting (If not included in Section 3.)
- Section 5 - Parts List (If not included in Section 3.)
- Section 6 - Lubrication Instructions (If not included in Section 3.)

4. These manuals shall be in addition to any instructions shipped with the equipment and shall be submitted only after ENGINEER has given final approval of Shop Drawings. All manuals shall be submitted to ENGINEER following final Shop Drawing approval and prior to the date of shipment of the equipment to the Site. Organize operation and maintenance manuals into suitable sets of manageable size, organized by section or process, as directed by ENGINEER. Bind properly indexed data in heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Appropriate identification shall be noted on the front and spine of each binder.

1.03 QUALITY ASSURANCE

- A. Compliance with OSHA: All equipment provided under this Contract shall meet all the requirements of the Federal and/or State Occupational Safety and Health Acts. Each equipment supplier shall submit to ENGINEER certification that the equipment furnished is in compliance with OSHA.
- B. Electrical Codes, Ordinances, and Industrial Standards: The design, testing, assembly, and methods of installation of the wiring materials, electrical equipment and accessories proposed under this Contract shall conform to the National Electrical Code and to applicable State and local requirements. UL listing and labeling shall be adhered to under this Contract. Any equipment that does not have a UL, FM, CSA, or other listed testing laboratory label shall be furnished with a notarized letter signed by the supplier stating that the equipment furnished has been manufactured in accordance with the National Electrical Code and OSHA requirements. Any additional cost resulting from any deviation from codes or local requirements shall be borne by CONTRACTOR.

1.04 SHIPPING AND HANDLING EQUIPMENT

- A. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment and handling.

1.05 SPARE MATERIALS

- A. All V-belt driven equipment shall be furnished with a complete set of spare belts per each piece of equipment. When two or more similar pieces of equipment are furnished, replacement belt assemblies shall be furnished for every other drive assembly.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Anchor Bolts: Anchor bolts, nuts, and washers shall be hot-dipped galvanized in conformity with ASTM A 385 and be supplied with sleeves.
- B. Shop Painting:
 1. Non-submerged Applications: Tnemec Series 37H, Chem-Prime.
 2. Submerged, Non-potable Applications: Tnemec Series 66, Hi-Build Epoxoline.
 3. Submerged, Potable Applications: Tnemec Series 139, Pota-Pox II.
 4. Rust preventive compound shall be:
 - a. Dearborn Chemical, No-Ox-ID2W.
 - b. Houghton, Rust Veto 344.

- c. Rust-Oleum R-9.

2.02 MANUFACTURED UNITS

- A. Wall and Slab Sleeves and Castings: Where water- or gas-tightness is essential and at other locations where indicated, wall castings and sleeves shall be provided with an intermediate flange located approximately at the center of the wall or slab.
 - 1. All sleeves and casting shall be flush with walls and underside of slabs but shall extend 2 inches above finished floors.

2.03 COMPONENTS

- A. Lubrication: Equipment shall be adequately lubricated by systems which require attention no more often than weekly during continuous operation. Lubrication system shall not require attention during start-up or shutdown and shall not waste lubricants.
 - 1. Lubrication point shall be easily accessible with all points of application provided with standard fittings for greasing or placing oil.
 - 2. Lubricants of the type recommended by the equipment manufacturer shall be provided in sufficient quantity for all consumption prior to completion of required testing and acceptance of equipment by OWNER.
- B. Safety Guards: All belt or chain drives, fan blades, couplings, vertical or horizontal drive shafts, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 gauge or heavier stainless steel or aluminum-clad sheet steel or 1/2-inch mesh stainless steel expanded metal. Each guard shall be designed for easy installation and removal and painted safety yellow.
 - 1. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be stainless steel.
 - 2. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.
- C. Anchor Bolts: All necessary anchor bolts shall be provided as per the manufacturer's recommendations for size, strength, and location and shall meet the requirements of Standard Details on Drawings. Substantial templates and working drawings for installation shall be provided. Two nuts shall be furnished.
 - 1. Unless otherwise shown or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete.
- D. Seals: Mercury seals will not be acceptable.
- E. Bearings: All antifriction bearings shall be designed per the Anti-Friction Bearing Manufacturers Association (AFBMA) recommendations with a rating life of B-10, 30,000 hours.
- F. Equipment Bases: A cast iron or welded steel baseplate shall be provided for all equipment and motor assemblies. Each baseplate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have a threaded drain connection. Bases shall be fully braced to withstand shock loads and resist buckling. Necessary safety guard mounting shall be provided as part of the equipment base.

- G. Motor Starters and Control Panels: Motor starters 480 volt or less shall be size one or larger and have 120 volt AC contactor coils. All control circuits and indicating lights associated with the starter shall be 120 volt. The control transformer shall be sized to have 100 VA minimum spare capacity for future use. A terminal strip shall be provided for all control wires entering the starter with spare terminals for future use. The terminal strip and wires shall be identified. One spare normally open auxiliary starter contact, wired to the terminal strip, shall be provided for future use. Indicating lights shall be 120 volt LED Lamps, oiltight, push-to-test type. Explosion-proof units shall meet NEC Class I, Division I, Group D requirements.
 - 1. Provide equipment enclosures appropriate for areas in which they are installed. Each area will be designated on Drawings with a type of construction, such as NEMA 4, 4X, 7, or 9 if it is other than NEMA 12. An area designated by a name and elevation includes space bounded by floor, ceiling, and enclosing walls.

2.04 FABRICATION

- A. Shop Painting: All iron and steel surfaces shall be protected by suitable paint or coatings applied in the shop or at point of fabrication. Surfaces which will be inaccessible after assembly shall be protected for the life of the equipment.
 - 1. All iron and steel surfaces which will be totally or partially submerged or located in a continuously or intermittently moist atmosphere during normal operation shall be shop blast cleaned to a near-white finish, removing all dirt, rust-scale, and foreign matter by any of the recommended methods outlined in the Steel Structures Painting Council Specification SP-10.
 - 2. The cleaned surfaces shall be shop primed before any rust bloom forms. All other exposed surface shall be properly filed, scraped, sanded, etched, brushed, sandblasted, and/or cleaned to provide surfaces free from dirt, loose crystals, rust, scale, oil, and grease and shop primed.
 - 3. Shop primed surfaces shall be painted with one or more coats of a primer which meets the requirements of this Section and is compatible with the finish painting system specified in Section 09900. Minimum shop coat thickness shall be 1.5 dry mills.
- B. Sluice gates shall be factory painted with coal tar.
- C. The exterior surfaces of all ground-buried valves shall receive a coal tar or bituminous coating in accordance with manufacturer's standards. The inside surfaces of all valves shall be coated with coal-tar pitch varnish in accordance with the latest AWWA Specifications.
- D. Electric motors, speed reducers, starters, pumps, motor control centers, control panels, and other self-contained or enclosed components shall be shop finished with 2 coats of an enamel paint as per manufacturer's recommendations.
- E. Where specified, steel and iron surfaces shall be hot-dipped galvanized in conformity with ASTM A 153 and A 385.
- F. Machined, polished, and nonferrous surfaces which are not to be painted or galvanized shall be coated with rust preventive compound.

PART 3 - EXECUTION

3.01 EQUIPMENT BASES

- A. The baseplate shall be installed on a concrete base. Baseplates shall be anchored to the concrete base with suitable anchor bolts and grouted in place.

3.02 WALL AND SLAB SLEEVES AND CASTINGS

- A. Unless otherwise shown on Drawings or specified, at all points where pipes or conduit pass through walls, slabs or roofs, suitable sleeves or castings shall be furnished and installed. Sleeves and castings shall not be painted in areas to be embedded in the concrete. All loose rust, scale, grease, or oil shall be removed prior to pouring the concrete.
- B. Unless otherwise shown or approved by ENGINEER, the space between the pipe and the sleeve shall be caulked. All ground buried and water or gas retaining wall or slab sleeves or castings shall be caulked with lead and oakum or be mechanical joint.

3.03 EQUIPMENT INSTALLATION CHECK

- A. An experienced, competent, and authorized representative of the manufacturer or supplier of each item of equipment shall visit Site of Work a minimum of 2 times, once prior to installation to review installation procedures with CONTRACTOR and once after installation to inspect, check, adjust if necessary, and approve the equipment's installation. The equipment supplier's representative shall revisit Site as often as necessary until all trouble is corrected and the equipment installation and operation is satisfactory to ENGINEER.
- B. Manufacturer's representative shall provide all necessary tools and testing equipment required including noise level and vibration sensing equipment.
- C. Each equipment supplier's representative shall furnish to OWNER, through ENGINEER, a written report certifying that the equipment:
 - 1. Has been properly installed and lubricated;
 - 2. Is in accurate alignment;
 - 3. Is free from any undue stress imposed by connecting piping or anchor bolts;
 - 4. Has been operated under full load condition and that it operated satisfactorily to ENGINEER;
 - 5. That OWNER's Representative has been instructed in the proper maintenance and operation of the equipment; and
 - 6. Furnish OWNER a copy of all test data recorded during the installation check including noise level and vibration readings.

3.04 OPERATION AND MAINTENANCE TRAINING

- A. Provide services of manufacturer's service representative to instruct OWNER's personnel in operation and maintenance of equipment. Training shall include start-up and shutdown, servicing and preventative maintenance schedule and procedures, and troubleshooting procedures plus procedures for obtaining repair parts and technical assistance.
 - 1. Manufacturer's representative shall provide a minimum of 2 on-Site training sessions.
 - a. Two sessions for Maintenance personnel
 - 2. Review operating and maintenance data contained in the final approved operating and maintenance manuals.
 - 3. Schedule training with OWNER, provide at least 10-day prior written notice to ENGINEER and OWNER.

END OF SECTION

SECTION 01650

START-UP AND DEMONSTRATION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Demonstrate to Owner and Engineer that the Work functions as a complete and operable system under normal and emergency operating conditions for each of the constructed sites of this contract. Each site shall undergo a separate start-up and demonstration period.
- B. Contractor shall provide all materials, personnel, equipment and expendables as needed and as specified to perform the required start-up and demonstration tests.
- C. Related Work Described Elsewhere:
 - 1. Progress Schedules: Section 01310.
 - 2. Instrumentation: Division 13.
 - 4. Electrical: Division 16.

PART 2 - PRODUCTS

2.01 START-UP PLAN

- A. Submit for approval by the Engineer a detailed start-up plan outlining the schedule and sequence of all tests and start-up activities, including submittal of checkout forms, submittal of demonstration test procedures, start-up, demonstration and testing, submittal of certification of completed demonstration and training. Start-up and commissioning may not begin until the plan is approved by the Engineer.

PART 3 - EXECUTION

3.01 COMPONENT TEST AND CHECK-OUT

- A. Start-up Certification: Prior to system start-up, successfully complete all the testing required of the individual components of the Work. Submit six (6) copies of check out forms for each individual component or piece of equipment, signed by the Contractor or the subcontractor and the manufacturer's representative. All copies of the Operation and Maintenance Manuals must be provided before start-up may begin. These forms shall be completed and submitted before Instruction in Operation to Owner or a request for initiating any final inspections. Insert one (1) copy of this form into the applicable section of each Operation and Maintenance Manual.
- B. Demonstrate to the Engineer and the Owner's representative, that all temporary jumpers and/or bypasses have been removed and that all of the components are operating under their own controls as designated.

- C. Coordinate start-up activities with the Owner's operating personnel and with the Engineer prior to commencing system start-up.

3.02 START-UP

- A. Confirm that all equipment is properly energized.
- B. Initiate start-up and training in accordance with the use of the operation and maintenance manuals.
- C. Observe the component operation and make adjustments as necessary to optimize the performance of the Work.
- D. Coordinate with Owner for any adjustments desired or operational problems requiring debugging.
- E. Make adjustments as necessary.

3.03 START-UP DEMONSTRATION AND TESTING (PER SITE, 3 TOTAL SITES)

- A. After all Work components have been constructed, field tested, and started up in accordance with the individual Specifications and manufacturer requirements, and after all Check-Out Forms have been completed and submitted, perform the Start-Up Demonstration and Testing. The demonstration period shall be held upon completion of all systems at a starting date to be agreed upon in writing by the Owner or his representative. Prior to beginning the start-up demonstration testing, the Contractor shall submit a detailed schedule of operational circumstances for approval by the Engineer. The schedule of operational circumstances shall describe, in detail, the proposed test procedures for each piece of equipment. Provide similar test procedure forms for each piece of equipment or section of the Work to include all particular aspects and features of that equipment or section of the Work and as specified in the Technical Sections of the Specifications.
- B. The Start-Up Demonstration Testing will be conducted for three (3) consecutive days. The Work must operate successfully during the three (3) day testing period in the manner intended. If the Work does not operate successfully, or if the start-up is interrupted due to other contracts, the problems shall be corrected and the test shall start over from day one. The party causing the interruption shall be subject to the assessment of actual damages due to delay.
- C. During the start-up demonstration period, operate the Work, instruct designated personnel in the function and operation of the Work, and cause various operational circumstances to occur. As a minimum, these circumstances will include performance standards, random equipment or process failures, interlocks and bypasses. Demonstrate the essential features of the equipment and its relationship to other equipment. The approved schedule of operational circumstances and demonstration test procedures will be used as the agenda during the Start-Up Demonstration Testing period for all equipment and sections of the Work. Coordination of the demonstration test schedule will be accomplished through the Engineer.
- D. Acceptability of the Work's performance will be based on the Work performing as specified under these actual and simulated operating conditions functioning as intended and as defined in the Contract Documents. The intent of the start-up demonstration and testing is for the Contractor to demonstrate to the Owner and the Engineer that the Work will function as a complete and operable system under normal, as well as emergency operating conditions, and is ready for final acceptance.

- E. Demonstrate the essential features of all electrical and instrumentation systems including, but not limited to, the following as they apply to the work:
 - 1. Electrical system controls and equipment.
 - 2. Mechanical systems.
 - 3. Communications systems.
 - 4. Wiring devices.
 - a. Outlets: convenience, special purpose.
 - b. Switches: regular, time.

- F. Upon successful completion of the Start-up, Demonstration and Testing, the Owner's personnel will receive the specified training for each system. Training of the Owner's personnel will not be considered valid unless it takes place using a system that has successfully passed the Start-up, Demonstration and Testing.

- G. Upon completion of all specified operator training, the Contractor shall submit to the Engineer six (6) copies of the Certificate of Completed Demonstration Form, for each item of equipment or system in the Work, signed by the Contractor, Subcontractor, Engineer, and the Owner. Insert one (1) copy of this form in the applicable section of each Operation and Maintenance Manual. Samples of the Check Out Form and Certificate of Completed Demonstration Form are provided at the end of this Section.

CHECK OUT FORM

<input type="checkbox"/>	OWNER	<u>City of Kalamazoo</u>	No. Copies	_____	CHECK-OUT
<input type="checkbox"/>	ENGINEER:	<u>Tetra Tech</u>	No. Copies	_____	MEMO NO. _____
<input type="checkbox"/>	ARCHITECT:	_____	No. Copies	_____	
<input type="checkbox"/>	CONTRACTOR:	_____	No. Copies	_____	
<input type="checkbox"/>	FIELD:	_____	No. Copies	_____	
<input type="checkbox"/>	OTHER:	_____	No. Copies	_____	

PROJECT DATA

CONTRACT DATA

NAME: _____
 LOCATION: _____
 OWNER: _____
 OTHER: _____

NUMBER: _____
 DATE: _____
 DRAWING NO: _____
 SPECIFICATION SECTION: _____

Name of equipment checked: _____

Name of manufacturer of equipment: _____

1. The equipment furnished by us has been checked on the job by us. We have reviewed, where applicable, the performance verification information submitted to us by the Contractor.
2. The equipment is properly installed, except for items noted below.*
3. The equipment is operating satisfactorily, except for items noted below.*
4. The written operating and maintenance information, where applicable, has been presented to the Contractor, and been discussed with him in detail. Five (5) copies of all applicable operating and maintenance information and parts lists have been furnished to him.

Checked By:

Name of Manufacturer's Rep.

Name of General Contractor

Address and Phone # of Rep.

Authorized Sig./Title/Date

Sig./Title/Pers. Making Chk.

Name of Subcontractor

Date Checked

Authorized Sig./Title/Date

Manufacturer's Representative Notations: Exceptions noted at time of check were:

Manufacturer's Representative to note adequacy of related equipment that directly affects operation, performance or function of equipment checked. (No comment presented herein will indicate adequacy of related systems or equipment):

CERTIFICATE OF COMPLETED DEMONSTRATION FORM

<input type="checkbox"/>	OWNER	<u>City of Kalamazoo</u>	No. Copies	_____	CERTIFICATE OF COMPLETED DEMONSTRATION MEMO NO. _____
<input type="checkbox"/>	ENGINEER:	<u>Tetra Tech</u>	No. Copies	_____	
<input type="checkbox"/>	ARCHITECT:	_____	No. Copies	_____	
<input type="checkbox"/>	CONTRACTOR:	_____	No. Copies	_____	
<input type="checkbox"/>	FIELD:	_____	No. Copies	_____	
<input type="checkbox"/>	OTHER:	_____	No. Copies	_____	

PROJECT DATA

NAME: _____
LOCATION: _____
OWNER: _____
OTHER: _____

CONTRACT DATA

NUMBER: _____
DATE: _____
DRAWING NO: _____
SPECIFICATION
SECTION: _____

NOTE TO CONTRACTOR:

Submit five (5) copies of all information listed below for checking at least one (1) week before scheduled demonstration of the Work. After all information has been approved by the Engineer, give the Owner a Demonstration of Completed Systems as specified and have the Owner sign five (5) copies of this form. After this has been done, a written request for a final inspection of the system shall be made.

MEMORANDUM:

This memo is for the information of all concerned that the Owner has been given a Demonstration of Completed Systems on the work covered under this Specification Section. This conference consisted of the system operation, a tour on which all major items of equipment were explained and demonstrated, and the following items were given to the Owner:

- (a) Owner's copy of Operation and Maintenance Manual for equipment or systems specified under this Section containing approved submittal sheets on all items, including the following:
 - (1) Maintenance information published by manufacturer on equipment items.
 - (2) Printed warranties by manufacturers of equipment items.
 - (3) Performance verification information as recorded by the Contractor.
 - (4) Check-Out Memo on equipment by manufacturer's representative.
 - (5) Written operating instructions on any specialized items.
 - (6) Explanation of guarantees and warranties on the system.
- (b) Prints showing actual "As-Built" conditions.

(c) A demonstration of the system in operation and of the maintenance procedures which will be required.

(Name of General Contractor)

By: _____
(Authorized Signature, Title and Date)

(Name of Subcontractor)

By: _____
(Authorized Signature, Title and Date)

Operation and Maintenance Manuals, Instruction Prints, Demonstration and Instruction in Operation Received:

(Name of Owner)

By: _____
(Authorized Signature/Title/Date)

END OF SECTION

SECTION 01730

CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Related Sections:
 - 1. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 15 and Division 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.
 - 2. Demolition of selected portions of the building for alterations is included in Section 02225.

1.02 SUBMITTALS

- A. Cutting and Patching Proposed Method: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval from ENGINEER to proceed.

1.03 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance or decreased operational life or safety.
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in ENGINEER's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance shall equal or surpass that of existing materials.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

3.02 PREPARATION

- A. Provide temporary support of Work to be cut.
- B. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit, or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.03 PERFORMANCE

- A. Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
- B. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- C. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
 - 1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
- D. Comply with requirements of applicable Sections of Division 2 where cutting and patching requires excavating and backfilling.
- E. Cap, valve or plug, and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after bypassing and cutting.
- F. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
 - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.04 CLEANING

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty, and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION

SECTION 01770

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies administrative and procedural requirements for Contract closeout including, but not limited to:
 - 1. Warranties and Bonds.
 - 2. Requirements for Substantial Completion.
 - 3. Project record document submittal.
 - 4. Equipment acceptance.
 - 5. Operating and maintenance manual submittal.
 - 6. Final cleaning.
- B. Refer to the General Conditions for terms of CONTRACTOR's special warranty of workmanship and materials.
- C. Specific requirements for warranties for the Work and products and installation that are specified to be warranted, are included in the individual Sections of Divisions 2 through 16.
- D. Certifications and other commitments and agreements for continuing services to OWNER are specified elsewhere in the Contract Documents.

1.02 WARRANTY REQUIREMENTS

- A. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve CONTRACTOR of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with CONTRACTOR.
- B. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- C. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- D. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. CONTRACTOR is responsible for the cost of replacing or rebuilding defective Work regardless of whether OWNER has benefited from use of the Work through a portion of its anticipated useful service life.
- E. OWNER's Recourse: Written warranties made to OWNER are in addition to implied warranties, and shall not limit the duties, obligations, rights, and remedies otherwise available under the law,

nor shall warranty periods be interpreted as limitations on time in which OWNER can enforce such other duties, obligations, rights, or remedies.

- F. Rejection of Warranties: OWNER reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- G. OWNER reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.03 SUBSTANTIAL COMPLETION

- A. Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
 - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documents for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Price.
 - 2. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 - 3. Advise OWNER of pending insurance changeover requirements.
 - 4. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
 - 5. Obtain and submit releases enabling OWNER unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates, and similar releases.
 - 6. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- B. Inspection Procedures: On receipt of a request for inspection, ENGINEER will either proceed with inspection or advise CONTRACTOR of unfilled requirements.
 - 1. ENGINEER will prepare the Certificate of Substantial Completion following inspection, or advise CONTRACTOR of construction that must be completed or corrected before the certificate will be issued.
 - 2. ENGINEER will repeat inspection when requested and assured that the Work has been substantially completed.
 - 3. Results of the completed inspection will form the basis of requirements for final acceptance.
- C. The warranty period for specific portions of the Work will begin on the date established on Component Acceptance Form or at such other date as agreed by OWNER, ENGINEER, and CONTRACTOR.

1.04 FINAL ACCEPTANCE

- A. Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
 - 1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 - 2. Submit an updated final statement, accounting for final additional changes to the Contract Price.

3. Submit a copy of ENGINEER's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by ENGINEER.
 4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when OWNER took possession of and responsibility for corresponding elements of the Work.
 5. Submit consent of surety to final payment.
 6. Submit a final liquidated damages settlement statement.
 7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 8. Submit record drawings, maintenance manuals, final Project photographs, damage or settlement survey, property survey, and similar final record information.
 9. Deliver tools, spare parts, extra stock, and similar items.
 10. Make final changeover of permanent locks and transmit keys to OWNER. Advise OWNER's personnel of changeover in security provisions.
 11. Complete start-up testing of systems, and instruction of OWNER's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
- B. Reinspection Procedure: ENGINEER will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to ENGINEER.
1. Upon completion of reinspection, ENGINEER will prepare a certificate of final acceptance, or advise CONTRACTOR of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
 2. If necessary, reinspection will be repeated.

1.05 REINSPECTION FEES

- A. Should the Engineer perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:
1. Contractor will compensate the Owner for such additional services.
 2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.06 SUBMITTALS

- A. Submit written warranties to ENGINEER prior to the date certified for Substantial Completion. If ENGINEER's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of ENGINEER.
- B. When a designated portion of the Work is completed and occupied or used by OWNER, by separate agreement with CONTRACTOR during the construction period, submit properly executed warranties to ENGINEER within 15 days of completion of that designated portion of the Work.
- C. When a special warranty is required to be executed by CONTRACTOR, or CONTRACTOR and a subcontractor, supplier, or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to OWNER through ENGINEER for approval prior to final execution.

- D. Refer to individual Sections of Divisions 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.

1.07 RECORD DOCUMENT SUBMITTALS

- A. Record Drawings:
 - 1. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown.
 - 2. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Drawings. The Record Drawings shall be supplemented by any detailed sketches as necessary or directed to indicate, fully, the Work as actually constructed. These master Record Drawings are the Contractor's representation of as-built conditions, including all revisions made necessary by addenda, change orders, RFIs, or other changes, and shall be maintained up-to-date during the progress of the Work.
 - 3. Mark whichever Drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
 - 4. In the case of those drawings which depict the detail requirement for equipment to be assembled and wired in the factory, such as motor control centers and the like, the Record Drawings shall be updated indicating any portions which are superseded by change order drawings or final shop drawings including appropriate reference information describing the change orders by number and the shop drawings by manufacturer, drawing, and revision numbers.
 - 5. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
 - 6. Mark new information that is important to OWNER, but was not shown on Contract Drawings or Shop Drawings.
 - 7. Note related Change Order numbers where applicable.
 - 8. Organize Record Drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on the cover of each set.
- B. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work.
 - 1. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to ENGINEER for OWNER's records.
- C. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01600, operation and maintenance manuals for items included under this Section.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 COMPONENT ACCEPTANCE

- A. Component Acceptance Certificate: For each item of equipment incorporated into the Project, ENGINEER will issue a Component Acceptance Certificate as shown in Section 00625.
- B. The certificate will certify that the equipment installation is complete, that manufacturer-provided inspection and start-up services and training have taken place, and that OWNER has beneficial use of the equipment.
- C. The data on the Component Acceptance Certificate may be used to establish the time of beginning for the warranty period for that piece of equipment, if OWNER begins to use it at that time.

3.02 FINAL CLEANING

- A. General cleaning during construction is required by the General Conditions.
- B. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
- C. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
 - 1. Remove labels that are not permanent labels.
 - 2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - 3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 - 4. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - 5. Clean Site, including landscape development areas, of rubbish, litter, and foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth even-textured surface.
- D. Comply with regulations of authorities having jurisdiction and safety standards for cleaning.
 - 1. Do not burn waste materials. Do not bury debris or excess materials on OWNER's property.
 - 2. Do not discharge volatile, harmful, or dangerous materials into drainage systems.
 - 3. Remove waste materials from Site and dispose of in a lawful manner.
- E. Where extra materials of value remaining after completion of associated Work have become OWNER's property, arrange for disposition of these materials as directed.

END OF SECTION

DIVISION 2
SITE WORK

SECTION 02225

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Selective Demolition Work requires selective removal and off-Site disposal of following:
 - 1. Portions of building structure shown on Drawings or required to accommodate new construction.
 - 2. Removal of interior partitions marked "remove" on Drawings.
 - 3. Removal of doors and frames marked "remove" on Drawings. Removal of built-in casework marked "remove" on Drawings. Removal of existing windows shown as "bricked-in."
 - 4. Removal and protection of existing fixtures and equipment items shown or marked as "remove and salvage."
 - 5. Removal, protection, and reinstallation of existing fixtures and equipment items shown or marked as "remove and reinstall."
- B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Sections, apply to Work of this Section.

1.02 DEFINITIONS

- A. Remove: Remove and dispose of items shown or scheduled. Discard demolished or removed items except for those shown to remain, those shown as reinstalled, those shown as salvaged, and historical items that are to remain OWNER's property.
 - 1. When equipment items are indicated for removal, all ancillary utilities, electrical items, concrete supports, and structural steel supports shall be completely removed unless indicated otherwise.
- B. Remove and Salvage: Items shown as "remove and salvage" remain OWNER's property. Carefully remove and clean salvage items; pack or crate to protect against damage.
- C. Remove and Reinstall: Remove items shown; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in same location or in location shown.
- D. Existing to Remain: Protect construction or items shown to remain against damage during selective demolition operations. When permitted by ENGINEER, CONTRACTOR may elect to remove items to suitable, protected storage location during selective demolition and properly clean and reinstall items in their original locations.

1.03 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
 - 1. Proposed dust control measures.
 - 2. Proposed noise control measures.
 - 3. Proposed haul routes between Site and disposal areas before commencing this Work.

- B. Submit Schedules listed below to OWNER.
 - 1. Detailed sequence of selective demolition and removal Work, with starting and ending dates for each activity.
 - 2. Inventory list of removed existing equipment not reused in Contract Work. Submit lists to OWNER. OWNER to determine or select items for retention by OWNER.
 - 3. Inventory list of removed and salvaged items.
 - 4. Inventory list of OWNER-removed items.
 - 5. Interruption of utility service.
 - 6. Coordination for shutoff, capping, and continuation of utility services.
 - 7. Use of elevator and stairs.
 - 8. Detailed sequence of selective demolition and removal Work to ensure uninterrupted progress of OWNER's on-Site operations.
 - 9. Coordination of OWNER's continuing occupancy of portions of existing building and of OWNER's partial occupancy of completed Work.
 - 10. Locations of temporary partitions and means of egress.

- C. Inventory list of existing equipment to be removed and not reused in Work. OWNER to determine or select items for retention by OWNER.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Demolition operations shall comply with OSHA and EPA requirements and EPA notification regulations insofar as they apply to selective demolition Work under this Contract.
 - 2. Comply with hauling and disposal regulations of authorities having jurisdiction.
 - 3. If hazardous materials are found during selective demolition operations, comply with applicable paragraphs of General Conditions.

- B. Pre-Installation Meetings:
 - 1. Do not close, block, or obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction.
 - a. Use alternative routes around closed or obstructed routes if required by governing regulations.
 - 2. Coordinate with OWNER's continuing occupation of portions of existing building, with OWNER's partial occupancy of completed new addition, and with OWNER's reduced usage during summer months.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Disassemble or cut large equipment items into smaller pieces to promote safe removal and transportation.
 - 1. Transport and unload items requested by OWNER at designated Site within distance of 5 miles.
 - 2. Haul away and dispose of debris and materials neither retained by OWNER, nor reused or reinstalled.
 - 3. Arrange for disposal areas.
 - 4. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

- B. Unloading Salvage Items: Where shown on Drawings as "Remove and Salvage," carefully remove shown items, clean, store, and turn over to OWNER and obtain receipt. OWNER will designate site for receiving items.
- C. Handling: CONTRACTOR shall take every precaution to prevent spillage of materials being hauled in public streets.
 - 1. It shall be CONTRACTOR's responsibility to immediately clean spillage that may accidentally occur.
 - 2. Do not burn removed material on or within Project Site.

1.06 PROJECT CONDITIONS

- A. Materials Ownership:
 - 1. Salvage Materials: Demolished materials shall become CONTRACTOR's property, except for items or materials shown as reused, salvaged, reinstalled, or otherwise shown to remain OWNER's property. Remove demolished material promptly from Site with further disposition at CONTRACTOR's option.
 - 2. Historical artifacts, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other articles of historical significance remain property of OWNER. Notify OWNER's Representative when these items are found and obtain method of removal and salvage from OWNER.
 - 3. Transport items of salvageable value to CONTRACTOR (CONTRACTOR's area) as they are removed. Storage or sale of demolition items on-Site is not allowed.
- B. Environmental Requirements: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations relating to environmental protection. Do not use water when it may create hazardous or objectionable conditions including ice, flooding, and pollution.
- C. Existing Conditions: OWNER will be continuously occupying building areas immediately adjacent to selective demolition areas.
- D. OWNER assumes no responsibility for actual condition of items or structures scheduled for selective demolition.
- E. OWNER will maintain conditions existing at Contract commencement insofar as practical. However, variations within structure may occur by OWNER's removal and salvage operation before selective demolition Work begins.
- F. Asbestos presence is unknown within buildings to be selectively demolished. If asbestos presence is suspected or confirmed, notify OWNER's Representative prior to disturbing suspected material.
 - 1. Do not disturb asbestos or any material suspected of containing asbestos except under procedures specified in General Conditions.

1.07 SEQUENCING

- A. Conduct selective demolition Work in manner that minimizes need for disruption or interference of OWNER's normal on-Site operations.
 - 1. Existing sodium hexametaphosphate system shall remain operational until new chemical system is tested and approved and coordinated with OWNER.

- B. Coordinate with OWNER's continuing occupation of portions of existing building, with OWNER's partial occupancy of completed new addition and OWNER's reduced usage during summer months.
- C. Include coordination for shutoff, capping, and continuation of utility services together with details for dust and noise control protection to ensure uninterrupted on-Site operations by OWNER.

1.08 SCHEDULING

- A. Schedule: Submit schedule showing proposed methods and sequence of operations for selective demolition Work to OWNER's Representative for review before commencement of Work.
- B. Arrange selective demolition schedule so as not to interfere with OWNER's on-Site operations.
- C. Give minimum of 72 hours advance notice to OWNER of demolition activities which affect OWNER's normal operations.
- D. Give minimum of 72 hours advance notice to OWNER if shutdown of service is necessary during changeover.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Site Verification of Conditions: Before beginning selective demolition Work, inspect areas of Work. Survey existing conditions and correlate with requirements shown to determine extent of selective demolition required. Photograph existing structure surfaces, equipment, or surrounding properties which could be misconstrued as damage resulting from selective demolition Work. File with OWNER's Representative before starting Work.
- B. Inventory and record condition of items scheduled as "remove and re-install" or items scheduled as "remove and salvage."
- C. Verify disconnection and capping of utilities within the affected area of Work.
- D. If unanticipated mechanical, electrical, or structural elements conflict with intended function or design, investigate and measure nature and extent of conflicts. Promptly submit detailed written reports to OWNER's Representative. Pending receipt of the directive from OWNER's Representative, rearrange selective demolition schedule to continue general job progress without delay.

3.02 UTILITY SERVICES

- A. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction.

- B. Maintain existing utilities shown as remaining. Keep in service and protect existing utilities against damage during selective demolition operations.

3.03 PREPARATION

- A. Drain, purge, or remove, collect and dispose of chemicals, gases, explosives, acids, flammable, or other dangerous material before proceeding with selective demolition operations.
 - 1. Existing chemical storage and feed systems shall remain operational until startup of new system. OWNER will feed as much stored liquid phosphate product as possible prior to startup of new system. Remaining liquid sodium hexametaphosphate and liquid poly-orthophosphate product may be landfill disposed. Under no circumstances shall any chemical be disposed to surface waters, sanitary sewer, or wastewater treatment plant.
 - 2. OWNER will remove existing solid sodium hexametaphosphate.
- B. Cover and protect furniture, equipment, and permanent fixtures from soiling or damage while demolition Work is done in rooms or areas where items remain in place.
- C. Protect existing finish Work that remains in place and becomes exposed during selective demolition operations.
- D. Protect floors with suitable coverings when necessary.
- E. Where selective demolition occurs immediately adjacent to occupied portions of building, or to separate areas of noisy or extensive dirt or dust operations, construct and maintain temporary, insulated, fire-rated solid dustproof partitions.
 - 1. Construct dustproof partitions of minimum 4-inch studs, 5/8-inch-thick drywall (joints taped on occupied side), 1/2-inch fire-retardant plywood on demolition side, and fill partition cavity with sound-deadening insulation.
 - 2. Equip partitions with dustproof doors and security locks if required.
- F. Provide weatherproof closures for exterior openings resulting from selective demolition Work. Provide temporary weather protection during interval between selective demolition and removal of existing construction on exterior surfaces, and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
- G. Provide and ensure free and safe passage of OWNER's personnel and general public to and from occupied portions of building around selective demolition areas.
 - 1. Provide temporary barricades and other forms of protection to protect OWNER's personnel and general public from injury.
 - 2. Build temporary covered passageways required by authorities having jurisdiction.
- H. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of demolished structures or elements, or adjacent facilities or Work to remain.
- I. Cease operations and notify OWNER's Representative immediately if safety of structure seems endangered. Take precautions to support structure until determination is made for continuing operations.
- J. Remove protection at completion of Work.

3.04 DEMOLITION

- A. Special Techniques: Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
- B. Demolish foundation walls to depth of not less than 12 inches below proposed ground surface. Demolish and remove below-grade wood or metal construction. Break up below-grade concrete slabs.
- C. For interior slabs on grade, use power saw or removal methods that do not crack or structurally disturb adjacent slabs or partitions.
- D. Completely fill below-grade areas and voids resulting from selective demolition Work. Either:
 - 1. Provide fill consisting of approved earth, gravel, or sand.
 - 2. Fill shall be free of trash, debris, stones over 6-inch diameter, roots, or other organic matter.OR
 - 3. Fill below-grade areas and voids with Class F concrete.
- E. Explosives: Use of explosives is not allowed.
- F. Interface with Other Work: Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
- G. Site Tolerances: Provide services for effective air and water pollution controls required by local authorities having jurisdiction.

3.05 REPAIR\RESTORATION

- A. Repair damages caused by demolition that was more extensive than required.
- B. Return structures and surfaces to condition existing before commencement of selective demolition Work.
- C. Repair adjacent construction or surfaces soiled or damaged by selective demolition Work.
- D. Promptly repair damages caused to adjacent facilities by selective demolition Work at no cost to OWNER.

3.06 CLEANING

- A. CONTRACTOR shall maintain an order of neatness and good housekeeping comparable to that observed by OWNER.
- B. Keep tools, scaffolding, and other demolition equipment in neat and orderly arrangement.
- C. Remove dirt and debris resulting from CONTRACTOR's demolition operations from Site daily. Dirt and debris shall not collect or interfere with OWNER's facility operations.

- D. Upon completion of selective demolition Work, remove tools, equipment, and demolished materials from Site. Remove protection and leave interior areas broom clean.

END OF SECTION

DIVISION 3
(NOT USED)

DIVISION 4
(NOT USED)

DIVISION 5
(NOT USED)

DIVISION 6
(NOT USED)

DIVISION 7
(NOT USED)

DIVISION 8
(NOT USED)

DIVISION 9
(NOT USED)

DIVISION 10
(NOT USED)

DIVISION 11
(NOT USED)

DIVISION 12
(NOT USED)

DIVISION 13

SPECIAL CONSTRUCTION

SECTION 13410

BASIC INSTRUMENTATION REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: General administrative and procedural requirements for instrumentation installations. Administrative and procedural requirements are included in this Section to expand on requirements specified in Division 1.

1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Sections 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
 - 1. Product data for each product specified.
 - 2. Wiring diagrams, both elementary and schematic, differentiating between manufacturer installed and field-installed wiring.
 - 3. Digital Systems: Provide the following:
 - a. Digital equipment layouts of input and output racks showing complete module model number and addressing assignment. Layouts of port pin assignment, connection schematic indicating cable types and port addresses.
- B. Record Drawings: At Project closeout, submit record drawings of installed products, in accordance with requirements of Section 01770.
 - 1. Where Drawings are drafted by computer equipment, CONTRACTOR shall furnish files on a disk. These Drawings shall include changes made by Field Orders, Change Orders, Addenda, and errors discovered during start-up and acceptance.
 - 2. Drawings shall include terminal numbers at each wiring termination and piping termination. A complete system diagram shall be included.
- C. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01600, operation and maintenance manuals for items included under this Section.
 - 1. Instructions shall be short, easy-to-understand directions specifically written for this Project describing various possible methods of operating equipment. Instructions shall include procedures for tests required, adjustments to be made, and safety precautions to be taken with equipment. These documents are to be submitted to ENGINEER's office.
 - 2. Provide 1 complete set of manufacturer's documentation covering programmable equipment supplied. Include hardware manuals and prints as manufacturer normally ships with programmable equipment.
- D. Warranty: Submit in accordance with requirements of Section 01770, warranties covering the items included under this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of equipment, of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years.

- B. Codes and Standards:
 - 1. National Electric Code.
 - 2. Applicable State and local requirements.
 - 3. UL listing and labeling shall be adhered to.
- C. Equipment that does not have a UL, FM, CSA, or other listed testing laboratory label shall be furnished with a notarized letter signed by the supplier stating that equipment furnished has been manufactured in accordance with National Electric Code and OSHA requirements.
- D. CONTRACTOR shall provide permits and licenses, observe and abide by applicable laws, regulations, ordinances, and rules of State, territory or political subdivision thereof, wherein the Work is done. CONTRACTOR shall pay fees for permits, inspections, licenses, and certifications when such fees are required.
- E. Calibration Equipment and Testing Apparatus: Equipment supplier shall have available test and calibration equipment for factory panel tests, installation, start-up, service contract, and maintenance or troubleshooting purposes.
 - 1. The equipment required for these tests is as follows:
 - a. Two - Digital Multimeters with an accuracy of plus or minus 0.1 percent.
- F. Component Requirements: For the purposes of uniformity and conformance to industry standards, signal transmission modes shall be either electronic 4-20 mA DC or pneumatic 3-15 psi only. No other signal characteristics are acceptable, except for remote temperature detector (RTD) and thermocouple (TC) sensing circuits; 4-20 mA DC signals shall be such that devices may be wired in parallel for 1-5 volt DC as required. 1-5 volt DC mode shall be employed only within control panel enclosures.
- G. Responsibility and Coordination: Drawings and Specifications are intended to include details of a complete equipment installation for purposes specified. CONTRACTOR shall be responsible for details which may be necessary to properly install, adjust, and place in operation complete installation. Any error on Drawings or in Specifications which prevents proper operation of supplied system shall be shown correct at time of Shop Drawing submittal for approval or brought to attention of ENGINEER with or prior to submittal.
- H. CONTRACTOR shall be responsible for costs incurred to correct aforementioned errors brought to ENGINEER's attention. CONTRACTOR shall assume full responsibility for additional costs which may result from unauthorized deviations from Specifications.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Manufactured material shall be adequately packed to prevent damage during shipping, handling, storage, and erection. Material shipped to Site shall be packed in a container properly marked for identification. Blocks and padding shall be used to prevent movement.
- B. CONTRACTOR shall inspect the material prior to removing it from carrier. If damage is observed, CONTRACTOR shall immediately notify carrier so that a claim can be made. If no such notice is given, material shall be assumed to be in undamaged condition; any subsequent damage that occurs to the equipment shall be the responsibility of CONTRACTOR. Repair and replacement of damaged parts will be done at no expense to OWNER.

- C. CONTRACTOR shall be responsible for any damage charges resulting from handling of materials.

PART 2 - PRODUCTS

2.01 EQUIPMENT SUPPLIERS

- A. Subject to compliance with specified requirements, equipment suppliers shall be the following (no "or equals"):
 - 1. Commerce Controls Inc.
 - 2. West Michigan Instrumentation Systems Inc.
- B. References made in these Specifications to specific manufacturer's products are intended to serve as a guide to type, construction, and materials. Listing of a manufacturer does not imply acceptance by ENGINEER of a manufacturer's particular product, product line, or latest product revision if it does not meet Specifications.
- C. Equipment Supplier: Equipment specified under Sections 13413 through 13899 and shown on Drawings shall be designed as a system, fabricated or purchased, shipped to Site, and started up by one of the qualified and approved equipment suppliers listed under this Section. Intent is for unit responsibility.
 - 1. Equipment supplier shall not assign any of its rights or delegate any of its obligations under these Sections without prior written acceptance by ENGINEER.
 - 2. Direct purchase of any items in these Sections by CONTRACTOR is not in compliance with this Specification and will not be permitted.
 - a. Project Engineer/Project Manager's name shall be forwarded to CONTRACTOR and ENGINEER within 30 days after receipt of a purchase order by equipment supplier.
 - b. Project Engineer/Project Manager shall be focal point for design, fabrication, Contract communications, and shall be responsible for start-up and acceptance. Project Engineer/Project Manager shall be at factory test at Site for start-up and at the Site during entire acceptance procedure. Only qualified and approved equipment suppliers shall be accepted as meeting this Specification.

2.02 EQUIPMENT

- A. Transmitted electronic signals to equipment of other vendors and between control panels shall be a separate isolated-floating output for each item of equipment and shall conform to ISA Standard S50.1.
- B. Enclosures shall be NEMA 1, 4, 4X, or 7 as indicated on Drawings. Intrinsically safe systems, as approved by Factory Mutual, shall be furnished when called for.
- C. No external power connections shall be allowed unless specifically called for in Specification. Where an external power source is called for, unit shall accept 120 VAC, plus or minus 10 percent power.
- D. Current-to-current converters shall be used as power boosters to provide sufficient signal power as required. It is equipment supplier's responsibility to determine under what circumstances and locations power boosters are required, provide them, and integrate them into the instrumentation system to make system function properly.

- E. Separate power supplies shall be totally enclosed with solderless terminals for connections. They shall be short circuit current limiting type that will automatically resume regulation after removal of short circuit. They shall operate from 120 volt AC, plus or minus 10 percent power. Regulated voltage shall be fixed. Units with internal trim potentiometers will be accepted.
 - 1. Pneumatic instruments shall have an input and output range of 3-15 psig. Units shall require a 20 psi supply. Provide an air set for each pneumatic unit or for each 20 psi manifold. Bubbler air sets, regulators, valves, etc., must be factory assembled on a subplate as specified and detailed.
 - 2. Instruments shall be panel-mounted or enclosed for wall mounting as shown on Drawings.
- F. Size and style of instruments are defined in Specifications. Pneumatic panel-mounted units shall match in appearance similar electronic components.
- G. Charts and scales are shown on Drawings. Standard scales shall not be accepted without ENGINEER's approval if it differs from those shown. Ratio station scales and other scales shall be graduated such that major graduations fall on whole numbers (i.e., 1, 2, 3, or 5, 10, 15, etc.) and minor graduations fall on 0.1 or 0.2 intervals (i.e., 1.1, 1.2 or 11, 12, etc.). If two scales are called for on ratio stations, each scale shall be indexed to meet Specification. Drawing of each scale for ratio stations shall be submitted with Shop Drawings for approval.
- H. Solid-state output switches, where used, shall be overvoltage transient protected and not be damaged by dI/dT or dv/dt for their design application under this Contract.
- I. Instruments shall be equipped with permanently attached identification tag. Tag shall be included on field- and panel-mounted devices. Tags shall include ENGINEER's tag identification and manufacturer's tag identification if different from ENGINEER's.
 - 1. Tags shall be either stamped metal or laminated phenolic with white letters engraved on a black background. Field-mounted devices shall have tags fastened with screws. Devices mounted in panels will be tagged inside panel on subplates or on device itself where it can be easily read.
- J. Finish on instruments and accessories shall provide protection against corrosion by elements in environment in which they are to be installed. Both the interior and exterior of enclosures shall be finished. Extra paint of each color used on material shall be provided by manufacturer for touch-up purposes.
- K. Provide equipment identification nameplates complying with Section 16075. Nameplates shall contain ENGINEER's item designation and, for indicators and transmitters, design range and units of device shown.

2.03 SOURCE QUALITY CONTROL

- A. PLCs, operator interface computers, touch screen computers, and associated control panels shall be tested at the factory prior to shipment to the Site. ENGINEER is to be given 6 weeks notice before the factory test date; ENGINEER will witness the tests. The purpose of factory testing is to verify correct functioning of equipment and conformity to Project requirements before shipment
- B. Once the PLCs, etc., are connected at the equipment supplier's factory, and it has been demonstrated that the equipment properly communicates, the panels shall remain at the supplier's facility for 5 weeks to allow ENGINEER to check out the ENGINEER developed plc software and operator interface software.

- C. Test Procedures:
 - 1. Hardware testing to verify system wiring, layout, workmanship, and appearance. Demonstrate correct function of inputs and outputs using a switch and lamp "mimic board." Perform a PLC load test to verify that outputs can be driven at full load simultaneously.
 - 2. Control logic tests begin with loading ENGINEER-developed ladder logic software. Control logic and sequences shall be tested and verified using a switch and lamp "mimic board."
 - 3. Operator interface integration test builds upon previously completed phases by exercising entire system from the operator interface computer(s).
- D. At completion of tests, system shall remain intact for a period of at least 2 weeks for ENGINEER's use correcting software errors found during the course of test.
- E. Schedule factory test not before 12 weeks after Shop Drawing status of deliverable items under this Section is either N.E.T. or F.A.C.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment provided under this Section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions, and recommendations of equipment manufacturer as approved by ENGINEER.
- B. Install equipment as indicated, in accordance with manufacturer's written instruction, and in compliance with recognized industry practices to ensure that products fulfill requirements.
- C. Elements that are supported by plumbing or piping, or that have only plumbing or piping connections shall be installed under those Sections.
- D. Plumbing, piping, or pneumatic signal connections to elements requiring such connections shall be made under those Sections. Control panels shall be installed in accordance with Division 16 Sections, with piping connections to control panels installed under Division 15 Sections.
- E. Drawings are not intended to show every detail of construction or location of piping, ductwork, or equipment. Where proper operation or construction makes it necessary or advisable to change location of piping, instrumentation equipment, air ducts, or other equipment, CONTRACTOR shall so inform ENGINEER for his approval and permission.

3.02 FIELD QUALITY CONTROL

- A. Calibrate equipment in accordance with manufacturer's instructions to ranges or set points indicated on Drawings.
- B. Installation and Start-up: Equipment supplier shall have an established service facility from which qualified technical service personnel and parts may be dispatched upon call. Such a service facility shall be no more than 6 hours travel time from Site.
 - 1. Equipment supplier shall provide an experienced, factory-trained, competent, and authorized service representative for a minimum of 3 times at Site, including once during installation and start-up and once during acceptance to inspect, check, and calibrate any part of system. Supplier's service representative shall revisit Site for 8 hours per day as often as necessary after

installation until trouble is corrected and equipment has passed acceptance test and is operating satisfactorily to ENGINEER.

2. Third trip is after equipment has been accepted and shall be used to instruct OWNER's personnel in aspects of operation and maintenance, such as fuse locations, use of controls, instruction manuals, etc. Third trip shall be for duration of two, 8-hour days at OWNER's facility.
- C. Equipment supplier shall provide two, 8-hour days of training for OWNER's personnel in aspects of operation and maintenance such as use of controls, fuse locations, instruction manuals, etc.
1. Training and instructions at the plant shall be given by the Project Engineer assigned to the Project by the equipment supplier or other personnel as approved by ENGINEER.

3.03 DEMONSTRATION

- A. Upon completion of installation and calibration, demonstrate functioning of equipment in accordance with requirements. Where possible, correct malfunctioning units at Site, then retest to demonstrate compliance; otherwise, remove and replace with new or repaired units, and retest to demonstrate compliance.

END OF SECTION

SECTION 13421

FLOW MEASUREMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Magnetic Flowmeter

1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Sections 01330 and 13410, Shop Drawings covering the items included under this Section.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include(no or equal):
 - 1. Magnetic Flow Meter:
 - a. Khrone
 - b. Rosemount.
 - c. Yokogawa.

2.02 MAGNETIC FLOW METER

- A. Magnetic flow meters shall be either flanged or flangeless type as indicated. Meters 4 inches or smaller shall be wafer style. Meters 6-inch or larger shall be of flange design.
- B. Meter body shall be Schedule 10, 304 stainless steel or Schedule 40 steel with 150-pound ANSI flange or AWWA Class D flange when ANSI is not an available option. Meters 4 inches or smaller shall be wafer or flangeless style and shall be designed for installation between 150 Class and 300 Class ANSI, DIN, or BS pipe flanges.
 - 1. Wafer or flangeless style meters 4 inches or smaller shall have a ceramic, Teflon, or Tefzel liner and Hastelloy "C" or platinum electrodes as indicated.
 - 2. Meters 6 to 12 inches shall have Teflon or polyurethane liner and Hastelloy "C" or platinum electrodes as indicated.
 - 3. Meters 14 inches and larger shall have an Elastomer or polyurethane liner and Hastelloy "C" or platinum electrodes as indicated.
- C. Liner material shall be suitable for the process flow indicated on Drawings.
 - 1. Meters 4 inches or smaller shall be furnished with a Teflon or Tefzel liner. Exception: Ceramic liner shall be furnished for meters 4 inches or smaller used for lime slurry, sludge, and abrasive process flows.
 - 2. Teflon liner shall be furnished for meters 6 to 12 inches.

3. Polyurethane liner shall be furnished for meters 14 inches and larger, or if not indicated otherwise on Drawings or in the Specifications.
- D. Electrodes shall be suitable for the process flow indicated on the drawings and shall be bullet nosed style made of Hastelloy "C." Exception: Platinum electrodes shall be provided for sodium hydroxide or other caustic process applications.
- E. Start-up and acceptance check for flow meters shall be performed by a qualified employee of flow meter manufacturer. Service personnel of sales representative or of equipment supplier of this Section will not be accepted.
- F. Meter shall be capable of withstanding continuous submergence in up to 30 feet of water without damage. Field coil design shall be such that they shall not overheat or otherwise be damaged if flow tube is not totally filled with fluid. Magmeters shall be provided with 2 grounding rings.
- G. Magnetic flow meter signal converter shall consist of solid-state, feedback-type microprocessor circuitry. Operational parameters shall be user configurable locally via an integral push-button arrangement or via a remote intelligent terminal. Appurtenances, including hand-held programmer and/or programming software, shall be provided for local configuration of operational parameters. Converter shall change a low-level flow signal from sensor electrodes into a proportional isolated 4-20 mA DC signal. The converter shall have an extremely high input impedance and not be affected by quadrature noise. The unit shall be capable of accommodating uni-directional or bi-directional flow. Sensing of meter failure shall activate a user-configurable zero or 130 percent output signal and a failure alarm contact closure.
- H. Where indicated on Drawings, a high-frequency digital proportional output shall be provided for use with high-accuracy totalizers. To eliminate errors, the converter shall incorporate an integral zero return circuit to provide a constant zero output signal in response to an external dry contact closure. An automatic empty pipe detector and low-flow cutoff shall be provided as standard.
- I. Magmeter shall be electronically isolated for grounding. Where insulated or nonconductive pipe is used, only orifice plate-type grounding rings will be acceptable. Grounding electrodes which penetrate the liner will not be acceptable. Ground ring tabs shall be of suitable length to extent above flanges of meter.
- J. Unit shall be supplied with an integral or local conduit-mounted flow indicator calibrated in engineering units. Indicator shall be tagged showing design range in units being measured and shall be capable of simultaneously displaying flow rate and totalization with an alphanumeric display.
- K. Zero stability shall be achieved by pulsing the sensing head magnetic field coils with a regulated direct current, first in one direction and then in opposite direction.
- L. Continuous zero stability shall be obtained by signal sampling during the quiescent coil states. There shall be no zero offset or zero adjustments required. The converter shall not require calibration over its expected life under normal use.
- M. Flow meter shall operate within Specifications on 120 volt AC plus 10 percent and 60 hertz plus 5 percent. Power consumption shall not exceed 25 VA for meters 24 inches and smaller, and 50 VA for meters 30 inches or greater.

- N. Input span shall be adjustable between 0-1 and 0-30 feet per second and range adjustment shall be digital. Converter shall include adjustable damping circuitry. Unit shall not be affected by power line aberrations such as those produced by SCR-type motor controllers or other voltage transients.
- O. System accuracy, including primary magnetic flow meter, shall be plus 0.3 percent of rate for maximum flow velocities from 1.33 to 33.33 feet per second, and plus .5 percent of rate for maximum flow velocities from 0.7 to 1.32 feet per second. Repeatability shall be plus 0.1 percent of span. Rangeability shall meet or exceed 30:1 turndown.
- P. The signal converter portion of the magnetic flow meter shall include both a magnetic driver to power the magnetic coils and the signal converter electronics. The converter shall have the ability to be either integrally or remotely mounted as specified. If not specified, converter shall be remotely mounted. It shall be housed in a NEMA 4X case. When remotely mounted, the signal cable shall be provided with the proper length.
- Q. Magmeter manufacturer shall comply with ISO9000 Standards and the meter shall be FM approved. Signal converters shall be interchangeable without effect of meter accuracy or the need for recalibration for all meter sizes. Provide spool-piece for meters sized 12 inches and smaller.

PART 3 - EXECUTION

3.01 GENERAL

- A. Examination, Installation, Field Quality Control, Demonstration: In accordance with Section 13410.

END OF SECTION

SECTION 13430

CONTROL PANELS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Control panels and consoles.
 2. Switches, push-buttons, lights.
 3. Relays.
 4. Intrinsically safe isolator relays.
 5. Timing devices.
 6. Terminal blocks.
 7. Control power transformers.

1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Sections 01330 and 13410, Shop Drawings covering the items included under this Section.

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Codes, Ordinances, and Industrial Standards: Design, testing, assembly, and methods of installation for materials, electrical equipment, and accessories proposed under this Section shall conform to National Electric Code and to applicable State and local requirements.
 2. UL listing and labeling of custom-built panels (UL 508) shall be adhered to under this Contract.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
1. Switches, Push-Buttons, Lights:
 - a. Allen-Bradley (Type 800MR).
 - b. American Solenoid Company.
 - c. Arrow Hart (Type OB).
 - d. Electroswitch.
 - e. Microswitch (Series PW).
 2. Relays:
 - a. Potter-Brumfield (Type KUP).
 - b. Schrack North America, Inc. (Type CAD).
 - c. Square D Co. (Type KU).
 - d. Rockwell.
 3. Intrinsically Safe Isolator Relay:
 - a. B/W Controls, Inc.

- b. MTL, Inc.
- c. R. Stahl, Inc.
- d. Symcom, Inc.
- e. Warrick Controls.
- 4. Solid-State Timers:
 - a. ATC (Series 306D).
 - b. Eagle Signal (Type DG100).
- 5. Terminal Blocks:
 - a. Allen-Bradley (Type 1492F1 or Type 1492CA1).
 - b. Altech (Type CTS4U-N).
 - c. Square D Co. (Class 9080, Type KCA-1).
 - d. Thomas & Betts (100 series or 200 series).
 - e. Weidmueller (SAKD2.5N or SAK2.5).
- 6. Fusible Terminal Blocks:
 - a. Allen-Bradley (Type 1492-H6)
- 7. Textured Polyurethane Enamel:
 - a. Sherwin-Williams, Polane T and/or Polane HST.
- 8. Wire Markers:
 - a. Brady.
 - b. T&B.
 - c. Westline.
- 9. Control Power Transformers:
 - a. Acme
 - b. Sola MCR

2.02 CONTROL PANELS

A. Sheet Metal Construction:

1. Panels shall be fabricated from sheet steel welded and bolted into a rigid self-supporting structure a maximum of 90 inches high and a minimum of 20 inches deep or as shown on drawings. Overall length shall be coordinated with space requirements as indicated by Drawings. Changes in length from that shown on Drawings must be brought to attention of ENGINEER within 90 days of Contract Award. Cost to modify floor plan or wall opening shall be at CONTRACTOR's expense after this 90-day period. Panel face layouts shown on Drawings are intended to indicate relative position of all components. Supplier shall fix exact locations and overall dimensions to meet requirements of its equipment.
2. Panel and console bodies shall be 12 gauge minimum steel for panels up to 42 inches in width, and 10 gauge minimum steel for panels exceeding 42 inches in width. Panel subplates shall be same gauge as enclosure. Stiffening members shall be provided for strength and stiffness as required.
3. A minimum of 3 inches shall be provided between edge of panel subplate and outside walls of panel body to ensure adequate wire-way space for external wires entering panel. Panel subplate shall be mounted on collar studs for easy removal. Print pockets shall be provided on each panel. Brackets welded to inside of panel, complete with lights, shall be provided on panels where indicated by Drawings.
4. Identification plates shall be laminated phenolic with white letters engraved on a black background and mounted with screws or double-back adhesive foam tape.
5. All components inside panel shall have identification plates. This includes instruments, relays, switches, circuit boards in plug-in racks, etc. Identification plates shall include engineering symbols (FBQ-1, SW-3, FIC-4, CR-1, etc.). Switches and circuit breakers inside panel shall

have names (Horn, Audio Tone, Panel Power, etc.) on identification plates as well as engineering symbol.

6. Identification plates shall be located on or adjacent to device they are identifying and shall be readable without looking around, under, or on top of device to find identification plate.

B. Access:

1. Wall- and/or floor-mounted control panels shall have continuous piano-hinged doors for ease of access. Door openings shall expose a minimum of 80 percent of panel interior. Door openings shall be sealed with a 0.125-inch thick minimum cellular neoprene gasket cemented with oil-resistant adhesive and held in place with a retaining strip. Print pockets shall be provided on each door. Two door enclosures shall have a removable center post. Panel doors less than 40 inches high shall be equipped with a 2-point latching mechanism. Panel doors 40 inches high or more shall be equipped with a 3-point latching mechanism.
2. Components and terminals shall be accessible without removing another component except covers. Swing out sections shall be used if mounting space is required that is not normally accessible.
3. Panels shall have open bottoms except where structural members are required.

C. Finish:

1. Panel face openings for mounting equipment shall be smoothly finished cut with counterboring and trim strips provided as required to give a neat finished appearance. Bezels shall be used on all front panel-mounted devices to cover panel cutouts. A chrome-plated or stainless steel bezel shall be used at parting line of panels that have shipping splits or at parting line of panels placed end to end.
2. Graphic plates, when used, shall be fastened to panel frame with fasteners not visible from front of graphic.
3. After fabrication, panel surfaces shall be given a phosphatizing treatment inside and out, and then finished with 2 coats of textured polyurethane enamel. Panel interior shall be painted white, ANSI No. 51. Exterior color will be selected by ENGINEER.
4. Panels shall have identical exterior finishes as selected by ENGINEER. Panel finishes on matching colored panels shall be identical. It is supplier's responsibility to achieve this result, especially for panels fabricated in different shops.

D. Pneumatics:

1. Interior panel piping shall be grouped, supported, and terminated at bottom of panel at bulkhead fittings unless indicated otherwise. Terminations shall be clearly tagged.
2. Tubing shall be color-coded per ISA RP7.2. Pneumatic systems shall be tested per ISA RP7.1.

E. Electrical:

1. Internal panel wiring shall be 19 strand No. 16 AWG, 90°C MTW, Class C stranded, or THHN/THWN approved as 90°C MTW. All panel wiring not run in wire ducts shall be bundled and tied. Each wire shall be identified at both ends with same exclusive number. Number shall be same number shown on control schematic. Number shall not be used again for any other purpose. Wires marked differently on each end will not be accepted. Wire markers shall be provided on end of each wire at termination point.
2. Control wiring associated with control circuits de-energized when main disconnect is opened shall be color-coded red. Control wiring associated with control circuits which remains "hot" when main disconnect is opened shall be color-coded yellow. DC control wiring shall be color-coded blue. Ground wires shall be color-coded green. Terminal blocks shall be numbered in

- numerical order. Yellow wiring leaving panel shall be brought to an isolated set of terminal blocks.
3. Provide an instrument common bus 0.1 by 0.5 by 6-inch minimum in enclosure and isolated from enclosure. A separate instrument common wire shall be run from each common terminal on an instrument to instrument common bus. Instrument common wires looped from one terminal to another and then to instrument common bus will not be accepted.
 4. Instrument common bus shall be connected to power supply common with a wire or wire braid strap as short as practical and of sufficient capacity to prevent troublesome voltage drop. Common terminals and common bus for instrument common shall be tagged "Instrument Common." Instrument signal wires of 4-20 mA or 1-5V shall be shielded wire. Telephone wires and telemetry equipment interconnection wires shall be shielded wires.
 5. Provide a copper ground bus 0.1 by 0.5 by 6-inch minimum in enclosure to which all instrument grounds and panel enclosure are tied. Separate ground wire shall be run from instrument enclosure ground terminal directly to ground bus. Instrument ground wires looped from one instrument to another will not be accepted. Under no circumstances shall neutral side of power source or any other terminals used for grounding power circuits be used as an instrument common.
 6. Wires to internal components shall be connected to inside of terminal strip. Wires to external components shall be connected to outside of terminal strip. No more than 2 wires shall be connected to one terminal point.
 7. Panel wire duct shall be provided between each row of components and adjacent to each terminal strip. Wire ducts shall be a minimum of 1-inch wide and 3 inches deep with removable snap-on covers and perforated walls for easy wire entrance. Wire ducts shall be constructed of nonmetallic materials with a voltage insulation in excess of maximum voltage carried therein.
 8. Floor-standing panels and consoles shall be equipped with a flange mounted 600V rated main non-automatic trip circuit breaker or disconnect switch. Single phase, 60 hertz power at voltage shown on Drawings shall be supplied to main disconnect. Panel fabricator shall provide any additional voltages and power requirements at control panel to meet requirements of equipment contained therein.
 9. Disconnect and transformer shall have enclosed protected terminations to prevent accidental shock.
 10. Relays, timers, etc., installed on panel subplate shall be provided with a minimum spacing between component and wire duct of 1.5 inches above and 1 inch below. Minimum spacing between adjacent components shall be 0.25 inch. Relays, timers, etc., shown in schematics are intended to show function. Additional relays may be required in conjunction with items shown to provide total number of contacts required. Where limit, pressure, float switches, etc., are used and more than SPDT contacts are indicated by schematics, provide additional contacts required by using auxiliary relays. However, if a DPDT switch is called for, using a SPDT with a relay will not be accepted. All control and pilot devices such as relays, timers, etc., shall be 120V, 3 amp rated except where noted with coil voltage as required. One N.O. spare contact shall be provided on each relay.

F. Panel/Subplate Layout:

1. Panel face-mounted equipment shall consist of pilot lights, push-buttons, selector switches, meters, indicating timer, etc. Spacing between horizontal rows of components shall be 1.5 inches minimum; spacing between vertical columns of components shall be 1.875 inches minimum. Components shall be grouped and/or located as indicated on Drawings. Distance from bottom row of components to floor shall be not less than 36 inches. Top row of recording and indicating instruments shall be centered approximately 60 inches above floor. Maximum height for annunciator windows shall be 85 inches above floor. In general, indicating lights,

push-buttons, etc., shall be mounted in accordance with sequence of operation from left to right and top to bottom.

2. A minimum of 2 inches shall be provided between terminal strips and wire ducts or terminal strips and terminal strips. In general, terminal strips shall be mounted on vertical edges of subplate. Where terminal strips are mounted side-by-side, terminals shall be elevated 1.5 inches above subplate to allow wires to pass underneath.
3. Subplates shall have a minimum of 15 percent spare mounting space, and terminal strips shall have a minimum of 20 percent spare terminal blocks.

2.03 SWITCH, PUSH BUTTONS, LIGHTS

- A. Selector switches shall be 120 VAC rated, oil-tight construction with standard operator knob.
- B. Start push buttons shall be 120 VAC rated, oil-tight construction with extended guard and black color insert.
- C. Stop push-buttons shall have a half-guard with red color insert. Contacts shall be rated NEMA B-150 and P-150.
- D. Pilot lights shall be push-to-test oil-tight construction with cap colors and voltages as required. Nameplates for each switch and light shall conform to manufacturer's series and type with engraving as called for on Drawings.

2.04 RELAYS

- A. Control Relays: Switching and output relays shall be plug-in type with contacts rated 120 VAC, 3 amp with 120 VAC or 24 VDC coil, indicating light, manual operator, and plastic transparent cover. Relays shall have a retainer mechanism to prevent loosening from vibration. Relays shall not be used for switching 1-5 VDC or 4-20 mA signals associated with instruments.
- B. Intrinsically Safe Isolator Relay:
 1. Intrinsically safe relay shall be provided between raw sewage floats and control circuits or where shown on Drawings.
 2. Relay shall operate at 120 VAC plus 10 percent with a switch rating of 1 amp rms and maximum holding current of 20 milliamp for solid-state devices. Relay shall be rated for ambient temperatures of 32 degrees F to 120 degrees F.
 3. Output shall be N.O. or N.C. Equipment supplier is responsible for choosing proper output for float specified and circuits specified. If float and circuit are not defined, intrinsically safe relay shall be of such a polarity as to fail in a safe condition for function being performed.
 4. When intrinsically safe relay is required in panels exposed to outdoor temperatures, relays shall be rated for ambient temperatures of -40 to 120 degrees F, or thermostatically controlled heaters must be added to panel to maintain an ambient in panel of 32 to 120 degrees F.

2.05 TIMING DEVICES

- A. Solid-state timers shall be plug-in type.
- B. Solid-state timers with ON or OFF delay cycles shall operate at 120 VAC, 60 hertz. Solid-state device may be analog or digital in operation. Time interval shall be as shown on Drawings or as required.

- C. Solid-state repeat cycle timers with adjustable ON-OFF cycles shall operate at 120 VAC, 60 hertz. Solid-state device may be analog or digital in operation. Time interval shall be as shown on Drawings or as required.

2.06 TERMINAL BLOCKS

- A. Terminal blocks shall be 300 or 600 volt rated, channel-mounted box lug with pressure plate type or binding head screw type with pressure plate, and shall have a white marking strip. Terminal blocks shall be color-coded according to the following coloring scheme:
 - Black 120V power circuits de-energized when main disconnect is opened.
 - White 120V neutral conductors.
 - Red 120V control circuits de-energized when main disconnect is opened.
 - Yellow 120V control circuits which remain hot when main disconnect is opened.
 - Blue Terminal blocks for DC wiring.
 - Gray Terminal blocks for shields in DC wiring.
 - Green Ground terminal blocks.
- B. For terminals associated with 120V nonisolated input cards, individually fused terminal blocks shall be used for 120V power to field devices.
- C. Provide a minimum of 20 percent spare terminals for each type and color of terminal used. All terminals of a given color shall be grouped with other terminals of the same color.

2.07 CONTROL POWER TRANSFORMERS

- A. Control power transformers shall be sized to handle in-rush currents and to accommodate continuous load of circuits plus 25 percent future load with 5 percent or less voltage drop. Transformer primary voltage shall be as indicated on Drawings.

PART 3 - EXECUTION

3.01 GENERAL

- A. Examination, Installation, Field Quality Control, Demonstration: In accordance with Section 13410.

END OF SECTION

DIVISION 14
(NOT USED)

DIVISION 15
(NOT USED)

DIVISION 16
ELECTRICAL

SECTION 16050

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: General administrative, procedural requirements, and installation methods for electrical installations specified in Division 16.
- B. The Drawings are schematic and are not intended to show every detail of construction.
 - 1. In general, conduits/raceways, transitions and offsets shown on Drawings indicate approximate locations in plan and elevation where the systems are intended to be run.
 - 2. CONTRACTOR shall fully coordinate electrical Work with other trades to avoid interferences.
 - 3. In the event of interferences, CONTRACTOR shall request clarification from ENGINEER in writing.
- B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Sections, apply to Work of this Section.

1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with requirements of Section 01330, Shop Drawings covering the items included under this Section of Work. Shop Drawing submittals shall include:
 - 1. Submit product data covering the items included under this Section of Work.
- B. Conforming to Construction Drawings: Submit a complete set of Drawings showing the locations of the piping, ductwork, etc., as actually installed. Such Drawings shall be submitted to ENGINEER on tracing cloth, Mylar, or sepia paper from which blueprints can be obtained.
- C. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01600, operation and maintenance manuals for items included under this Section. Include following information for equipment items:
 - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 - 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 4. Servicing instructions and lubrication charts and schedules.

1.03 RECORD DOCUMENTS

- A. Prepare Record Documents in accordance with requirements in Section 01770. In addition, CONTRACTOR shall submit, prior to final payment, Drawings conforming to construction records of systems it has installed. Vendor drawings shall be sized as manufacturers' standard.

- B. Provide typewritten data sheets on motor control circuits with following information on each branch feeder: Load name, horsepower or KVA (transformer), fuse size, starter size, service factor of motor, motor nameplate currents, power factor correction capacitor size (if used), and thermal overload part number.

1.04 QUALITY ASSURANCE

- A. National Electrical Code: Comply with NFPA 70, National Electrical Code.
- B. UL Compliance and Labeling: Use products and components labeled by UL.

1.05 PERMITS, INSPECTIONS, AND LICENSES

- A. CONTRACTOR shall procure all necessary permits and licenses, observe and abide by all applicable laws, codes, regulations, ordinances, and rules of the State, territory, or political subdivision thereof, wherein Work is done, or any other duly constituted public authority, and further agrees to hold OWNER harmless from liability or penalty which might be imposed by reason of an asserted violation of such laws, codes, regulations, ordinances, or other rules.
 - 1. Upon completion of Work, CONTRACTOR shall secure certificates of inspection from the inspector having jurisdiction and shall submit 3 copies of the certificates to OWNER. CONTRACTOR shall pay the fees for the permits, inspections, licenses, and certifications when such fees are required.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification. Equipment shall be packaged to prevent damage during shipment, storage, and handling. Do not install damaged units; replace, and remove damaged units from Site.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 GENERAL ELECTRICAL INSTALLATION

- A. Provide electrical materials and equipment enclosures appropriate for areas in which they are installed. Each area will be designated on Drawings with a type of construction such as NEMA 4, 4X, 7 or 9 if it is other than NEMA 12. An area designated by a name and elevation includes space bounded by floor, ceiling, and enclosing walls.
 - 1. Exception: Provide manufacturer's standard construction for indoor or outdoor application where equipment is not manufactured to NEMA specifications (e.g., switchgear, transformers, high voltage capacitors, bus duct, and light fixtures; materials and equipment used in finished areas such as offices, laboratories, etc.).

- B. Provide nonmetallic electrical materials and equipment enclosures in NEMA 4X areas; watertight NEMA 4 and equipment enclosures for outdoor applications and indoor applications below grade; explosion-proof NEC Class I, Division 1, Group C and D equipment for NEMA 7 areas; explosion-proof NEC Class II, Division 2, Group F equipment for NEMA 9 areas.
- C. Coordinate with power company high voltage and/or low voltage metering requirements. Furnish, install, and connect metering equipment not furnished, installed or connected by power company.
- D. Coordinate with telephone company the communication service requirements. Furnish, install, and connect cable and terminal equipment not furnished, installed, or connected by telephone company. Furnish and install a 4-foot by 8-foot by 3/4-inch plywood backboard painted white, raceway from backboard to property line, and cross-connect base and blocks which utilize punchdown wiring methodology.
- E. Provide chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
- F. Supporting devices and sleeves shall be set in poured-in-place concrete and other structural components as they are constructed.
- G. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom possible. Locate light fixtures at approximately 8 feet above floor and where fixtures may be readily serviced.
- H. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- I. Install systems, materials, and equipment to conform with approved submittal data, including coordination Drawings, to greatest extent possible. Conform to arrangements indicated by Drawings recognizing that portions of Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to ENGINEER.
- J. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components where installed exposed in finished spaces.
- K. As much as practical, connect equipment for ease of disconnecting with minimum of interference with other installations.
- L. Install access panel or doors where units are concealed behind finished surfaces.
- M. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.02 RACEWAY INSTALLATION

- A. Outdoors, use the following materials:
 1. Exposed Conduit: PVC externally coated rigid metal conduit and fittings.
 2. Underground Direct Buried Conduit: PVC externally coated rigid metal conduit.
 3. Underground Concrete Encased Conduit: Fiberglass-reinforced conduit or rigid nonmetallic conduit if the conductors are used for power or 120 VAC; otherwise, use rigid metal conduit.

4. Conduit Used to Connect to Vibrating Equipment including transformers and hydraulic, pneumatic or electric solenoid or motor-driven equipment: Liquidtight flexible metal conduit.
- B. Indoors, use the following wiring materials:
1. Connection to Vibrating Equipment, including transformers and hydraulic, pneumatic or electric solenoid or motor-operated equipment: Liquidtight flexible metal conduit.
 - a. Exception: NEMA 7 or 9 areas require explosion-proof flexible conduit.
 2. Exposed Conduit: Rigid metal conduit or intermediate metal conduit.
 - a. Exceptions:
 - 1) Areas indicated as NEMA 4X, use rigid Schedule 40 PVC conduit.
 - 2) Areas indicated as NEMA 7 or NEMA 9 (such as grit and raw sewage rooms), use PVC externally coated rigid steel conduit.
 3. Concealed Conduit: Rigid metal conduit or intermediate metal conduit unless indicated otherwise.
- C. Minimum size conduit shall be 3/4 inch unless shown otherwise.
- D. Instrument Signal Conduit Requirements: Shielded signal wires for 4-20 mA type instruments or thermocouple wires assigned to the same control panel may be run in the same conduit. Shielded instrument signal wires, thermocouple wires, and shielded 2-wire intercom wires may be run in the same conduit. No other wires will be permitted in an instrument signal/2-wire intercom conduit. Conduit shall be RMC or PVC-coated RMC.
- E. Conduit Thread Paint: Make threaded conduit joints watertight by coating threaded portions with a spray-on or brush-on zinc-bearing paint. Provide paint containing 90 percent minimum by weight of metallic zinc powder in the dried film. Clean field-cut threads of oil using the recommended solvent prior to coating threads.
- F. Install expansion fittings in all exposed rigid nonmetallic conduit runs of 20 feet or more.
- G. Install expansion/deflection fittings where conduit passes a building expansion joint or where conduits are attached to two structures joined by a concrete expansion joint.
- H. Exposed or Concealed Construction: Install conduit exposed inside buildings except for areas with finished walls (e.g., offices, laboratories, lavatories, locker rooms, etc.) unless otherwise indicated.
- I. Concealed Raceways: Raceways embedded in slabs shall be installed in the middle third of the slab thickness where practical and leave at least 1-inch concrete cover. Tie raceways to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Space raceways laterally to prevent voids in the concrete. Run 1-inch and smaller raceways with a minimum of bends in the shortest practical distance. Run larger conduit parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab. Where nonmetallic conduit or fiberglass-reinforced conduit is used, raceways must be converted to PVC externally coated rigid metal conduit before rising above floor.
- J. Exposed Raceways: Install parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical. Make bends and offsets so the inside diameter is not effectively reduced. Keep the legs of a bend in the same plane and the straight legs of offsets parallel. Conduits shall slope away from loads to keep moisture from entering the load. Run parallel or banked raceways together. Make bends in parallel or banked runs from the same centerline so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed

parallel. This requires that there be a change in the plane of the run, such as from wall to ceiling and that the raceways be of the same size. In other cases, provide field bends for parallel raceways. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.

- K. Space raceways, fittings, and boxes 0.25 inch from mounting surface in NEMA 4 and NEMA 7 areas. Spacers shall be one-piece construction of stainless steel, galvanized steel, PVC, ABS, or other noncorrosive material.
- L. Sleeves: Install in concrete floor slabs except where conduit passes through a housekeeping pad. Install in exterior walls below grade.
- M. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid metal conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this Contract, install screwdriver-operated threaded flush plugs with floor.
- N. Flexible Connections: Use short length (maximum 6 feet for lighting fixtures; maximum 3 feet for all other equipment) of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement, and all motors. Use liquidtight flexible conduit in wet locations and rated flexible connections for hazardous locations. Install separate ground conductor across flexible connections.
- O. Join raceways with fittings designed and approved for the purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.
- P. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate metal conduit, use threaded rigid metal conduit fittings. For PVC externally coated rigid metal conduit, use only factory-coated fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduit.
- Q. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL listed sealing compound. For concealed raceways, install each fitting in a flush metal box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
 - 1. Where conduits enter or leave hazardous locations.
 - 2. Where conduits enter or leave NEMA 4X areas.
 - 3. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
 - 4. Where required by the NEC.
- R. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- S. Install device boxes at the height above the floor as follows for:
 - 1. Light switches, 4 feet.

2. Receptacles and telephone jacks, 18 inches except in NEMA 4 and 4X areas, 4 feet.
 3. Thermostats, 4'-0".
 4. Clock receptacles, 7'-0".
- T. Avoid installing boxes back-to-back in walls. Provide not less than 6-inch (150 mm) separation.
- U. Position recessed outlet boxes accurately to allow for surface finish thickness.
- V. Fasten electrical boxes firmly and rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete masonry.
- W. Provide fire-retardant barriers in all pull and junction boxes containing circuits that are otherwise continuously separated in conduit. Securely fasten these barriers within box. Size barriers so that space between barrier and box wall does not exceed 0.125 inch anywhere around the perimeter of barrier.
- X. Support exposed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.
- Y. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from building structure.
- Z. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box and tighten the chase nipples so no threads are exposed.
- AA. Complete installation of electrical raceways before starting installation of conductors within raceways and prevent foreign matter from entering raceways by using temporary closure protection. Cap spare conduit. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- BB. Install pull wires in empty raceways: Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-pound tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.

3.03 WIRE AND CABLE INSTALLATION

- A. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant where necessary.
- B. Keep branch circuit conductor splices to minimum. Splice feeders only where indicated. Use a standard kit. No splices are allowed for instrument and telephone cables except at indicated splice points.
- C. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced. Use splice and tap connectors which are compatible with conductor material and are UL listed as pressure type connectors.

- D. Provide adequate length of conductors within electrical enclosures and train conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than No. 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at terminal.
- E. Terminate power conductors at equipment using pressure-type terminals specifically designed for type of terminations to be made. Terminate no more than 2 conductors No. 8 AWG and smaller within the same pressure-type terminal. These 2 conductors shall be no more than 4 wire gauge sizes apart. Terminate no more than 1 conductor larger than No. 8 AWG within any pressure-type terminal.
 - 1. Exception: Power factor correction capacitor conductors may be terminated at the motor disconnect switch load terminals.
- F. Seal wire and cable ends until ready to splice or terminate.

3.04 CUTTING AND PATCHING

- A. Perform cutting and patching in accordance with requirements in Section 01730. In addition, the following requirements apply.
 - 1. Perform cutting, fitting, and patching of electrical equipment and materials required to uncover Work to provide for installation of ill-timed Work, remove and replace Work that is either defective or does not conform to requirements of Drawings.
 - 2. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated including, but not limited to, removal of electrical items indicated to be removed and items made obsolete by new Work. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.
 - 3. Patch existing finished surfaces and building components using new materials matching existing materials.

3.05 EQUIPMENT CHECKOUT AND TESTING

- A. In addition to testing recommended by equipment or material supplier and called for in equipment or material specification, perform the following.
- B. Motor Testing: Motor insulation shall be tested by using a 500 VDC (minimum) megger and applying test until a constant megohm reading of the following magnitude is obtained:

$$R_{\min.} = 4 (KV + 1) \text{ at } 25 \text{ degrees C winding temp.}$$

$$R_{\min.} = IV + 1 \text{ at } 40 \text{ degrees C winding temp.}$$

- 1. If motors do not meet requirements of megger test, blow hot air through motors to dry out and repeat until test is passed. If desirable, drying can be done by applying an electrical potential to equipment. However, in no case, induced or direct, shall voltage or current exceed continuous rating of equipment being dried.
 - 2. After passing megger test, motors shall be hi-pot tested at 200 percent rated voltage for a minimum of 1 minute.
- C. Equipment Testing: The following tests which are applicable for a particular item of equipment shall be performed:

1. Megger bus work phase-to-phase and phase-to-ground. Minimum acceptable steady-state value is 100 megohms.
 2. Megger power circuit breakers and circuits supplied phase-to-phase and phase-to-ground (100 megohms minimum).
 3. Test current transformer circuits by applying current to secondary wiring at current transformer terminals until contactor trips.
 4. Test, time, and set protective relays. Relays shall be timed at various multiples (minimum of 3 points) of the pick-up value to determine agreement with published curves and adjust as necessary to agree with coordination study required settings. Exact tests to be performed vary with type of relay. Manufacturer's instructions for relay shall be complied with.
 5. After Work has been completed, demonstrate to OWNER's Representative that entire electrical installation is in proper working order and will perform functions for which it was designed by functional testing.
 6. Make any specific tests required by the manufacturer's installation instructions.
- D. Check-out Procedures. In general, check-out procedures (as listed below) which are applicable for a particular item of equipment shall be performed:
1. Vacuum interior of cubicles and remove foreign material.
 2. Wipe clean with a lint-free cloth insulators, bushings, bus supports, etc.
 3. Check and adjust time delay, under-voltage devices, phase relay, over-current relays, etc., as required by coordination study or ENGINEER.
 4. Fill motor bearings requiring oil.
 5. Check and change, as required, thermal overload heater elements to correspond with motor full-load current and service factors of installed motor.
 6. Check direction of rotation of motors and reverse connections if necessary. Check rotation with motor mechanically uncoupled where reverse rotation could damage equipment.
 7. Equipment with two or more sources of power connected by tie breakers, transfer switches, or generator receptacles shall be checked for rotation from each possible combination of power sources. Power sources must have the same phase sequence for each source throughout entire facility.
 8. Check exposed bolted power connections for tightness.
 9. Check operation of breakers, contactors, etc., and control and safety interlocks.
 10. Check tightness of bolted structural connections.
 11. Check leveling and alignment of enclosures.
 12. Check operating parts and linkages for lubrication, freedom from binding, vibration, etc.
 13. Check tightness and correctness of control connections at terminal blocks, relays, meters, switches, etc.
 14. Clean auxiliary contacts and exposed relay contacts after vacuuming.

END OF SECTION

SECTION 16060

GROUNDING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Electrical grounding and bonding Work as follows:
 - 1. Solidly grounded.
- B. Applications of electrical grounding and bonding Work in this Section:
 - 1. Underground metal piping.
 - 2. Underground metal water piping.
 - 3. Underground metal structures.
 - 4. Metal building frames.
 - 5. Electrical power systems.
 - 6. Grounding electrodes.
 - 7. Separately derived systems.
 - 8. Raceways.
 - 9. Service equipment.
 - 10. Enclosures.
 - 11. Equipment.
 - 12. Lighting standards.
 - 13. Landscape lighting.
 - 14. Signs.

1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
 - 1. Product Data: Submit manufacturer's data on grounding and bonding products and associated accessories.

1.03 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. UL Compliance: Comply with applicable requirements of UL Standards No. 467, "Electrical Grounding and Bonding Equipment," and No. 869, "Electrical Service Equipment," pertaining to grounding and bonding of systems, circuits, and equipment. In addition, comply with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are UL listed and labeled for their intended usage.
 - 2. IEEE Compliance: Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141, and 142 pertaining to grounding and bonding of systems, circuits, and equipment.

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING

A. Materials and Components:

1. Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for complete installation. Where more than one type component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications indicated.
2. Conductors: Electrical copper grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.
3. Ground Bus: 0.25 inch by 1 inch minimum copper ground bus where indicated.
4. Service Arrester: Electrical service arrester, 480 volts, 3-phase, 4-wire, for exterior mounting.
5. Grounding Electrodes: Steel with copper welded exterior, 3/4-inch diameter by 20 feet.
6. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

3.01 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

- A. Connect grounding conductors to underground grounding electrodes using exothermic weld process or mechanical compression type connectors.
- B. Ground electrical service system neutral at service entrance equipment to grounding electrodes.
- C. Ground each separately derived system neutral to effectively grounded metallic water pipe, effectively grounded structural steel member, and separate grounding electrode.
- D. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
- E. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing.
- F. Connect grounding electrode conductors to 1-inch diameter or greater, metallic cold water pipe using a suitably sized ground clamp. Provide connections to flanged piping at street side of flange.
- G. Connect building reinforcing steel, building steel beam, building steel roof and walls and duct bank and vault reinforcing steel to ground mat using No. 4/0 AWG bare copper grounding cable.
- H. Bond bare No. 4/0 AWG grounding cable in duct banks to grounding cable in vaults and to power equipment ground bus at ends of each duct bank.

- I. Bond strut and other metal inside of electrical manholes and vaults to bare No. 4/0 AWG grounding cable carried in duct bank.
- J. Bond grounding cables to both ends of metal conduit or sleeves through which such cables pass.
- K. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque-tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.
- L. Install braided type bonding jumpers with code-sized ground clamps on water meter piping to electrically bypass water meters.
- M. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible while following building lines to minimize transient voltage rises. Protect exposed cables and straps where subject to mechanical damage.
- N. Apply corrosion-resistant finish to field connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed and are subjected to corrosive action.

3.02 FIELD QUALITY CONTROL

- A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester using the 3-point fall of potential method. Testing shall be performed during normal dry weather conditions with at least 5 non-rain days elapsing prior to test. Where tests show resistance-to-ground is over 5 ohms, take appropriate action to reduce resistance to 5 ohms or less by driving additional ground rods; then retest to demonstrate compliance.
- B. Test ground paths for continuity by applying a low DC voltage source of current, capable of furnishing up to 100 amps, between electrical equipment grounds and ground grid. Grounding path must conduct a 100-amp current at a resistance of 0.010 ohms or less as calculated from circuit voltage.

END OF SECTION

SECTION 16070

SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
 - 1. Product data for each type of product specified.

1.03 QUALITY ASSURANCE

- A. Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
 - 1. Slotted Metal Angle and U-Channel Systems:
 - a. Allied Tube & Conduit.
 - b. American Electric.
 - c. B-Line Systems, Inc.
 - d. Cinch Clamp Co., Inc.
 - e. GS Metals Corp.
 - f. Haydon Corp.
 - g. Kin-Line, Inc.
 - h. Unistrut Diversified Products.
 - 2. Conduit Sealing Bushings:
 - a. Bridgeport Fittings, Inc.
 - b. Cooper Industries, Inc.
 - c. Elliott Electric Mfg. Corp.
 - d. GS Metals Corp.
 - e. Killark Electric Mfg. Co.
 - f. Madison Equipment Co.
 - g. L.E. Mason Co.
 - h. O-Z/Gedney.
 - i. Producto Electric Corp.
 - j. Racco, Inc.
 - k. Red Seal Electric Corp.

- l. Spring City Electrical Mfg. Co.
- m. Thomas & Betts Corp.

2.02 COATINGS

- A. Coating: Supports, support hardware, and fasteners shall be stainless steel. Products for use outdoors, in NEMA 4 areas, or embedded in concrete or in Nema 12 areas indoors shall be stainless steel.

2.03 MANUFACTURED SUPPORTING DEVICES

- A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and stainless steel spring clamps.
- B. Fasteners. Types, materials, and construction features as follows:
 1. Expansion Anchors: 304 stainless steel wedge or sleeve type.
 2. Toggle Bolts: 304 stainless steel springhead type.
 3. Hanger Rods: 0.375-inch diameter minimum, 304 stainless steel.
- C. Conduit Sealing Bushings: Factory fabricated, watertight conduit sealing bushing assemblies suitable for sealing around conduit or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.
- D. Cable Supports for Vertical Conduit: Factory fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of 304 stainless steel.
- E. U-Channel Systems: 12 gauge or 0.105-inch-thick 304 stainless steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center in top surface. Provide fittings and accessories that mate and match with U-channel and are of same manufacturer.

2.04 FABRICATED SUPPORTING DEVICES

- A. Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.
- B. 304 stainless steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.
- C. Pipe Sleeves: Provide a waterstop on pipe sleeves. Provide pipe sleeves of 2 standard sizes larger than conduit/pipe passing through it and of one of the following:
 1. Steel Pipe: Fabricate from Schedule 40 stainless steel pipe.
 2. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 16075

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including, but not limited to, the following:
 - 1. Buried electrical line warnings.
 - 2. Identification labeling for cables and conductors.
 - 3. Operational instruction signs.
 - 4. Warning and caution signs.
 - 5. Equipment labels and signs.

1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
 - 1. Product Data for each type of product specified.

PART 2 - PRODUCTS

2.01 ELECTRICAL IDENTIFICATION PRODUCTS

- A. Colored Adhesive Marking Tape for Wires and Cables: Self-adhesive, vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.
- B. Pre-tensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: Flexible acrylic bands sized to suit raceway diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.
- C. Underground Line Marking Tape: Permanent, bright colored, continuous printed, plastic tape compounded for direct-burial service not less than 6 inches wide by 4 mils thick. Printed legend indicative of general type of underground line below.
- D. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with pre-printed numbers and letter.
- E. Aluminum, Wraparound Cable Marker Bands: Bands cut from 0.014-inch-thick aluminum sheet, fitted with slots or ears for securing permanently around wire or cable jacket or around groups of conductors. Provide for legend application with stamped letters or numbers.
- F. Engraved, Plastic Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16 inch minimum thick for signs up to 20 square inches or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in white letters on black face and punched for mechanical fasteners.

- G. Baked Enamel Warning and Caution Signs for Interior Use: Pre-printed aluminum signs, punched for fasteners, with colors, legend, and size appropriate to the location.
- H. Exterior Metal-Backed Butyrate Warning and Caution Signs: Weather-resistant, nonfading, pre-printed cellulose acetate butyrate signs with 20-gauge galvanized steel backing, with colors, legend, and size appropriate to location. Provide 1/4-inch grommets in corners for mounting.
- I. Fasteners for Plastic Laminated and Metal Signs: Self-tapping stainless steel screws or Number 10/32 stainless steel machine screws with nuts and flat and lock washers.
- J. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18 inch minimum width, 50-pound minimum tensile strength, and suitable for a temperature range from minus 50 to 350 degrees F. Provide ties in specified colors when used for color coding.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification Work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by Code.
- B. Underground Electrical Line Identification: During trench backfilling for exterior nonconcrete encased underground power, signal, and communications lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench, do not exceed an overall width of 16 inches; install a single line marker.
- C. Install line marker for underground wiring, both direct buried and in raceway.
- D. Conductor Color Coding: Provide color coding for secondary service, feeder, and branch circuit conductors throughout the Project secondary electrical system following OWNER's method of phase identification or as follows:

<u>Phase</u>	<u>480/277 Volts</u>
A	Yellow
B	Brown
C	Orange
Neutral	White
Ground	Green

- E. Wiring Standards:
 - 1. 480/277 Volt, 3-Phase Power:
 - a. Brown.
 - b. Orange.
 - c. Yellow.
 - d. Grey Neutral.

2. 208 Volt, 3-Phase Power:
 - a. Black.
 - b. Red.
 - c. Blue.
 3. 240/120 Volt, 1-Phase Power:
 - a. Black.
 - b. Red.
 - c. White Neutral.
 4. Motor Leads, Control Cabinet/MCC:
 - a. Black, numbered L1-T1, etc.
 5. Control Wiring:
 - a. Red Control circuit wiring that is de-energized when the main disconnect is opened.
 - b. Yellow Control circuit wiring that remains energized when the main disconnect is opened.
 - c. Blue DC.
 - d. Green Ground.
- F. Use conductors with color factory applied entire length of conductors except as follows:
1. The following field applied color coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
 - a. Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last 2 laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.
 - b. In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply 3 ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.
- G. Power Circuit Identification: Securely fasten identifying metal tags of aluminum wraparound marker bands to cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms with 1/4-inch steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-pound test monofilament line or one-piece self-locking nylon cable ties.
- H. Install wire/cable designation tape markers at termination points, splices, or junctions in each circuit. Circuit designations shall be as indicated on Drawings.

END OF SECTION

SECTION 16090

DEMOLITION AND EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Limited scope general construction materials and methods for application with electrical installations as follows:
 - 1. Selective Demolition including:
 - a. Nondestructive removal of materials and equipment for reuse or salvage as indicated.
 - b. Dismantling electrical materials and equipment made obsolete by these installations.
 - 2. Excavation for underground utilities and services, including underground raceways, vaults, and equipment.

1.02 PROJECT CONDITIONS

- A. Conditions Affecting Selective Demolition: The following Project conditions apply:
 - 1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
 - 2. Locate, identify, and protect electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.
- B. Conditions Affecting Excavations: The following Project conditions apply:
 - 1. Maintain and protect existing building services which transit the area affected by selective demolition.
 - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
 - 3. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. OWNER will not be responsible for interpretations or conclusions drawn from this information.
 - 4. Existing Utilities: Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations.
 - 5. Remove existing underground utilities indicated to be removed.
 - a. Uncharted or Incorrectly Charted Utilities: Contact utility owner immediately for instructions.
 - b. Provide temporary utility services to affected areas. Provide minimum of 48-hour notice to ENGINEER prior to utility interruption.
 - 6. Use of explosives is not permitted.

1.03 SEQUENCING AND SCHEDULING

- A. Coordinate the shutoff and disconnection of electrical service with OWNER and utility company.
- B. Notify ENGINEER at least 5 days prior to commencing demolition operations.

- C. Perform demolition in phases as indicated.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 SELECTIVE DEMOLITION

- A. Demolish, remove, demount, and disconnect abandoned electrical materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- B. Materials and Equipment to be Salvaged: Remove, demount, and disconnect existing electrical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to location designated for storage.
- C. Disposal and Clean Up: Remove from Site and legally dispose of demolished materials and equipment not indicated to be salvaged.
- D. Electrical Materials and Equipment: Demolish, remove, demount, and disconnect the following items:
 - 1. Inactive and obsolete raceway systems, controls, and fixtures.
 - 2. Raceways embedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Remove materials above accessible ceilings.
- E. Perform cutting and patching required for demolition in accordance with Section 01730.

3.02 EXCAVATION

- A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.
- B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
- C. Remove and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
- D. Install sediment and erosion control measures in accordance with local codes and ordinances.
- E. Dewatering: Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding Project Site and surrounding area.
 - 1. Do not allow water to accumulate in excavations. Remove to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.

2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
- F. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
1. Locate and retail soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
 2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.
- G. Excavation for Underground Vaults and Electrical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
1. Excavate, by hand, areas within drip line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
 2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- H. Trenching: Excavate trenches for electrical installations as follows:
1. Excavate trenches to uniform width, sufficiently wide to provide ample working room and minimum of 6 to 9 inches clearance on both sides of raceways and equipment.
 2. Excavate trenches to depth indicated or required.
 3. Limit length of open trench to that in which installations can be made and trench backfilled within same day.
 4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceways and equipment. Provide minimum of 6 inches of stone or gravel cushion between rock bearing surface and electrical installations.
- I. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F (1 degree C).
- J. Backfilling and Filling. Place soil materials in layers to required subgrade elevations for each area classification listed below:
1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
 2. Under building slabs, use drainage fill materials.
 3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
 4. For raceway less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation of raceways, provide a 4-inch-thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
 5. Other areas, use excavated or borrowed materials.
- K. Backfill excavations as promptly as work permits, but not until completion of following:
1. Inspection, testing, approval, and locations of underground utilities have been recorded.
 2. Removal of concrete formwork.
 3. Removal of shoring and bracing, and backfilling of voids.
 4. Removal of trash and debris.

- L. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- M. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- N. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.
- O. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.
 - 1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
 - a. Areas Under Structures, Building Slabs and Steps, Pavements: Compact to 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 - b. Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 - c. Other Areas: Compact 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.
 - 2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during or subsequent to compaction operations.
- P. Subsidence. Where subsidence occurs at electrical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

END OF SECTION

SECTION 16120

WIRES AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Low-Voltage Wire and Cable.
 - 2. Medium-Voltage Cable.
 - 3. Instrument Cable.
 - 4. Local Area Network Wiring (LAN).

1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Include Shop Drawings of wires, cables, connectors, splice kits, and termination assemblies.
- B. Reports of field tests prepared as noted in Section 01600.

1.03 QUALITY ASSURANCE

- A. UL Compliance: Provide components which are listed and labeled by UL. For cables intended for use in air handling space comply with applicable requirements of UL Standard 710, "Test Method for Fire and Smoke characteristics of cables used in Air Handling Spaces."
- B. NEMA/ICEA Compliance: Provide components which comply with following standards:
 - 1. NEMA WC 70-1999/ICEA S-95-658-1999, Nonshielded Power Cables Rated 2,000 Volts or Less for the Distribution of Electrical Energy.
 - 2. NEMA WC 71-1999/ICEA S-96-659-1999, Standard for Nonshielded Cables Rated 2,001-5,000 Volts for use in the Distribution of Electrical Energy.
 - 3. NEMA WC 74-2000/ICEA S-93-639, 5-46 kV Shielded Power Cable for use in the Transmission and Distribution of Electrical Energy.
- C. IEEE Compliance: Provide components which comply with the following standard.
 - 1. Standard 82, Test procedures for Impulse Voltage Tests on Insulated Conductors.
- D. Network Wiring Experience: CONTRACTOR must be able to prove to the satisfaction of OWNER that it has significant experience in the installation of Local Area Network cable systems. Installation must include installation of Network cable, cable termination, knowledge of interconnect equipment, and a thorough knowledge of testing procedures.
- E. Labeling: Handwritten labels are not acceptable. All labels shall be machine printed on clear or opaque tape, stenciled onto adhesive labels, or typewritten onto adhesive labels. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be of a color contrasting with the label such that it may be easily read. If labeling tape is utilized, the font color shall contrast with the background. Patch panels shall exhibit workstation numbers or some type of location identifier, in

sequential order, for all workstations or devices attached. Each Network cable segment shall be labeled at each end with its respective identifier.

- F. Network Wiring Interconnect Equipment (Patch Panels): Interconnect equipment shall be used in all Local Area Network cable installations. Patch panels shall be mounted in the equipment racks or panel mounted. Interconnect equipment mounted in racks shall be affixed to the rack by at least 4 screws. All interconnect devices shall be assembled and installed in accordance with the manufacturer's instructions and recommendations.
- G. Patch Cords: Patch cords shall be provided for each Local Area Network port on the patch panel. Patch cords shall meet or exceed technical specifications of all installed Local Area Network cable. Patch cord connectors shall be matched with patch panel connector type and network module connector type as required.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
 - 1. Low-Voltage Wire and Cable:
 - a. American Insulated Wire Corp.
 - b. General Cable.
 - c. The Okonite Co.
 - d. Southwire Co.
 - 2. Connectors for Low-Voltage Wires and Cable Conductors:
 - a. AMP.
 - b. O-Z/Gedney Co.
 - c. Square D Company.
 - d. 3M Company.
 - 3. Medium-Voltage Cable:
 - a. American Insulated Wire Corp.
 - b. General Cable.
 - c. Kerite Co.
 - d. The Okonite Co.
 - e. Prysmian Cables & Systems.
 - f. Southwire Co.
 - 4. Medium-Voltage Cable Splicing and Terminating Products and Accessories:
 - a. Adelet-PLM.
 - b. Amerace Corp.
 - c. Electrical Products Division 3M.
 - d. G&W Electric Co.
 - e. M.P. Husky Corp.
 - f. Raychem Corp.
 - g. RTE Components.
 - 5. Instrument Cable:
 - a. Belden (Trade Nos. 1120A and 1118A).
 - 6. Local Area Network Cable:
 - a. Belden 7882A/7883A, or equal.

2.02 LOW-VOLTAGE WIRES AND CABLES

- A. Conductors: Provide stranded conductors conforming to ASTM Standards for concentric stranding, Class B. Construction of wire and cable shall be single conductor (1/c) unless multiconductor cable is shown by notation in form (x/c) where x indicates the number of separate insulated conductors per cable.
- B. Conductor Material: Copper. Minimum size power wire shall be No. 12 AWG.
- C. Insulation: Provide RHW/USE insulation for power conductors used in single- and 3-phase circuits with more than 120 volts to ground. Provide RHW/USE, XHHW, or THWN/THHN insulation for power conductors used in single- and 3-phase circuits with 120 volts or less to ground
 1. Provide RHW, THHN/THWN, or XHHW insulation for grounding conductors installed in raceways.
 2. Provide THHN/THWN insulation for control conductors.

2.03 CONNECTORS FOR LOW-VOLTAGE WIRES AND CABLES

- A. Provide UL listed factory fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types, and classes for applications and services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

2.04 MEDIUM-VOLTAGE CABLE

- A. Cable shall be single-conductor type, size as indicated, and conforming to UL Standard 1072, "Medium Voltage Power Cables."
- B. Cable shall be ethylene propylene rubber (EPR) insulated and shall conform to NEMA Standard WC 74-2000 (ICEA S-93-639) "5-46 kV Shielded Power Cable for use in the Transmission and Distribution of Electrical Energy."
- C. Conductors: Class B stranded, annealed copper.
- D. Conductor Shield: Extruded, semiconducting.
- E. Insulation Shield: Extruded, semiconducting.
- F. Concentric Neutral: Evenly spaced, annealed, coated, solid copper wires applied concentrically over semiconducting insulation shield. Individual wires shall be No. 14 AWG minimum. Concentric neutral ampacity shall be not less than 1/3 the ampacity of central conductor.
- G. Metallic Shielding: Copper shielding tape, helically applied over semiconducting insulation shield or evenly spaced solid copper wires applied concentrically over semiconducting insulation shield.
- H. Cable Jacket: Sunlight-resistant PVC, cross-linked polyolefin, or chlorosulfonated polyethylene (hypalon).
- I. Cable Voltage Rating: 5 kV phase to phase.
- J. Cable Voltage Rating: 8 kV phase to phase.

- K. Cable Voltage Rating: 15 kV phase to phase.
- L. Cable Voltage Rating: 25 kV phase to phase.
- M. Cable Voltage Rating: 28 kV phase to phase.
- N. Cable Voltage Rating: 35 kV phase to phase.
- O. Cable Voltage Rating: 46 kV phase to phase.

2.05 MEDIUM-VOLTAGE SPLICING AND TERMINATING PRODUCTS

- A. Types: Compatible with cable materials and shall be suitable for indoor or outdoor environments as required.
- B. Connectors: Compression type as recommended by cable or splicing kit manufacturer for application.
- C. Splicing and Terminating Kits: As recommended by manufacturer in writing for specific sizes, ratings, and configurations of cable conductor, splices, and terminations specified. Kits shall contain components required for a complete splice or termination including detailed instructions and shall be the product of a single manufacturer. Completed splices and terminations shall provide insulation equivalent to the insulation class of cable it connects and maintain current carrying capacity and mechanical strength of cable.

2.06 INSTRUMENT CABLE

- A. Instrument Cable: 600 volt minimum insulated shielded cable with two or more twisted No. 16 or No. 18AWG stranded copper conductors; PVC, nylon, or polyethylene outer jacket; and 100 percent foil shielding.

2.07 LOCAL AREA NETWORK CABLE

- A. Category 6 (Ethernet) Data and Patch Cable:
 - 1. Paired, 4-pair, 24 AWG, solid bare copper conductors with polyethylene insulation, overall aluminum foil-polyester tape shield with 24 AWG stranded tinned copper drain wire, 100 percent shield coverage, PVC jacket.
 - 2. UL verified to Category 6.
 - 3. Provide plenum rated cable where installed exposed.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Prior to energizing, check installed 480 volt, 3-phase power circuits and higher wires and cables with a 1,000-volt megohm meter to determine insulation resistance levels to assure requirements are fulfilled. Minimum acceptable megohm meter reading is 100 megohms held at a constant value for 15 seconds. A certified copy of megohm meter tests shall be submitted to ENGINEER. Test reports shall include ambient temperature and humidity at time of testing. Notify ENGINEER 48 hours prior to test with schedule.

- B. Medium-Voltage Cable Tests shall include high-potential test of cable and accessories and such tests and examinations required to achieve specified objectives. Where new cables are spliced to existing cables, high-potential test shall be performed on the new cable prior to splicing. After test results for new cables are approved and splice is made, an insulation resistance test and continuity test on the length of cable including the splice with existing cables being tested to the nearest disconnect point.
- C. Local Area Network (LAN) Cable Tests: Testing of all cable segments shall be completed in compliance with EIA/TIA-568-B.1 Standards. Testing shall be done by CONTRACTOR with at least 5 years of experience in testing Network cabling systems.
1. TESTING: CONTRACTOR shall test each network cable segment. **OWNER reserves the right to have representation present during all or a portion of the testing process. CONTRACTOR must notify OWNER 5 days prior to commencement of testing.** If OWNER elects to be present during testing, test results will only be acceptable when conducted in the presence of OWNER.
 2. DOCUMENTATION (Network Cable): CONTRACTOR shall provide documentation to include test results and as-built Drawings. Network Cable Results: Handwritten results are acceptable provided the test is neat and legible. Copies of test results are not acceptable. Only original signed copies will be acceptable.
 - a. Each cable installed shall undergo complete testing in accordance with TIA/EIA-568-B.1 to guarantee performance to this Standard.
 - b. All required documentation shall be submitted within 30 days at conclusion of the project to OWNER.
 - c. Test Criteria: Pass rate to conform to latest TIA/EIA-568-B.1 Standards that incorporate link performance testing through entire path, including cable, couplers, and jumpers.
 3. ACCEPTANCE: Acceptance of the Data Communications System, by OWNER, shall be based on the results of testing, functionality, and receipt of documentation.
- D. Reports (non-LAN cable): Testing organization shall maintain a written record of observations and tests, report defective materials and workmanship, and retest corrected defective items. Testing organization shall submit written reports to ENGINEER.

END OF SECTION

SECTION 16130

RACEWAYS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Raceways for electrical wiring. Types of raceways in this Section include the following:
1. Flexible metal conduit.
 2. Intermediate metal conduit.
 3. Liquidtight flexible conduit.
 4. Underground plastic utilities duct.
 5. Rigid metal conduit.
 6. Rigid nonmetallic conduit.
 7. Surface raceways.
 8. PVC externally coated rigid metal conduit.
 9. Fiberglass reinforced conduit.
 10. Electrical nonmetallic tubing.
 11. Wireway.
 12. Conduit bodies.

1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
1. Product data for the following products:
 - a. Surface raceway and fittings.
 - b. Wireway and fittings.
 - c. Conduit.
 - d. Conduit bodies.

1.03 QUALITY ASSURANCE

- A. Codes and Standards:
1. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.
 2. UL Compliance and Labeling: Comply with applicable requirements of UL standards pertaining to electrical raceway systems. Provide raceway products and components listed and labeled by UL, ETL, or CSA.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in Work include:

1. Conduit:
 - a. Allied Tube.
 - b. Carlon.
 - c. Johns Manville.
 - d. Occidental Coatings.
 - e. Orangeburg.
 - f. Perma-Cote Industries.
 - g. Republic Steel.
 - h. Steelduct Co.
 - i. Triangle Conduit.
 - j. Wheatland Tube.
 - k. Youngstown Sheet and Tube.
2. Liquidtight Conduit:
 - a. Anamet, Inc.
 - b. Carlon.
 - c. Electric-Flex.
 - d. Thomas and Betts.
3. Conduit Bodies:
 - a. Adalet-PLM.
 - b. American Electric.
 - c. Appleton Electric Co.
 - d. Carlon.
 - e. Crouse-Hinds Division, Cooper Industries, Inc.
 - f. Delta Industrial Products.
 - g. Killark Electric Mfg. Co.
 - h. Kraloy Products Co.
 - i. O-Z/Gedney Co.
 - j. Perma-Cote Industries.
 - k. Spring City Electrical Mfg. Co.
4. Conduit Thread Paint:
 - a. CRC Chemicals, USA.
 - b. Sherwin Williams.
 - c. ZRC Chemical Products Co.
5. Wireway:
 - a. Alrey-Thompson Co.
 - b. Anchor Electric Co.
 - c. Hoffman Engineering Co.
 - d. Keystone/Rees, Inc.
 - e. Robroy Industries, Inc.
 - f. Square D Company.
6. Surface Metal Raceway:
 - a. Allied Tube & Conduit.
 - b. B-Line Systems, Inc.
 - c. Butler Mfg. Co.
 - d. Hoffman Engineering Co.
 - e. Isoduct Energy Systems.
 - f. Isotrol Systems.
 - g. Keystone/Rees, Inc.
 - h. Square D Company.
 - i. The Wiremold Co.

7. Surface Nonmetallic Raceway:
 - a. Anixter Brothers, Inc.
 - b. Hoffman Engineering Co.
 - c. Hubbell, Inc.
 - d. Panduit Corp.
 - e. Premier Telecom Products, Inc.
 - f. Thermotools Co.
 - g. The Wiremold Co.

2.02 METAL CONDUIT AND TUBING

- A. Rigid Metal Conduit: ANSI C 80.1, hot-dip galvanized.
- B. PVC Externally Coated Rigid Metal Conduit and Fittings: ANSI C 80.1 and NEMA RN 1., Type 40, 40 mil nominal coating and thickness. The bond of the PVC to the substrate shall be stronger than the tensile strength of the PVC.
- C. Flexible Metal Conduit: UL 1, zinc-coated metal.
- D. Liquidtight Flexible Metal Conduit and Fittings: UL 360. Fittings shall be specifically approved for use with this raceway.

2.03 NONMETALLIC CONDUIT AND DUCTS

- A. Rigid Nonmetallic Conduit (RNC): NEMA TC 2 and UL 651, Schedule 40 or 80 PVC.
- B. PVC Conduit and Tubing Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.
- C. Underground PVC and ABS Plastic Utilities Duct: NEMA TC 6, Type I for encased burial in concrete, Type II for direct burial.
- D. PVC and ABS Plastic Utilities Duct Fittings: NEMA TC 9; match to duct type and material.
- E. Liquidtight Flexible Nonmetallic Conduit and Fittings: UL 1660. Fittings shall be specifically approved for use with this raceway.
- F. Fiberglass-Reinforced Conduit and Fittings: CSA B196.1 and B1089 A.

2.04 CONDUIT BODIES

- A. Provide matching gasketed covers secured with corrosion-resistant screws. Use cast covers in NEMA 4 areas and stamped steel covers in NEMA 1 and 12 areas. Use nonmetallic covers in NEMA 4X areas and threaded, ground joint covers in NEMA 7 and NEMA 9 areas.
- B. Metallic Conduit and Tubing: Use metallic conduit bodies as follows:
 1. Rigid Metal Conduit: Use cast or malleable iron conduit bodies with zinc electroplating, aluminum enamel or lacquer finish, and threaded hubs.
 2. Intermediate Metal Conduit: Use cast or malleable iron conduit bodies with zinc electroplating, aluminum enamel or lacquer finish, and threaded hubs.

3. Electrical Metallic Tubing: Use cast or malleable iron conduit bodies with zinc electroplating, aluminum enamel or lacquer finish, and compression type or setscrew connectors.
4. PVC Externally Coated Rigid Metal Conduit: Use hot-dipped galvanized or cadmium-plated cast or malleable iron conduit bodies with threaded hubs factory PVC-coated. Field application of PVC coating to conduit bodies is not acceptable. Secure covers using PVC encapsulated or stainless steel screws.
5. Nonmetallic Conduit and Tubing: Use nonmetallic conduit bodies conforming to UL 514 B.
6. NEMA 7 and NEMA 9 Areas: Use materials conforming to UL standards for the area.

2.05 WIREWAYS

- A. Fittings and accessories including but not limited to couplings, offsets, elbows, expansion joints, adapters, hold-down straps, and end caps shall match and mate with wireway as required for complete system. Where features are not indicated, select to fulfill wiring requirements and comply with applicable provisions of NEC.
- B. Wireway covers shall be hinged type.

2.06 SURFACE RACEWAYS

- A. Sizes and channels as indicated. Provide fittings that match and mate with raceway.
- B. Surface Metal Raceway: Construct of galvanized steel with snap-on covers, with 1/8-inch mounting screw knockouts in base approximately 8 inches o.c. Finish with manufacturer's standard prime coating suitable for painting. Provide raceways of types suitable for each application required.
- C. Surface Nonmetallic Raceway: Two-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color. Raceway and system components shall meet UL 94 requirements for nonflammable, self-extinguishing characteristics.

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 16135

CABINETS, BOXES, AND FITTINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Cabinets, boxes, and fittings for electrical installations and certain types of electrical fittings not covered in other Sections. Types of products specified in this Section include:
1. Outlet and device boxes.
 2. Pull and junction boxes.
 3. Terminal boxes.
 4. Bushings.
 5. Locknuts.
 6. Conduit hubs.

1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
1. Shop Drawings for floor boxes and boxes, enclosures, and cabinets that are to be shop-fabricated, (nonstock items). For shop-fabricated junction and pull boxes, show accurately scaled views and spatial relationships to adjacent equipment. Show box types, dimensions, and finishes.
 2. Product data for boxes, fittings, cabinets, and enclosures.

1.03 QUALITY ASSURANCE

- A. Codes and Standards:
1. UL Listing and Labeling: Items provided under this section shall be listed and labeled by UL.
 2. NEMA Compliance: Comply with NEMA Standard 250, "Enclosures for Electrical Equipment (1,000 Volts Maximum)."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
1. Outlet Boxes, Concealed Conduit System:
 - a. Adalet-PLM Div., Scott Fetzer Co.
 - b. Appleton Electric, Emerson Electric Co.
 - c. Bell Electric, Square D Company
 - d. Eagle Electric Mfg. Co., Inc.
 - e. Midland-Ross Corp.
 - f. OZ/Gedney, General Signal Co.
 - g. Pass and Seymour, Inc.
 - h. RACO Div., Harvey Hubbell, Inc.

- i. Thomas & Betts Co.
- 2. Outlet Boxes, Exposed Conduit System:
 - a. Appleton Electric, Type JB, GS, or SHE.
 - b. Crouse-Hinds, Type GS or GRF.
- 3. Device Boxes, Concealed Conduit Systems:
 - a. Adalet-PLM Div., Scott Fetzer Co.
 - b. Appleton Electric; Emerson Electric Co.
 - c. Bell Electric, Square D Company.
 - d. Eagle Electric Mfg. Co., Inc.
 - e. Midland-Ross Corp.
 - f. OZ/Gedney, General Signal Co.
 - g. Pass and Seymour, Inc.
 - h. RACO Div., Harvey Hubbell, Inc.
 - i. Thomas & Betts Co
- 4. Device Boxes, Exposed Conduit System:
 - a. Appleton Electric, Type FS/FD.
 - b. Crouse-Hinds, Type FS/FD.
- 5. Junction and Pull Boxes, Concealed System:
 - a. Adalet-PLM Div., Scott Fetzer Co.
 - b. Appleton Electric, Emerson Electric Co.
 - c. Arrow-Hart Div., Crouse-Hinds Co.
 - d. Bell Electric, Square D Company.
 - e. GTE Corporation.
 - f. Keystone Columbia, Inc.
 - g. OZ/Gedney Co.; General Signal Co.
 - h. Spring City Electrical Mfg. Co.
- 6. Junction and Pull Boxes, Exposed Conduit System:
 - a. Appleton Electric, Type FS/FD.
 - b. Crouse-Hinds, Type FS/FD.
- 7. Terminal Boxes:
 - a. AMFCO.
 - b. Boss.
 - c. Hoffman.
 - d. Keystone.
 - e. Hope.
- 8. Bushings, Knockout Closures, Locknuts, and Connectors:
 - a. Adalet-PLM Div., Scott Fetzer Co.
 - b. AMP, Inc.
 - c. Arrow-Hart Div., Crouse-Hinds Co.
 - d. Appleton Electric Co., Emerson Electric Co.
 - e. Bell Electric; Square D Co.
 - f. Midland-Ross Corp.
 - g. Midwest Electric, Cooper Industries, Inc.
 - h. OZ/Gedney Co., General Signal Co.
 - i. RACO Div., Harvey Hubbell, Inc.
 - j. Thomas & Betts Co., Inc.

2.02 CABINETS, BOXES, AND FITTINGS - GENERAL

- A. Outlet Boxes: Suitable for the conduit system installation as follows:

1. Exposed Conduit: Provide cast outlet boxes finished with aluminum lacquer or enamel. Provide cast metal covers with neoprene gaskets for NEMA 12 and 4 areas and undesignated areas.
 - a. Exception: Provide non-metallic outlet boxes for NEMA 4X areas. Provide the appropriate explosion-proof rating for outlet boxes installed in NEMA 7 and NEMA 9 areas. Provide factory PVC-coated boxes where PVC-coated conduit is specified.
 2. Concealed Conduit: Provide galvanized coated flat-rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct outlet boxes with mounting holes and with cable and conduit-size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding. Provide cast metal outlet boxes for exterior outlets.
- B. Device Boxes: Suitable for the conduit system as follows:
1. Exposed Conduit: Provide cast or malleable iron, zinc electroplated device boxes finished with aluminum lacquer or enamel. Provide exterior mounting lugs on device boxes.
 - a. Exception: Provide non-metallic outlet boxes for NEMA 4X areas. Provide appropriate explosion-proof rating for device boxes installed in NEMA 7 and NEMA 9 areas. Provide factory PVC-coated device boxes where PVC-coated conduit is specified.
 2. Concealed Conduit: Provide galvanized coated flat-rolled sheet-steel non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices. Provide cable clamps and corrosion-resistant screws for fastening cable clamps, and for equipment type grounding. Provide cast metal device boxes for exterior devices.
- C. Junction and Pull Boxes: Suitable for the conduit system installation as follows:
1. Exposed Conduit: For pull and junction boxes provide 316 stainless steel hinged boxes. Provide exterior mounting lugs. Grind exposed edges smooth or roll edges to prevent scuffing of wire during installation. Provide a continuous neoprene or rubber gasket cemented to the box cover where it contacts the box body.
 - a. Exceptions: Provide nonmetallic pull and junction boxes in NEMA 4X areas. Provide appropriate explosion-proof construction for boxes located in NEMA 7 and NEMA 9 areas. Provide factory PVC-coated boxes for areas where PVC conduit is used.
 2. Concealed Conduit: Provide 316 stainless steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws, and washers.
- D. Terminal Boxes: Provide compression lug type terminal strips in each terminal box with a minimum of 20 percent spare terminals. Provide appropriate NEMA enclosure rating for area in which terminal box is installed.
- E. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications. Provide watertight hubs on conduits terminated at sheet steel enclosures in NEMA 4 areas.

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Receptacles.
 - 2. Ground fault circuit interrupter receptacles.
 - 3. Plugs.
 - 4. Plug connectors.
 - 5. Telephone and network outlets.
 - 6. Wall plates.

1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
 - 1. Product data for each type of product specified.

1.03 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. UL and NEMA Compliance: Provide wiring devices which are listed and labeled by UL and comply with applicable UL and NEMA standards.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
 - 1. Bryant Electric Co., Division of Hubbell Corporation.
 - 2. Cooper Wiring Devices.
 - 3. Hubbell, Inc.
 - 4. Leviton Manufacturing Co., Inc.
 - 5. Pass and Seymour, Inc.

2.02 WIRING DEVICES

- A. Provide devices which are UL listed and which comply with NEMA WD 1 and other applicable UL and NEMA standards. Provide ivory color devices and wall plates except as otherwise indicated.
- B. Receptacles: Provide specification grade or heavy-duty grounding receptacles with the NEMA rating shown on Wiring Device Schedule on Drawings. Comply with UL 498 and NEMA WD1.

- C. Receptacles, Industrial Heavy-Duty: Provide pin and sleeve design receptacles conforming to UL 498. Comply with UL 1010 where installed in hazardous locations. Provide features indicated.
- D. Ground Fault Interrupter (GFI) Receptacles: Provide specification grade or heavy-duty "feed-through" type ground fault circuit interrupter, with integral grounding type NEMA 5-20R duplex receptacles arranged to protect connected downstream receptacles on same circuit. Provide units rated Class A, Group 1, per UL Standard 94.3.
- E. Plugs: 15 amperes, 125 volts, 3-wire, grounding, armored cap plugs, parallel blades with cord clamp, and 0.4-inch cord hole; match NEMA configuration with power source's.
- F. Plug Connectors: 15 amperes, 125 volts, bakelite-body armored connectors, 3-wire, grounding, parallel blades, double wipe contact, with cord clamp, and 0.4-inch cord hole, match NEMA configuration to mating plug's. Arrange as indicated.
- G. Telephone and Network Outlets: Telephone outlets shall consist of box, wall plate, and RJ-12 jack. Network outlets shall consist of box, wall plate, and RJ-45 jack. Network outlet shall comply with requirements of CAT-5E cabling systems. Wall plates shall match color and style of receptacle and switch wall plates used throughout the Project.

2.03 WIRING DEVICE ACCESSORIES

- A. Wall plates: Single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide wall plates with engraved legend where indicated. Exterior receptacle covers shall provide rainproof protection while in use. Conform to requirements of Section 16075. Provide plates possessing the following additional construction features:
 - 1. NEMA 12 and Unclassified Areas. Material and Finish: 0.04-inch-thick stainless steel, or 0.04-inch-thick brass, chrome plated.
 - 2. NEMA 4 Area Material and Finish: Cast screw cap and cover plate for receptacles. Cast cover plate with lever or plunger operator for switches.
 - 3. NEMA 4X Material and Finish: Non-metallic, watertight wall plates 0.05-inch-thick aluminum, anodized.
 - 4. NEMA 7 and NEMA 9 Material and Finish: cast metal cover plates meeting NEC requirements for area.

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 16238

TRANSFER SWITCHES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Types of transfer switches required for the Project and include the following:
1. Automatic transfer.

1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
1. Product Data: Submit manufacturer's data and installation instructions for electrical power transfer switches.
 2. Wiring Diagrams: Submit wiring diagrams for electrical transfer switches, and associated control diagrams showing connections to prime and alternate power sources, electrical load, and equipment components. Differentiate between portions of wiring that are manufacturer installed and portions that are field installed.

1.03 QUALITY ASSURANCE

- A. Codes and Standards:
1. UL Compliance: Comply with applicable requirements of UL 1008, "Automatic Transfer Switches," and UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide transfer switches and components which are UL listed and labeled.
 2. NEMA Compliance: Comply with applicable requirements of NEMA Standards Pub/Nos. ICS 2, "Industrial Control Devices, Controllers and Assemblies," ICS 6 and 250, pertaining to transfer switches.
 3. NFPA Compliance: Comply with applicable requirements of NFPA 99, "Standard for Health Care Facilities," and NFPA 101, "Code for Safety to Life from Fire in Buildings and Structures," pertaining to transfer switches.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
1. Automatic Transfer Switches:
 - a. Automatic Switch Co. (ASCO).
 - b. Caterpillar, Inc.
 - c. Cummins.
 - d. Russelectric, Inc.

2.02 AUTOMATIC TRANSFER SWITCHES

- A. Automatic Transfer Switch: UL listed and 600 volt-rated with amperage rating shown on Drawings and shall be the mechanically held, electrically operated type rated for continuous duty in an unventilated sheet metal enclosure.
- B. Switch shall be double throw, with an off position, having electrical operated normal-emergency positions inherently interlocked mechanically, and with main contacts mechanically attached to a common shaft. Main contacts shall be silver alloy wiping-action type. They shall be protected by arcing contacts.
- C. Switch and Relay Contacts, Coils, Springs, and Control Elements: Removable from front of transfer switch without removal of the switch panels from enclosure and without disconnection of drive linkages or power conductors. Sensing and control relays shall be continuous duty industrial control type with 600 volt, 10 amp rated contacts.
- D. Upon drop in normal voltage of 83-85 percent of rated voltage, and after an override delay of 3 seconds nominal, switch shall start generator and transfer the load to emergency source, provided emergency source voltage and frequency are 90 percent of rated or higher.
- E. Upon return of normal source voltage for 5 seconds nominal, to 92-95 percent of rated, switch shall retransfer load to normal source after a minimum transfer time or if emergency source fails. Provide a 5- to 60-second adjustable time delay to maintain transfer switch in the "Off" position during transfer to either source.
- F. Sensing relays shall operate without contact chatter or false response when voltage is slowly varied to dropout and pickup levels.
- G. Four auxiliary contacts shall be provided: Two for transfer switch position indicating use, and two auxiliary contacts, one N.O. and one N.C. to operate after completion of the 3-second override delay for starting generator. All auxiliary contacts shall be 600 volt, 10 amp continuous rating.
- H. Accessory devices shall be provided as follows:
 - 1. Time delay to override harmless power dips and outages. (Inverse time characteristic with voltage.)
 - 2. Test switch.
 - 3. Auxiliary contacts (as specified herein).
 - 4. Selector relay (as specified herein).
 - 5. Lockout relay (sensitive to voltage and frequency).
 - 6. Full phase protection with nominal 75-80 percent dropout and 92-95 percent pickup on phase relay.
 - 7. Adjustable time delay on retransfer to normal source. Minimum retransfer of 2 minutes and maximum of 25 minutes. Built-in circuitry to nullify the retransfer time delay if the emergency source fails and the normal source is available.
 - 8. Adjustable (10-20 minutes) time delay for running generator unloaded after transfer for cool down.
 - 9. Adjustable time delay or delays (5 to 60 seconds) for holding transfer switch in the "Off" position when switching from standby source to normal and normal source to standby.
 - 10. Engine starting contact.
 - 11. Exerciser to exercise generator for 15 minutes every 168 hours. A selector switch shall permit generator to be exercised with or without load.

12. The switch at station no.31 shall include a service entrance rated main circuit breaker.

- I. Bypass-Isolation Switches: Provide factory-fabricated, manually operated, bypass-isolation switches and auxiliary equipment of types, sizes, ratings, and electrical characteristics for services indicated; used in conjunction with automatic transfer switch to provide a means of directly connecting load conductors to a power source and isolating the automatic transfer switch. Select switches with 2-way bypass to emergency source and capable of functioning as an independent manual transfer switch. In addition, design bypass switch with an intermediate position to permit electrical operation and testing of automatic transfer switch without affecting power to critical load. Provide capability for total electrical isolation of automatic transfer switch for maintenance, testing, and repair. Equip 3-pole drawout-type switches with gang-operated externally operated handle mechanism arranged for padlocking in open position with 1 to 3 padlocks. Provide free standing 14-gauge welded steel NEMA Type 4 enclosure. Coat enclosure with manufacturer's standard color acrylic enamel finish over a corrosion-resisting primer. Color to match automatic transfer switch.

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 16410

CIRCUIT AND MOTOR DISCONNECTS

PART 1 - GENERAL

1.01 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
 - 1. Product data for each type of product specified.
- B. Operation and Maintenance Manuals: Submit in accordance with requirements of Sections 01600 and 13410, operation and maintenance manuals for items included under this Section, including circuits and motor disconnects.

1.02 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. Electrical Component Standards: Provide components which are listed and labeled by UL. Comply with UL Standard 98 and NEMA Standard KS 1.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
 - 1. Allen-Bradley.
 - 2. Square D Company.
 - 3. Siemens

2.02 CIRCUIT AND MOTOR DISCONNECT SWITCHES

- A. Provide NEMA 4, 4X, 7, 9, or 12 enclosure to match the rating of the area in which switch is installed. For motor and motor starter disconnects through 100 horsepower, provide units with horsepower ratings suitable to loads. For motor and motor starter disconnects above 100 horsepower, clearly label switch, "DO NOT OPEN UNDER LOAD."
- B. Fusible Switches: (Heavy-duty) switches, with fuses of classes and current ratings indicated. See Section "Fuses" for specifications. Where current limiting fuses are indicated, provide switches with non-interchangeable feature suitable only for current limiting type fuses.
- C. Circuit Breaker Switches: Where individual circuit breakers are required, provide factory-assembled, molded-case circuit breakers with permanent instantaneous magnetic and thermal trips in each pole, and with fault-current limiting protection, ampere ratings as indicated. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication. Provide push-to-trip feature for testing and exercising circuit breaker trip mechanism. Construct breakers for mounting and operating in any physical position and in an ambient

temperature of 40 degrees C. Provide with AL/CU-rated mechanical screw type removable connector lugs.

- D. Non-fusible Disconnects: (Heavy-duty) switches of classes and current ratings as indicated.
- E. Double-Throw Switches: (Heavy-duty) switches of classes and current ratings as indicated.
- F. Bolted Pressure Switches: Bolted pressure switches conforming to and listed under UL Standard 977, single- or double-throw arrangement as indicated. For fusible units, provide fuses as indicated.
- G. Service Switches: (Heavy-duty) fusible/circuit breaker switches. UL listed for use as service equipment under UL Standard 98 or 869.
- H. Switches for Classified (Hazardous) Locations: Heavy-duty switches with UL labels and listings for hazardous location classifications in which installed.

2.03 ACCESSORIES

- A. Special Enclosure Material: Provide special enclosure material as follows for switches indicated:
 - 1. Stainless Steel for NEMA 12 and NEMA 4 switches.
 - 2. Molded fiberglass-reinforced plastic for NEMA 4X switches.

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 16420

MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Types of motor controllers, including:

1. Combination controllers.
2. Solid-state reduced voltage controllers.
3. Fractional HP manual controllers.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:

1. Shop Drawings: Submit Shop Drawings of motor controllers showing dimensions and sizes.
2. Product Data: Submit manufacturer's data and installation instructions on motor controllers.
3. Wiring Diagrams: Submit power and control wiring diagrams for motor controllers

1.03 QUALITY ASSURANCE

A. Codes and Standards:

1. UL Compliance: Comply with applicable requirements of UL 486A and B, and UL 508, pertaining to installation of motor controllers. Provide controllers and components which are UL listed and labeled.
2. NEMA Compliance: Comply with applicable requirements of NEMA Standards ICS 2, "Industrial Control Devices, Controllers and Assemblies," and Pub No. 250, "Enclosures for Electrical Equipment (1,000 Volts Maximum)," pertaining to motor controllers and enclosures.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include (no or equal):

1. Allen-Bradley Co.
2. Square D Company.

2.02 MOTOR CONTROLLERS

A. Except as otherwise indicated, provide motor controllers and ancillary components which comply with manufacturer's standard materials, design, and construction in accordance with published product information and as required for a complete installation.

- B. Combination Controllers: Consist of controller and circuit breaker or fusible disconnect switch mounted in common enclosure of types, sizes, ratings, and NEMA sizes indicated. Equip starters with block-type manual reset overload relays. Provide control and pilot devices indicated. Provide 90 degree C SIS or MTW, No. 14 AWG control wiring, tagged at each termination. Provide operating handle for disconnect switch mechanism with indication and control of switch position, with enclosure door either opened or closed, and capable of being locked in OFF position with 3 padlocks. Construct and mount controllers and disconnect switches in single NEMA-type enclosure suitable for the location in which it is installed; coat with manufacturer's standard color finish.
1. The 3-phase starter may be the following types:
 - a. Full Voltage Non-reversing (FVNR): One 3-pole magnetic contactor with a set of 3 overload devices.
 - b. Full Voltage Reversing (FVR): Two 3-pole magnetic contactors with a common set of 3 overload devices.
 - c. Two-speed (for two winding motor): Two, 3-pole magnetic contactors, each with its own set of 3 overload devices.
 - d. Two-speed (for single winding motor): Two magnetic contactors, a 5-pole for high speed, and a 3-pole for low speed, each with its own set of 3 overload devices.
 - e. Reduced Voltage (for wye-connected part winding motors): Two 3-pole magnetic contactors, each with its own set of 3 overload devices and a timer for closing of the running contactor. Running contactor shall be sized for motor full load current, and starting (half-winding) contactor shall be sized for at least 75 percent of the full load current and shall be capable of interrupting at least 10 times full load current.
 - f. Reduced Voltage (closed transition autotransformer type): Three magnetic contactors, two 2-pole and one 3-pole with a common set of 3 overloads, a timing relay and an autotransformer with taps at 50, 65, 80, and 100 percent, and an integral temperature switch or timing relay to protect transformer windings.
- C. Solid-State Reduced Voltage Controllers(Allen-Bradley only-no or equal): Provide 3-phase, solid-state, reduced voltage motor controllers of sizes and ratings indicated.
1. The controller shall be microprocessor-based and shall provide as a minimum the following modes of operation.
 - a. Soft start with selectable kick-start.
 - b. Soft stop.
 - c. Current limit.
 - d. Full voltage.
 2. The controller shall be self-calibrating and shall automatically adjust itself for line voltage, frequency and current fluctuations. It shall have adjustable starting acceleration and stopping deceleration. Provide transient protection for all controllers furnished.
- D. Control and Pilot Devices: Provide an individually fused control power transformer in each starter unit. Provide 2 fuses in the transformer primary circuit and 1 in transformer secondary circuit. Size transformers such that they can supply 100VA in excess of the unit requirements or provide 150VA rated transformer, whichever is greater. Provide 300 volt rated, oiltight type LED pilot lights, push buttons with extended guard and black color insert. Equip stop push buttons with half guard and red color insert. Provide 120/6 volt transformer type push-to-test pilot lights with lens color indicated. Provide machine tool type relays, each with 1 spare N.O. contact. Provide 6-digit elapsed time indicators with one-tenth hour increments. When timers are required, they shall be synchronous type.

- E. Fractional HP Manual Controllers: Provide 3-phase and single-phase fractional horsepower manual motor controllers, of sizes and ratings indicated. Equip with manually operated quick-make, quick-break toggle mechanisms, and with one-piece melting alloy type thermal units. Controller shall become inoperative when thermal unit is removed. Provide controllers with double-break silver alloy contacts, visible from both sides of controller, and switch capable of being padlocked-OFF. Enclose controller unit in NEMA-type enclosure suitable for the location in which it is installed; coat with manufacturer's standard color finish.

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 16422

VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Types of motor controllers, including:
1. Variable Frequency Drives

1.02 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings (seven copies) covering the items included under this Section. Shop Drawing submittals shall include:
1. Shop Drawings: Submit Shop Drawings of motor controllers showing wiring diagrams, dimensions and sizes.
 2. Product Data: Submit manufacturer's data and installation instructions on motor controllers.
 3. Wiring Diagrams: Submit power and control wiring diagrams for motor controllers
 4. Submit operation and maintenance manuals for the drives. Submit electronic copies on CD, as well as three hard cover copies.

1.03 QUALITY ASSURANCE

- A. Codes and Standards:
1. UL Compliance: Comply with applicable requirements of UL 486A and B, and UL 508, pertaining to installation of motor controllers. Provide controllers and components which are UL listed and labeled.
 2. NEMA Compliance: Comply with applicable requirements of NEMA Standards ICS 2, "Industrial Control Devices, Controllers and Assemblies," and Pub No. 250, "Enclosures for Electrical Equipment (1,000 Volts Maximum)," pertaining to motor controllers and enclosures.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturer offering products shall be (no or equal):
1. Allen-Bradley Co.(Power Flex 753 Series) for Woods Lake LS.
 2. Allen-Bradley Co.(Power Flex 525 Series) for August-Webster and Climax LS.
 3. ABB ACS 580 Series.

2.02 MOTOR CONTROLLERS

- A. Variable Frequency Drives: This system shall comprise a motor and a variable frequency drive and
1. Motor: as coordinated with the pump manufacturer.
 2. Variable Frequency Drive: The variable frequency drive unit shall convert 480 volt plus 10 percent, minus 5 percent; 3-phase; 60 hertz plus or minus 2 hertz, input power into an adjustable frequency output. Output power shall be of suitable capacity and wave form to provide stepless speed control of the specified AC motor throughout a continuous speed range

of 10:1 under variable torque load not exceeding 1.25 times the motor's full load rating in an ambient of 0-40 degrees C with up to 95 percent humidity. The drive continuous run amperes rating shall be 1.25 times the full load ampere of the load or as shown on the electrical one-line drawings whichever is greater. The drive shall be able to withstand external short circuits without fuse blowing or device failure. The drive shall comply with the latest requirements of IEEE519 2014.

3.
 - a. Drives of the pulse-width-modulation type shall have current limit protection for the drive and load of 110 percent of motor nameplate rating for variable torque loads for a minimum of 1 minute before automatically disconnecting the drive.
 - b. Provide instantaneous static overvoltage and overcurrent protection. Provide undervoltage trip upon input power loss or phase loss without component failure and automatic restart upon return of full power and command. The drive shall not be damaged by application of incorrect phase sequence.
 - c. Provide input circuit breaker interlocked with the door.
 - d. Provide input, output, and bypass contactors(Nema rated) where shown on contract drawings.
 - e. Provide three spare fuses of each type used.
 - f. Provide 3-phase thermal overloads at the output to the motor.
 - g. Provide line voltage transient suppression and immunity to local ambient electrical noise. The drive shall not create radiated or conducted RFI which disturbs the function of adjacent equipment. Units shall be furnished as six pulse drives with input and output filtering to comply with above requirements. Furnish 5% input line reactor or Matrix AP input filter as shown on drawings and DV/DT output filters on drive output for each drive.
 - h. Provide drive fault detection circuit with contacts for remote alarm used by others. The drive shall shut down on any type of failure. Cause of drive shutdown shall be displayed on operator interface.
 - i. Provide isolation of signal circuits from the power circuits. The drive shall have self-protection from regenerative power on rapid decrease of speed signals.
 - j. Provide a forced air ventilation system to remove heat from the drive enclosure. Power for the ventilation system shall be provided from the drive circuits. The fans shall be completely serviceable without having to dis-assemble the drive and shall be interlocked with the drive run status.
 - k. Where shown on the wiring diagrams, the drive shall accept a speed control signal from either an isolated or non-isolated 4-20 mA source while in the automatic speed control mode and from a door-mounted speed potentiometer when the manual mode is selected. In addition, provide a door-mounted operator interface panel that allows remote/local mode selection and manual speed control. Furnish selector switches and pilot lights for the control shown on the wiring diagrams. Devices to be mounted on face of drive door, controls section.
 - l. The drive shall output an isolated 4-20 mA speed signal for remote speed indication.
 - m. The drive shall accept a remote start/stop contact closure while in the Auto mode and from operator interface when the Local mode is selected. Refer to the wiring diagrams for additional control requirements.
 - n. The drive shall have an alphanumeric operator interface display capable of displaying amps, voltage, kW, rpm, frequency, and elapsed running time.
 - o. Provide a delay to restart the motor after the motor is running. The delay to restart shall be adjustable from 3 to 60 seconds. Minimum delays greater than 5 seconds will not be accepted.
 - p. The 4-20 mA input signal shall control the motor speed between 10 percent of full speed and full speed. The 20mA signal being full speed and 4mA being minimum speed. The

- 4-20 mA input signal shall control the motor speed between the adjustable minimum and maximum speed settings. The minimum speed shall be field adjustable from 10-70 percent of rated speed. The maximum speed shall be field adjustable from 70-100 percent of rated speed. The minimum and maximum speed settings shall override the 4-20 mA signal at their respective settings. The speed signal shall follow a linear time ramp, adjustable from 4 to 20 seconds. Provide separate acceleration and deceleration control. The motor speed shall follow the input signal, in the steady state, with a plus or minus 2 percent linearity.
- q. The drive shall be of modular construction for ease of maintenance.
 - r. The drive shall be capable of communicating monitoring and diagnostic functions.
 - s. Coordinate with the pump supplier for the installation and wiring associated with the seal leak/motor temperature sensor. Refer to the wiring diagrams for additional information.
 - 1) Provide, for remote use by others, two normally open contacts rated 3amps at 120 volt AC which close when the controller is running, or faults.
 - t. In pump applications and where shown on Drawings, the variable frequency drives shall contain the necessary circuitry to energize a 120 volt AC pump seal water solenoid valve when the pump is running. The rating of this circuit shall be sufficient to control a solenoid valve with an inrush of 360 VA and a holding VA of 120.
 - u. The drives including the enclosure and controls shown shall be assembled, and built by the manufacturer. Drives assembled by the Contractor do not comply with this specification.
 - v. The entire drive electronics/circuit boards shall be conformal coated.
 - w. Drives shall be provided with input surge protection and fast acting electronic fuses.
 - x. Three spare fans shall be provided.
 - y. The drive shall be supplied within a free standing NEMA 12 enclosure or as shown on contract drawings. Drives shall be constructed such that they can be located back to back. Service of equipment including fans and ventilation filters shall be from the front, of the enclosure. No maintenance of parts shall be required from the drive rear. Cable entry for incoming power and pump wiring shall be from the bottom or top of the enclosure as coordinated with the Contractor.
 - z. The door mounted keypad shall also serve to maintain/store the drive configuration.
 - aa. Selector switches, contactors, relays, pilot lights, etc., shall be NEMA rated.
 - bb. The drive including the VFD, contactors, relays, switches, drive enclosure shall be supplied as a complete system by the VFD manufacturer Rockwell or ABB.
4. All wires are to be identified, and the identifying mark shown on the schematics and wiring diagram. Documentation of schematics, wiring diagrams, terminal strips, and operating and maintenance manuals shall be supplied at Shop Drawing time and delivered with the equipment.
 5. The drive manufacturer shall provide a field start-up and calibration service on-Site for five eight hour days for the drives. The manufacturer shall configure the drive parameters based on the inputs shown and motor information as supplied by the Contractor/pump manufacturer/Owner. The manufacturer's personnel shall have a stable 4-20 mA source, and a plus or minus 0.5 percent accurate 3-1/2-digit, digital milliamp meter to be used in the calibration procedure.
 6. The system calibration shall be checked at 100 percent, 75 percent, 50 percent, and minimum speed points. The minimum and maximum speeds shall be set. The deceleration and acceleration rates shall be set. The delay to restart shall be set. Settings by the drive manufacturer, to be performed on-site as coordinated with the Owner/Engineer.
 7. Furnish a 36 month warranty on each drive from date drives are placed on-line at the Owner's facility.
 8. Furnish one eight hour day of follow-up training following installation and start-up of the drives at the Owners facility. Provide training materials and handouts for up to twenty (20) people of the Owners staff.

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 16231

STANDBY NATURAL GAS GENERATOR SET

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Extent of natural gas generator set Work as indicated by Drawings and/or Schedules, and is hereby defined to include, but not by way of limitation:
 - 1. Natural gas engine.
 - 2. Electrical generator.
 - 3. Engine starting system, including batteries, instrument control panel, protective housing, annunciator panel, exhaust silencer, wall thimble, and accessories.

- B. Types of generator sets required for the Project include:
 - 1. Permanent natural gas engine-driven generator.

1.02 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
 - 1. Product Data: Submit manufacturer's data on natural gas engine-driven generator sets and components.
 - a. Generator dimensions.
 - b. Generator weight.
 - c. Generator rating.
 - d. Alternator rating.
 - e. Generator starting system data:
 - 1) Battery size and ratings.
 - 2) Charging system capacity.
 - 3) Battery heater data.
 - 4) Battery warranty.
 - f. Generator control panel data:
 - 1) Layout.
 - 2) Wiring diagrams.
 - 3) Control interconnection.
 - 4) Instrumentation.
 - g. Exhaust system data:
 - 1) Muffler size.
 - 2) Decibel reduction curve.
 - 3) Fuel system data.
 - h. Cooling system data:
 - 1) Radiator capacity.
 - 2) Cooling reduction capacity.
 - i. Enclosure data:
 - 1) Materials.
 - 2) Size.
 - 3) Assembly/disassembly instructions.
 - 4) Door locations.

- 5) Noise reduction.
- j. Warranty data.
- k. Accessory and miscellaneous equipment.
2. Wiring Diagrams: Submit wiring diagrams for natural gas engine-driven generator units showing connections to electrical power panels, feeders, and ancillary equipment. Differentiate between portions of wiring that are manufacturer installed and portions that are field installed.
3. Agreement to Maintain: Prior to time of final acceptance, Installer shall submit 4 copies of an agreement for continued service and maintenance of natural gas engine-driven generator sets for OWNER's possible acceptance. Offer terms and conditions for furnishing parts and providing continued testing and servicing, including replacement of materials and equipment, for 1-year period with option for renewal of Agreement by OWNER.
4. Certifications: Provide natural gas engine-driven generator sets certified test record of the following final production testing:
 - a. Single-step load pickup.
 - b. Transient and steady state governing.
 - c. Safety shutdown device testing.
 - d. Voltage regulation.
 - e. Rated power.
 - f. Maximum power.
 - g. Provide certified test record prior to engine-driven generator set being shipped from factory to Project location.

1.03 QUALITY ASSURANCE

A. Codes and Standards:

1. NFPA Compliance: Comply with applicable requirements of NFPA 37, "Installation and Use of Stationary Combustion Engines and Gas Turbines," NFPA 99, "Standard for Health Care Facilities," and NFPA 101, "Code for Safety to Life from Fire in Buildings and Structures."
2. UL Compliance: UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors;" UL 2200, "Standard for Safety for Stationary Engine Generator Assemblies," rated 600 volts or less.
3. ANSI/NEMA Compliance: Comply with applicable requirements of ANSI/NEMA MG1, "Motors and Generators," and MG2, "Safety and Use of Electric Motors and Generators."
4. IEEE Compliance: Comply with applicable portions of IEEE Standard 446, "IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications."

- B. Warranty: Submit warranties covering the items included under this Section. Unit shall be provided with a full factory warranty of 2 years from date of ENGINEER's acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which shall be incorporated in Work include(no or equal):
1. Standby Natural Gas Generator Sets:
 - a. Caterpillar.
 - b. Cummins.
 - c. Kohler Co.

2.02 GENERATOR SETS

- A. Except as otherwise indicated, provide manufacturer's standard natural gas engine-driven generator set and auxiliary equipment as indicated by published product information and as required for a complete installation. Generator set shall be rated to continuously power the total accumulated load and starting load shown on Schedule at 100 degrees F ambient temperature and at altitude where installed.
- B. Natural Gas Engine: Provide a 4-cycle, spark ignition type engine for operation on a commercial grade of natural gas such as that furnished by Consumers Energy Co. Engine operating speed shall not exceed 1,800 rpm and shall be controlled by a governor to maintain alternator frequency within plus or minus 3 hertz of 60 hertz from no load to full load. Frequency shall recover to steady-state tolerance within 5 seconds after application of 90 percent rated load. NOTE: Furnish propane gas engine for the generator to be provided at 6th street elevated tank. In addition, furnish a low gas pressure switch on the gas supply line within the enclosure for alarming to the existing SCADA system. Pressure switch dry contact closure to be rated for 24VDC at 1 amps.
- C. Starting System: Provide engine-generator unit with 12 or 24 volt negative ground starting system, including positive engagement solenoid shift-starting motor, batteries, and 35 ampere or greater automatic battery charging alternator with solid-state voltage regulator. Mount batteries in a plastic- or epoxy-coated metal platform near the starter but not on the generator, and coat battery terminals with an anti-oxidant. Generator sets rated 150 kW or less shall have a battery rated 650 amperes cold cranking at 0 degree F and 170 minutes reserve capacity by SAE Standard J-537. Larger generators shall have a battery rated either 220 ampere-hours or 900 amperes cold cranking and 430 minutes reserve capacity. Batteries shall have a 12-month full warranty and 60-month prorated warranty.
- D. Battery Charger: Provide a solid-state current limiting, float-type battery charger with 5 ampere minimum capacity. Charger shall operate from 120 volt AC single phase, 60 hertz power and shall automatically keep batteries at full charge. Equip charger with ammeter and voltmeter.
- E. Alternator: Provide a single bearing, brushless, self-excited alternator with inherently regulated rotating rectifier exciter system or a revolving field design with a temperature compensated solid-state voltage regulator. Connect the alternator housing directly to the engine flywheel housing. Couple the alternator rotor directly to engine flywheel with a semi-flexible steel disk coupling.
 - 1. Provide windings with Class F insulation with epoxy impregnation and fungus-resistant coating. Temperature rise shall be as defined in NEMA Standard MG1-22.40.
 - 2. The alternator shall be capable of starting load given on Schedule with 35 percent maximum instantaneous voltage dip. Recovery to stable equation within plus or minus 5 percent of rated voltage shall occur within 3 seconds.
- F. Engine Cooling Radiator: Provide a complete engine cooling system equipped with a radiator and blower type fan sized to maintain safe operation, 190 degrees F engine outlet water temperature at 100 degrees F maximum ambient temperature. The engine cooling system shall be filled with a solution of 50 percent ethylene glycol. On indoor mounted units, radiator shall be equipped with a duct adapter flange. An air duct with flexible connecting sections shall be provided between radiator duct flange and exhaust damper.

1. Surge tanks or hot well tanks shall be provided as required by installation location of radiator relative to engine. Provide air vents, liquid level indicators, drain valves, and overflow and refill connections for tank supplied. Tank shall be located to prevent air from entering engine. It shall be the responsibility of CONTRACTOR to furnish the proper cooling components and related valves and adjustments to meet the operating specifications.
- G. Instrument Control Panel: Provide engine-generator unit with engine oil pressure and water temperature indicators, reset circuit breaker, static voltage regulator, voltage-adjusting rheostat, voltmeter, ammeter with phase selector switch with OFF position, and running time indicator and frequency meters. Select circuitry of plug-in design, capable of quick replacement and accepting a plug-in device which allows maintenance to test control panel performance without operating the engine.
1. Provide a cranking limiter to open starting circuit in 45 to 90 seconds if engine has not started within that time, or after a series of 3 or more cranking intervals separated by 2 or more rest periods.
 2. Provide engine safety devices to shut unit down on high engine temperature, low oil pressure, overspeed, and overcrank. Provide for each of these conditions, an alarm light and unpowered, normally open contact for remote use. Provide an audible alarm with silence switch which is activated by any alarm condition.
 3. Provide a relay with 2 normally open and 2 normally closed contacts rated 5A at 120 volts AC and which is energized when unit is running. Wire these contacts to terminal strips for remote use.
 4. Provide a RUN-OFF-AUTO switch. In AUTO position, unit shall start when a remote contact closes and stop when contact opens. In RUN position, unit shall start and run until OFF position is selected.
 5. Mount instrument control panel on unit such that it is isolated from generator set vibration.

2.03 PERMANENT ENGINE-GENERATOR SET ACCESSORIES

- A. Enclosure: Engine-generator set shall be enclosed in a heavy gauge reinforced sheet steel, weather-protective housing, which allows ample air flow around unit for proper operation. Housing shall be factory attached to generator set mounting base and radiator cowling. Provide removable panels on each side complete with lockable doors. A hinged and lockable door shall be provided over instrument panel.
1. When this enclosure is specified for an outdoor permanent or a portable unit, the temperature specifications for unit shall be -20 to 120 degrees F with ambient air at radiator intake being 100 degrees F maximum.
- B. Sound Attenuation: Enclosure shall be insulated to attenuate sound and include sound attenuating features that direct radiant cooling air in a route to minimize ambient noise when generator is running. Enclosure shall reduce noise by 82 dBA minimum. Enclosure sound proofing insulation thickness to be 2 inches minimum.
- C. Fuel System: Provide unit with all necessary fuel supply lines. Fuel lines shall be furnished pre-assembled to unit. Fuel shut-off valve shall be closed when the engine is not running. Provide flexible connections at engine for all gas lines. Furnish and install Interconnecting lines from gas line to engine.
- D. Coolant Heater: Provide an engine coolant heater of voltage indicated on Schedule, with thermostatic controls to maintain engine coolant at proper temperature to fulfill start-up requirements of NFPA 99.

- E. Inlet and Exhaust Systems: Silencers and exhaust ducting to silencers shall be self-supporting when assembled. Provide all necessary supporting members for ductwork between silencer and outlet. Provide all required cutting as shown on Drawings and noted herein. The unit shall be complete with raincap. All exhaust ducts shall be Schedule 10 steel pipe minimum. Inlet silencer and filter to be self-supporting. Provide necessary supports for all intake ductwork. All intake ducts shall be Schedule 10 steel pipe minimum.
 - 1. Provide bellows sections, insulated wall thimbles, and inlet and outlet flexible section. Design of exhaust silencer and stack including all ducting shown shall have a pressure drop not exceeding 5 inches of water.
 - 2. Provide a silencer which meets sound standards of a critical area. Silencer shall provide attenuation (input to output) of 25 dB or greater at frequencies of 125 hertz to 8 kilohertz. A curve shall be submitted with Shop Drawings showing attenuation (input to output) in dB versus frequency. Curve shall be on manufacturer's standard data sheet or from an independent test lab. A spiral or bellows-type flexible section of pipe shall be installed in the exhaust line between the muffler and engine manifold connection. An insulated thimble section shall be provided where exhaust line passes through roof or wall. Exhaust lines shall be pitched and a condensation trap provided at nondraining low points in line. Exhaust shall exit the top of the enclosure and be provided with a rain cap. Exhaust discharge shall not point horizontal with the enclosure.

- F. Circuit Breaker: A generator power circuit breaker shall be installed as a manual load circuit interrupter and an automatic overload and short circuit protection device.
 - 1. The circuit breaker shall be a solid-state trip type for all sizes rated 300 amp continuous and larger. Solid-state trip shall include Long-time, Short time, and Instantaneous. Trip settings for all breakers shall be selected for the rating of the generator power circuit as indicated on Drawings or on Schedule.

PART 3 - EXECUTION

3.01 INSTALLATION OF NATURAL GAS ENGINE-DRIVEN GENERATOR SETS

- A. Install natural gas engine-driven generator units as indicated, in accordance with equipment manufacturer's written instructions and recognized industry practices to ensure that engine-generator units fulfill requirements. Comply with NFPA and NEMA standards pertaining to installation of engine-generator sets and accessories.

- B. Coordinate with other work, including raceways, electrical boxes and fittings, fuel tanks, piping, and accessories, as necessary to interface installation of engine-generator equipment work with other work.

- C. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B and the National Electrical Code.

- D. Install units on steel spring type vibration isolators fastened to an inertia base in accordance with manufacturer's instructions.

- E. Connect fuel piping to generator equipment as indicated, and comply with manufacturer's installation instructions.

3.02 GROUNDING

- A. Provide equipment grounding connections for natural gas engine-driven generator units as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to ensure permanent and effective grounding.

3.03 FIELD QUALITY CONTROL

- A. Start-up Testing:
 - 1. Engage local equipment manufacturer's representative to perform start-up and building load tests upon completion of installation, with ENGINEER in attendance; provide certified test record. Tests are to include the following:
 - a. Check gas pressure, gas supply volume, lubricating oil, and antifreeze in liquid-cooled models for conformity to manufacturer's recommendations under environmental conditions present.
 - b. Test prior to cranking engine for proper operation, accessories that normally function while the set is in a standby mode. Accessories include: engine heaters, battery charger, generator strip heater, remote annunciator.
 - c. Check, during start-up test mode, for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and phase rotation.
 - d. Test, by means of simulated power outage, automatic start-up by remote-automatic starting, transfer of load, and automatic shutdown. Prior to this test, adjust for proper system coordination, transfer switch timers. Monitor throughout the test, engine temperature, oil pressure, battery charge level, generator voltage, amperes, and frequency.
 - 1) On generating sets exceeding 50 kW, a starting load test is to be performed after installation. Voltage dip will be observed with a recording oscilloscope furnished by supplier for this test only. Voltage dip is defined as the peak-to-peak voltage minimum, at starting compared to the average peak-to-peak voltage with the starting load running. The difference shall be less than 35 percent of the running P-P voltage.
 - e. Upon completion of installation, demonstrate capability and compliance of system with requirements. Where possible, correct malfunctioning units at Site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting. Initial testing and retesting to be at no cost to OWNER.

3.04 PERSONNEL TRAINING

- A. Building Operating Personnel Training: Train OWNER's building personnel in procedures for starting-up, testing, and operating natural gas engine-driven generator sets. In addition, train OWNER's personnel in periodic maintenance of batteries.

PERMANENT ENGINE-GENERATOR SCHEDULE

Load at starting: 5 KVA of server and network equipment load.

Load applied after the above starting load is running: 5KVA of server and communication equipment load.

Voltage Starting 120V/240V single phase..

<u>Accessories</u>	<u>Required</u>	<u>Remarks</u>
Engine Cooling Radiator	X	
Engine Cooling Heat		
Engine Cooling Remote Radiator:		
Horizontal Distance		Feet
Radiator Elevation Above or Below Engine		Feet
Coolant Heater	X	120volts
Enclosure	X	
Sound Attenuation**	X	
Fuel System		
Vertical Lift Distance		Feet
Horizontal Pumping		

Minimum Generator Size: 20 kW*

*Stated minimum does not release CONTRACTOR from successfully completing the load test.

PERMANENT ENGINE-GENERATOR SCHEDULE

(STATION NO.11)

Load at starting: 100HP booster pump operated thru a variable frequency drive

Load applied after the above starting load is running: 100P booster pump operated thru a variable frequency drive, 20KVA of miscellaneous load. Then, 7-15HP well pumps each started one at a time. Well pumps are started across the line.

Voltage Starting Type: 6-pulse variable frequency drive with input line reactor for the booster pumps

Accessories	Required	Remarks
Engine Cooling Radiator	X	
Engine Cooling Heat Exchanger		
Engine Cooling Remote Radiator:		
Horizontal Distance	Feet	
Radiator Elevation above or below Engine	Feet	
Coolant Heater	X	208volts single phase
Enclosure	X	
Sound Attenuation	X	

Minimum Generator Size: 600kW*

*Stated minimum does not release CONTRACTOR from successfully completing the load test.

END OF SECTION



PLANS

REMOTE STATION UPGRADES

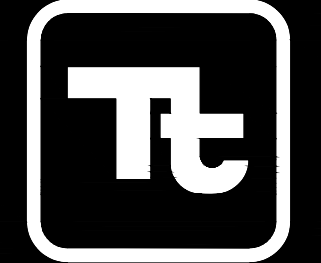
Bid Reference #: 91438-004.0

CITY OF KALAMAZOO, MICHIGAN

SEWAGE LIFT STATIONS ELECTRICAL, AND CONTROLS UPGRADES AUGUSTA-WEBSTER CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE

710 AVIS DRIVE
ANN ARBOR, MI 48108
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TETRA TECH

ELECTRICAL SHEETS

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- E-3 ELECTRICAL SITE ADDRESSES
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PROJECT LOCATION:

KALAMAZOO, MICHIGAN

CLIENT INFORMATION:

CITY OF KALAMAZOO

Tt PROJECT No.:

200-19743-21003

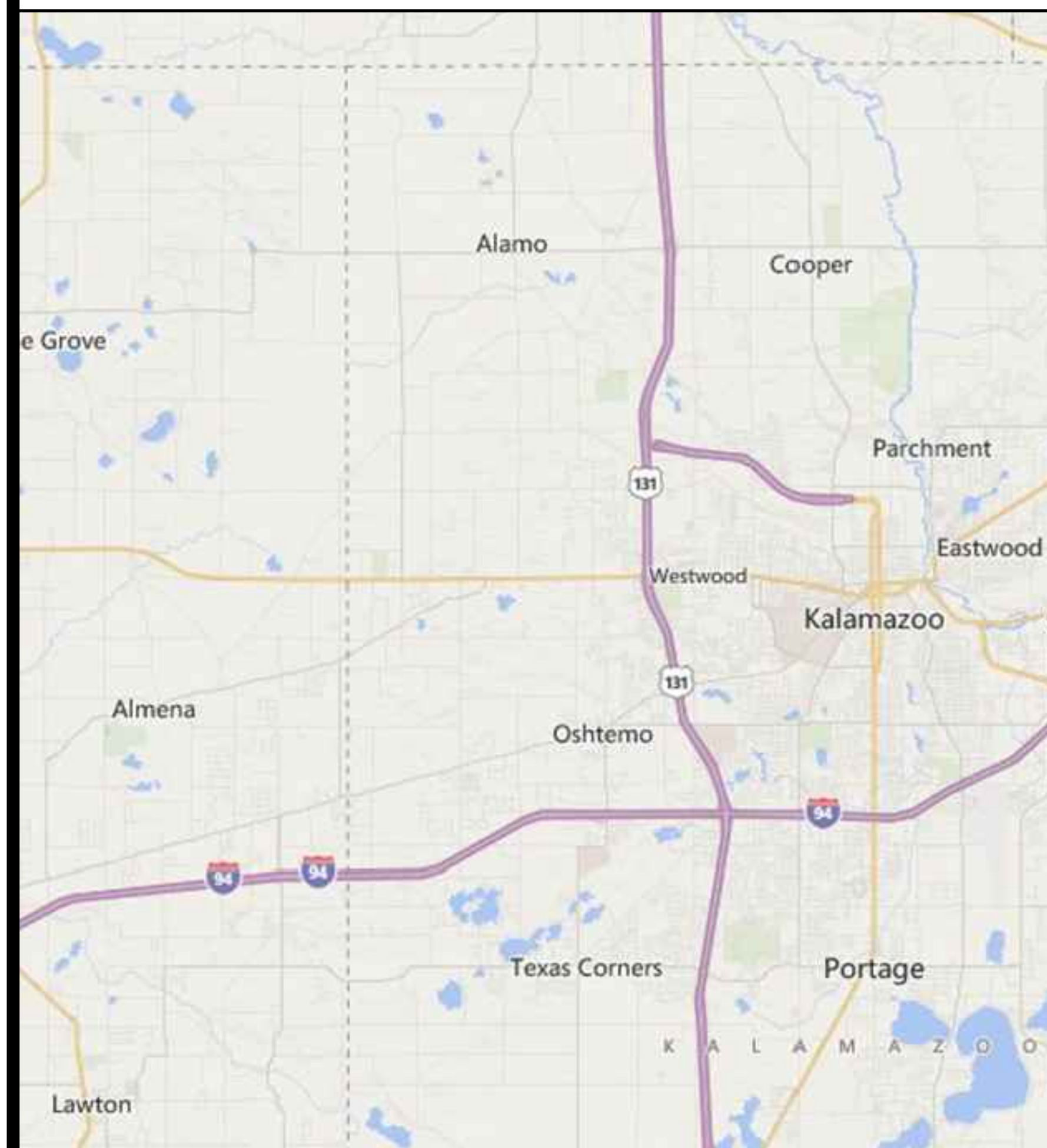
CLIENT PROJECT No.:

PROJECT DESCRIPTION / NOTES:

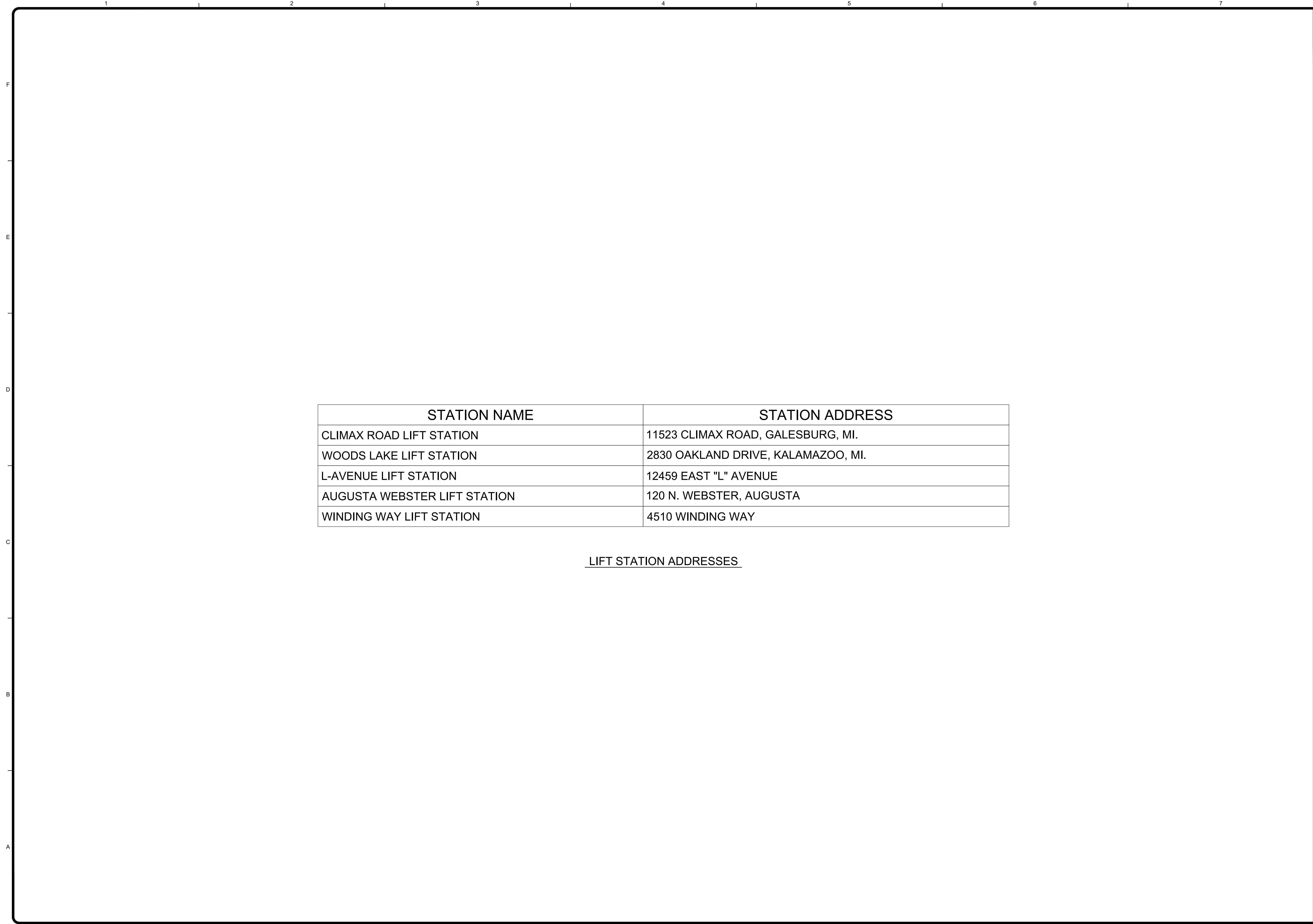
ISSUED:

OWNER REVIEW 10-15-21
OWNER REVIEW 11-4-21
OWNER REVIEW 1-27-22
FINAL OWNER REVIEW 2-18-22
QA/QC 4-27-22
FOR BIDDING AND CONSTRUCTION 4-28-22

VICINITY MAP:



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STATION NAME	STATION ADDRESS
CLIMAX ROAD LIFT STATION	11523 CLIMAX ROAD, GALESBURG, MI.
WOODS LAKE LIFT STATION	2830 OAKLAND DRIVE, KALAMAZOO, MI.
L-AVENUE LIFT STATION	12459 EAST "L" AVENUE
AUGUSTA WEBSTER LIFT STATION	120 N. WEBSTER, AUGUSTA
WINDING WAY LIFT STATION	4510 WINDING WAY

LIFT STATION ADDRESSES



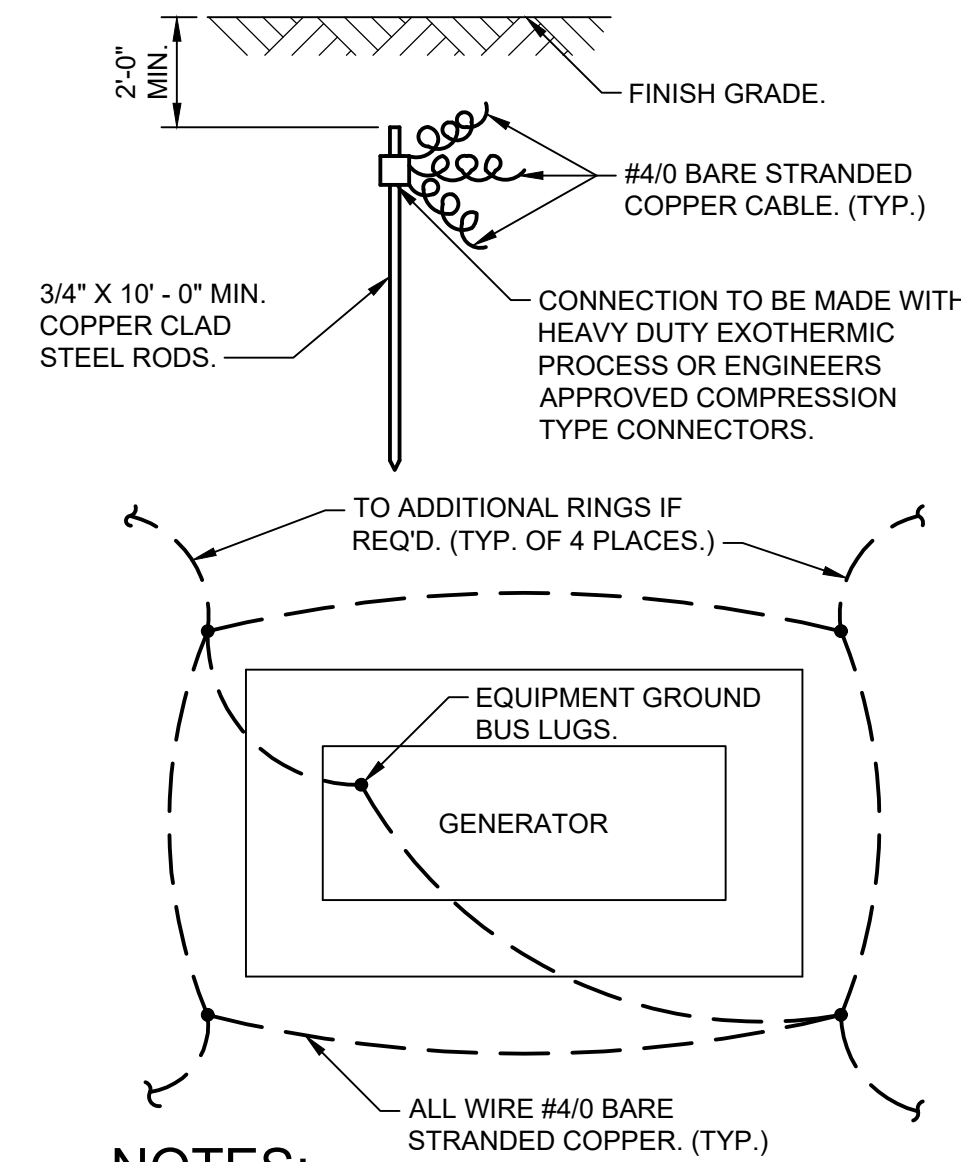
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CITY OF KALAMAZOO, MICHIGAN
 SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
 CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE
**ELECTRICAL
 SITE ADDRESSES**

Project No.: 200-19743-21003
 Designed By: GCJ
 Drawn By: JLS
 Checked By: MSJ/GCJ

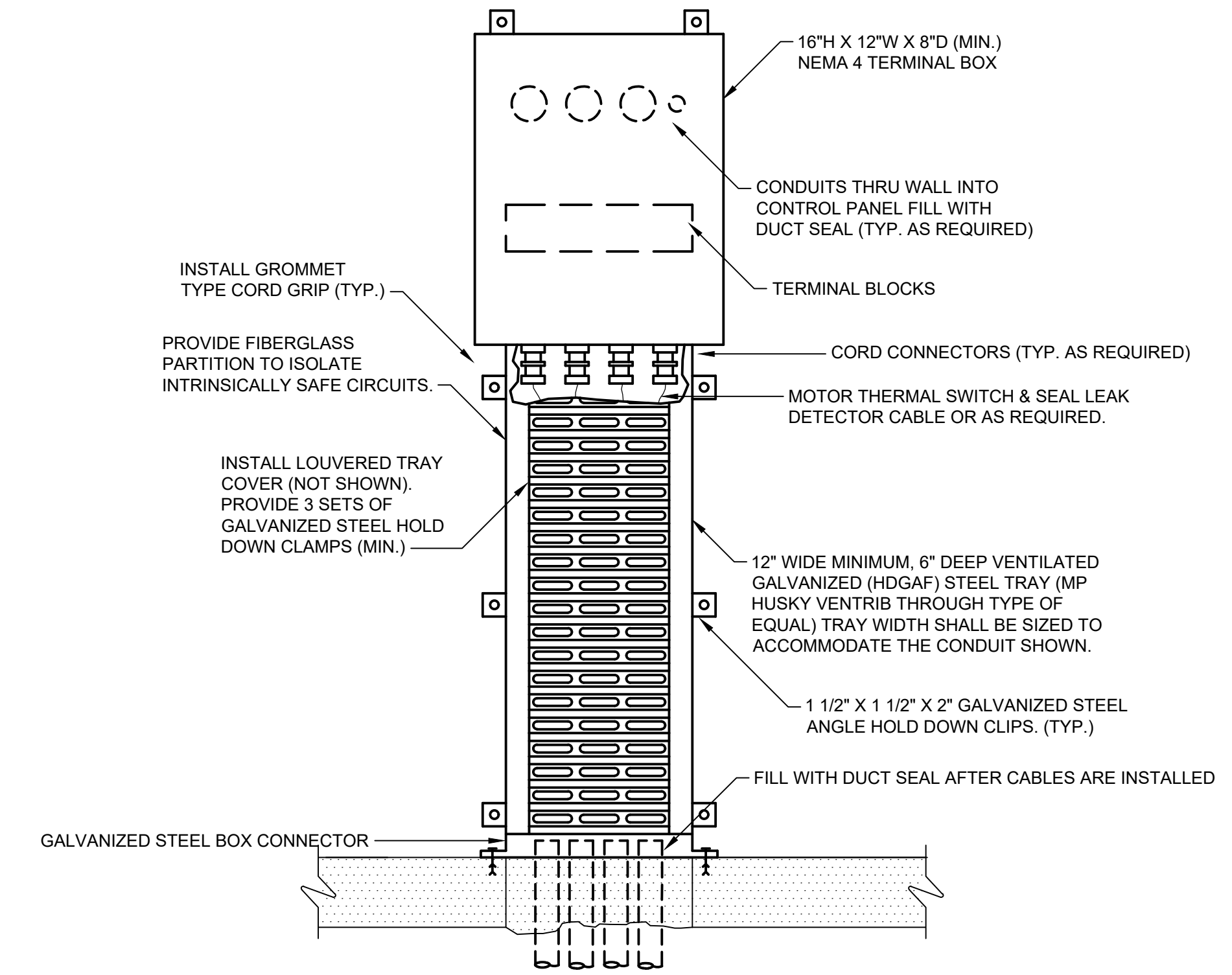
NOTES:

1. DEMOLISH THE EXISTING PUMP CONTROL PANEL AND TURN OVER TO OWNER.
2. REMOVE THE EXISTING LEVEL TRANSMITTER AND RELOCATE TO NEW PANEL/SUBPLATE.
3. REWORK EXISTING CONDUITS INTO SIDE, AND BOTTOM TO SUIT NEW PANEL INSTALLATION THAT ARE TO REMAIN.
4. RECONNECT EXISTING WIRES FOR POWER, CONTROL AND SIGNAL.
5. INSTALL NEW PVC-RMC CONDUITS BETWEEN WETWELL, AND VENTED TRAY. SEE EXISTING WETWELL PLAN BELOW, THIS SHEET.
6. INSTALL THREE (3) NEW VENTED TRAYS AS SHOWN. FROM EACH TRAY TERMINAL BOX, INSTALL PVC-RMC CONDUITS TO THE NEW PUMP CONTROL PANEL AS SHOWN. SEPARATE THE INTRINSICALLY SAFE CIRCUITS FOR LEVEL MEASUREMENT AND BACK-UP FLOATS AS REQUIRED. PROVIDE SEAL FITTINGS ON CONDUITS BETWEEN NEW PUMP CONTROL PANEL AND THE NEW TERMINAL BOXES/VENTED TRAYS.
7. INSTALL NEW 24 FT. 2" SCHEDULE 40 ALUMINUM MAST PIPE TO NEW STRUT RACK BESIDE NEW PCP. ROUTE CABLE FROM ANTENNA INTO SIDE OF PCP.
8. MOUNT YAGI ANTENNA AT TOP OF MAST PIPE. GROUND MAST PIPE WITH NO.6 AWG GREEN INSULATED RHW-USE GROUND WIRE.
9. SAWCUT EXISTING CONCRETE PAD AS REQUIRED FOR NEW CONDUITS. PATCH BACK TO ORIGINAL CONDITION.



NOTES:
ADDITIONAL CONCENTRIC RINGS SHALL BE ADDED AS REQ'D. TO MEET THE (5) OHM SPECIFIED RESISTANCE. EACH RING TO HAVE 4 GROUND RODS, AND SPACE 10 FEET FROM THE INNER RING.

GROUND MAT
NO SCALE



VENTED TRAY DETAIL (TYP. OF 3.)
PUMP NO. 1, PUMP NO. 2, AND CONTROLS.

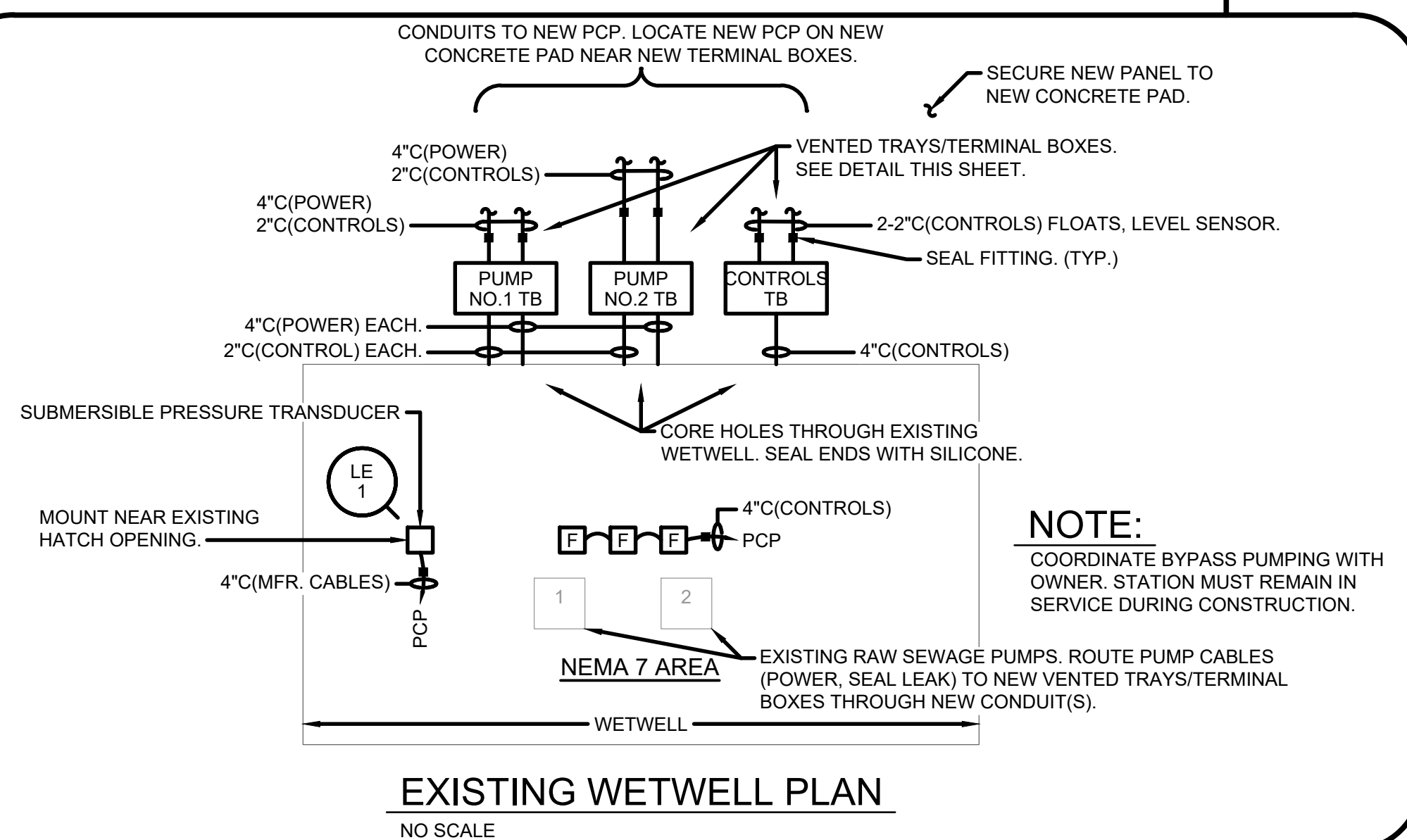
POUR NEW CONCRETE PAD 8" THICK BY 24" WIDE BY 72" LONG MINIMUM FOR NEW PANEL.

INSTALL NEW GROUND MAT, THIS AREA. BOND TO NEW PUMP CONTROL PANEL, RADIO PANEL, AND COAXIAL CABLE/MAST PIPE ON NEW WOOD POLE.



EXISTING FLOW METER CABINET BEHIND PANEL TO REMAIN. PROVIDE 1" (2/C#16SH) FROM METER PANEL TO PCP.

THE EXISTING SUPPORT RACK, ATS, MAIN DISCONNECT ARE TO REMAIN. THE EXISTING FLOWMETER TRANSMITTER ENCLOSURE ON THE BACKSIDE OF THE EXISTING RACK TO REMAIN. CONTRACTOR SHALL RE-WORK EXISTING CONDUITS FOR POWER, AND CONTROLS AS REQUIRED TO NEW PCP ENCLOSURE. VENTED TRAYS/TERMINAL BOXES SHALL BE LOCATED 10 FEET AWAY FROM EXISTING GENERATOR



EXISTING WETWELL PLAN
NO SCALE



CLIMAX LIFT STATION BACKGROUND PLAN PHOTOS
NO SCALE

NOTE:
COORDINATE BYPASS PUMPING WITH OWNER. STATION MUST REMAIN IN SERVICE DURING CONSTRUCTION.

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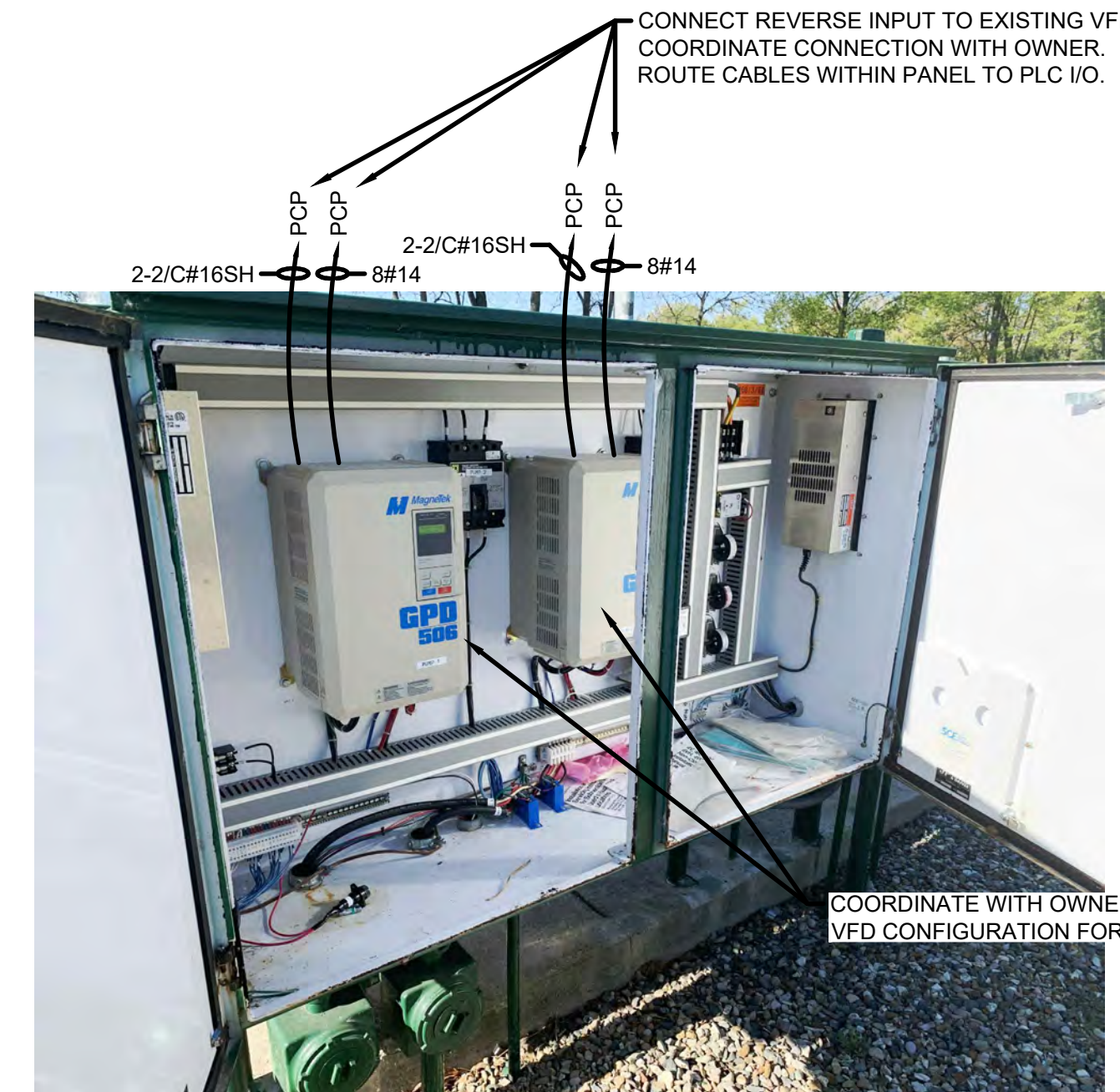
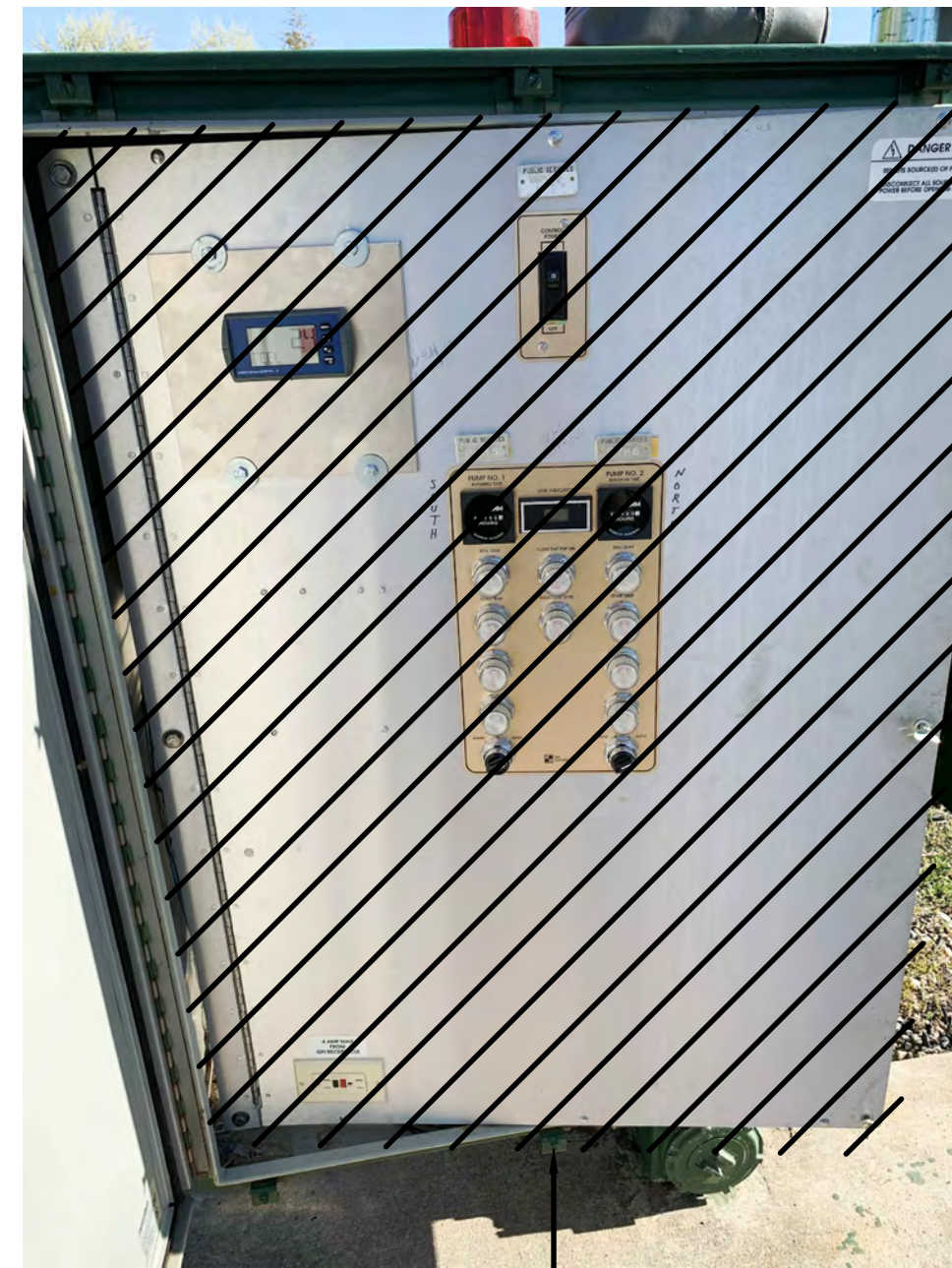
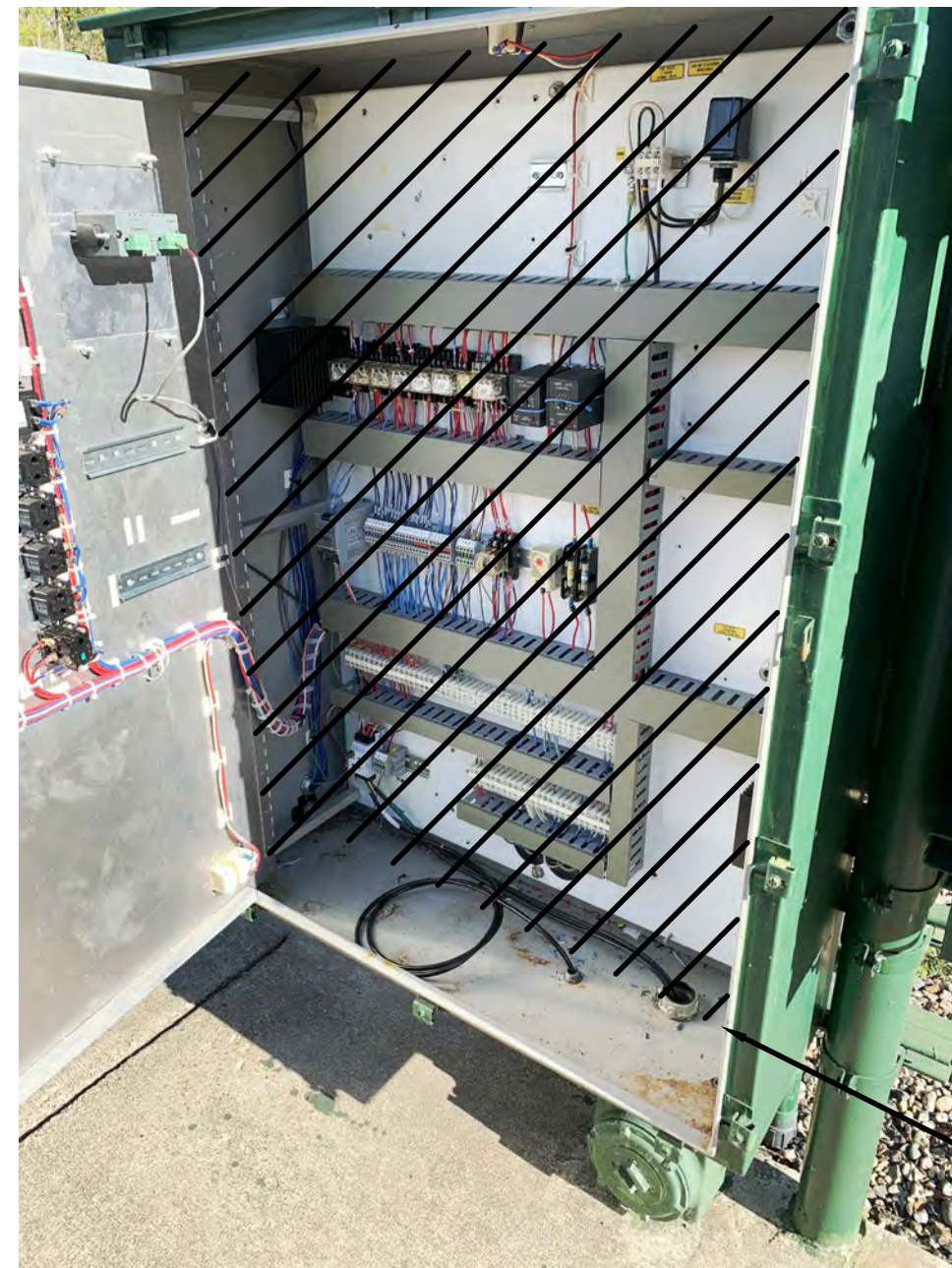
MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE
ELECTRICAL
CLIMAX LIFT STATION
BACKGROUND PLAN

Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

NOTES:

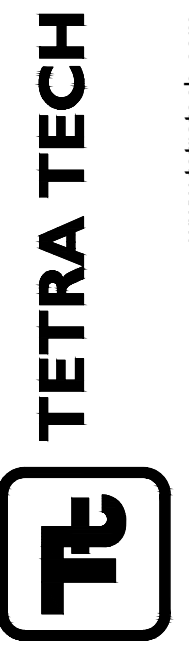
1. FURNISH AND INSTALL A NEW BACKPANEL AND INNER DOOR WITHIN THE EXISTING PUMP CONTROL SECTION CABINET.
2. REFER TO INSTRUMENTATION DRAWINGS FOR ADDITIONAL INFORMATION AND REQUIREMENTS.
3. INSTALL ANTENNA AT TOP OF NEW 80 FOOT WOOD POLE. (WOOD POLE BY OWNER) ROUTE CABLE UP POLE, AND SECURE AS REQUIRED. CABLE, AND GROUND KITS/WEATHERPROOF KITS ARE FURNISHED BY CONTRACTOR, INSTALLED BY CONTRACTOR. 80 FOOT WOOD POLE IS FURNISHED AND INSTALLED BY OWNER. ANTENNA IS FURNISHED BY OWNER, INSTALLED BY CONTRACTOR.
4. INSTALL NEW RADIO PANEL AT BASE OF POLE. INSTALL NEW 2 - 1 INCH PVC-RMC CONDUITS FOR POWER AND FIBER TO NEW PUMP CONTROL PANEL 1" (3#12.6#14), 1" (2 - 50-MICRON DUPLEX FIBER ZIP CORDS). FROM RADIO PANEL AT POLE. DISTANCE FROM POLE TO PANEL (100 FT.)
5. SAWCUT EXISTING CONCRETE PAD AS REQUIRED FOR NEW CONDUITS. PATCH BACK TO ORIGINAL CONDITION.



INSTALL NEW SUBPLATE, AND INTERIOR DOOR WITHIN EXISTING PANEL. FIELD MEASURE EXISTING PANEL, AND INSTALL NEW SUBPLATES, AND DOOR TO SUIT EXISTING PANEL DIMENSIONS. SEE SHEETS I-17 THROUGH I-21 FOR ADDITIONAL INFORMATION. RELOCATE EXISTING SEAL LEAK/MOTOR TEMPERATURE RELAYS TO NEW PANEL. RE-POWER, AND CONDUIT TO NEW PLC INPUTS.

NOTE:
COORDINATE BYPASS PUMPING WITH OWNER. STATION MUST REMAIN IN SERVICE DURING CONSTRUCTION.

L-AVENUE LIFT STATION PHOTOS



www.tetrattech.com
710 AVIS DRIVE
ANN ARBOR, MI 48108
PHONE: (734) 665-6000 FAX: (734) 213-3003

MARK	DATE	DESCRIPTION	BY

CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE
**ELECTRICAL
L-AVENUE LIFT STATION
BACKGROUND PLAN**

Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

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NOTES:

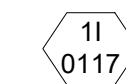
- FIELD VERIFY CONDUIT ROUTING AT SEWAGE LIFT STATIONS WITH OWNER. CORE HOLES AS REQUIRED TO SUIT INSTALLATION OF THE CONDUITS SHOWN. PATCH WITH NON-SHRINK GROUT.
- TURN OVER TO OWNER AT PROJECT COMPLETION OPERATION AND MAINTENANCE MANUALS (QUANTITY AS SPECIFIED) TO OWNER.

GENERAL CONSTRUCTION NOTES:

- ELECTRICAL MATERIALS AND EQUIPMENT ITEMS SHOWN IN LIGHT LINE WEIGHTS ON THE DRAWINGS ARE EXISTING ITEMS TO REMAIN. ELECTRICAL MATERIALS AND EQUIPMENT ITEMS SHOWN IN HEAVY LINE WEIGHTS ARE NEW THIS CONTRACT.
- ITEMS SHOWN OR NOTED TO BE DEMOLISHED ON THE DRAWINGS ARE EXISTING ITEMS TO BE REMOVED FROM SITE BY CONTRACTOR UNLESS NOTED TO BE TURNED OVER TO OWNER.
- FOR ITEMS INDICATED AS "FIELD LOCATE", THE CONTRACTOR SHALL FIELD VERIFY FOR INTERFERENCE AND FOR LOCATIONS OF MOUNTING FLANGES, CONNECTION POINTS, ETC.
- CONDUIT ROUTINGS SHOWN ON BACKGROUND PLANS ARE INTENDED ROUTINGS ONLY. EXACT CONDUIT ROUTINGS FOR CONDUITS, AND LENGTH SHALL BE FIELD LOCATED AND VERIFIED BY THE CONTRACTOR. COORDINATE CONDUIT ROUTING IN FINISHED AREAS WITH OWNER. CONDUIT TO BE CONCEALED IN THESE AREAS.
- REFER TO THE CABLE MANUFACTURER'S RECOMMENDATIONS FOR MINIMUM BEND RADIUS FOR FIBER OPTIC CABLES. INSTALL NEW PULL BOXES (PB) AS REQUIRED FOR CONDUITS. SIZE PULL BOXES AS REQUIRED PER FIBER OPTIC CABLE MANUFACTURERS RECOMMENDATIONS.
- CONDUITS/RACEWAYS, PULL BOXES AND JUNCTION BOXES TO BE INSTALLED WITH 316 STAINLESS STEEL CHANNEL STRUT. MINIMUM STRUT LENGTH TO BE 12 INCHES, WHERE POSSIBLE.
- PANELS SHALL BE MOUNTED OFF WALLS WITH STRUT, CONDUITS SHALL BE MOUNTED ON STRUT INCLUDING SINGLE RUNS.
- CONDUIT ENTERING CONTROL PANELS AND ELECTRICAL EQUIPMENT ENCLOSURES SHALL BE FILLED WITH DUCT SEAL, INCLUDING OPENINGS IN BOTTOM OF PANELS, AND EQUIPMENT.
- REPAIR SIDEWALKS AND ROADWAYS DUE TO SITE WORK ADDITIONS, THE EXTENT OF THE REPAIR REQUIRED SHALL BE FIELD VERIFIED PRIOR TO BIDS IN CONJUNCTION WITH THE WORK SHOWN IN THE CONTRACT DOCUMENTS. PRIOR TO TRENCHING, FIELD LOCATE EXISTING GAS LINES, TELEPHONE LINES, SPRINKLER LINES, ETC. COORDINATE WITH OWNER
- PULL CORDS SHALL BE INSTALLED IN CONDUITS CONTAINING NETWORK CABLES, AND FIBER OPTIC CABLES.
- CORE HOLES AS REQUIRED TO SUIT INSTALLATION OF CONDUIT AND WIRING/CABLING AS SHOWN. FIELD VERIFY EXACT EXTENT OF WORK REQUIRED.
- FURNISH PULL BOXES FOR FIBER OPTIC CABLE. COORDINATE EXACT BENDING RADIUS WITH MANUFACTURER.
- NEW CONDUITS INSTALLED THIS CONTRACT WITH FIBER OPTIC CABLES ARE TO BE LABELED WITH PHENOLIC TAGS (AT BEGINNING TO END) TO INDICATE THE NUMBER OF STRANDS, ORIGINATION AND DESTINATION. TAGS TO BE COLOR CODED ORANGE FOR MULTIMODE.
- WHERE NEW CONDUITS SHOWN TO BE INSTALLED PASS UNDER ROADWAYS, CONDUITS SHALL BE CONCRETE ENCASED.
- PRIOR TO EXCAVATION, FIELD LOCATE EXISTING UTILITIES. COORDINATE WITH OWNER.
- AREAS WHERE CAMERAS ARE SHOWN TO BE INSTALLED SHALL BE CLASSIFIED AS NEMA 4, UNLESS CALLED OUT OTHERWISE.
- THE ASSOCIATED INSTRUMENTATION DRAWINGS SHOW EXISTING WIRES AND TERMINAL NUMBERS REQUIRED TO PROPERLY INTERFACE WITH NEW EQUIPMENT. THIS INFORMATION WAS COLLECTED FROM AS-BUILT DRAWINGS AND EXTENSIVE FIELD VERIFICATION. THE INFORMATION SHALL BE USED AS A GUIDE IN RE-TERMINATION. IT SHALL REMAIN THE CONTRACTOR'S RESPONSIBILITY TO EXAMINE THE WIRING AND TO REVISE TO SUIT AS REQUIRED. CHANGES IN THE CONTRACT OR COST WILL NOT BE GRANTED FOR THIS COORDINATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO EXAMINE PROPOSED WORK SHOWN.
- CONDUIT ROUTINGS SHOWN ON BACKGROUND PLANS ARE PROPOSED ROUTINGS ONLY. EXACT CONDUIT ROUTINGS AND LENGTH SHALL BE FIELD LOCATED AND VERIFIED BY THE CONTRACTOR. COORDINATE CONDUIT ROUTING IN FINISHED AREAS WITH OWNER. CONDUIT TO BE CONCEALED IN THESE AREAS.
- RACEWAYS, PULL BOXES AND JUNCTION BOXES TO BE INSTALLED WITH 316 STAINLESS STEEL FASTENERS SUPPORTS, AND THREADED ROD, ETC. (CHANNEL STRUT TO ALSO BE STAINLESS STEEL). MINIMUM STRUT LENGTH TO BE 12 INCHES, WHERE POSSIBLE. TYPICAL FOR NEMA 12, 4, AND 7 AREAS.
- WIRING FOR STARTERS SHALL BE IN ACCORDANCE WITH NEMA CLASS II B STANDARDS. SUBMIT ENGINEERED SHOP DRAWINGS FOR ALL STARTERS SHOWN TO BE WIRED.
- WIRE NUMBERS (1, 3, 5, ETC.) SHALL BE PREFIXED WITH STARTER TAG NUMBERS. THE WIRE NUMBER AFTER THE PREFIX SHALL BE THE MANUFACTURER'S WIRE NUMBERING SYSTEM. WIRE MARKERS SHALL BE USED AT EACH WIRE TERMINATION POINT.
- IN AREAS WHERE EQUIPMENT AND CONDUIT IS REMOVED, REPAIR WALL AND FLOOR SURFACES AS REQUIRED TO MATCH SURROUNDING AREA. WHERE DEVICES ARE REMOVED FROM CONCEALED BOXES, FURNISH AND INSTALL A BLANK COVER ON THE BOX.
- FIBER OPTIC CABLE SHALL BE AS CALLED OUT ON SYSTEM CONFIGURATION DRAWINGS, SINGLE MODE, ALL DIELECTRIC, SUITABLE FOR INSTALLATION UNDERGROUND IN WET CONDUIT.

GENERAL NOTES:

- PRIOR TO SUBMITTING A BID FOR THE WORK DETAILED UNDER THIS CONTRACT, BIDDER SHALL VISIT THE SEWAGE LIFT STATIONS. THE BIDDER SHALL FULLY ACQUAINT ONESELF WITH EXISTING FIELD CONDITIONS AT EACH SITE. NO BULLETINS WILL BE WRITTEN FOR WORK DUE TO LACK OF VERIFICATION OF EXISTING SITE CONDITIONS AND WIRING.
- NO WIRES SHALL BE TERMINATED TO TERMINAL STRIPS, OR OTHER EQUIPMENT WITHOUT FIRST VERIFYING SIGNAL TYPE. DAMAGES RESULTING IN LACK OF VERIFICATION SHALL BE BORNE BY THE CONTRACTOR. CONTRACTOR SHALL COORDINATE SIGNAL TYPE AND VOLTAGE WITH I/O CARDS SHOWN.
- WITHIN CONTROL PANELS, NAMEPLATES SHALL BE PROVIDED TO INDICATE DIFFERENT VOLTAGE LEVELS WITHIN PANELS. ALSO, A NAME TAG (YELLOW BACKGROUND, RED LETTERING) SHALL BE LOCATED ON THE FRONT OF EVERY PANEL INDICATING THAT WHEN MAIN PANEL DISCONNECTED 120V IS STILL PRESENT FROM FIELD DEVICES (YELLOW WIRING/ISOLATED INPUT CARDS.)
- PHENOLIC TAGS ON FACE OF CONTROL PANELS TO HAVE WHITE BACKGROUND AND BLACK LETTERING (EXCEPT WARNING TAGS; YELLOW BACKGROUND RED LETTERING).
- PROVIDE SAFETY COVERS ON ALL 480V MOLDED CASE MAIN CIRCUIT BREAKERS TO INSULATE THE INCOMING CABLES AND SIDE CONDUCTORS FROM CONTACT. (TYP. FOR CONTROL PANELS.) PROVIDE BREAKER LOCKS FOR PUMP CIRCUIT BREAKERS (MCP) AND MAIN PANEL BREAKERS.
- REFER TO WIRING DIAGRAMS FOR ADDITIONAL INFORMATION ON ISOLATED I/O. A COMMON NEUTRAL MAY BE USED FOR SEVERAL ISOLATED INPUTS FROM THE SAME STARTER. PROVIDE NEUTRAL JUMPERS WIRES WITHIN THE PANEL AS REQUIRED.
- ELECTRICAL MATERIALS AND EQUIPMENT ITEMS SHOWN IN LIGHT LINE WEIGHTS ON THE DRAWINGS ARE EXISTING ITEMS TO REMAIN. ELECTRICAL MATERIALS AND EQUIPMENT ITEMS SHOWN IN HEAVY LINE WEIGHTS ARE NEW THIS CONTRACT.
- ITEMS SHOWN CROSSHATCHED (OR NOTED TO BE DEMOLISHED) ON THE DRAWINGS ARE EXISTING ITEMS TO BE REMOVED, FROM SITE BY CONTRACTOR.
- INSTALL A SINGLE CONDUCTOR INSULATED (RHW, THHN, OR XHHW) COPPER GROUND WIRE IN EACH CONDUIT, SIZE AS SHOWN ON DRAWINGS, OR AS A MINIMUM PER THE NATIONAL ELECTRICAL CODE. THIS GROUND WIRE SHALL BE CONNECTED AT EACH END TO THE EQUIPMENT GROUND. THIS ALSO INCLUDES INSTRUMENTATION DEVICES SUCH AS LEVEL, PRESSURE, FLOW TRANSMITTERS, LIMIT SWITCHES, CONDUITS, NETWORK AND I/O CABLES.
- THE FOLLOWING EXAMPLE COMPONENT IDENTIFICATION SHALL BE USED AS APPROPRIATE:
 (F) FIELD MOUNTED, NOT AT STARTER OR OTHER CONTROL PANELS
 (S) STARTER PANEL MOUNTED
 (MCP) AT MAIN CONTROL PANEL
 (1) AT CONTROL PANEL NO.1
 (2) AT CONTROL PANEL NO.2
 (TCP) AT TEMPERATURE CONTROL PANEL
- REFER TO DETAIL SHEETS. CONTRACTOR SHALL FURNISH AND INSTALL HARDWARE AND APPURTENANCES (I.E. PIPE TAPS, WETWELL BUBBLER TUBES, VALVES, COPPER TUBING, BALL VALVES, PNEUMATIC PIPING, SPOOL PIECES, ETC.) FOR FIELD DEVICES SHOWN (FLOWMETERS, PRESSURE TRANSMITTERS, LEVEL TRANSMITTERS, ETC.). WORK SHALL BE COORDINATED WITH OTHER TRADES (MECHANICAL INSTRUMENTATION, ETC.) CONTRACTOR SHALL BE RESPONSIBLE FOR SYSTEM COORDINATION AND INSTALLATION.
- ETHERNET AND FIBER OPTIC TERMINATIONS SHALL BE PERFORMED BY A QUALIFIED REPRESENTATIVE OF CABLE MANUFACTURER. THE CABLES SHALL BE TESTED. NO SPLICING SHALL BE PERMITTED OF FIBER OPTIC CABLES, BETWEEN PANELS. FIBERS SHALL BE TERMINATED AT PATCH PANELS, INCLUDING SPARES.
- REFER TO THE CABLE MANUFACTURER'S RECOMMENDATIONS FOR MINIMUM BEND RADIUS FOR FIBER OPTIC CABLES. INSTALL NEW PULL BOXES (PB) AS REQUIRED FOR CONDUITS. SIZE PULLBOXES AS REQUIRED PER FIBER OPTIC CABLE MANUFACTURERS RECOMMENDATIONS.
- CONDUIT ENTERING CONTROL PANELS AND ELECTRICAL EQUIPMENT ENCLOSURES SHALL BE FILLED WITH DUCT SEAL, INCLUDING OPENINGS IN BOTTOM OF PANEL.
- CABLES (INCLUDING FIBER, ETHERNET, CONTROL WIRE, ETC.) WHERE PASSING THROUGH A PULLBOX SHALL BE LABELED AND COMPLETELY IDENTIFIED WITH IDENTIFICATION NUMBERS AND ORIGINATION/DESTINATION. THIS ALSO INCLUDES ALL CABLE BUNDLES ENTERING CONTROL PANELS, PULLBOXES, ETC.
- CONTROL WIRES SHALL BE TAGGED WITH THE PLC I/O ADDRESS IN THE FIELD AND AT THE PANEL.
- THE FIELD DEVICES SHOWN ON THE P&ID'S, ELECTRICAL BACKGROUNDS, AND DETAILS SHEETS MAKEUP THE FIELD DEVICE EQUIPMENT REQUIREMENTS. NOT ALL FIELD DEVICES REQUIRED ARE SHOWN ON THE P&ID'S.
- UPS SELECTED SHALL BE COMPATIBLE WITH ISOLATION TRANSFORMERS. (TYP.)
- REFER TO I/O DRAWING LAYOUT FOR ADDITIONAL SIGNALS NOT SHOWN ON P&ID FLOW DIAGRAMS.



PROCESSOR NO.1, INPUT RACK 0, SLOT (OR GROUP) 1, BIT 18

EXAMPLE OF P&ID I/O SYMBOL

NOTE: THE PLC I/O ADDRESS SHALL BE USED AS THE WIRING TAG SCHEME FOR ALL PANEL AND FIELD CONTROL WIRING. COORDINATE WITH ELECTRICAL CONTRACTOR.

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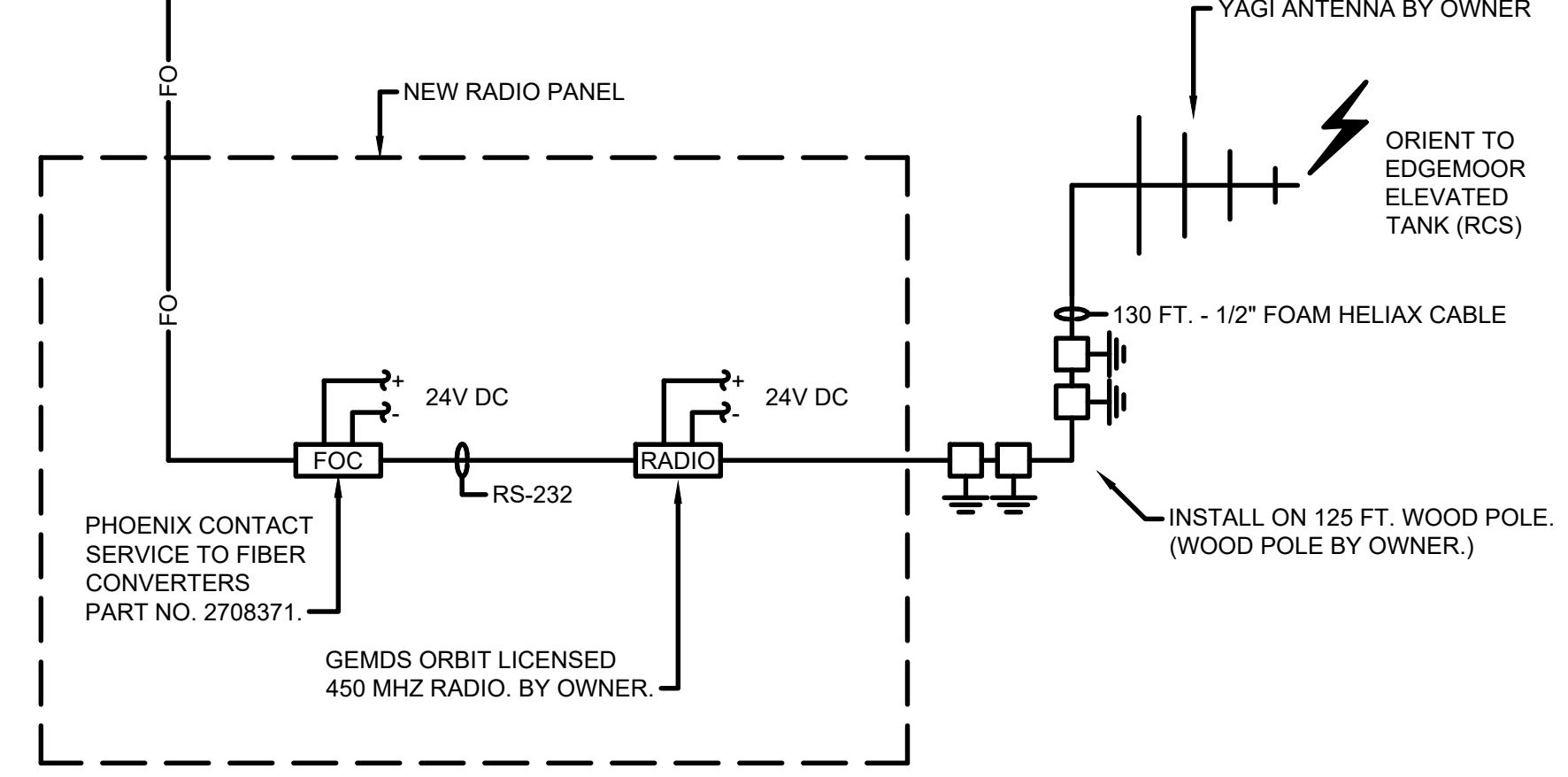
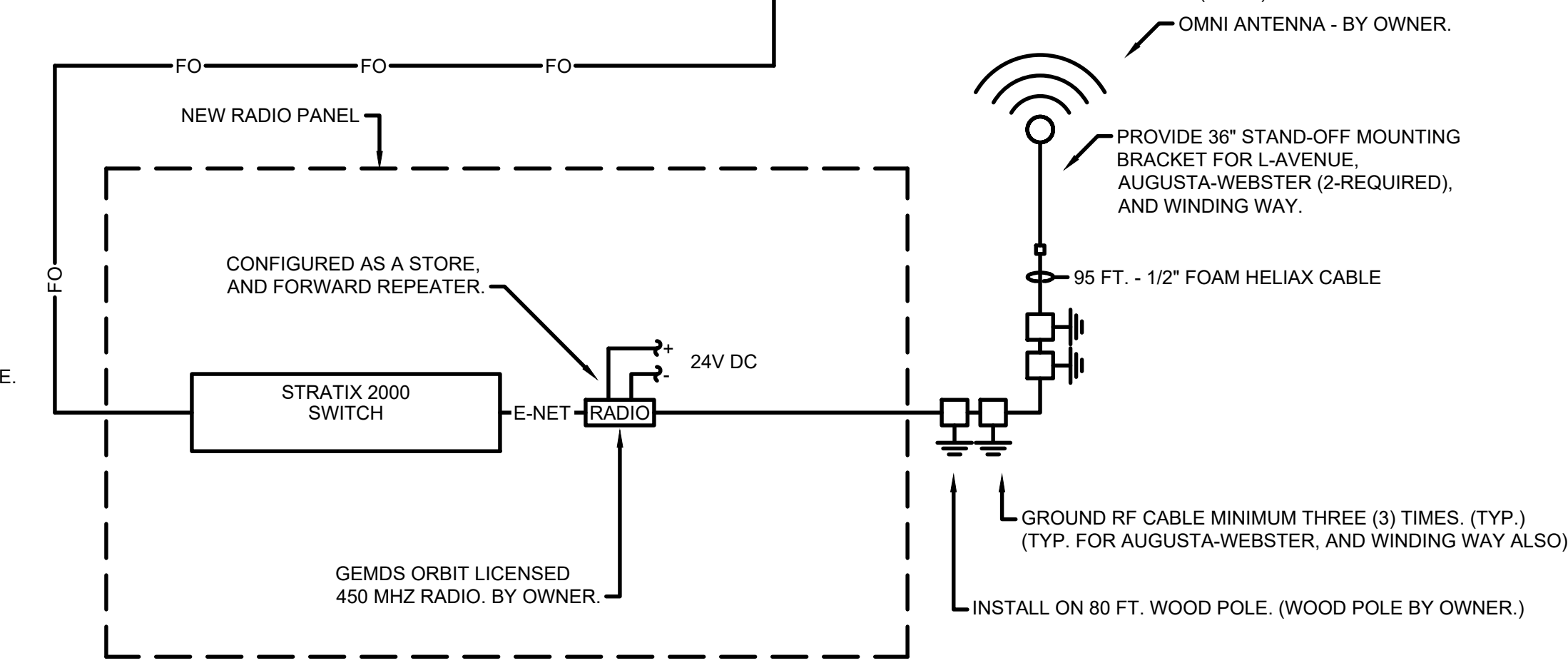
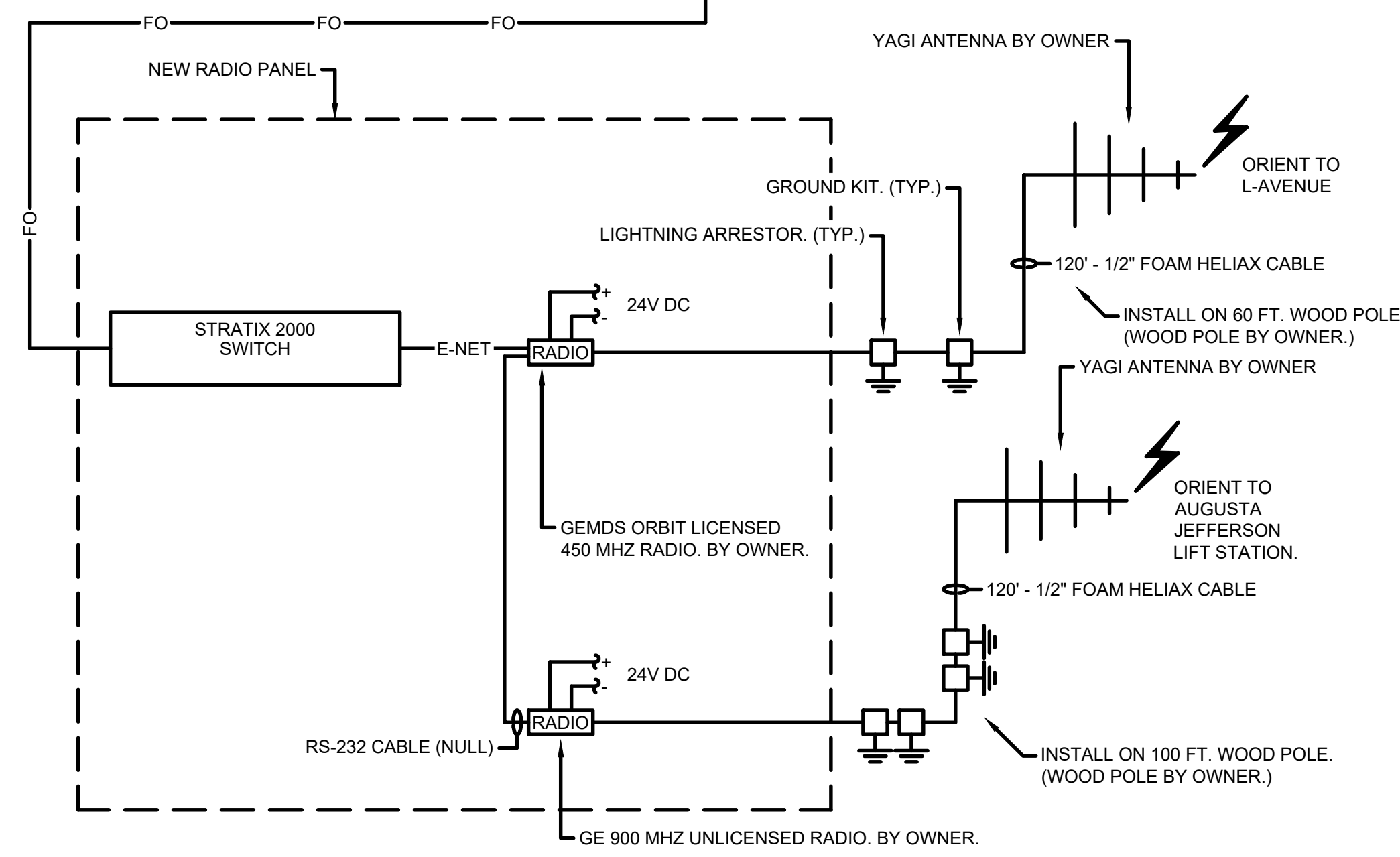
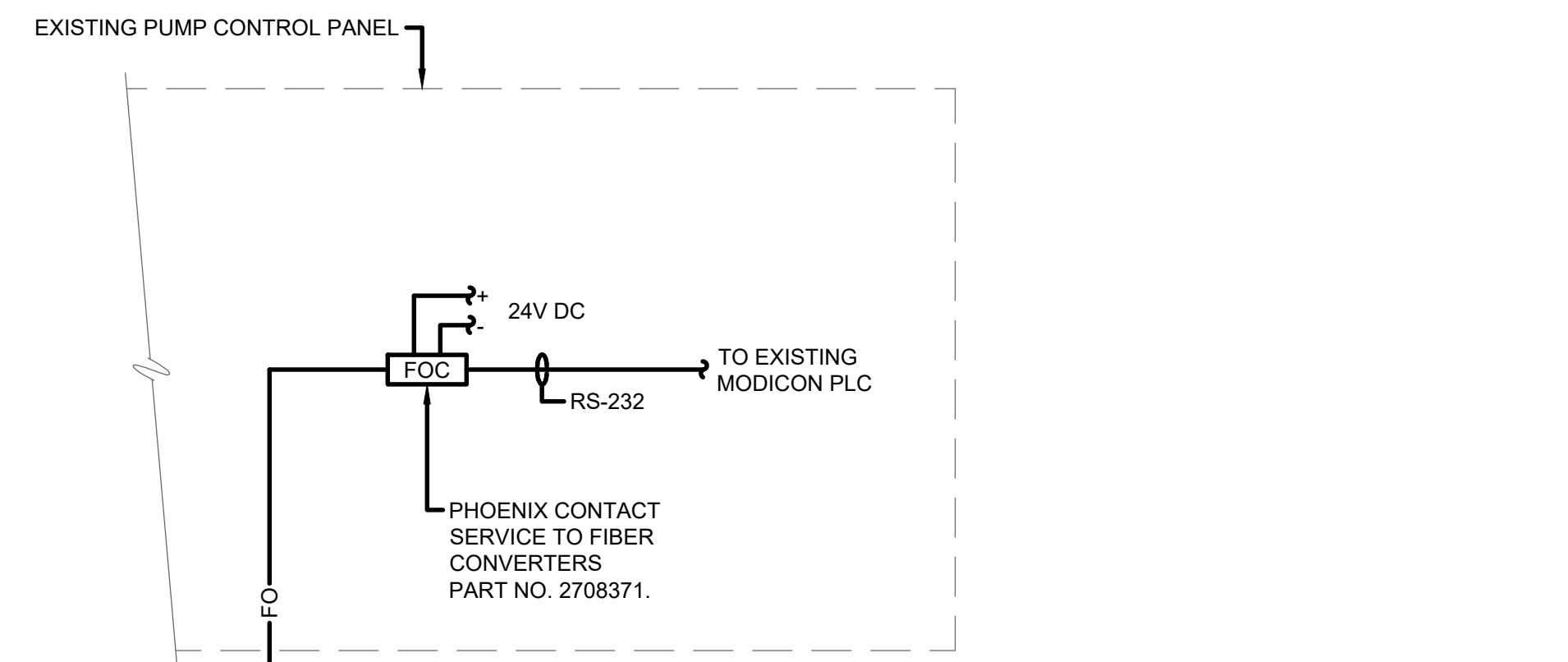
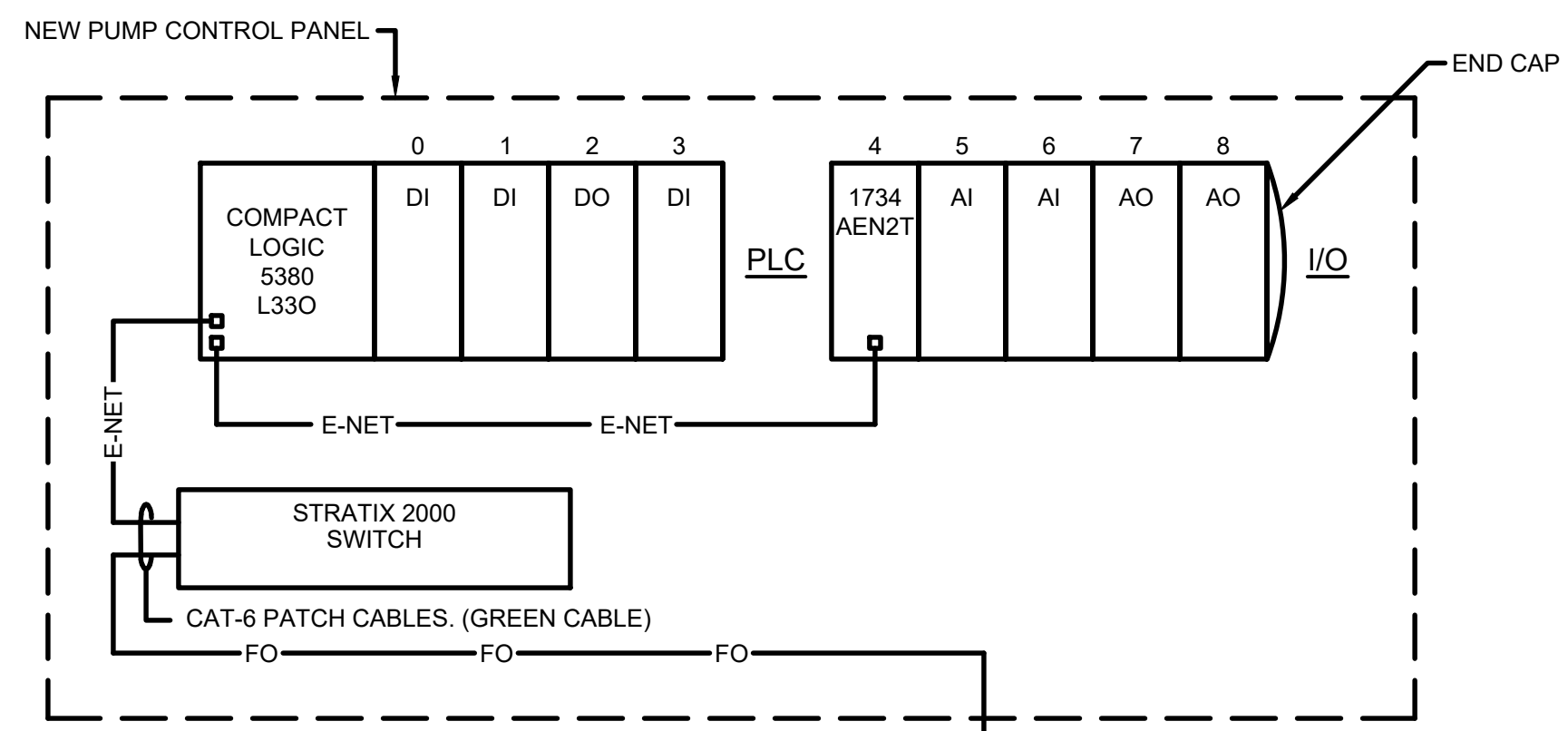
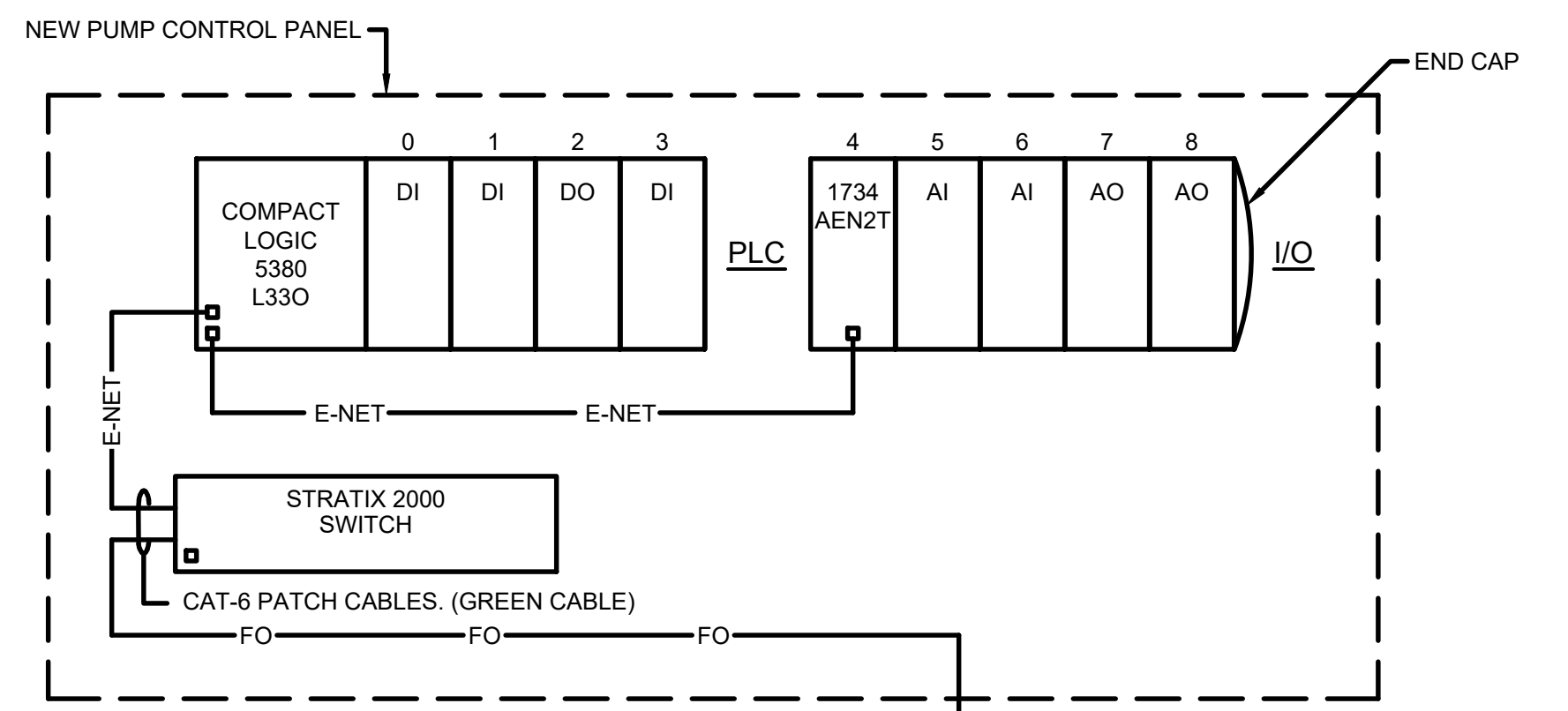
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MARK	DATE	DESCRIPTION	BY

CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
CLIMAX, LA AVENUE, WINDING WAY, WOODS LAKE
INSTRUMENTATION NOTES

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MS.J/G.C.J.

2/25/2022 3:32:04 PM - \\TT.LOCAL\IERPROJECTS\ANN ARBOR\IER19743\200-19743-21003\CAD\SHEETFILES\IEPUMP STATIONS\3_Sys CONF DWG - SHANK, JASON

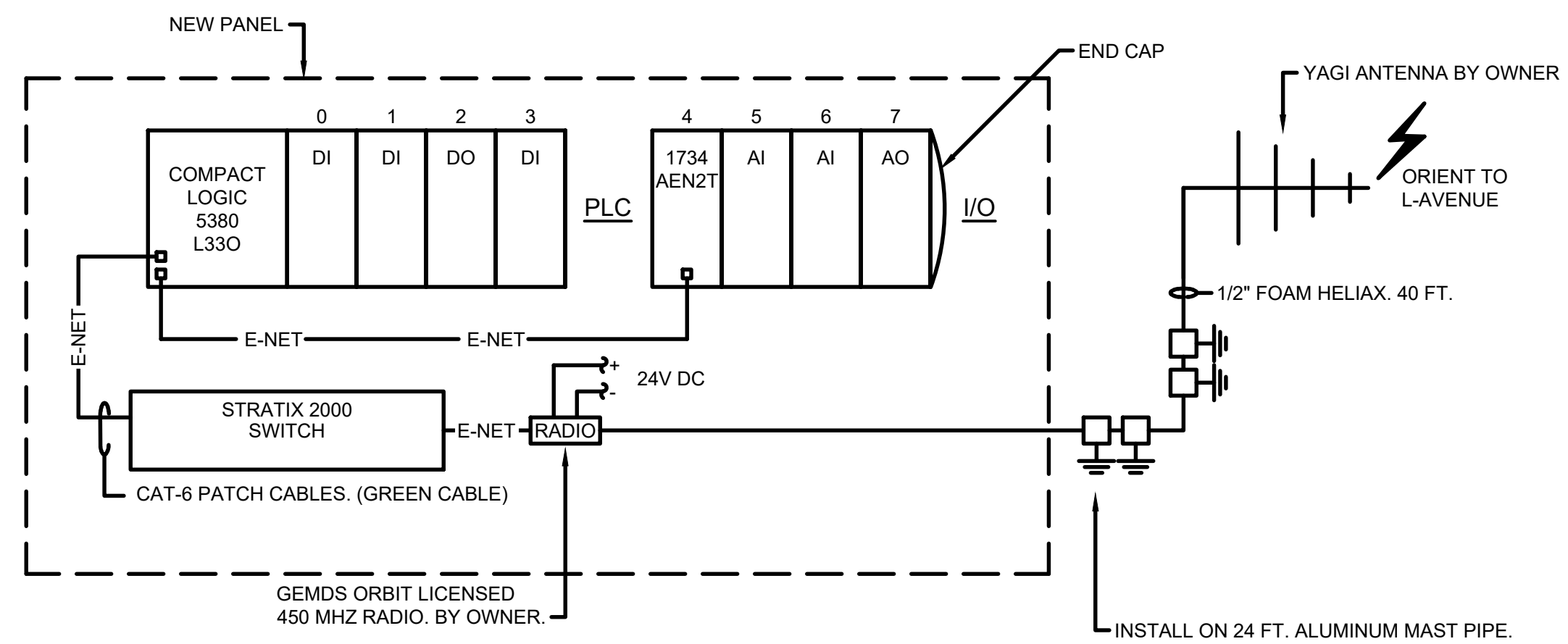
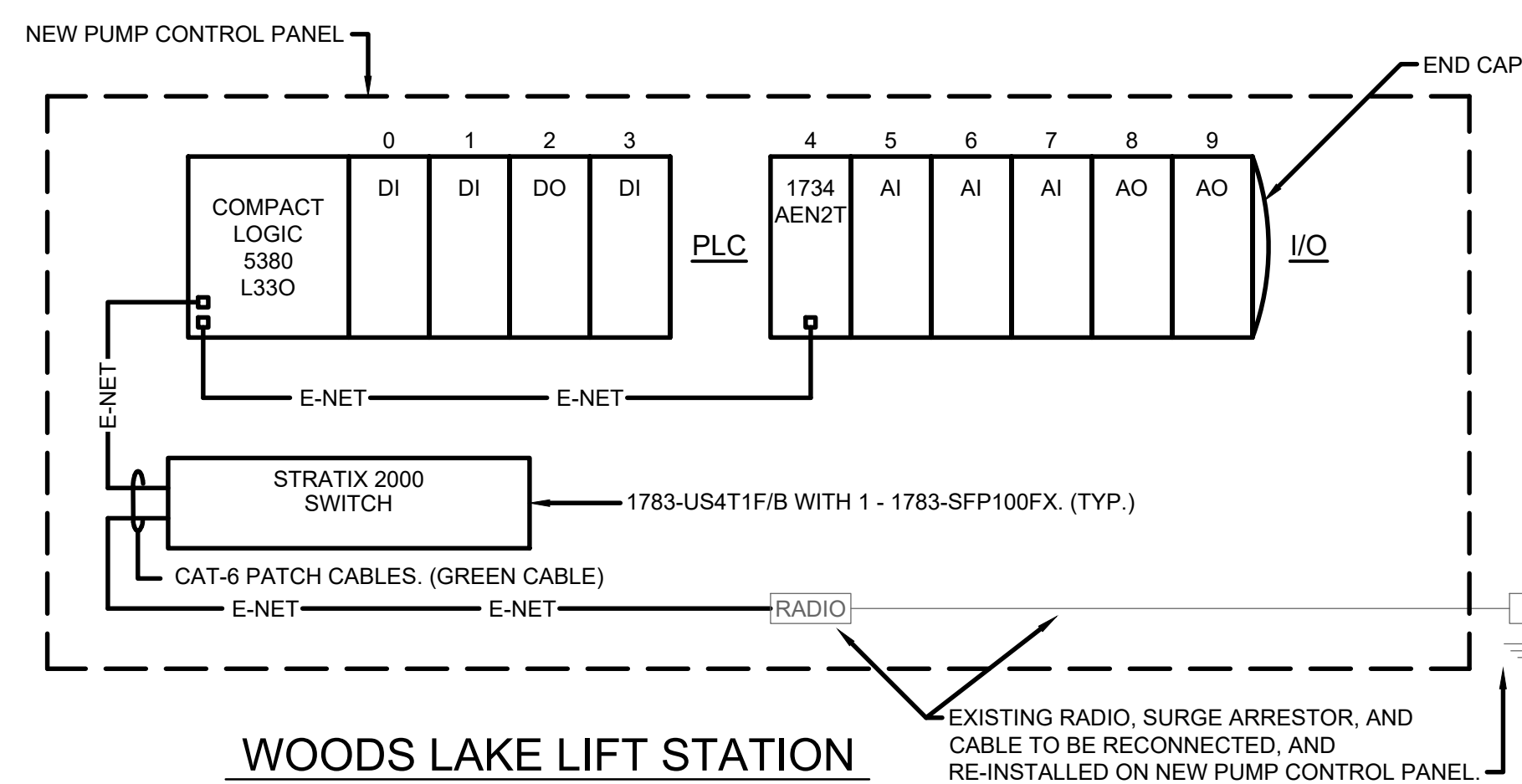


AUGUSTA - WEBSTER LIFT STATION

L-AVENUE LIFT STATION

WINDING WAY LIFT STATION

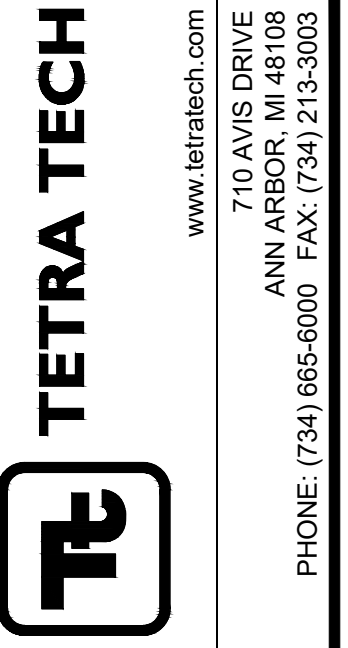
CONTRACTOR SHALL PROVIDE POWER TERMINAL REMOVABLE TERMINAL BLOCKS (RTB) KIT, SCREW TYPE (RTB'S), AND 1734-TOP TERMINAL BASE AS REQUIRED. (TYP.)



WOODS LAKE LIFT STATION

CLIMAX LIFT STATION

NOTE:
PLC PROGRAMMING, AND RADIO PROGRAMMING BY OWNER/TETRATECH.

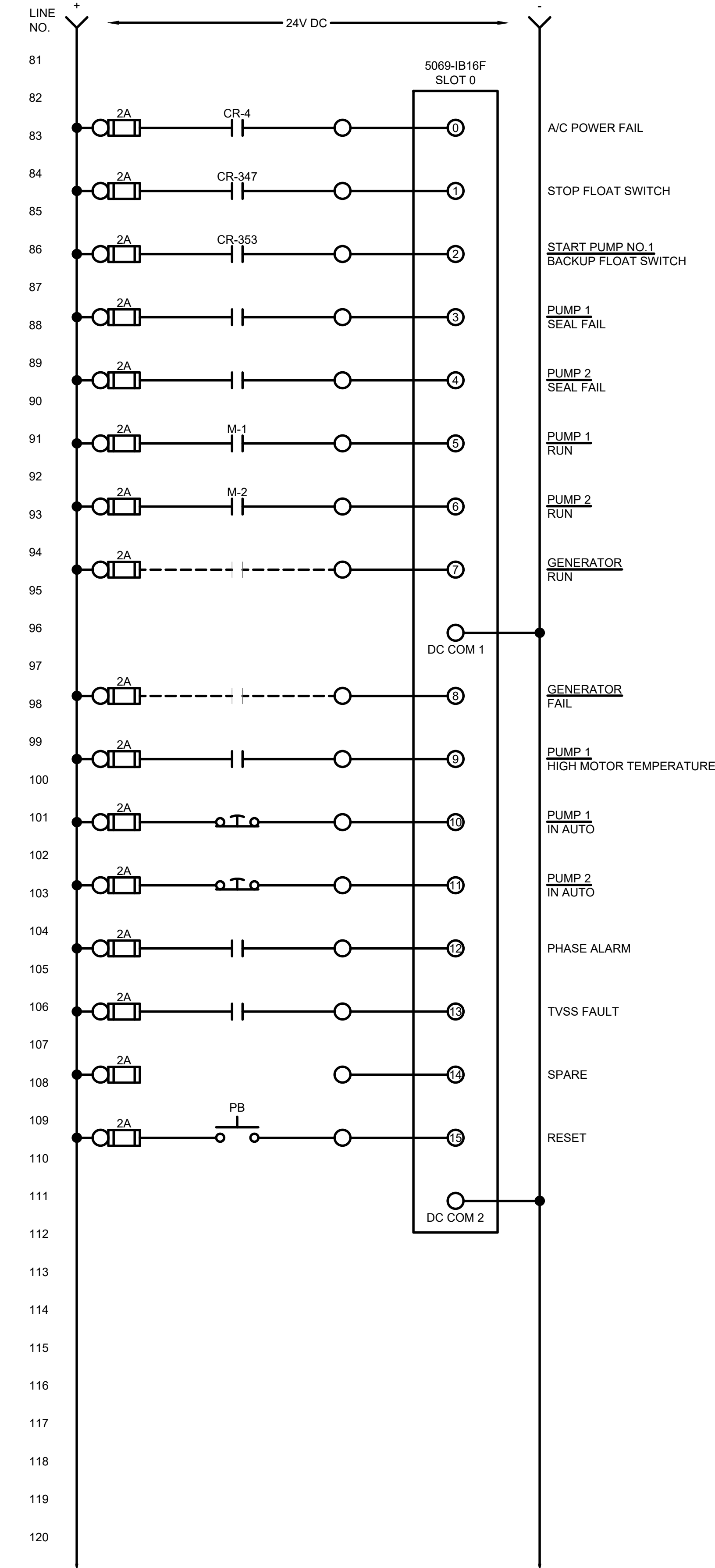
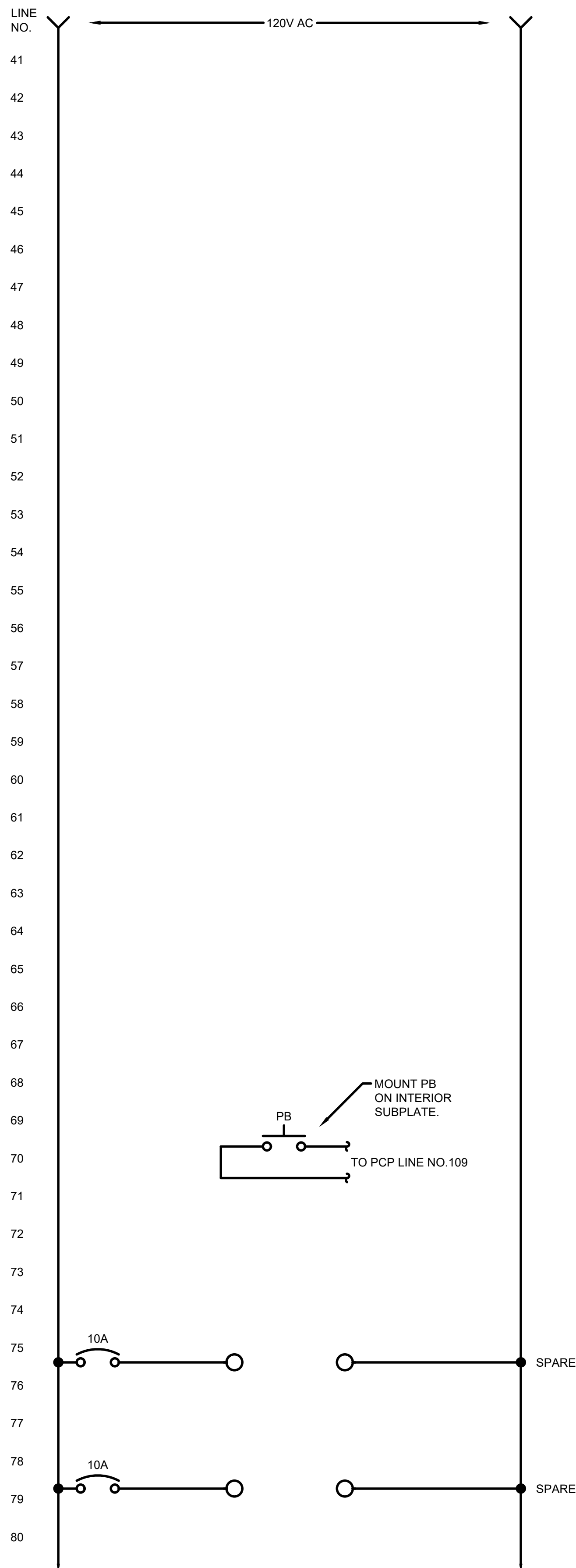
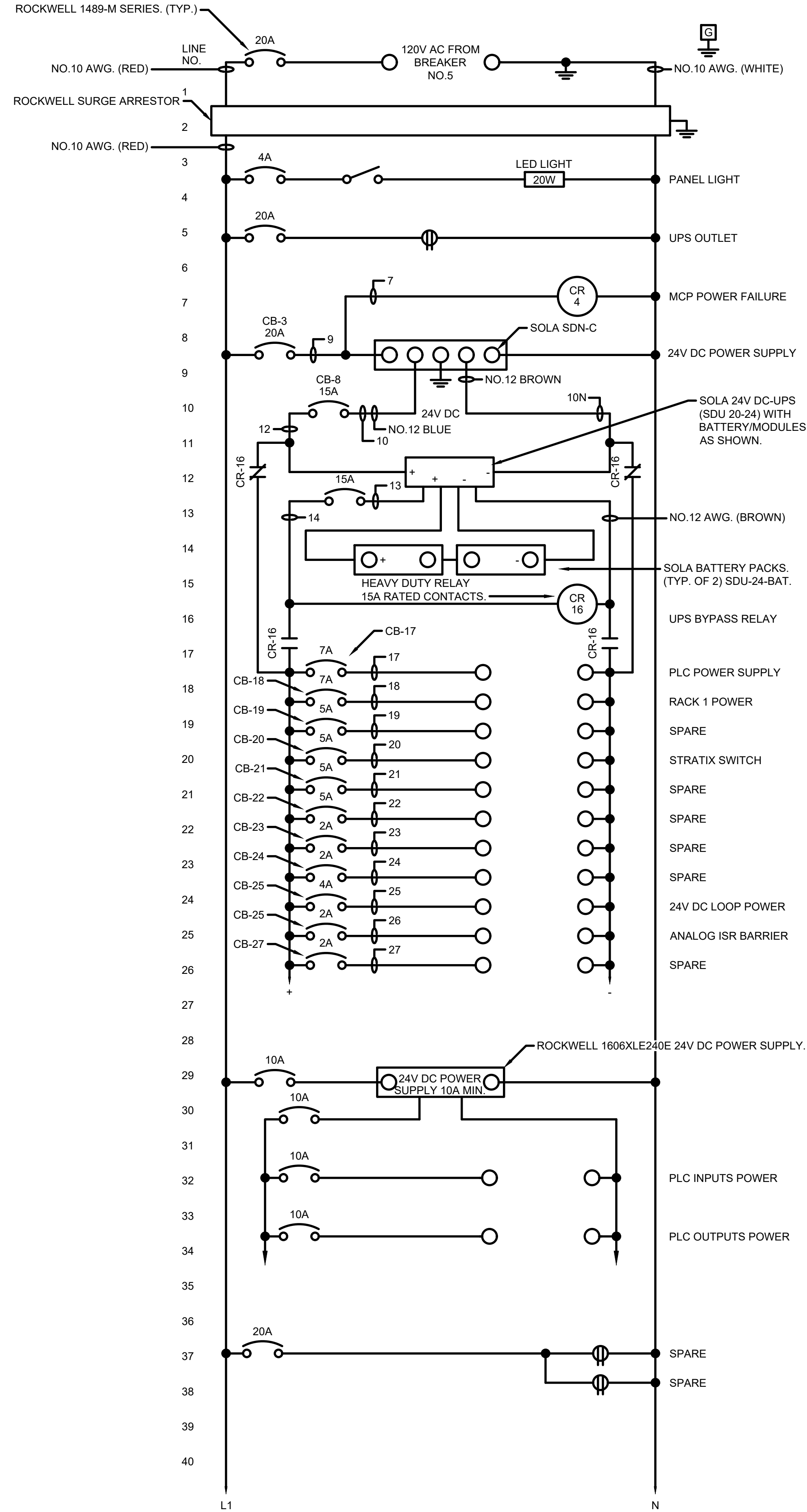


MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE
INSTRUMENTATION DRAWING

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	M.S.J./G.C.J.

2/25/2022 1:48:51 PM - \\TT.LOC\ALI\PROJECTS\ANN ARBOR\19743\200-19743-21003\CAD\SHEETFILES\PCP STATIONS\6_CLIMAX_PCP_WIRING DIAGRAM.DWG - SHANK, JASON



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BY	DATE	DESCRIPTION

BY	DATE	DESCRIPTION

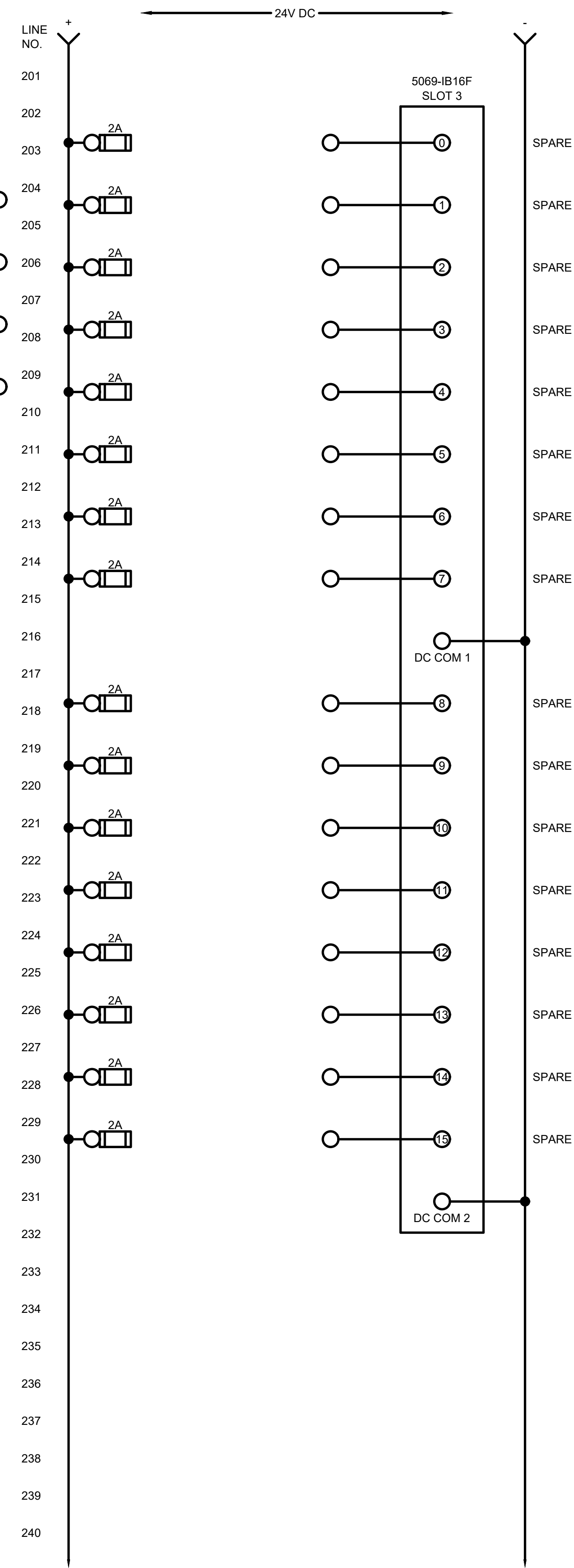
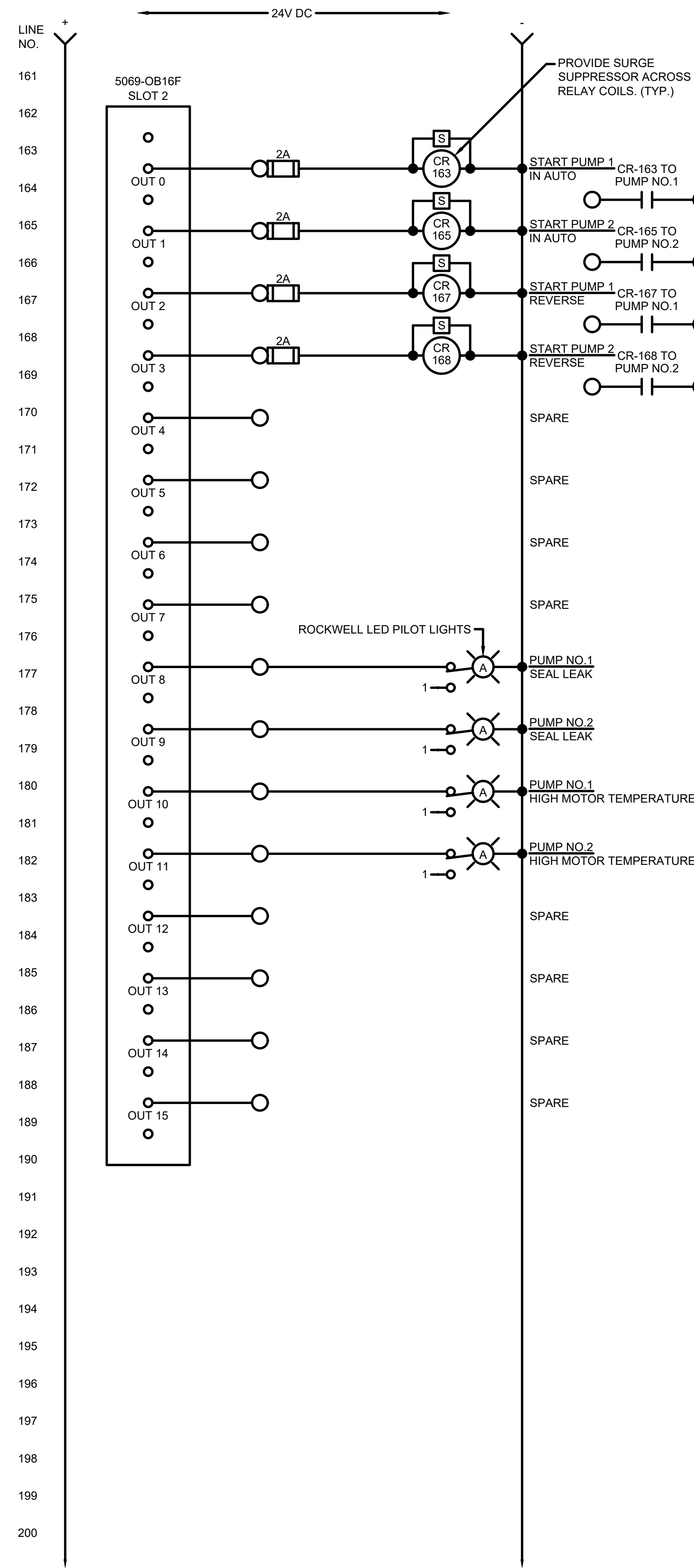
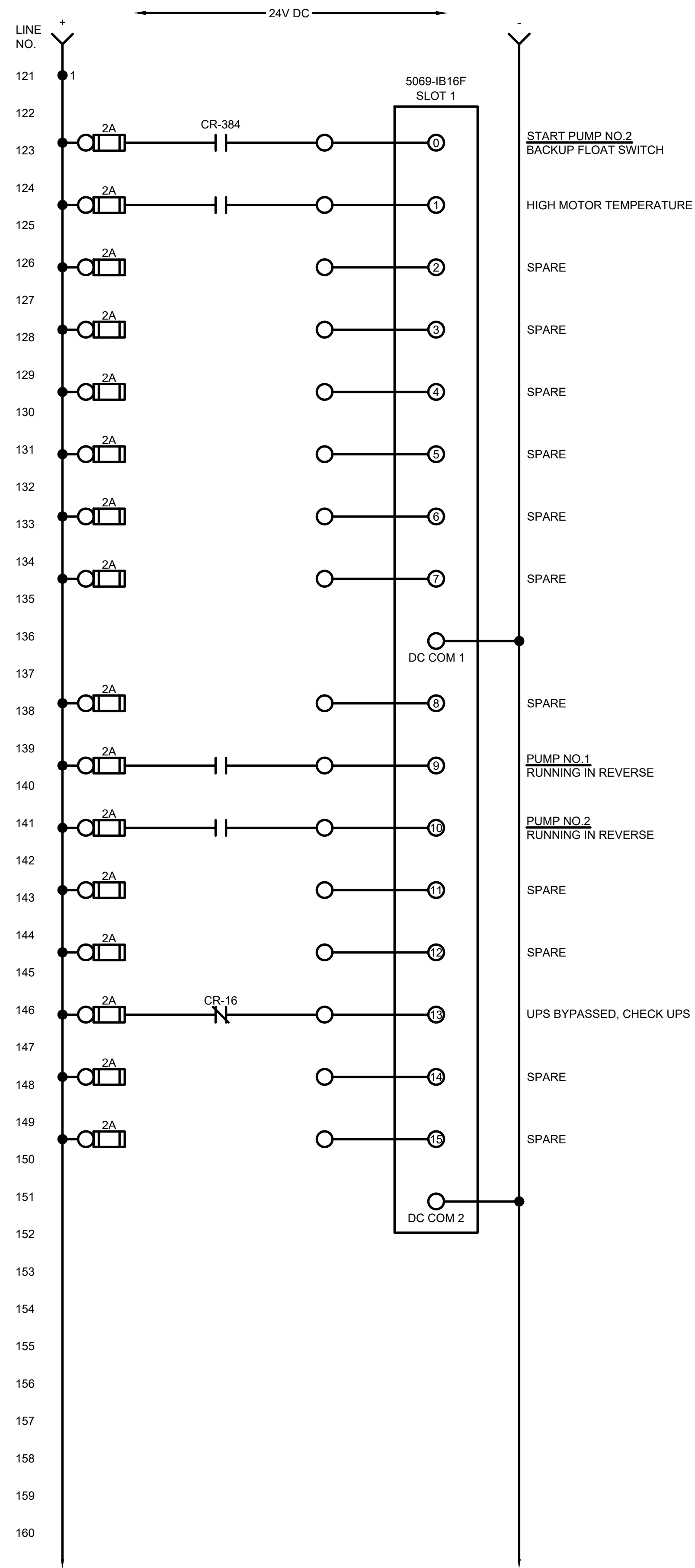
CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE

**INSTRUMENTATION
CLIMAX PUMP CONTROL PANEL
WIRING DIAGRAM**

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	M.S.J./G.C.J.

1-6
OF 28

2/25/2022 1:50:32 PM - \\T\LOCAL\PROJECTS\ANN ARBOR\ER19743\200-19743-21003\CAD\SHEETFILES\PCP STATIONS\7_CLIMAX_PCP WIRING DIAGRAM_1.DWG - SHANK, JASON



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DATE: _____

DESCRIPTION: _____

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SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE

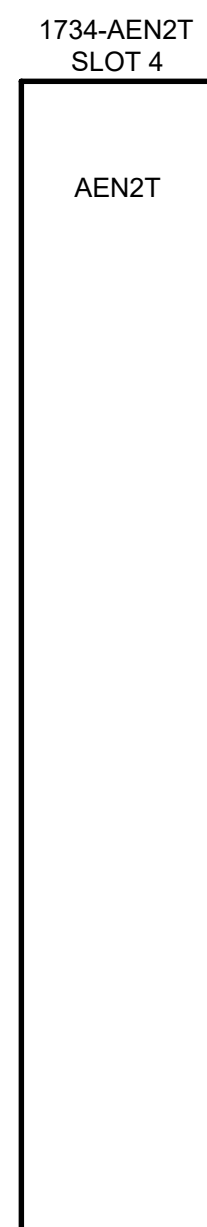
**INSTRUMENTATION
CLIMAX PUMP CONTROL PANEL
WIRING DIAGRAM**

Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

1-7
OF 28

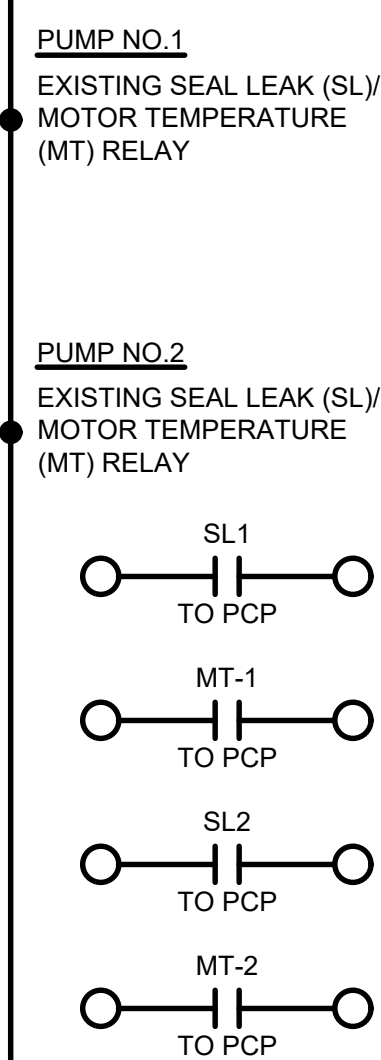
Copyright: Tetra Tech
Bar Measures 1 inch

LINE NO. 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280



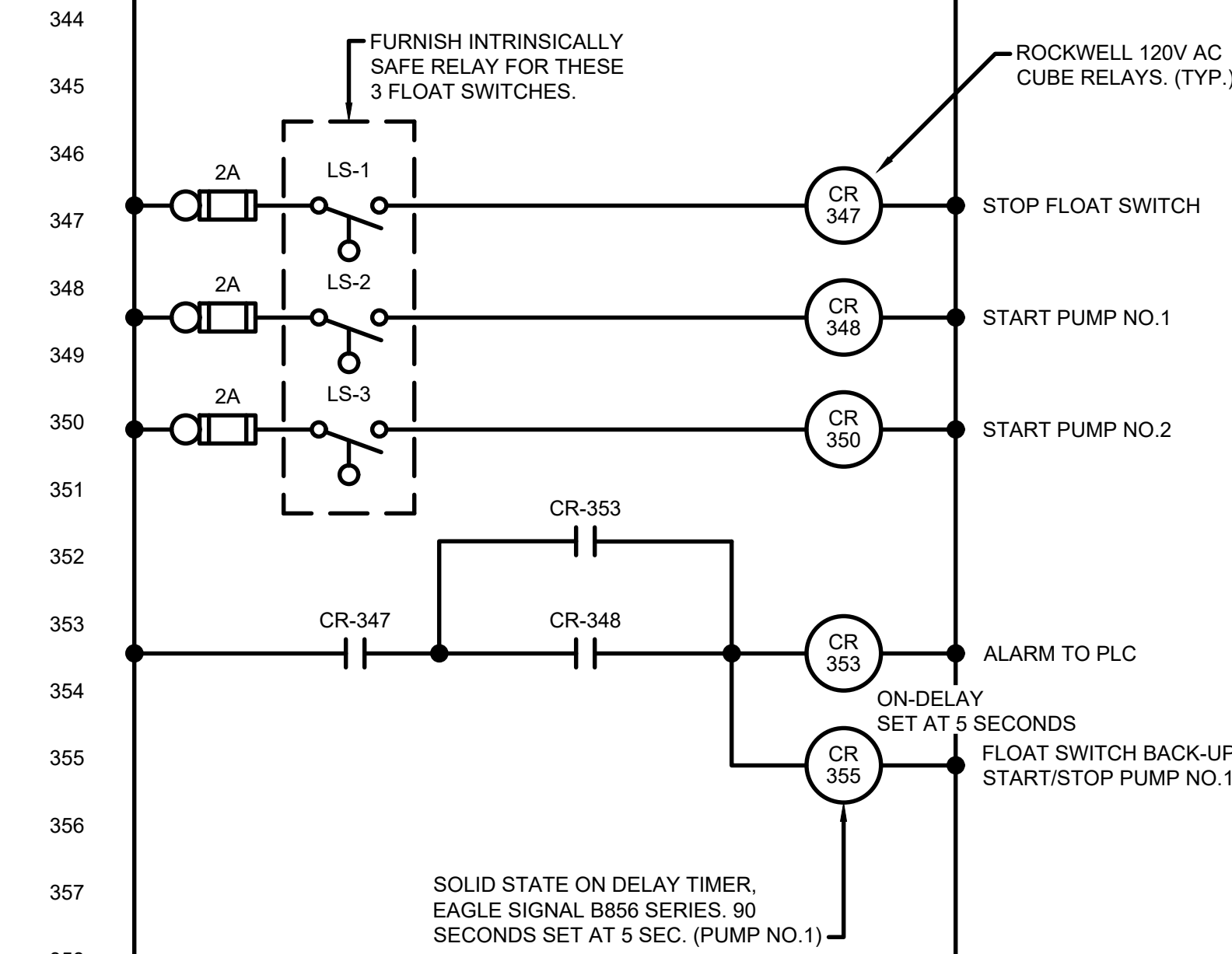
LINE NO. 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320

FIELD VERIFY EXISTING VOLTAGE REQUIREMENTS.



LINE NO. 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360

120V AC
PUMP BACK-UP CONTROLS FROM CIRCUIT BREAKER NO. 12



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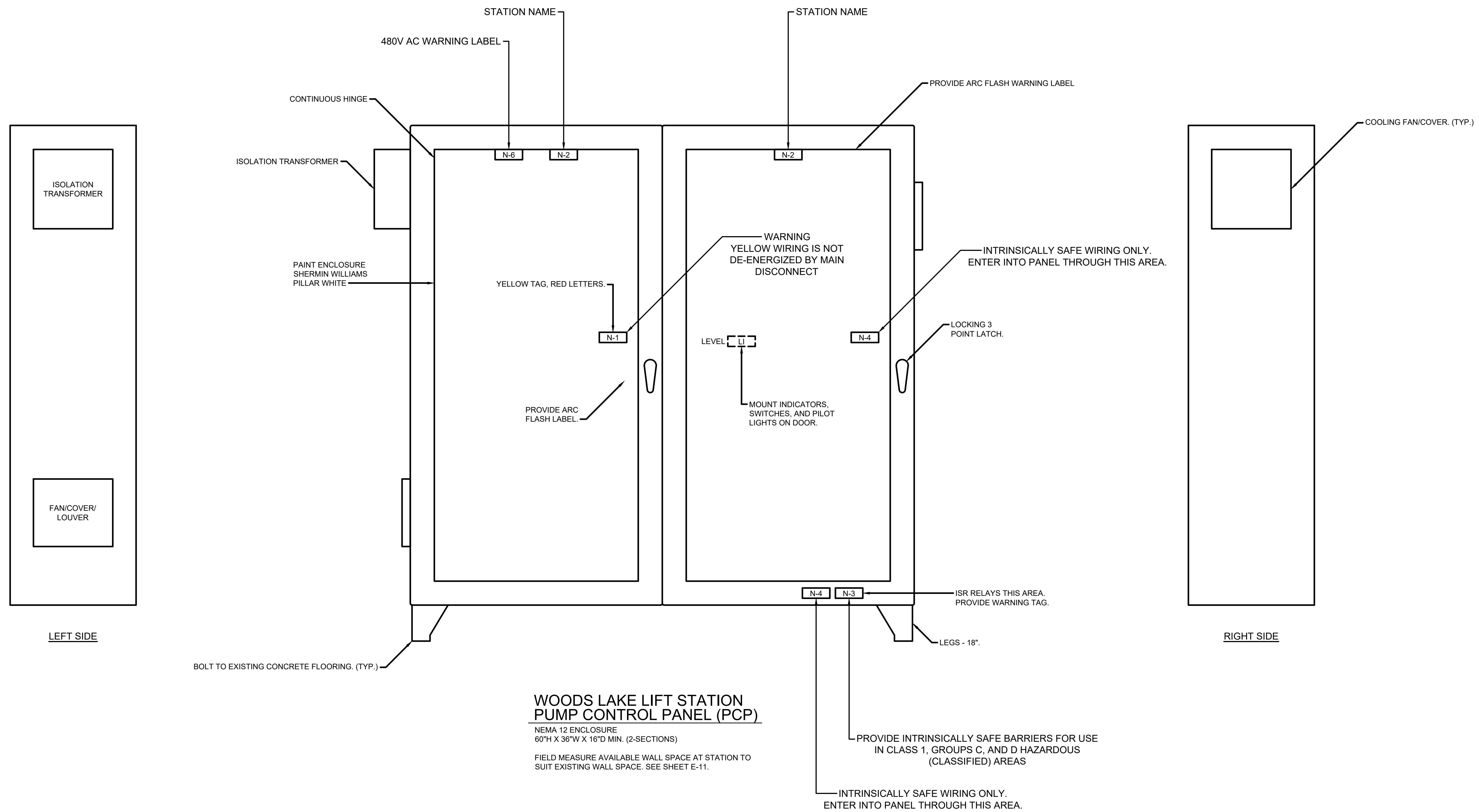
BY	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
CLIMAX, LA AVENUE, WINDING WAY, WOODS LAKE

INSTRUMENTATION CLIMAX PUMP CONTROL PANEL WIRING DIAGRAM

Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

2/25/2022 1:57:25 PM - \\TT.LOCAL\PROJECTS\ANN ARBOR\RIEY19743\200-19743-21003\CAD\SHEETFILES\ELECTRICAL\SUBPLATE DETAILS.DWG - SHANK, JASON



**WOODS LAKE LIFT STATION
PUMP CONTROL PANEL (PCP)**

NEMA 12 ENCLOSURE
60"H X 36"W X 16"D MIN. (2-SECTIONS)
FIELD MEASURE AVAILABLE WALL SPACE AT STATION TO
SUIT EXISTING WALL SPACE. SEE SHEET E-11.



MARK	DATE	DESCRIPTION	BY

CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
CLIMAX, LA AVENUE, WINDING WAY, WOODS LAKE

**INSTRUMENTATION
WOODS LAKE LIFT STATION MAIN CONTROL
PANEL LAYOUT, SUBPLATE DETAILS**

Project No.: 200-19743-21003
Designed By: G.C.J.
Drawn By: J.L.S.
Checked By: M.S.J./G.C.J.

2/25/2022 2:04:37 PM - \\T:\LOCAL\PROJECTS\ANN ARBOR\RIE\19743\200-19743-21003\CAD\DWG\14_WOODS LAKE_PCP WIRING DIAGRAM_II.DWG - SHANK, JASON

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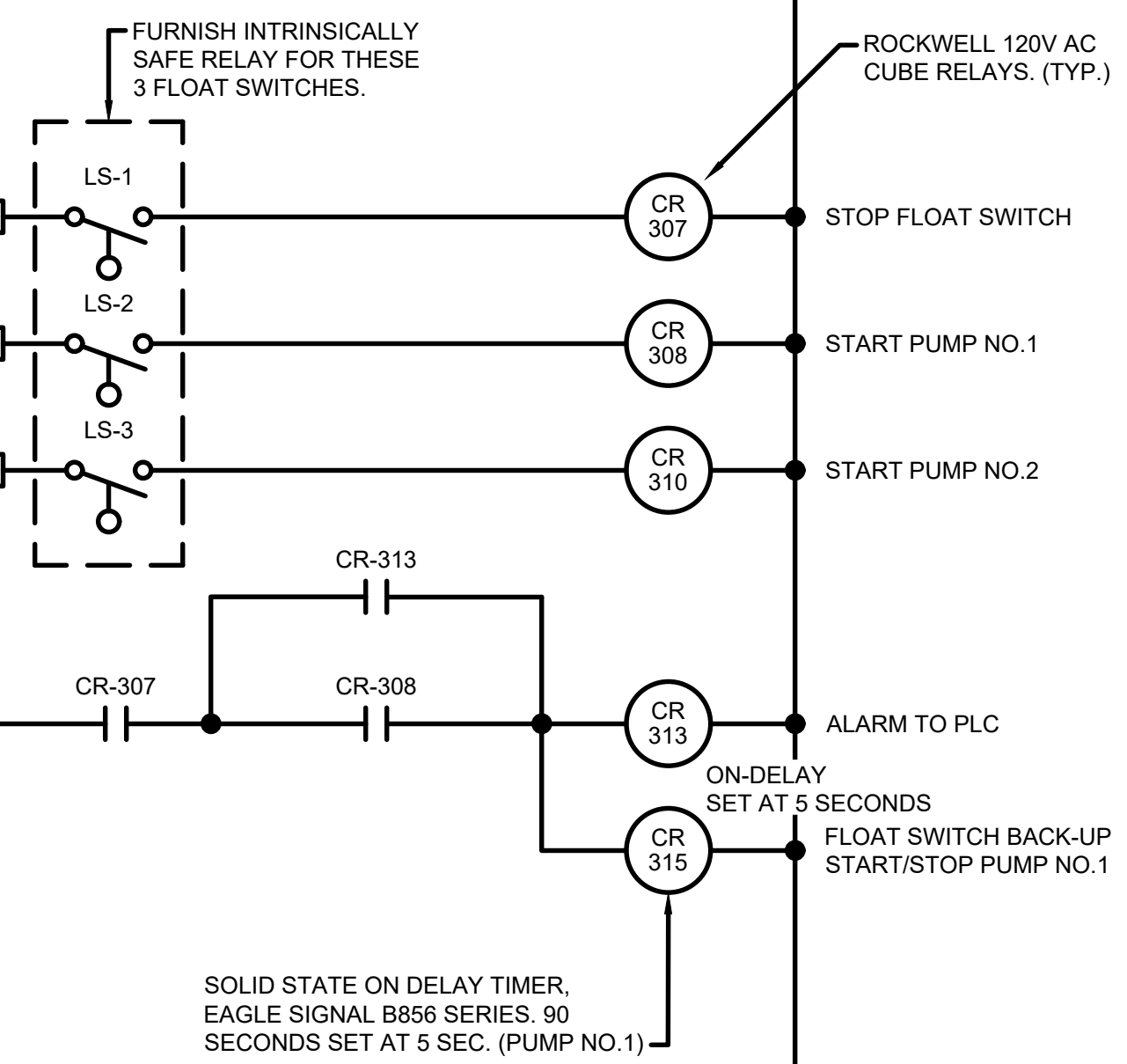
1734-AEN2T
SLOT 4

AEN2T

LINE NO.
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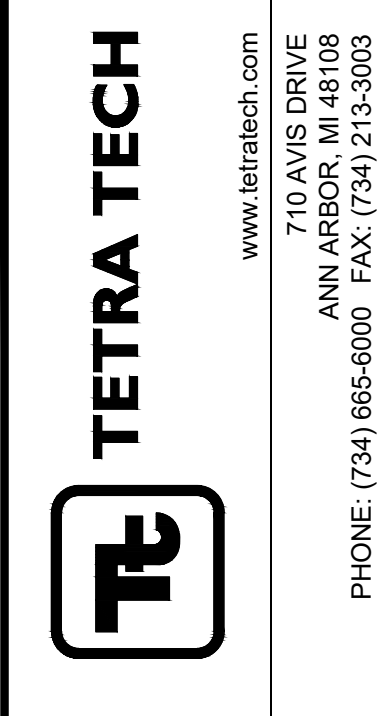
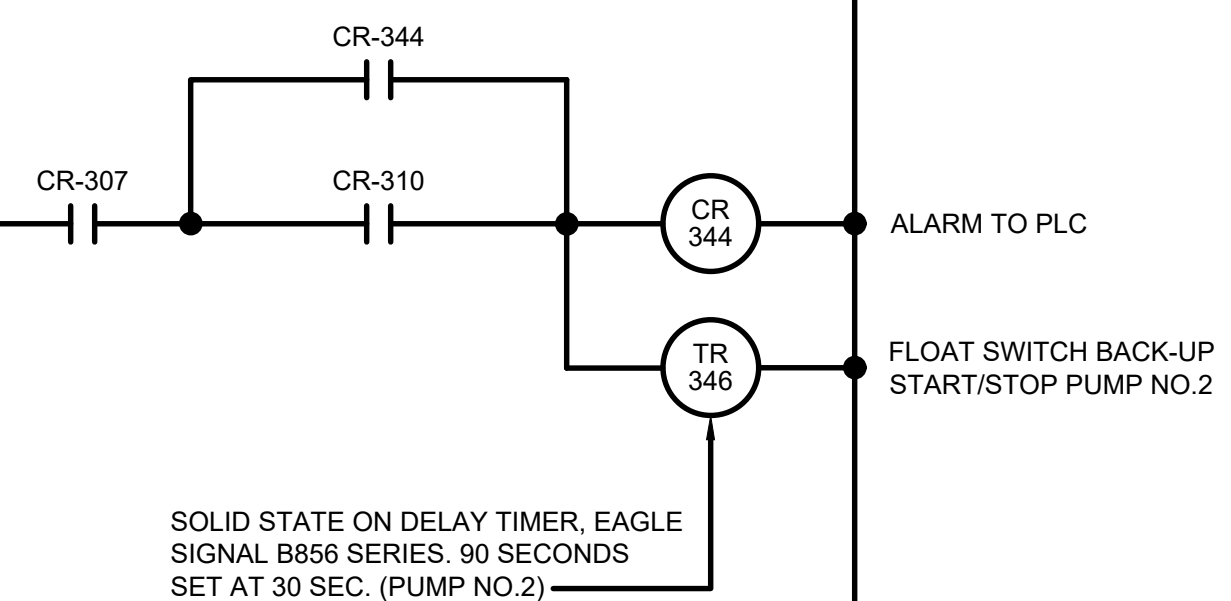
120V AC

PUMP BACK-UP CONTROLS
FROM LINE NO.79.



LINE NO.
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120V AC



MARK	DATE	DESCRIPTION

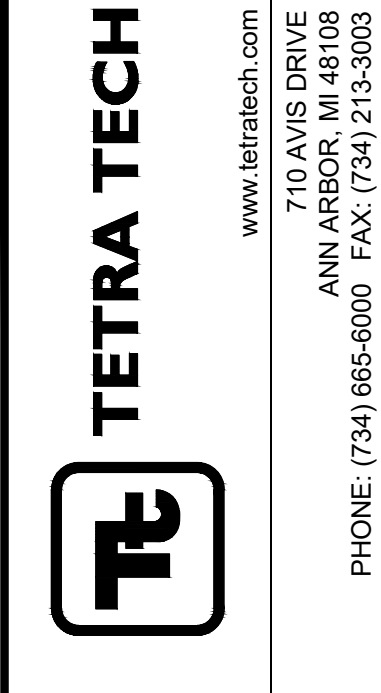
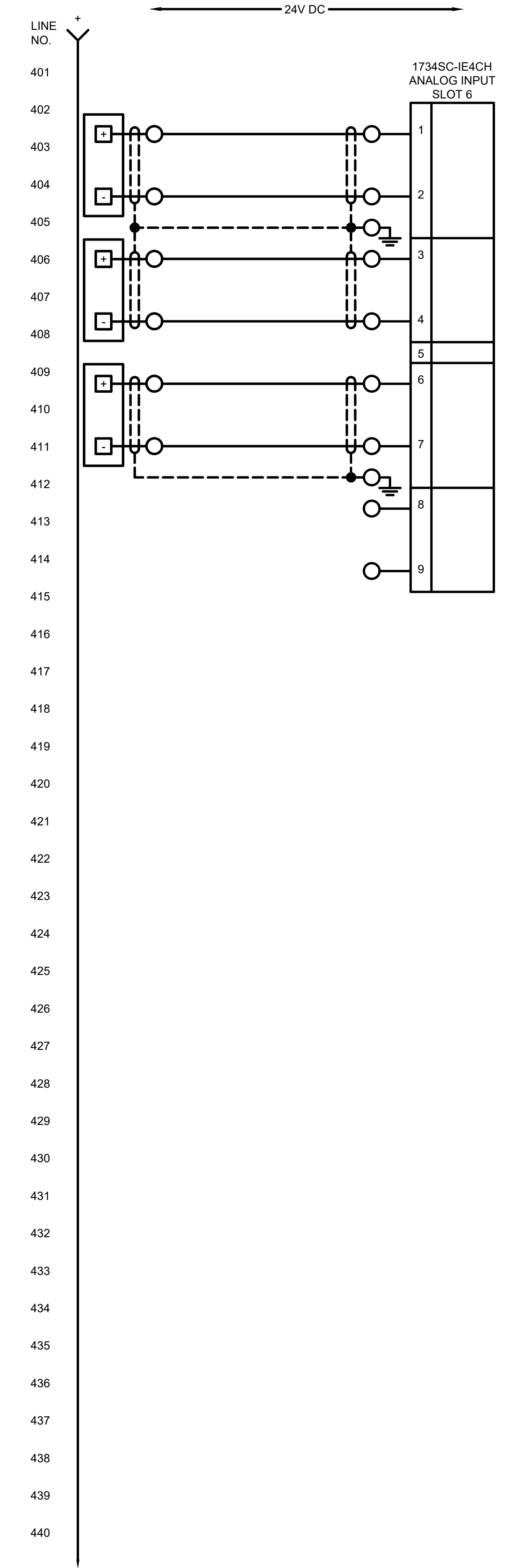
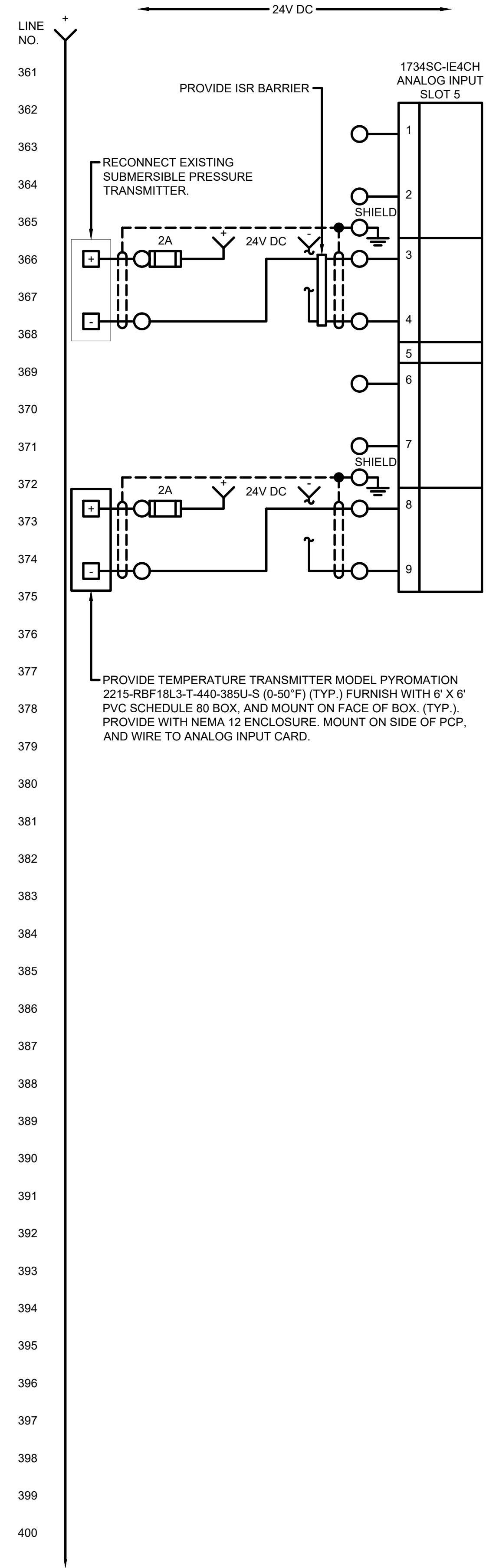
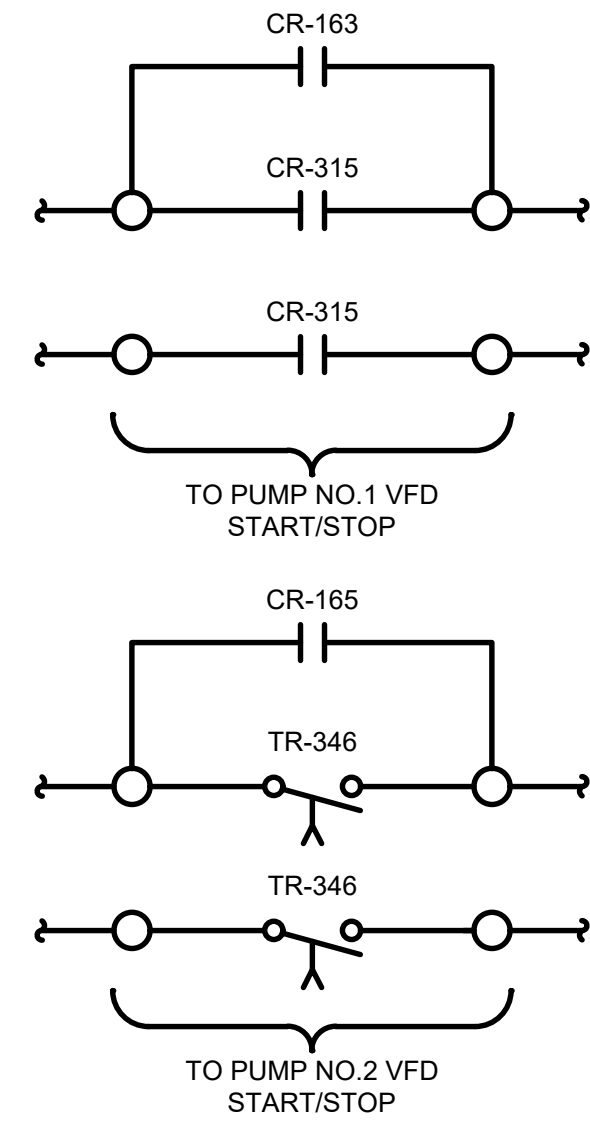
CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE

**INSTRUMENTATION
WOODS LAKE PUMP CONTROL PANEL
WIRING DIAGRAM**

Project No.: 200-19743-21003
Designed By: G.C.J.
Drawn By: J.L.S.
Checked By: M.S.J./G.C.J.

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2/25/2022 2:05:44 PM - \\T\LOCAL\PROJECTS\ANN ARBOR\RIER\19743\200-19743-21\003\CAD\SHEET\FILE\PCP WIRING DIAGRAM_IV.DWG - SHANK, JASON

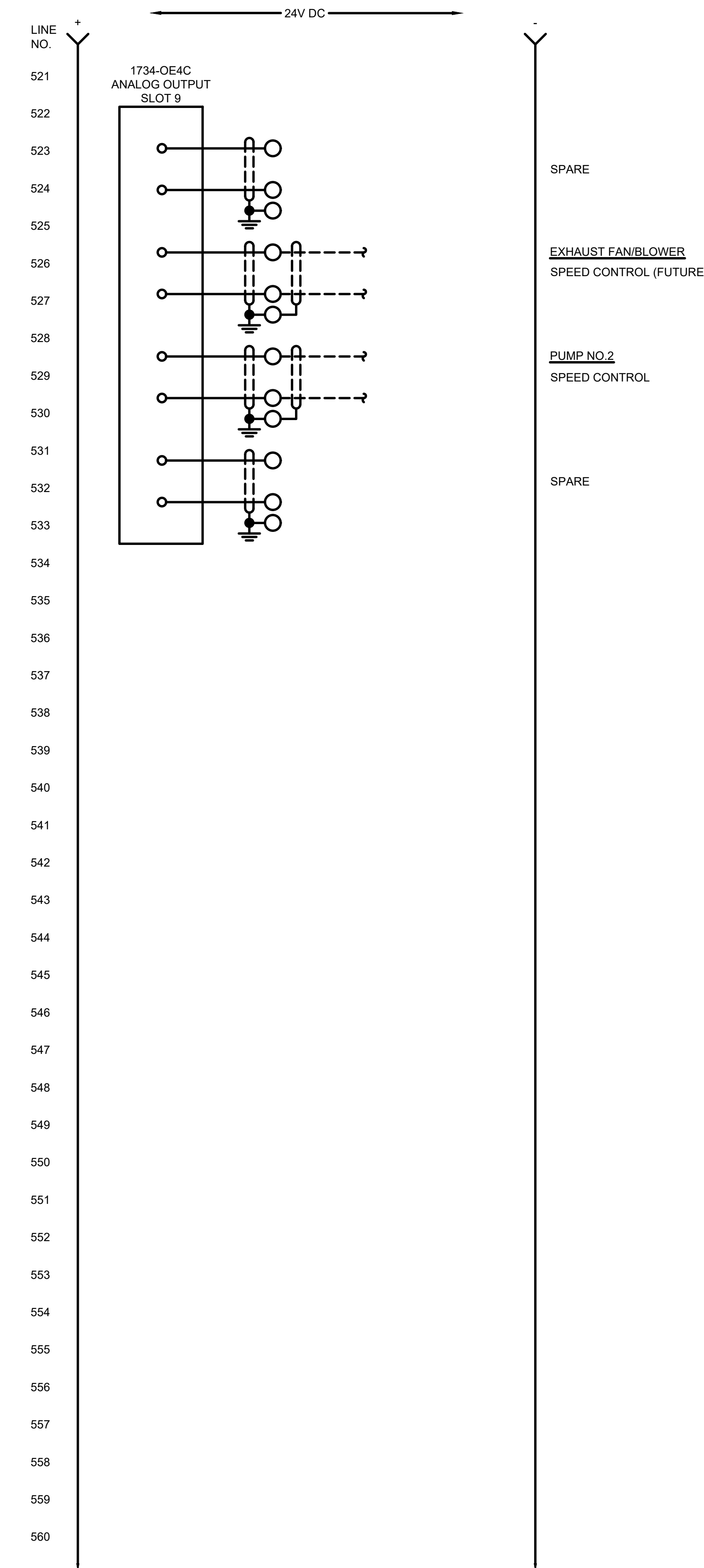
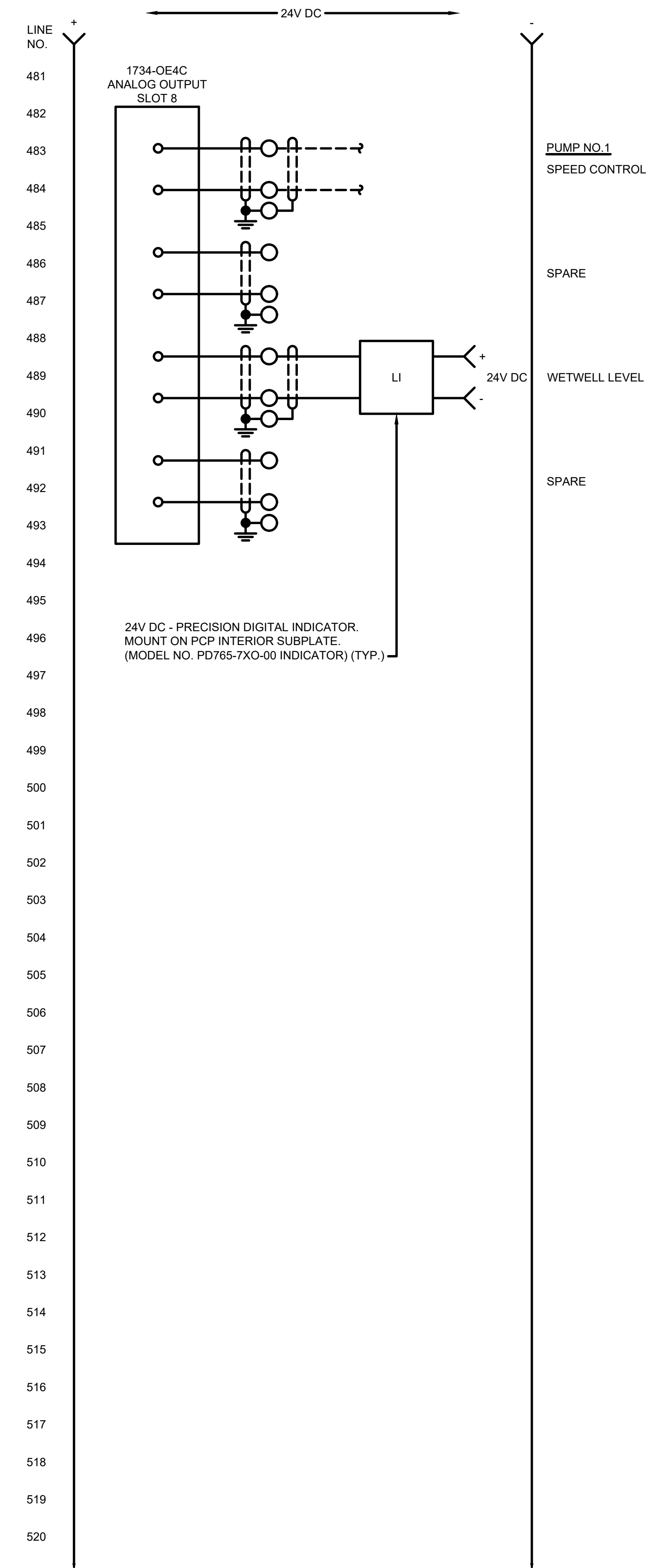
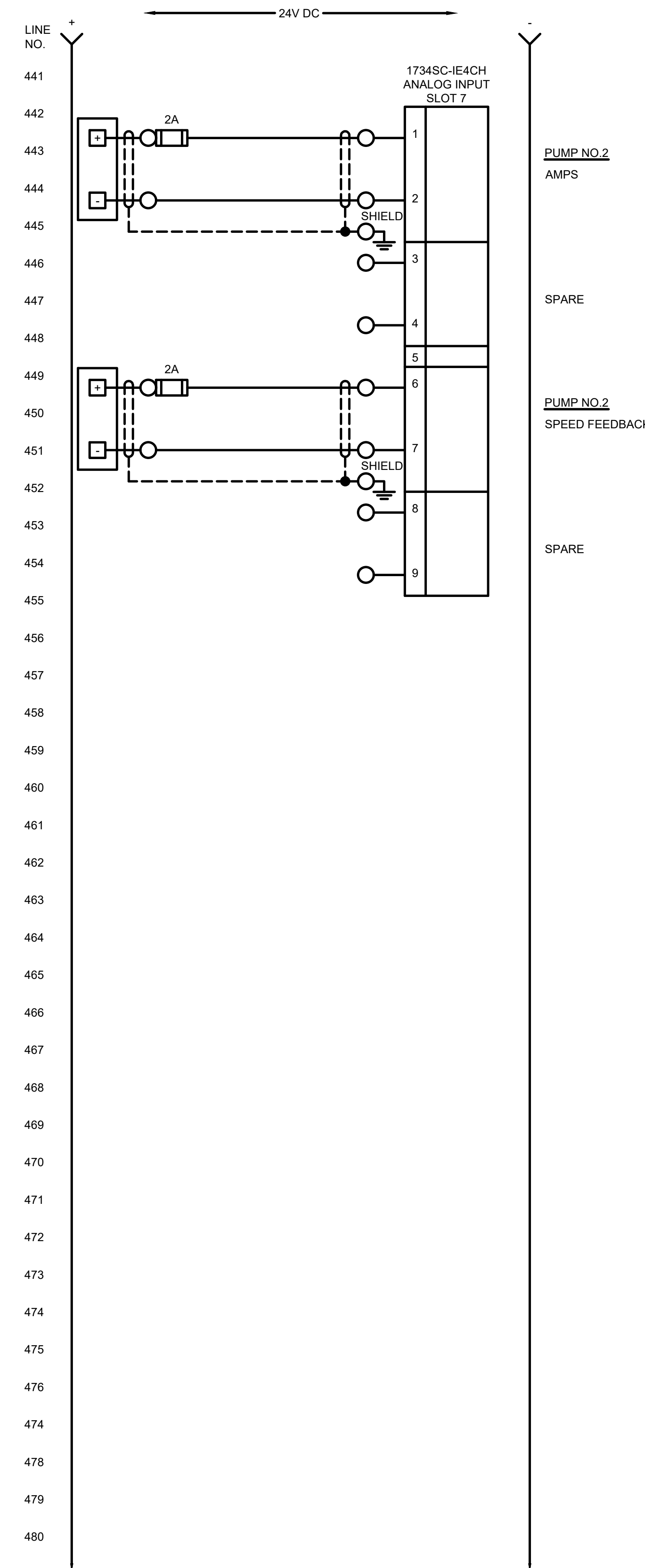


BY	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE

**INSTRUMENTATION
WOODS LAKE PUMP CONTROL PANEL
WIRING DIAGRAM**

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MSJ/GC.J.



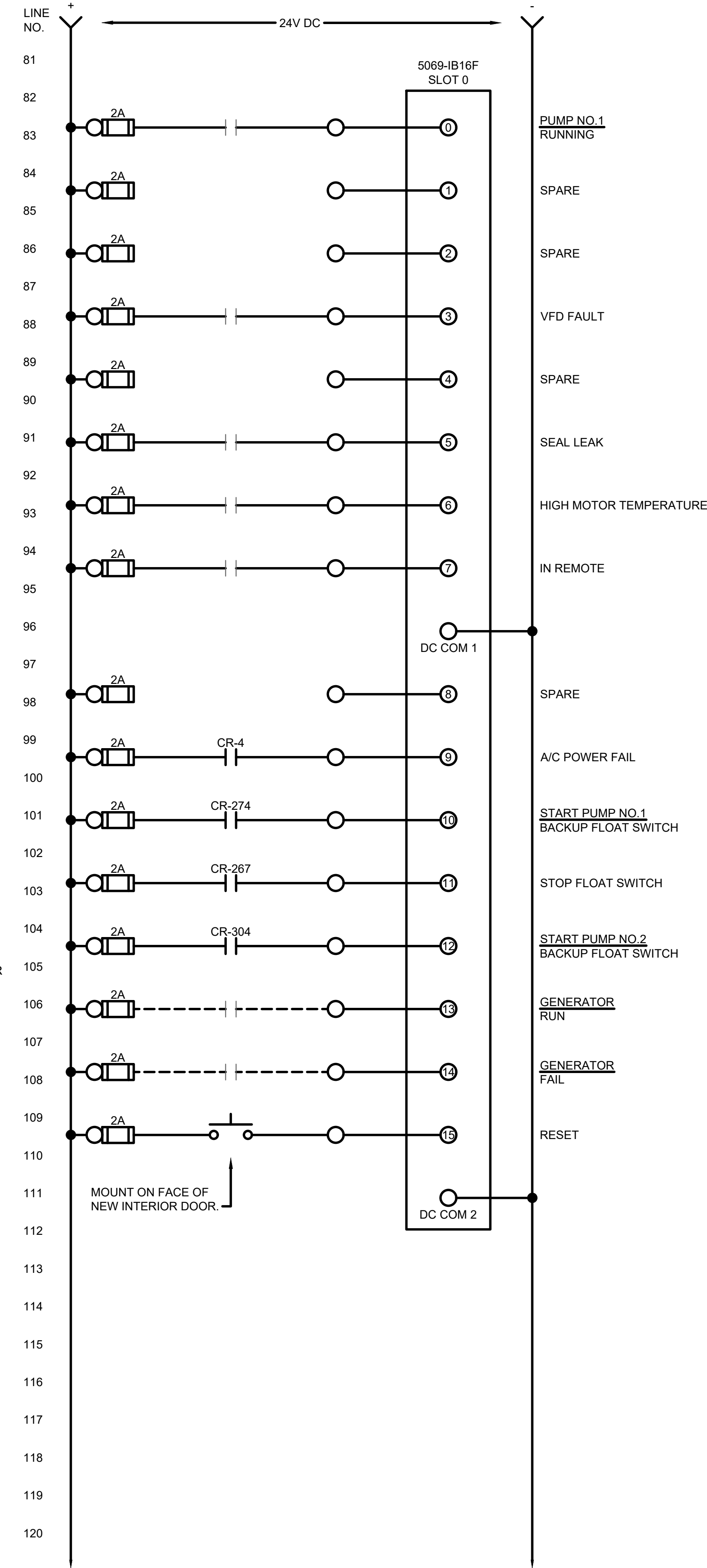
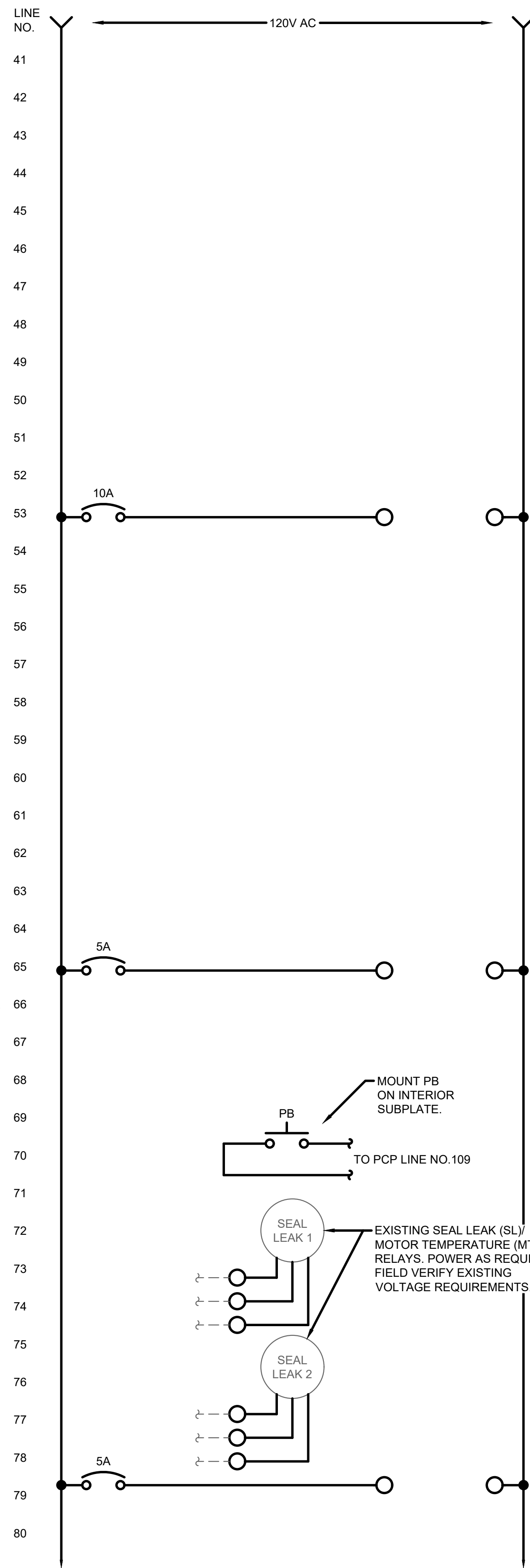
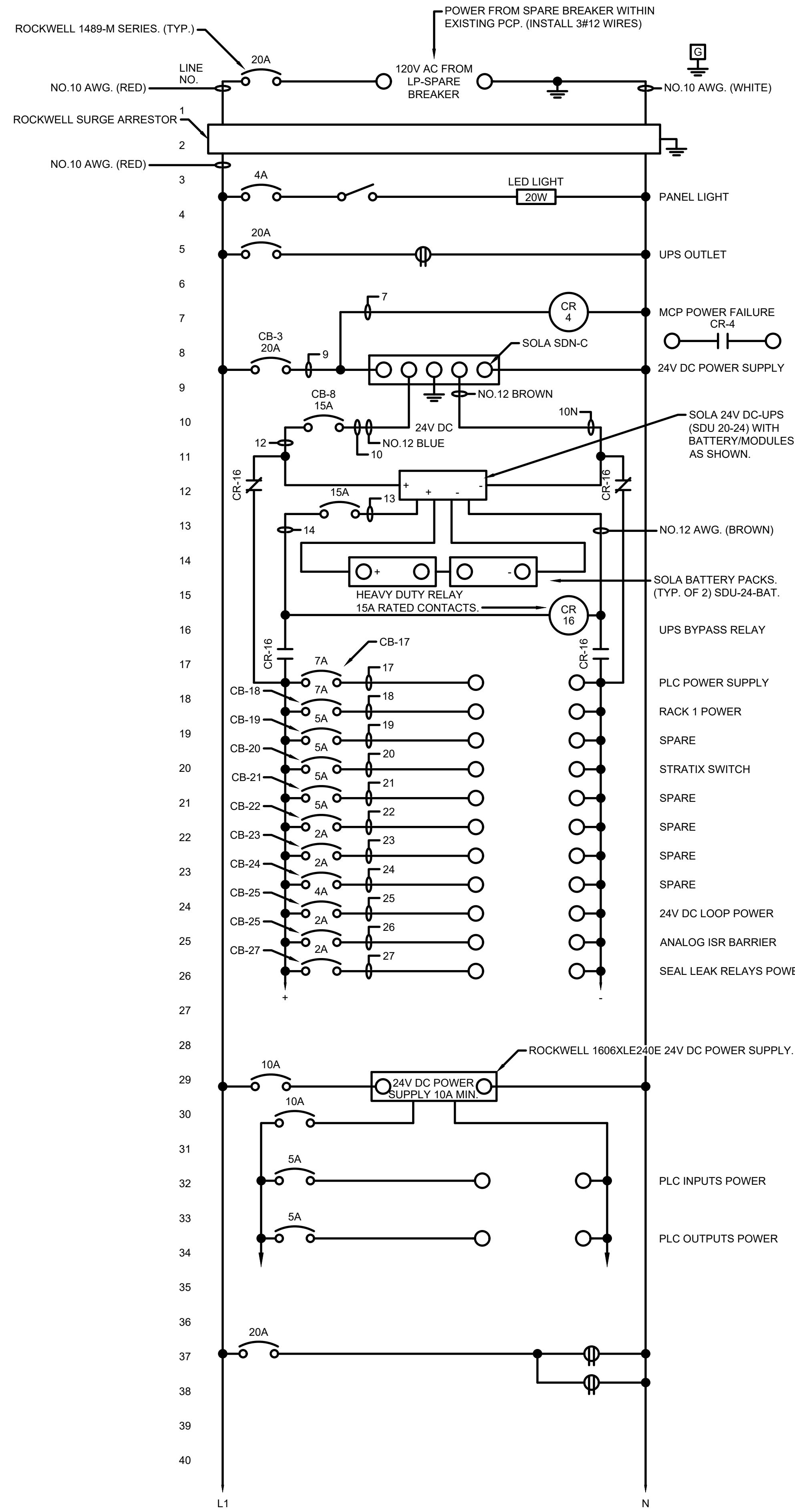
MARK	DATE	DESCRIPTION	BY

CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
CLIMAX, LA AVENUE, WINDING WAY, WOODS LAKE

**INSTRUMENTATION
WOODS LAKE PUMP CONTROL PANEL
WIRING DIAGRAM**

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MS.J/GC.J.

4/27/2022 11:56:08 AM - \\TT.LOCAL\PROJECTS\ANN ARBOR\IER19743\200-19743-2\1003\CAD\3\SHEETFILES\E/PUMP-STATIONS\17_L-AVENUE_PCP_WIRING DIAGRAM.DWG - SHANK, JASON



NEW SUBPLATE. SEE NOTE.
(FIELD MEASURE EXISTING PANEL SPACE)

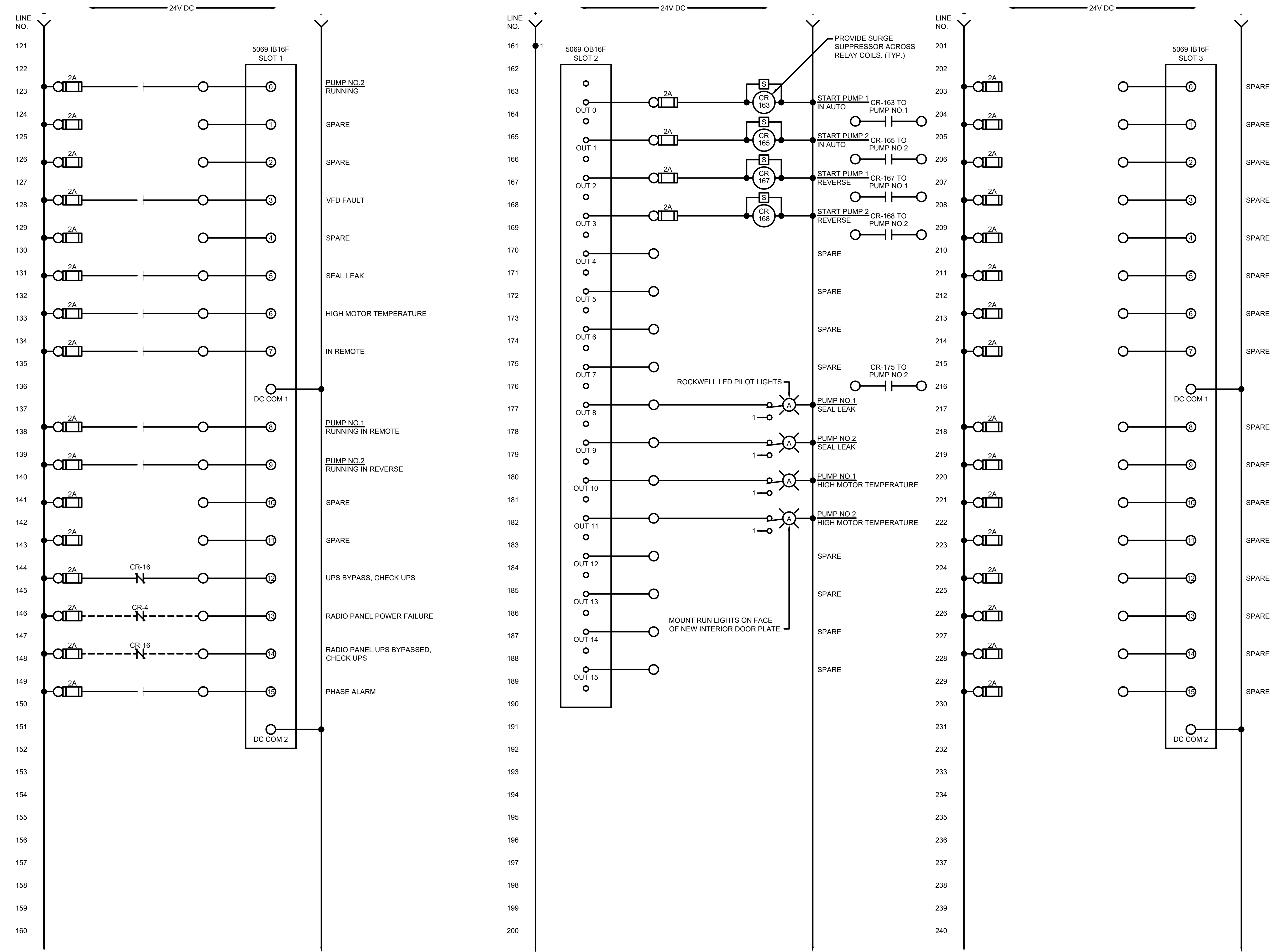
NOTE:
MOUNT NEW EQUIPMENT ON NEW SUBPLATE, AND NEW INTERIOR DOOR. INSTALL IN EXISTING PANEL. SEE SHEET E-14 FOR ADDITIONAL INFORMATION. SIZE SUBPLATE AS REQUIRED TO SUIT INSTALLATION IN EXISTING PANEL.

MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE
**INSTRUMENTATION
L-AVENUE PUMP CONTROL PANEL
WIRING DIAGRAM**

Project No.: 200-19743-21003
Designed By: G.C.J.
Drawn By: J.L.S.
Checked By: M.S.J./G.C.J.

2/24/2022 12:28:10 PM - I:\LOCAL\PROJECTS\ANN ARBOR\IER\19743\200-19743-2\1003\CAD\1\19743-2\1003\PCP WIRING DIAGRAM_1.DWG - SHANK, JASON



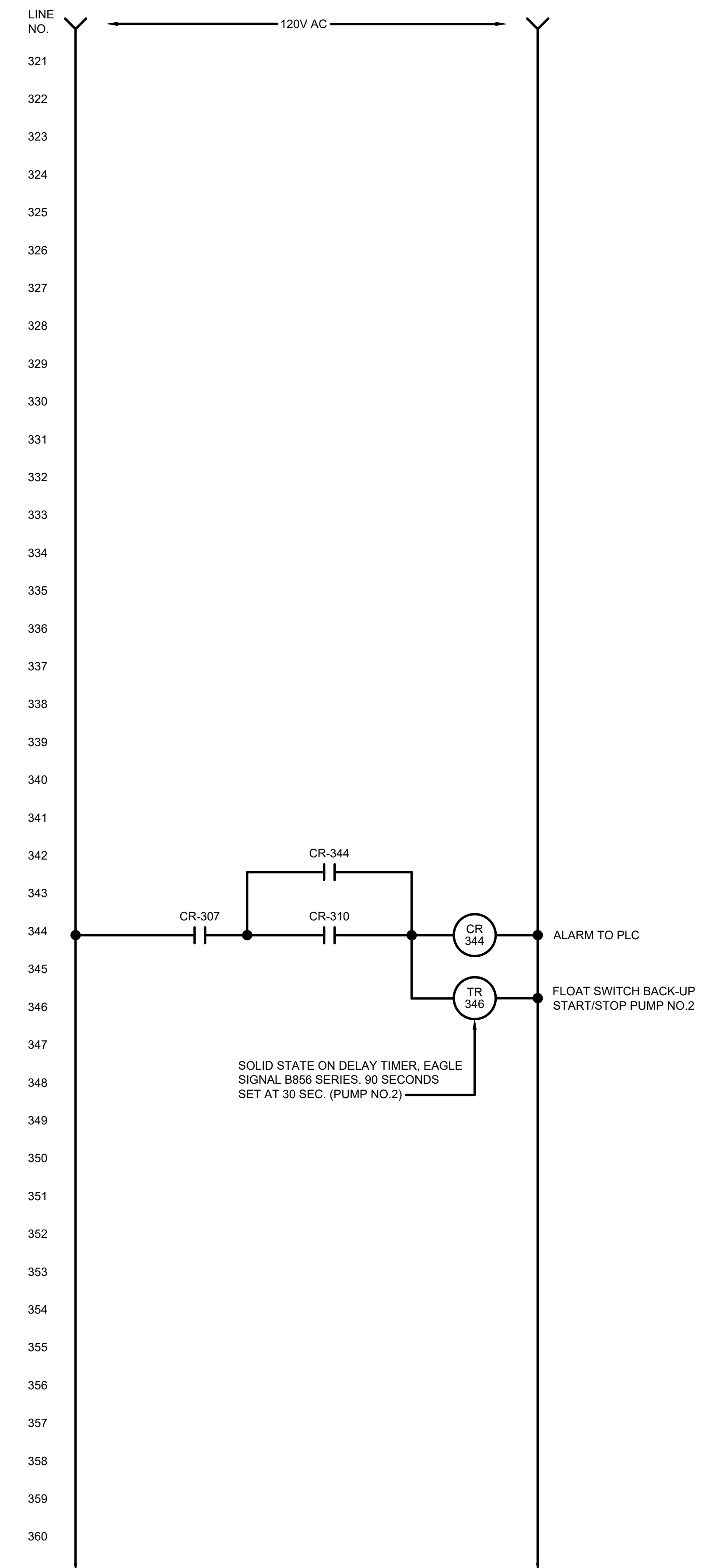
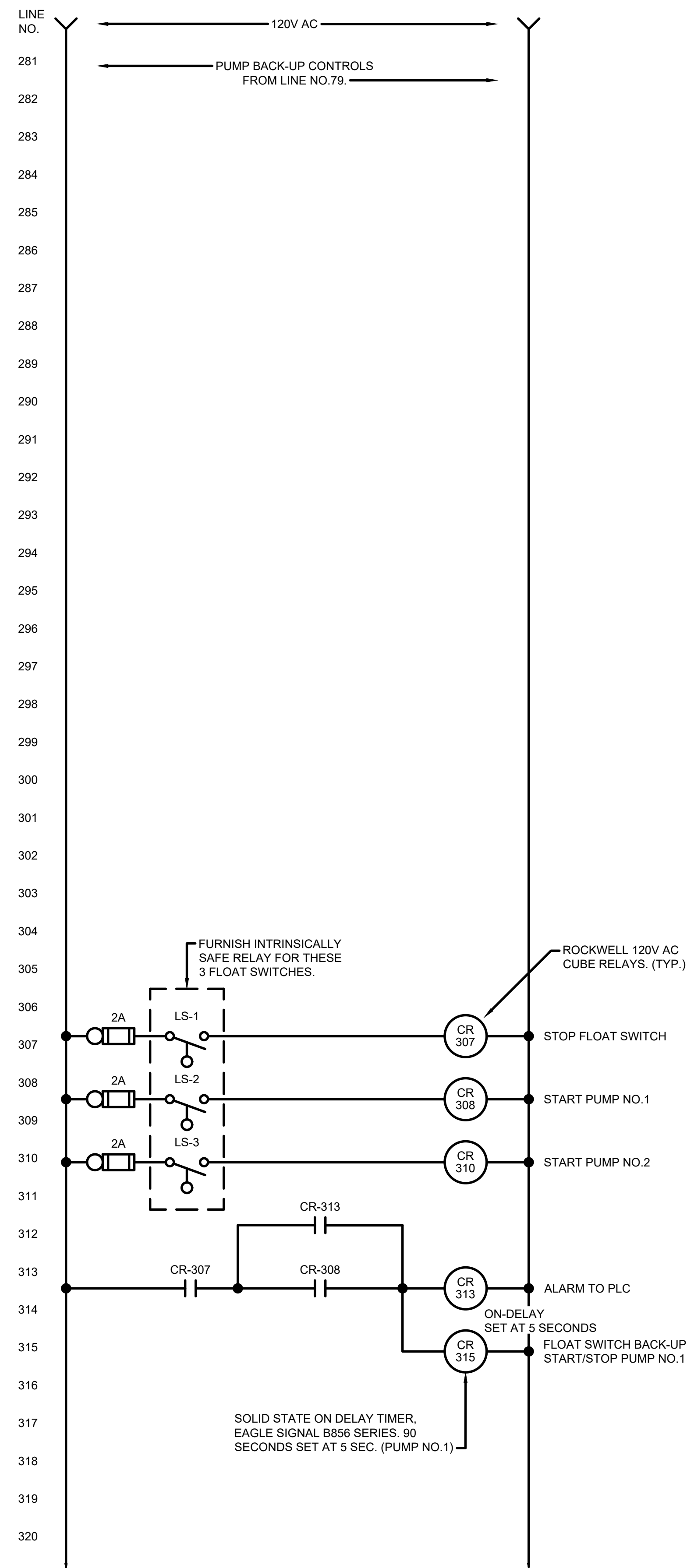
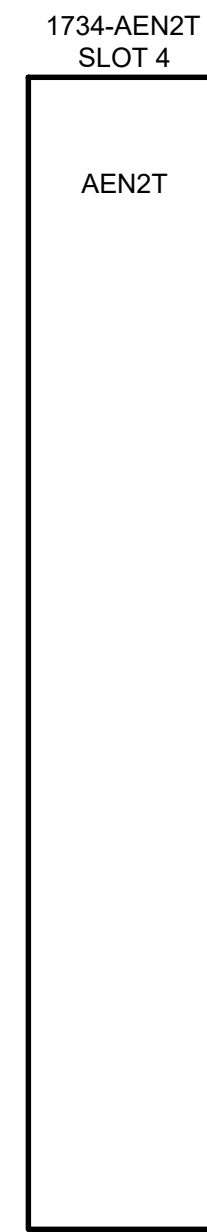
MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE

**INSTRUMENTATION
L-AVENUE PUMP CONTROL PANEL
WIRING DIAGRAM**

Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

LINE NO.	
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CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE

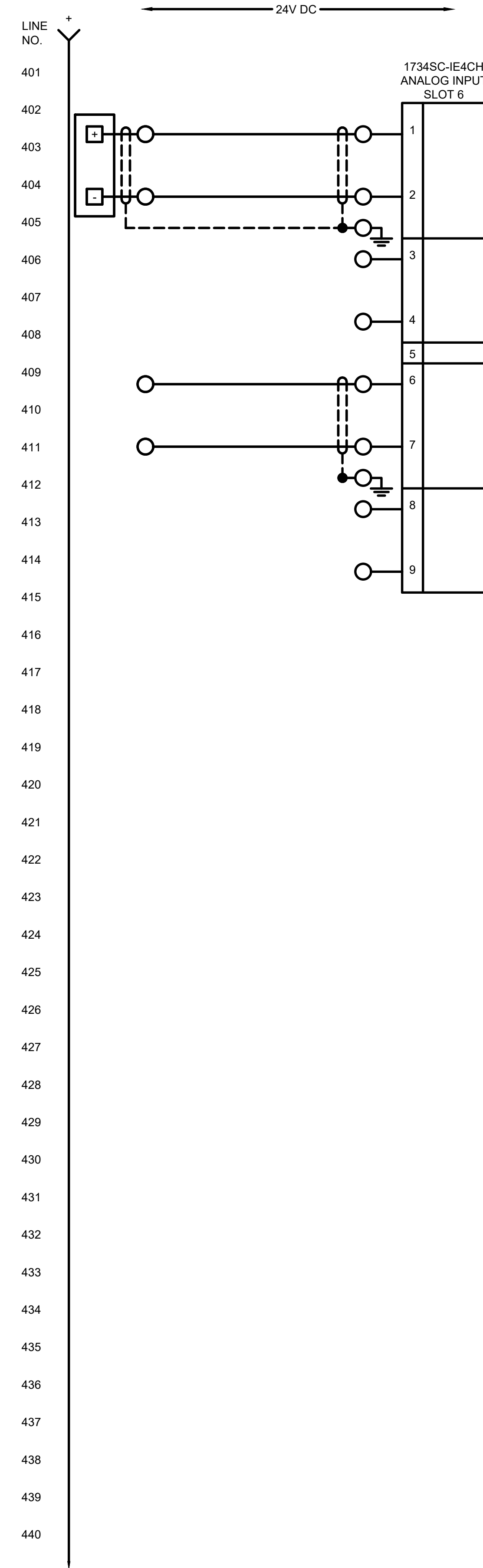
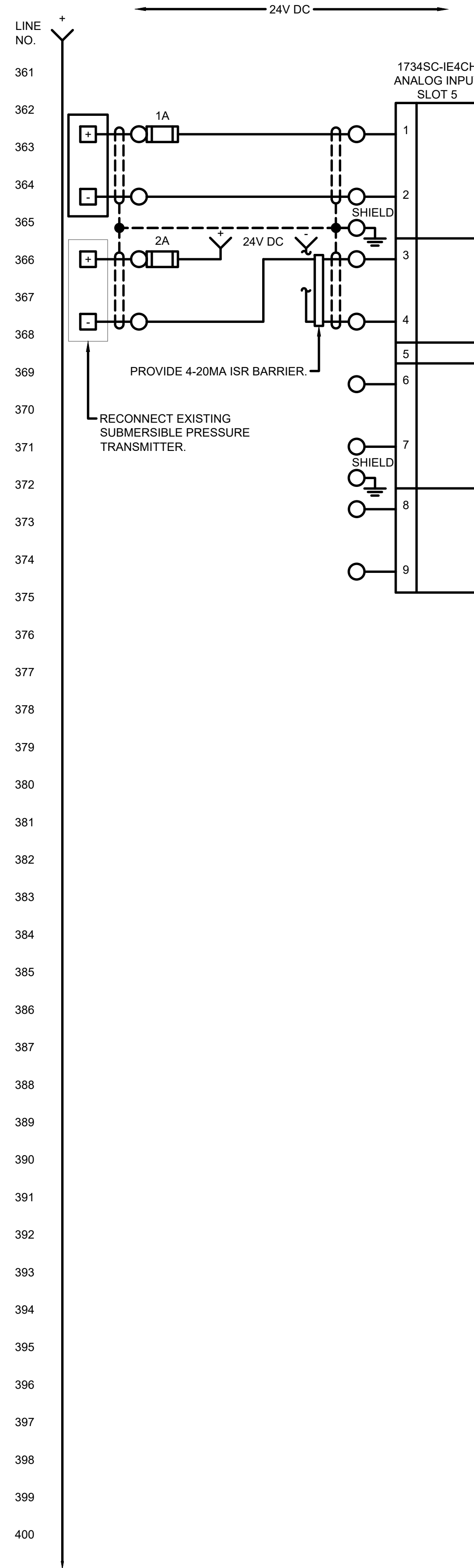
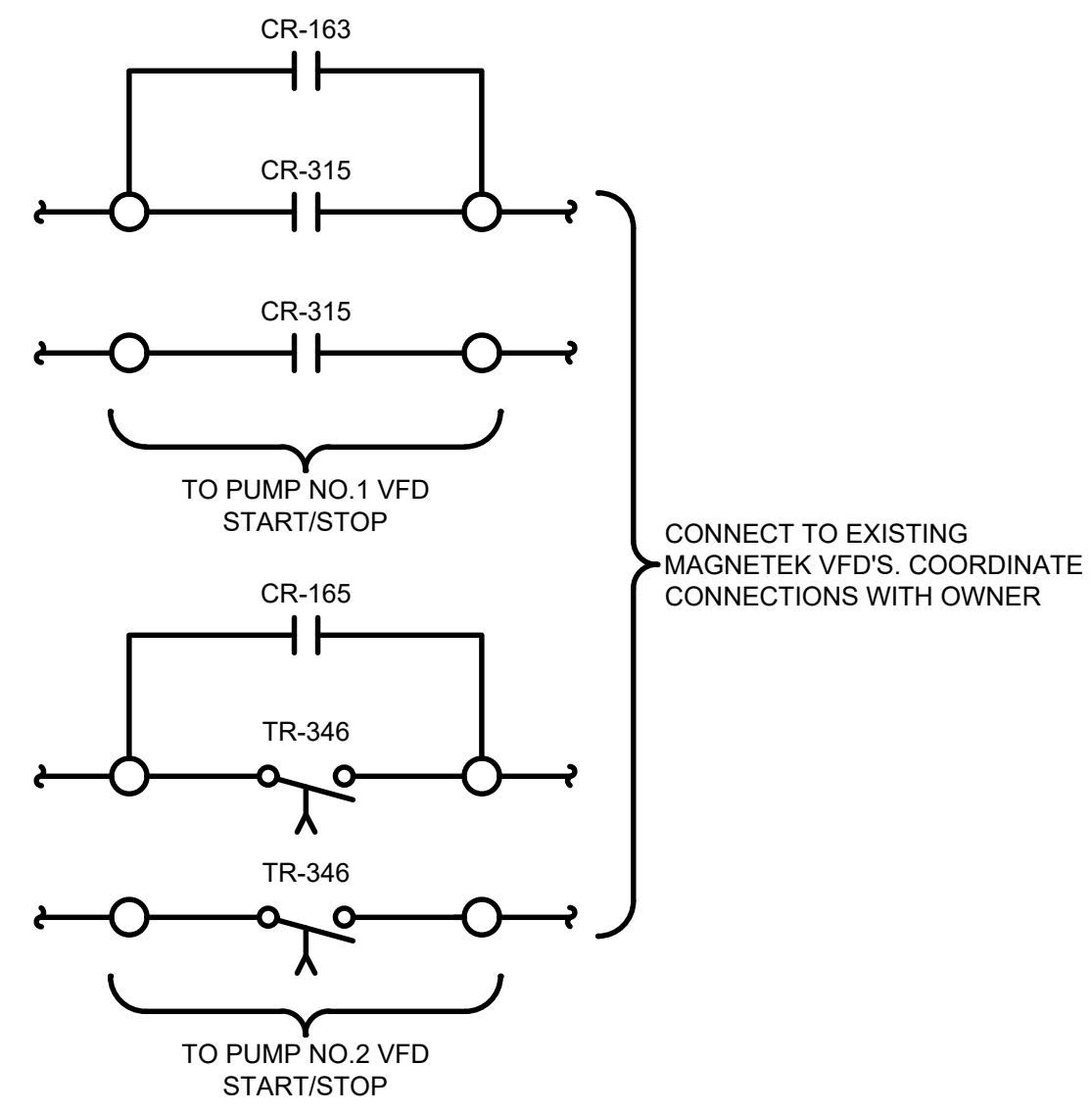
INSTRUMENTATION
L-AVENUE PUMP CONTROL PANEL
WIRING DIAGRAM

Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

I-19
OF 28

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Bar Measures 1 inch



NEW SUBPLATE

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CITY OF KALAMAZOO, MICHIGAN

SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER

CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE

INSTRUMENTATION

L-AVENUE PUMP CONTROL PANEL

WIRING DIAGRAM

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MSJ/G.C.J.

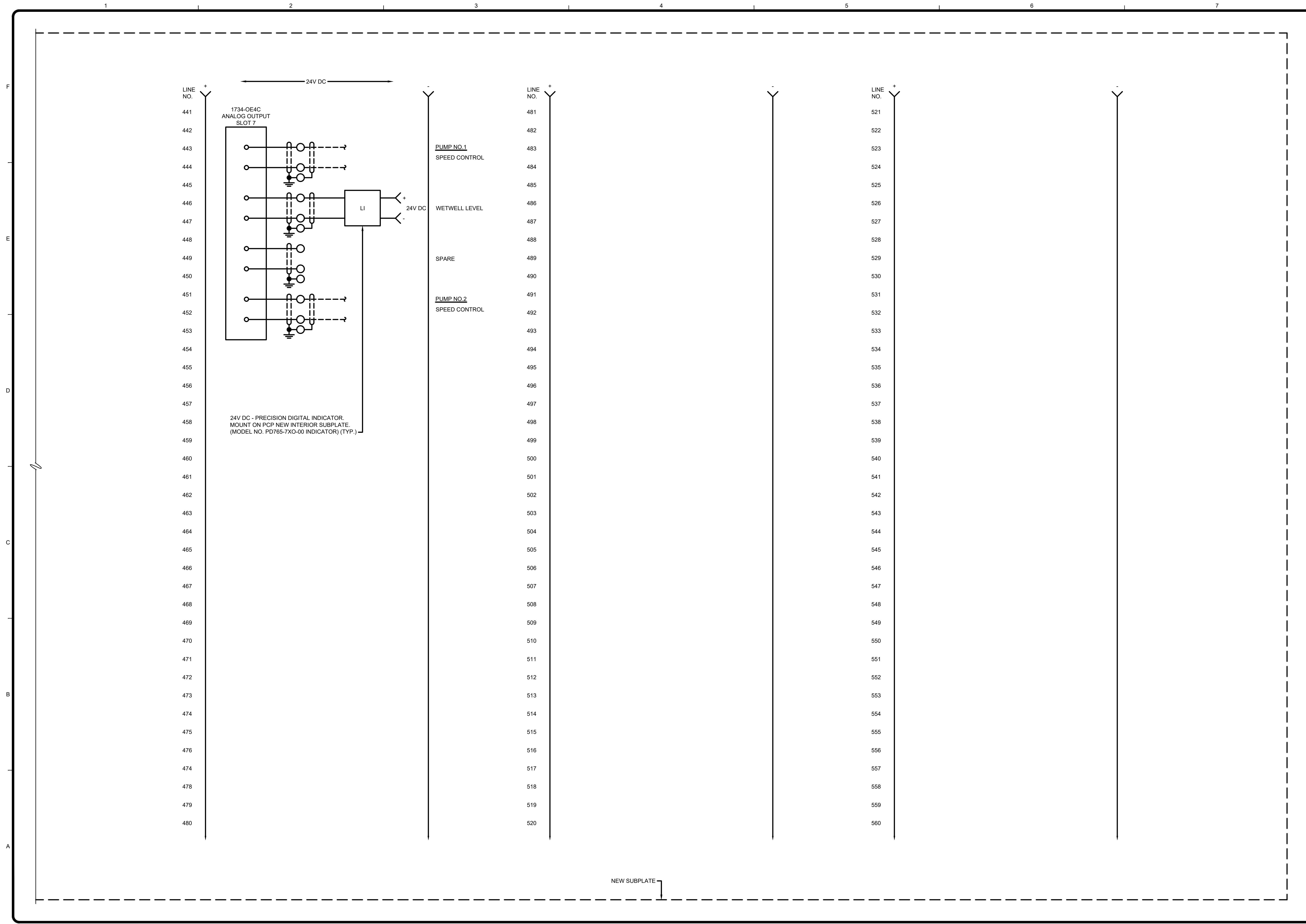
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OF 28

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Bar Measures 1 inch

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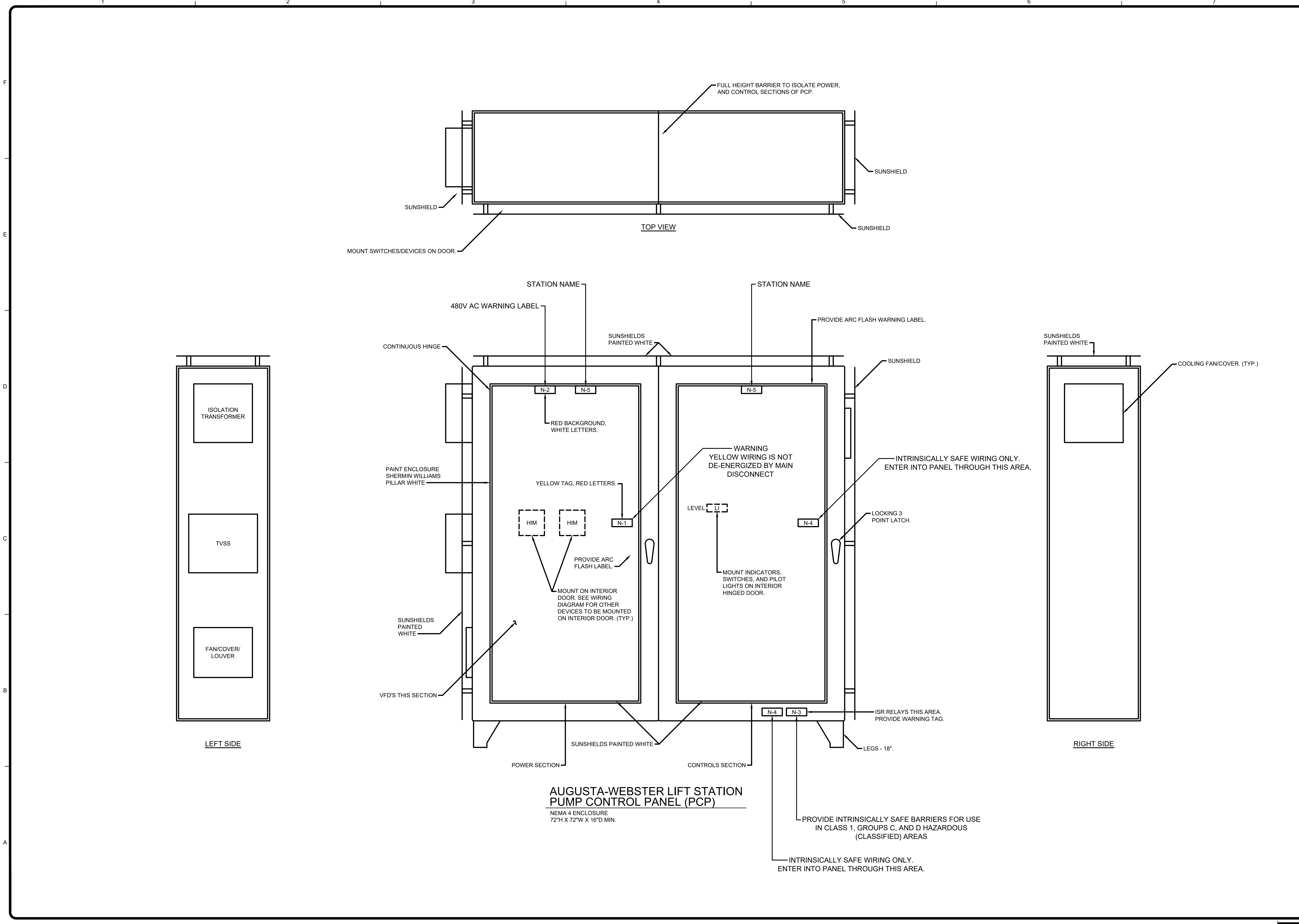
BY	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE

INSTRUMENTATION L-AVENUE PUMP CONTROL PANEL WIRING DIAGRAM

Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

4/27/2022 11:57:13 AM - \\TT.LOCA\I\PROJECTS\ANN ARBOR\I\19743\200-19743-2\1003\CAD\SHETS\FILES\I\PUMP STATIONS\I-22_AUGUSTA-WEBSTER_MCP_LAYOUT_SUBPLATE DETAILS.DWG - SHANK, JASON



MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
SEWAGE LIFT STATIONS ELECTRICAL AND CONTROLS UPGRADES AUGUSTA-WEBSTER
CLIMAX, L-AVENUE, WINDING WAY, WOODS LAKE
INSTRUMENTATION
AUGUSTA-WEBSTER LIFT STATION MAIN CONTROL
PANEL LAYOUT, SUBPLATE DETAILS

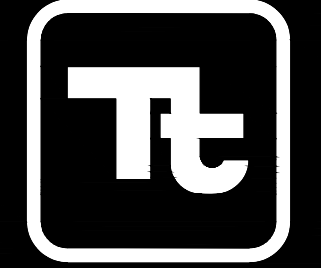
Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MS.J/G.C.J.

I-22
OF 28
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Bar Measures 1 inch

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23. INSTRUMENTATION 6TH STREET PANEL LAYOUT, WIRING DIAGRAM
24. ELECTRICAL DETAILS
25. ELECTRICAL DETAILS

PROJECT LOCATION:

KALAMAZOO, MICHIGAN

CLIENT INFORMATION:

KALAMAZOO, MICHIGAN

Tt PROJECT No.:

200-19743-21002

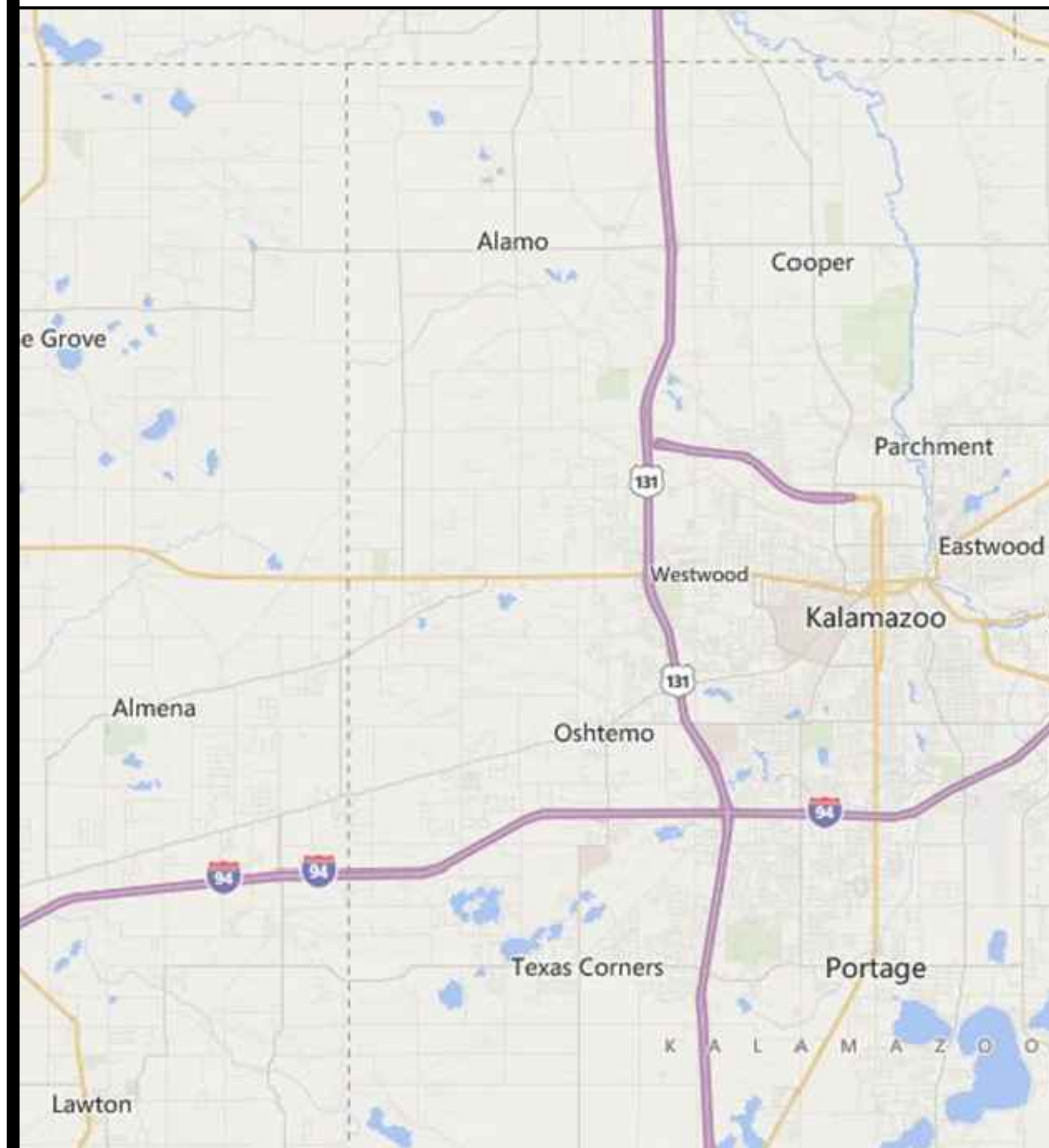
CLIENT PROJECT No.:

PROJECT DESCRIPTION / NOTES:

ISSUED:

OWNER REVIEW 10-15-21
OWNER REVIEW 10-28-21
OWNER REVIEW 1-14-22
FINAL OWNER REVIEW 2-18-2022
QA/QC 4-27-22
FOR BIDDING AND CONSTRUCTION 4-28-22

VICINITY MAP:



3/1/2022 11:08:27 AM - \\TT.LOCAL\IERPROJECTS\ANN ARBOR\IER19743200-19743-21002\CAD\SHEETFILES\11_E-LEG.DWG - SHANK, JASON

BACKGROUND PLAN AND ONE LINE SYMBOLS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	CONTROL SWITCH (SEL. OR P.B.) SEE CIRCUITS FOR SPECIFIC TYPE		TAG NO. (BALLOON) FOR DEVICE INDICATED
	SEE CIRCUITS FOR SPECIFIC TYPE		FOR POWER (SEE NOTE 2 ON STANDARD NOTE SHEET)
	TEMPERATURE - HUMIDISTAT SWITCH (SUBSCRIPT=NO. OF STAGES)		CONDUIT AND WIRE RUN FROM DEVICE INDICATED TO LOCATION INDICATED
	LIMIT (PROXIMITY TYPE) PRESSURE - VACUUM SWITCH ELECTRICAL OR MECHANICAL ALTERNATOR (SEE WIRING)		CAPACITOR, 3 PHASE, SIZE AS INDICATED
	OVERLOAD SWITCH OR DEVICE		DISCONNECT SWITCH (F) = FUSED, (C) = CIRCUIT BREAKER
	TERMINAL BOX		MAGNETIC STARTER (BACKGROUND DRAWINGS ONLY)
	SOLENOID VALVE		COMBINATION MAGNETIC STARTER FUSED UNLESS NOTED (CIRCUIT BREAKER)
	PHOTOCELL LINE VOLTAGE		COMBINATION LIGHTING CONTACTOR WITH HAND-OFF-AUTO SWITCH
	AS NOTED (LIGHTING PANEL, CONTROL PANEL, DISTRIBUTION PANEL, ETC.) WALL MOUNTED		MANUAL STARTER (R) = REVERSING
	JUNCTION BOX		CONTROL PANEL
	TRANSFORMER		UNIT HEATER, 1/8 HORSEPOWER
	CONDUIT WITH CONDUIT SEAL FITTING		LIGHTING ARRESTOR
	CONDUIT EXPOSED		LOW VOLTAGE HOME RUNS 120/208V, 120/240V (SEE NOTE 2 ON STANDARD NOTE SHEET)
	CONDUIT CONCEALED		WATERTIGHT
	DIRECT BURIED CONDUIT		WATERTIGHT AND CORROSION PROOF
	DIRECT BURIED CABLE		EXPLOSION PROOF - CLASS I, DIVISION 1, GROUP D
	OVERHEAD LINE		EXPLOSION PROOF - CLASS II, DIVISION 1
	UNDERGROUND DUCT BANK		KEYLOCK
	EXISTING UNDERGROUND DUCT BANK		SMOKE DETECTOR
	CONCRETE ENCASED DUCT BANK WITH CABLE LOCATIONS, AND SPARE DUCTS AS INDICATED ON DRAWINGS		EXIT LIGHT
	CABLE REEL		FLUORESCENT LUMINAIRE
	MULTI-STACK ALARM LIGHTS		INCANDESCENT LUMINAIRE
	SELECTOR SWITCH / PUSHBUTTON. FUNCTIONS AS SHOWN IN WIRING DIAGRAMS		HIGH INTENSITY DISCHARGE LIGHT
	LOW VOLTAGE DISCONNECT SWITCH		EMERGENCY BATTERY PACK
	LOW VOLTAGE FUSE (BELOW 600V)		DESK INTERCOM SET
	HIGH VOLTAGE FUSE (ABOVE 600V)		CAMERA
	ALL STARTERS SHALL BE FULL VOLTAGE, NON-REVERSING UNLESS OTHERWISE INDICATED.		DOME CAMERA (PAN, TILT, ZOOM)
	(FVR) FULL VOLTAGE REVERSING (RV) REDUCED VOLTAGE (2S, 2W) TWO SPEED, TWO WINDING		DRAW OUT CIRCUIT BREAKER (ABOVE 600 VOLT)
			CIRCUIT BREAKER WITH STAB CONNECTION
	600V, 3 POLE MOLDED CASE CIRCUIT BREAKER, FRAME & RATING AS SHOWN		CURRENT TRANSFORMER, AND RATIO (WITH NUMBER REQUIRED SHOWN)
	SINGLE PHASE, FRACTIONAL HP MOTOR TO LOCATION INDICATED (SEE NOTE 2 ON STANDARD NOTE SHEET)		SECONDARY TRANSFORMER
	DEVICE SYMBOL WITH TYPE DEVICE		MOLDED CASE CIRCUIT BREAKER
	THREE PHASE LOAD WITH IDENTIFICATION		GENERAL DISCONNECT SWITCH

WIRING DEVICE SCHEDULE

SYMBOL	DESCRIPTION	NEMA TYPE
	125V, 2P, DUPLEX, 3W	5-20 R
	SIMPLEX RECEPTACLE	
	QUAD RECEPTACLE	
	20A, 120/277V SWITCH	SPST

CONTROL CIRCUIT & PILOT DEVICE LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	PRESSURE ACTUATED SWITCH		SELECTOR SWITCH - NORMALLY OPEN
	FLOW ACTUATED SWITCH		TEMP. ACTUATED SWITCH
	LIMIT SWITCH - NORMALLY OPEN		LIMIT SWITCH - NORMALLY CLOSED
	LIMIT SWITCH - NORMALLY CLOSED - HELD OPEN		LIMIT SWITCH - NORMALLY OPEN - HELD CLOSED
	LATCHING CABLE SWITCH		TIME DELAY FUSE
	MOMENTARY PUSHBUTTON OPERATOR-NORMALLY CLOSED		PUSHBUTTON OPERATOR WITH MUSHROOM HEAD
	MOMENTARY PUSHBUTTON OPERATOR-NORMALLY OPEN		FIELD LOCATED STOP BUTTON
	CONTROL RELAY CONTACT - NORMALLY OPEN		CONTROL RELAY CONTACT - NORMALLY CLOSED
	TIMING RELAY INSTANTANEOUS CONTACT		TIMING RELAY INSTANTANEOUS CONTACT
	CONTROL RELAY COIL		SELECTOR SWITCH OPERATOR WITH FUNCTION SHOWN
	TWO COIL LATCHING RELAY		TIMED OPEN CONTACT ON ENERGIZATION
	TIMED CLOSED CONTACT ON ENERGIZATION		TIMED CLOSED CONTACT ON DE-ENERGIZATION
	TIMED OPEN CONTACT ON DE-ENERGIZATION		PUSH-TO-TEST INDICATING LIGHT
	ZERO SPEED OR ANTI-PLUGGING SWITCH		MAINTAINED STOP - MOMENTARY START PUSHBUTTON (JOG)
	MAINTAINED STOP-START PUSHBUTTON OPERATOR		SOLENOID OR CLUTCH
	MAINTAINED PUSH - PULL OPERATOR		ELAPSED TIME INDICATOR
	LOCAL TERMINALS WITH EXTERNAL WIRING		120VAC TRANSFORMER
	TIMING RELAY COIL		PUSHBUTTON OPERATOR WITH MUSHROOM HEAD
	TIMING RELAY COIL (OFF DELAY)		THERMAL OVERLOAD
	INDICATING LIGHT		FIELD LOCATED
	PUSH-TO-TEST INDICATING LIGHT		TERMINAL POINT
	SECONDARY TRANSFORMER		TERMINAL
	MOLDED CASE CIRCUIT BREAKER		LOW VOLTAGE FUSE
	GENERAL DISCONNECT SWITCH		FUSIBLE TERMINAL BLOCK
			CONTROL POWER TRANSFORMER
			RECEPTACLE

NOTE: THE PLC I/O ADDRESS SHALL BE USED AS THE WIRING TAG SCHEME FOR ALL PANEL AND FIELD CONTROL WIRING. COORDINATE WITH ELECTRICAL CONTRACTOR.

I.S.A. STANDARD LETTER FUNCTIONS

SYMBOL	FIRST LETTER	SUCCEEDING LETTERS
A	ANALYSIS, ANALOG	ALARM
B	BURNER, FLAME	BATCH
C	CONDUCTIVITY, COMMAND	CONTROL (FEEDBACK TYPE)
D	DENSITY, SPECIFIC GRAVITY	
E	VOLTAGE	PRIMARY ELEMENT
F	FLOW RATE	RATIO
G	GAGING	GLASS
H	HAND, MANUAL	HIGH
I	CURRENT	INDICATE
J	POWER	SCAN
K	TIME, TIME SCHEDULE	CONTROL (NO FEEDBACK)
L	LEVEL, LIGHT	LOW
M	MOISTURE, HUMIDITY	MIDDLE, MODULATE
N		
O	OVERLOAD	ORIFICE
P	PRESSURE, VACUUM	POINT
Q	QUANTITY	TOTALIZE, INTEGRATE
R	RADIOACTIVITY	RECORD, PRINT, RECEIVE
S	SPEED, FREQUENCY, SOLENOID	SWITCH
T	TEMPERATURE, TURBIDITY	TRANSMIT, TRANSFORM
U	MULTIVARIABLE	MULTIFUNCTION
V	VIBRATION, VISCOSITY	VALVE, DAMPER, LOUVER
W	WEIGHT, FORCE	
X		RELAY, COMPUTE
Y		DRIVE, ACTUATE
Z	POSITION	

PROTECTIVE RELAY LEGEND

DEVICE NO.	DESCRIPTION
2	SYNC. TIMER 0-5 MIN.
25	SYNCHRONIZING
27	SHORT TIME UNDERVOLTAGE
32	REVERSE POWER RELAY
38	TEMPERATURE
40	LOSS OF EXCITATION
43	SELECTOR SWITCH
47	PHASE SEQUENCE & UNDERVOLTAGE
49	THERMAL
50/51	INSTANTANEOUS AND VERY INVERSE
51	VERY INVERSE
51G	INVERSE GROUND FAULT
51N	NEUTRAL OVERCURRENT
51V	OVERCURRENT RELAY WITH VOLTAGE RESTRAINT
52/CS	CONTROL SWITCH
59	INSTANTANEOUS OVERVOLTAGE
60	VOLTAGE BALANCE
62	TIME DELAY
64	SHORT TIME LOW PICK UP OVERVOLTAGE
67	DIRECTIONAL OVERCURRENT
69	LOCKOUT CONTROL SWITCH
78	OUT OF STEP
81	OVER/UNDER FREQUENCY RELAY
83	MULTI-CONTACT AUXILIARY
86/HR	MULTI-CONTACT AUX. HAND RESET
87	DIFFERENTIAL OVERCURRENT

SYMBOL LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	POTENTIAL TRANSFORMER		WATTMETER
	CURRENT TRANSFORMER		ALARM POINT
	AMMETER		CONTROL POWER TRANSFORMER
	VOLTMETER		NUMBER OF DEVICES REQUIRED
	POWER FACTOR METER		ELAPSED TIME METER



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CITY OF KALAMAZOO, MICHIGAN

REMOTE SITE GENERATORS
ELECTRICAL LEGEND

Project No.: 200-19743-21002
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ



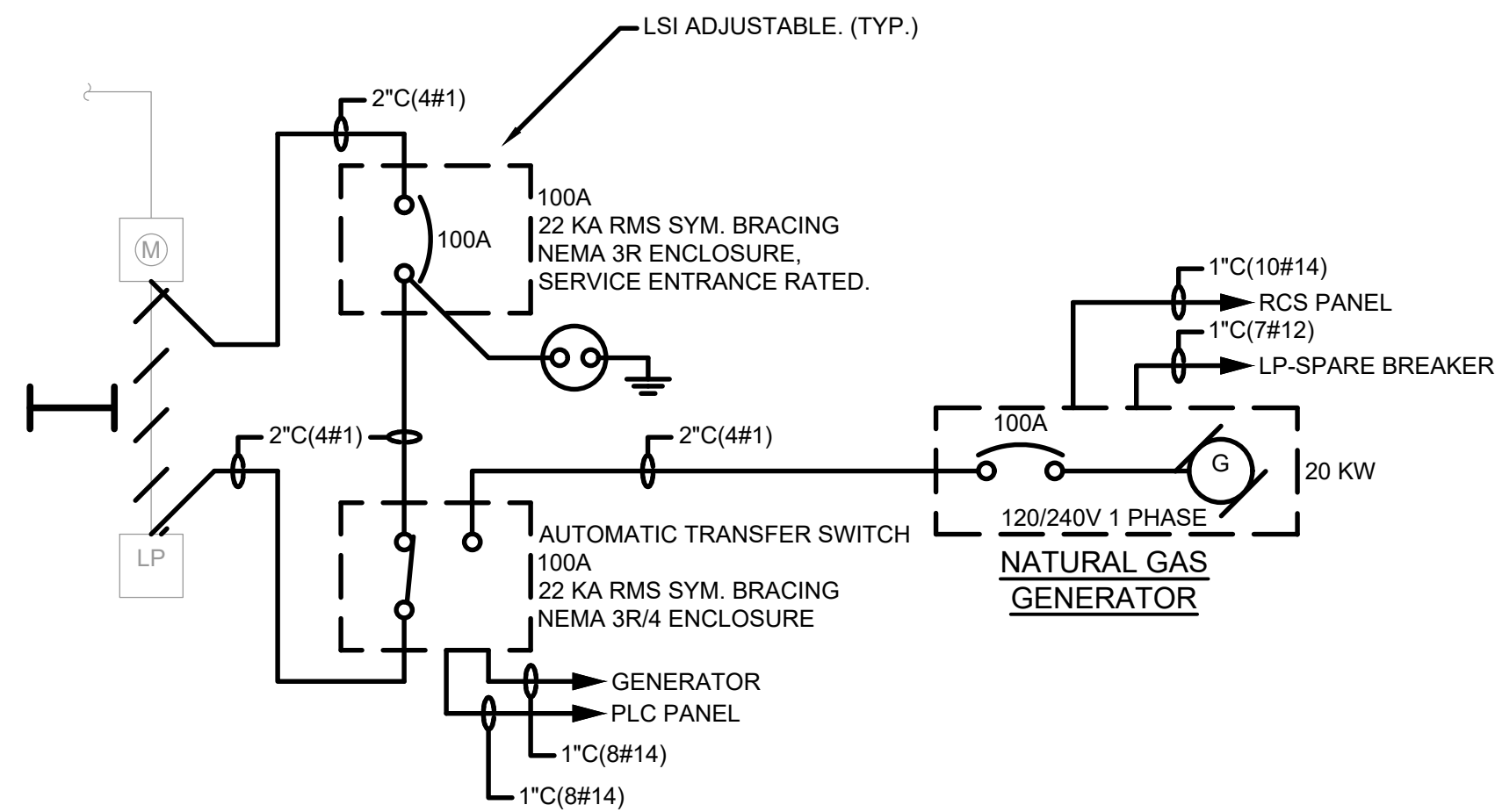
EXISTING PLC PANEL



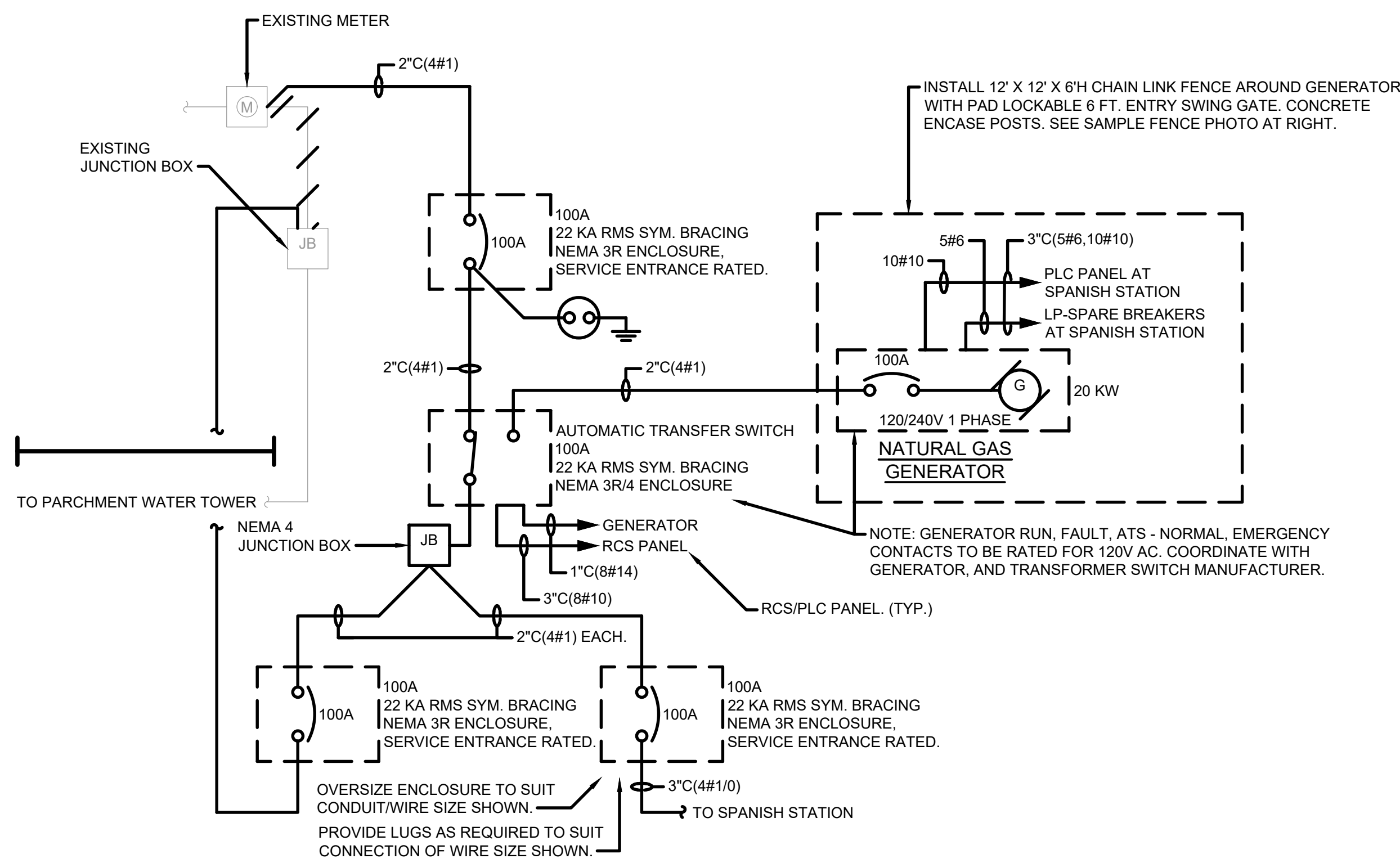
EXISTING PANELBOARD



EXISTING LIGHTING PANEL



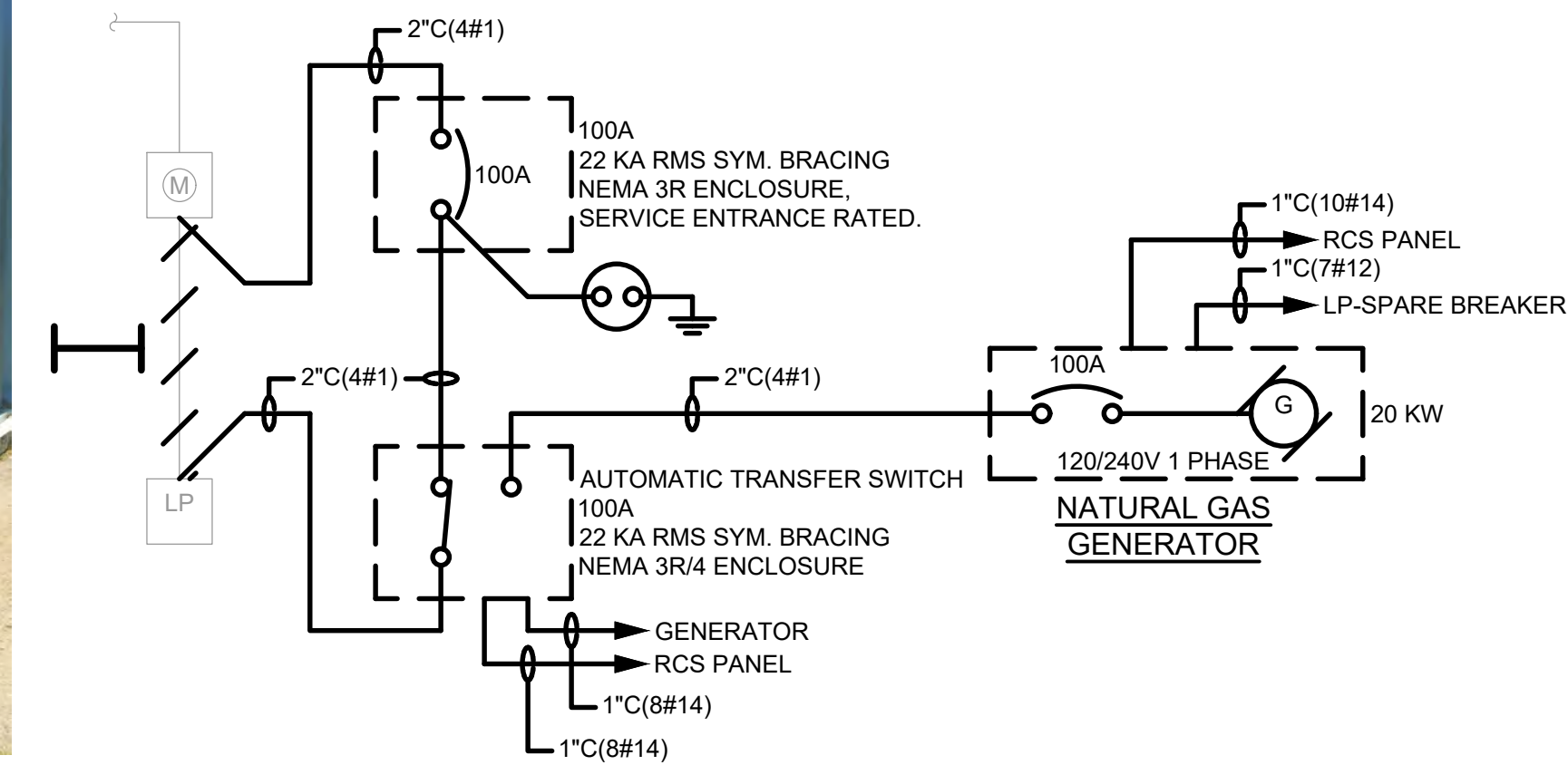
EDGEMOOR TANK



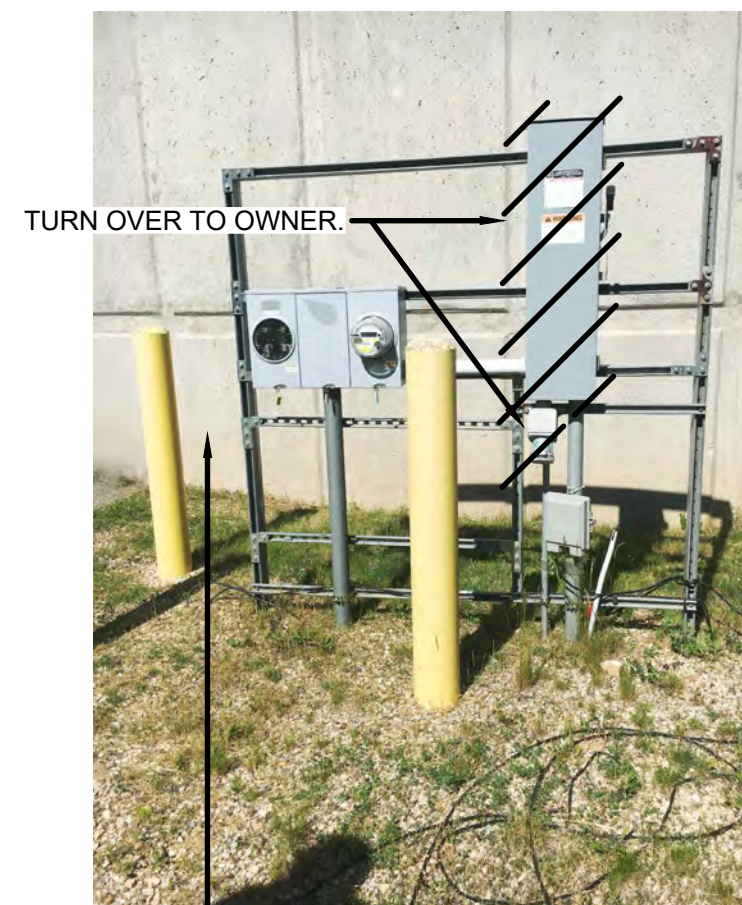
PARCHMENT



CORE HOLE(S) AS REQUIRED FOR NEW CONDUITS. SEE NOTE NO. 10, AND NOTE NO. 12 BELOW.

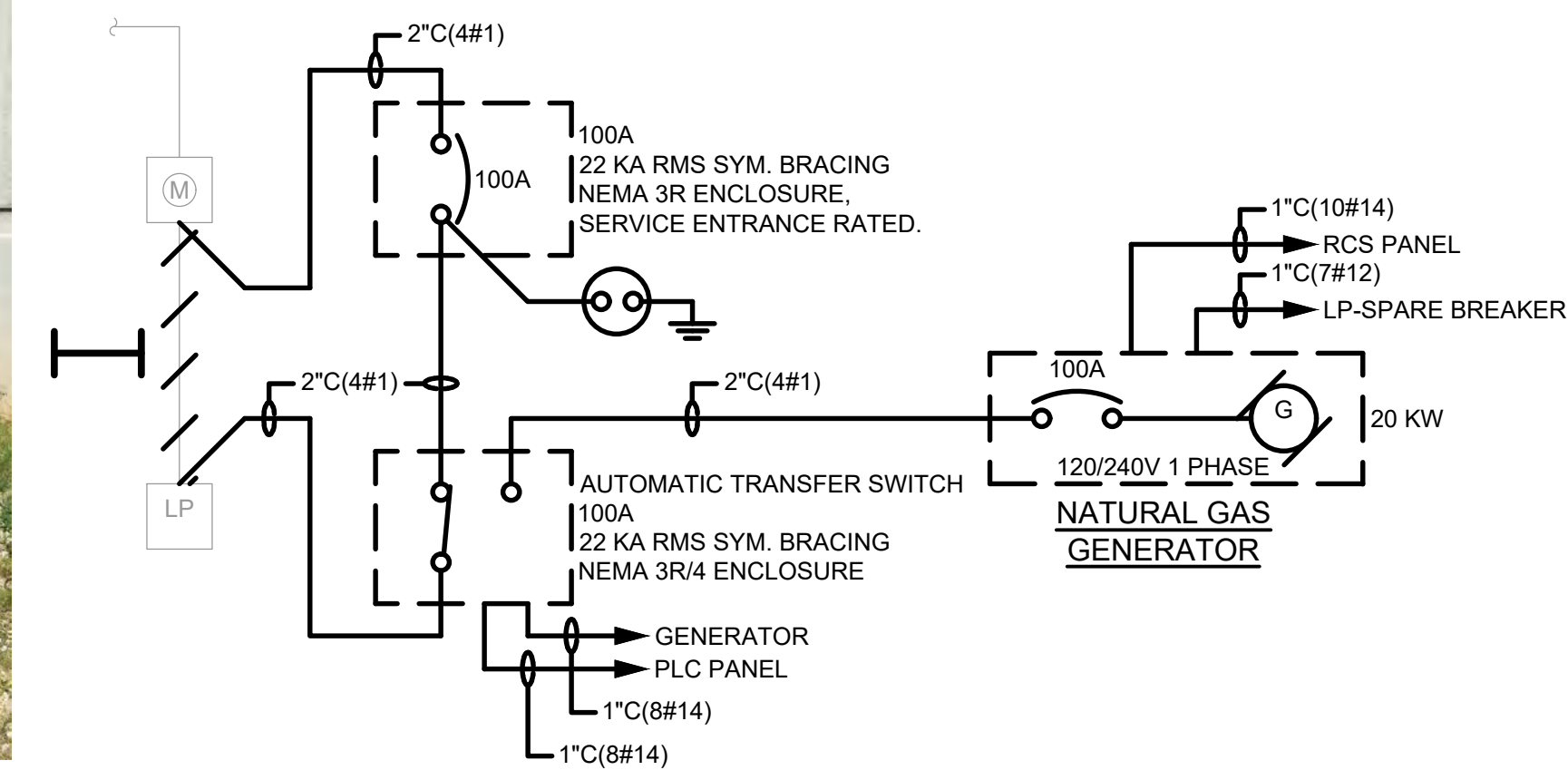


GULL ROAD TANK

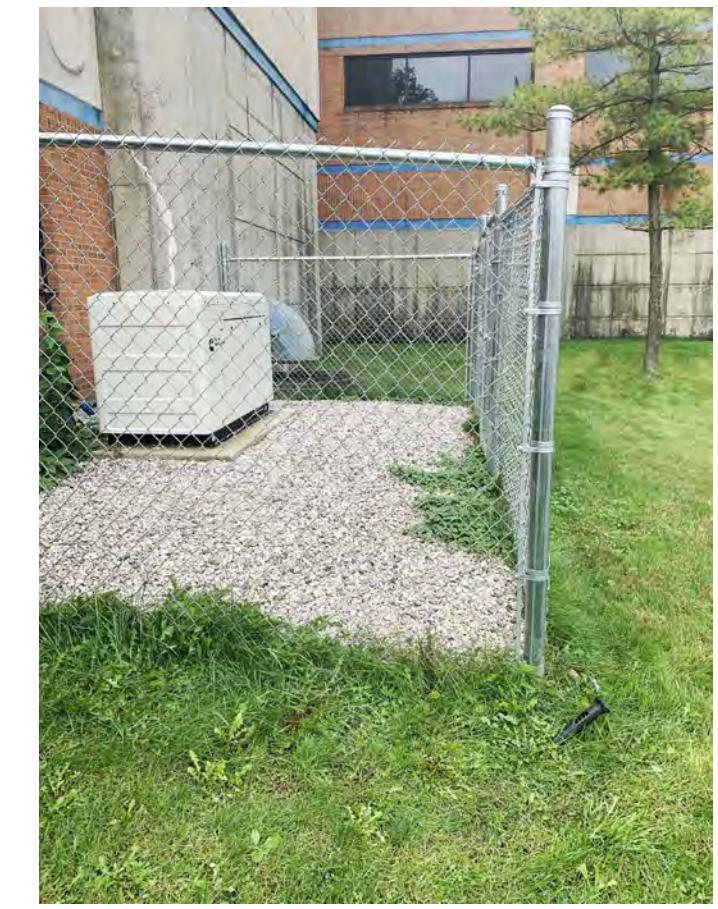


TURN OVER TO OWNER.

CORE HOLES AS REQUIRED FOR NEW CONDUITS. SEE NOTES NO. 11, AND NO. 12.



BEECH TANK



SAMPLE FENCE PHOTO

NOTES:

(WORK SHOWN ON SHEETS NO.3, AND NO.4 ARE TYPICAL FOR EDGEMOOR, GULL, PARCHMENT, BEECH, SIESTA, MT. OLIVET, 6TH STREET, AND BLAKESLEE)
NOTE: 6TH STREET REQUIRES A PROPOSED TANK.

- CONTRACTOR SHALL COORDINATE THE INSTALLATION OF THE GAS LINE AND METER AND PAY THE FEES TO CONSUMERS ENERGY. REFER TO THE ALLOWANCE IN THE PROJECT MANUAL. NO MARK-UPS SHALL BE PERMITTED ON THE ALLOWANCE.
- FURNISH AND INSTALL A CONCRETE PAD FOR THE GENERATOR. SIZE PAD AS REQUIRED TO SUIT NEW GENERATOR. PAD SIZE TO INCLUDE AT LEAST 3 FEET CLEAR ALL THE WAY AROUND THE GENERATOR. REFER TO DETAIL SHEET FOR PAD REQUIREMENTS.
- FURNISH AND INSTALL A GROUND MAT AROUND EACH GENERATOR. BOND FRAME OF GENERATOR AS WELL AS BOND THE ATS AND MAIN BREAKER WITH BARE 4/0. REFER TO DETAIL SHEET FOR GROUND MAT REQUIREMENTS.
- MOUNT THE NEW MAIN BREAKER AND AUTOMATIC TRANSFER SWITCH ON A NEW STAINLESS STEEL STRUT RACK. SUPPORT RACK WITH 6 INCH STEEL POSTS CONCRETE ENCASED. POUR CONCRETE PAD BETWEEN POSTS.
- INSTALL SHUT OFF VALVE AND 2 INCH GAS LINE FROM METER TO GENERATOR. THE GAS LINE BETWEEN THE METER AND GENERATOR SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. REFER TO LOCAL AND NFPA CODES #54 AND #58 BEFORE SELECTING PIPING. AS A GUIDE, THE PIPING USED SHOULD BE MOUNTED IN A MANNER TO REDUCE VIBRATION, BE OF BLACK IRON, HAVE A CODE SPECIFIED FLEXIBLE HOSE BETWEEN THE GENERATOR SET CONNECTION AND RIGID PIPE INLET AND ALL PIPING HAS TO BE PURGED AND LEAK TESTED WITHIN LOCAL CODES. THE PIPING SHOULD HAVE THE DIAMETER TO DELIVER THE REQUIRED PRESSURE. COORDINATE EXACT PRESSURE REQUIREMENTS WITH GENERATOR MANUFACTURER. INCLUDE IN BID TO INSTALL 50 FT. OF GAS LINE FROM THE CONSUMERS ENERGY GAS METER TO GENERATOR. NOTE: STATION NO.11 IS 4\"/>

Eric Binkowski
Ph: 616-374-3221
Cell: 616-292-1288

MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
REMOTE SITE GENERATORS
ELECTRICAL ONE-LINE DIAGRAMS

Project No.: 200-19743-21002
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

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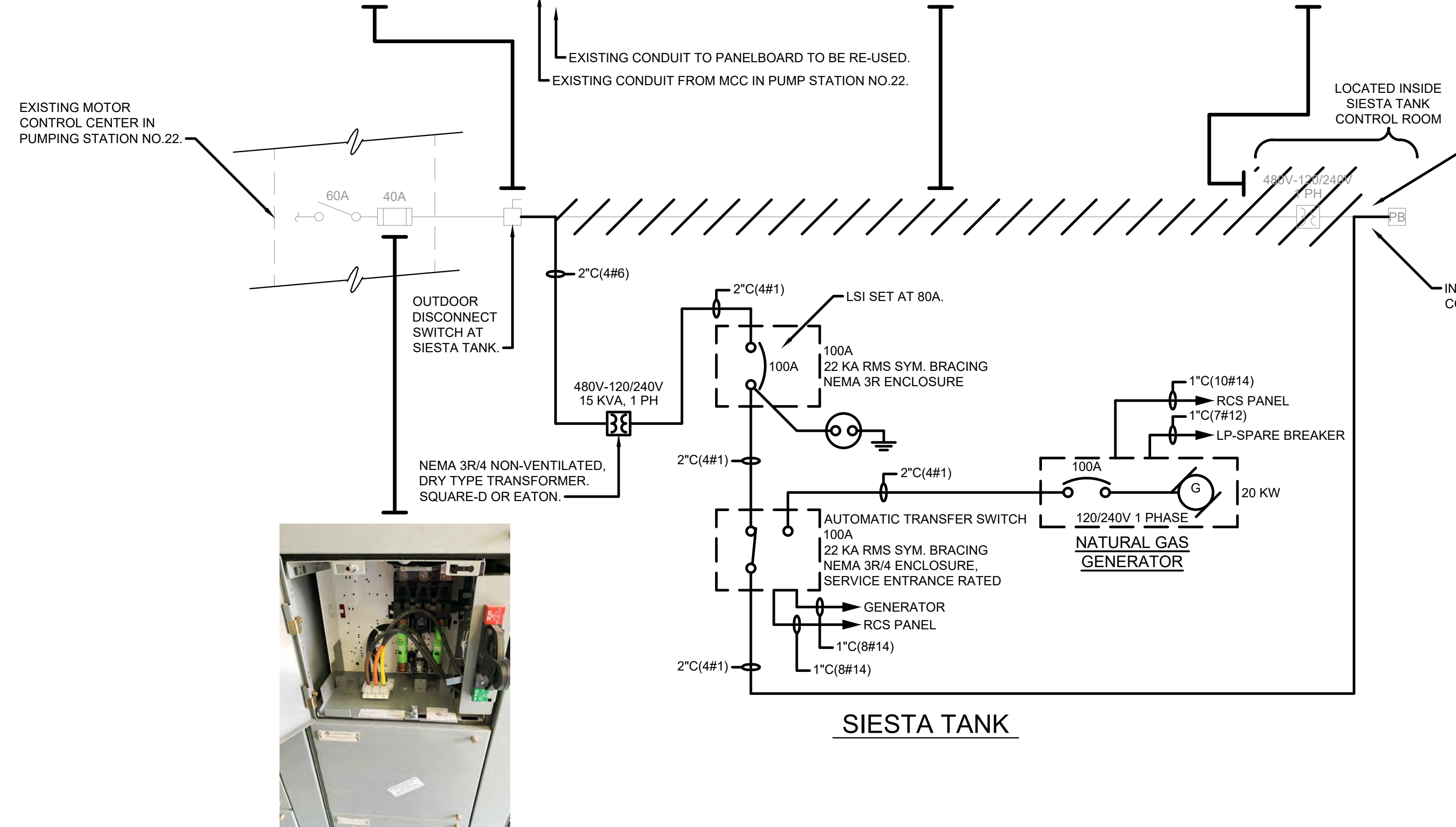
REWORK CONDUIT TO EXISTING PB. INSTALL NEW WIRES AS SHOWN.

EXISTING PANELBOARD (PB)

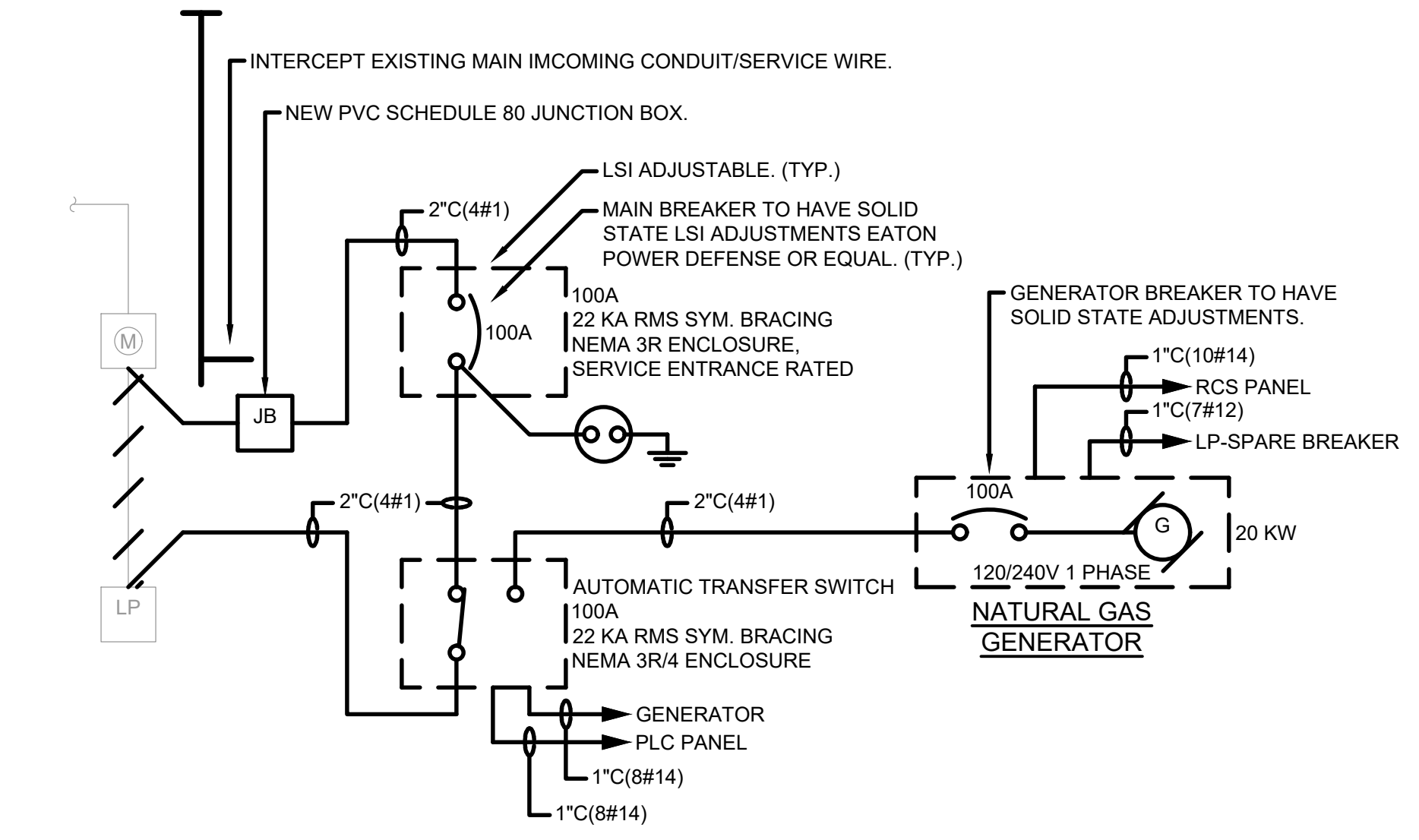
INSTALL NEW WIRES IN EXISTING CONDUIT TO EXISTING PANELBOARD.

EXISTING 2" CONDUIT TO BE RE-USED TO RE-FEED EXISTING PB.

CONDUIT FROM CPO METER. (INCOMING SERVICE)



SIESTA TANK



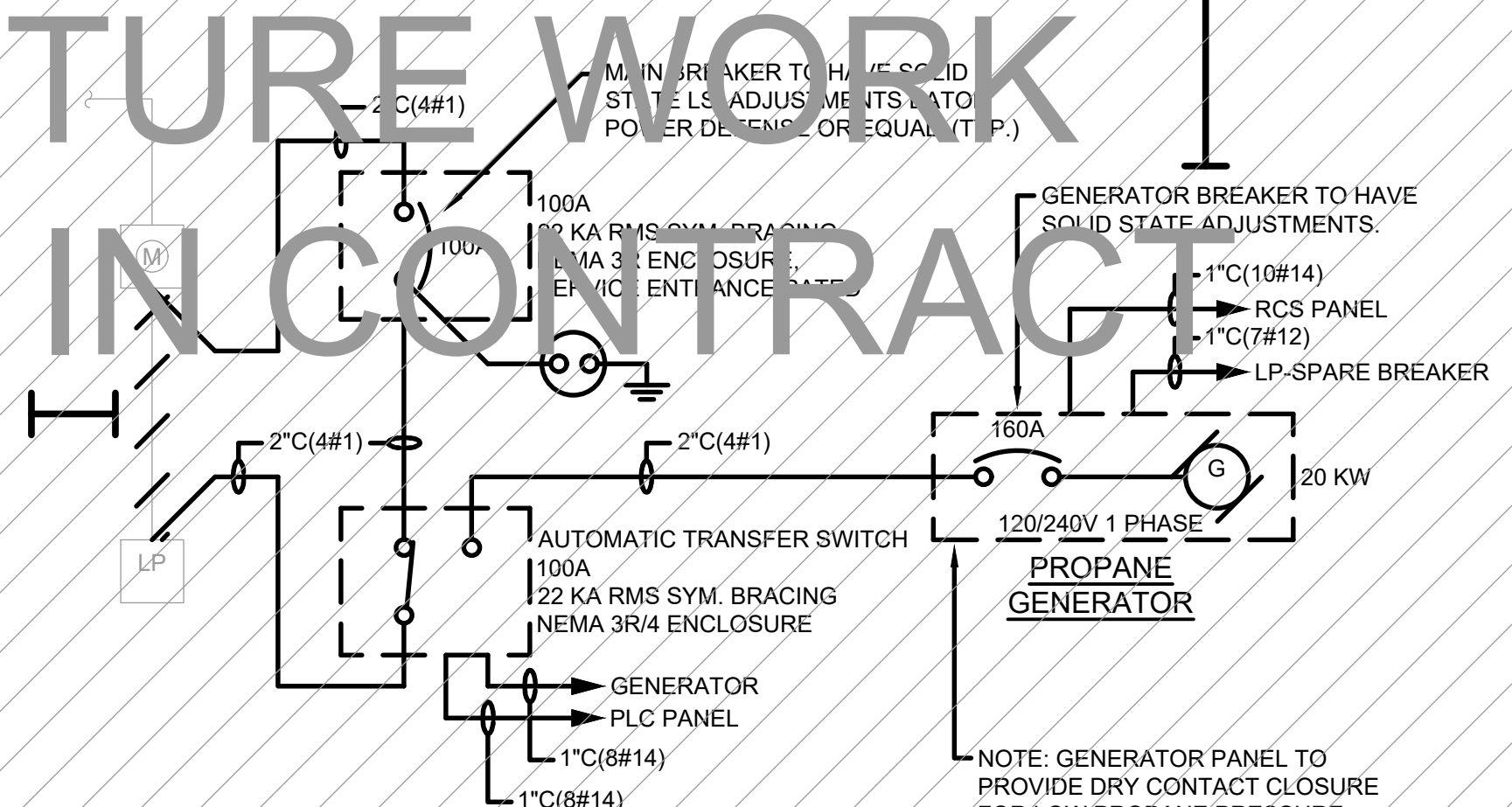
BLAKESLEE TANK



SAMPLE PROPANE TANK

TO BE PAID BY CONTRACTOR, AND INSTALLED INCLUDING SUPPLY LINE TO GENERATOR

EXISTING CPO METER TURN OVER TO OWNER



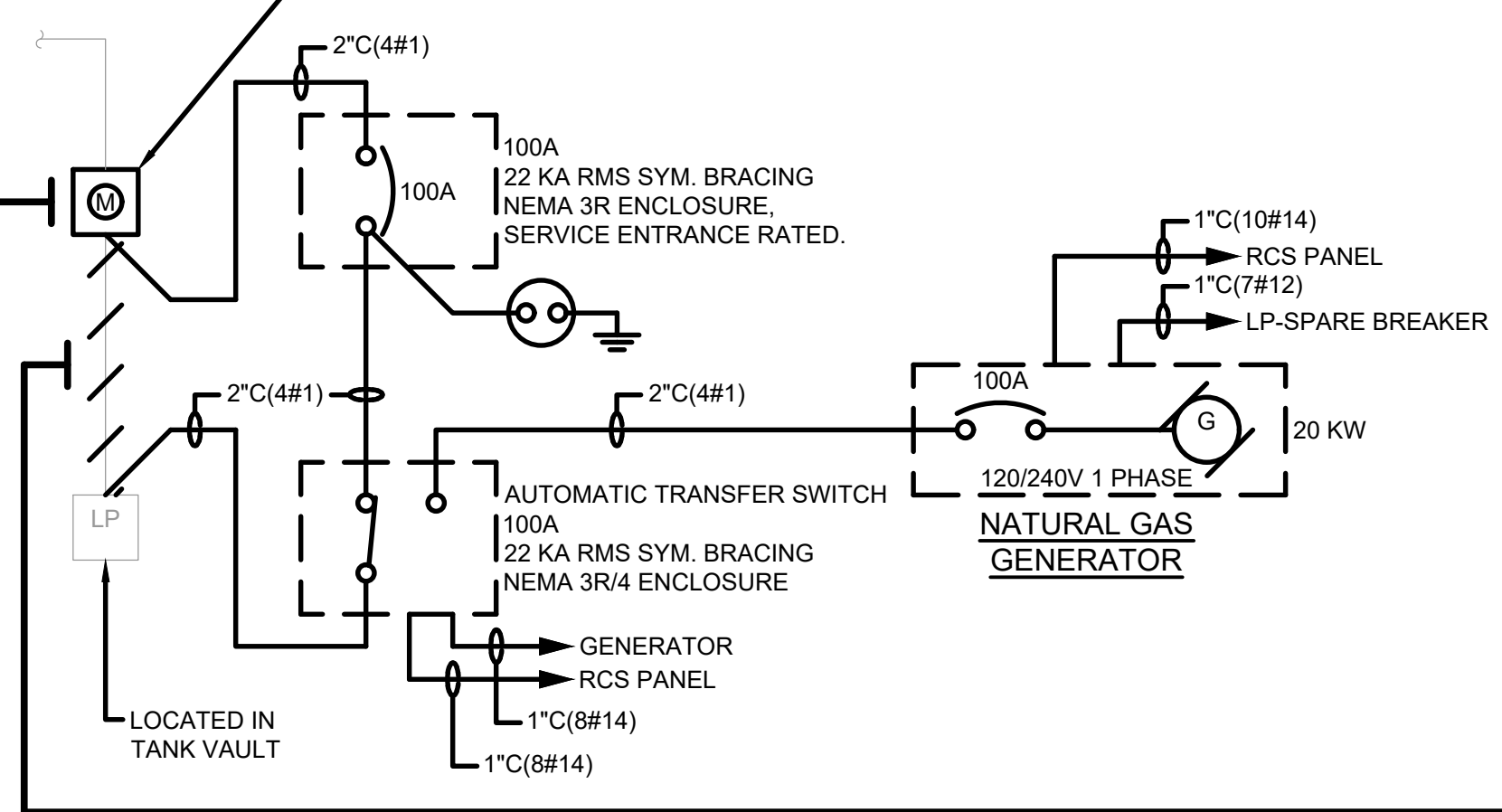
6TH STREET TANK

NOTE: GENERATOR PANEL TO PROVIDE DRY CONTACT CLOSURE FOR LOW PROPANE PRESSURE.



INSTALL NEW METER/SERVICE. COORDINATE WITH CONSUMERS ENERGY, AND PAY THE ASSOCIATED FEES.

DEMOLISH EXISTING METER, AND SERVICE. COORDINATE WITH CONSUMERS ENERGY.



MT. OLIVET TANK

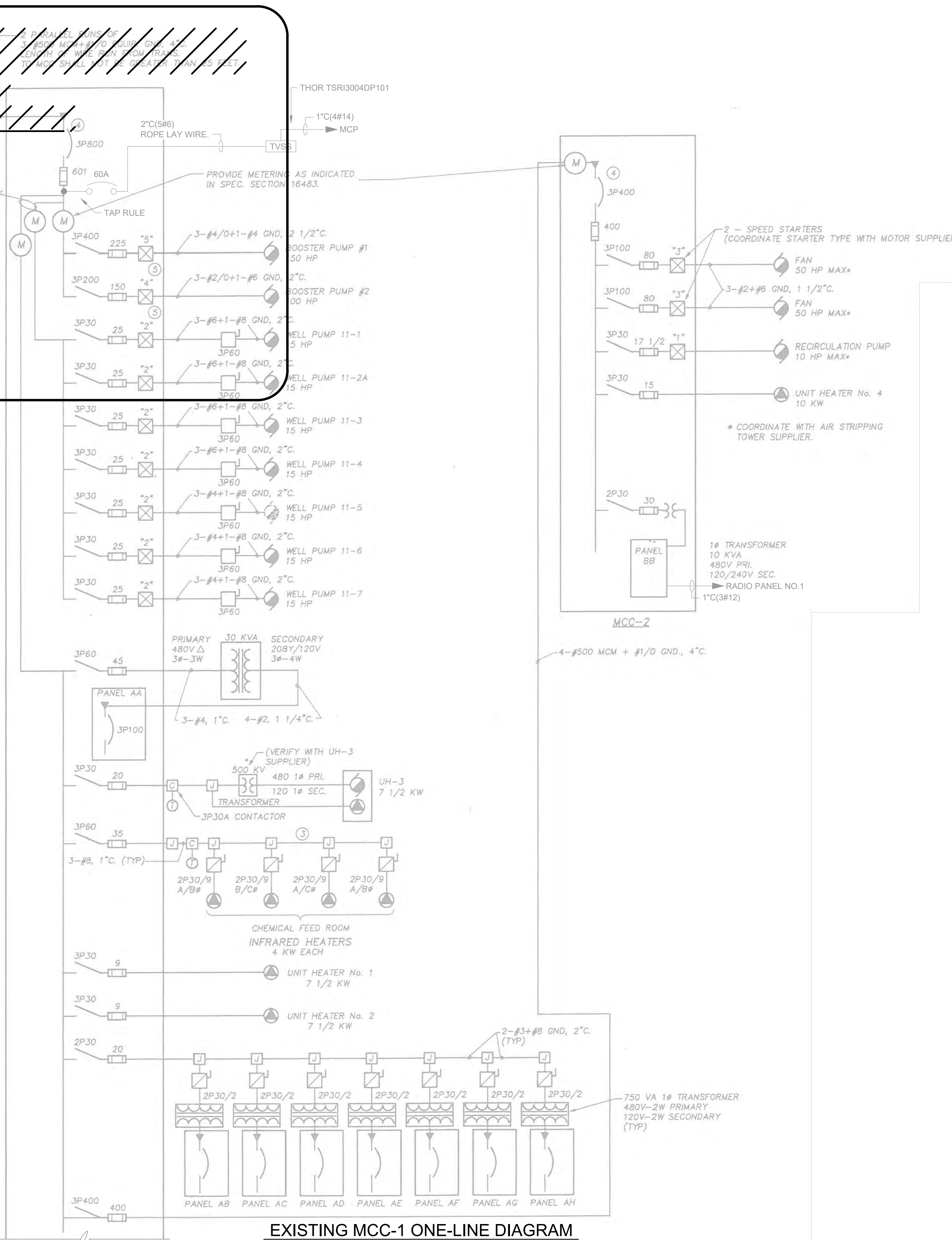
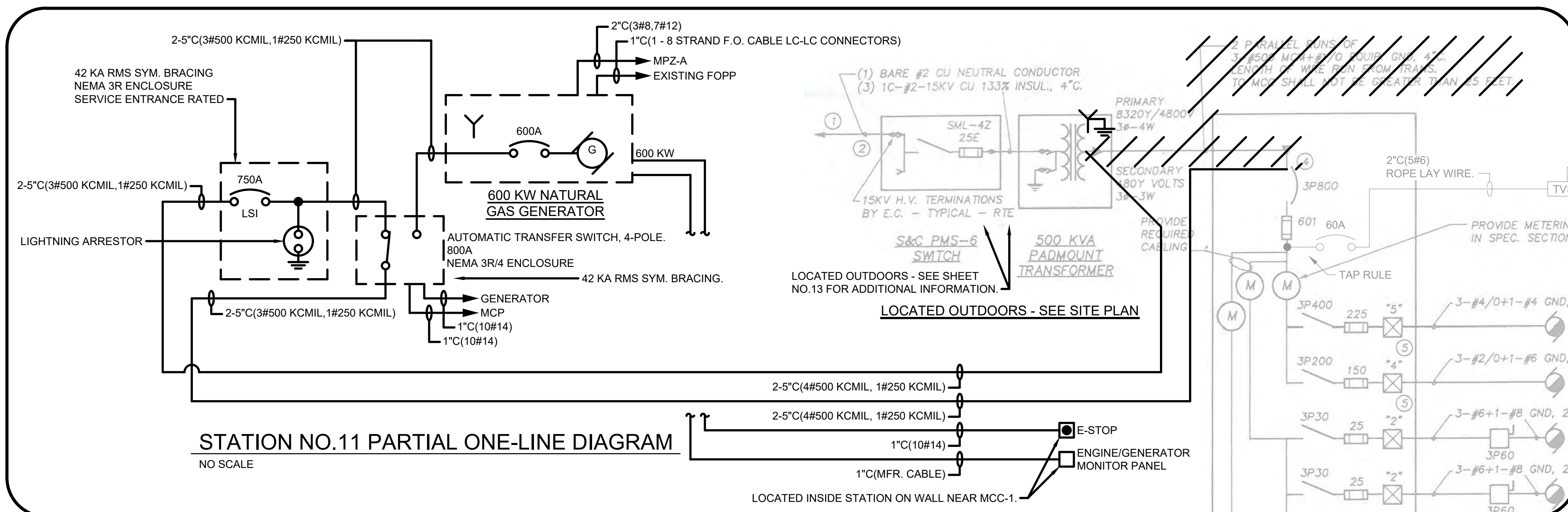
MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
 REMOVE SITE GENERATORS
ELECTRICAL ONE-LINE DIAGRAMS

Project No.: 200-19743-21002
 Designed By: GCJ
 Drawn By: JLS
 Checked By: MSJ/GCJ

4/27/2022 3:22:45 PM - \\TT.LOCAL\PROJECTS\ANN ARBOR\19743-21002\CAD\SHEETFILES\EM4_ONELINES_II.DWG - SHANK, JASON

4/27/2022 3:24:24 PM - \\TT.LOCAL\PROJECTS\ANN ARBOR\19743200-19743-21002\CAD\SHEETFILES\5 STATION NO.11 ONE-LINE.DWG - SHANK, JASON



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CITY OF KALAMAZOO, MICHIGAN
REMOTE SITE GENERATORS

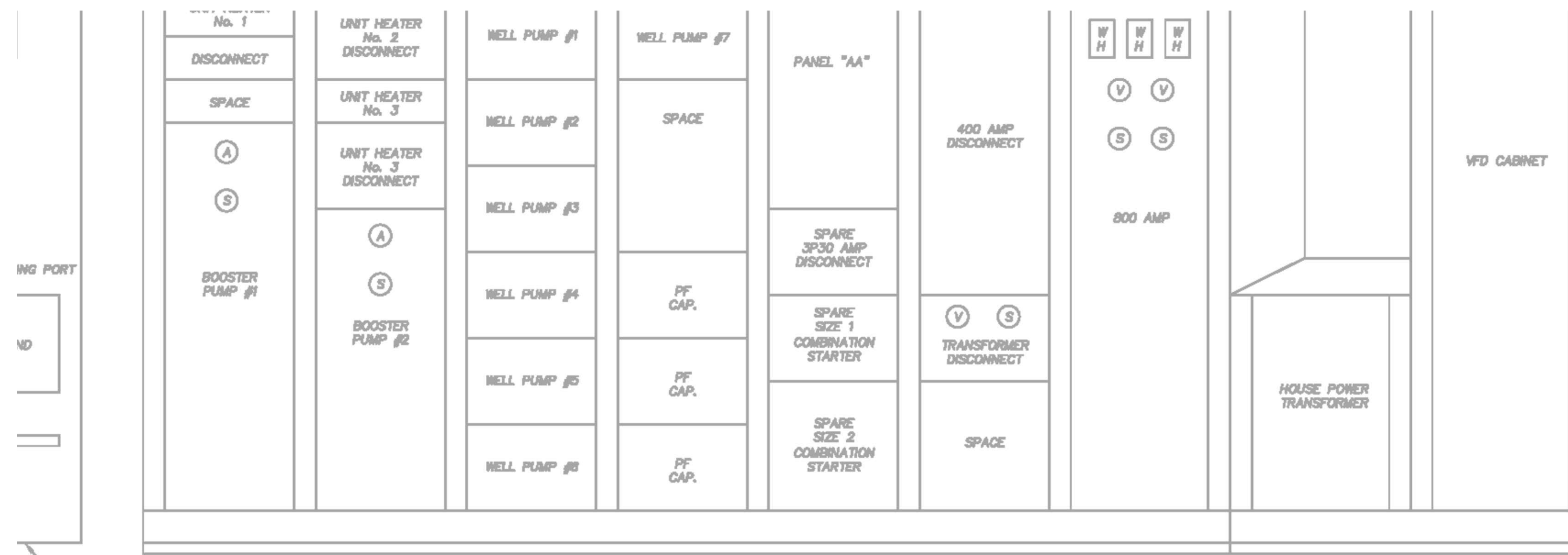
**ELECTRICAL
STATION NO.11
ONE-LINE DIAGRAM**

Project No.: 200-19743-21002
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

5
OF 25

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Bar Measures 1 inch

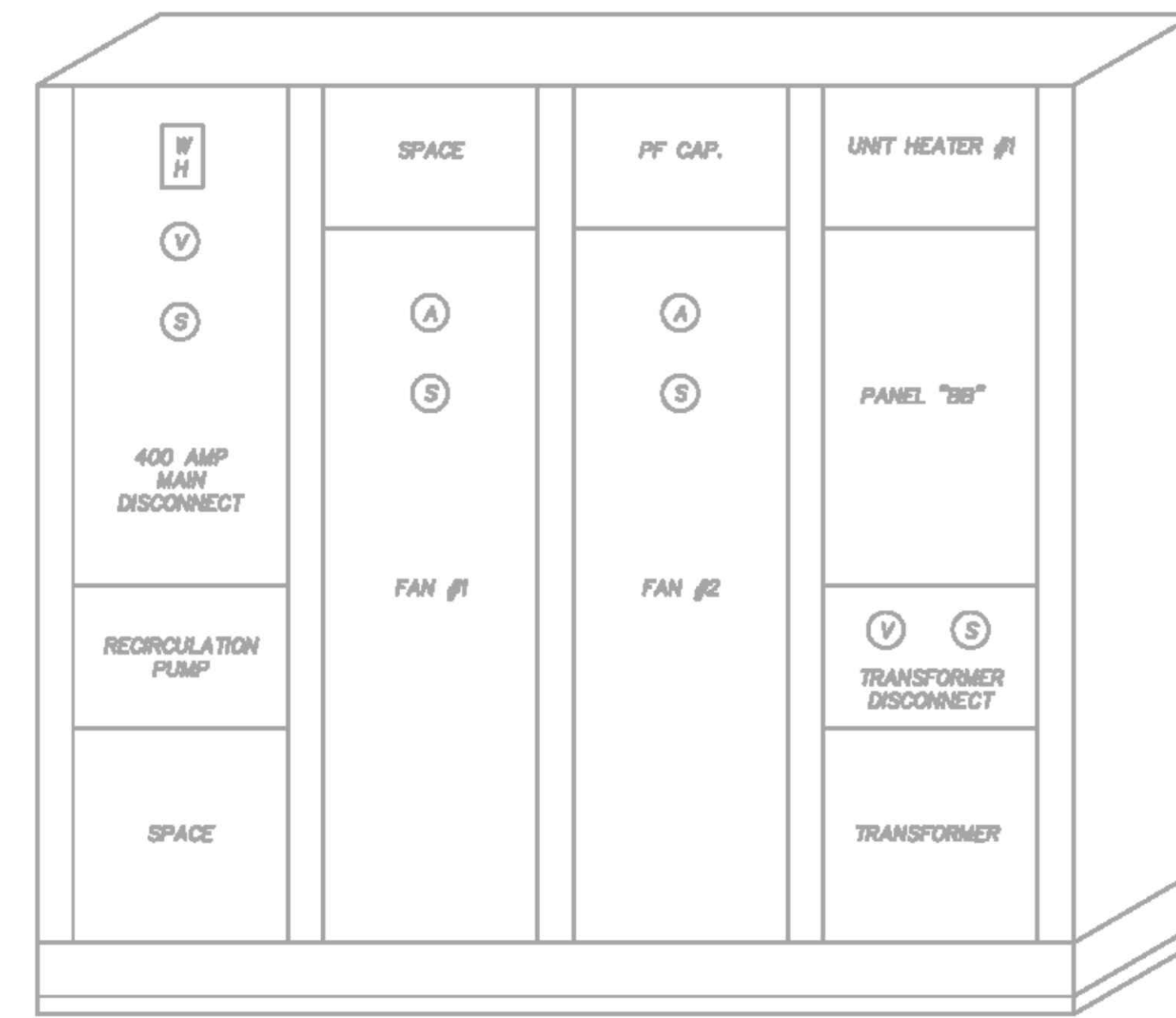
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FOR THIS SECTION
SEE DWG. PS11C-01



DEMOLISH EXISTING INCOMING CONDUIT/WIRE TO OUTDOOR TRANSFORMER. INSTALL NEW CONDUIT/WIRE AS SHOWN ON SHEET NO.5. CORE HOLES AS REQUIRED INTO EXISTING BLOCK BUILDING.

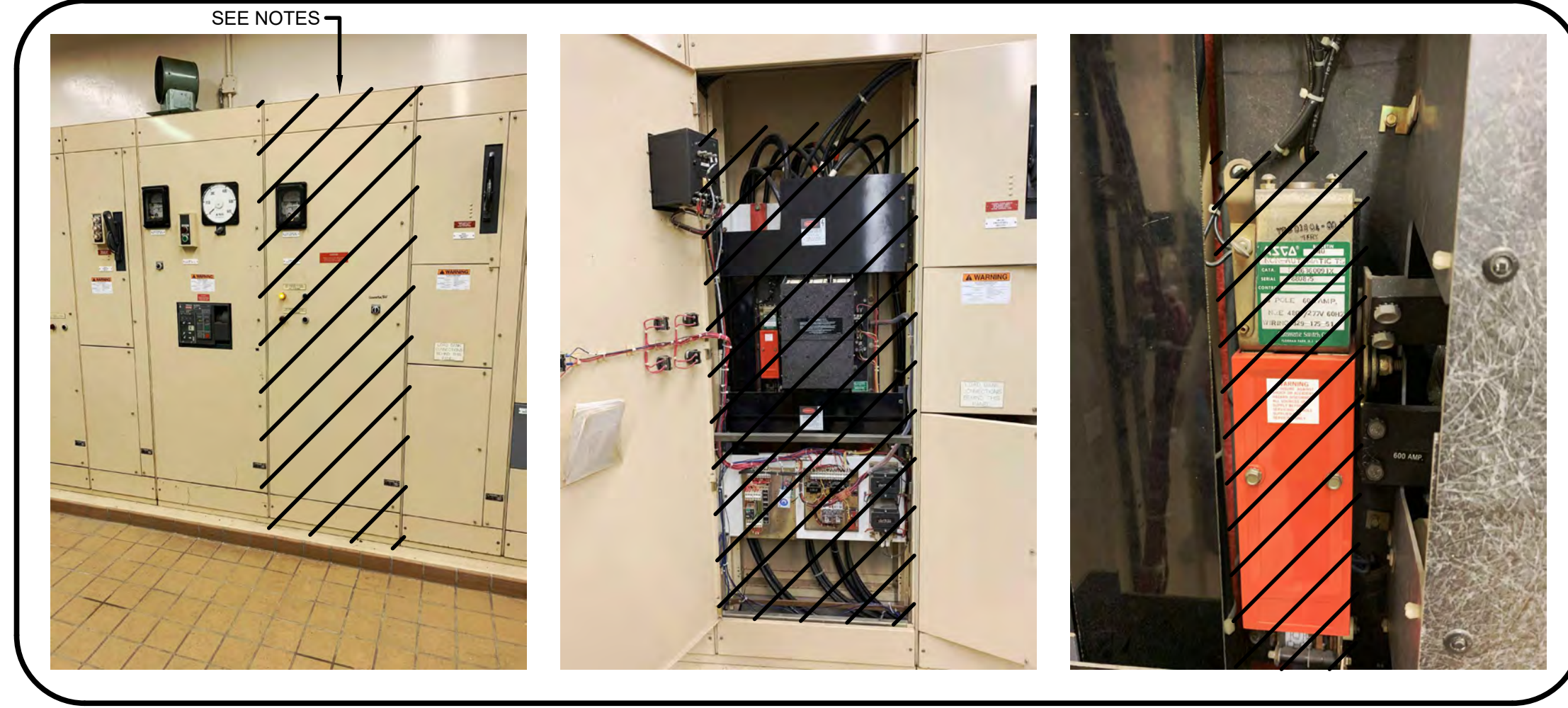
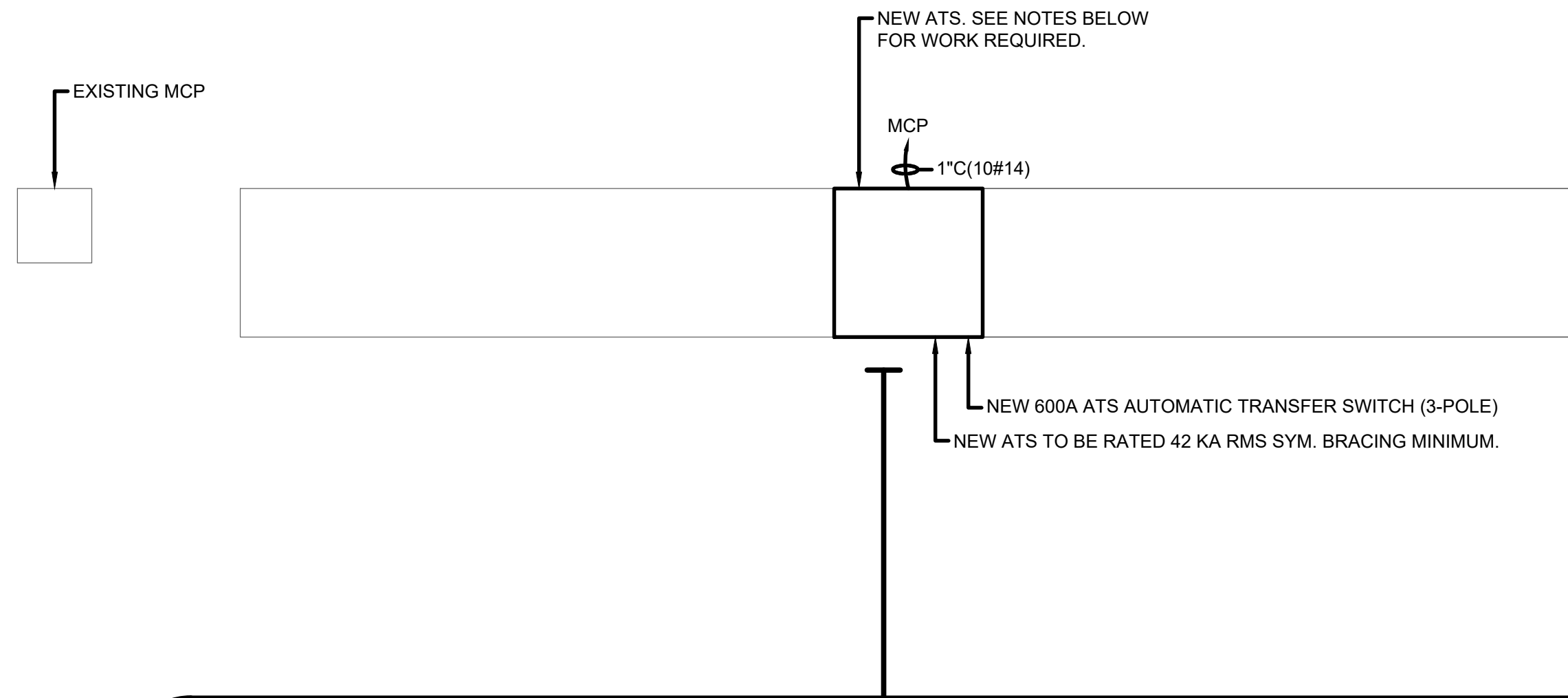


BY	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
REMOTE SITE GENERATORS
**ELECTRICAL
STATION NO.11
MOTOR CONTROL CENTER**

Project No.: 200-19743-21002
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

EXISTING DRAWING FROM PREVIOUS PROJECT.
PROPOSED WORK SHOWN BOLD,
CROSSHATCHED, AND/OR CIRCLED.



**WATER STATION NO.4
ATS REPLACEMENT SCOPE OF WORK:**

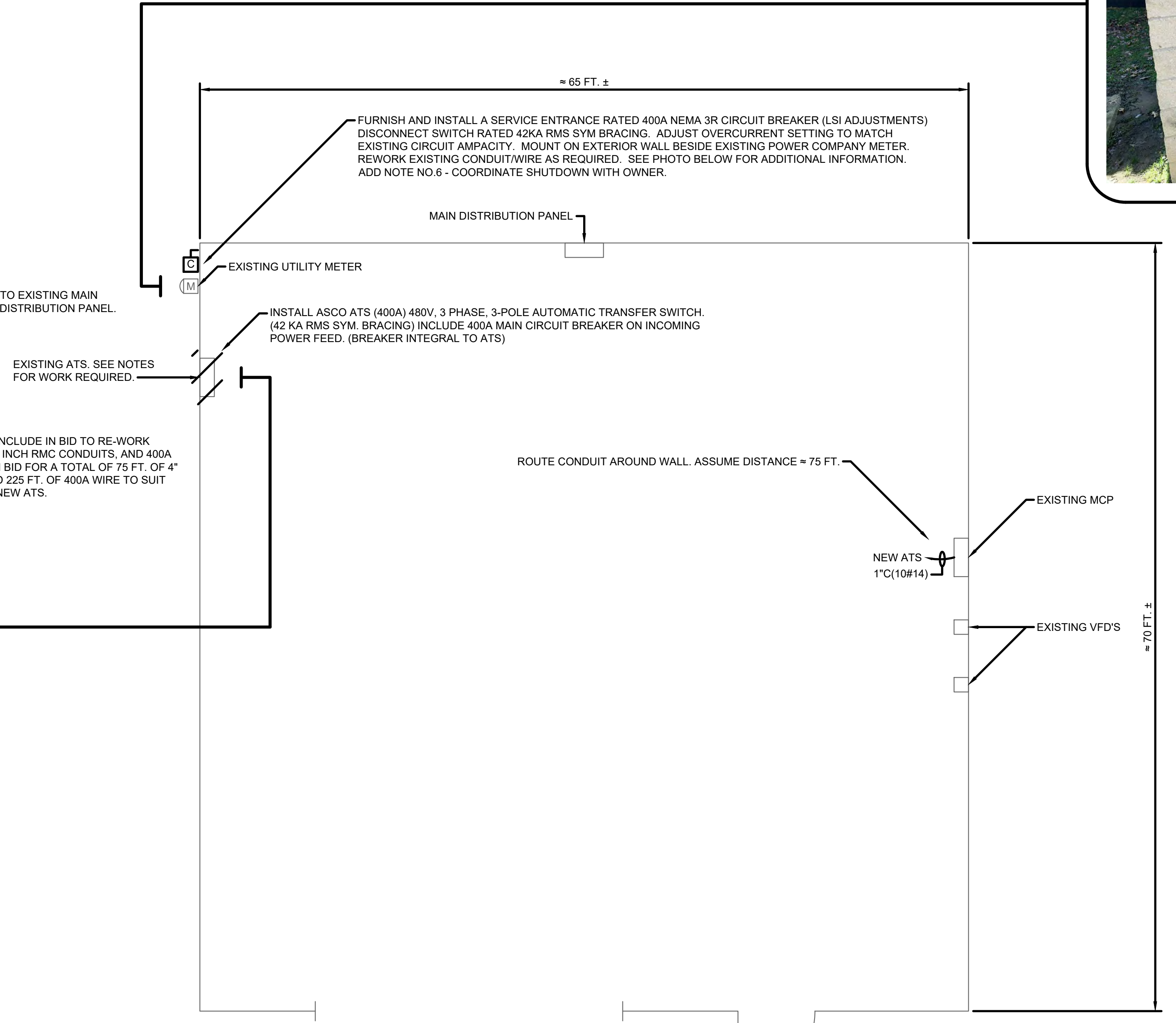
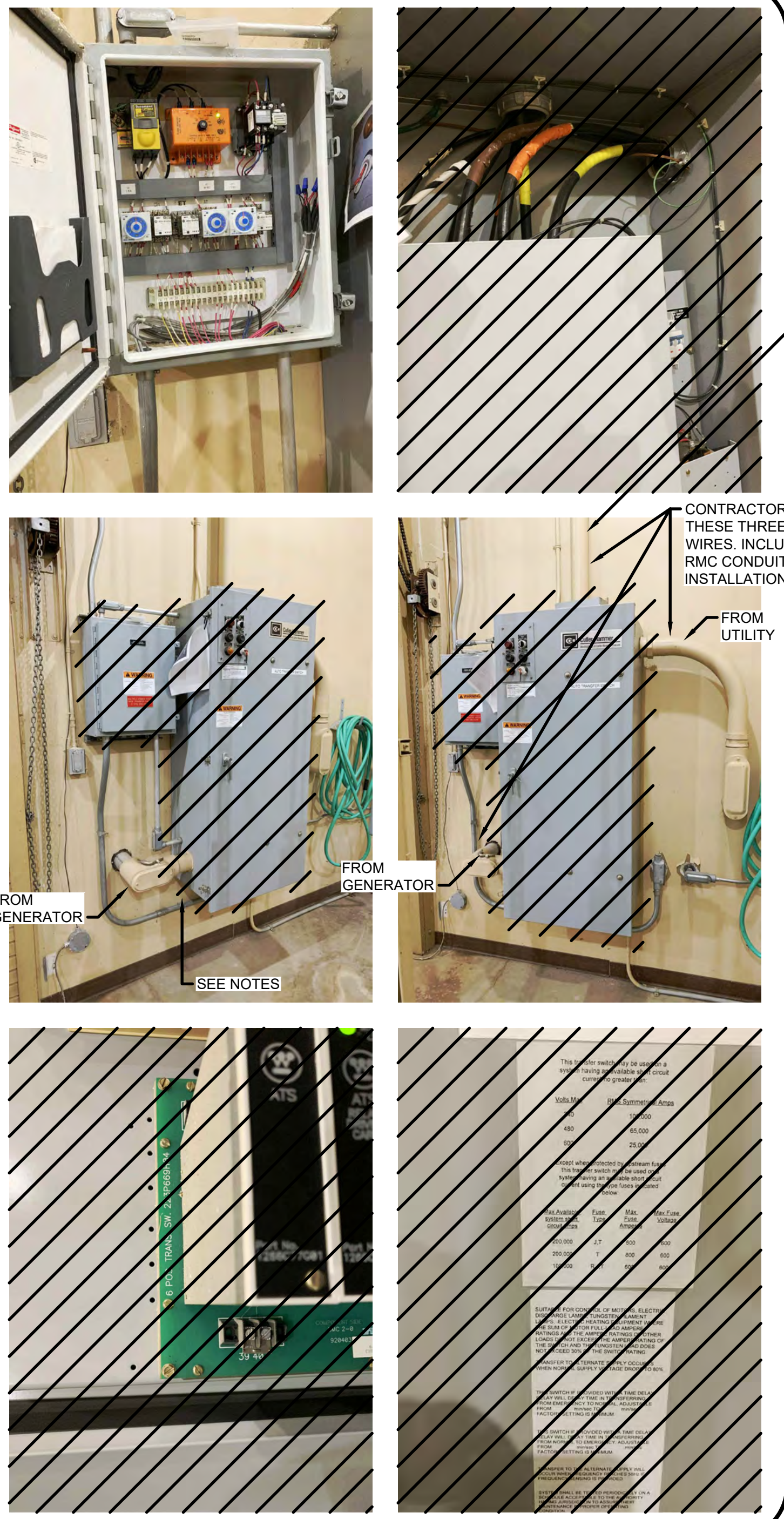
- OBTAIN THE SERVICES OF ROCKWELL AUTOMATION FIELD ENGINEERING SERVICES TO PERFORM THE FOLLOWING WORK:
- DEMOLISH THE EXISTING ASCO NON-AUTOMATIC TRANSFER SWITCH LOCATED INSIDE THE EXISTING ALLEN-BRADLEY MOTOR CONTROL CENTER.
 - REMOVE THE DOOR ON THE FACE OF THE MOTOR CONTROL CENTER/TRANSFER SWITCH.
 - FURNISH AND INSTALL A NEW ASCO AUTOMATIC TRANSFER SWITCH. MATCH EXISTING SWITCH AMPERAGE RATING, CONTACTS, AND SHORT CIRCUIT WITHSTAND RATINGS. SEE PHOTOS ON THIS SHEET. EXISTING ASCO SWITCH SERIAL NUMBER 880875.
 - FURNISH AND INSTALL A NEW DOOR COMPLETE WITH THE TRANSFER SWITCH CONTROLS AND INDICATORS THAT WOULD NORMALLY ACCOMPANY AN ASCO AUTOMATIC TRANSFER SWITCH SUPPLIED IN A STAND ALONE ENCLOSURE.
 - PROVIDE NEW WIRING, CONNECTIONS, TERMINAL BLOCKS AS REQUIRED FOR A FULLY FUNCTIONAL AUTOMATIC TRANSFER SWITCH.
 - PROVIDE NEW NAMETAGS ON EXTERIOR OF SWITCH DOOR.
 - SCHEDULE THE WORK WITH THE OWNER. STATION CAN NOT BE DOWN FOR MORE THAN ONE 12 HOUR DAY, ONE DAY AT A TIME.

MARK	DATE	DESCRIPTION	BY

CITY OF KALAMAZOO, MICHIGAN
REMOTE SITE GENERATORS
ELECTRICAL
STATION NO.4 AUTOMATIC
TRANSFER SWITCH REPLACEMENT

Project No.: 200-19743-21002
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

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- NOTES:**
1. DEMOLISH EXISTING AUTOMATIC TRANSFER SWITCH.
 2. FURNISH AND INSTALL NEW 400A, 3-POLE, 480V, 3 PHASE AUTOMATIC TRANSFER SWITCH. INSTALL NEW 4\"/>
 - 3. RE-WORK EXISTING CONDUITS FOR INCOMING UTILITY POWER, INCOMING GENERATOR POWER, AND OUTGOING POWER TO EXISTING POWER DISTRIBUTION PANEL.
 - 4. CONNECT SIGNALS FOR AT'S IN NORMAL AND AT'S IN EMERGENCY POSITION TO EXISTING STATION MAIN CONTROL PANEL. COORDINATE EXACT CONNECTIONS WITH OWNER.
 - 5. COORDINATE SHUTDOWNS WITH CONSUMERS ENERGY.

PARTIAL PLAN
NO SCALE
(NEMA 12 AREA)

MARK	DATE	DESCRIPTION	BY

CITY OF KALAMAZOO, MICHIGAN
REMOTE SITE GENERATORS
ELECTRICAL
STATION NO.31 AUTOMATIC
TRANSFER SWITCH REPLACEMENT

Project No.: 200-19743-21002
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

CANOPY DESIGN CRITERIA

- A. REFERENCES:**
- ICC INTERNATIONAL BUILDING CODE, 2015 EDITION
 - RISK CATEGORY III IN ACCORDANCE WITH TABLE 1604.5
 - STATE BUILDING CODE: MICHIGAN BUILDING CODE, 2015 EDITION.
 - ASCE/SEI 7-10 - MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES
- B. ROOF SNOW LOAD:**
- GROUND SNOW LOAD, P_g = 35 PSF
 FLAT ROOF SNOW LOAD, P_f = 23.5 PSF
 SNOW EXPOSURE FACTOR, C_e = 1.0
 SNOW LOAD IMPORTANCE FACTOR, I = 0.8
 THERMAL FACTOR, C_t = 1.2
- C. WIND LOAD:**
- BASIC WIND SPEED, V = 105 MPH
 NOMINAL DESIGN WIND SPEED = 81 MPH
 RISK CATEGORY = I
 WIND EXPOSURE CATEGORY = C
 DIRECTIONALITY FACTOR, K_d = 0.85
 TOPOGRAPHY = 1.0
 BUILDING ENCLOSURE CLASSIFICATION = OPEN
- D. SEISMIC DESIGN DATA:**
- RISK CATEGORY = I
 SEISMIC IMPORTANCE FACTOR, I = 1.00
 SDS = 0.093
 SD1 = 0.079
 SS = 0.087
 S1 = 0.05
 SITE CLASS = D
 SEISMIC DESIGN CATEGORY = B

CANOPY NOTES. - MT. OLIVET:

- ALUMINUM CANOPY TO BE MOUNTED WITH NEW CONCRETE ENCASED POSTS AROUND EXISTING PAD. ENCASE POSTS IN CONCRETE 5 FT. DEEP X 12" WIDE. (TYP. OF 4 POSTS MINIMUM). THE CANOPY SHALL EXTEND A MINIMUM OF 1' BEYOND THE BACK AND SIDES AND 5' ON THE FRONT OF THE ELECTRICAL EQUIPMENT. THE CANOPY SHALL BE 8' MIN. TALL AND SLOPE TO THE BACK OF THE EQUIPMENT. THE DESIGN OF THE CANOPY SHALL MEET THE ABOVE CRITERIA.
- BOND CANOPY TO EXISTING GROUND MAT WITH BARE 4/0. BOND 3 TIMES WITH BARE 4/0.
- INSTALL NEW GROUND MAT AROUND EXISTING CONCRETE PAD. BOND ROOF, AND EXISTING PANELS TO GROUND MAT.

SEE NOTES NO.11, AND NO.12 ON SHEET NO.3.

TURN OVER EXISTING EQUIPMENT TO OWNER.



LOCATE NEW GENERATOR/ ELECTRICAL EQUIPMENT THIS AREA.

NOTE: COORDINATE GAS SERVICE/METER LOCATION WITH CONSUMERS ENERGY COMPANY, AND PAY THE CONSUMERS ENERGY COMPANY FEES THROUGH THE ALLOWANCE. CONTRACTOR SHALL INCLUDE IN BID TO INSTALL 50 FT. OF 2" LINE FROM METER TO GENERATOR. (TYP. FOR ALL STATIONS EXCEPT STATION NO. 11. SEE SHEET NO.13 REGARDING STATION NO.11.)

BEECH

THE GAS LINE BETWEEN THE METER AND GENERATOR SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. REFER TO LOCAL AND NFPA CODES #54 AND #58 BEFORE SELECTING PIPING. THE PIPING USED SHALL BE MOUNTED IN A MANNER TO REDUCE VIBRATION, BE OF BLACK IRON, HAVE A CODE SPECIFIED FLEXIBLE HOSE BETWEEN THE GENERATOR SET CONNECTION AND RIGID PIPE INLET AND ALL PIPING HAS TO BE PURGED AND LEAK TESTED WITHIN LOCAL CODES. THE PIPING SHOULD HAVE THE DIAMETER TO DELIVER THE REQUIRED PRESSURE. 2 INCH SIZE MINIMUM. COORDINATE EXACT PRESSURE REQUIREMENTS WITH GENERATOR MANUFACTURER AND CONSUMERS ENERGY. GAS LINES DIRECT BURIED SHALL INCLUDE AN EPOXY COATING MAKING THEM SUITABLE FOR DIRECT BURIAL.

SEE NOTES NO.11, AND NO.12 ON SHEET NO.3.



LOCATE NEW GENERATOR/ ELECTRICAL EQUIPMENT THIS AREA. INSTALL TWO GUARD POSTS.



GULL ROAD

THE GAS LINE BETWEEN THE METER AND GENERATOR SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. REFER TO LOCAL AND NFPA CODES #54 AND #58 BEFORE SELECTING PIPING. THE PIPING USED SHALL BE MOUNTED IN A MANNER TO REDUCE VIBRATION, BE OF BLACK IRON, HAVE A CODE SPECIFIED FLEXIBLE HOSE BETWEEN THE GENERATOR SET CONNECTION AND RIGID PIPE INLET AND ALL PIPING HAS TO BE PURGED AND LEAK TESTED WITHIN LOCAL CODES. THE PIPING SHOULD HAVE THE DIAMETER TO DELIVER THE REQUIRED PRESSURE. 2 INCH SIZE MINIMUM. COORDINATE EXACT PRESSURE REQUIREMENTS WITH GENERATOR MANUFACTURER AND CONSUMERS ENERGY. GAS LINES DIRECT BURIED SHALL INCLUDE AN EPOXY COATING MAKING THEM SUITABLE FOR DIRECT BURIAL.



SAMPLE PROPANE TANK

TO BE PAID BY CONTRACTOR INCLUDING SUPPLY LINE TO GENERATOR

LOCATE NEW PROPANE TANK ON CONCRETE PAD, THIS AREA. PROVIDE PROPANE TANK, AND GAS LINE TO NEW GENERATOR. SEE SAMPLE PICTURE FOR TANK SIZE.

SEE NOTES NO.11, AND NOTE NO.12 ON SHEET NO.3.



6TH STREET

LOCATE NEW GENERATOR/ ELECTRICAL EQUIPMENT THIS AREA.



SHORTEN EXISTING STRUT SUPPORT TO SUIT NEW CANOPY ROOF HEIGHT.



INSTALL NEW CANOPY OVER EXISTING PANELS.



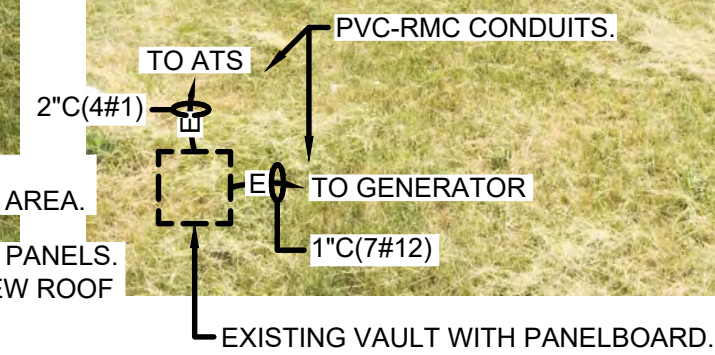
LOCATE NEW GENERATOR/ ELECTRICAL EQUIPMENT THIS AREA.

INSTALL STEEL ROOF OVER OUTDOOR PANELS. SEE NOTES, AND SAMPLE PICTURE. NEW ROOF CANOPY TO BE 10'W X 16'L X 8'H MIN.



MT. OLIVET

THE GAS LINE BETWEEN THE METER AND GENERATOR SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. REFER TO LOCAL AND NFPA CODES #54 AND #58 BEFORE SELECTING PIPING. THE PIPING USED SHALL BE MOUNTED IN A MANNER TO REDUCE VIBRATION, BE OF BLACK IRON, HAVE A CODE SPECIFIED FLEXIBLE HOSE BETWEEN THE GENERATOR SET CONNECTION AND RIGID PIPE INLET AND ALL PIPING HAS TO BE PURGED AND LEAK TESTED WITHIN LOCAL CODES. THE PIPING SHOULD HAVE THE DIAMETER TO DELIVER THE REQUIRED PRESSURE. 2 INCH SIZE MINIMUM. COORDINATE EXACT PRESSURE REQUIREMENTS WITH GENERATOR MANUFACTURER AND CONSUMERS ENERGY. GAS LINES DIRECT BURIED SHALL INCLUDE AN EPOXY COATING MAKING THEM SUITABLE FOR DIRECT BURIAL.



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MARK	DATE	DESCRIPTION	BY

CITY OF KALAMAZOO, MICHIGAN
 REMOVE SITE GENERATORS
ELECTRICAL
 RCS TANK DETAILS
 MT. OLIVET, BEECH, 6TH STREET, GULL ROAD

Project No.: 200-19743-21002
 Designed By: GCJ
 Drawn By: JLS
 Checked By: MSJ/GCJ

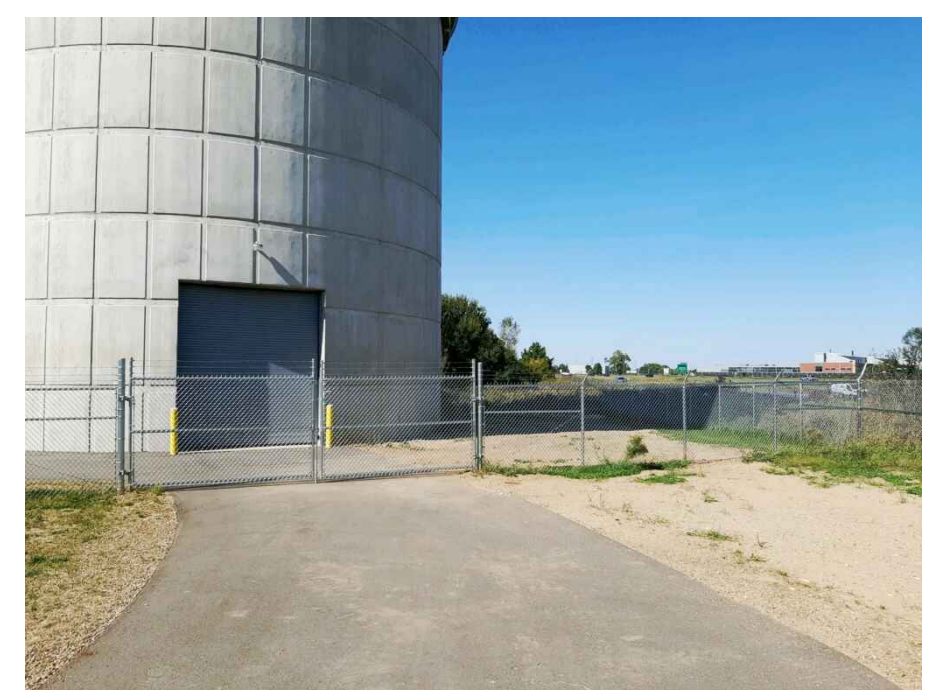
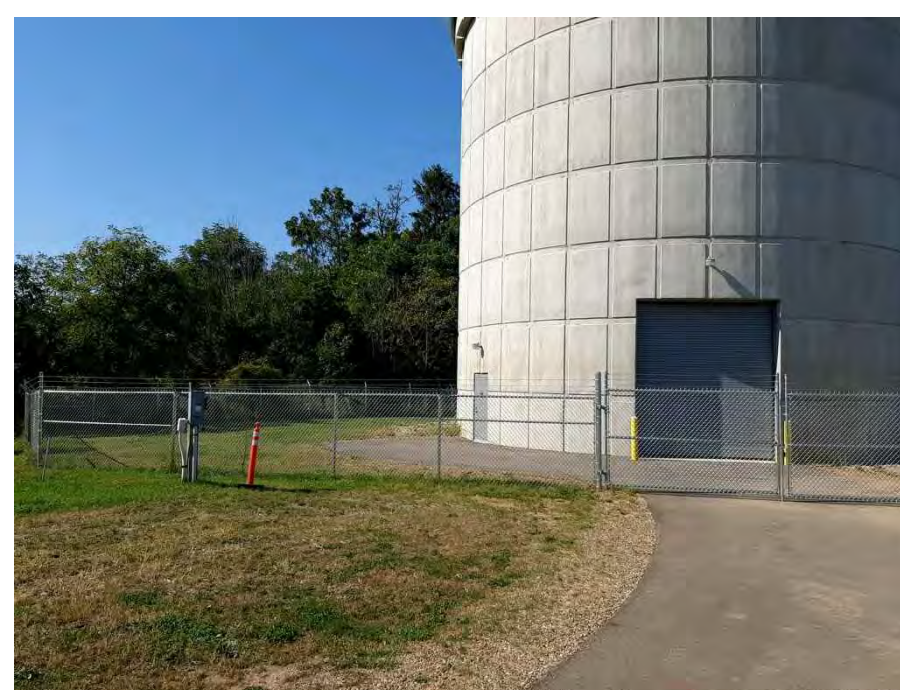
4/27/2022 3:40:42 PM - \\TT.LOCAL\IER\PROJECTS\ANN ARBOR\IER\19743\200-19743-21\002\CAD\SHEETFILES\10_BACKGROUND_PLAN_ILDWG - SHANK, JASON

4/27/2022 3:42:27 PM - \\T\LOCAL\PROJECTS\ANN ARBOR\ER\19743\200-19743-21002\CAD\PROJECTS\11_BACKGROUND_PLAN_11.DWG - SHANK, JASON



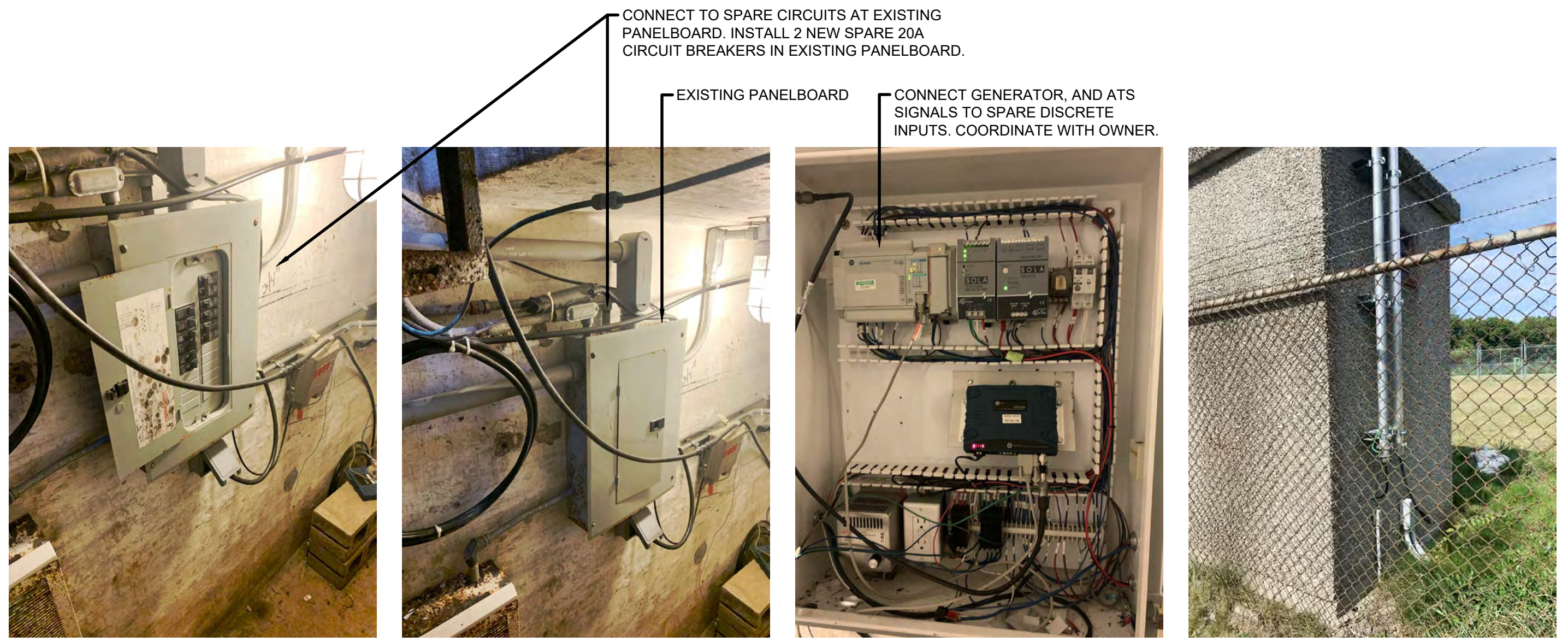
INSTALL TWO NEW 1" CONDUITS FOR POWER, AND SIGNAL TO EXISTING PANELBOARD, AND MCP. DIRECT BURY CONDUITS AROUND TANK EXTERIOR. SEE NOTES ON SHEET NO.4.

LOCATE NEW GENERATOR/ ELECTRICAL EQUIPMENT THIS AREA.



SIESTA TANK

THE GAS LINE BETWEEN THE METER AND GENERATOR SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. REFER TO LOCAL AND NFPA CODES #54 AND #58 BEFORE SELECTING PIPING. THE PIPING USED SHALL BE MOUNTED IN A MANNER TO REDUCE VIBRATION, BE OF BLACK IRON, HAVE A CODE SPECIFIED FLEXIBLE HOSE BETWEEN THE GENERATOR SET CONNECTION AND RIGID PIPE INLET AND ALL PIPING HAS TO BE PURGED AND LEAK TESTED WITHIN LOCAL CODES. THE PIPING SHOULD HAVE THE DIAMETER TO DELIVER THE REQUIRED PRESSURE. 2 INCH SIZE MINIMUM. COORDINATE EXACT PRESSURE REQUIREMENTS WITH GENERATOR MANUFACTURER AND CONSUMERS ENERGY. GAS LINES DIRECT BURIED SHALL INCLUDE AN EPOXY COATING MAKING THEM SUITABLE FOR DIRECT BURIAL.



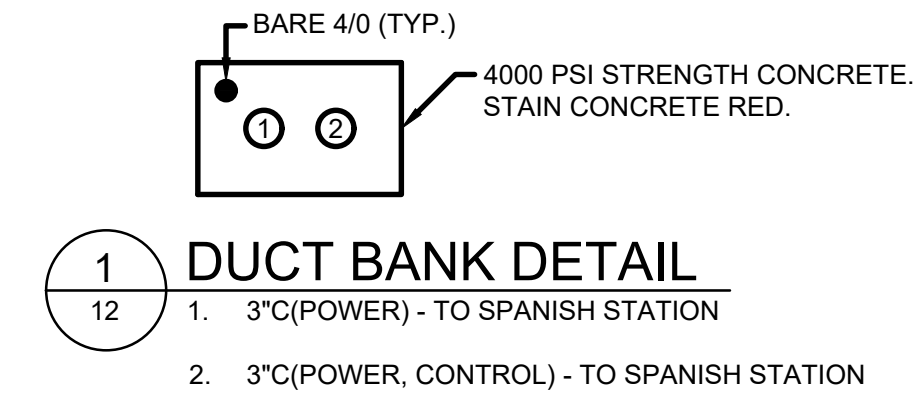
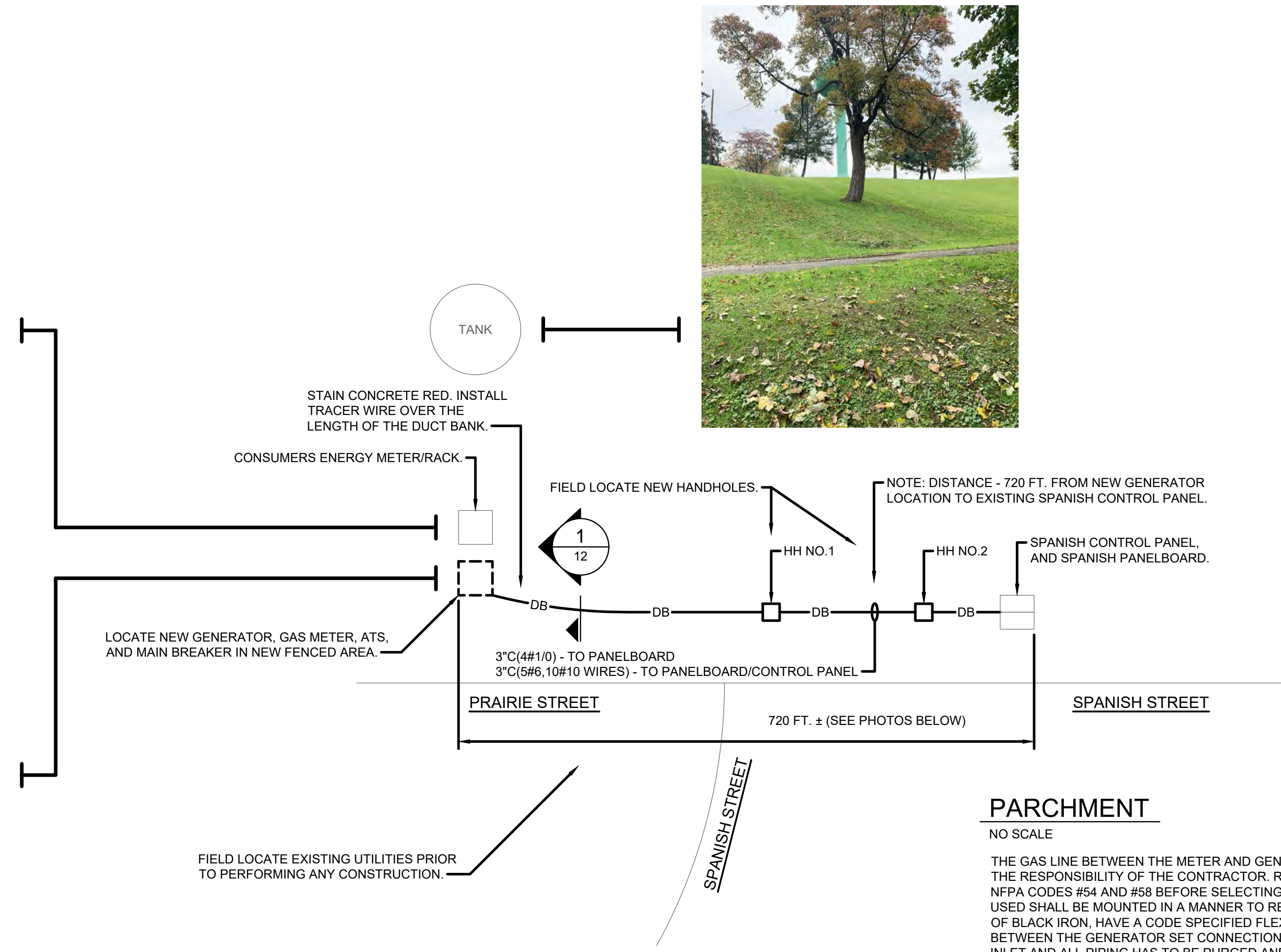
BLAKESLEE

THE GAS LINE BETWEEN THE METER AND GENERATOR SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. REFER TO LOCAL AND NFPA CODES #54 AND #58 BEFORE SELECTING PIPING. THE PIPING USED SHALL BE MOUNTED IN A MANNER TO REDUCE VIBRATION, BE OF BLACK IRON, HAVE A CODE SPECIFIED FLEXIBLE HOSE BETWEEN THE GENERATOR SET CONNECTION AND RIGID PIPE INLET AND ALL PIPING HAS TO BE PURGED AND LEAK TESTED WITHIN LOCAL CODES. THE PIPING SHOULD HAVE THE DIAMETER TO DELIVER THE REQUIRED PRESSURE. 2 INCH SIZE MINIMUM. COORDINATE EXACT PRESSURE REQUIREMENTS WITH GENERATOR MANUFACTURER AND CONSUMERS ENERGY. GAS LINES DIRECT BURIED SHALL INCLUDE AN EPOXY COATING MAKING THEM SUITABLE FOR DIRECT BURIAL.

MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
REMOTE SITE GENERATORS
ELECTRICAL
RCS TANK DETAILS
SIESTA, BLAKESLEE

Project No.: 200-19743-21002
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ



NOTES:

1. FIELD VERIFY PROPOSED CONDUIT ROUTING PRIOR TO BIDS.
2. PATCH BACK EXISTING DRIVEWAYS, ASPHALT DRAIN LOCATIONS OFF ROADWAY, AND RESEED EXISTING YARD AREAS AS A RESULT OF THE NEW CONDUITS INSTALLATION.
3. DURING INSTALLATION OF CONDUITS, INCLUDE IN BID NECESSARY STREET SIGNS, AND TRAFFIC REROUTING AS REQUIRED TO SUIT NEW CONDUIT WORK.
4. COORDINATE WORK WITH CITY OF PARCHMENT, AND CITY OF KALAMAZOO.

PARCHMENT

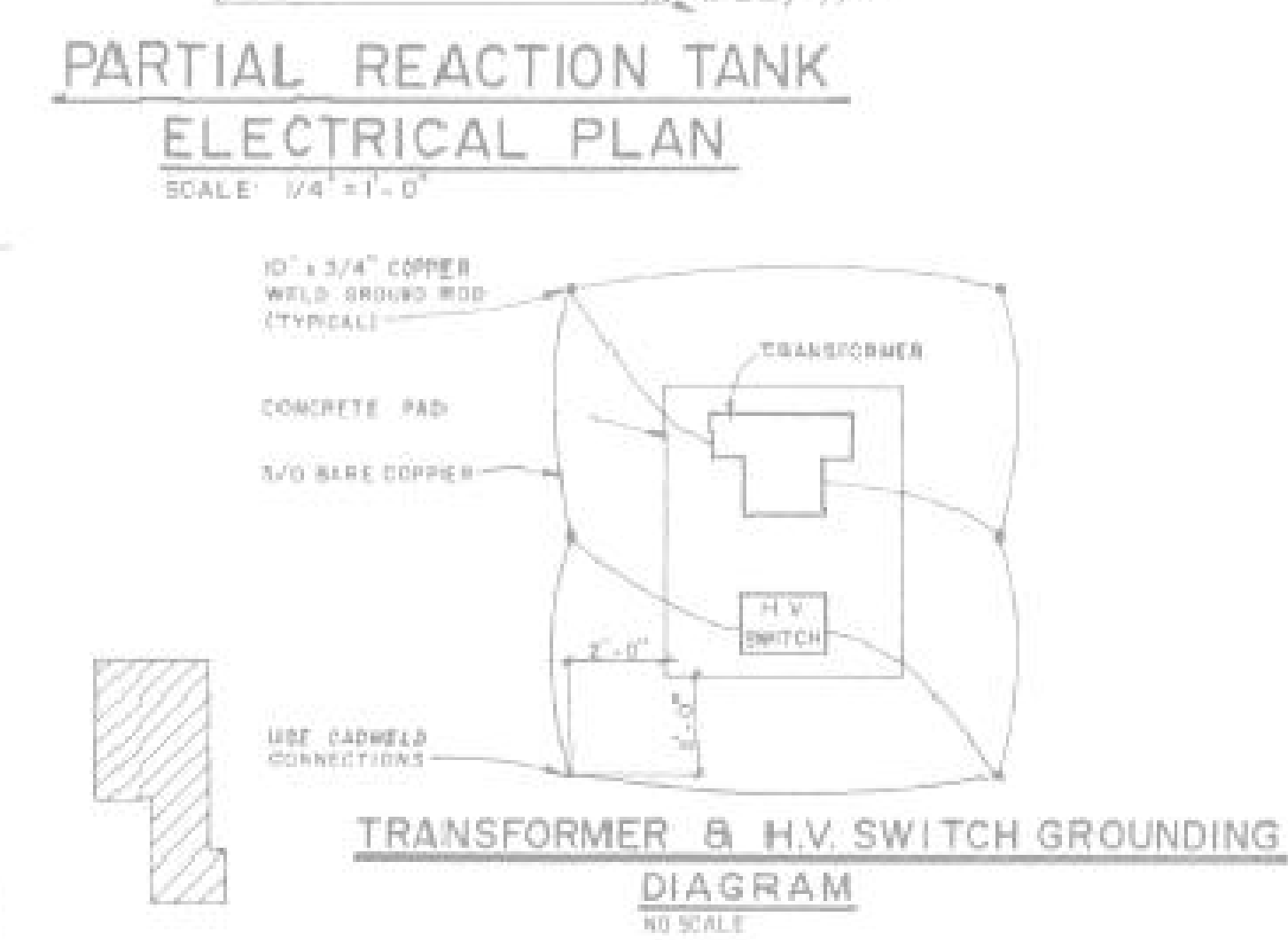
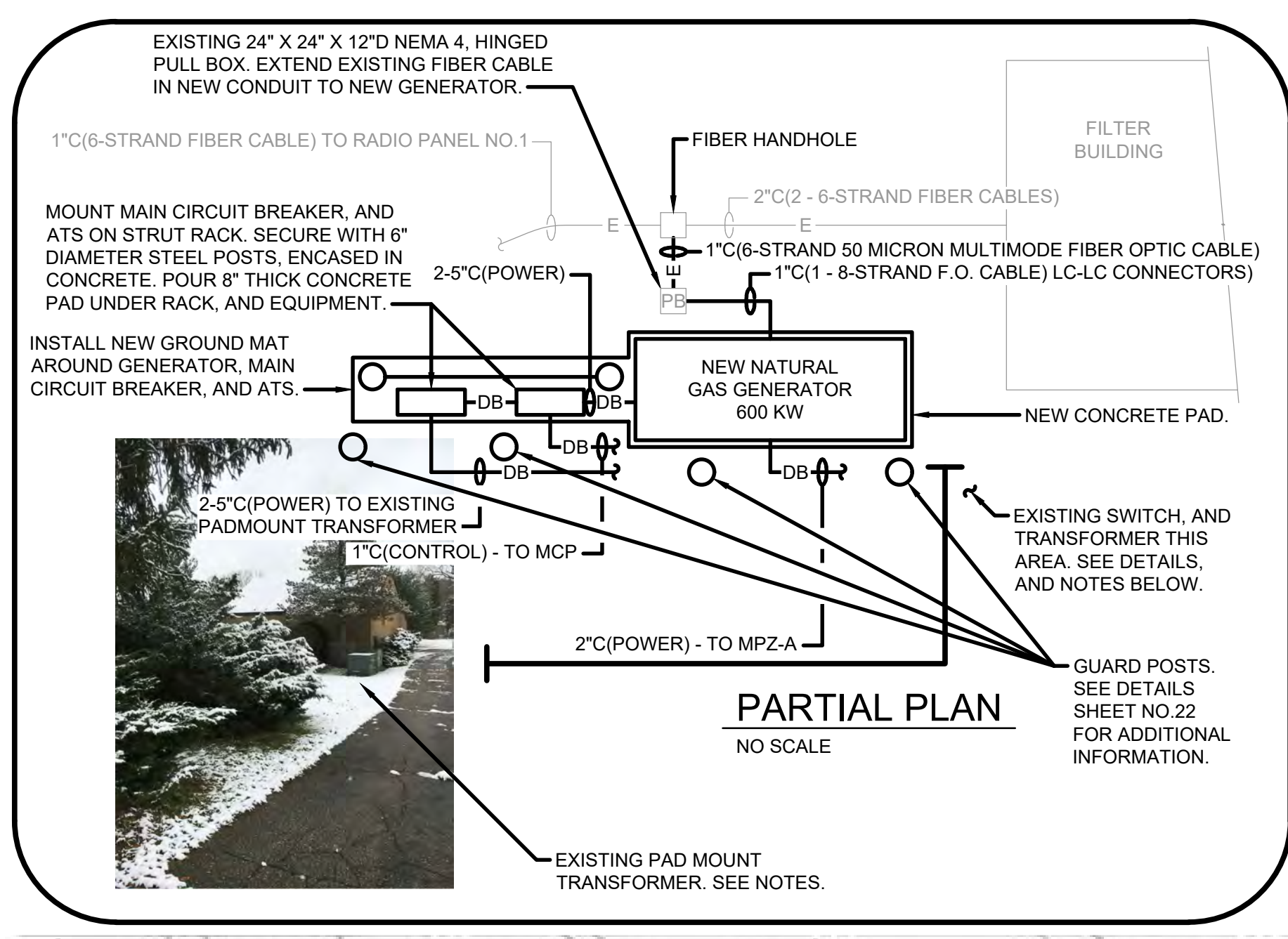
NO SCALE

THE GAS LINE BETWEEN THE METER AND GENERATOR SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. REFER TO LOCAL AND NFPA CODES #54 AND #58 BEFORE SELECTING PIPING. THE PIPING USED SHALL BE MOUNTED IN A MANNER TO REDUCE VIBRATION. BE OF BLACK IRON, HAVE A CODE SPECIFIED FLEXIBLE HOSE BETWEEN THE GENERATOR SET CONNECTION AND RIGID PIPE INLET AND ALL PIPING HAS TO BE PURGED AND LEAK TESTED WITHIN LOCAL CODES. THE PIPING SHOULD HAVE THE DIAMETER TO DELIVER THE REQUIRED PRESSURE. 2 INCH SIZE MINIMUM. COORDINATE EXACT PRESSURE REQUIREMENTS WITH GENERATOR MANUFACTURER AND CONSUMERS ENERGY. GAS LINES DIRECT BURIED SHALL INCLUDE AN EPOXY COATING MAKING THEM SUITABLE FOR DIRECT BURIAL.



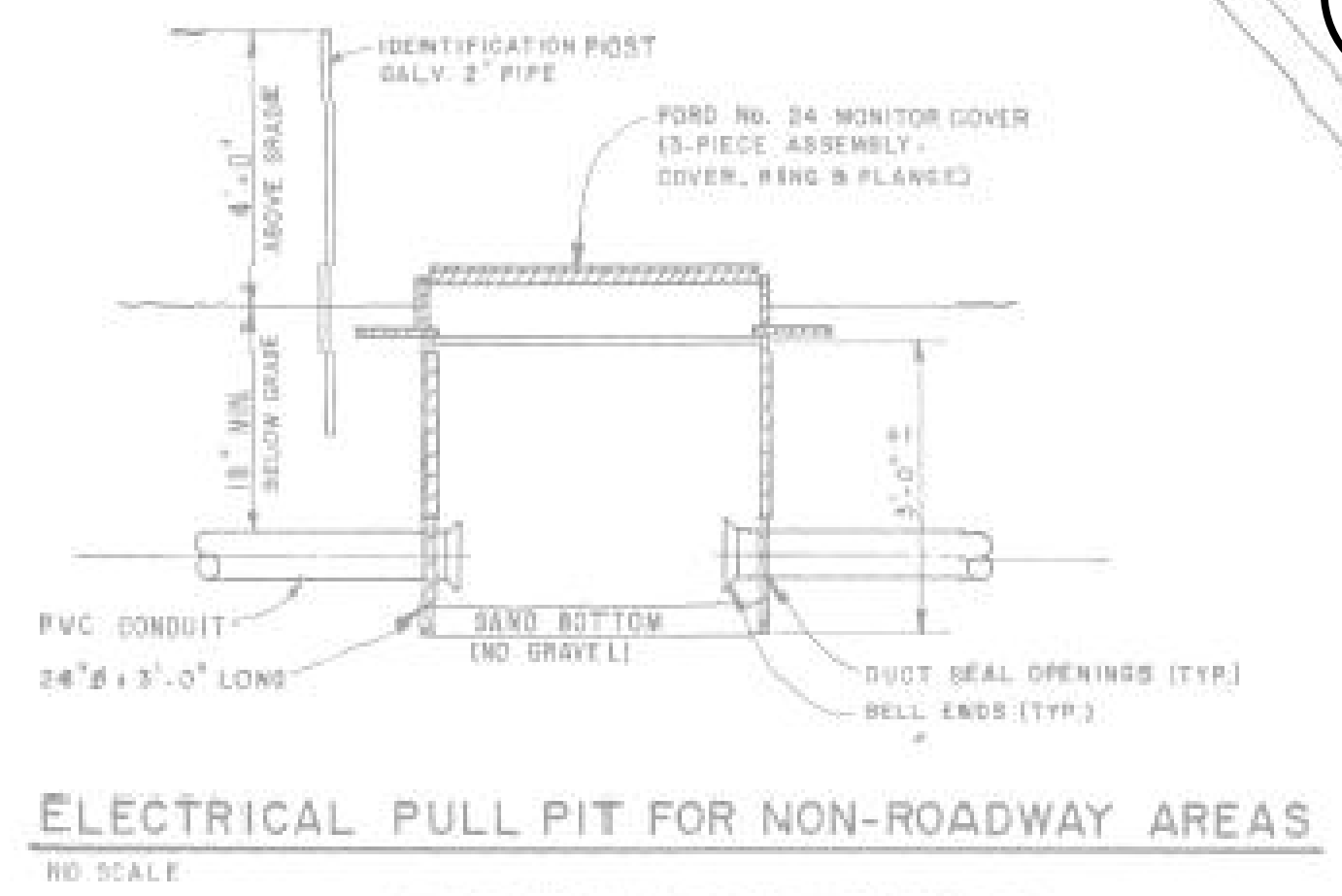
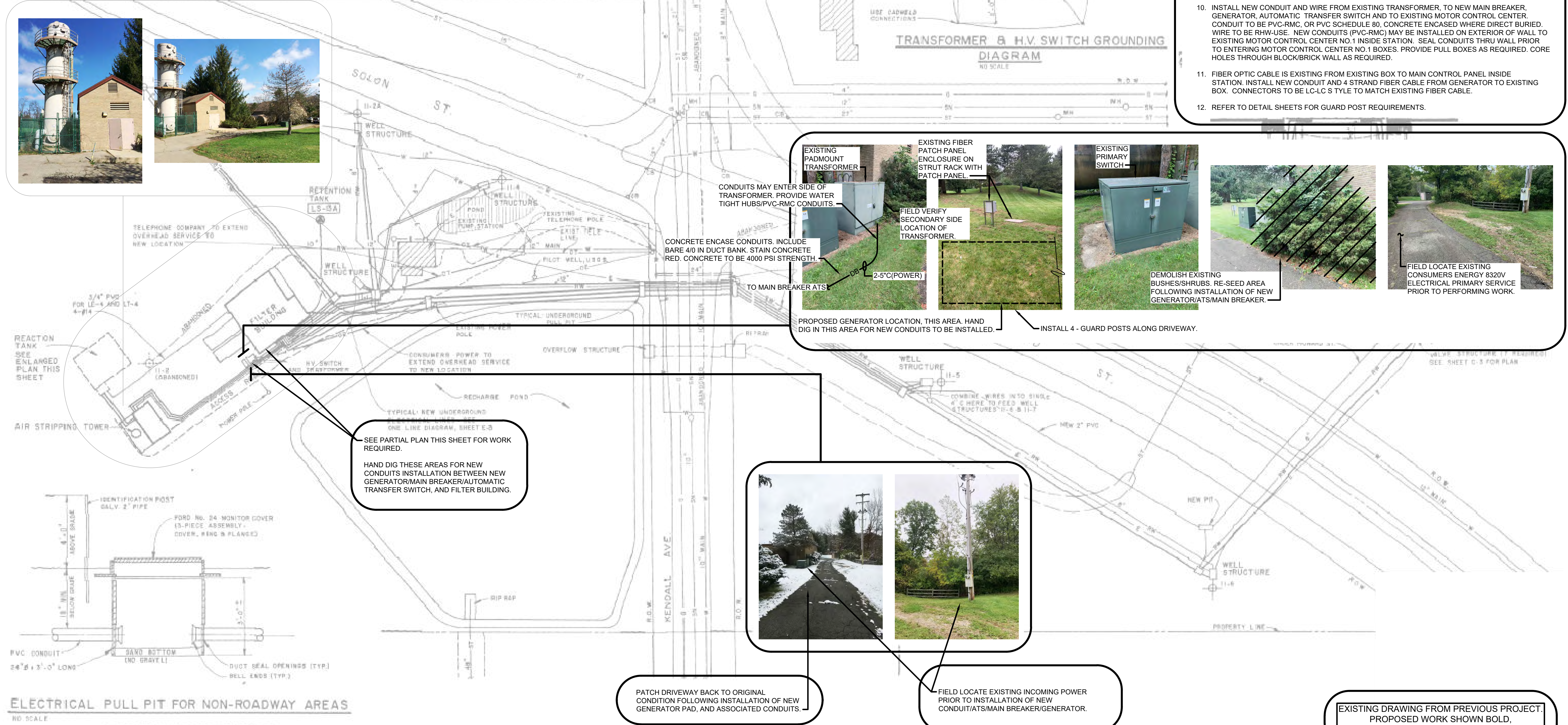
PARCHMENT YARD/DRIVEWAY/ROADWAY PHOTOS

MARK	DATE	DESCRIPTION



NOTES:

- CONTRACTOR SHALL COORDINATE THE INSTALLATION OF THE GAS LINE AND METER AND PAY THE FEES TO CONSUMERS ENERGY. REFER TO THE ALLOWANCE IN THE PROJECT MANUAL. NO MARK-UPS SHALL BE PERMITTED ON THE ALLOWANCE.
- FURNISH AND INSTALL A CONCRETE PAD FOR THE GENERATOR. SIZE PAD AS REQUIRED TO SUIT NEW GENERATOR. PAD SIZE TO INCLUDE AT LEAST 3 FEET CLEAR ALL THE WAY AROUND THE GENERATOR. REFER TO DETAIL SHEET FOR PAD REQUIREMENTS.
- FURNISH AND INSTALL A GROUND MAT AROUND GENERATOR. BOND FRAME OF GENERATOR AS WELL AS BOND THE ATS AND MAIN BREAKER WITH BARE 4/0. REFER TO DETAIL SHEET FOR GROUND MAT REQUIREMENTS.
- MOUNT THE NEW MAIN BREAKER AND AUTOMATIC TRANSFER SWITCH ON A NEW CONCRETE PAD AND SUPPORT TO PAD WITH STAINLESS STEEL STRUT.
- INSTALL SHUT OFF VALVE AND 4 INCH GAS LINE FROM METER TO GENERATOR. THE GAS LINE BETWEEN THE METER AND GENERATOR SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. REFER TO LOCAL AND NFPA CODES #54 AND #58 BEFORE SELECTING PIPING. AS A GUIDE, THE PIPING USED SHOULD BE MOUNTED IN A MANNER TO REDUCE VIBRATION, BE OF BLACK IRON, HAVE A CODE SPECIFIED FLEXIBLE HOSE BETWEEN THE GENERATOR SET CONNECTION AND RIGID PIPE INLET AND ALL PIPING HAS TO BE PURGED AND LEAK TESTED WITHIN LOCAL CODES. THE PIPING SHOULD HAVE THE DIAMETER TO DELIVER THE REQUIRED PRESSURE. COORDINATE EXACT PRESSURE REQUIREMENTS WITH GENERATOR MANUFACTURER. INCLUDE IN BID TO INSTALL 100 FT. OF 4" GAS LINE.
- COORDINATE LOCATION OF EXACT UTILITIES PRIOR TO BEGINNING CONSTRUCTION.
- DEMOLISH THE EXISTING CONDUIT AND WIRE FROM THE TRANSFORMER SECONDARY TO THE EXISTING MOTOR CONTROL CENTER MAIN BREAKER. CORE NEW HOLES AS REQUIRED TO SUIT NEW CONDUIT INSTALLATION. NEW CONDUIT MAY ENTER TOP OF EXISTING MOTOR CONTROL CENTER. PROVIDE BOXES AS REQUIRED TO SUIT CABLE BEND RADIUS.
- COORDINATE EXACT LOCATION OF GENERATOR PAD WITH OWNER AND CONSUMERS ENERGY.
- PROVIDE CONCRETE GUARD POSTS PAINTED YELLOW FOR PROTECTION OF GENERATOR, MAIN BREAKER, AUTOMATIC TRANSFER SWITCH AND RACK.
- INSTALL NEW CONDUIT AND WIRE FROM EXISTING TRANSFORMER, TO NEW MAIN BREAKER, GENERATOR, AUTOMATIC TRANSFER SWITCH AND TO EXISTING MOTOR CONTROL CENTER. CONDUIT TO BE PVC-RMC, OR PVC SCHEDULE 80. CONCRETE ENCASED WHERE DIRECT BURIED. WIRE TO BE RHW-USE. NEW CONDUITS (PVC-RMC) MAY BE INSTALLED ON EXTERIOR OF WALL TO EXISTING MOTOR CONTROL CENTER NO. 1 INSIDE STATION. SEAL CONDUITS THRU WALL PRIOR TO ENTERING MOTOR CONTROL CENTER NO. 1 BOXES. PROVIDE PULL BOXES AS REQUIRED. CORE HOLES THROUGH BLOCK/BRICK WALL AS REQUIRED.
- FIBER OPTIC CABLE IS EXISTING FROM EXISTING BOX TO MAIN CONTROL PANEL INSIDE STATION. INSTALL NEW CONDUIT AND 4 STRAND FIBER CABLE FROM GENERATOR TO EXISTING BOX. CONNECTORS TO BE LC-LC S TYPE TO MATCH EXISTING FIBER CABLE.
- REFER TO DETAIL SHEETS FOR GUARD POST REQUIREMENTS.



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BY	DATE	DESCRIPTION

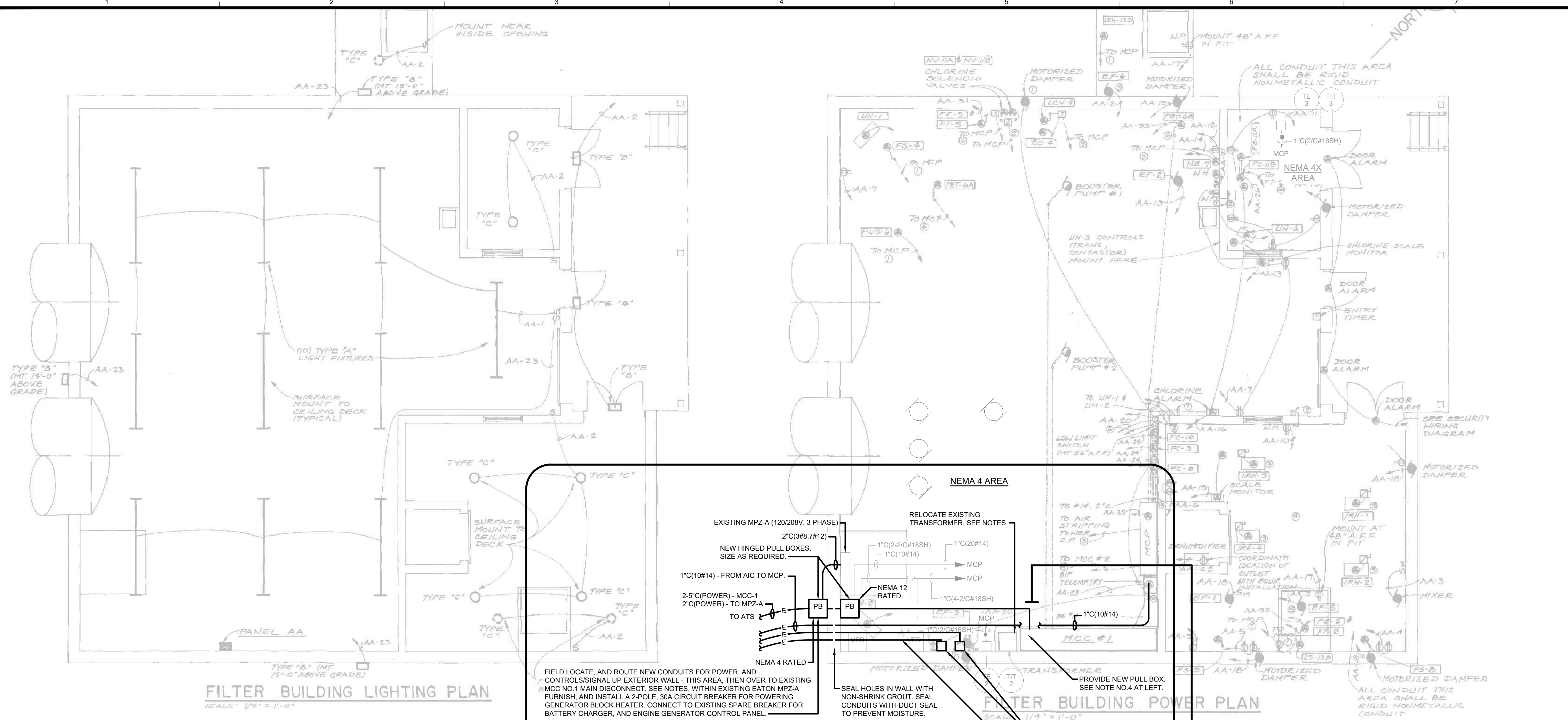
CITY OF KALAMAZOO, MICHIGAN
REMOTE SITE GENERATORS

ELECTRICAL STATION NO. 11 BACKGROUND PLAN

Project No.: 200-19743-21002
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

4/27/2022 3:48:49 PM - \\T\LOCAL\PROJECTS\ANN ARBOR\19743\200-19743-21\002\CAD\SHEETFILES\E113_STATION NO. 11 BACKGROUND PLAN.DWG - SHANK, JASON

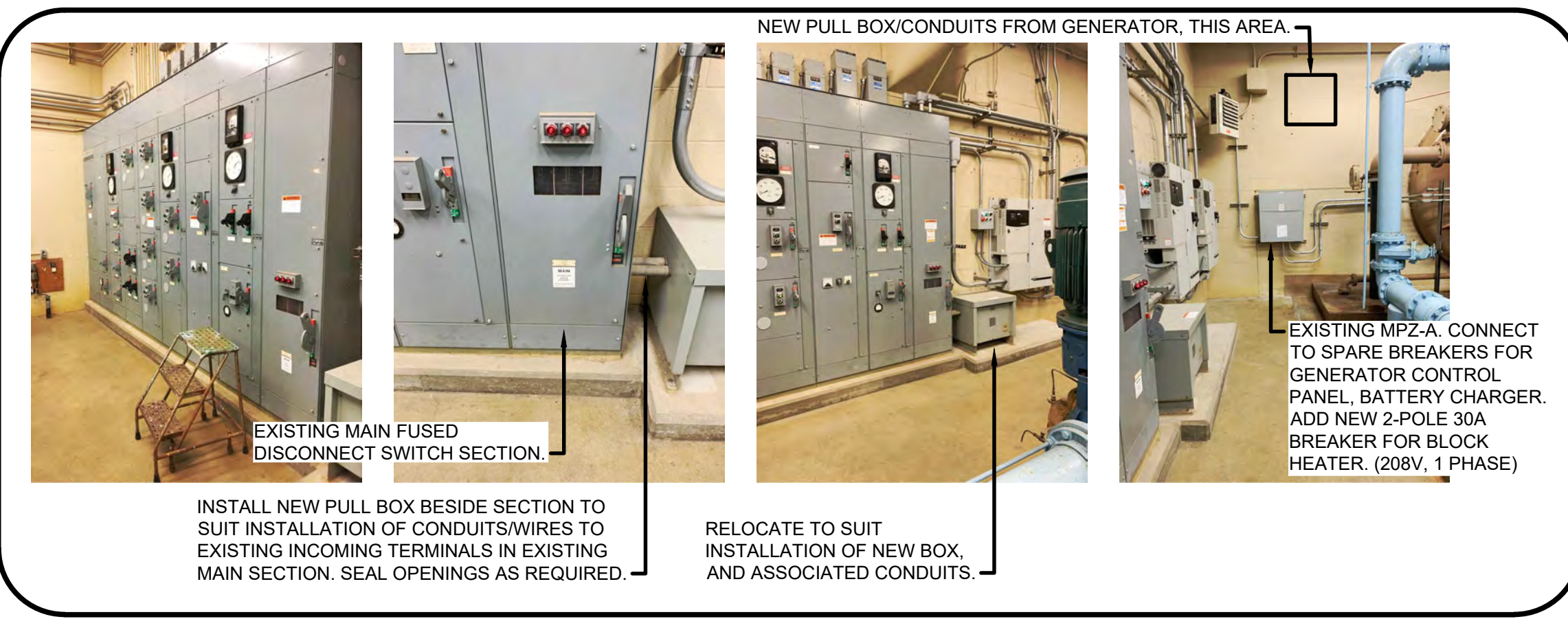
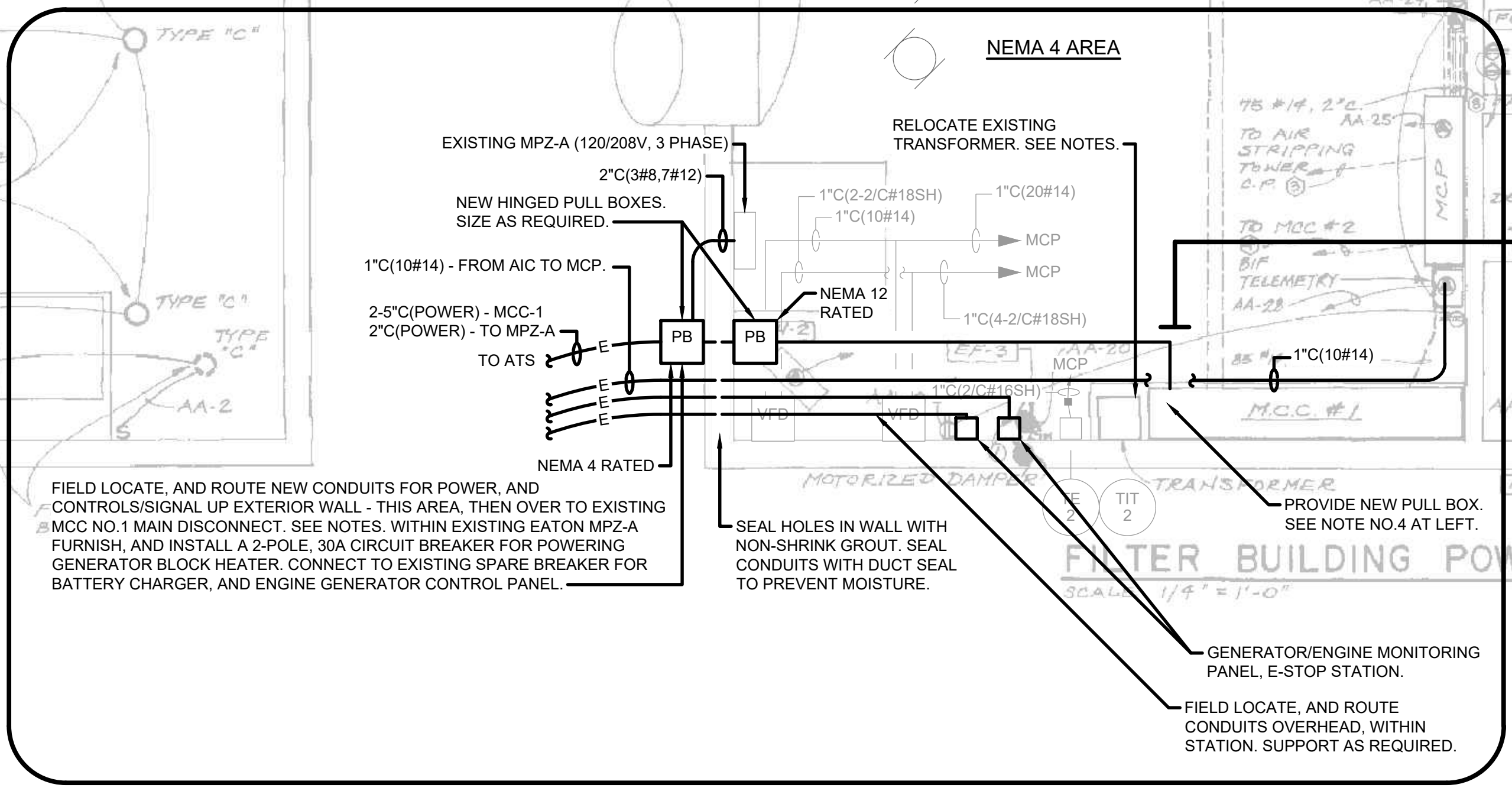
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FILTER BUILDING LIGHTING PLAN
SCALE: 1/4" = 1'-0"

FILTER BUILDING POWER PLAN
SCALE: 1/4" = 1'-0"

- NOTES:**
1. FIELD LOCATE EXISTING PRIMARY SERVICE AND SECONDARY CONDUITS/WIRES PRIOR TO BEGINNING ANY WORK.
 2. INTERCEPT EXISTING CONDUITS FROM EXISTING PADMOUNT TRANSFORMER SECONDARY THAT GO UNDERGROUND INTO BUILDING TO FEED EXISTING MCC NO.1.
 3. INSTALL NEW CONDUITS AND WIRES FROM EXISTING TRANSFORMER SECONDARY TO NEW MAIN BREAKER AND ATS. INSTALL NEW CONDUITS AND WIRES FROM NEW ATS AND GENERATOR CIRCUITS FOR BLOCK HEATER, CONTROL PANEL, AND BATTERY CHARGER AND INSTALL UNDERGROUND TO BACKSIDE OF STATION NO.11. INSTALL CONDUITS UP BACKSIDE OF STATION NO.11 TO NEW HINGED NEMA 4 PULL BOXES.
 4. CORE HOLES THRU BLOCK WALL AS REQUIRED. INSTALL NEW CONDUITS OVER TO EXISTING MCC NO.1. BESIDE EXISTING MCC NO.1. RELOCATE EXISTING TRANSFORMER TO SUIT LOCATION OF NEW HINGED PULLBOX. INSTALL NEW BOX BESIDE EXISTING MCC NO.1 FOR FACILITATING INSTALLATION OF NEW CONDUITS AND WIRES FOR RE-POWERING EXISTING MAIN DISCONNECT AT MCC NO.1.



EXISTING DRAWING FROM PREVIOUS PROJECT. PROPOSED WORK SHOWN BOLD, CROSSHATCHED, AND/OR CIRCLED.

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BY	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
REMOTE SITE GENERATORS

ELECTRICAL
STATION NO.11
BACKGROUND PLAN

Project No.: 200-19743-21002
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

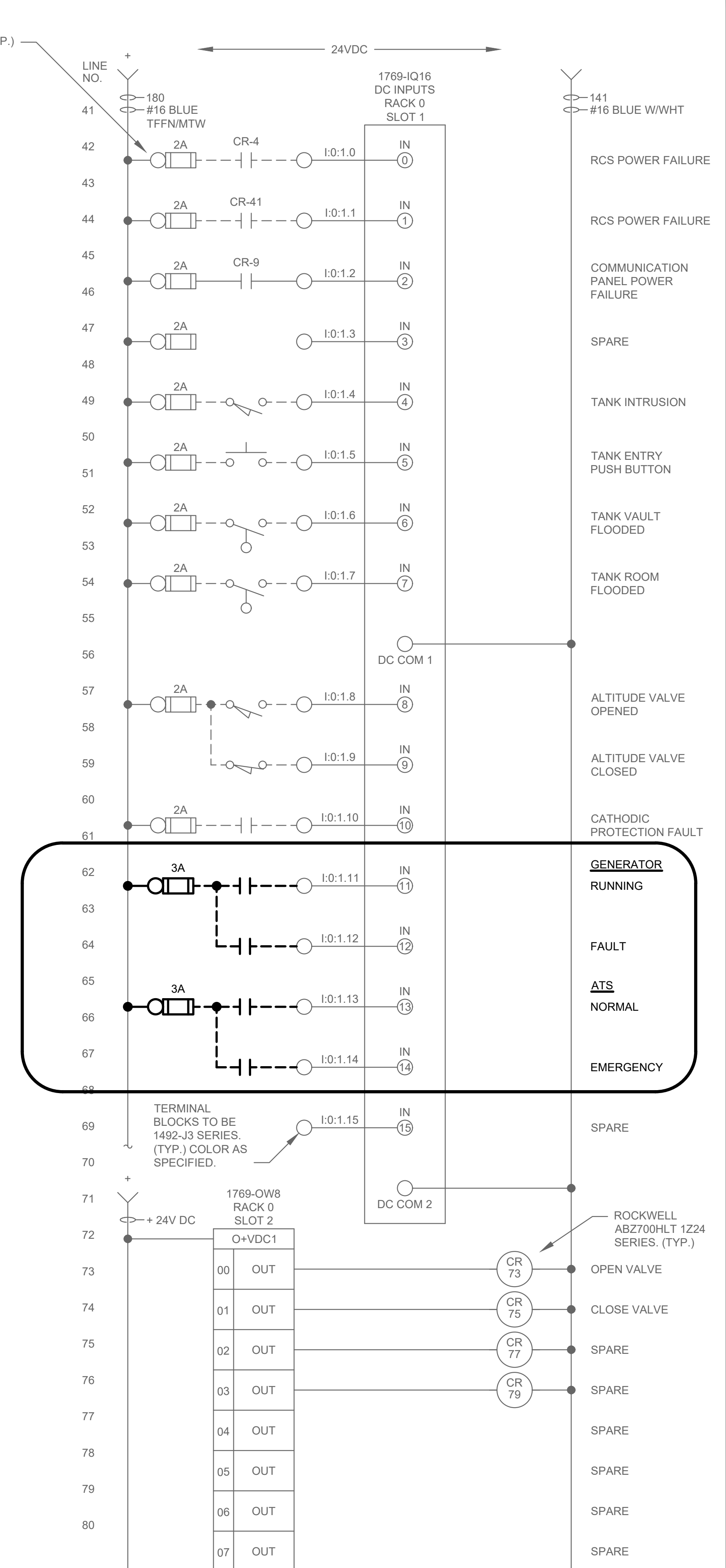
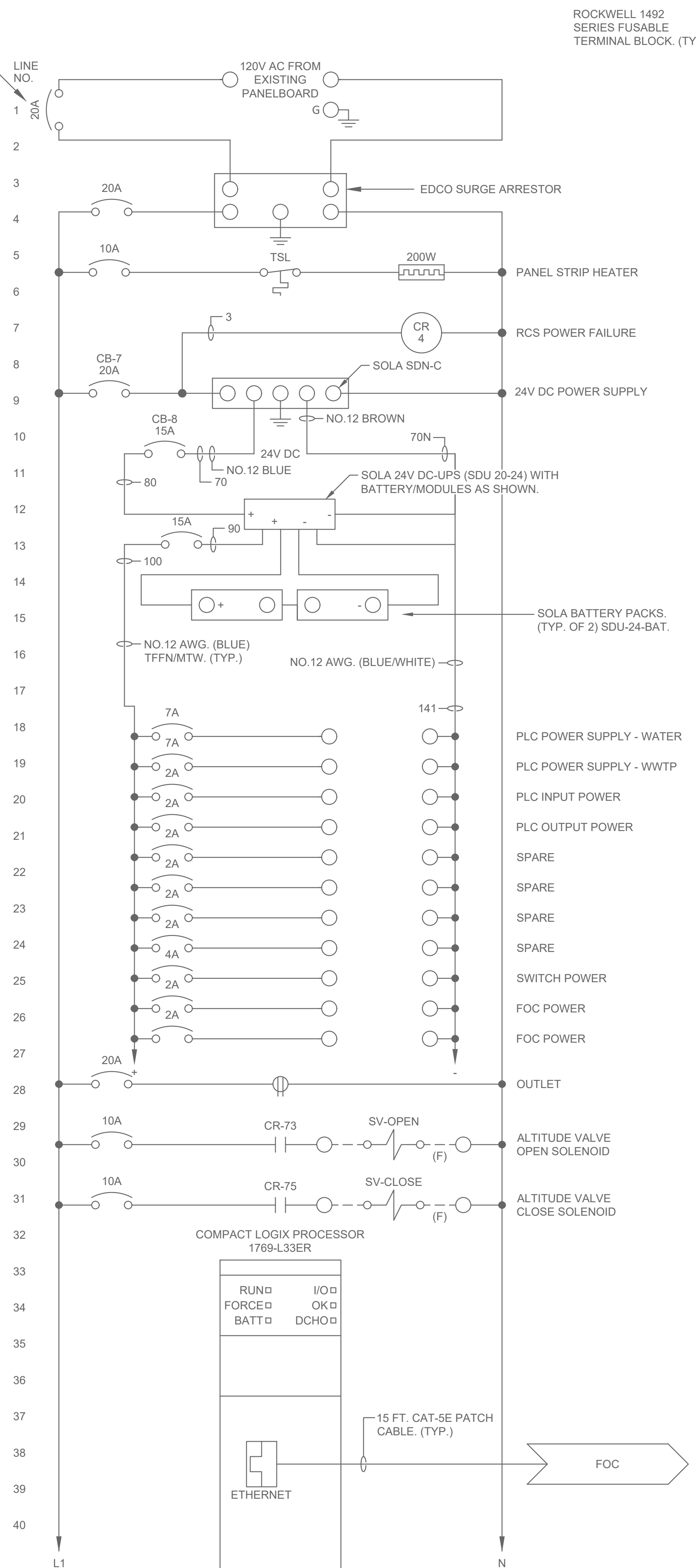
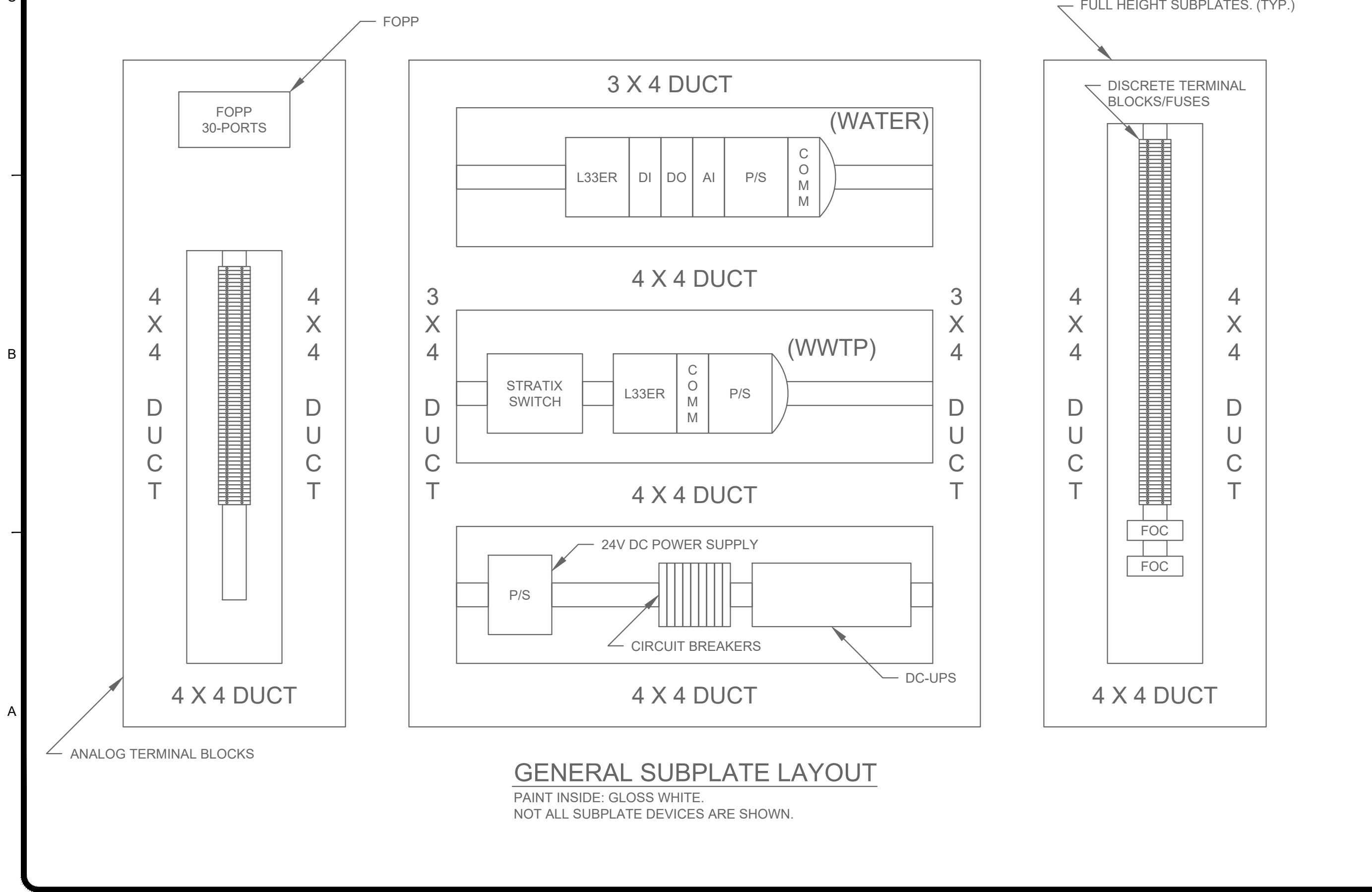
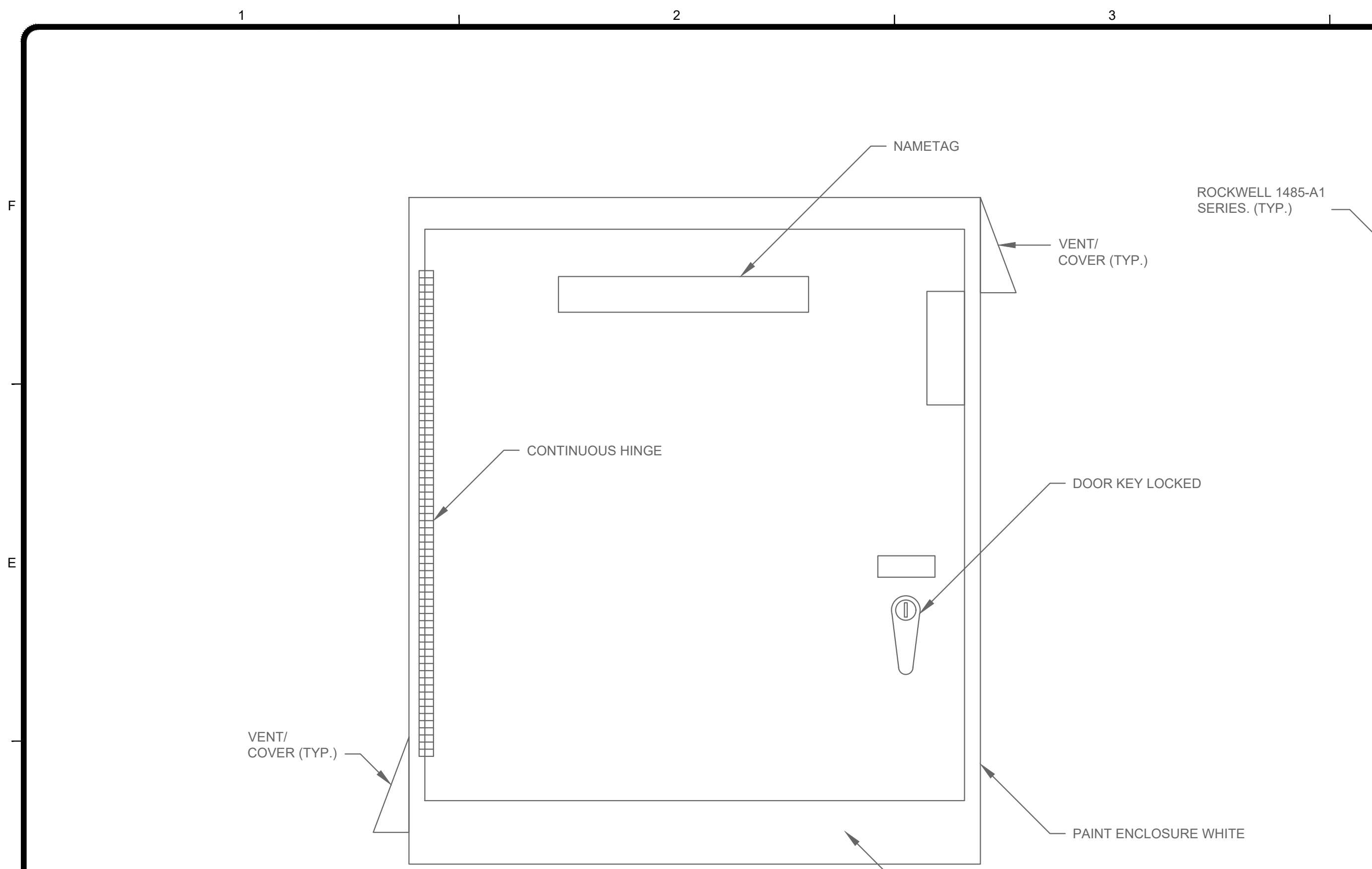
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OF 25

Bar Measures 1 inch

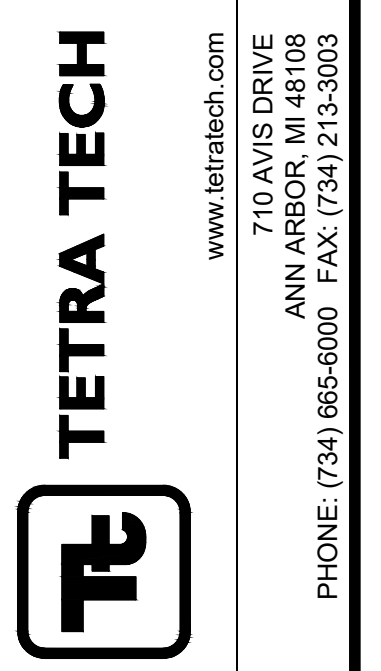
Copyright: Tetra Tech

3/1/2022 11:27:08 AM - \\T\LOCAL\PROJECTS\ANN ARBOR\19743\200-19743-2\1002\CAD\SHEETFILES\15_GULL RD WIR DIA.DWG - SHANK, JASON



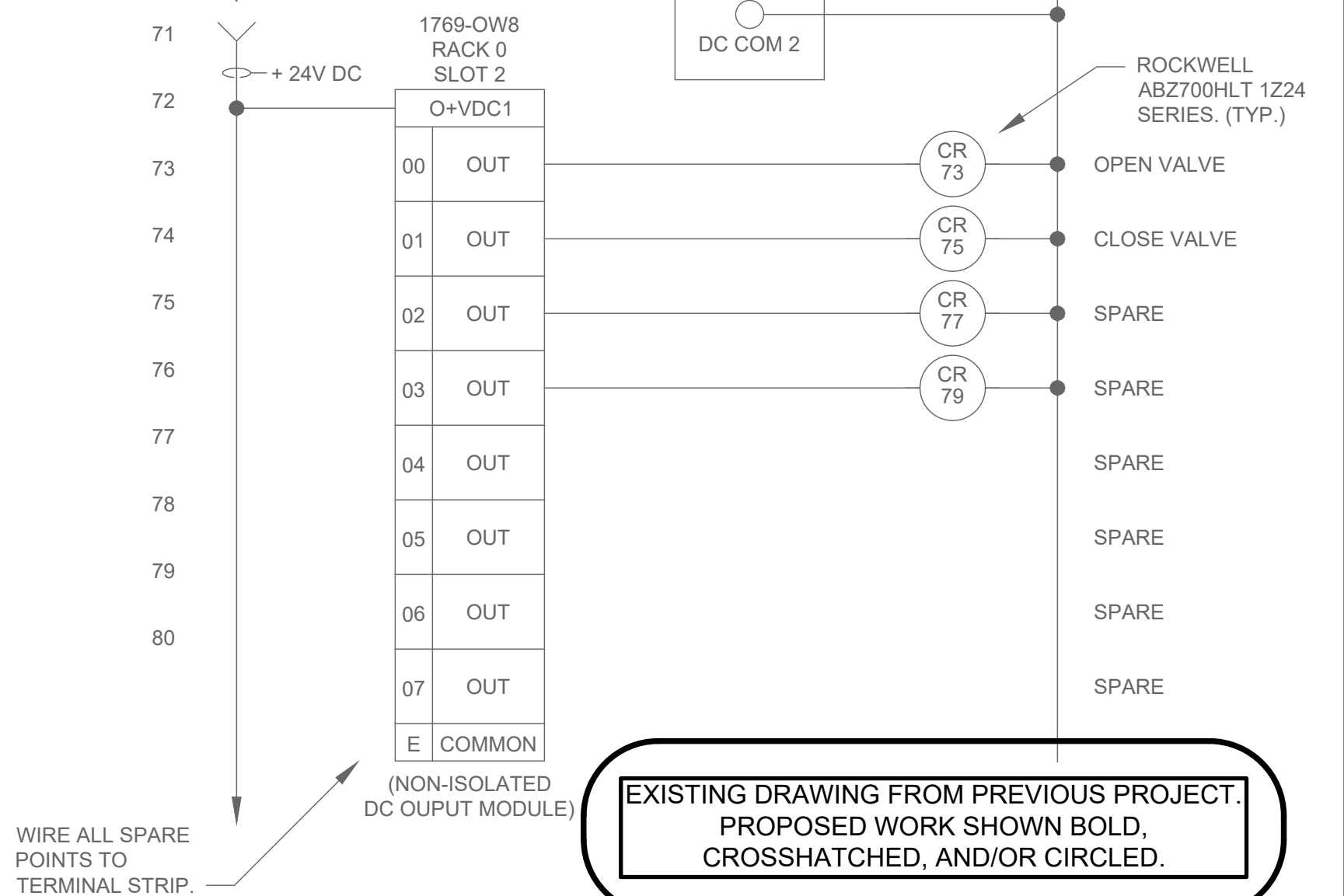
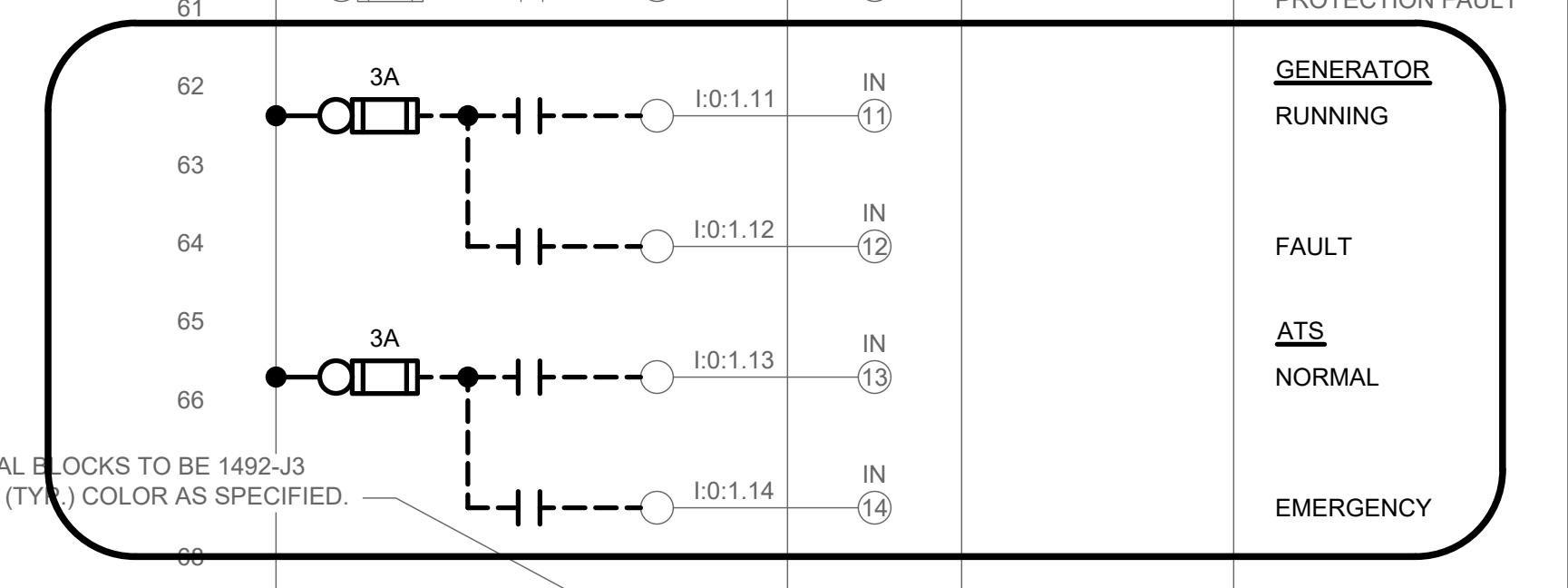
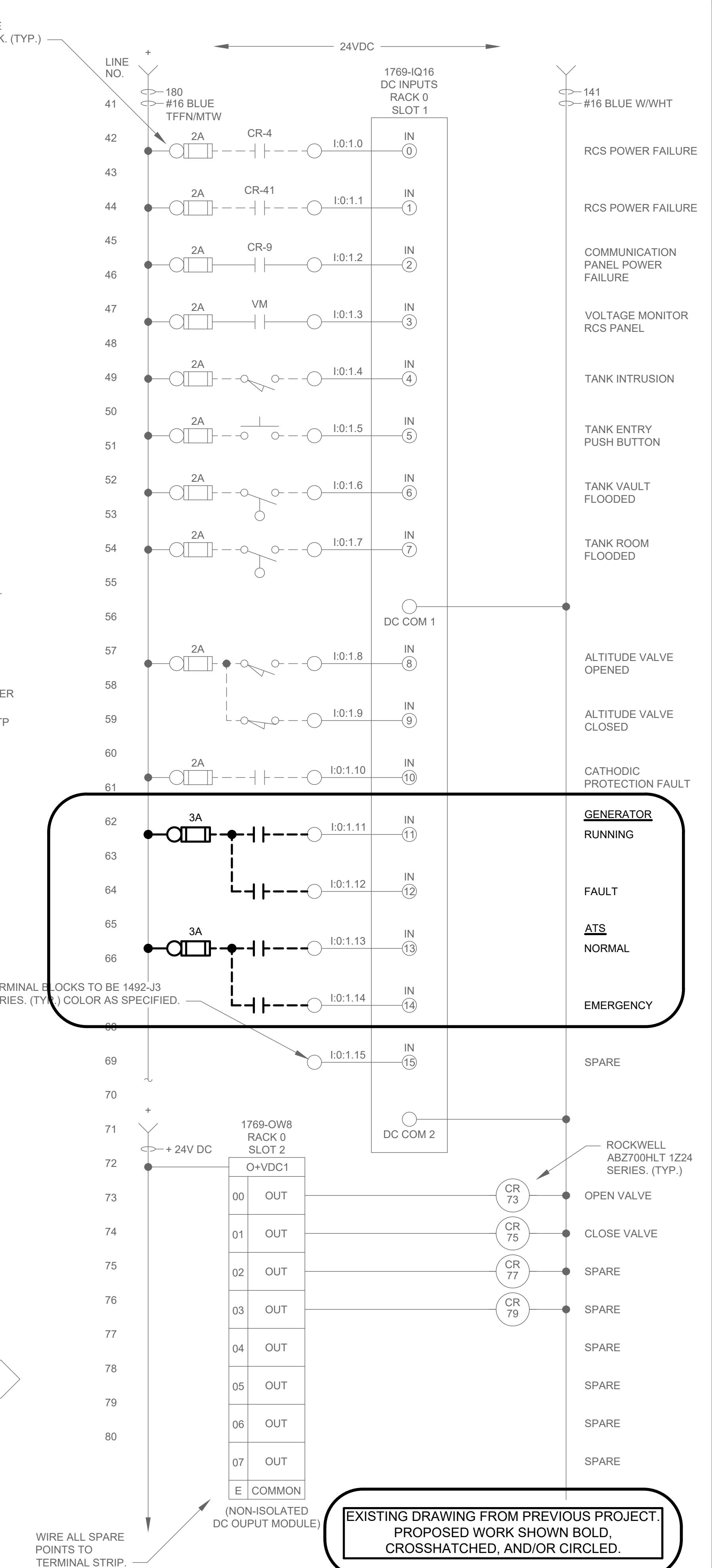
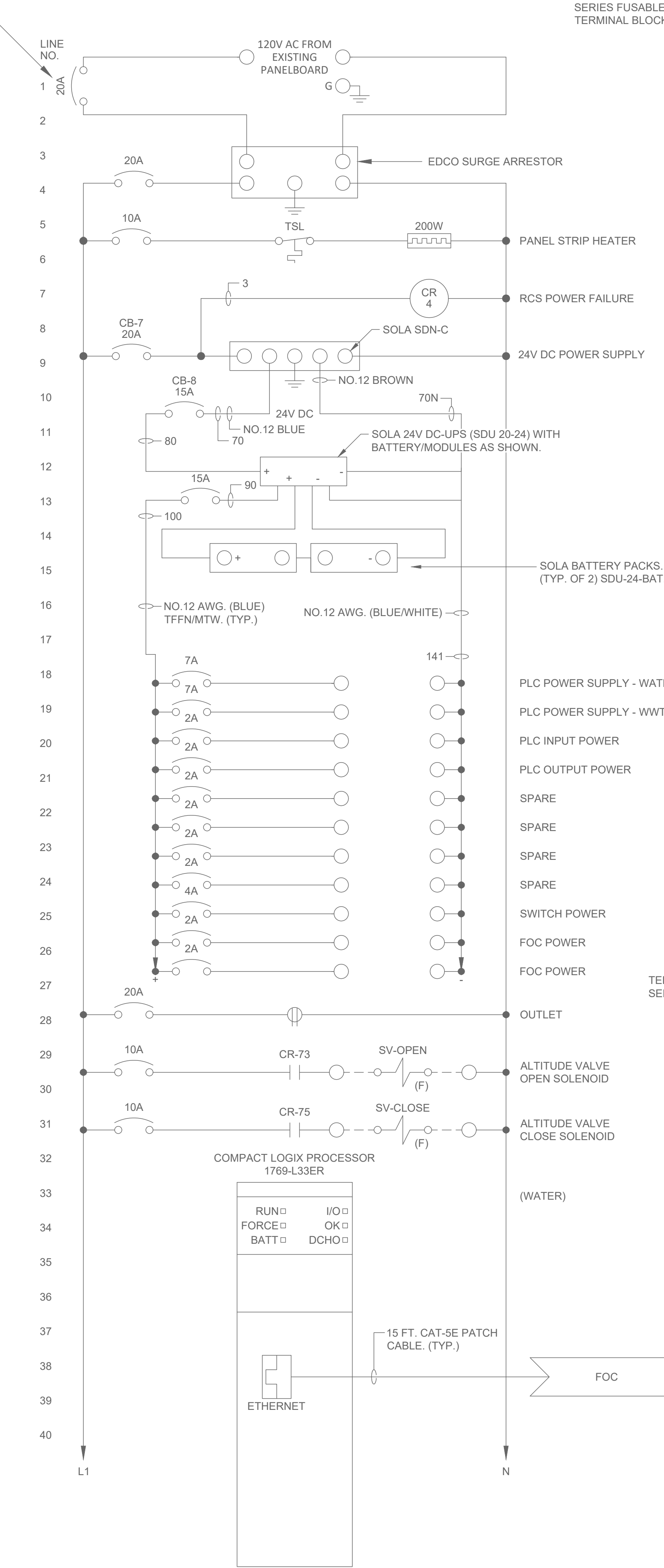
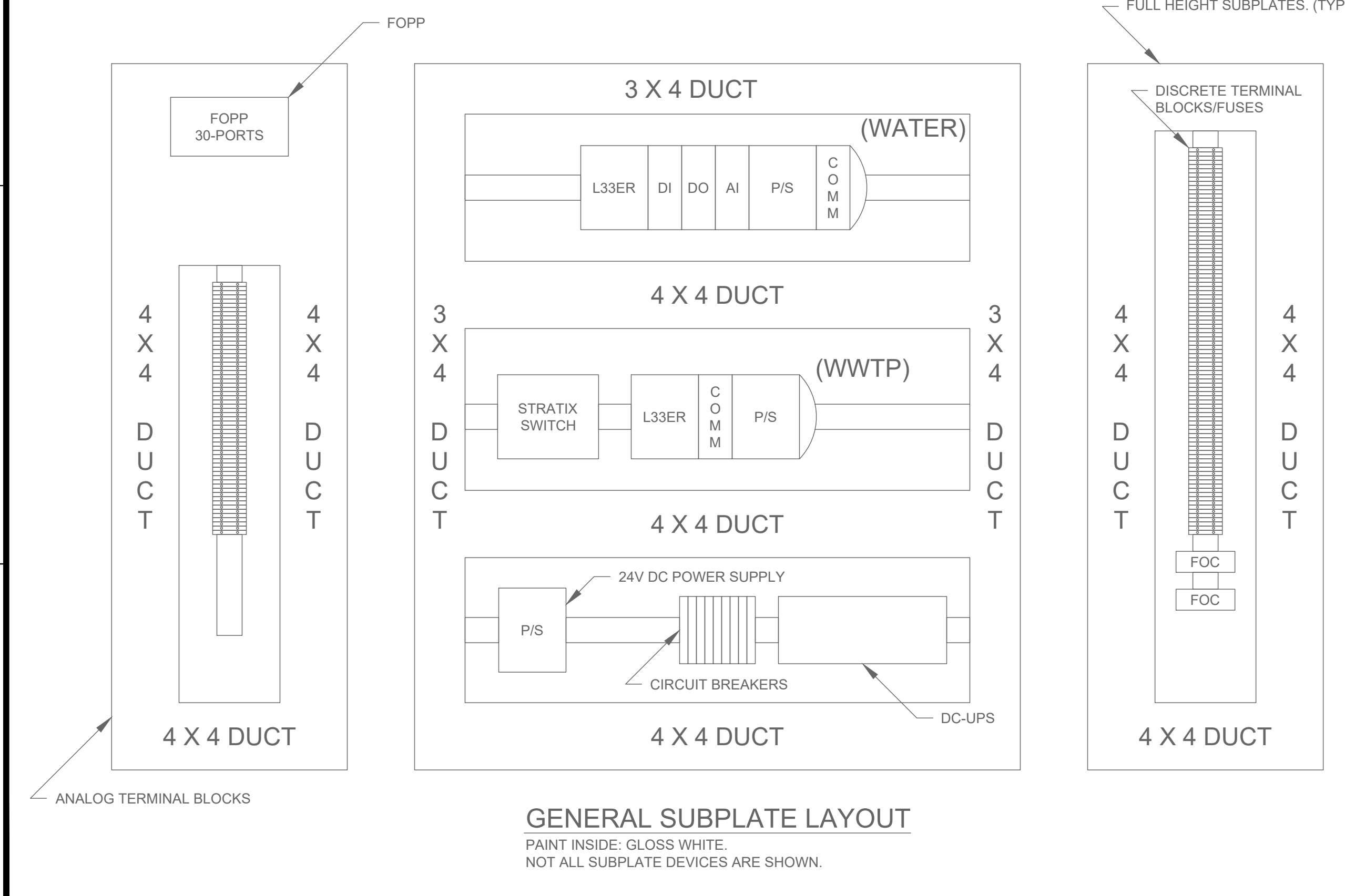
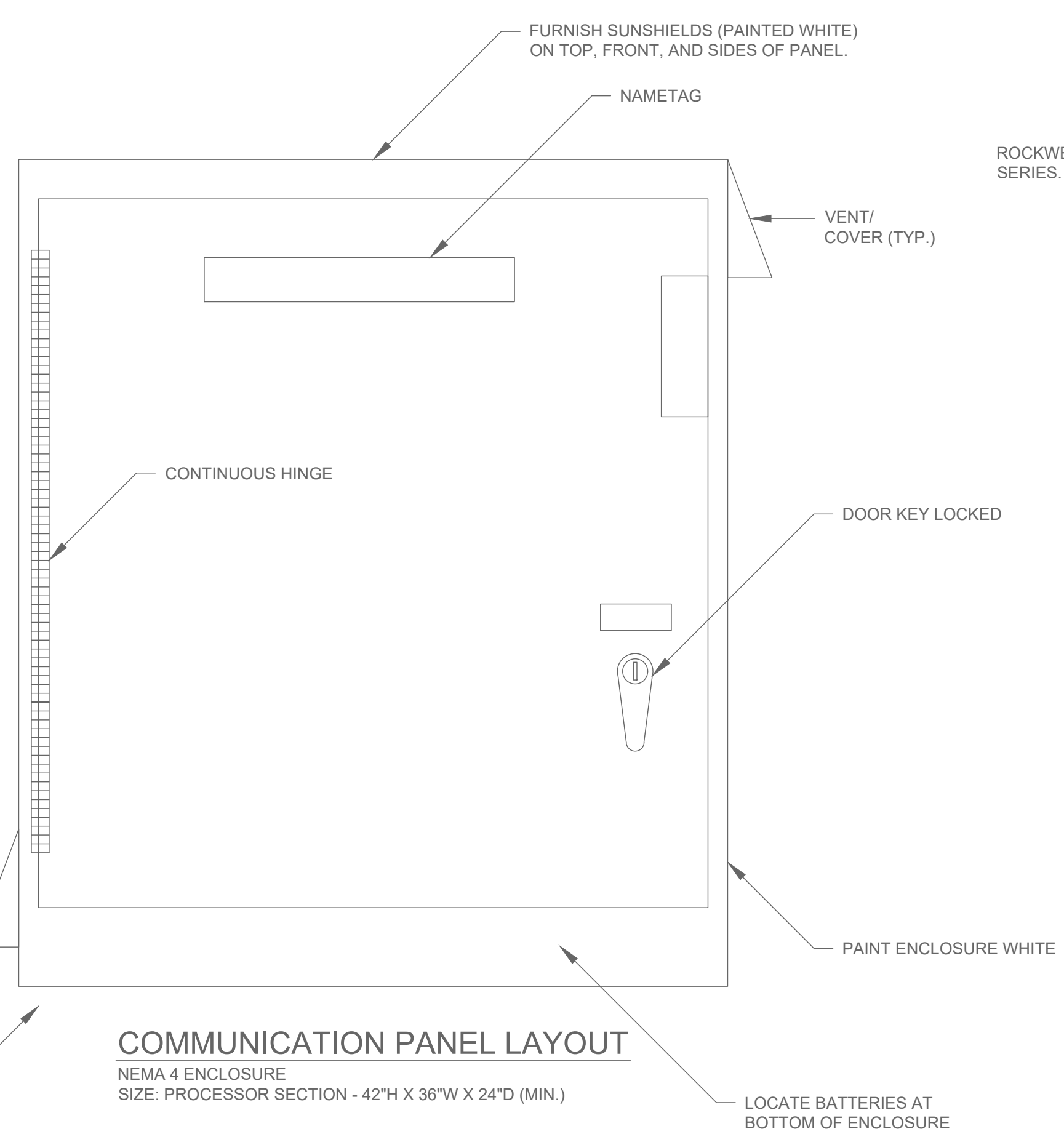
MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
 REMOTE SITE GENERATORS
INSTRUMENTATION
GULL ROAD WATER TOWER COMMUNICATION
PANEL LAYOUT, WIRING DIAGRAM



EXISTING DRAWING FROM PREVIOUS PROJECT.
PROPOSED WORK SHOWN BOLD,
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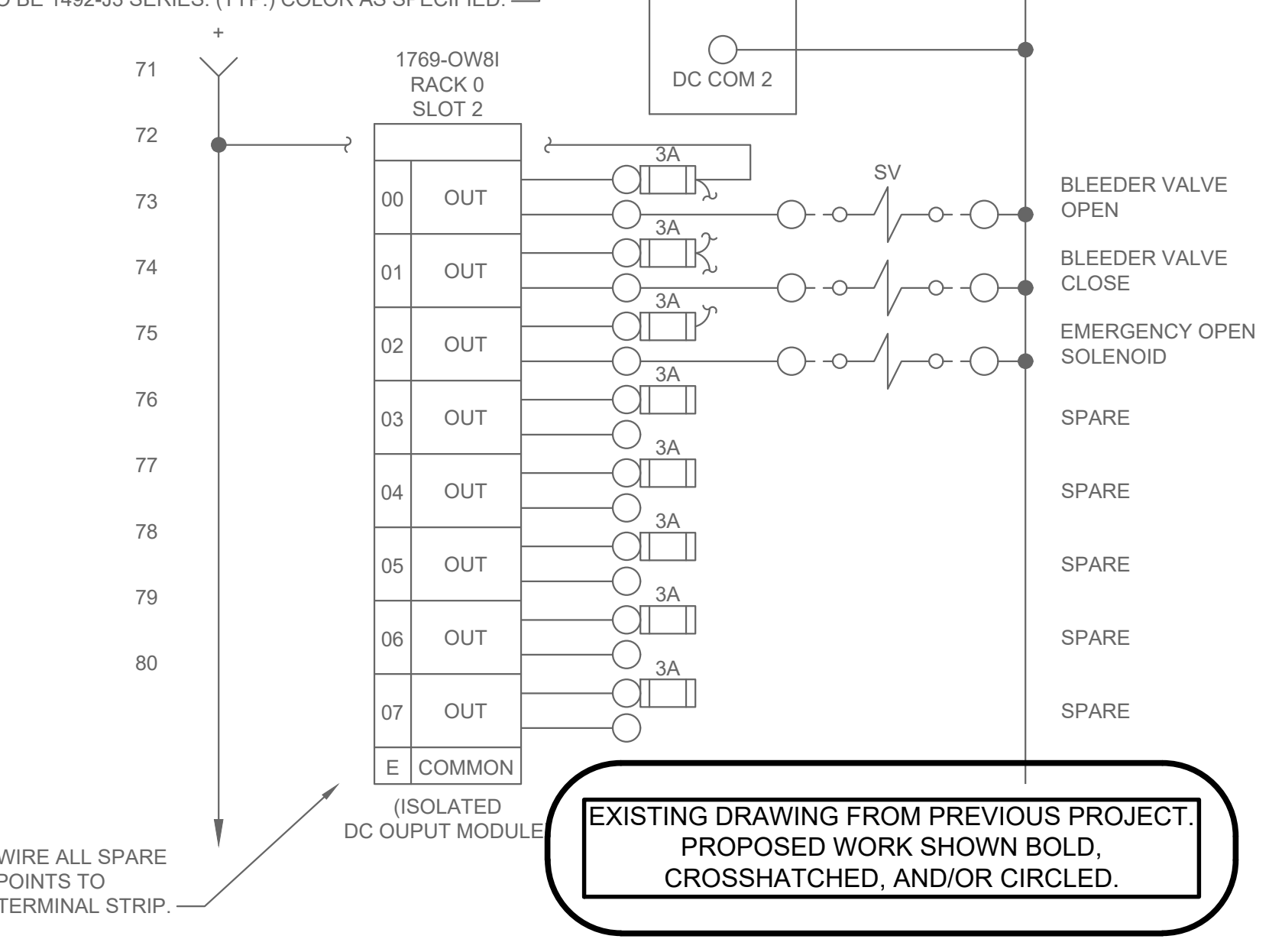
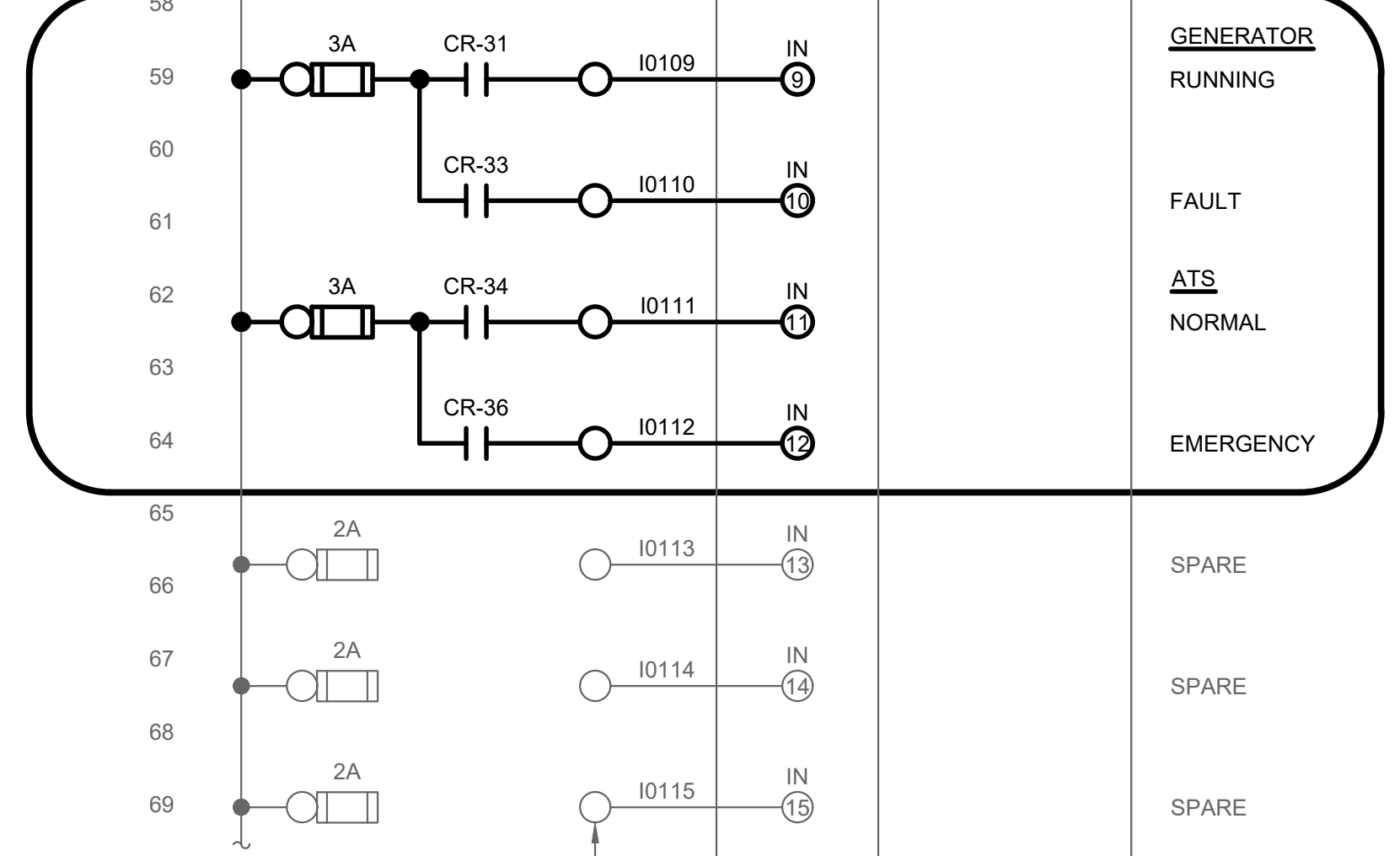
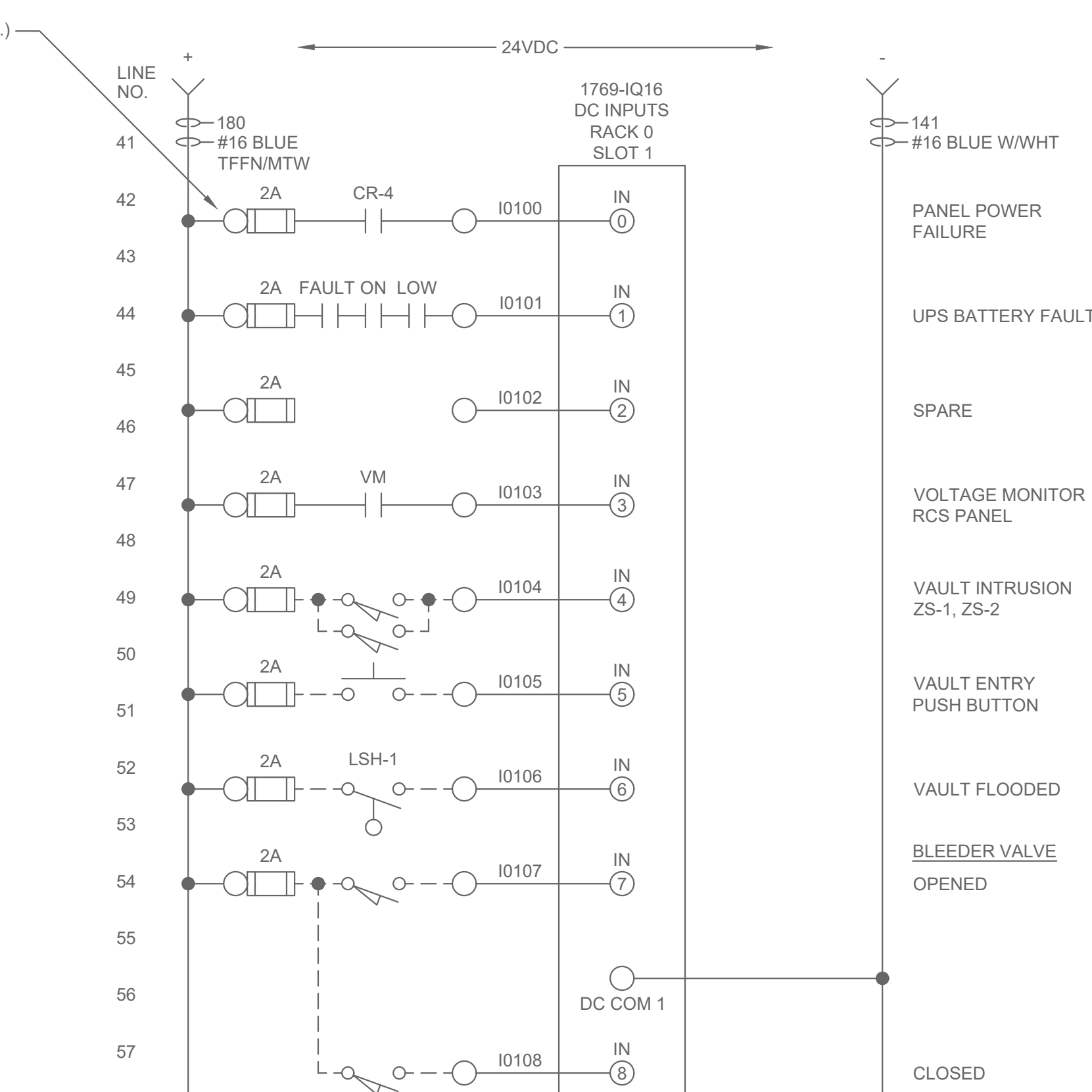
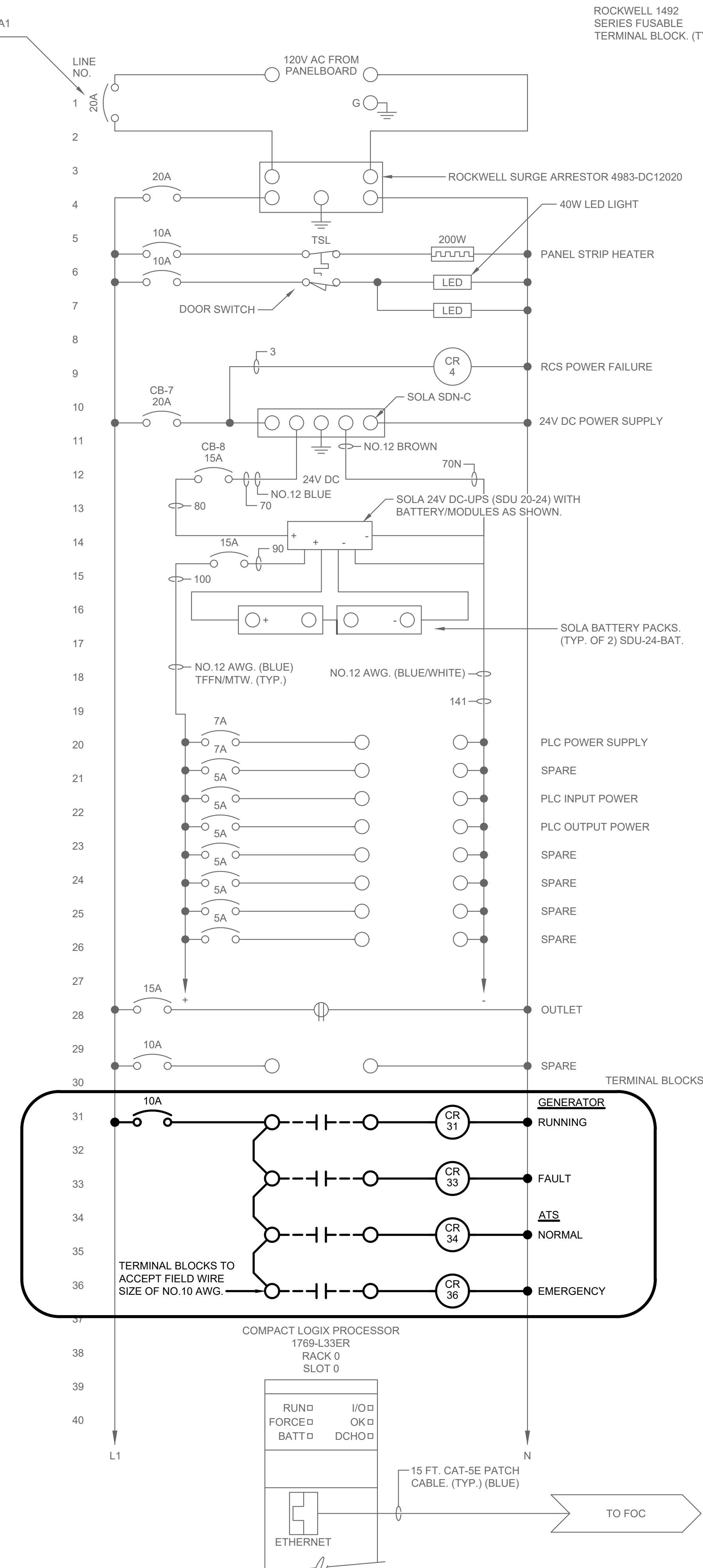
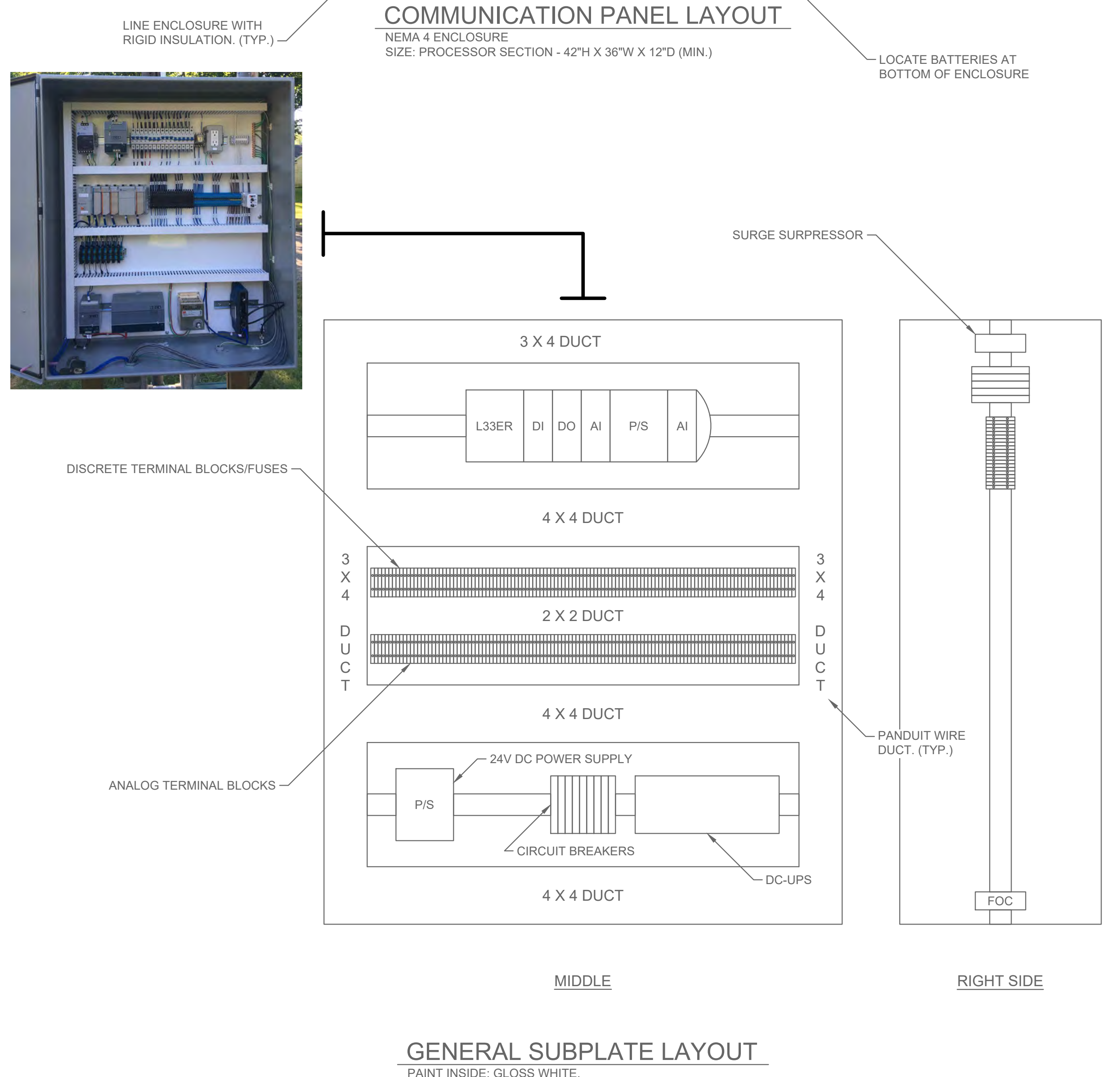
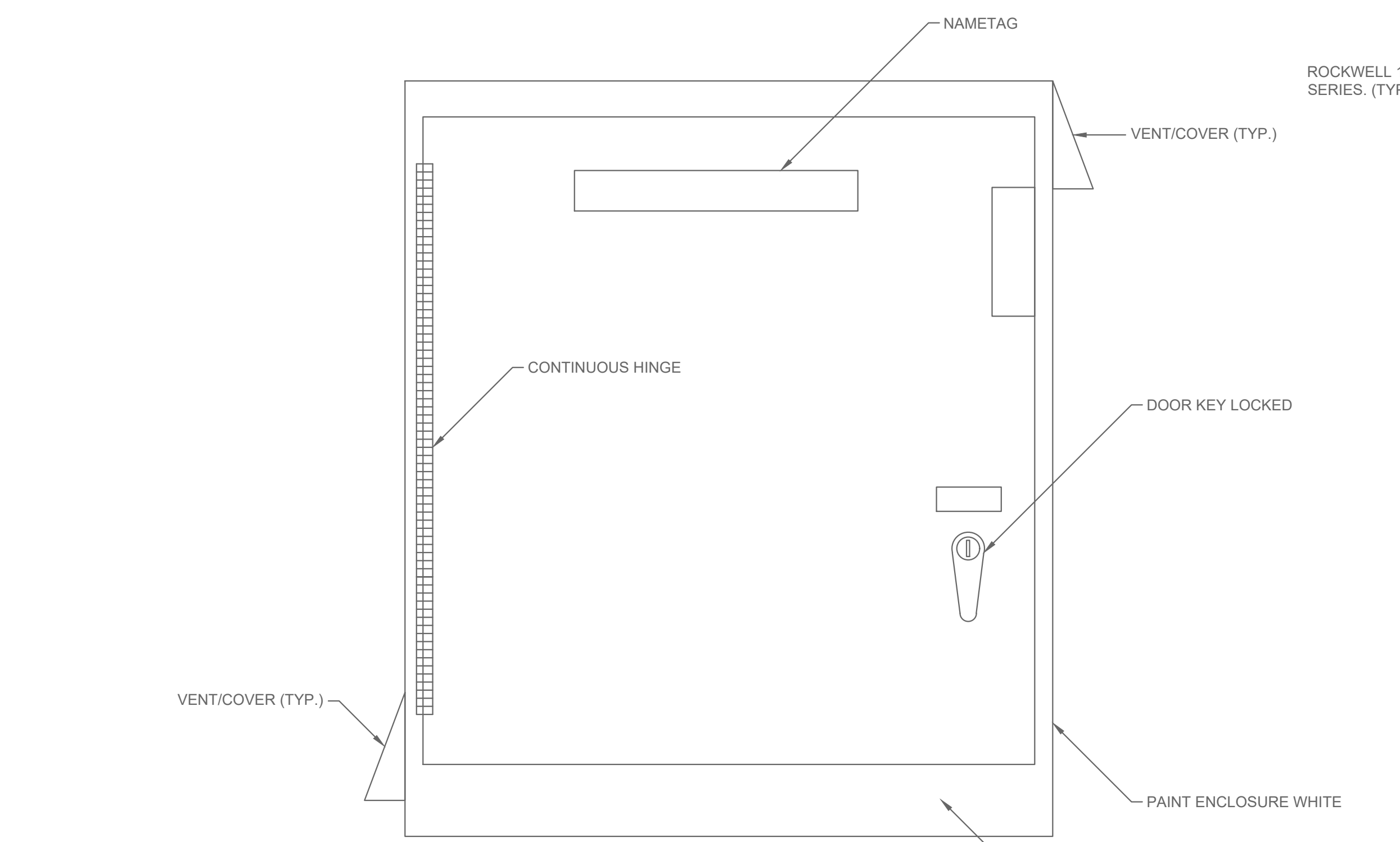


MARK	DATE	DESCRIPTION

Project No.: 200-19743-21002
Designed By: G.C.J.
Drawn By: J.L.S.
Checked By: M.S.J./G.C.J.

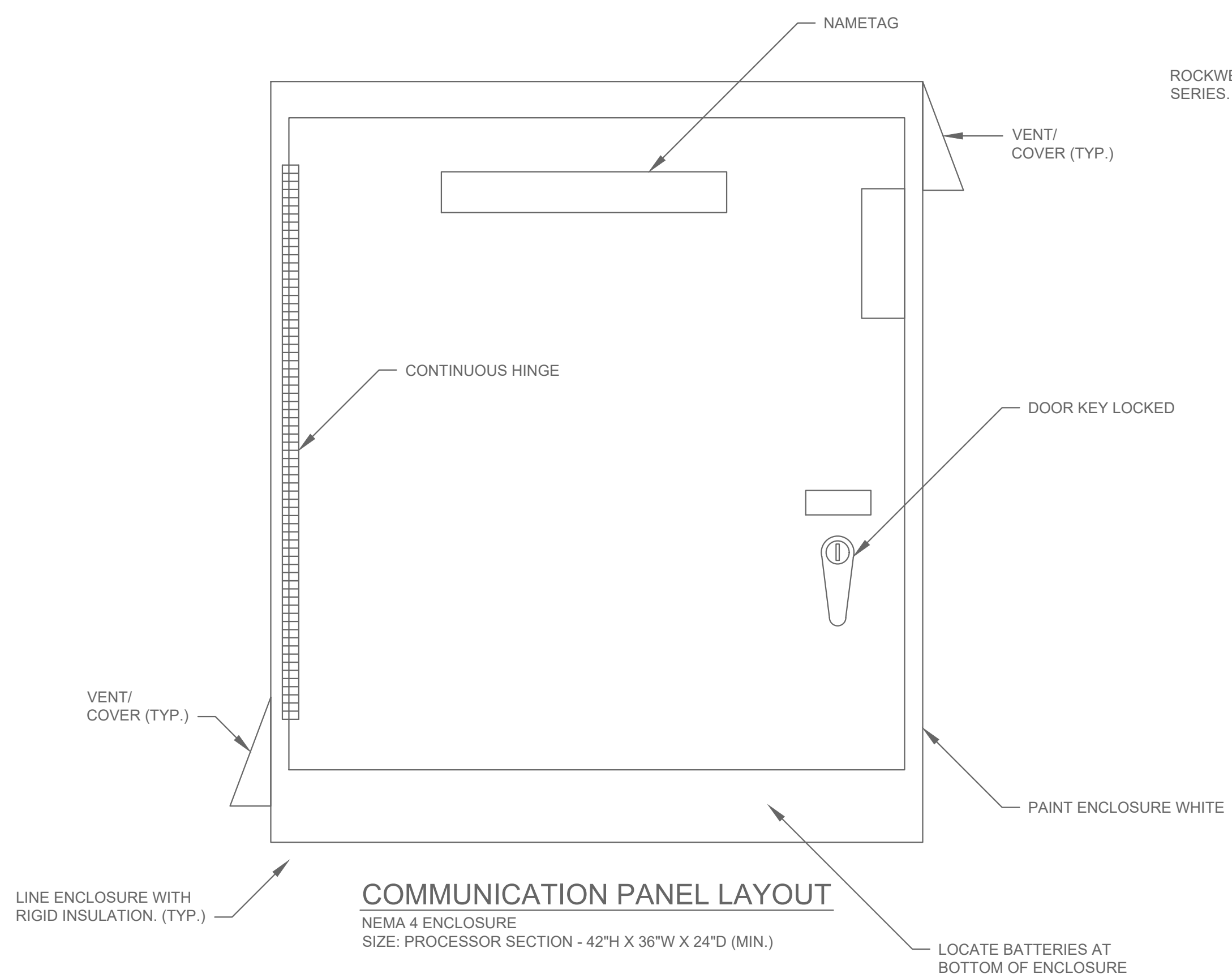
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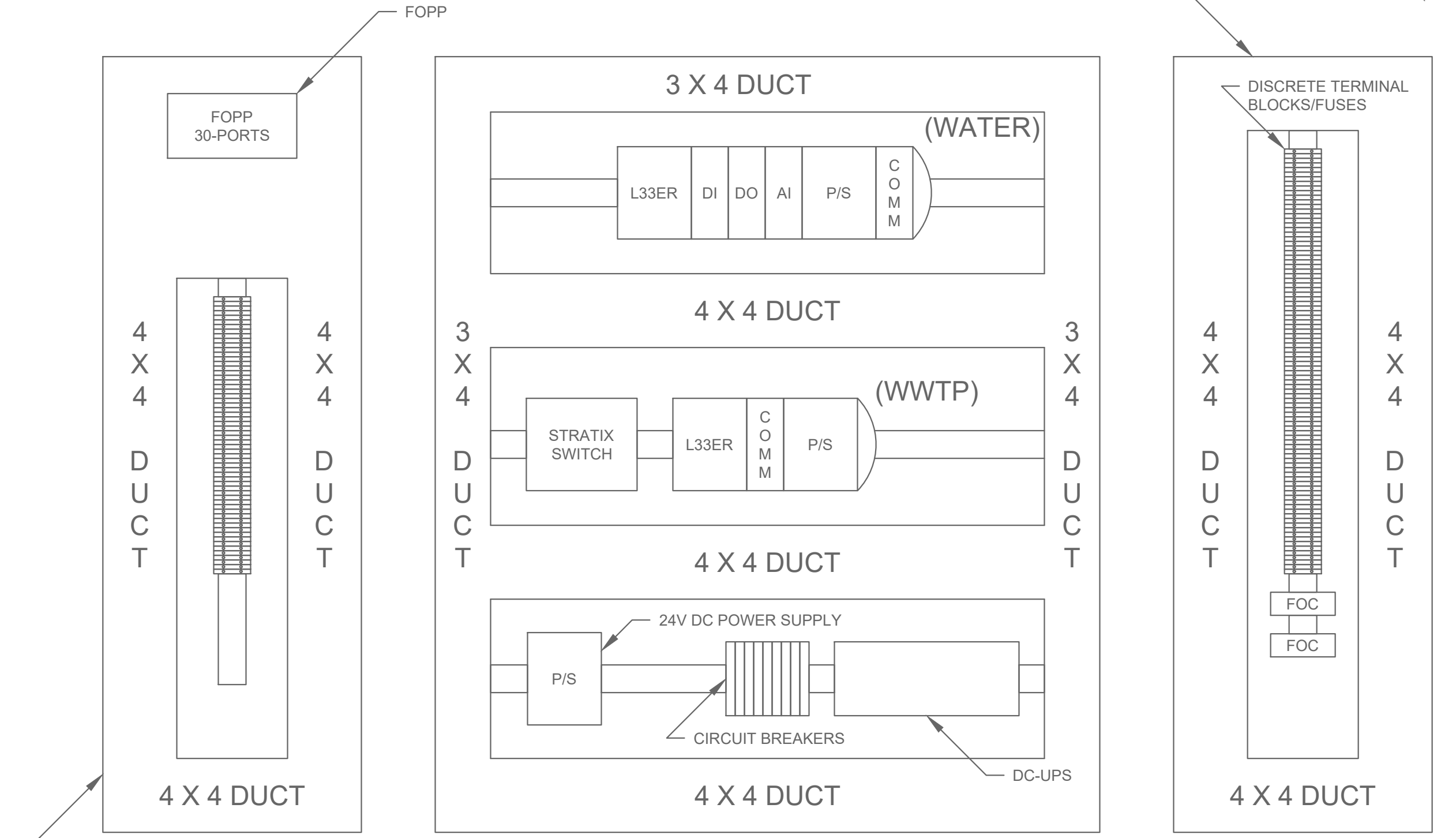


TETRA TECH logo and contact info. Title block containing Project No. 200-19743-21002, City of Kalamazoo, Michigan, Instrumentation Spanish Control Panel, and a table for revision control. Includes a note: 'EXISTING DRAWING FROM PREVIOUS PROJECT. PROPOSED WORK SHOWN BOLD, CROSSHATCHED, AND/OR CIRCLED.'

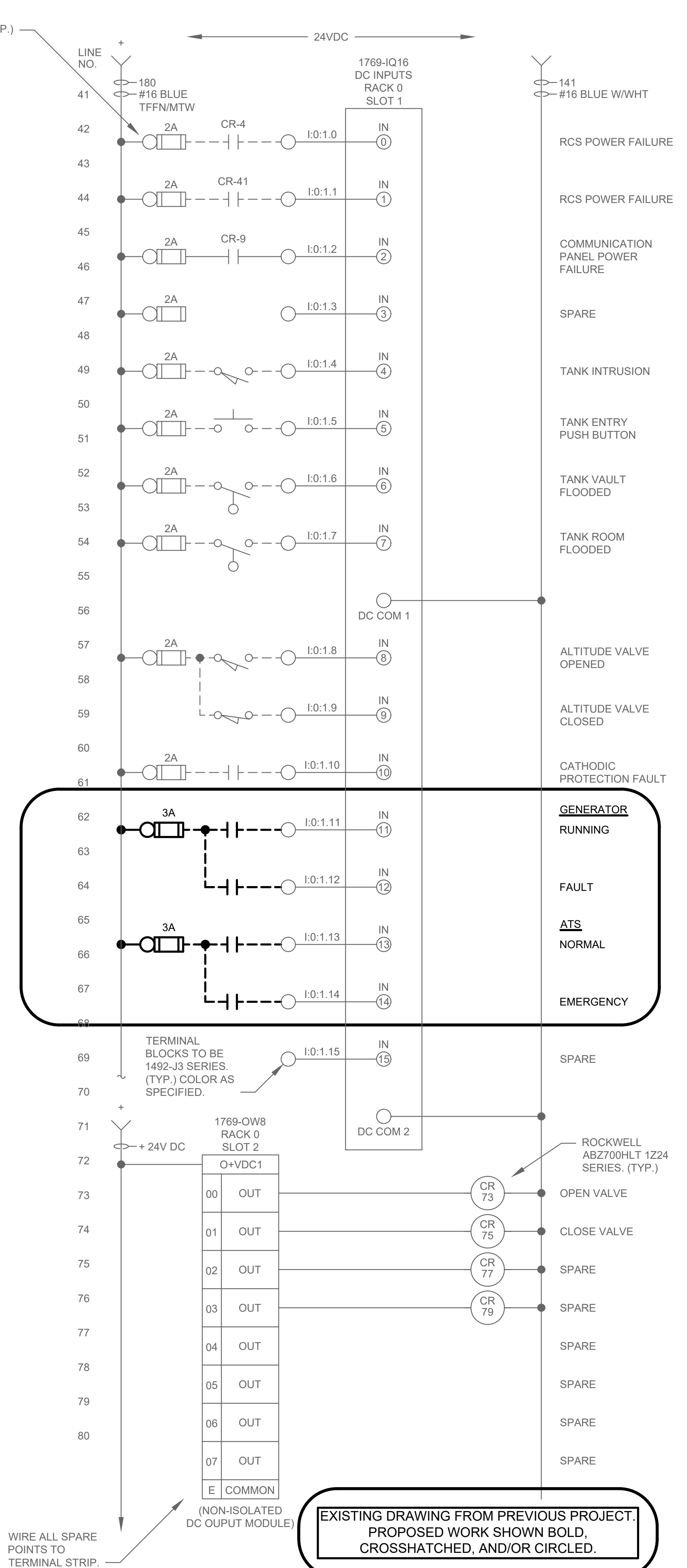
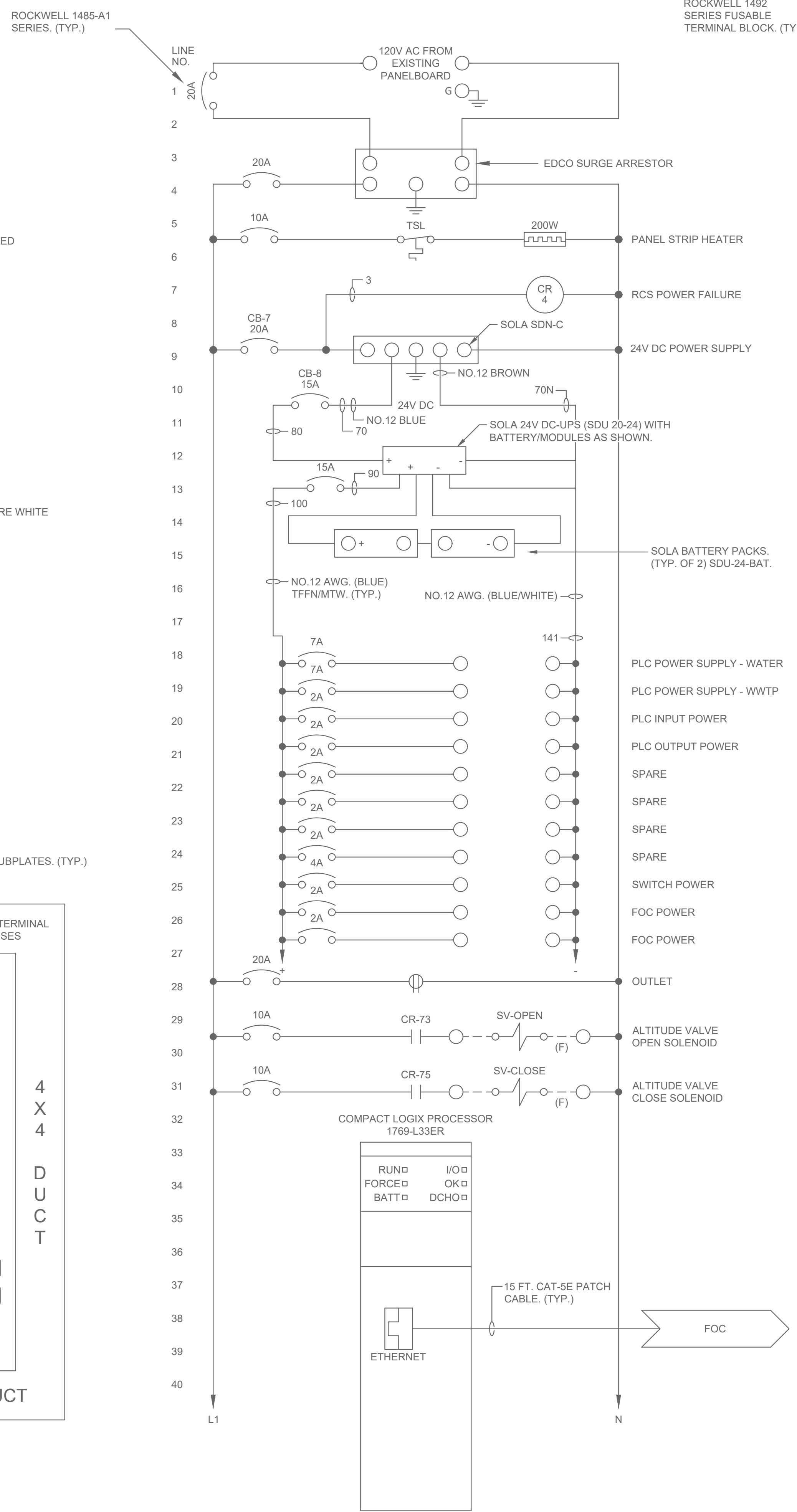
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COMMUNICATION PANEL LAYOUT
NEMA 4 ENCLOSURE
SIZE: PROCESSOR SECTION - 42"H X 36"W X 24"D (MIN.)



GENERAL SUBPLATE LAYOUT
PAINT INSIDE: GLOSS WHITE
NOT ALL SUBPLATE DEVICES ARE SHOWN.

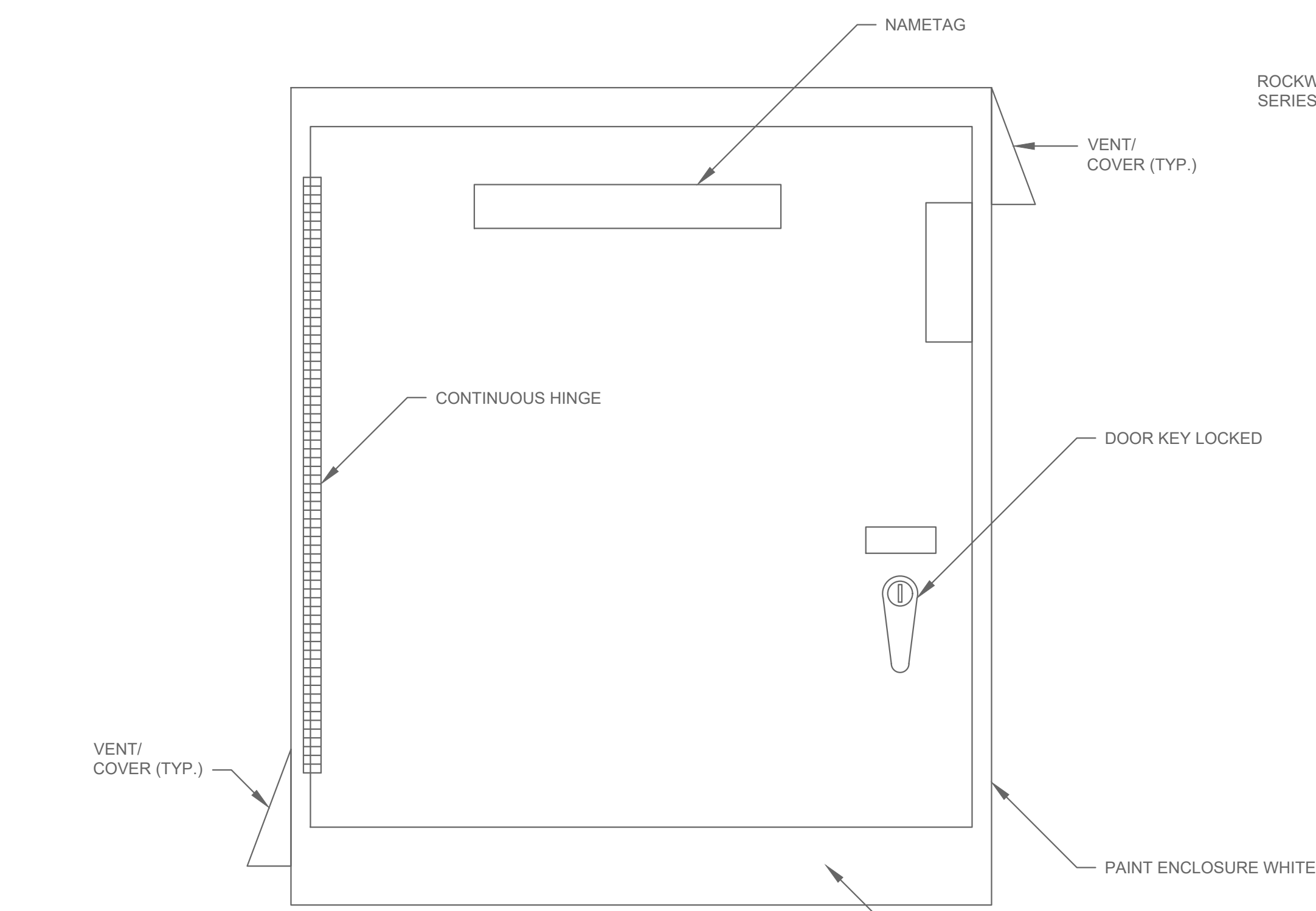


WIRE ALL SPARE POINTS TO TERMINAL STRIP.
(NON-ISOLATED DC OUTPUT MODULE)
EXISTING DRAWING FROM PREVIOUS PROJECT. PROPOSED WORK SHOWN BOLD, CROSSHATCHED, AND/OR CIRCLED.

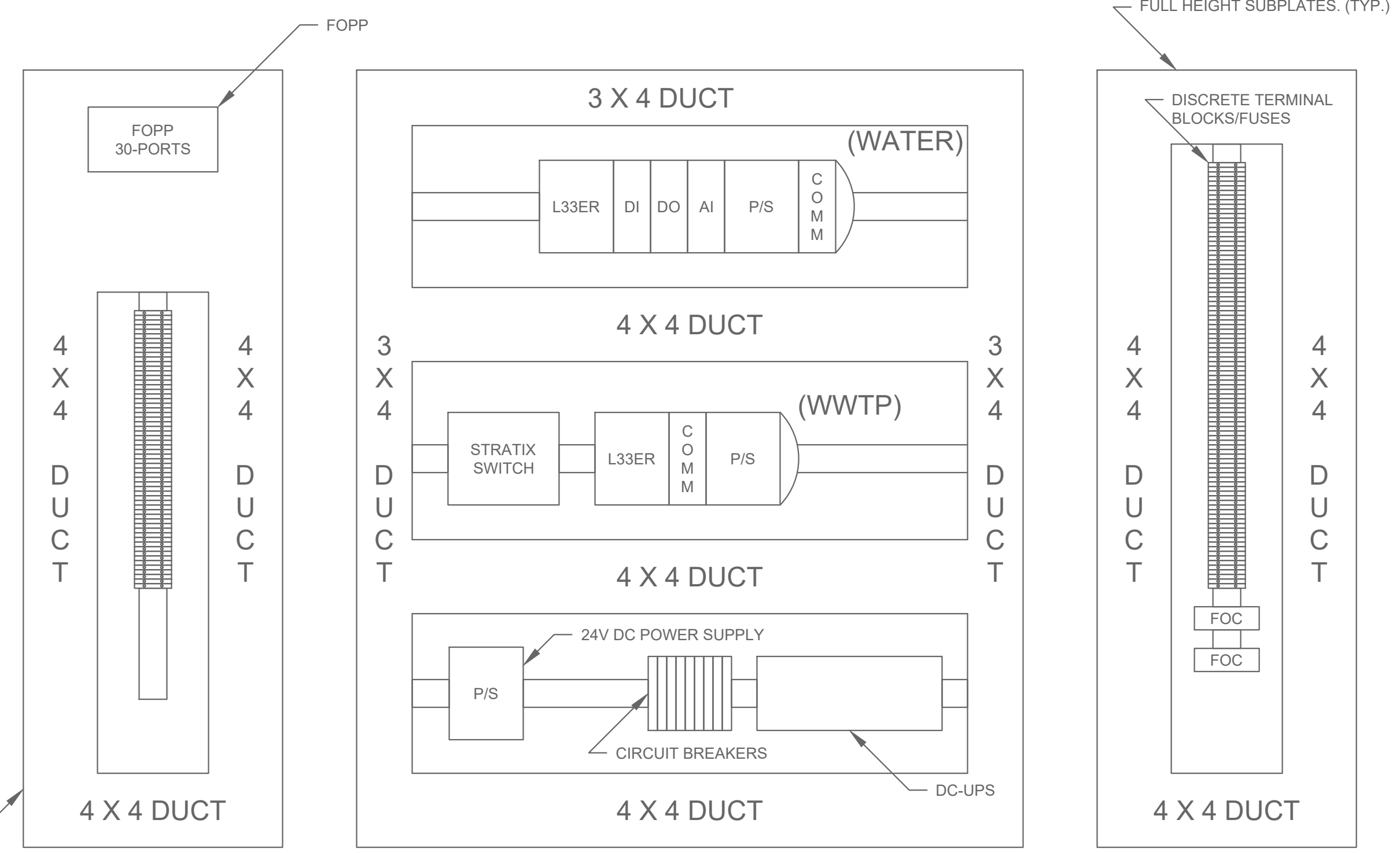
MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
REMOTE SITE GENERATORS
INSTRUMENTATION
EDGEMOOR WATER TOWER
PANEL LAYOUT, WIRING DIAGRAM

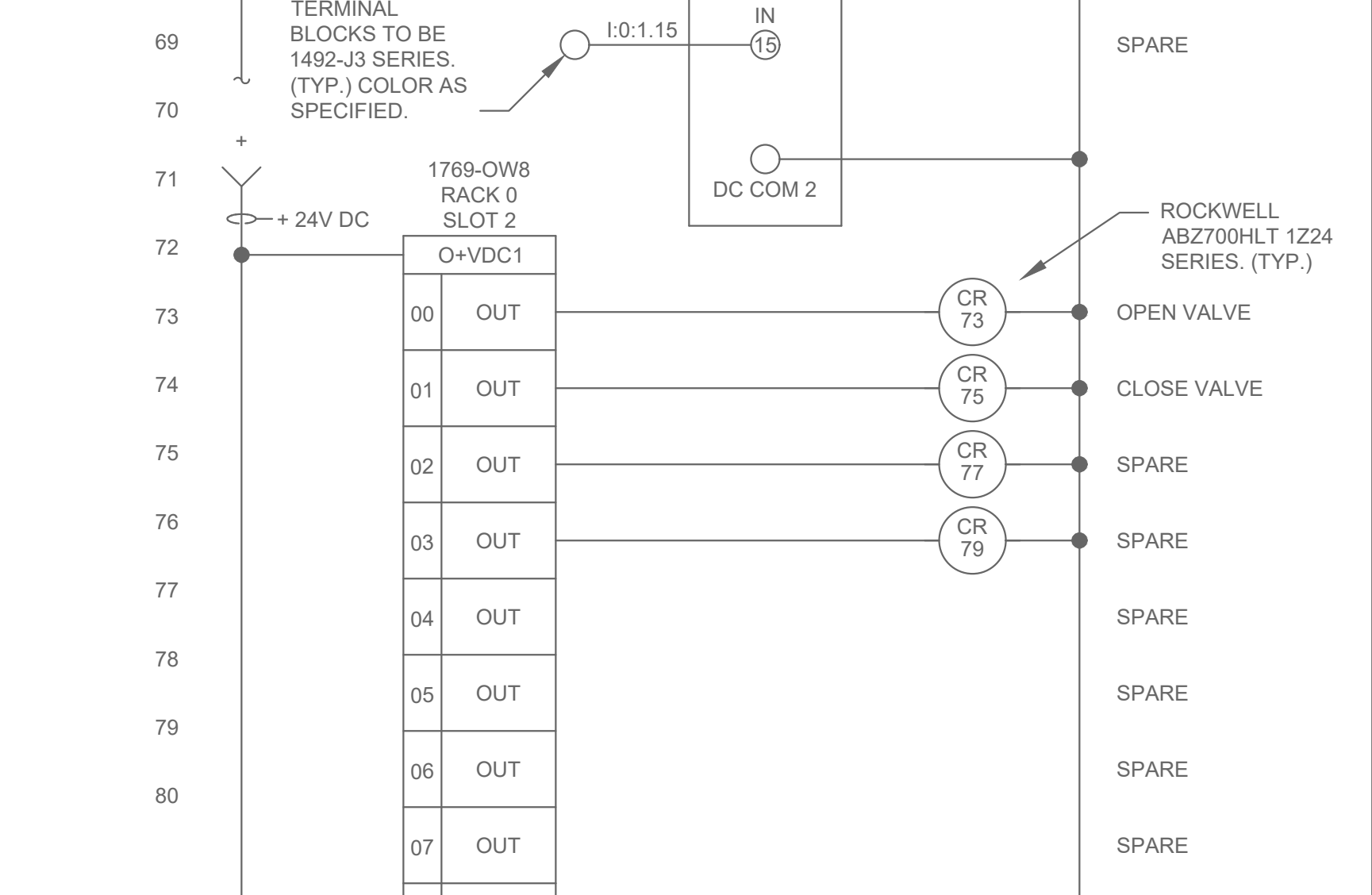
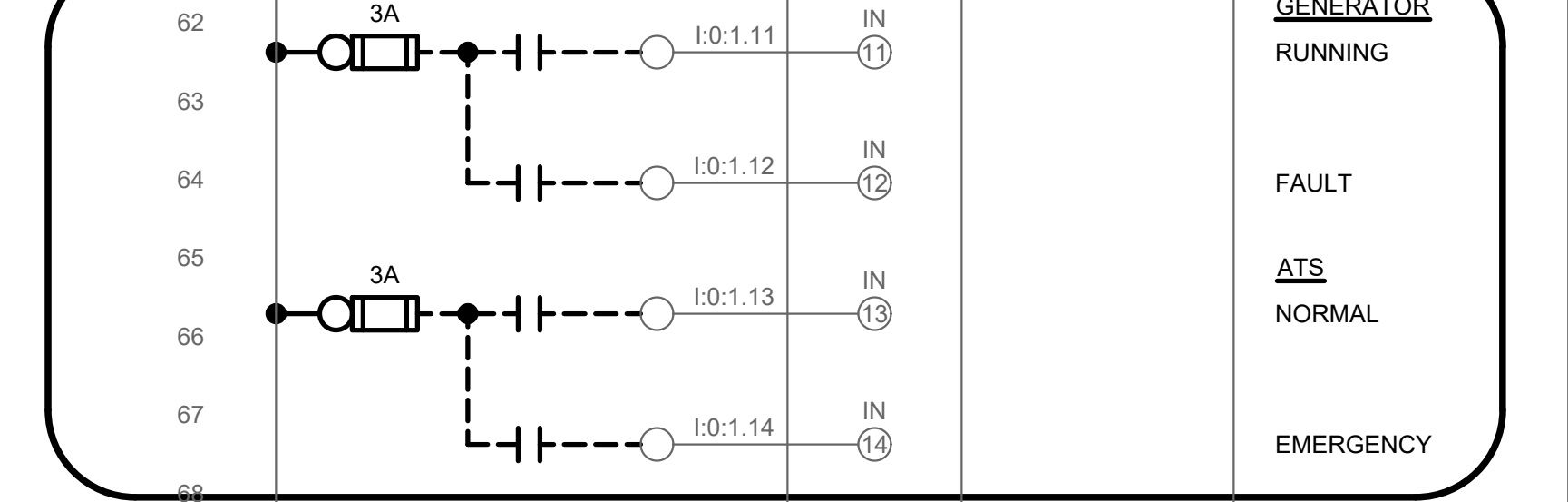
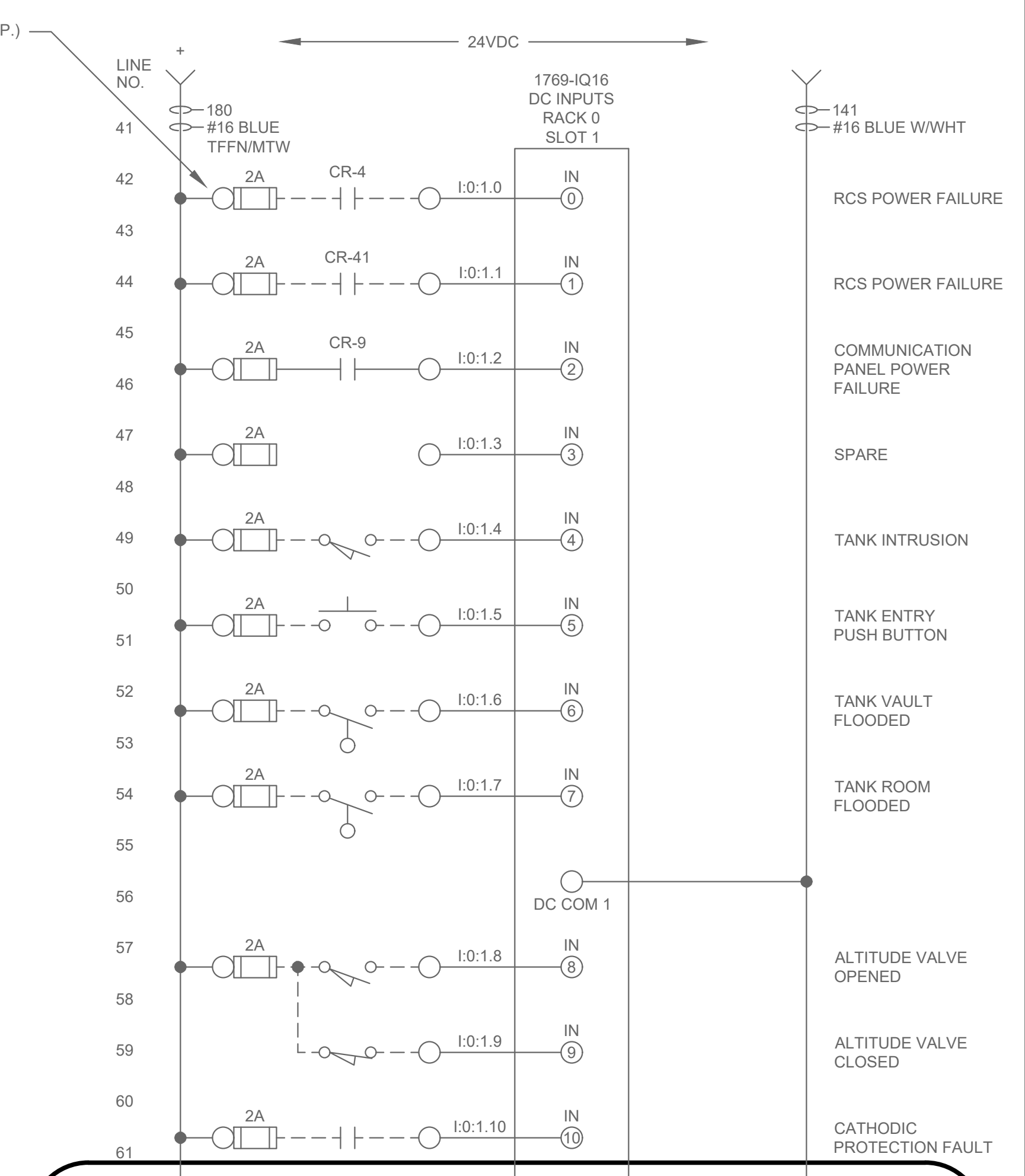
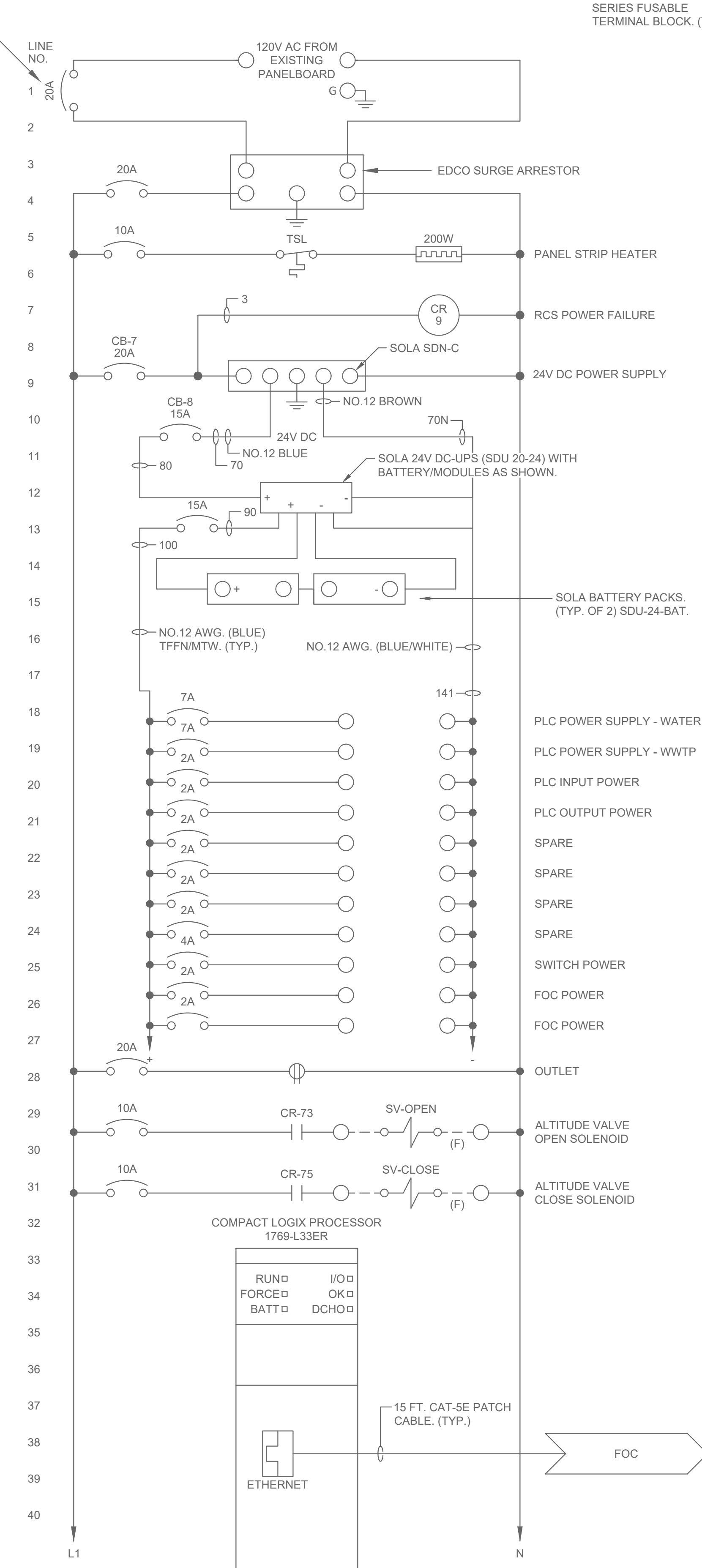
Project No.:	200-19743-21002
Designed By:	GJC
Drawn By:	JLS
Checked By:	MSJ/GJC



COMMUNICATION PANEL LAYOUT
NEMA 4 ENCLOSURE
SIZE: PROCESSOR SECTION - 42"H X 36"W X 24"D (MIN.)



GENERAL SUBPLATE LAYOUT
PAINT INSIDE: GLOSS WHITE
NOT ALL SUBPLATE DEVICES ARE SHOWN.



EXISTING DRAWING FROM PREVIOUS PROJECT. PROPOSED WORK SHOWN BOLD, CROSSHATCHED, AND/OR CIRCLED.

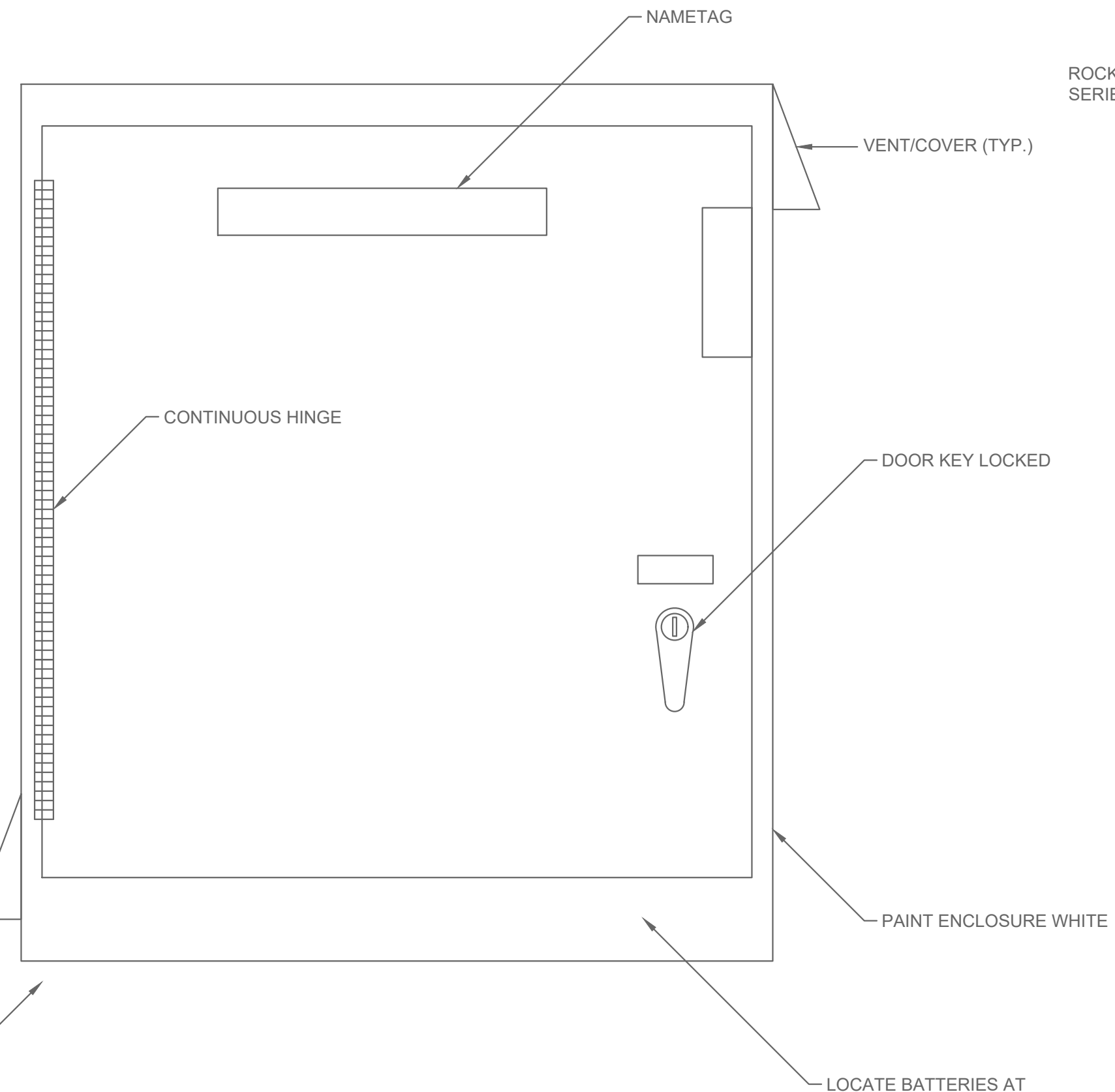


MARK	DATE	DESCRIPTION

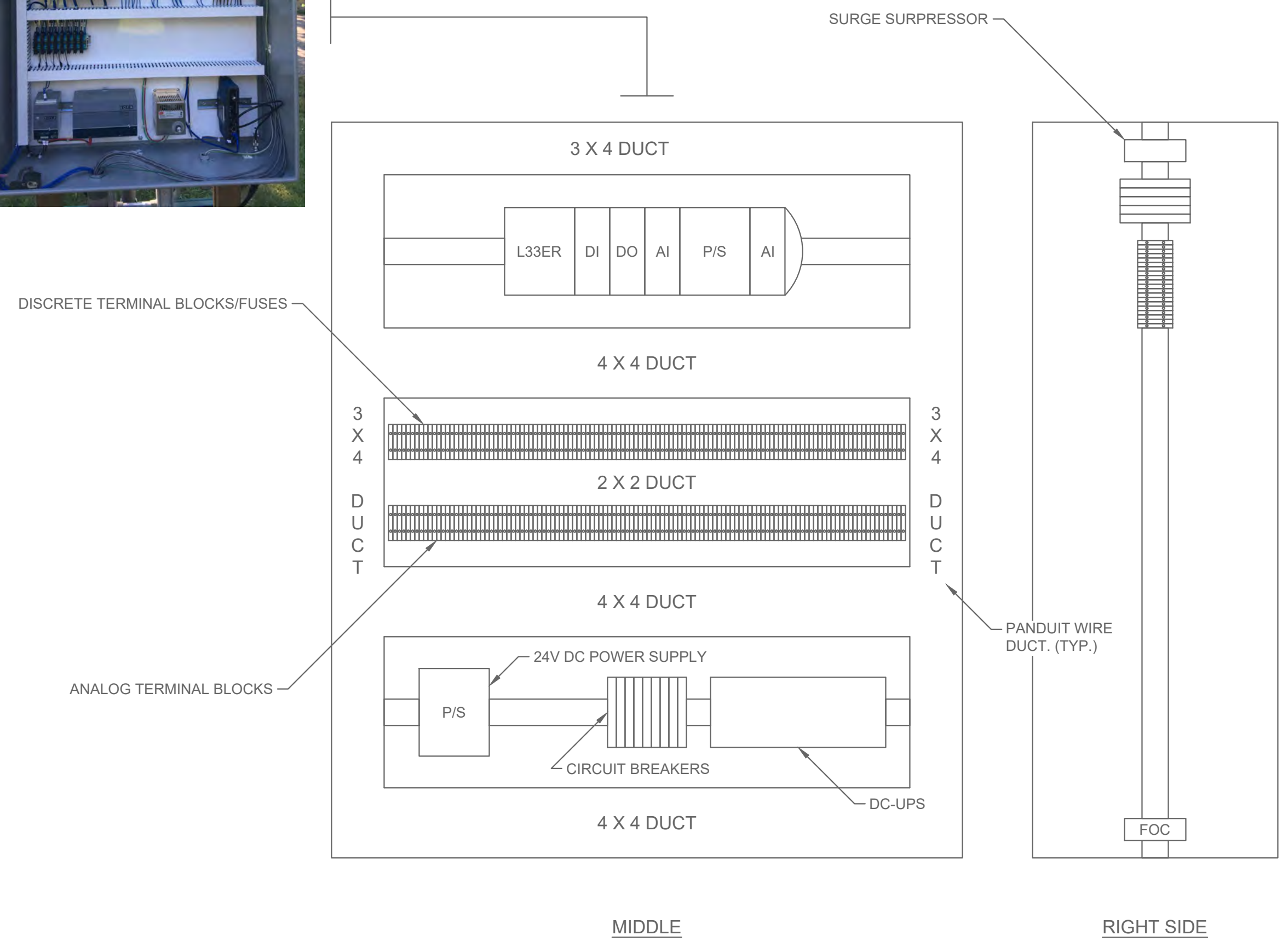
BY												

CITY OF KALAMAZOO, MICHIGAN
REMOTE SITE GENERATORS
INSTRUMENTATION
BEECH STREET WATER TOWER
PANEL LAYOUT, WIRING DIAGRAM

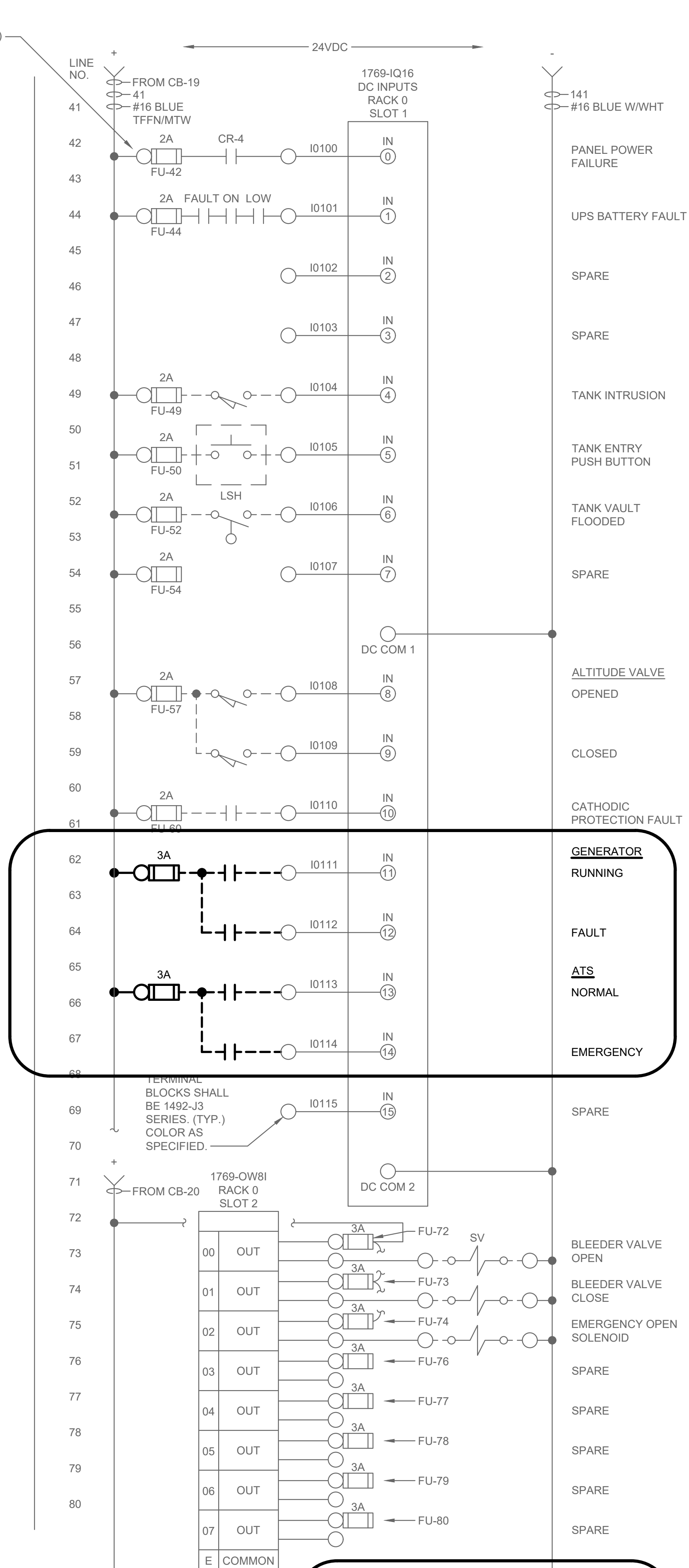
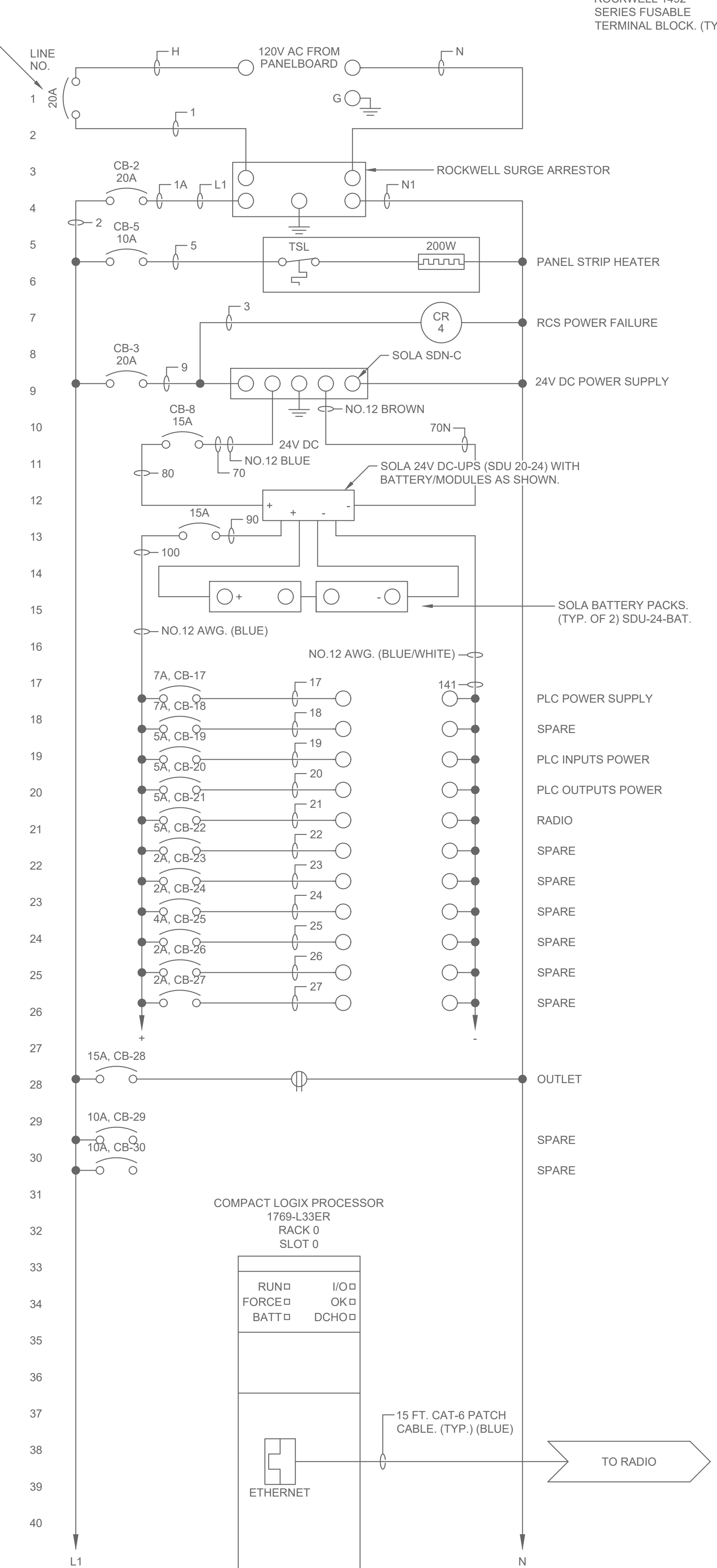
Project No.: 200-19743-21002
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ



SIESTA TANK CONTROL PANEL LAYOUT
NEMA 4 ENCLOSURE
SIZE: 42"H X 36"W X 12"D (MIN.)



GENERAL SUBPLATE LAYOUT
PAINT INSIDE: GLOSS WHITE.



EXISTING DRAWING FROM PREVIOUS PROJECT. PROPOSED WORK SHOWN BOLD, CROSSHATCHED, AND/OR CIRCLED.

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710 AVIS DRIVE
ANN ARBOR, MI 48108
PHONE: (734) 665-6000 FAX: (734) 213-3003

MARK	DATE	DESCRIPTION	BY

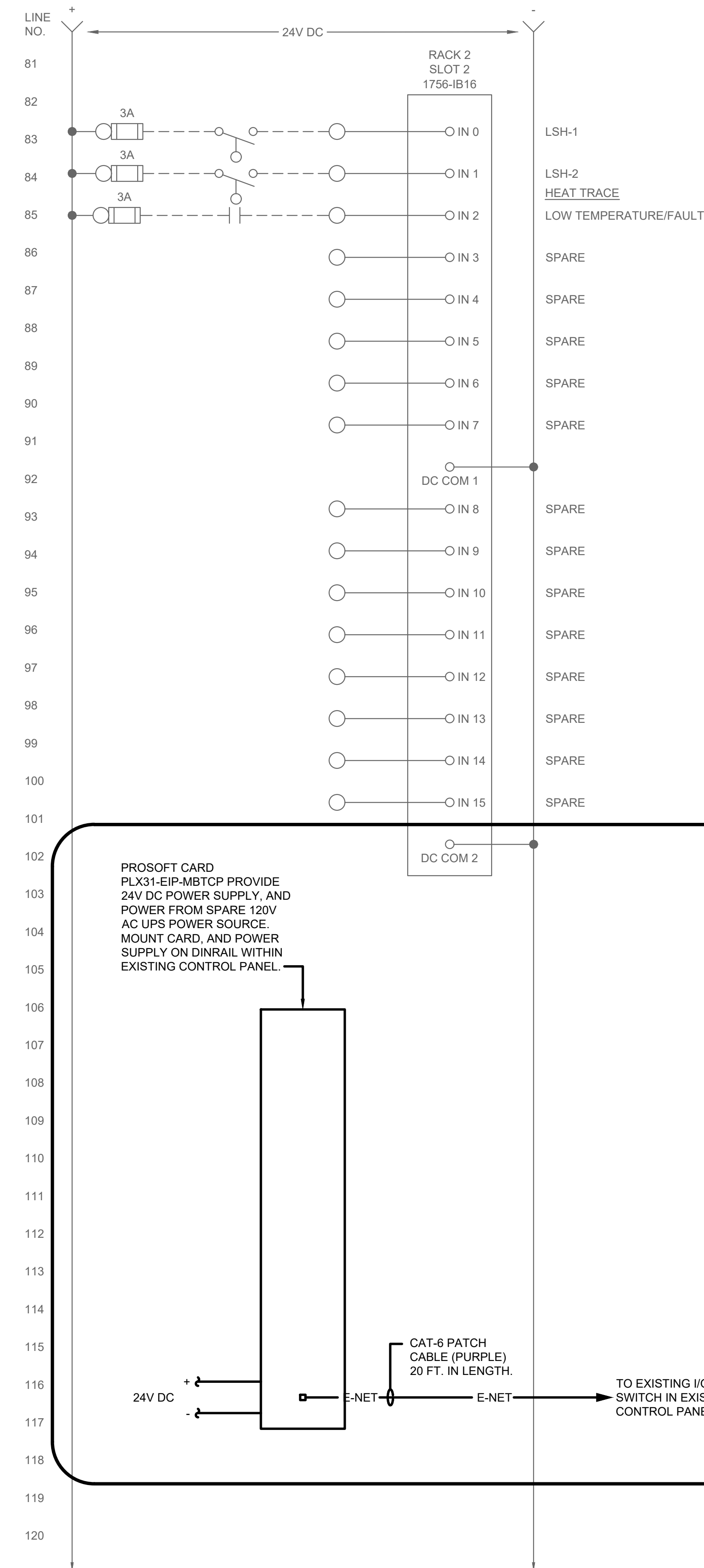
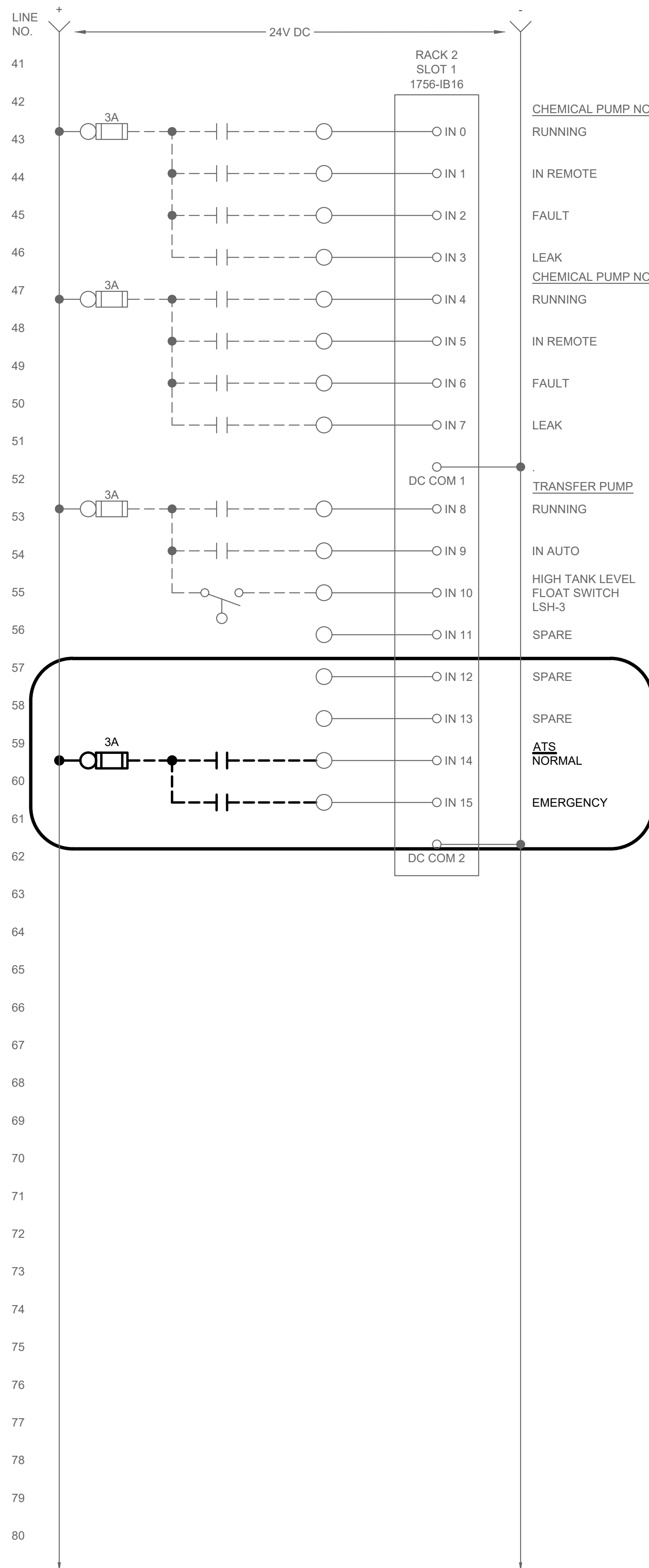
**CITY OF KALAMAZOO, MICHIGAN
REMOTE SITE GENERATORS
INSTRUMENTATION
SIESTA TANK WATER TOWER
PANEL LAYOUT, WIRING DIAGRAM**

Project No.:	200-19743-21002
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MSJ/GCJ

20
OF 25
Bar Measures 1 inch

4/27/2022 3:57:59 PM - \\TT.LOCAL\IERPROJECTS\ANN ARBOR\IER19743\200-19743-21002\CAD\SHEETFILES\EI21_STATION NO.11 WIR DIA.DWG - SHANK, JASON

LINE NO.
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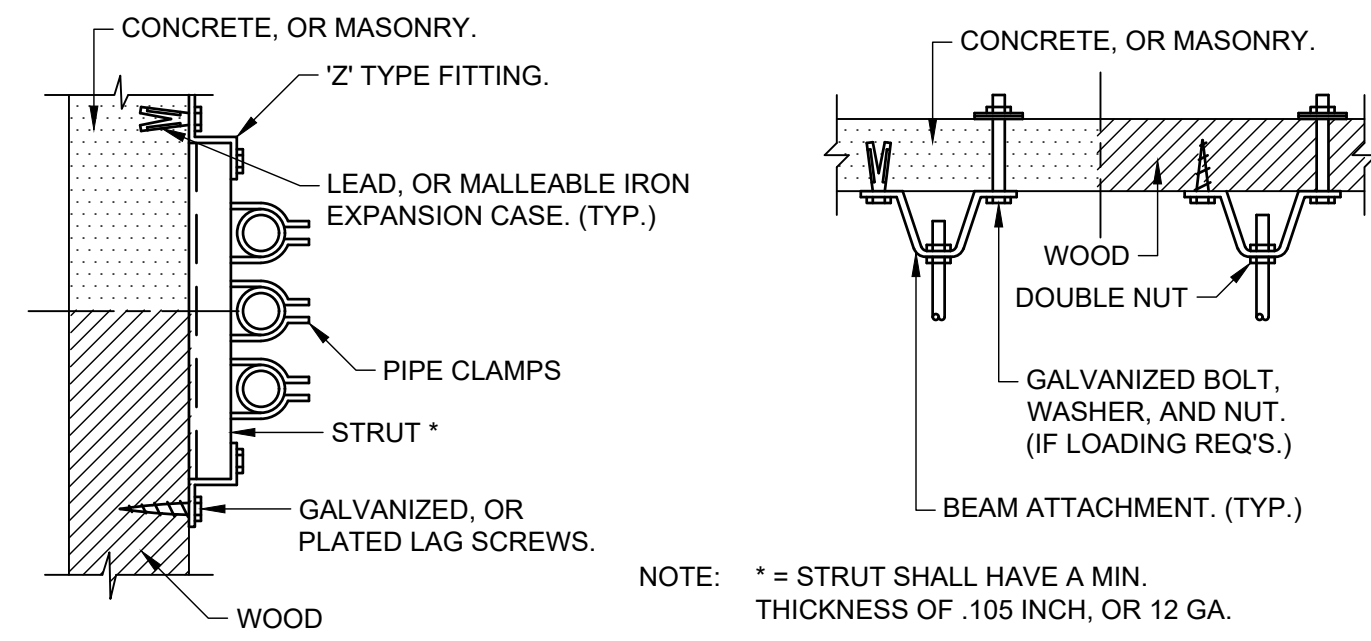


EXISTING DRAWING FROM PREVIOUS PROJECT.
PROPOSED WORK SHOWN BOLD,
CROSSHATCHED, AND/OR CIRCLED.

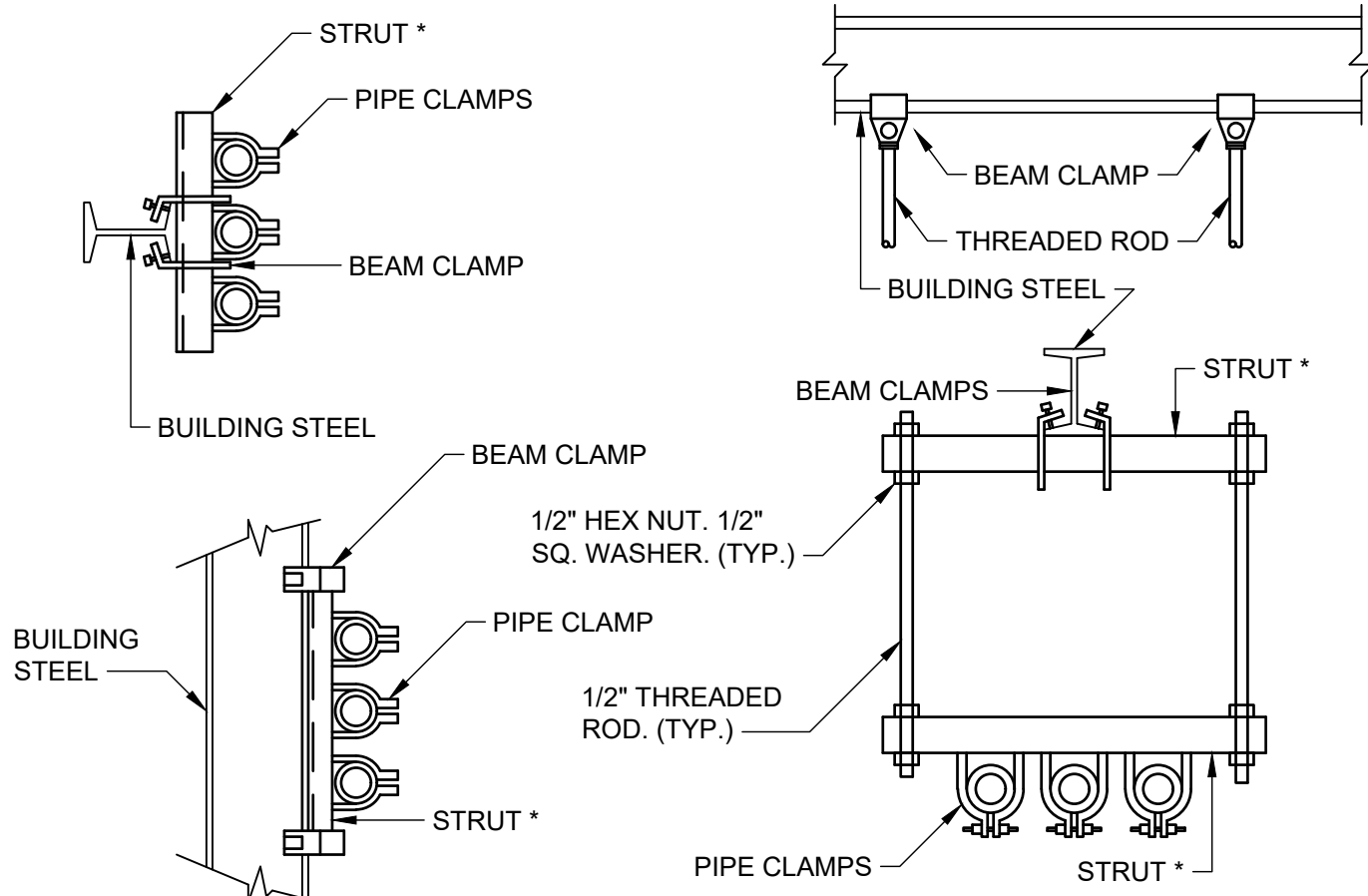
MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
REMOTE SITE GENERATORS
**INSTRUMENTATION
STATION NO.11
PANEL LAYOUT, WIRING DIAGRAM**

Project No.: 200-19743-21002
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

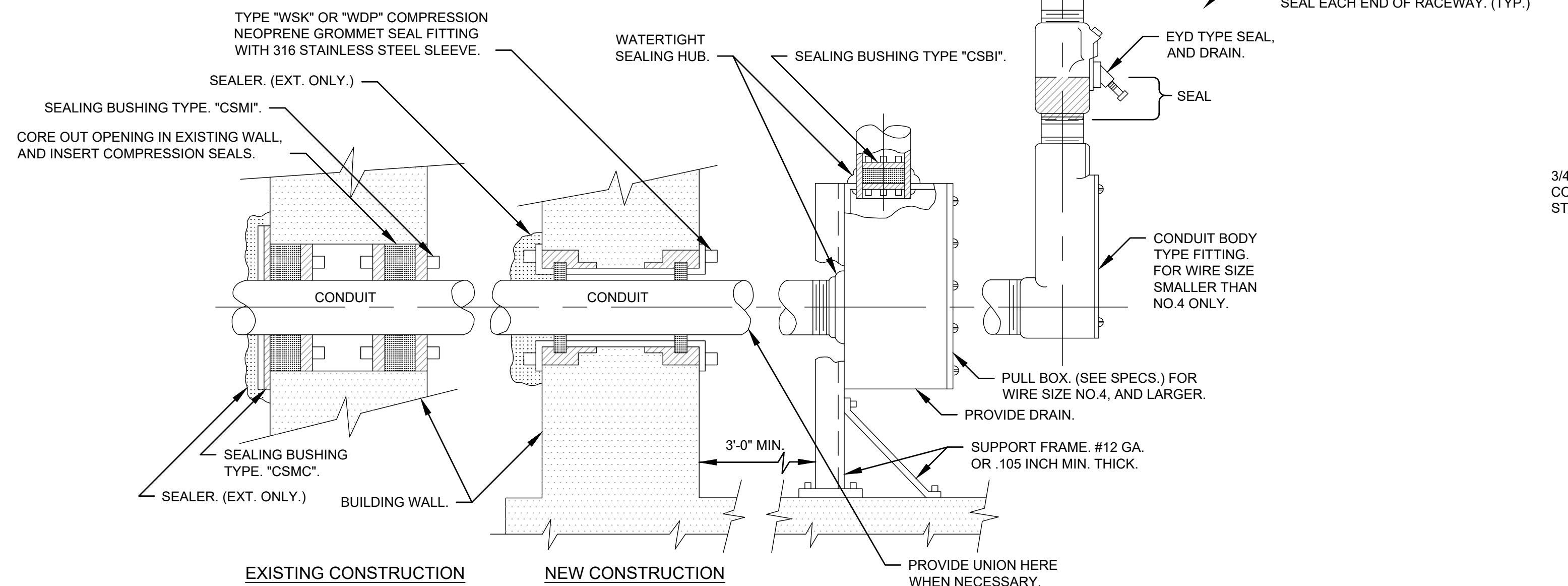


NOTE: * = STRUT SHALL HAVE A MIN. THICKNESS OF .105 INCH. OR 12 GA.



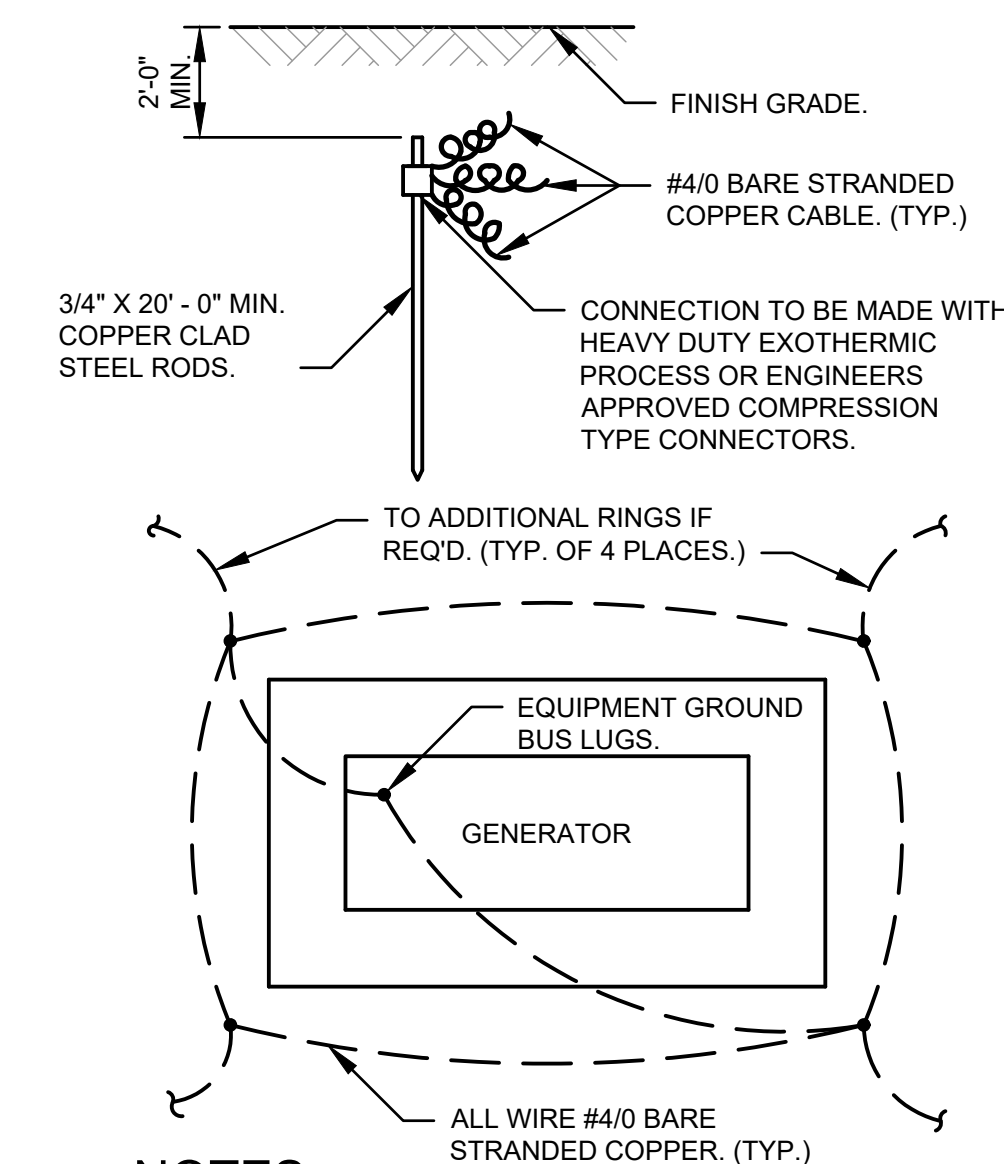
VERTICALLY RACKED AND VERTICAL RUNS
NO SCALE

HORIZONTAL RACKED SUSPENDED RUN
NO SCALE



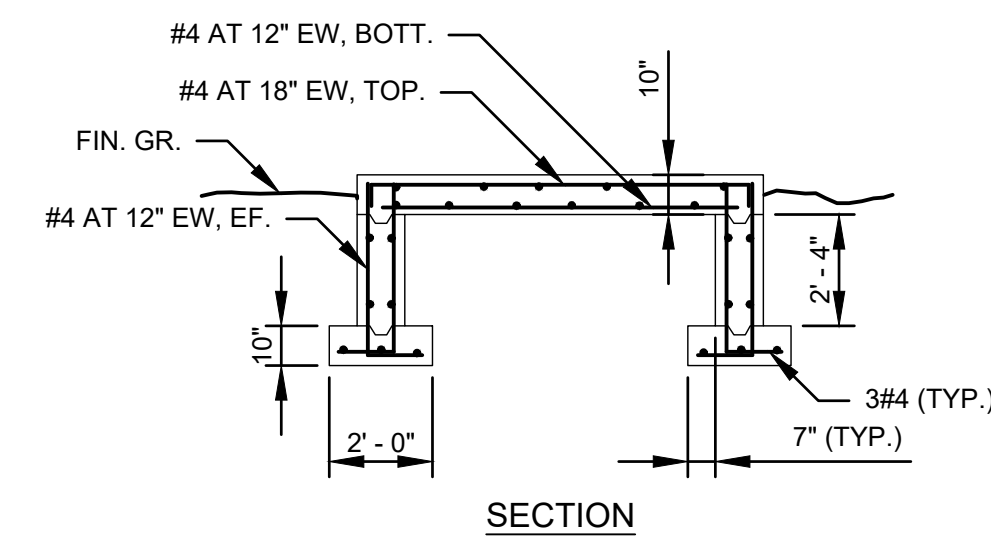
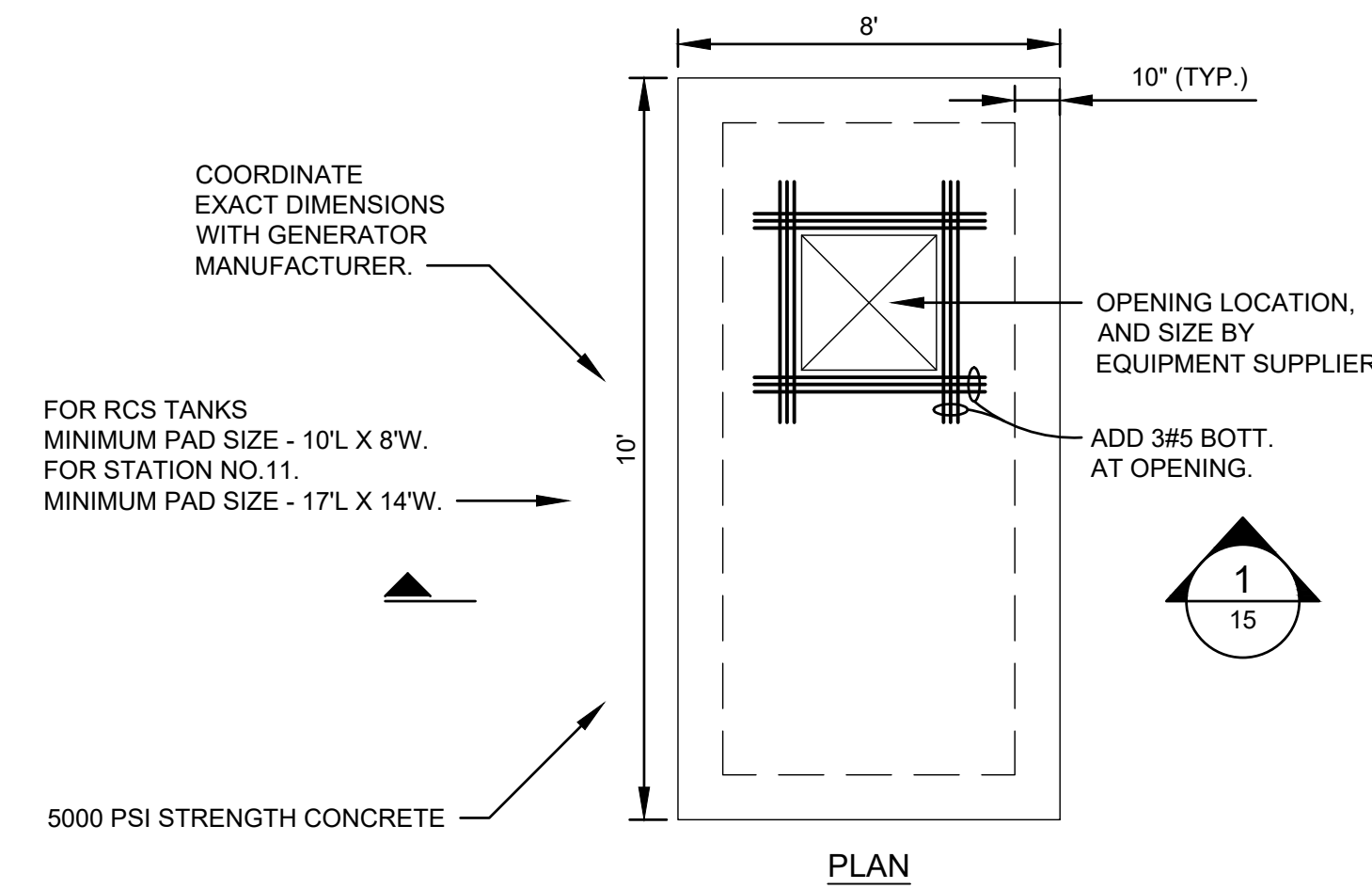
BELOW OR ABOVE GRADE SAMPLE CONDUIT ENTRANCE DETAIL
NO SCALE

NOTE: ALL CONDUIT ENTRANCES SHALL HAVE SEAL, AND DRAIN.

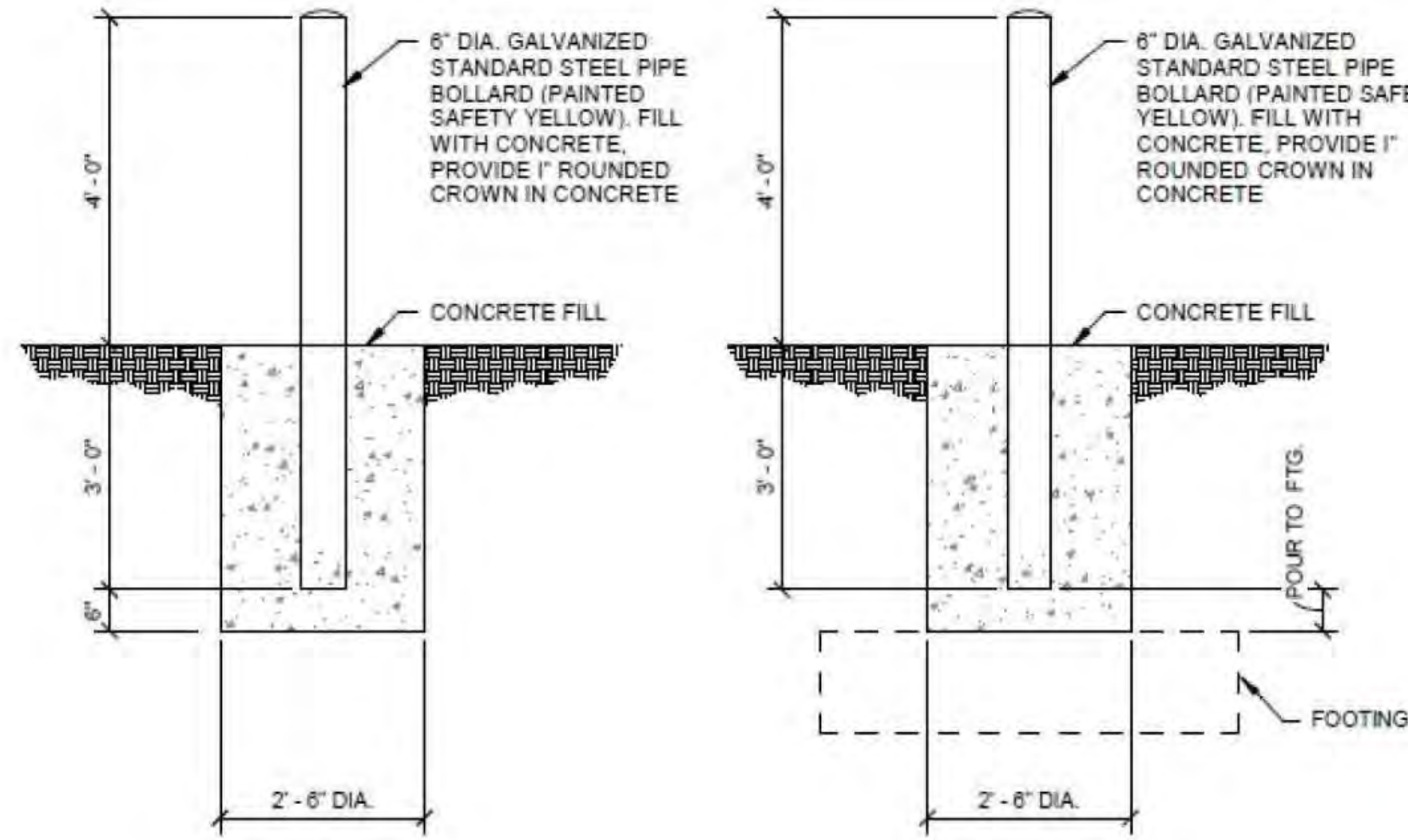


NOTES:
ADDITIONAL CONCENTRIC RINGS SHALL BE ADDED AS REQ'D. TO MEET THE (5) OHM SPECIFIED RESISTANCE. EACH RING TO HAVE 4 GROUND RODS, AND SPACE 10 FEET FROM THE INNER RING.

GROUND MAT DETAIL
NO SCALE

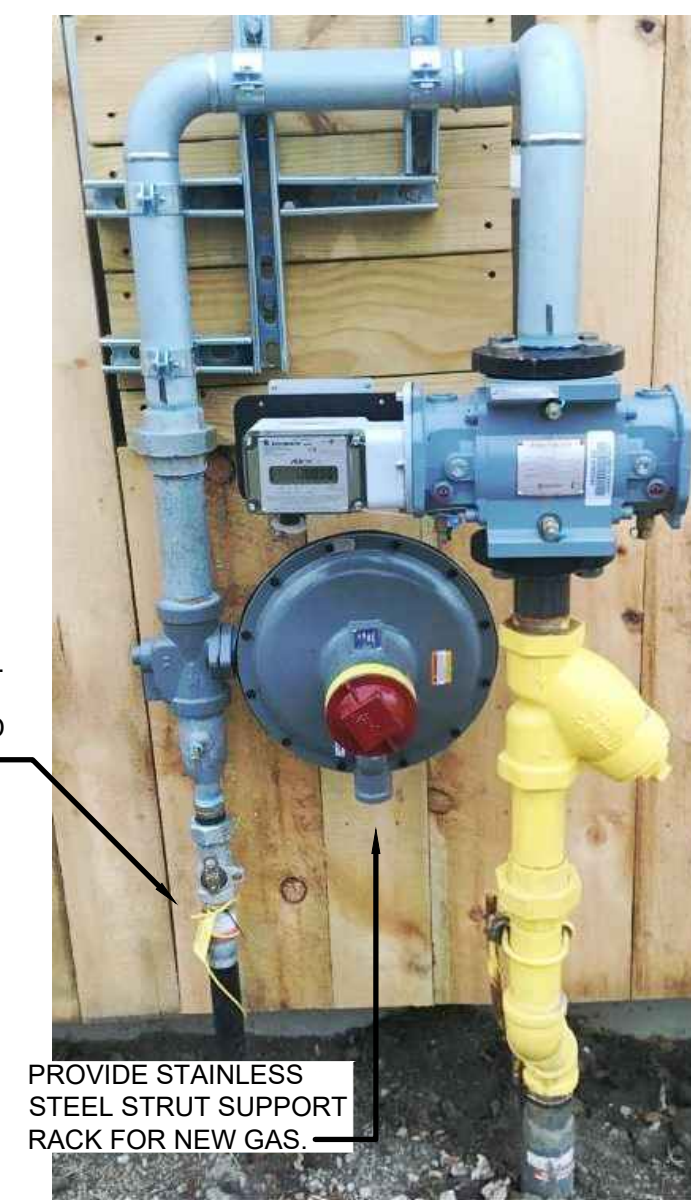


GENERATOR PAD
1/15



TYPICAL BOLLARD DETAIL (GUARD POSTS)
SCALE 1/2\"/>

PROVIDE SHUT OFF VALVE, AND GAS LINE TO GENERATOR. (TYP.) (TYPICAL ALL SITES.) SIZE, AND DISTANCE AS NOTED ON CONTRACT DRAWINGS.



SAMPLE GAS METER DETAIL - PHOTO

COORDINATE METER/GAS SERVICE LOCATION, AND INSTALLATION REQUIREMENTS WITH CONSUMERS ENERGY. (NO SCALE)

ALL HARDWARE SHALL BE 316 STAINLESS STEEL INCLUDING NUTS, BOLTS, WASHERS, ANCHORS, STRUTS, ETC. THIS REQUIREMENT HAS PRECEDENCE OVER STANDARD DETAILS, AND PROJECT MANUAL/SPECIFICATIONS.

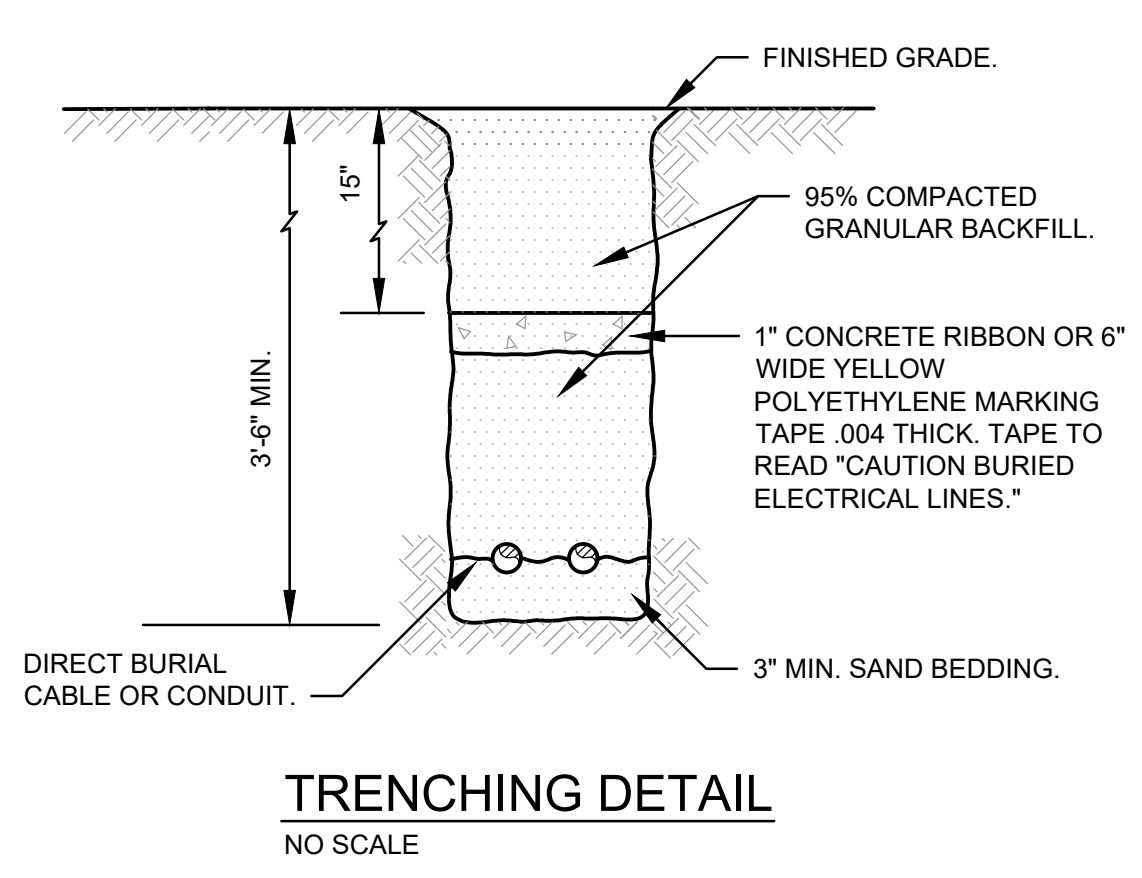
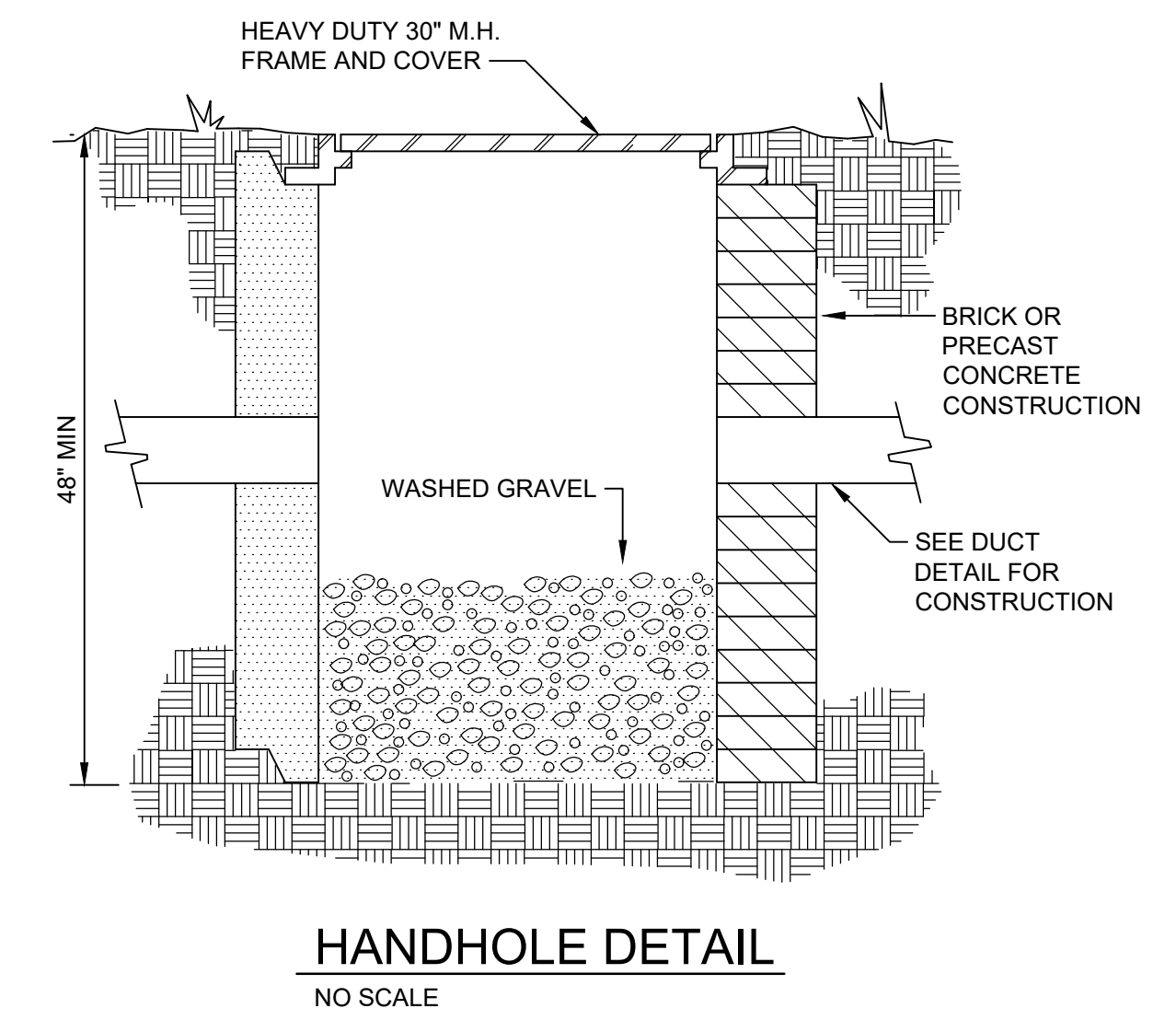
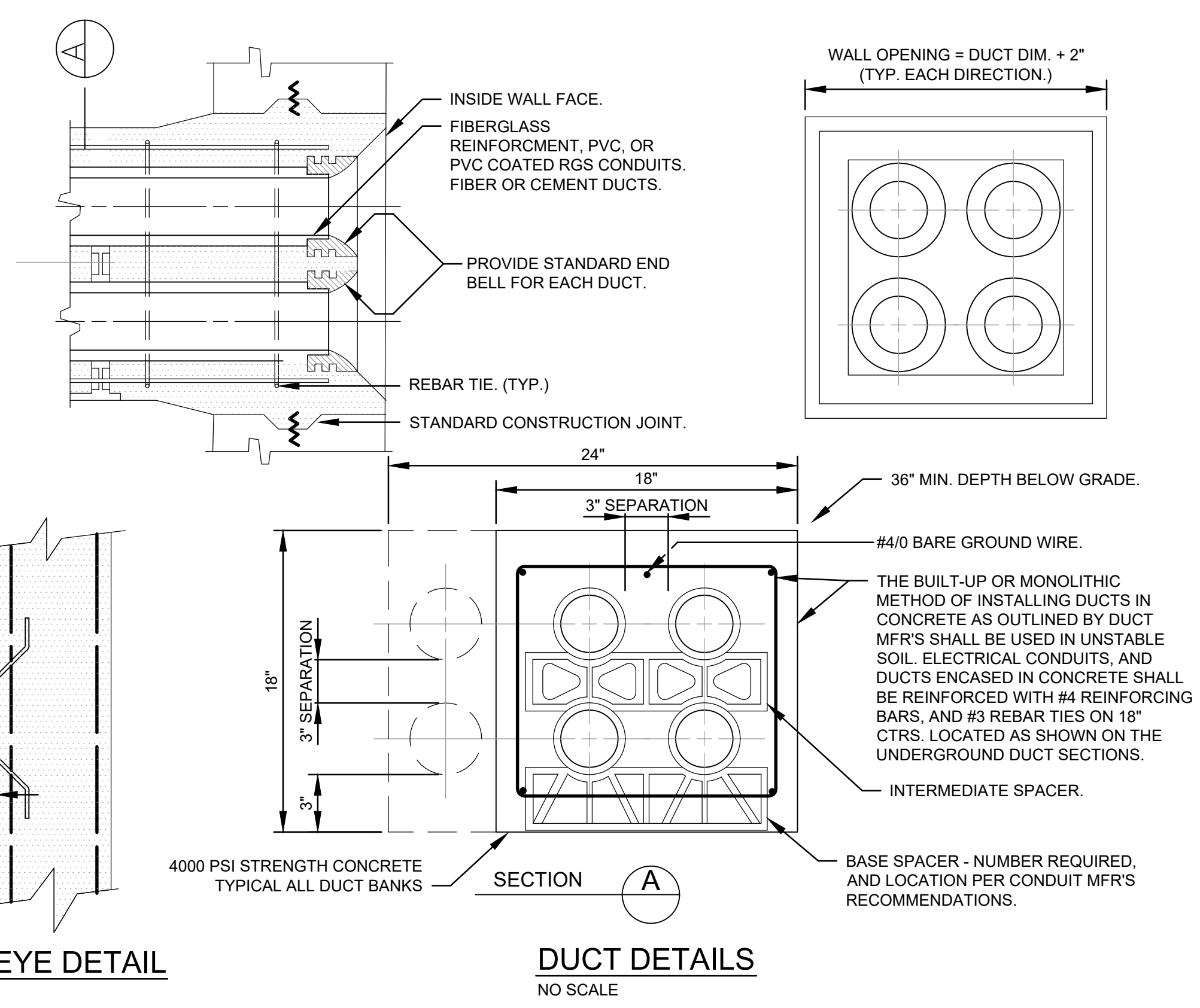
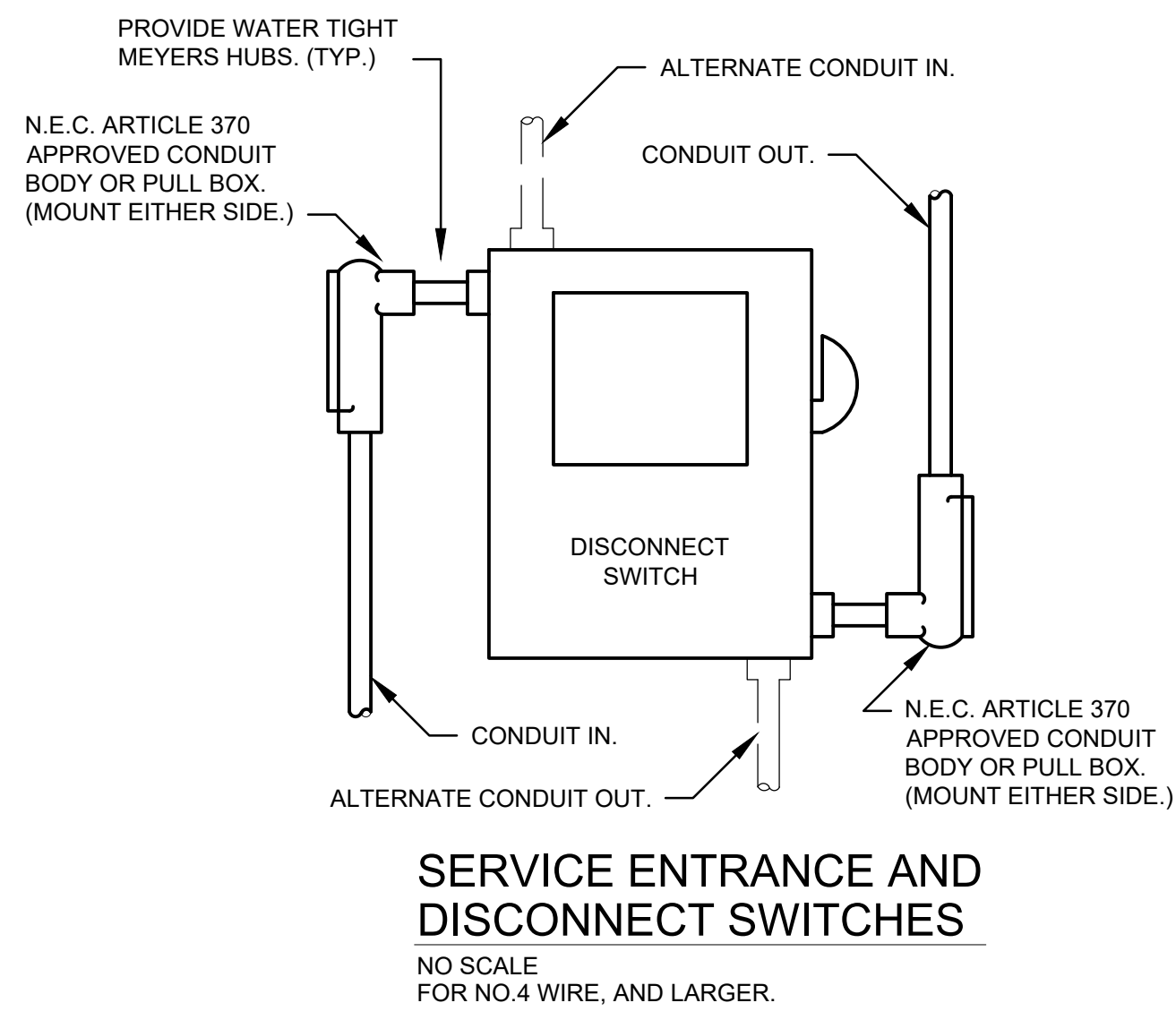
3/1/2022 11:33:17 AM - \\TT.LOCAL\PROJECTS\ANN ARBOR\19743-21002\CAD\SHEETFILES\E24_E-DETAILS.DWG - SHANK, JASON

MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
REMOTE SITE GENERATORS

Project No.: 200-19743-21002
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

4/27/2022 3:59:35 PM - \\T\LOCAL\PROJECTS\ANN ARBOR\RIERY19743200-19743-21002\CAD\SHEETFILES\25_E-DETAILS_1\DWG - SHANK, JASON



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MARK	DATE	DESCRIPTION	BY

CITY OF KALAMAZOO, MICHIGAN
REMOTE SITE GENERATORS
ELECTRICAL DETAILS

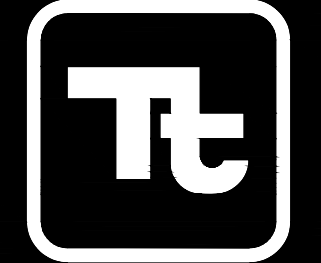
Project No.: 200-19743-21002
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

CITY OF KALAMAZOO, MICHIGAN

METERING STATIONS CONTROL UPGRADES

710 AVIS DRIVE
ANN ARBOR, MI 48108
PHONE: (734) 665-6000 FAX: (734) 213-3003

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TETRA TECH

ELECTRICAL SHEETS

1. ELECTRICAL LEGEND
2. ELECTRICAL NOTES, DETAILS
3. SYSTEM CONFIGURATION DRAWING
4. SYSTEM CONFIGURATION DRAWING
5. O-AVENUE METERING STATION ONE-LINES, DETAILS
6. O-AVENUE CONTROL PANEL LAYOUT, WIRING DIAGRAM
7. O-AVENUE CONTROL PANEL WIRING DIAGRAM
8. MATTAWAN METERING STATION ONE-LINES, DETAILS
9. MATTAWAN CONTROL PANEL LAYOUT, WIRING DIAGRAM
10. MATTAWAN CONTROL PANEL WIRING DIAGRAM
11. VICKSBURG METERING STATION ONE-LINES, DETAILS
12. VICKSBURG CONTROL PANEL LAYOUT, WIRING DIAGRAM
13. VICKSBURG CONTROL PANEL WIRING DIAGRAM
14. SOUTH COUNTY METERING STATION ONE-LINES, DETAILS
15. SOUTH COUNTY CONTROL PANEL LAYOUT, WIRING DIAGRAM
16. SOUTH COUNTY CONTROL PANEL WIRING DIAGRAM
17. PFIZER METERING STATION ONE-LINES, DETAILS
18. PFIZER CONTROL PANEL LAYOUT, WIRING DIAGRAM
19. PFIZER CONTROL PANEL WIRING DIAGRAM
20. GRAPHICS PACKAGING METERING STATION ONE-LINES, DETAILS
21. GRAPHICS PACKAGING CONTROL PANEL LAYOUT, WIRING DIAGRAM
22. GRAPHICS PACKAGING CONTROL PANEL WIRING DIAGRAM
23. BELLS BREWERY METERING STATION ONE-LINES, DETAILS
24. BELLS BREWERY CONTROL PANEL LAYOUT, WIRING DIAGRAM
25. BELLS BREWERY CONTROL PANEL WIRING DIAGRAM
26. COOPER METERING STATION ONE-LINES, DETAILS
27. COOPER CONTROL PANEL LAYOUT, WIRING DIAGRAM
28. COOPER CONTROL PANEL WIRING DIAGRAM
29. PARCHMENT METERING STATION ONE-LINES, DETAILS
30. PARCHMENT CONTROL PANEL LAYOUT, WIRING DIAGRAM
31. PARCHMENT CONTROL PANEL WIRING DIAGRAM
32. ALLNEX METERING STATION ONE-LINES, DETAILS
33. ALLNEX CONTROL PANEL LAYOUT, WIRING DIAGRAM
34. ALLNEX CONTROL PANEL WIRING DIAGRAM
35. PORTAGE CREEK METERING STATION ONE-LINES, DETAILS
36. PORTAGE CREEK CONTROL PANEL LAYOUT, WIRING DIAGRAM
37. PORTAGE CREEK CONTROL PANEL WIRING DIAGRAM
38. MEREDITH METERING STATION ONE-LINES, DETAILS
39. MEREDITH CONTROL PANEL LAYOUT, WIRING DIAGRAM
40. MEREDITH CONTROL PANEL WIRING DIAGRAM

PROJECT LOCATION:

KALAMAZOO, MICHIGAN

CLIENT INFORMATION:

CITY OF KALAMAZOO

Tt PROJECT No.:

200-19743-21003

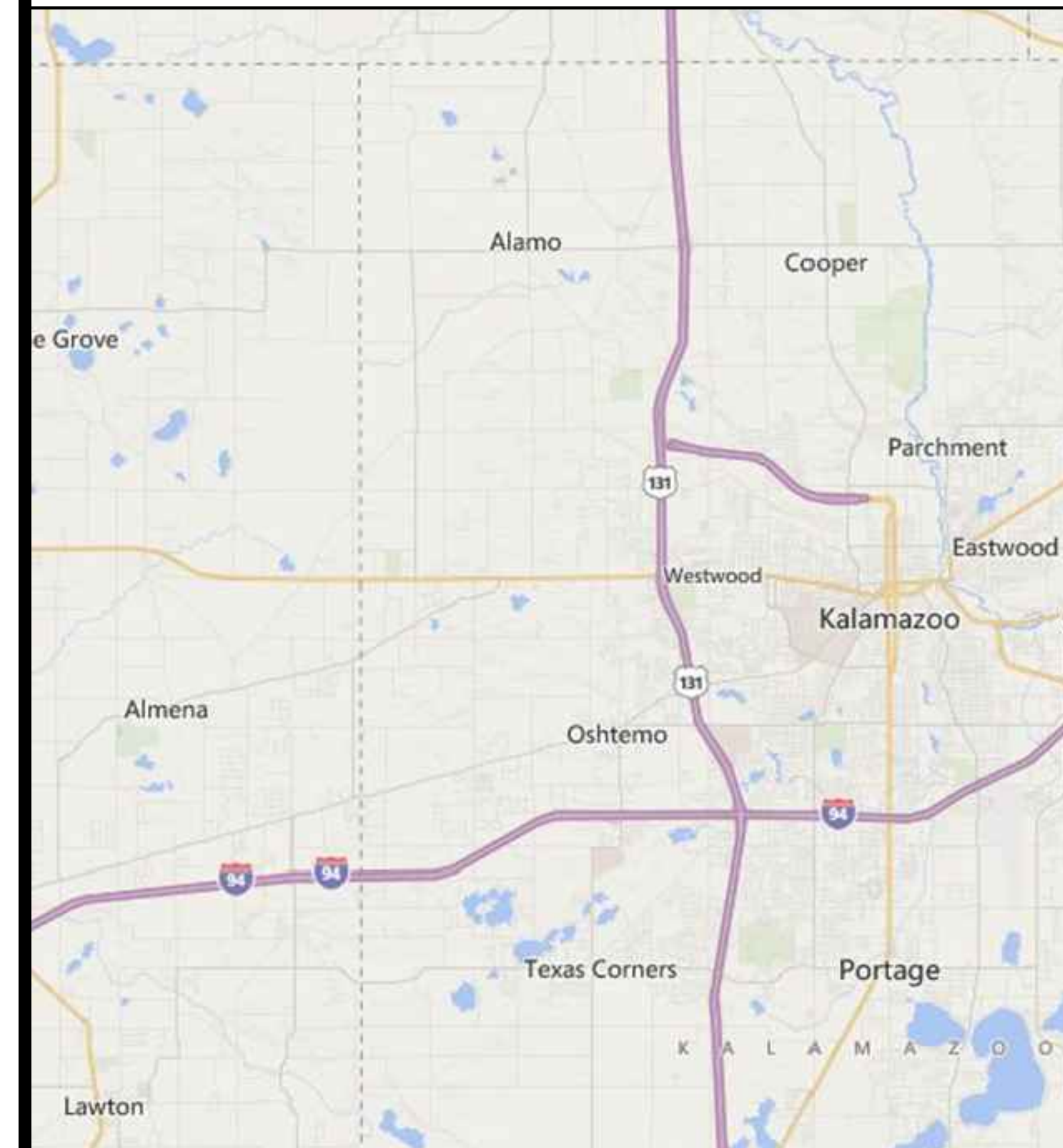
CLIENT PROJECT No.:

PROJECT DESCRIPTION / NOTES:

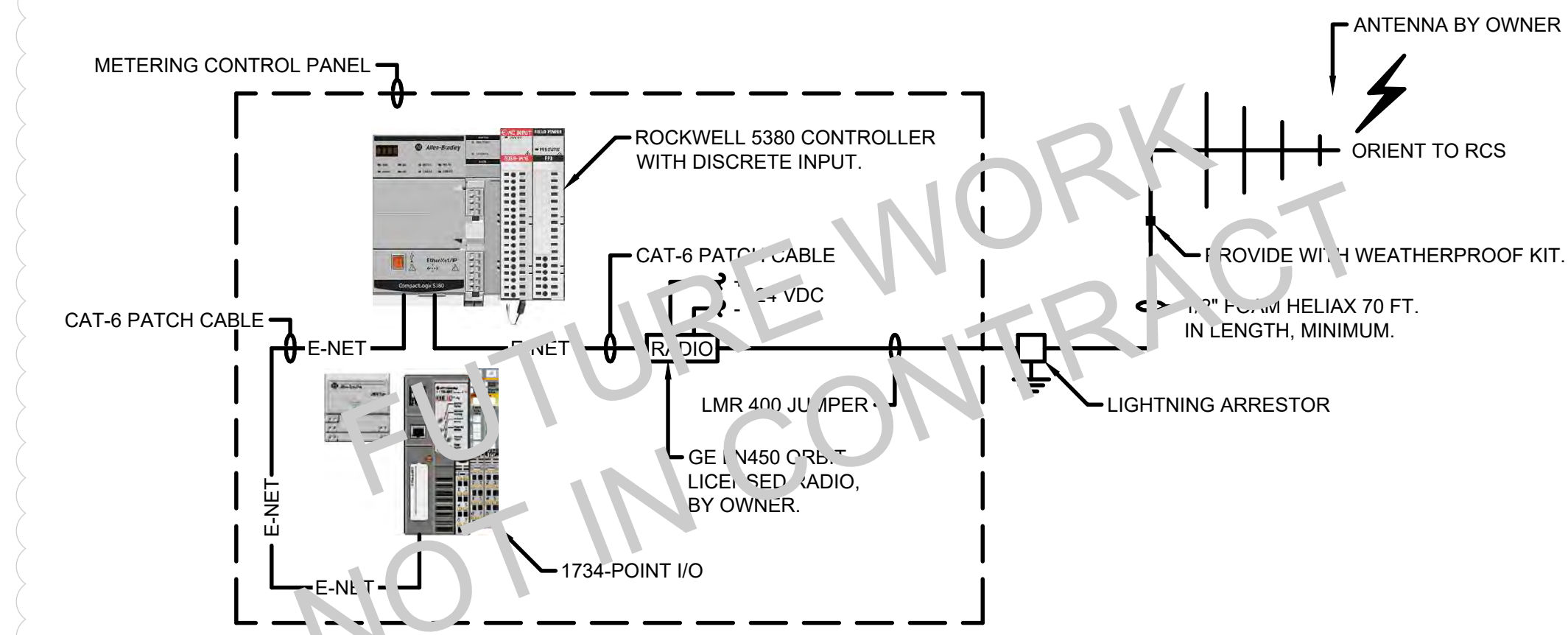
ISSUED:

OWNER REVIEW 10-15-21
OWNER REVIEW 11-4-21
OWNER REVIEW 1-14-22
FINAL OWNER REVIEW 2-18-22
QA/QC 4-27-22
FOR BIDDING AND CONSTRUCTION 4-28-22

VICINITY MAP:

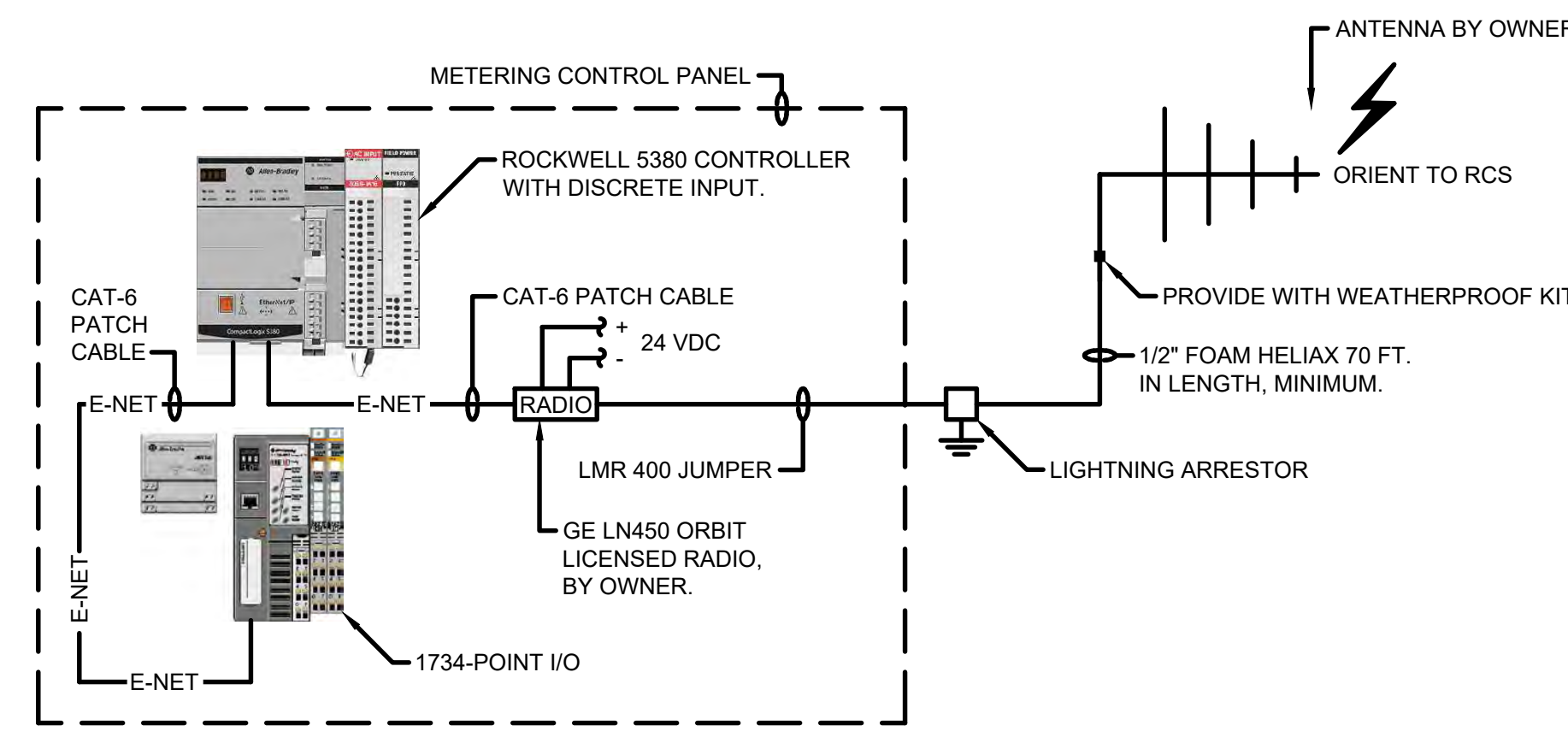


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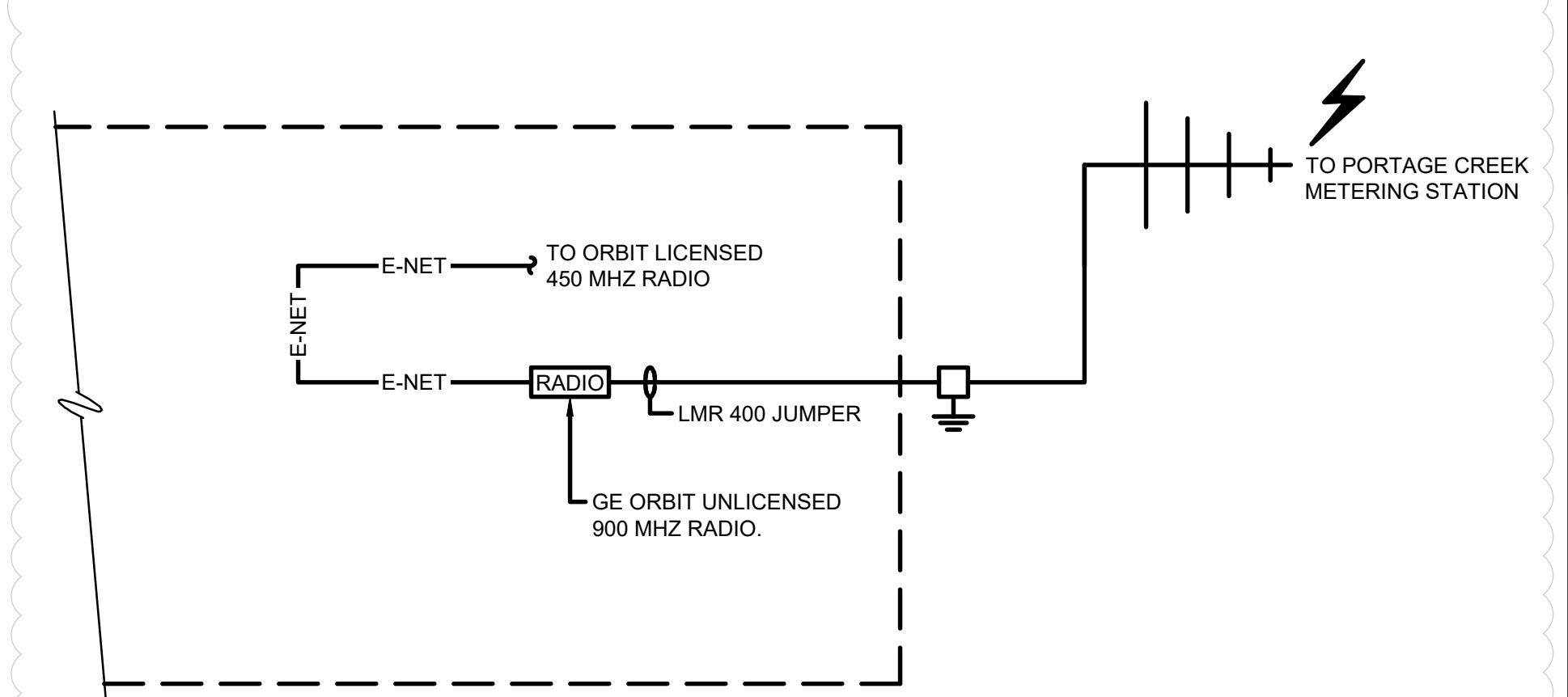
O-AVENUE

NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRATECH.



SOUTH COUNTY

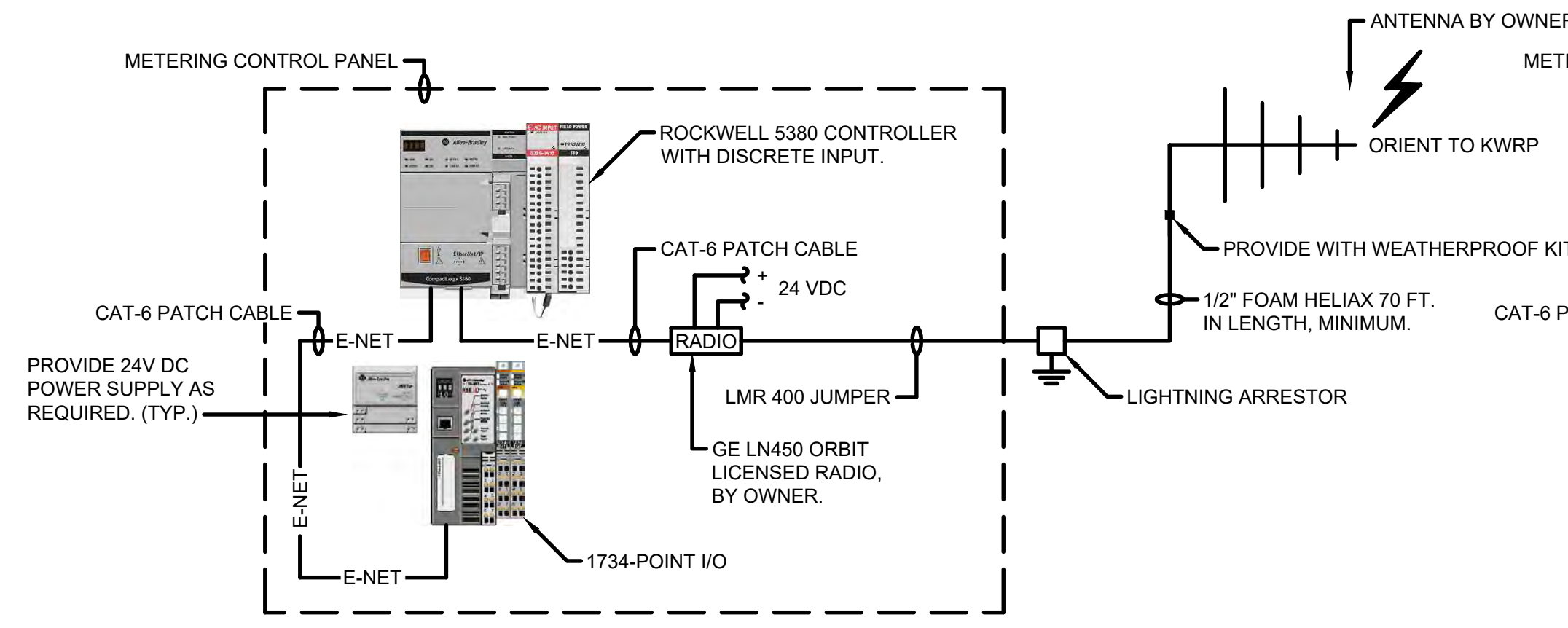
NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRATECH.



WATER STATION NO.8

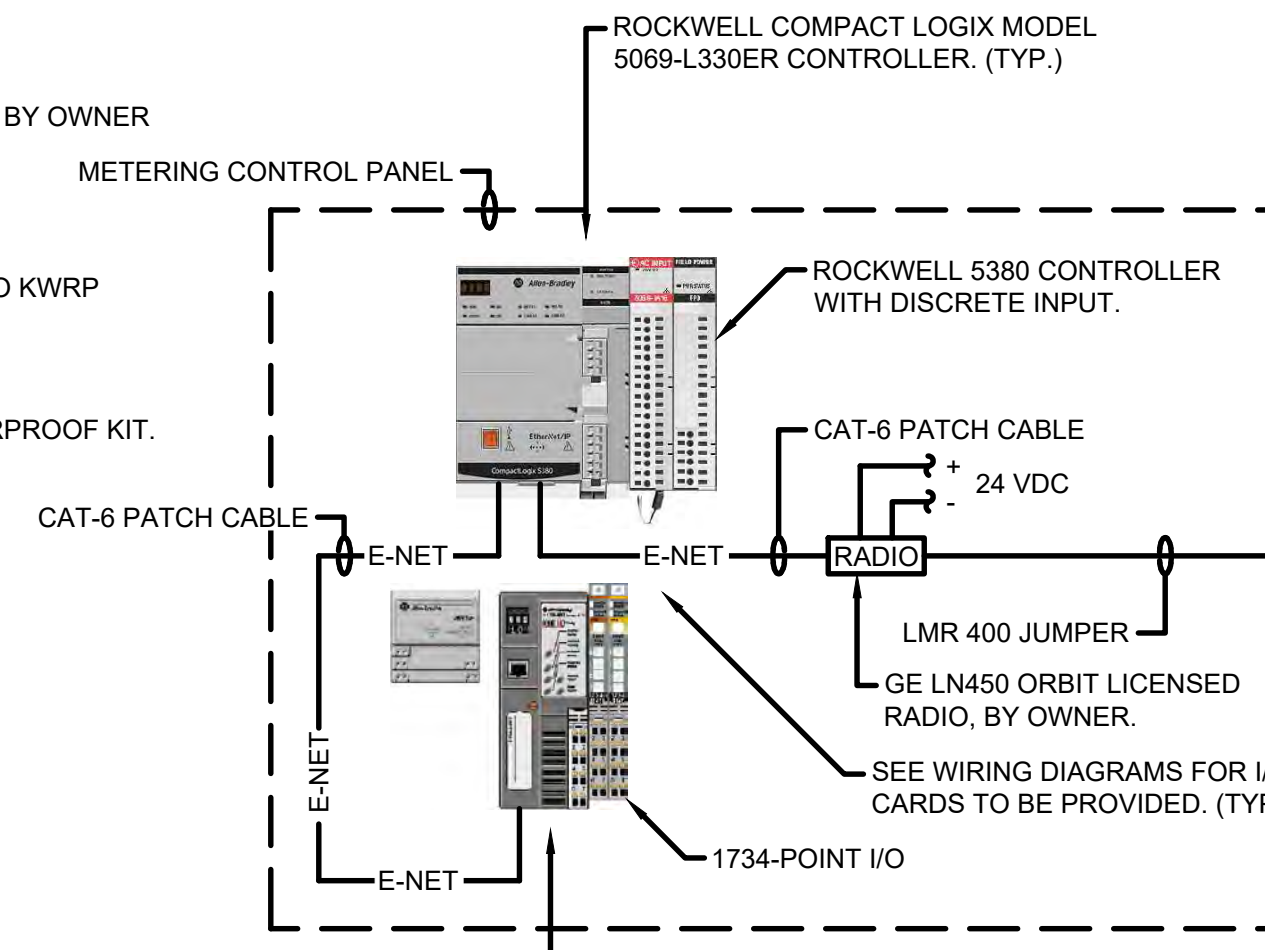
WORK SHOWN BY OWNER.

THIS WORK NOT IN CONTRACT. BY OWNER.



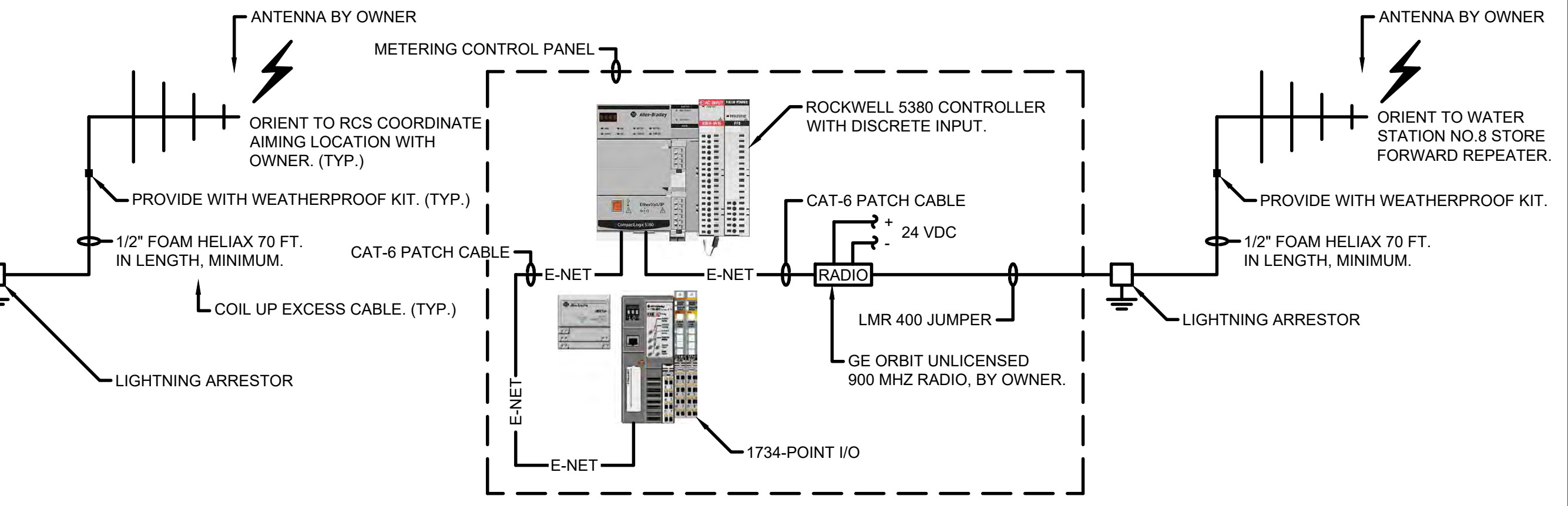
COOPER

NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRATECH.



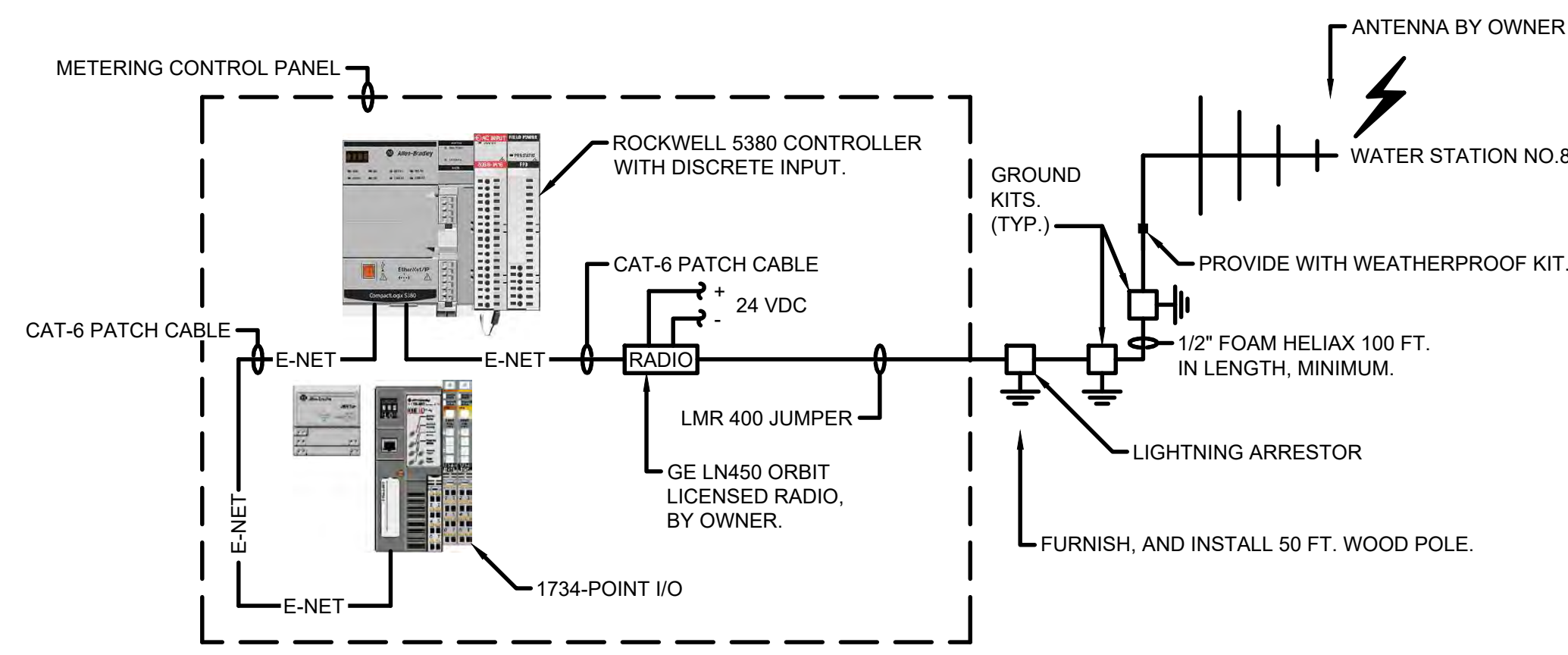
GRAPHICS PACKAGING

NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRATECH.



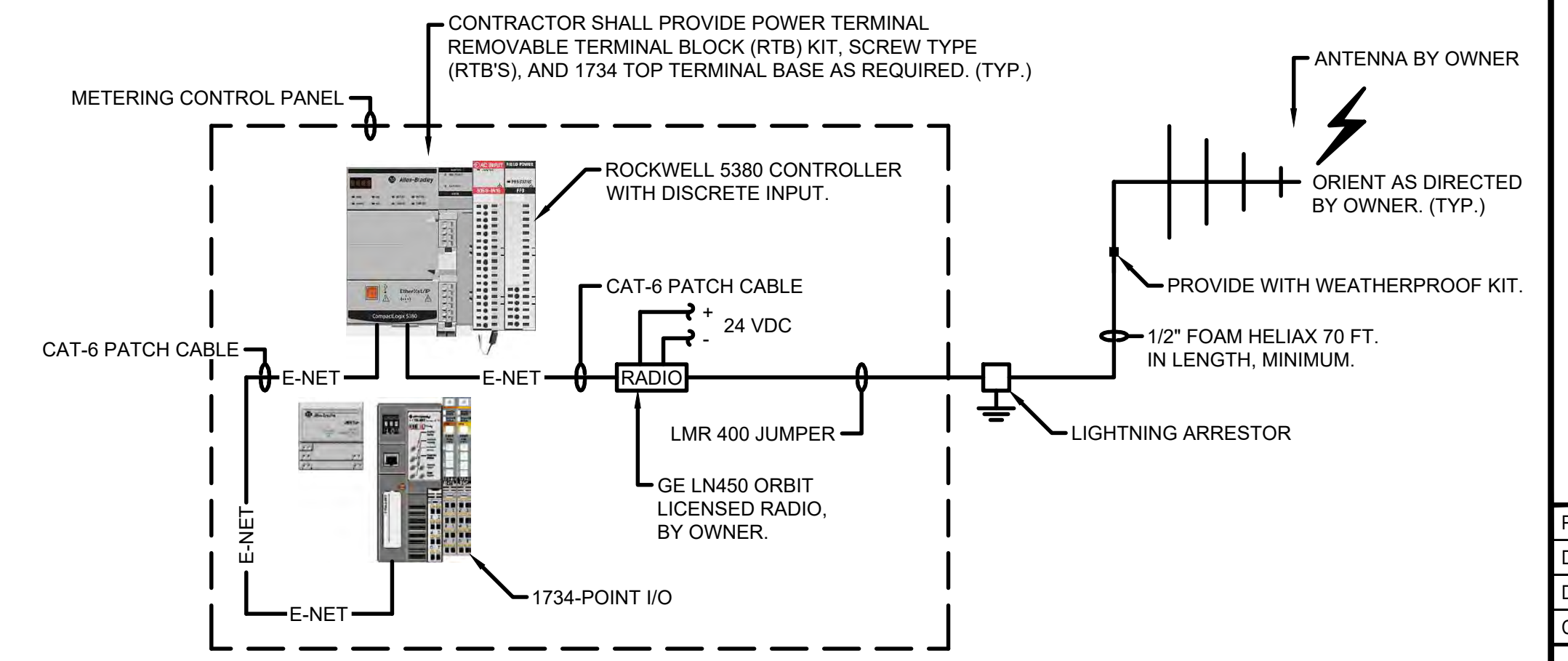
PORTAGE CREEK

NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRATECH.



PFIZER

NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRATECH.



MATTAWAN

NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRATECH.

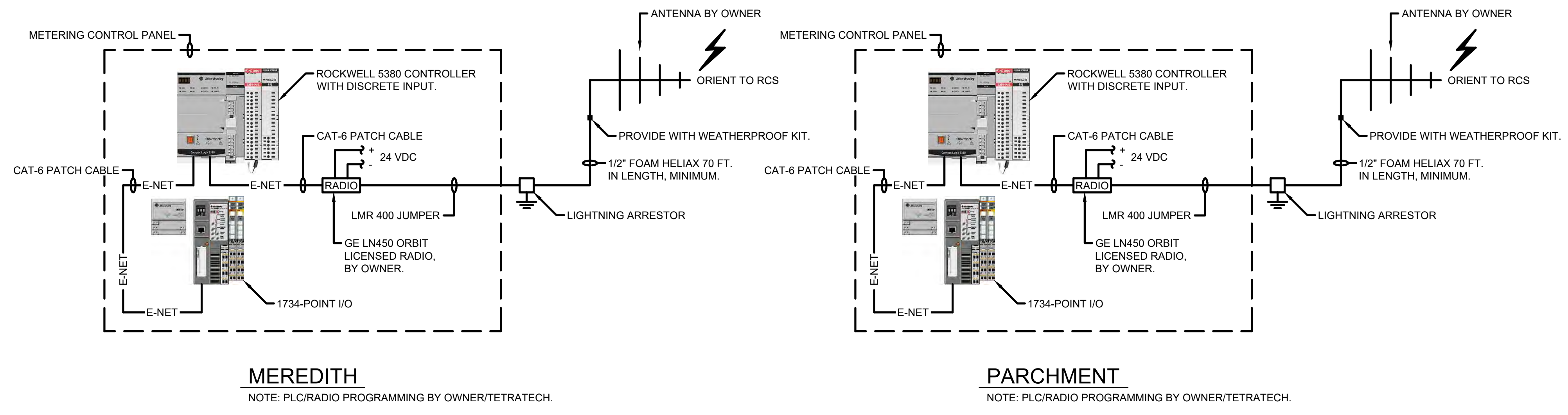
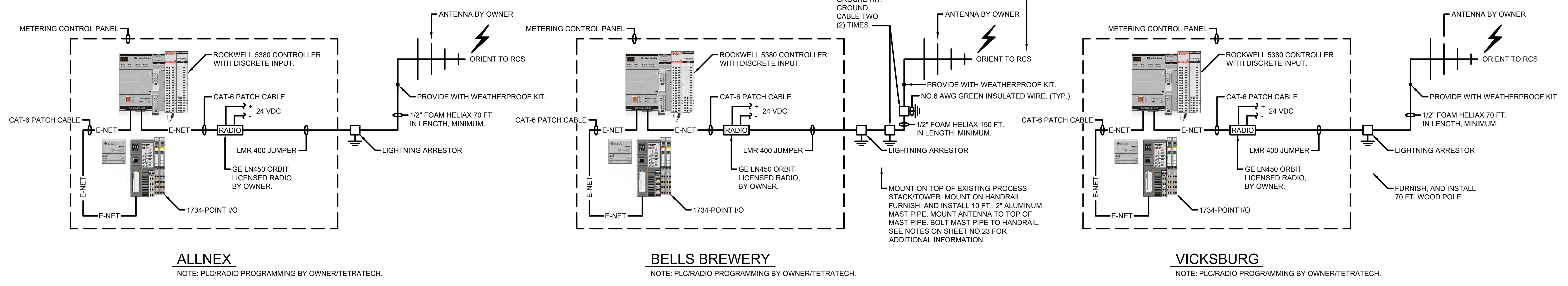


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ANN ARBOR, MI 48108
PHONE: (734) 665-6000 FAX: (734) 213-3003

MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
SYSTEM CONFIGURATION DRAWING
Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ
3
OF 40
Copyright: Tetra Tech
Bar Measures 1 inch

2/21/2022 3:10:22 PM - \\TT.LOC\LIER\PROJECTS\ANN ARBOR\RIERY19743\200-19743-21003\CAD\SHEET\VIEW\METERING4_SYS_CONF_ID\DWG - SHANK, JASON



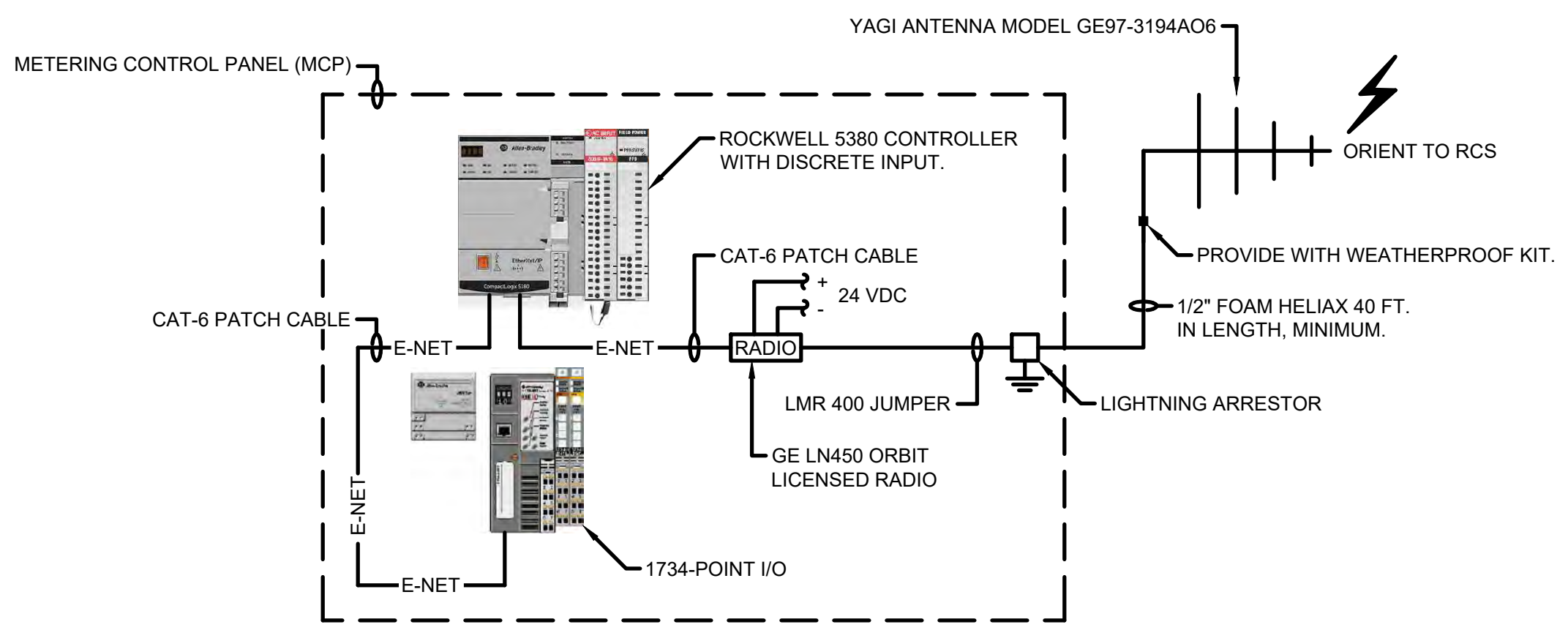
BY	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
SYSTEM CONFIGURATION DRAWING

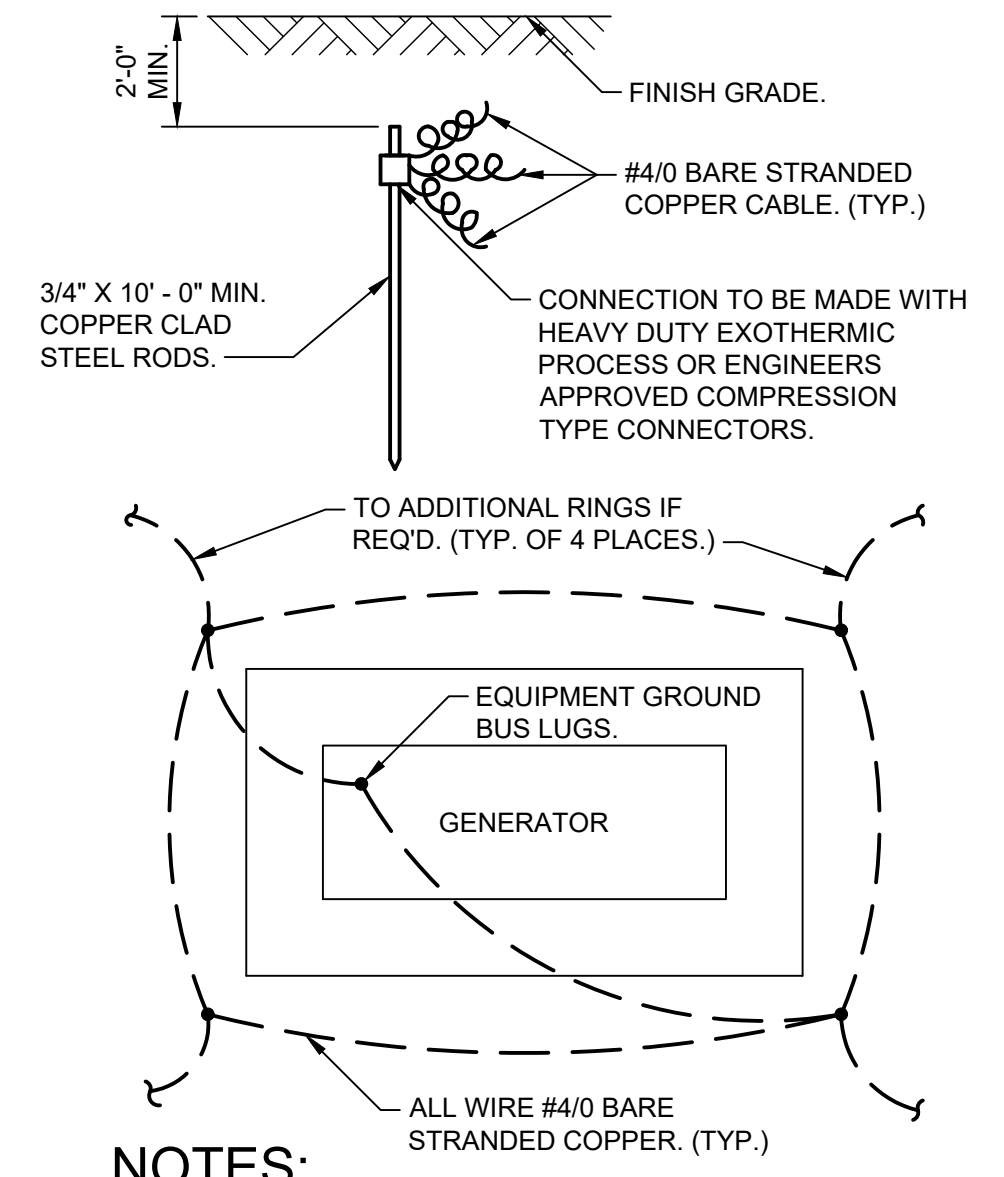
Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

4
OF 40

Copyright: Tetra Tech
Bar Measures 1 inch

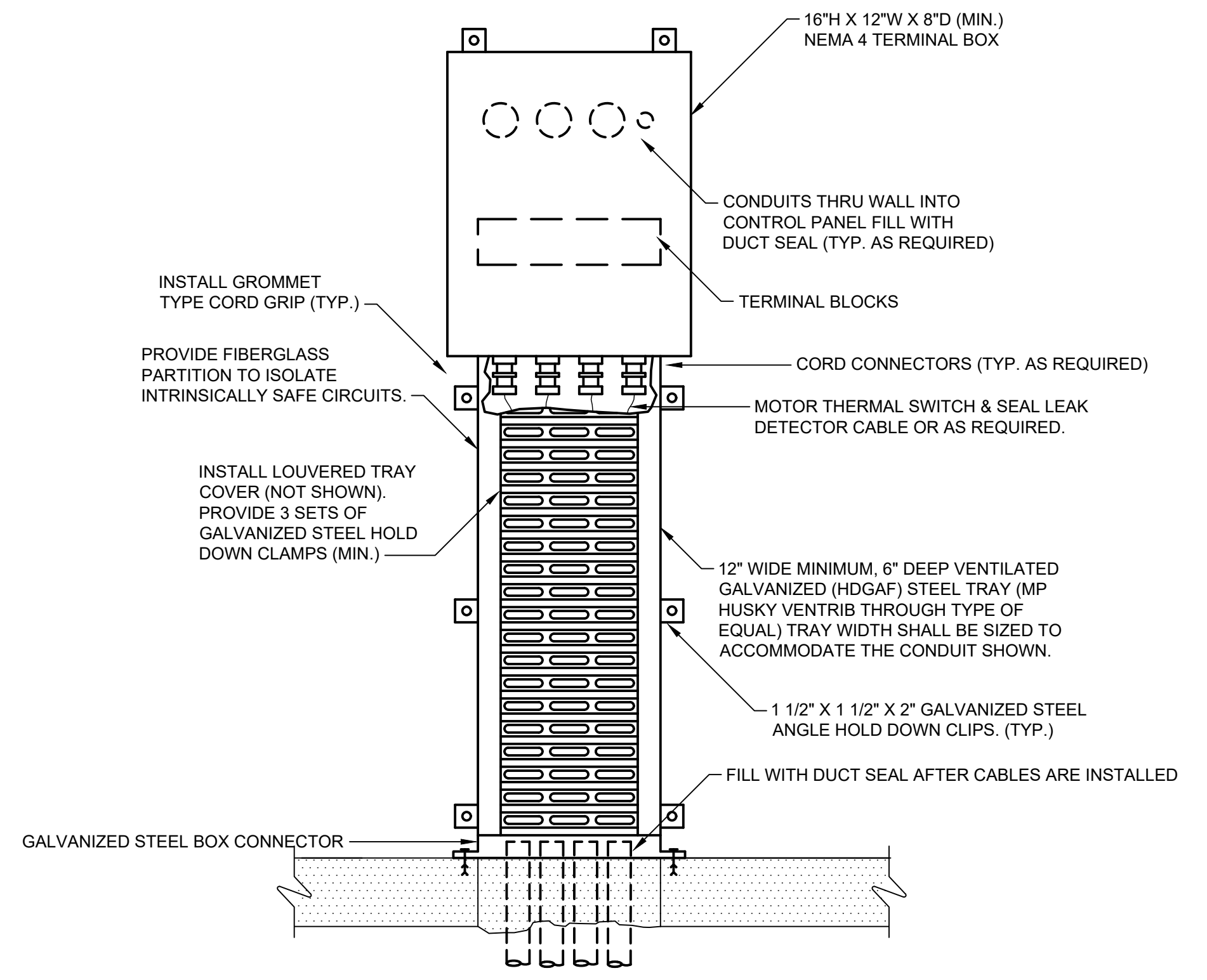


SYSTEM CONFIGURATION DRAWING
NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRA TECH.

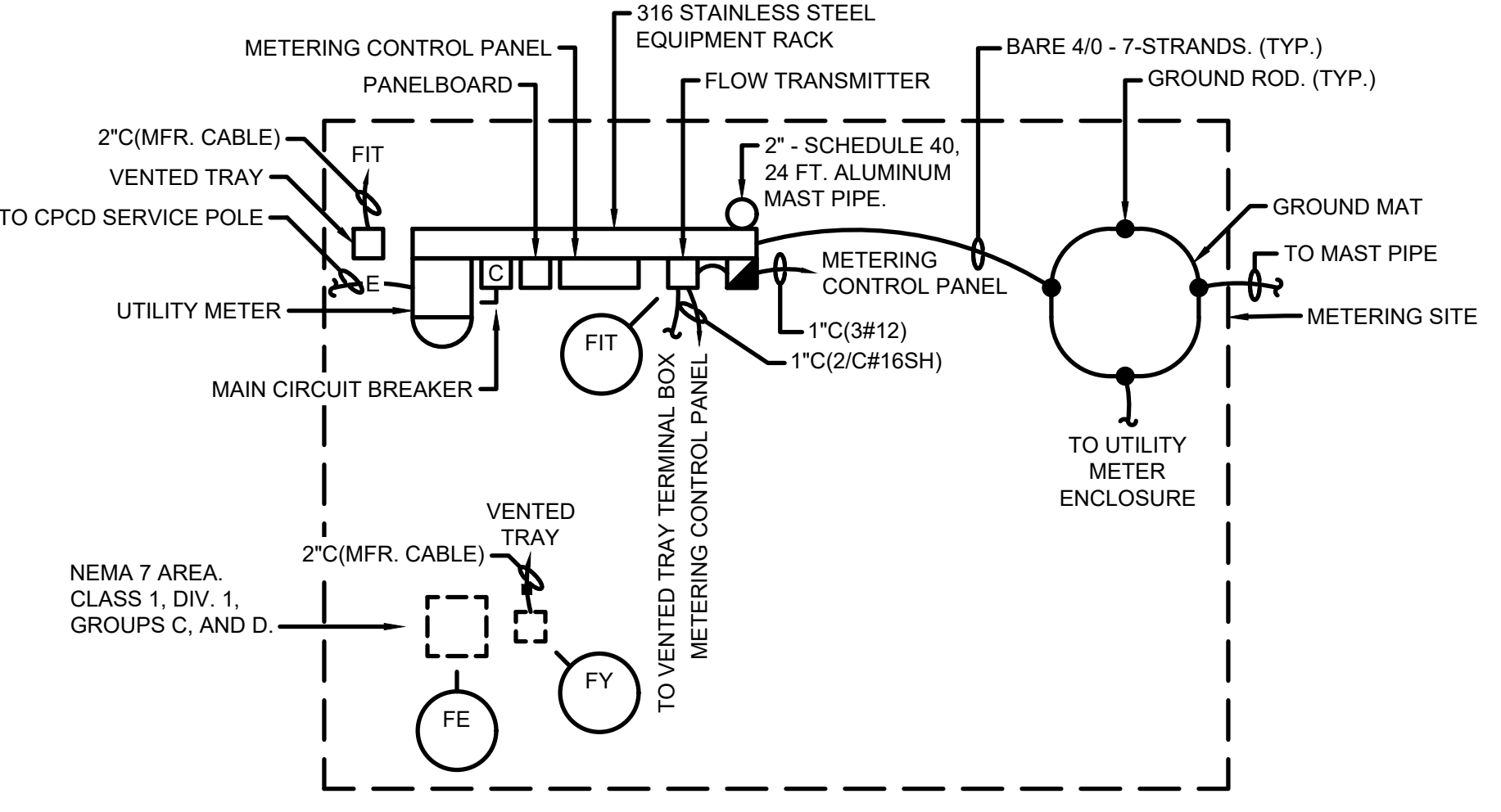


NOTES:
ADDITIONAL CONCENTRIC RINGS SHALL BE ADDED AS REQ'D. TO MEET THE (5) OHM SPECIFIED RESISTANCE. EACH RING TO HAVE 4 GROUND RODS, AND SPACE 10 FEET FROM THE INNER RING.

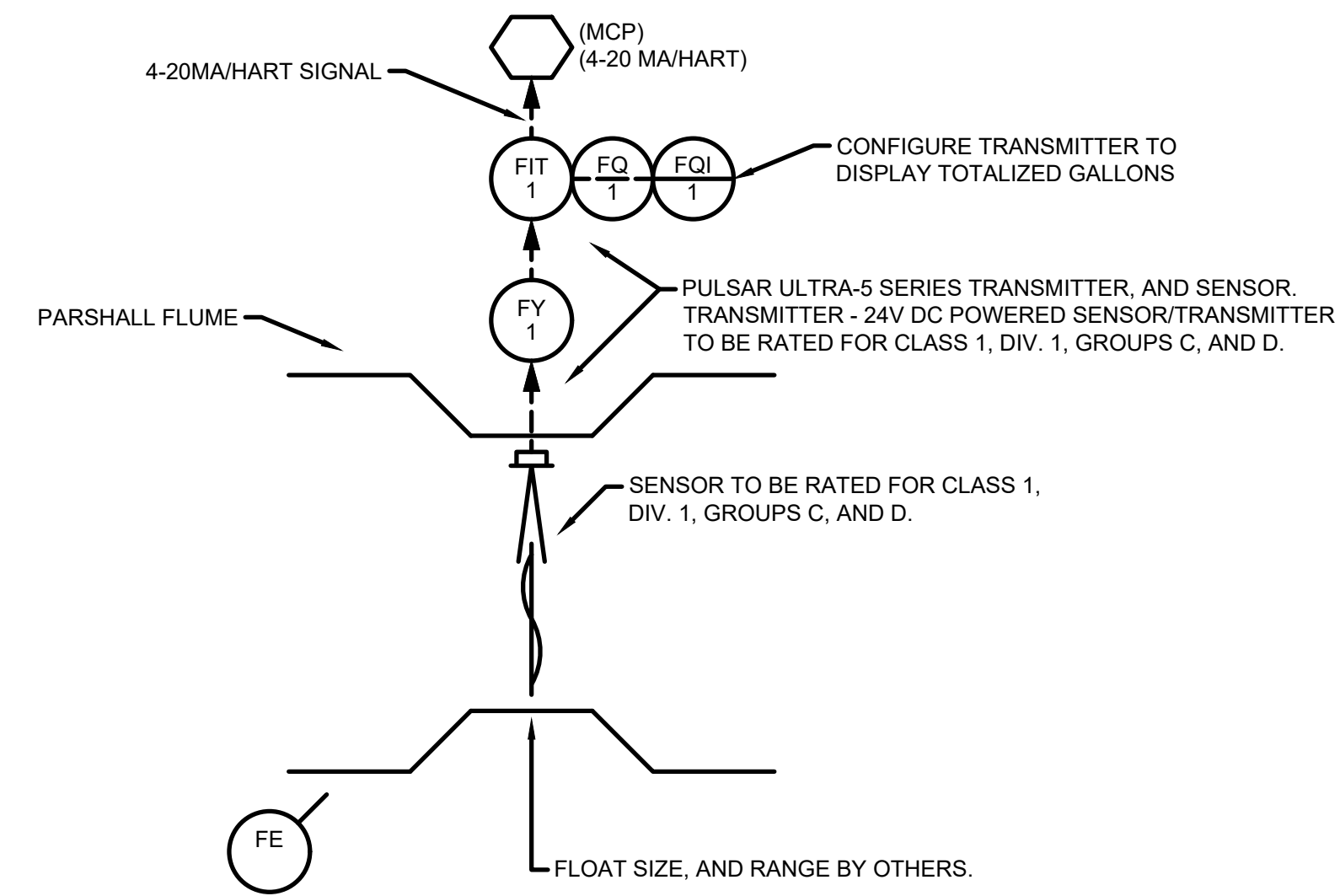
GROUND MAT
NO SCALE



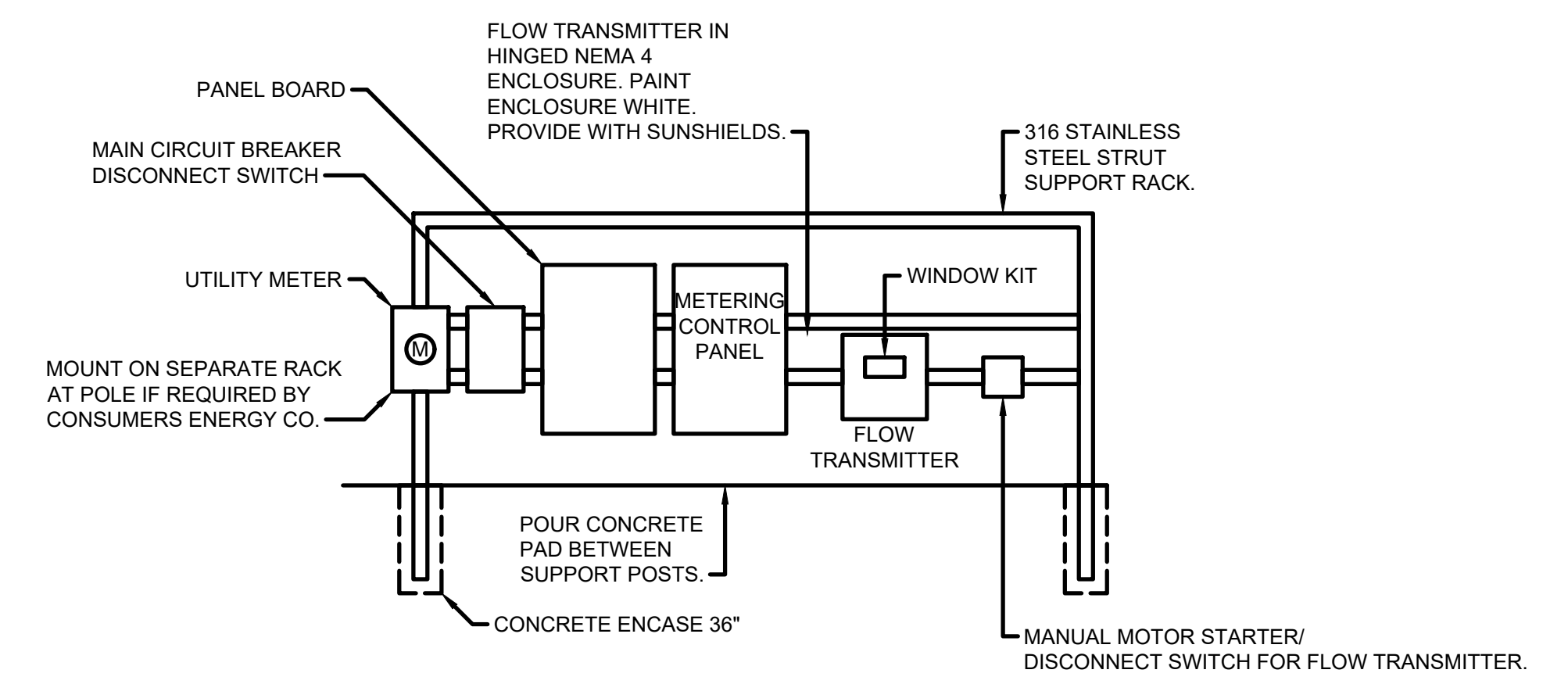
VENTED TRAY DETAIL
PARSHALL FLUME



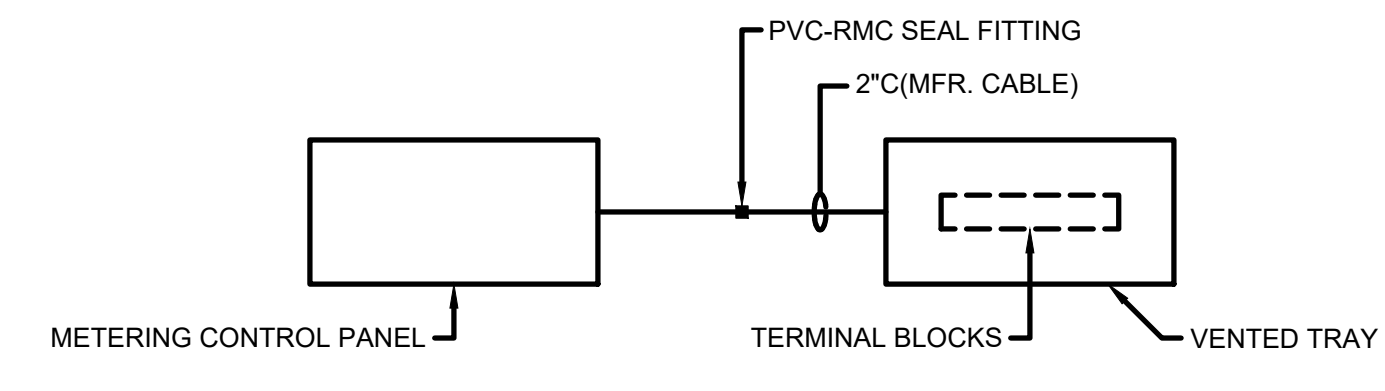
PARTIAL SITE PLAN
NO SCALE



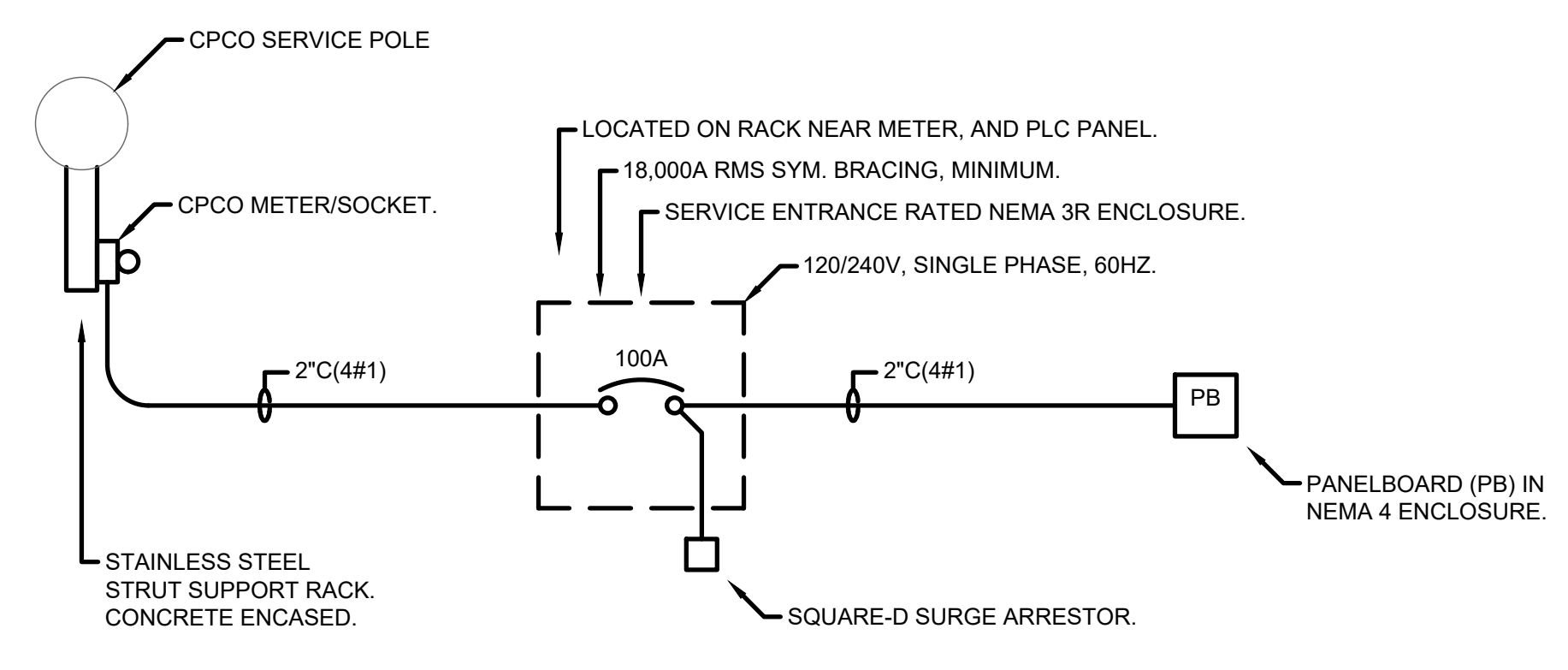
PARTIAL P&ID DIAGRAM



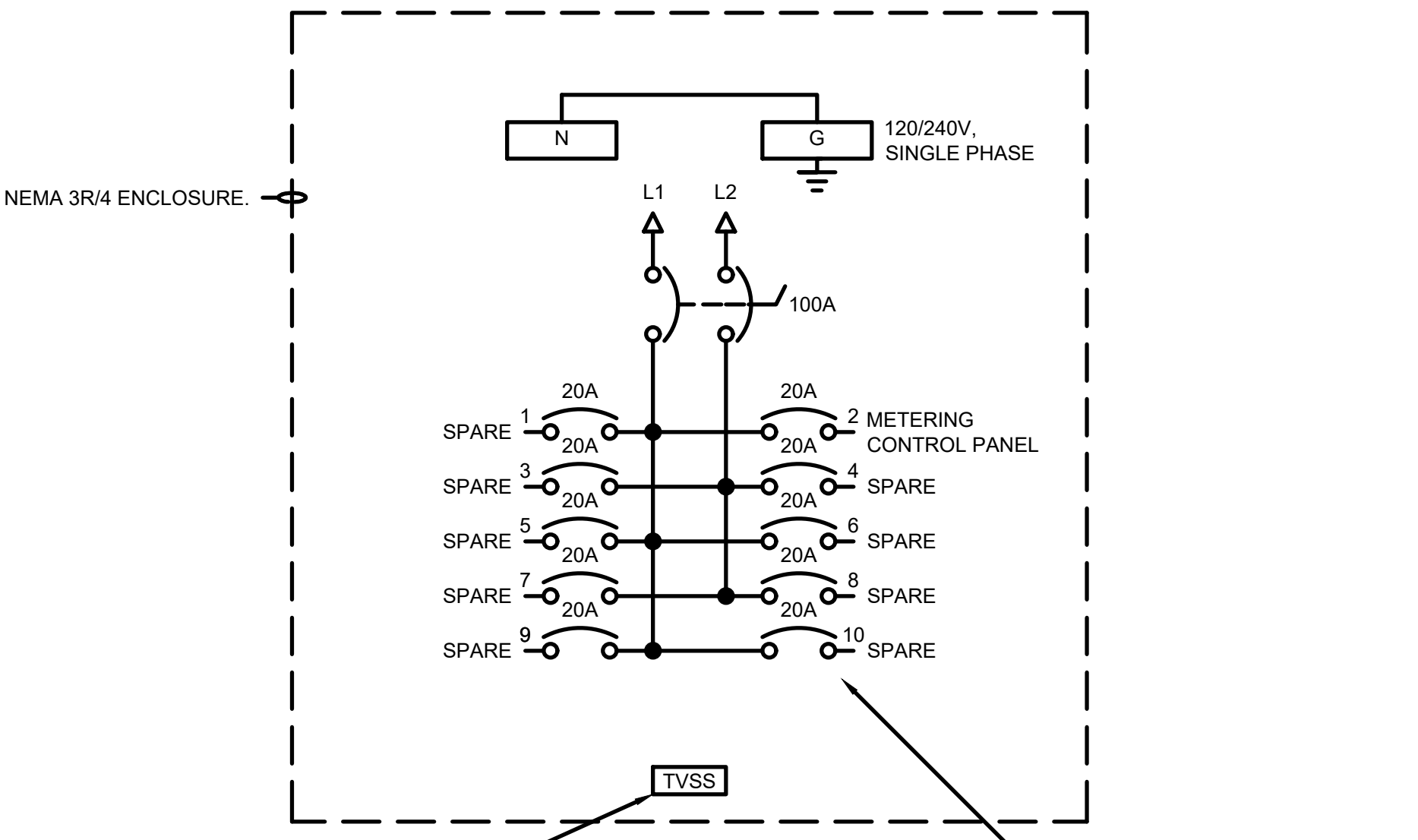
SAMPLE RACK LAYOUT
NO SCALE



TOP VIEW - VENTED TRAY



PARTIAL ONE-LINE DIAGRAM - PROPOSED WORK
NO SCALE



PANELBOARD - PB

**FUTURE.
WORK NOT IN
CONTRACT.**

BY	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
O-AVENUE METERING STATION
ONE-LINES, DETAILS

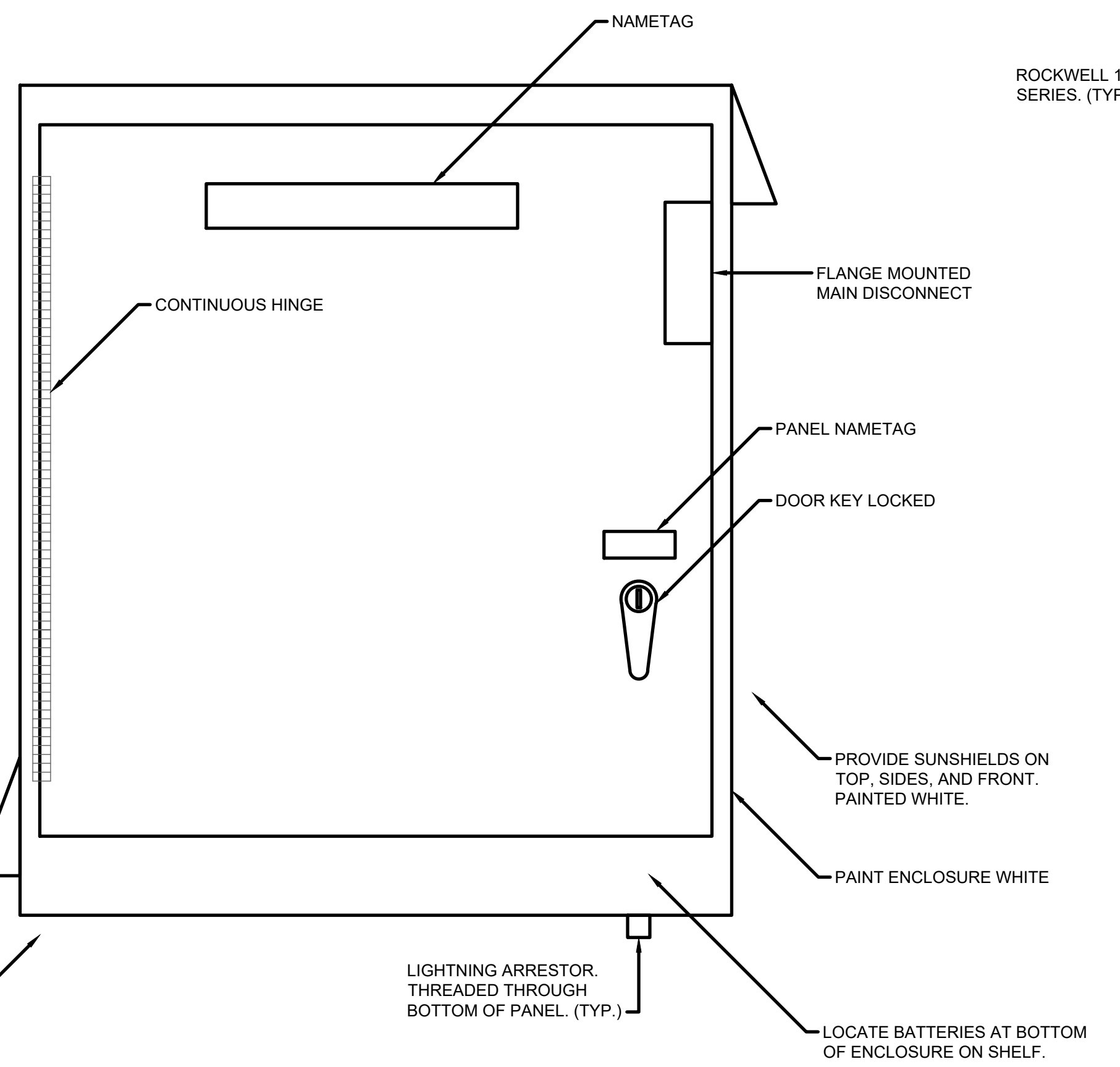
Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

2/21/2022 3:10:29 PM - \\T\LOCAL\PROJECTS\ANN ARBOR\19743\200-19743-21003\CAD\SHEET\METERING\5_O-AVENUE_DETAILS.DWG - SHANK, JASON

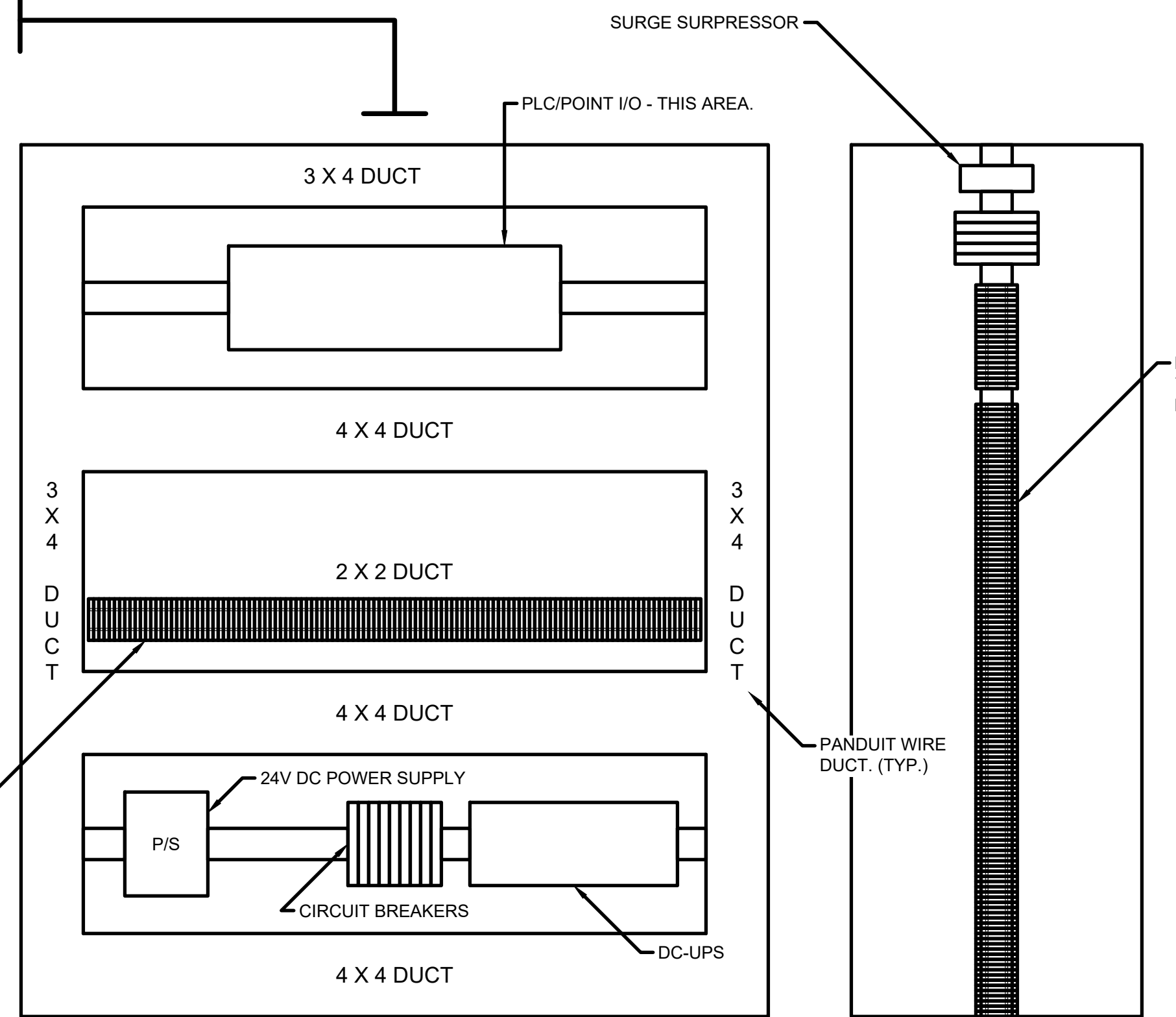
Copyright: Tetra Tech
Bar Measures 1 inch



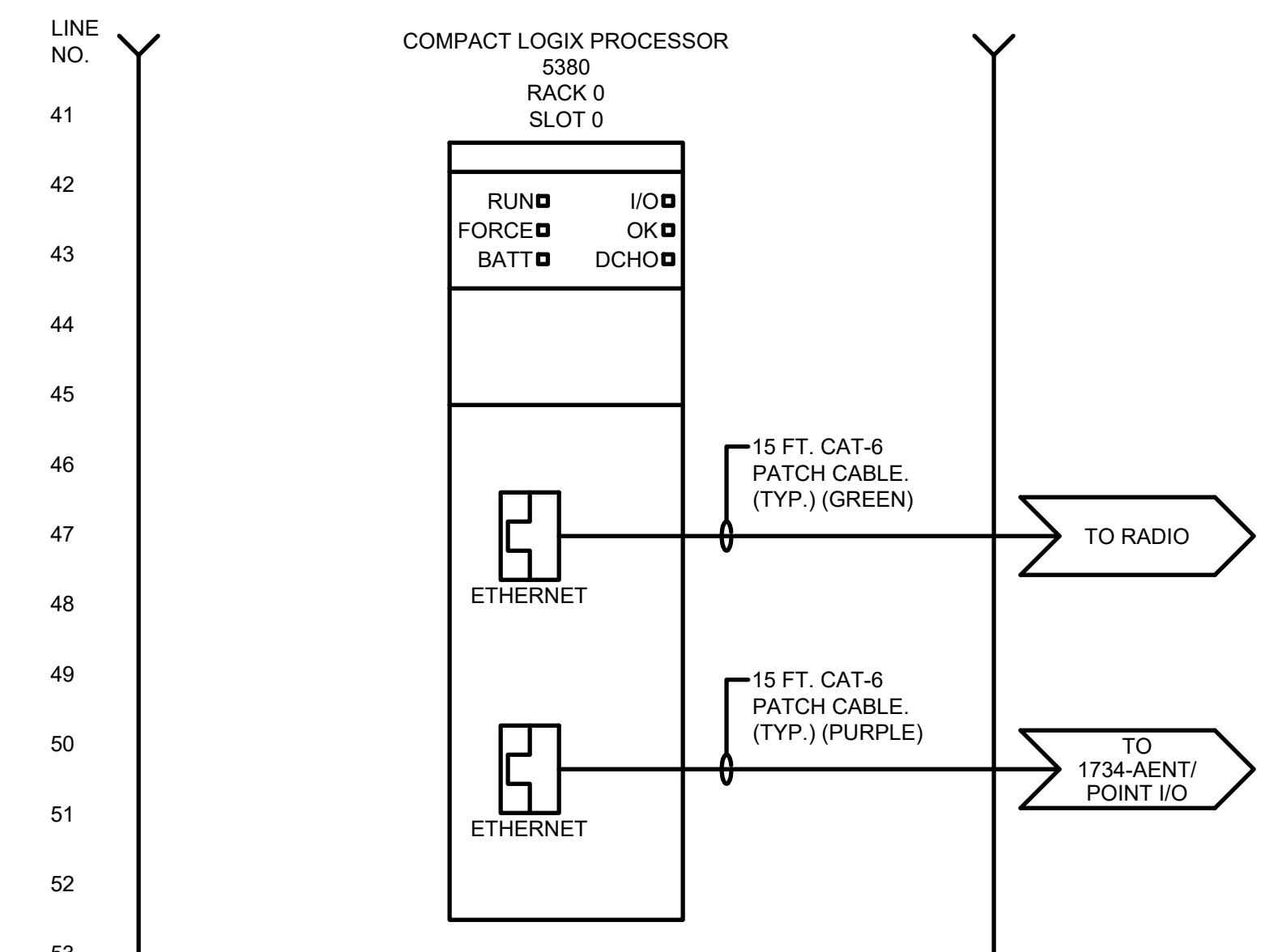
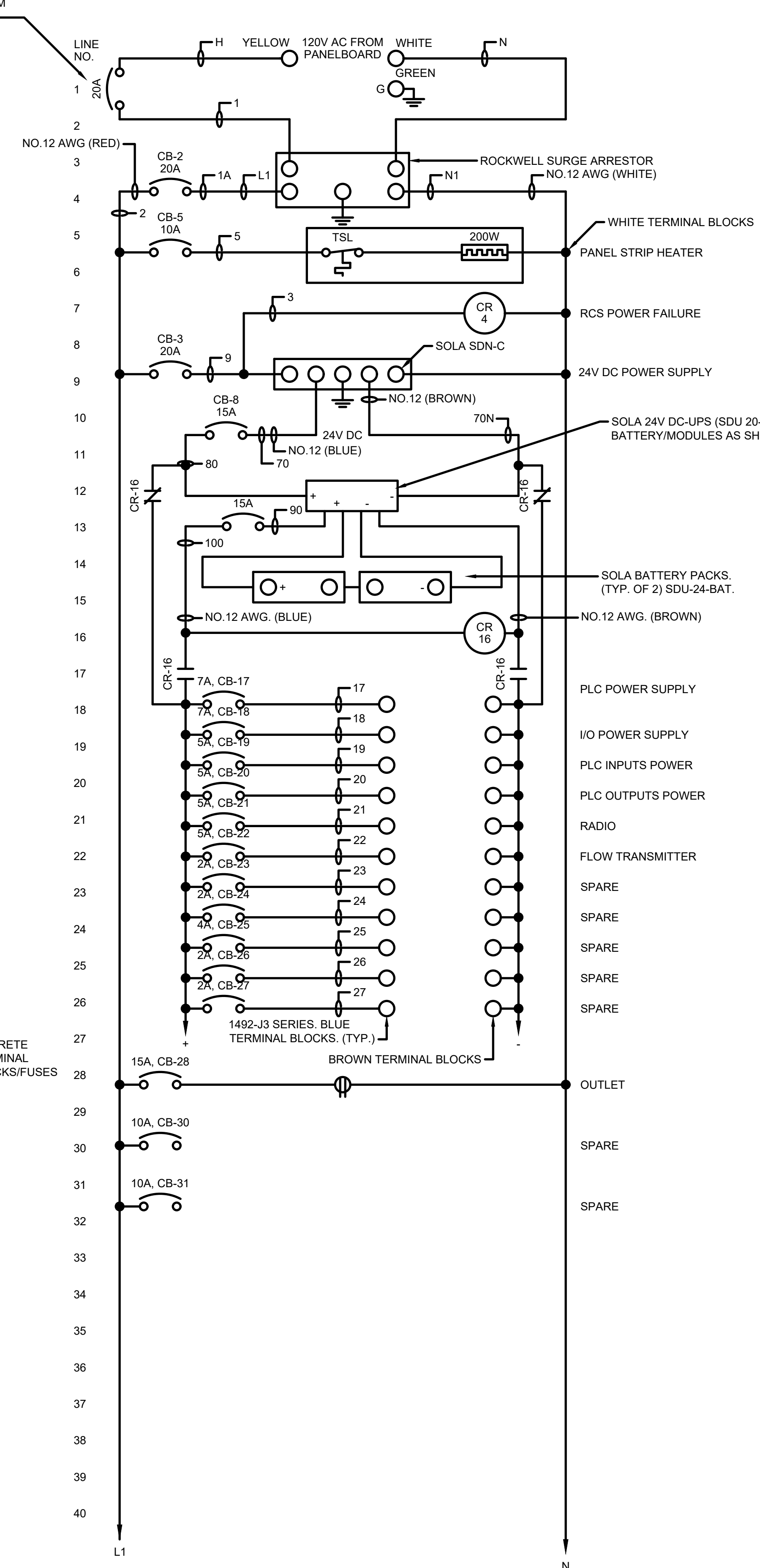
**SAMPLE METERING
PANEL LAYOUT**
NO SCALE



**METERING STATION
CONTROL PANEL LAYOUT**
NEMA 4 ENCLOSURE
SIZE: 42"H X 36"W X 12"D (MIN.)
PANEL TO BE CONSTRUCTED BY A UL LISTED PANEL SHOP. (TYP.)



GENERAL SUBPLATE LAYOUT
PAINT INSIDE: GLOSS WHITE.
NOTE: NOT ALL SUBPLATE DEVICES ARE SHOWN.
SEE WIRING DIAGRAMS FOR ADDITIONAL REQUIREMENTS. (TYP.)



**FUTURE.
WORK NOT IN
CONTRACT.**

TETRA TECH
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BY	DESCRIPTION	DATE	MARK

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
O-AVENUE CONTROL PANEL LAYOUT, WIRING DIAGRAM

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MS.J/G.C.J.

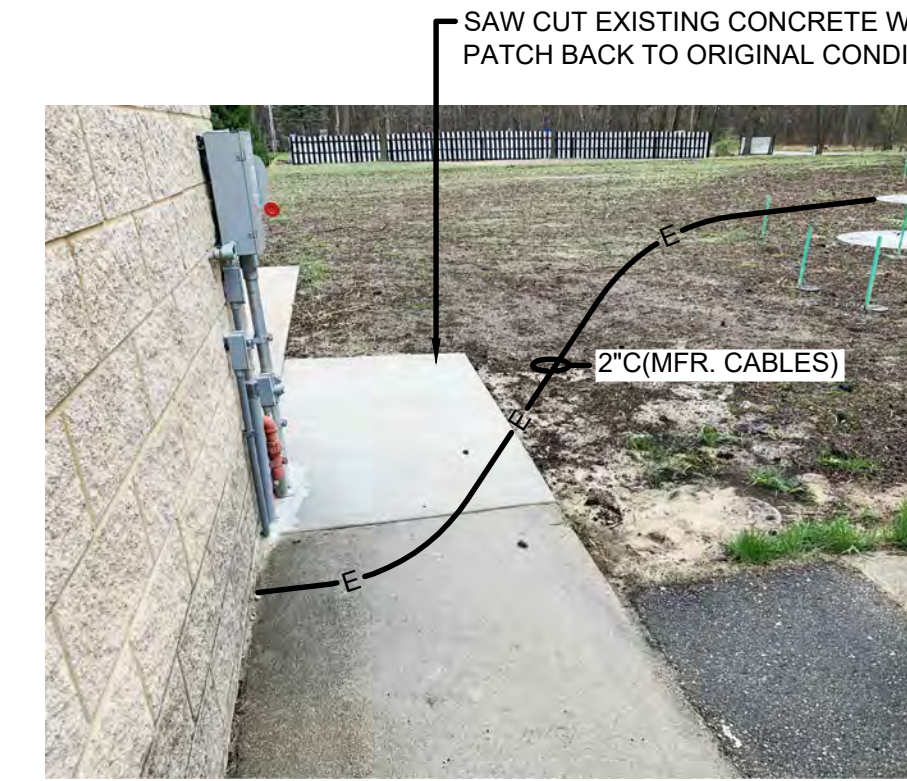
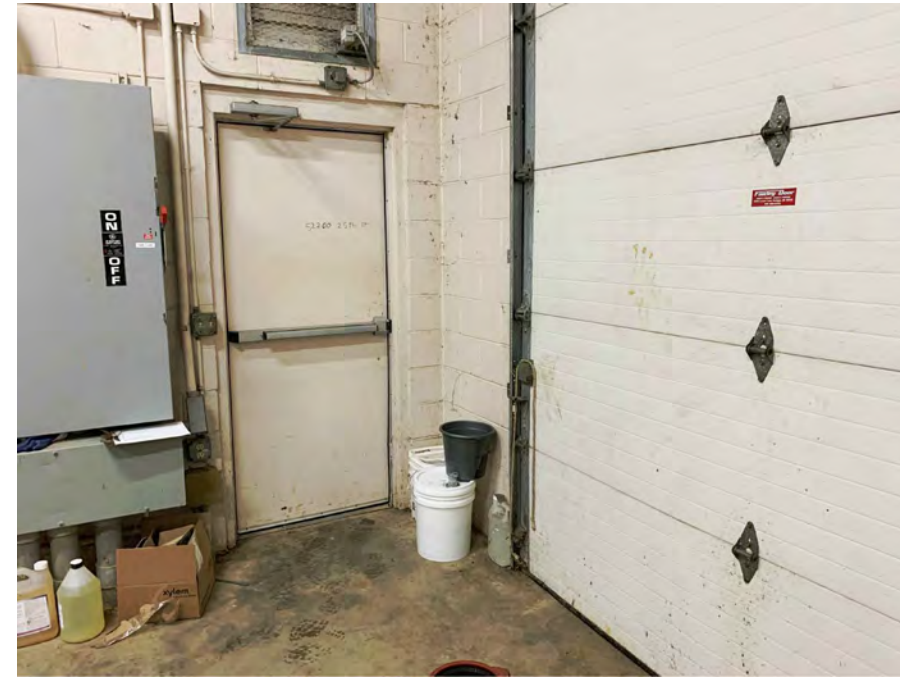
Copyright: Tetra Tech

6
OF 40
Bar Measures 1 inch

DEMOLISH EXISTING F&P FLOW TRANSMITTER, AND FLOWMETER. INSTALL NEW MAGNETIC FLOWMETER. MODIFY EXISTING PIPING AS REQUIRED. PROVIDE MAKEUP SPOOL PIECE AS REQUIRED. INSTALL NEW PIPE SUPPORTS (2). TURN OVER EXISTING METER, AND TRANSMITTER TO OWNER. ASSUME DISTANCE FROM METER VAULT TO BUILDING TO BE 125 FT. PROVIDE CABLE LENGTH (150 FT. MINIMUM) FROM METER TO TRANSMITTER.



PROVIDE NEW 20A BREAKER FOR POWERING NEW METERING CONTROL PANEL.

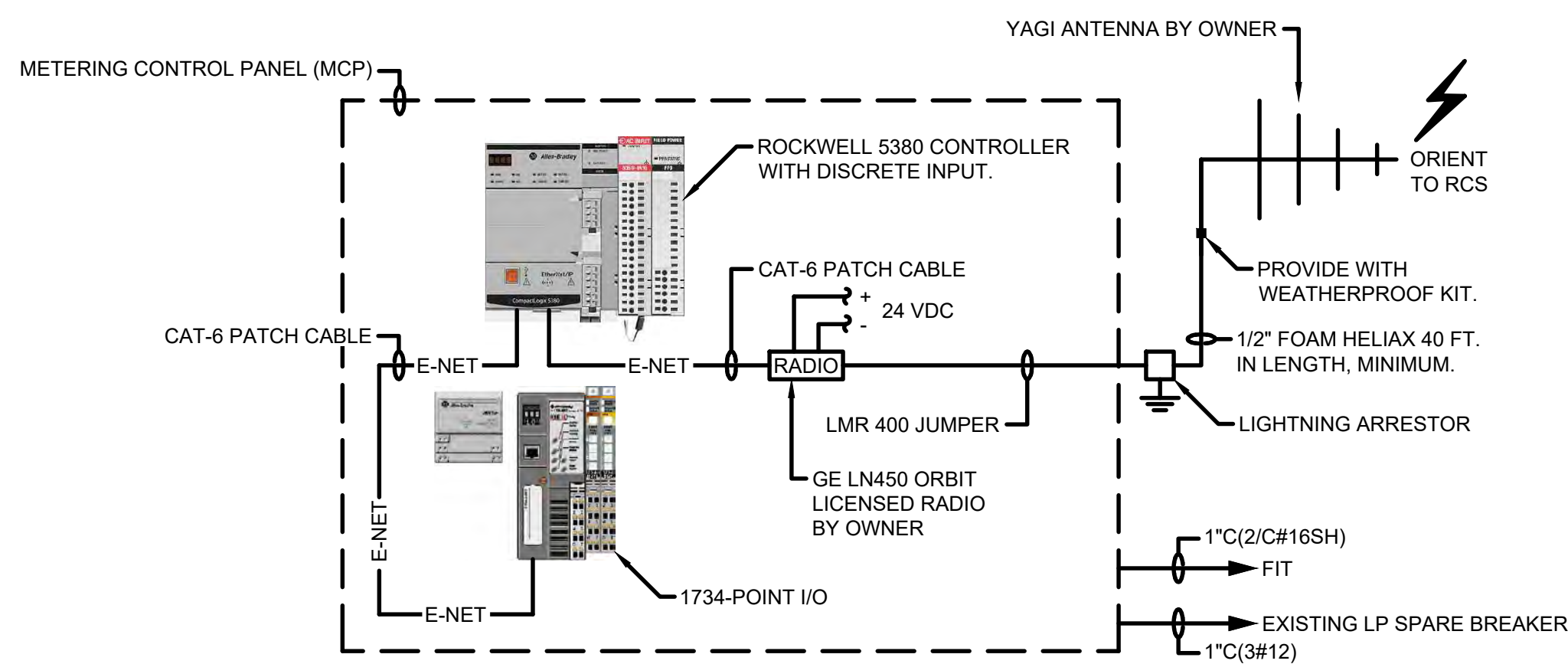


SAW CUT EXISTING CONCRETE WALKWAY. PATCH BACK TO ORIGINAL CONDITION.

CORE HOLE THROUGH VAULT, AND STATION WALL. SEAL WITH NON-SHRINK GROUT.

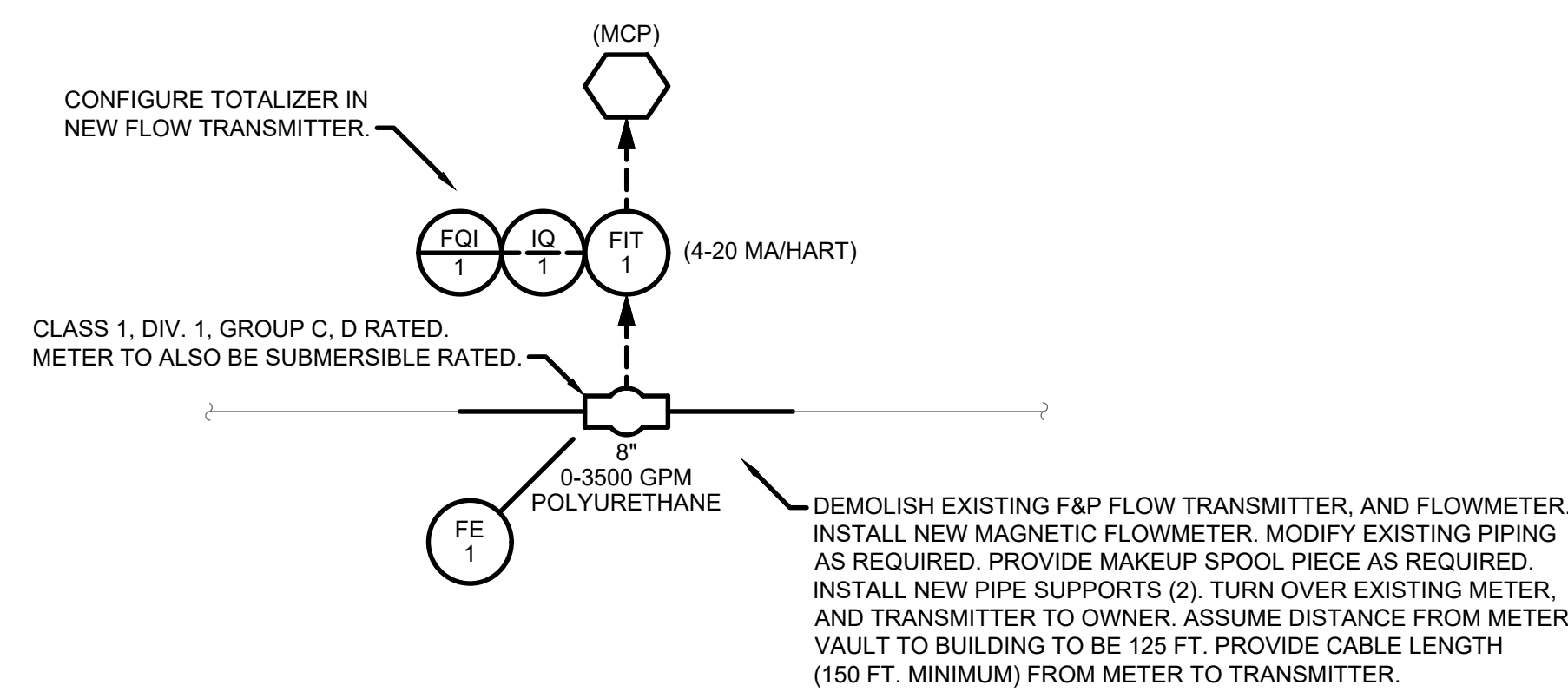
DEMOLISH EXISTING F&P FLOW TRANSMITTER, AND FLOWMETER. INSTALL NEW MAGNETIC FLOWMETER. MODIFY EXISTING PIPING AS REQUIRED. PROVIDE MAKEUP SPOOL PIECE AS REQUIRED. INSTALL NEW PIPE SUPPORTS (2). TURN OVER EXISTING METER, AND TRANSMITTER TO OWNER. ASSUME DISTANCE FROM METER VAULT TO BUILDING TO BE 125 FT. PROVIDE CABLE LENGTH (150 FT. MINIMUM) FROM METER TO TRANSMITTER.

STATION PHOTOS



SYSTEM CONFIGURATION DRAWING

NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRA TECH.



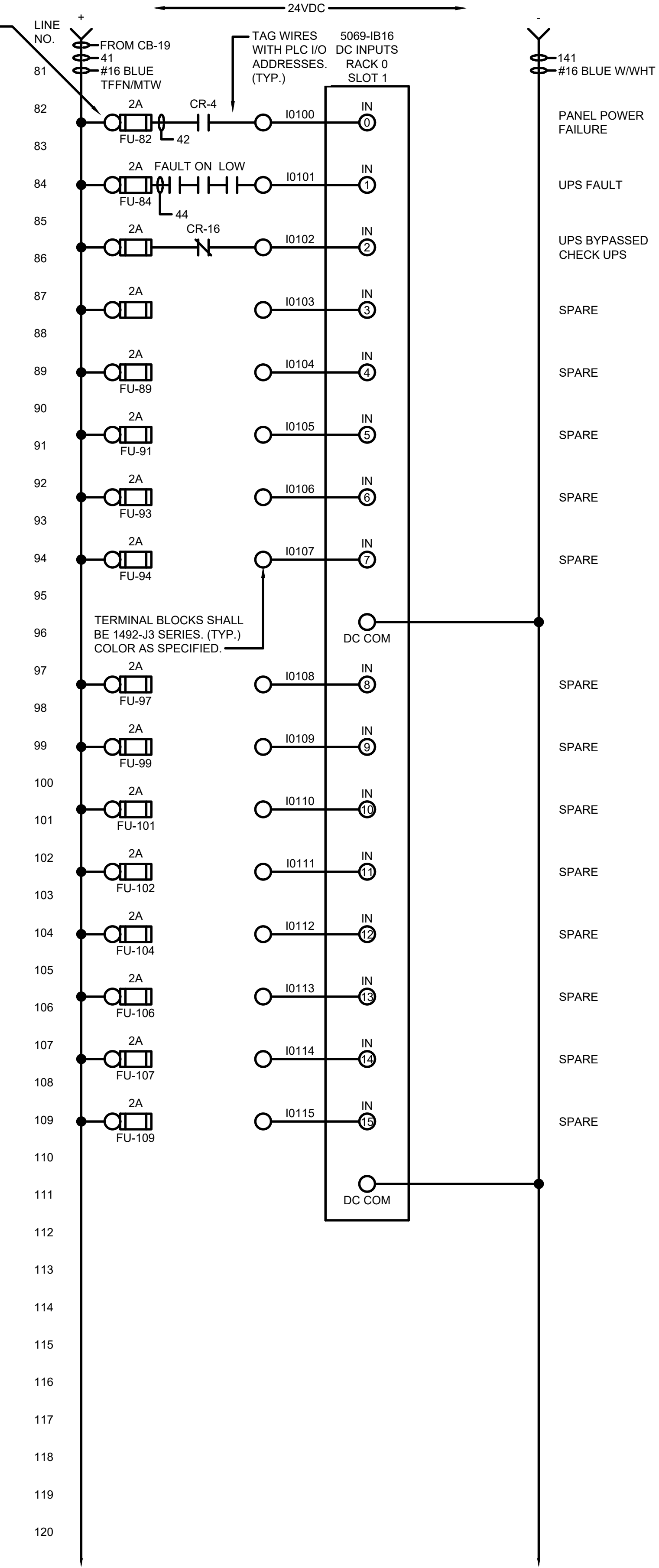
PARTIAL P&ID DIAGRAM

NOTES:

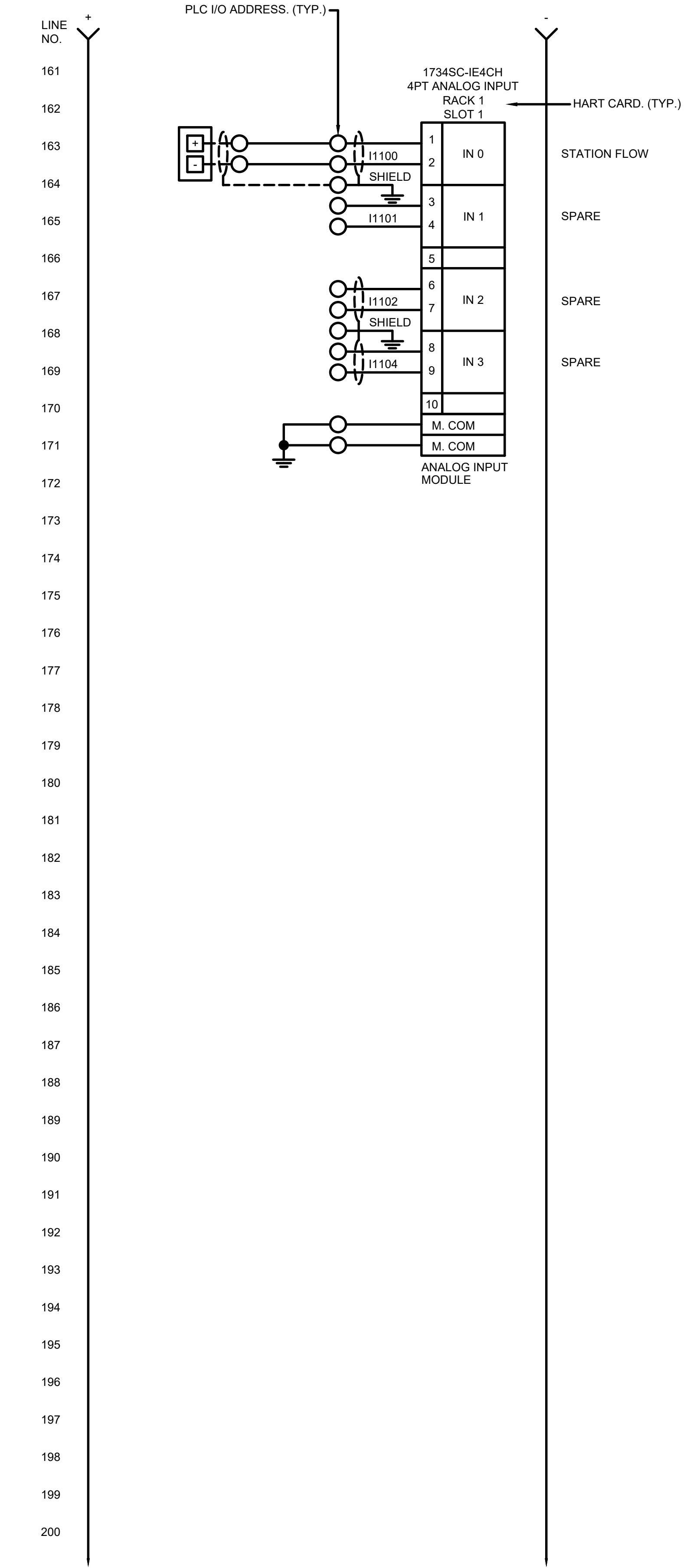
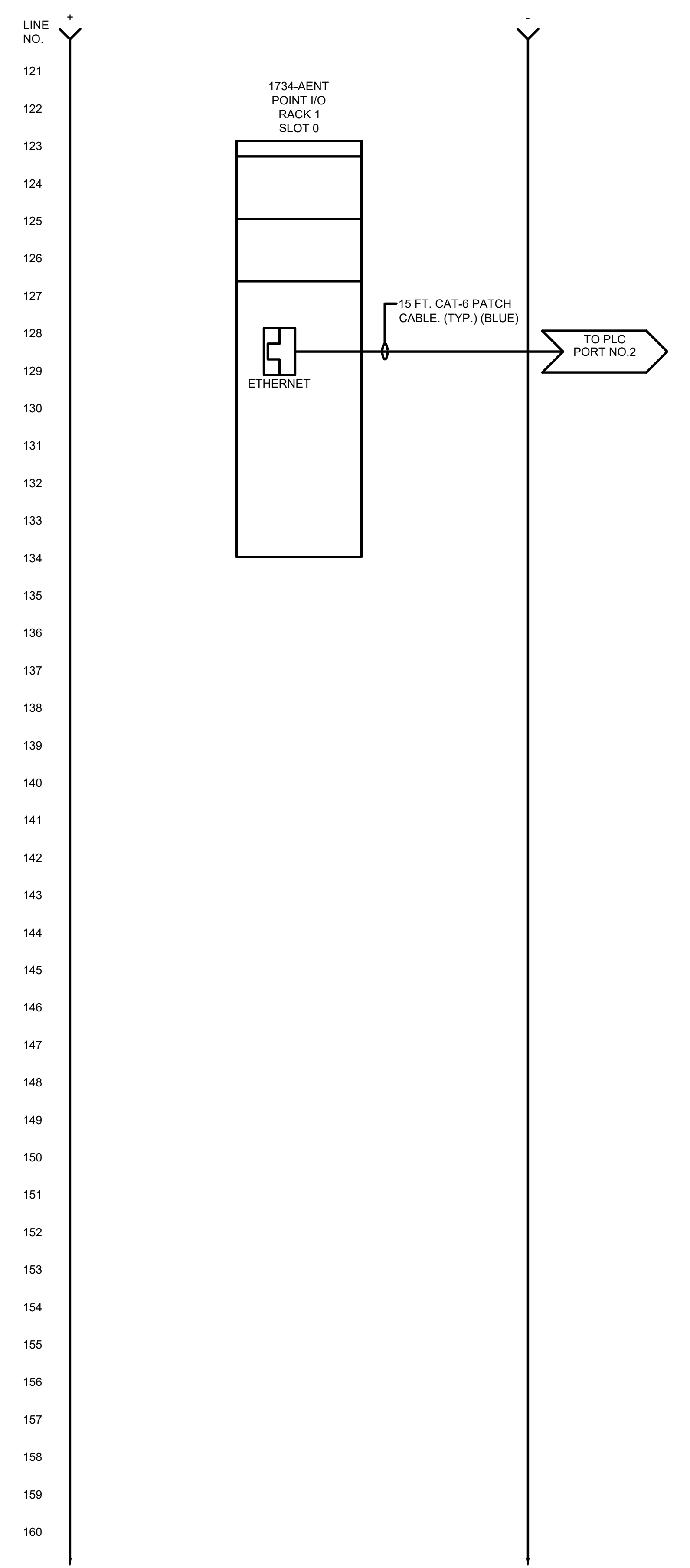
- INSTALL NEW MCP ON WALL INSIDE EXISTING RAW SEWAGE PUMP STATION. PROVIDE A 1/4 INCH CONDUIT WITH 3#12 WIRES AND POWER NEW MCP FROM SPARE BREAKER IN EXISTING PANELBOARD. LABEL SPARE BREAKER IN PANELBOARD WITH NEW MCP DESIGNATION.
- MOUNT THE NEW MAGNETIC FLOW TRANSMITTER ON WALL IN PLACE OF EXISTING F&P FLOW TRANSMITTER. POWER FROM 24VDC POWER SUPPLY IN NEW MCP.
- INSTALL 2 - 1 INCH PVC-RMC CONDUITS WITH 3#12 WIRES AND 2/C#18SH CABLE FROM THE NEW FIT TO THE NEW MCP.
- FROM THE NEW MCP, INSTALL THE 1/2 INCH COAXIAL CABLE TO THE NEW YAGI ANTENNA. LOCATE NEW ANTENNA ON A NEW 24 FOOT LONG 2 INCH ALUMINUM SCHEDULE 40 MAST PIPE MOUNTED ON THE SIDE OF THE EXISTING RAW SEWAGE PUMP STATION. GROUND MAST PIPE WITH NO.6 AWG RHW-USE WIRE. INSTALL TWO GROUND RODS IN YARD AREA NEAR EXISTING FLOW MONITORING BUILDING AND EXTERIOR MOUNTED MCP. CONNECT NO.6 WIRE TO GROUNDS RODS.
- OBTAIN THE SERVICES OF OUBBIER CALIBRATION SERVICES TO SET UP THE TRANSMITTER, CALIBRATE AND PLACE ON-LINE.
- FURNISH AND INSTALL A NEW 2 INCH PVC-RMC CONDUIT WITH MANUFACTURER CABLES TO THE EXISTING METER VAULT LOCATED IN THE YARD APPROXIMATELY 125 FEET FROM THE PUMP STATION. DIRECT BURY A NEW PVC-RMC CONDUIT FROM PUMP STATION TO METER LOCATION. GRADE AREA BACK TO ORIGINAL CONDITION. SAW CUT EXISTING SIDEWALK AND WALKWAY AREAS AS REQUIRED TO SUIT NEW CONDUIT INSTALLATION AND PATCH AREAS BACK TO ORIGINAL CONDITION.
- TURN OVER EXISTING FLOWMETER, AND TRANSMITTER TO OWNER.

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ROCKWELL 1492
SERIES FUSABLE
TERMINAL BLOCK (TYP.)



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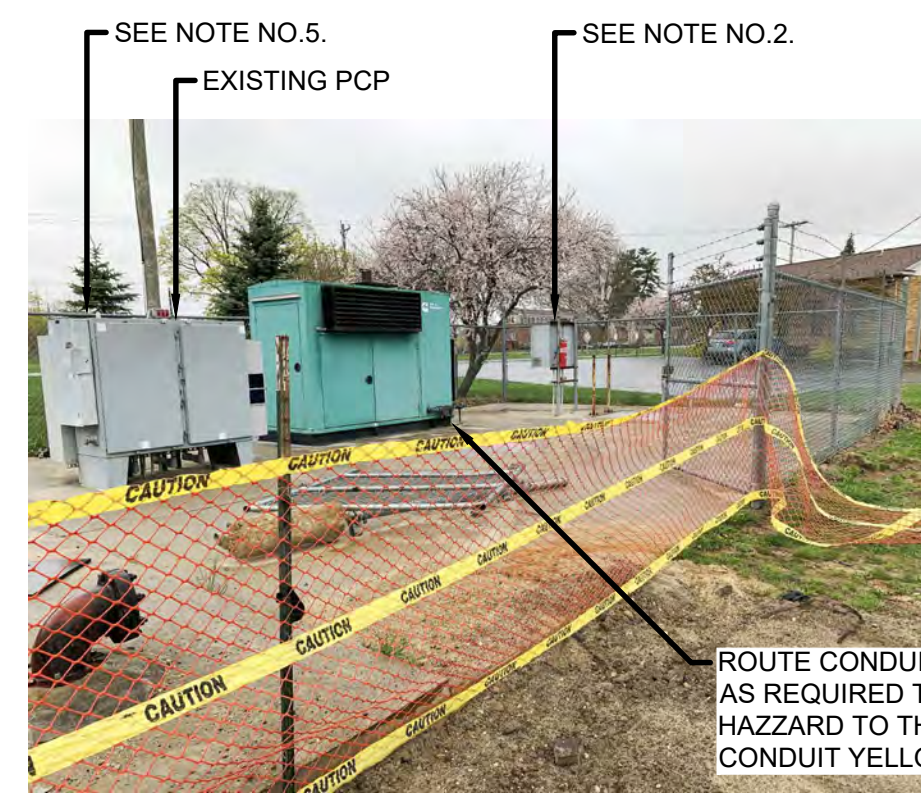
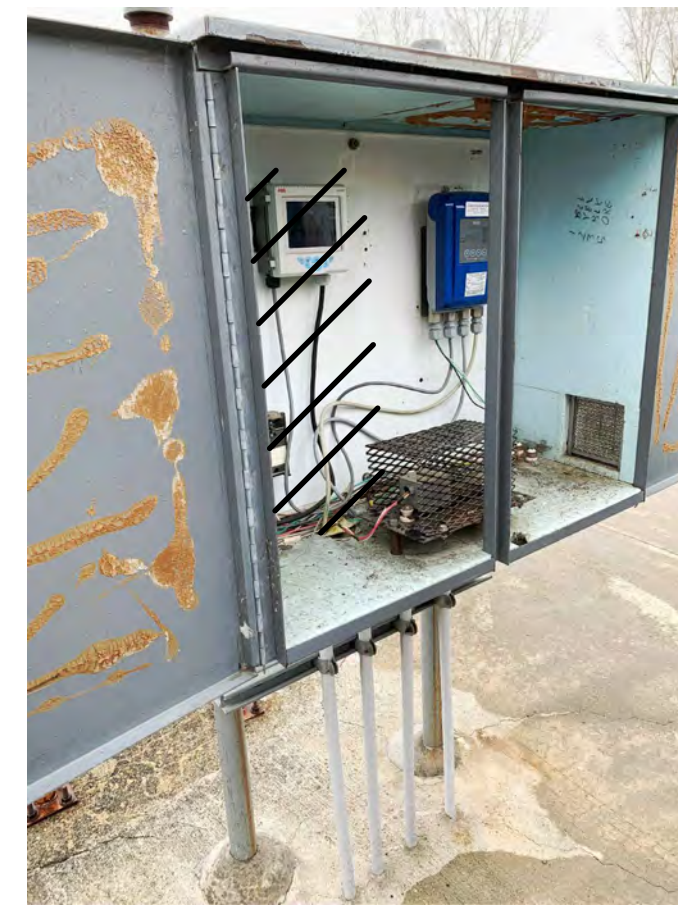
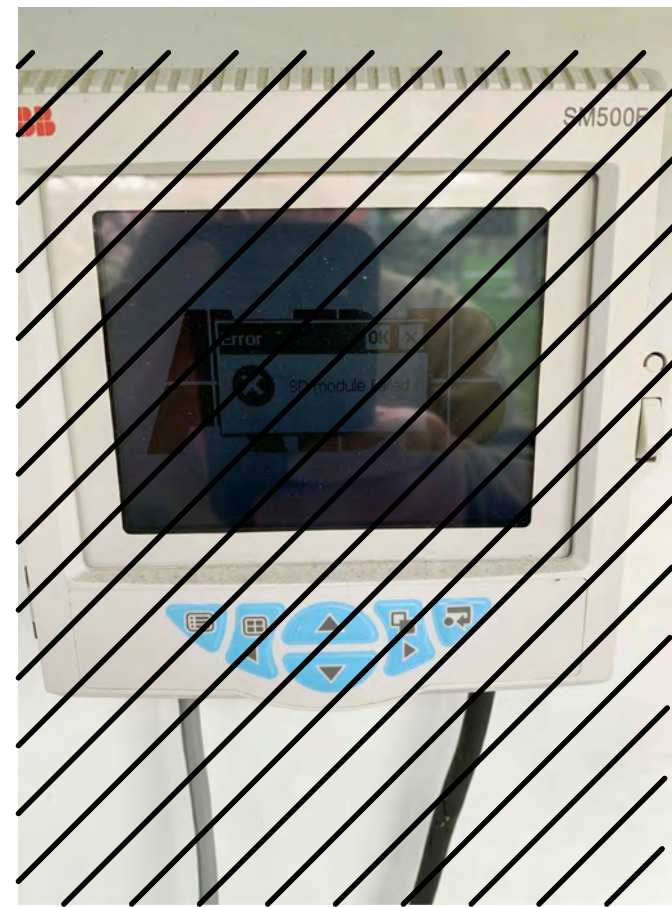
BY	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
**MATTAWAN CONTROL PANEL
WIRING DIAGRAM**

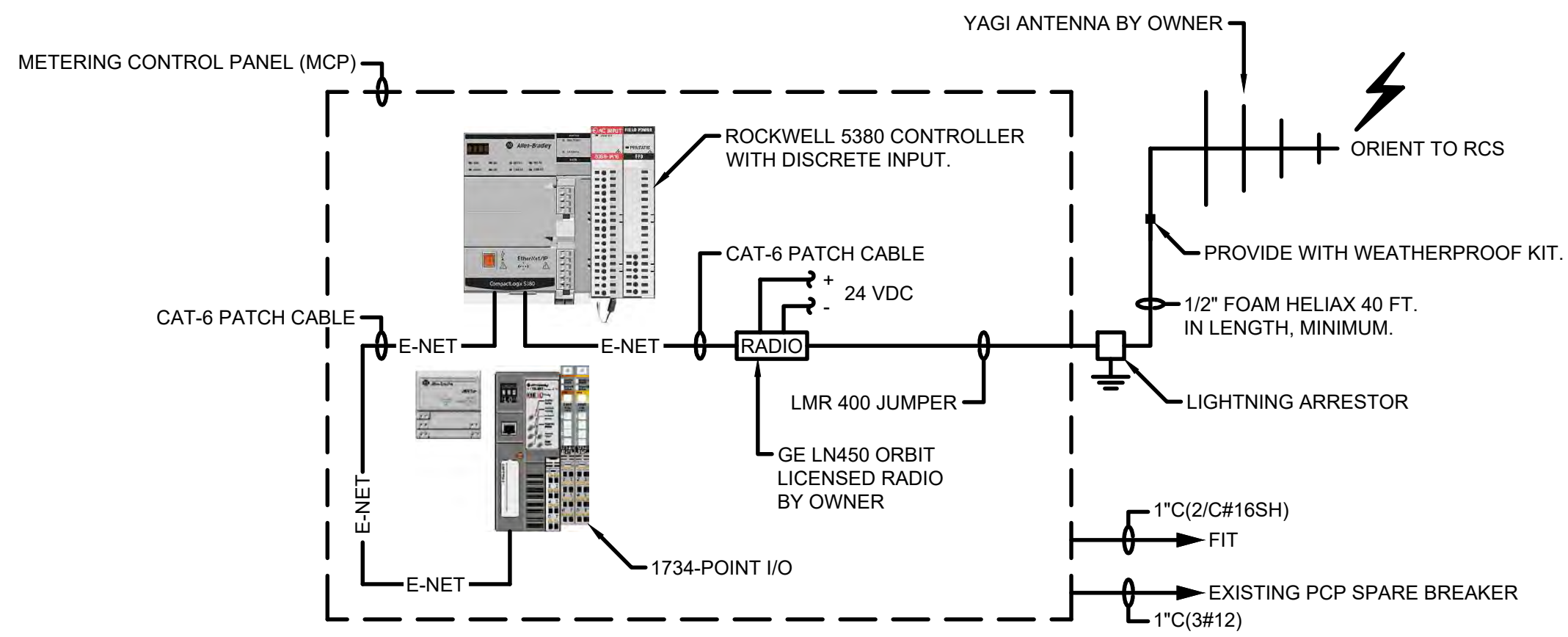
Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MS.J/G.C.J.

4/27/2022 12:33:52 PM - \\T:\LOCALIER\PROJECTS\ANN ARBOR\IER\19743\200-19743-2\1003\CAD\SCHEMETSHEET\METERING10_MATTAWAN_PANEL.WIR.DIA.DWG - SHANK, JASON

4/27/2022 12:36:25 PM - I:\T\LOCAL\PROJECTS\ANN ARBOR\IER1\19743\200-19743-2\1003\CAD\SHEETFILES\WATERMETERING\11_VICKSBURG_ONELINE_DETAILS.DWG - SHANK, JASON

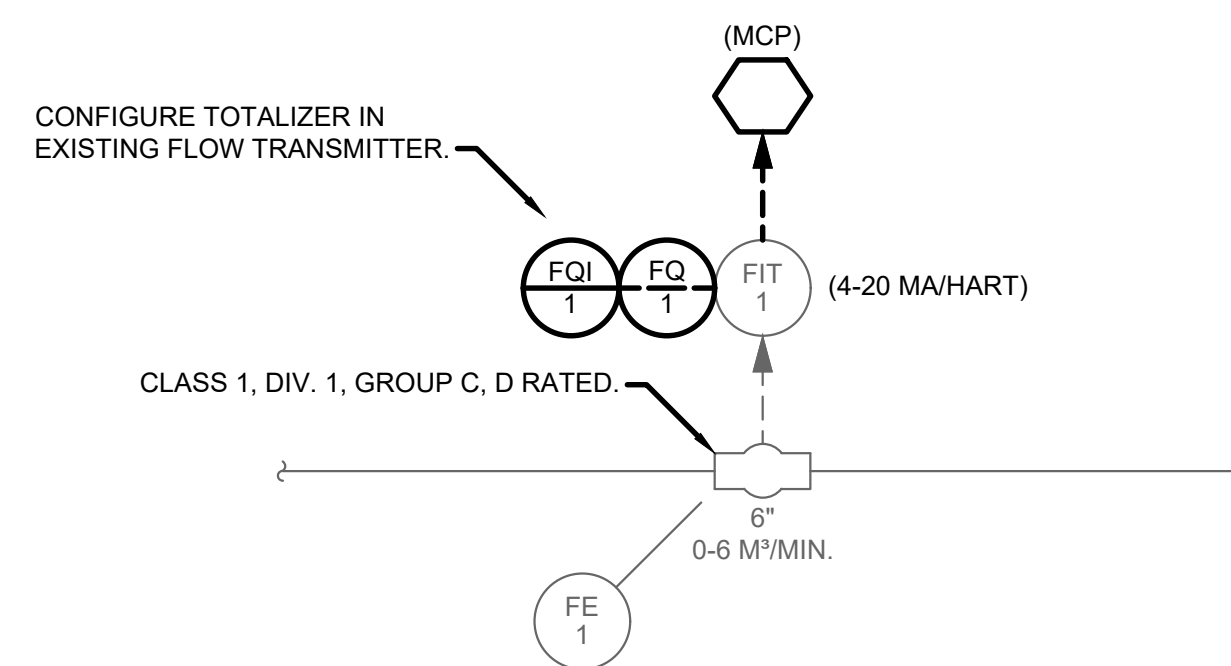


STATION PHOTOS



SYSTEM CONFIGURATION DRAWING

NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRA TECH.



PARTIAL P&ID DIAGRAM

NOTES:

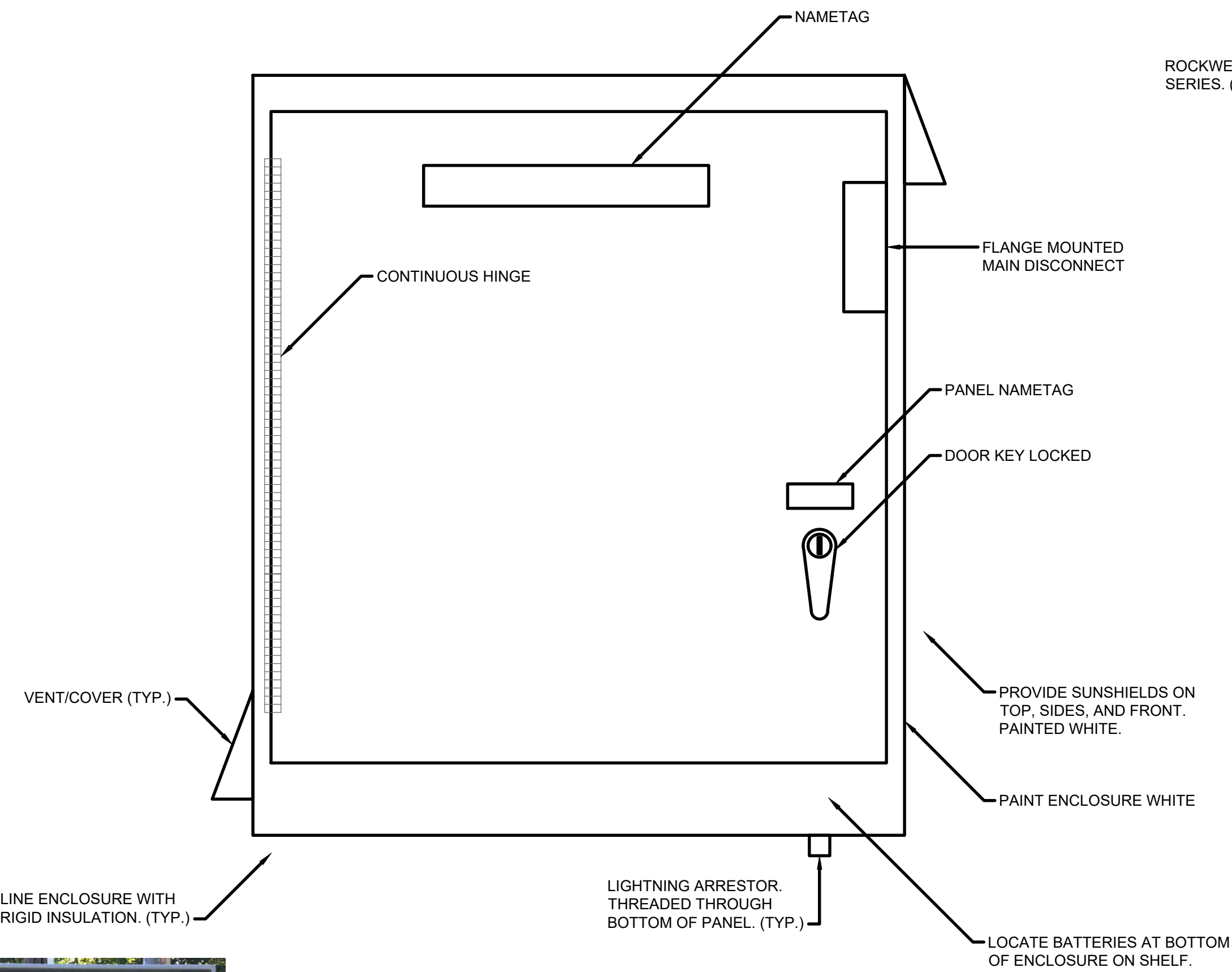
1. INSTALL NEW MCP OUTSIDE ON A NEW 316 STAINLESS STEEL STRUT SUPPORT RACK. PROVIDE A 1/2 INCH CONDUIT WITH #12 WIRES AND POWER FROM SPARE BREAKER WITHIN EXISTING PANELBOARD. LABEL SPARE BREAKER IN PANELBOARD WITH NEW MCP DESIGNATION.
2. INSTALL A 1 INCH CONDUIT WITH 2/C#18SH CABLE TO THE NEW MCP FROM THE EXISTING MAGNETIC FLOW TRANSMITTER/PANEL.
3. FROM THE NEW MCP, INSTALL THE 1/2 INCH COAXIAL CABLE TO THE NEW YAGI ANTENNA. LOCATE NEW ANTENNA ON A NEW 24 FOOT LONG 2 INCH SCHEDULE 40 ALUMINUM MAST PIPE MOUNTED ON THE BACKSIDE OF THE NEW STRUT SUPPORT RACK. GROUND MAST PIPE WITH NO.6 RHW-USE WIRE. INSTALL TWO GROUND RODS IN YARD AREA NEAR EXISTING EQUIPMENT RACK AND EXTERIOR MOUNTED MCP. CONNECT NO.6 WIRE TO GROUND RODS.
4. OBTAIN THE SERVICES OF OUBBIER CALIBRATION SERVICES TO SET UP THE TRANSMITTER, CALIBRATE AND PLACE ON-LINE.
5. INSTALL NEW PANEL ON 316 STAINLESS STEEL STRUT SUPPORT RACK. SECURE STRUT TO CONCRETE PAD. PROVIDE 3/4" C WITH #12. AND POWER FROM SPARE 120V BREAKERS IN EXISTING PANELBOARD. RE-LABEL EXISTING PANELBOARD DIRECTORY AS REQUIRED.

MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
VICKSBURG METERING STATION ONE-LINES, DETAILS

Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

Copyright: Tetra Tech

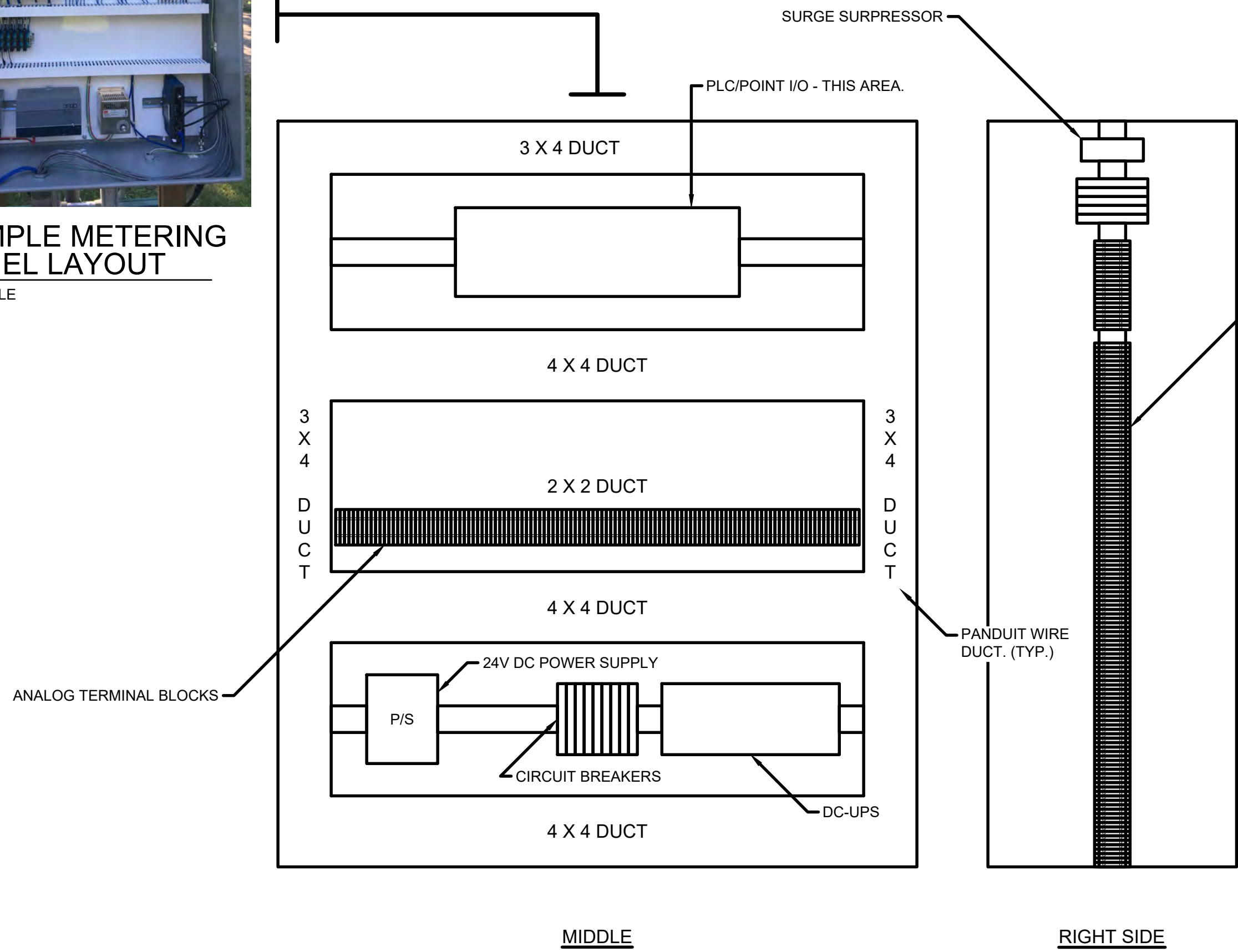


METERING STATION CONTROL PANEL LAYOUT

NEMA 4 ENCLOSURE
 SIZE: 42"H X 36"W X 12"D (MIN.)
 PANEL TO BE CONSTRUCTED BY A UL LISTED PANEL SHOP.
 PLC/RADIO PROGRAMMING BY OWNER.

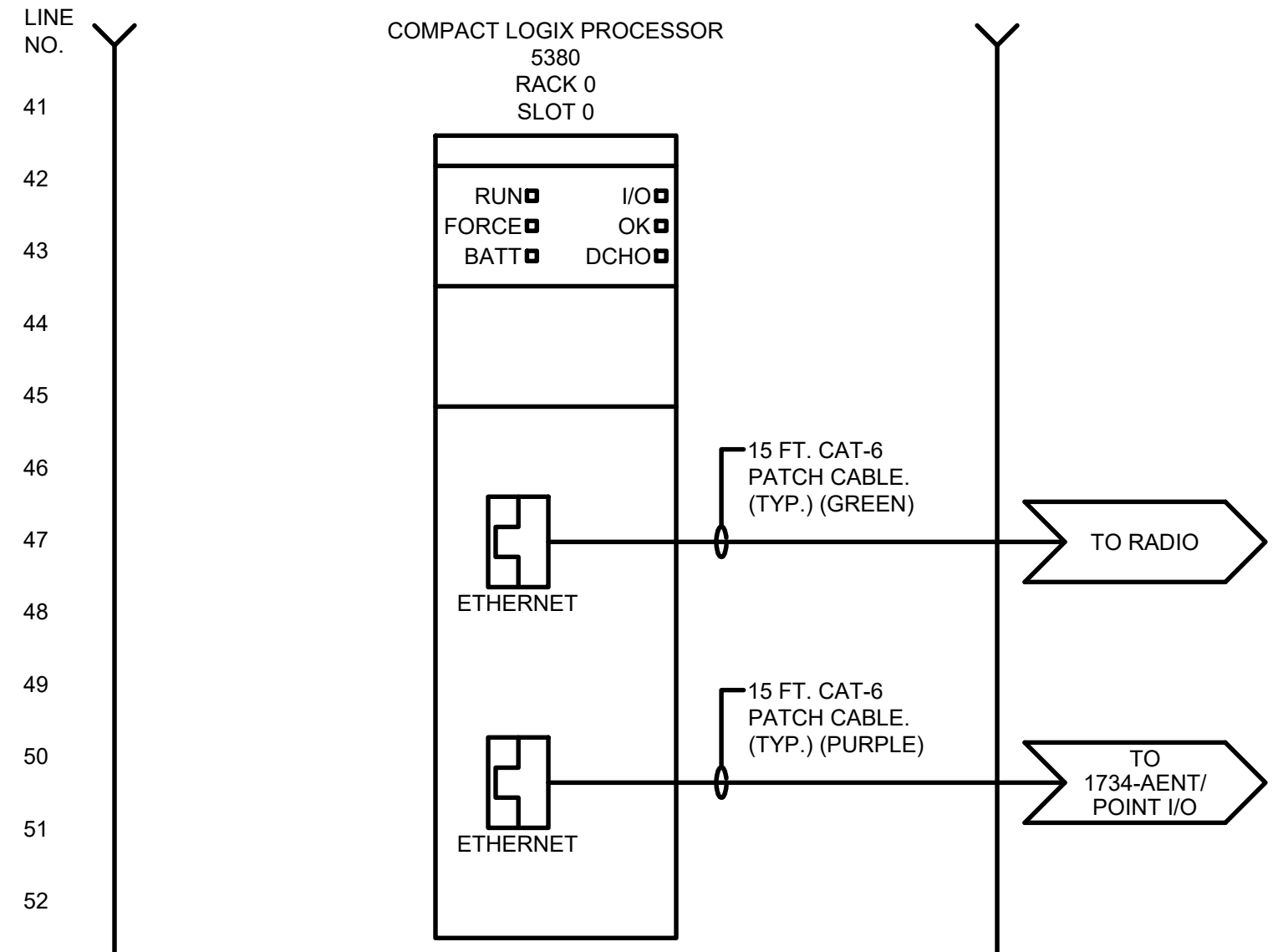
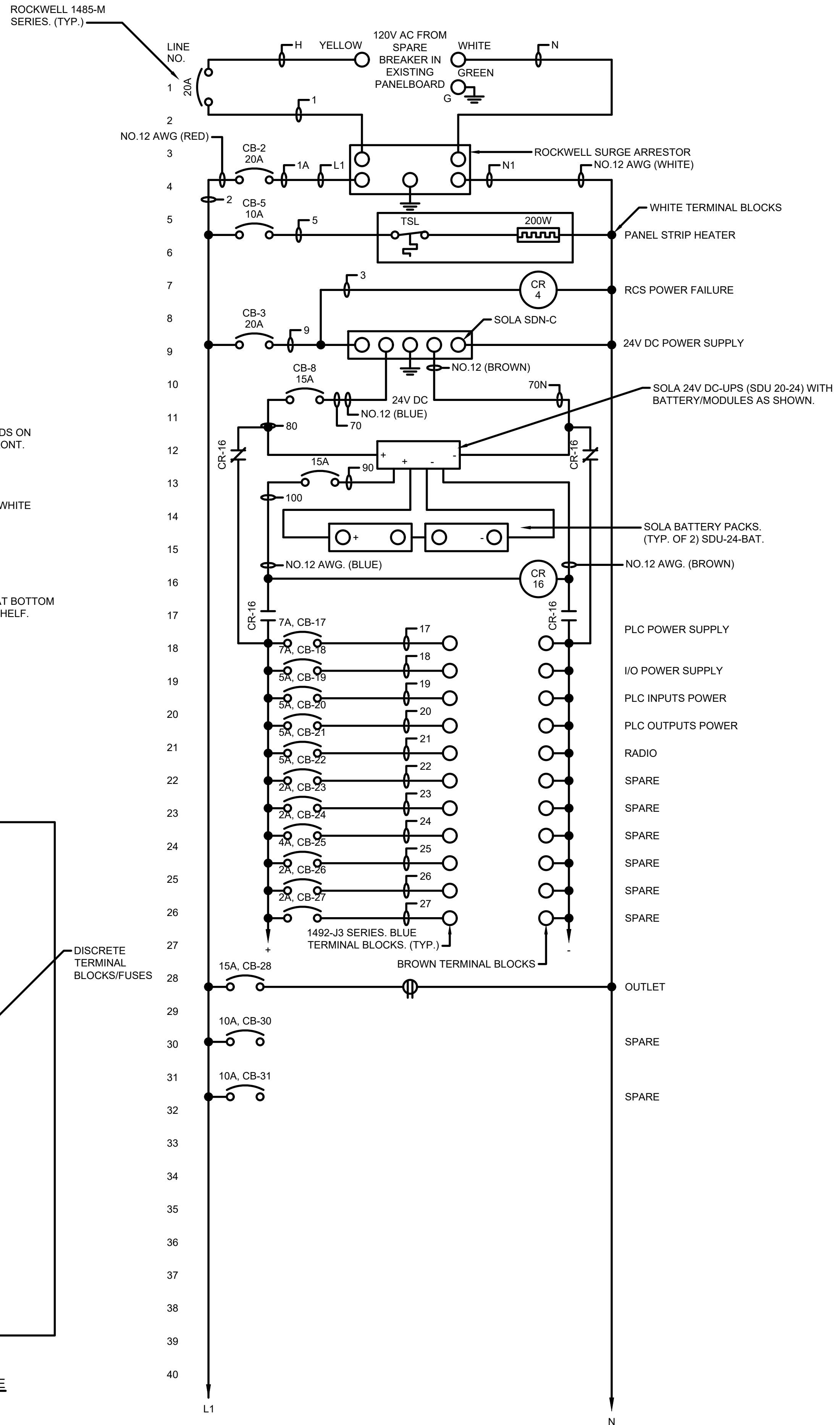


SAMPLE METERING PANEL LAYOUT
 NO SCALE



GENERAL SUBPLATE LAYOUT

PAINT INSIDE: GLOSS WHITE.
 NOTE: NOT ALL SUBPLATE DEVICES ARE SHOWN.
 SEE WIRING DIAGRAMS FOR ADDITIONAL REQUIREMENTS. (TYP.)



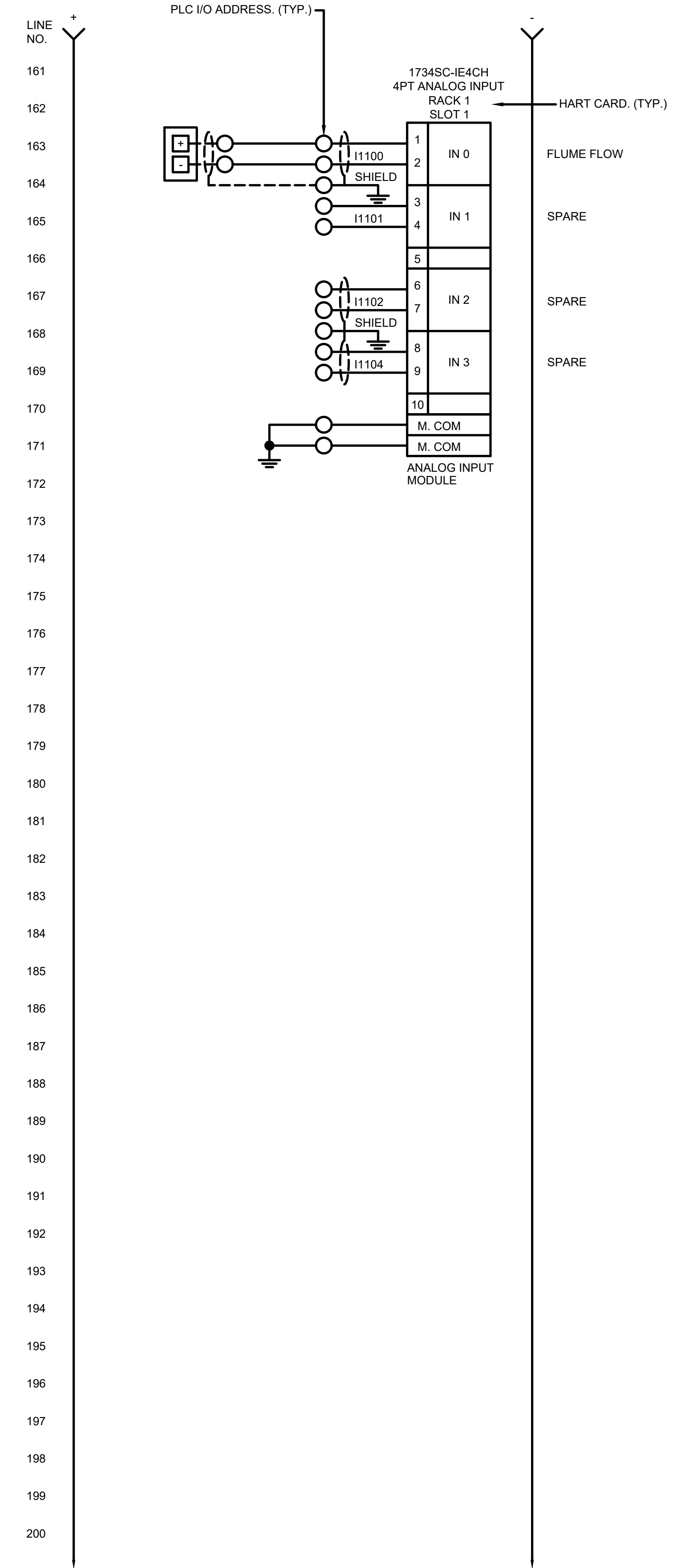
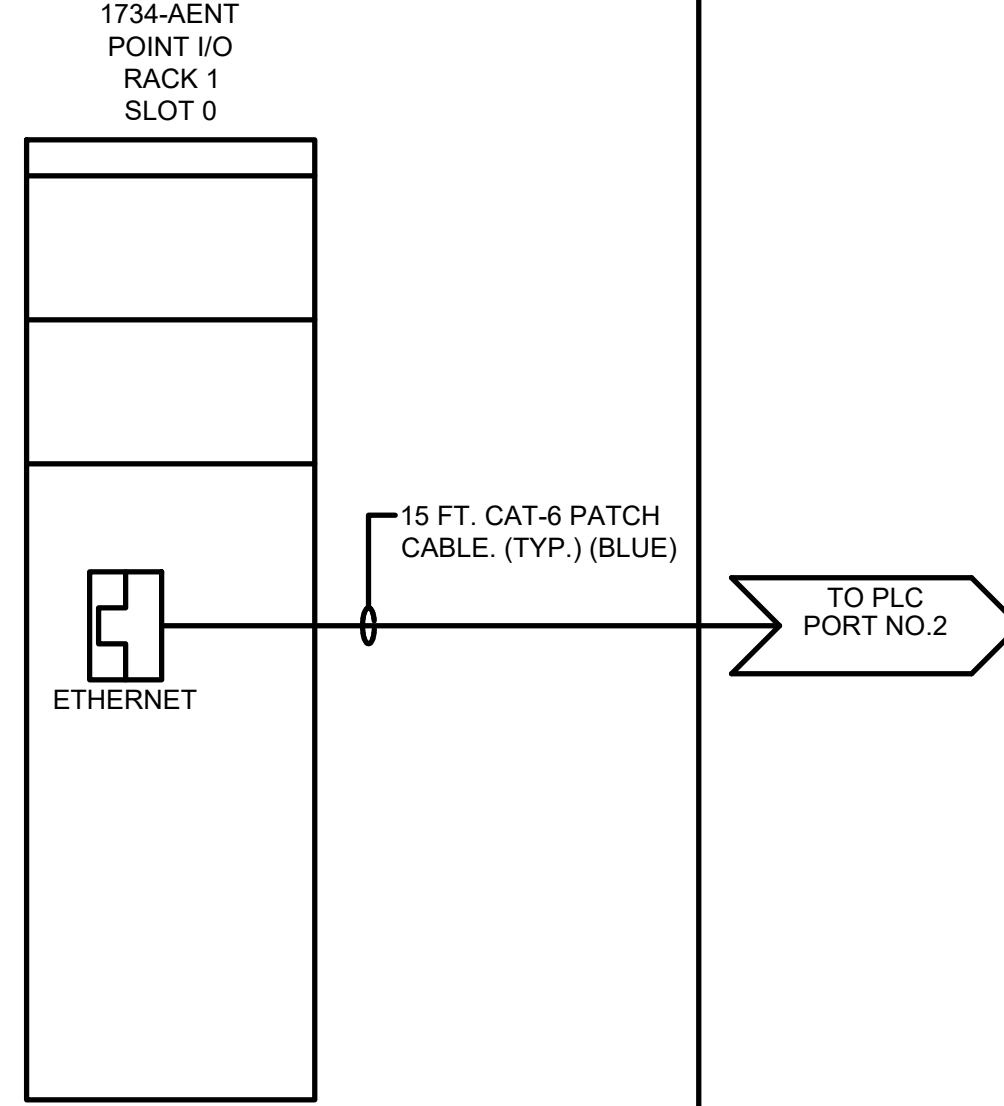
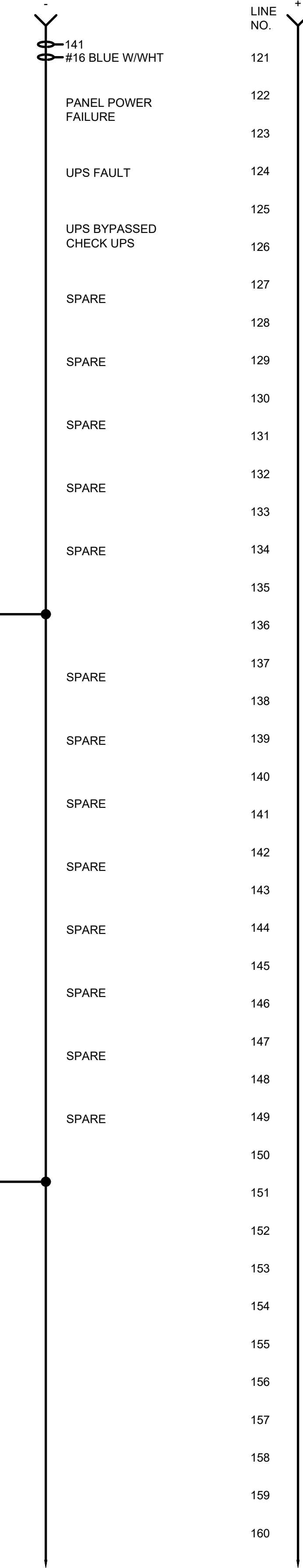
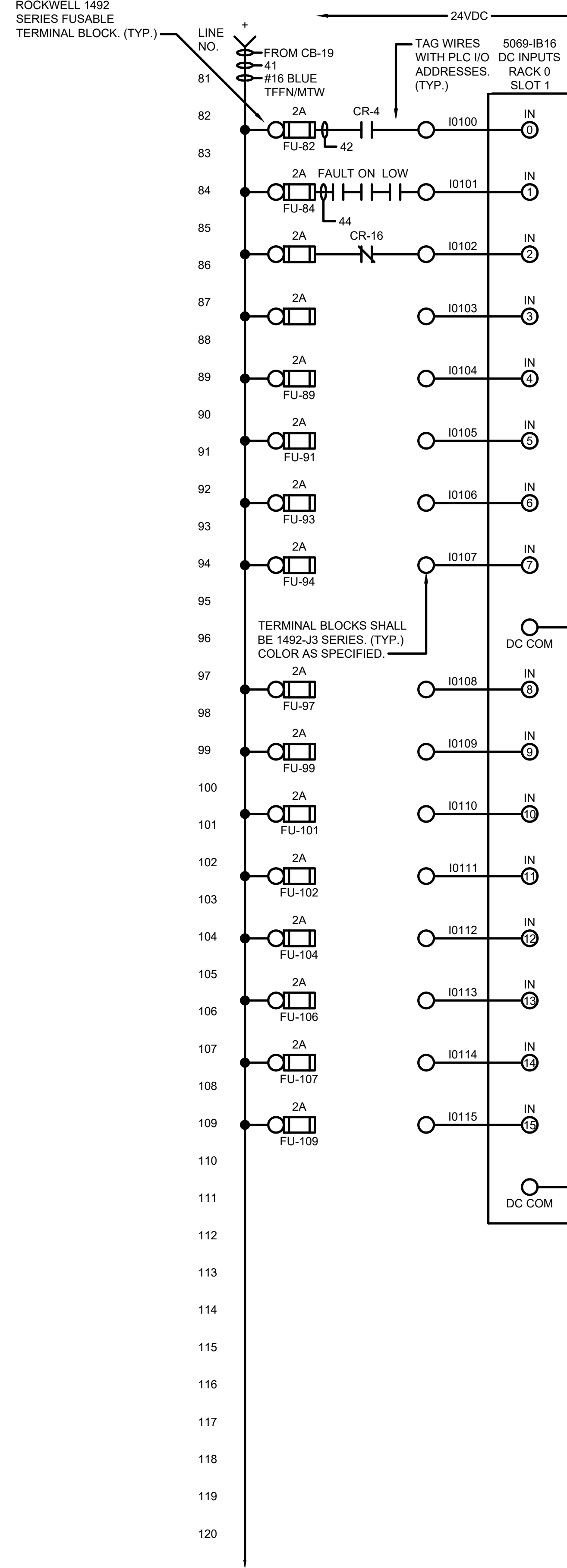
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MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
 METERING STATIONS CONTROL UPGRADES
VICKSBURG CONTROL PANEL LAYOUT, WIRING DIAGRAM

Project No.: 200-19743-21003
 Designed By: GCJ
 Drawn By: JLS
 Checked By: MSJ/GCJ

2/21/2022 3:11:48 PM - \\TT.LOC\ALIERPROJECTS\ANN ARBOR\RIERY19743\200-19743-21003\CAD\SHEETFILES\WIRING\G13_VICKSBURG_PANEL_WIR.DWG - SHANK, JASON



MARK	DATE	DESCRIPTION

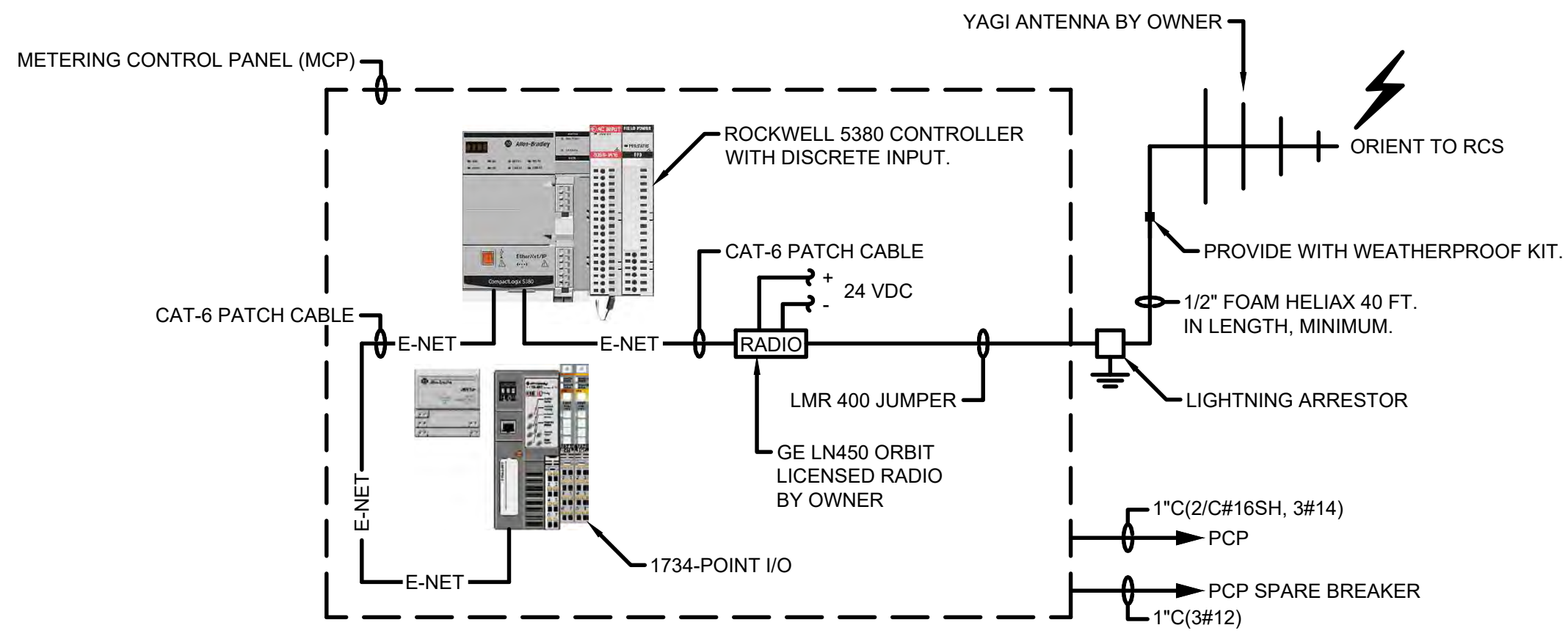
CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES

VICKSBURG CONTROL PANEL WIRING DIAGRAM

Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

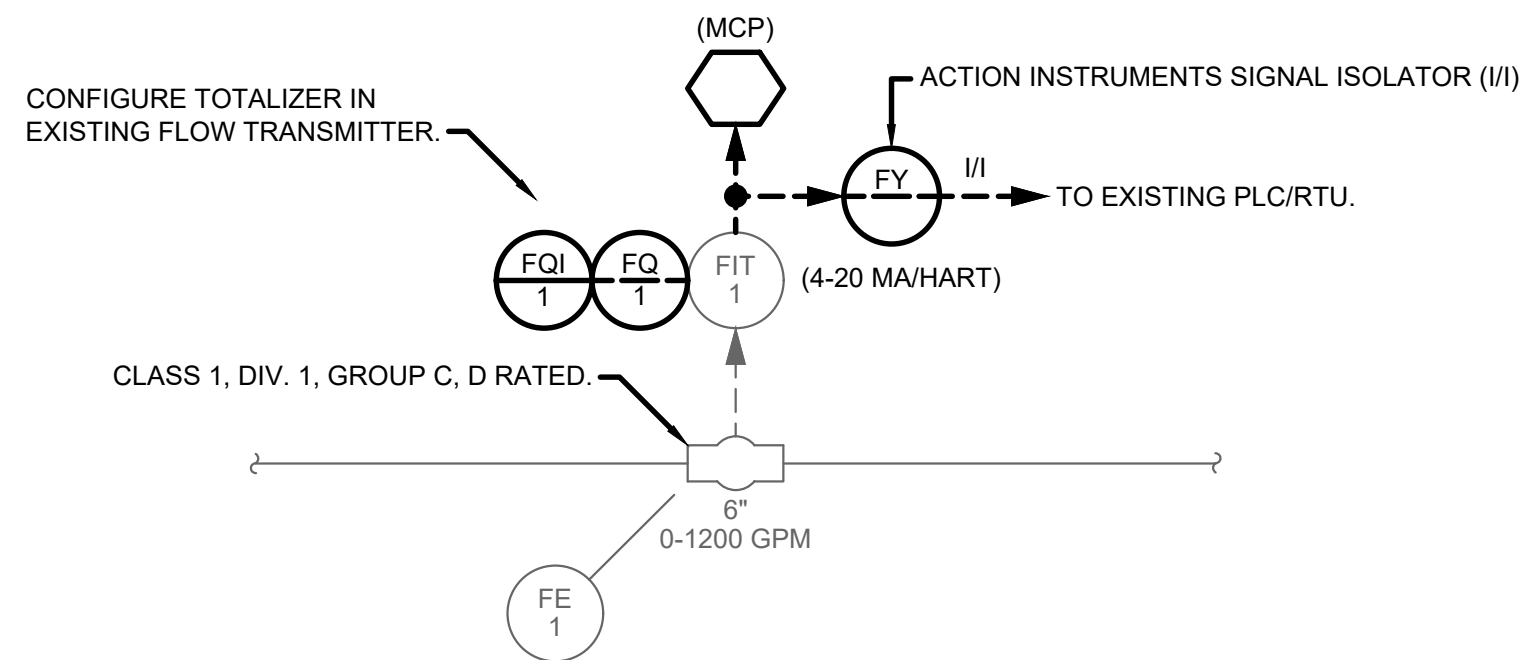


STATION PHOTOS



SYSTEM CONFIGURATION DRAWING

NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRA TECH.



PARTIAL P&ID DIAGRAM

NOTES:

1. INSTALL NEW MCP OUTSIDE NEAR EXISTING OUTDOOR EQUIPMENT STRUT RACK. PROVIDE NEW 316 STAINLESS STEEL STRUT AND MOUNT NEW PANEL SECURE RACK TO CONCRETE PAD. PROVIDE A 1 INCH CONDUIT WITH 3#12 WIRES AND POWER FROM EXISTING PANELBOARD. LABEL SPARE BREAKER IN EXISTING PANELBOARD WITH NEW MCP DESIGNATION.
2. INSTALL A 1 INCH CONDUIT WITH 2/C#18SH CABLE TO THE NEW MCP FROM THE EXISTING ABB MAGNETIC FLOW TRANSMITTER INSIDE THE EXISTING CONTROL PANEL.
3. FROM THE NEW MCP, INSTALL THE 1/2 INCH COAXIAL CABLE TO THE NEW YAGI ANTENNA. LOCATE NEW ANTENNA ON A NEW 24 FOOT LONG 2 INCH SCHEDULE 40 ALUMINUM MAST PIPE MOUNTED ON THE BACKSIDE OF THE EXISTING STRUT RACK. GROUND MAST PIPE WITH NO.6 AWG RHW-USE WIRE. INSTALL TWO GROUND RODS IN YARD AREA NEAR EXISTING STRUT SUPPORT RACK. CONNECT NO.6 WIRE TO GROUNDS RODS
4. OBTAIN THE SERVICES OF OUBBIER CALIBRATION SERVICES TO SET UP THE TRANSMITTER, CALIBRATE AND PLACE ON-LINE.
5. INSTALL A SIGNAL ISOLATOR (I/I) TO FEED THE EXISTING 4-20 MA FLOW SIGNAL TO THE NEW MCP. AND THEN RE-TRANSMIT TO EXISTING PLC/RTU.

4/27/2022 12:56:00 PM - \\TT.LOCAL\PROJECTS\ANN ARBOR\19743-21003\CAD\3\SHEET\METERING14_SOUTH COUNTY_ONELINE_DETAILS.DWG - SHANK, JASON



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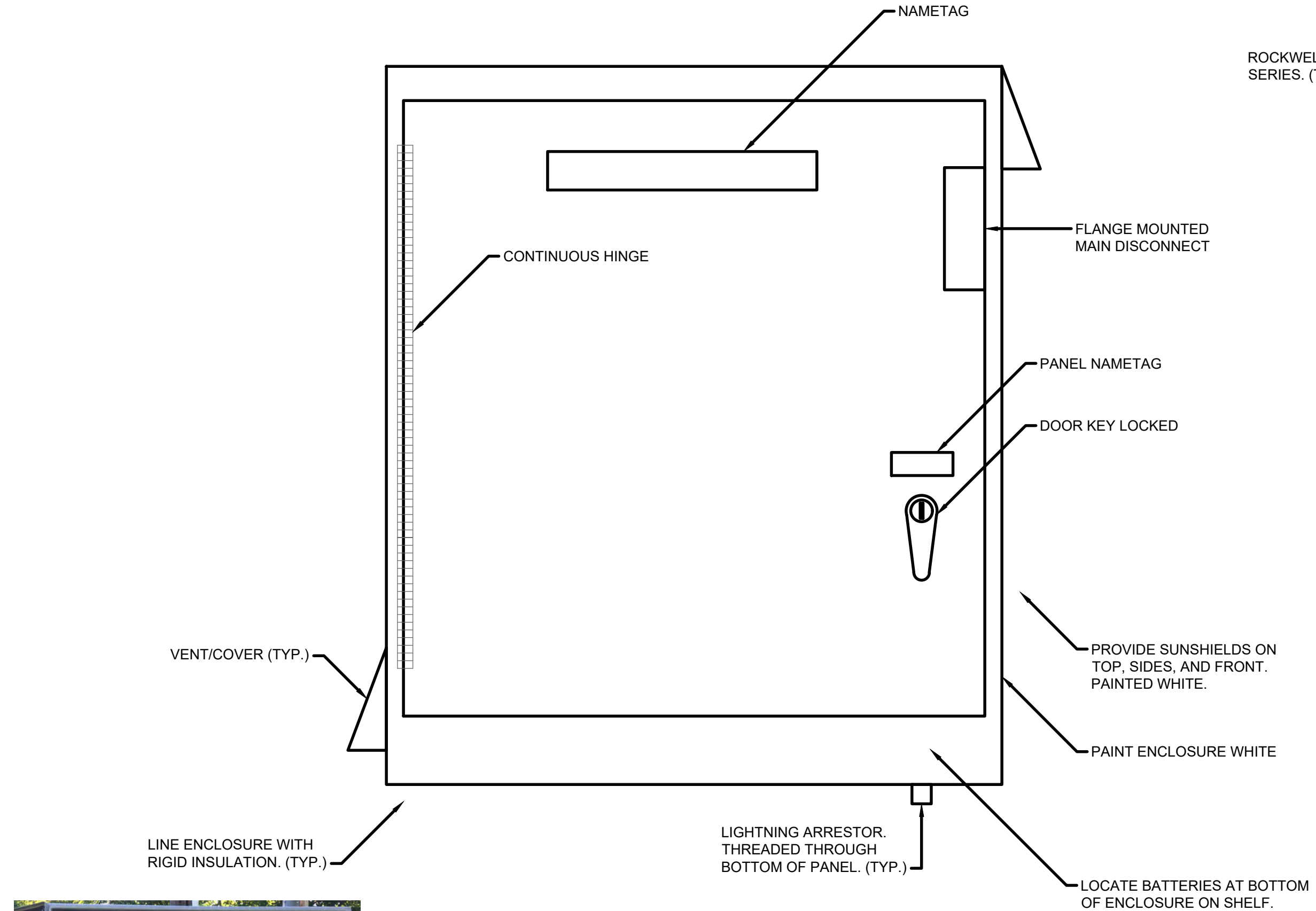
MARK	DATE	DESCRIPTION	BY

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
**SOUTH COUNTY METERING STATION
ONE-LINES, DETAILS**

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MS.J/G.C.J.

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4/27/2022 12:39:41 PM - \\T:\LOCAL\PROJECTS\ANN ARBOR\19743\200-19743-2\1003\CAD\SHEETFILES\EMETERING\15_SOUTH COUNTY_PANEL_LAYOUT_WIR.DWG - SHANK, JASON



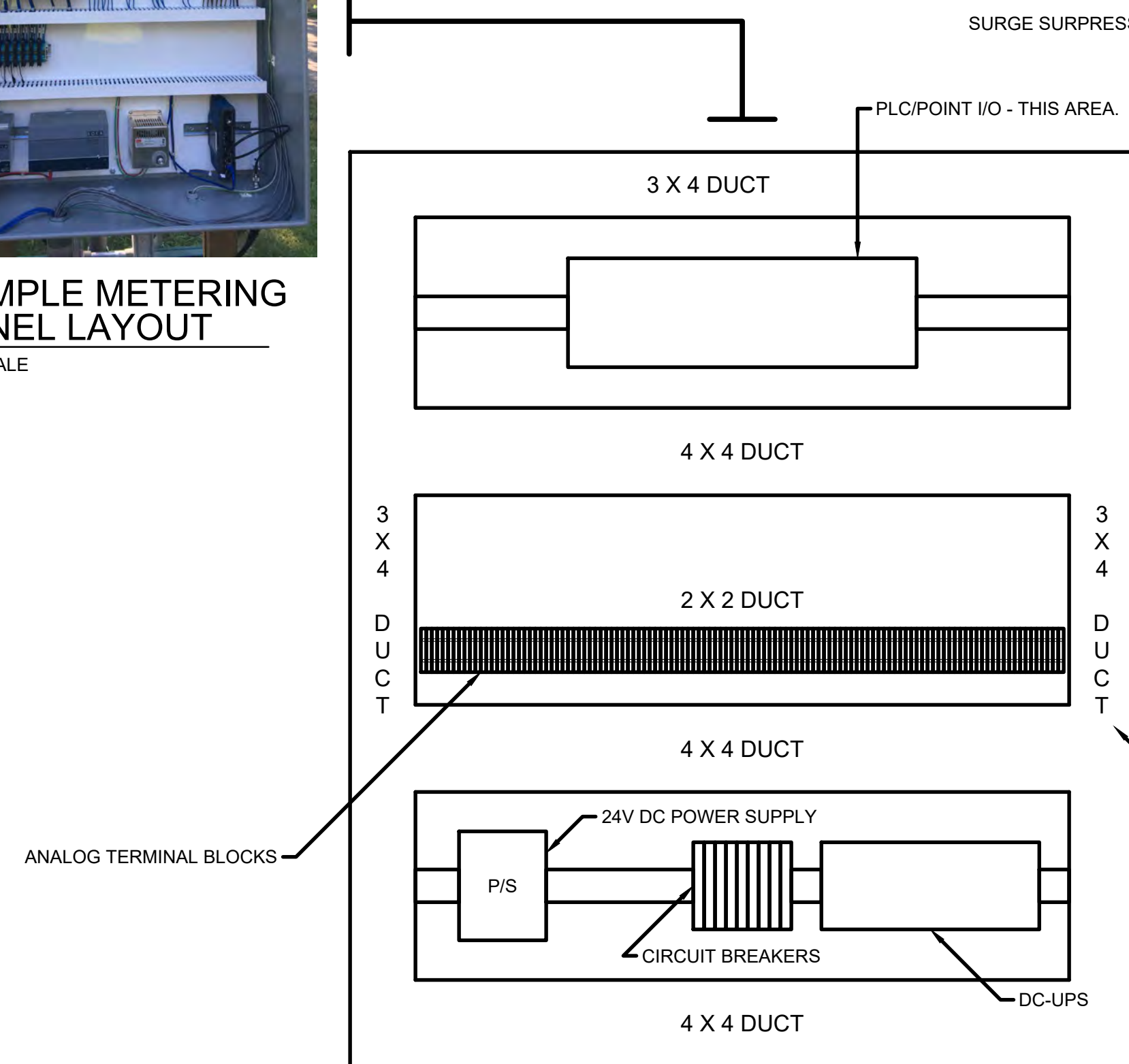
METERING STATION CONTROL PANEL LAYOUT

NEMA 4 ENCLOSURE
SIZE: 42" H X 36" W X 12" D (MIN.)
PANEL TO BE CONSTRUCTED BY A UL LISTED PANEL SHOP.



SAMPLE METERING PANEL LAYOUT

NO SCALE

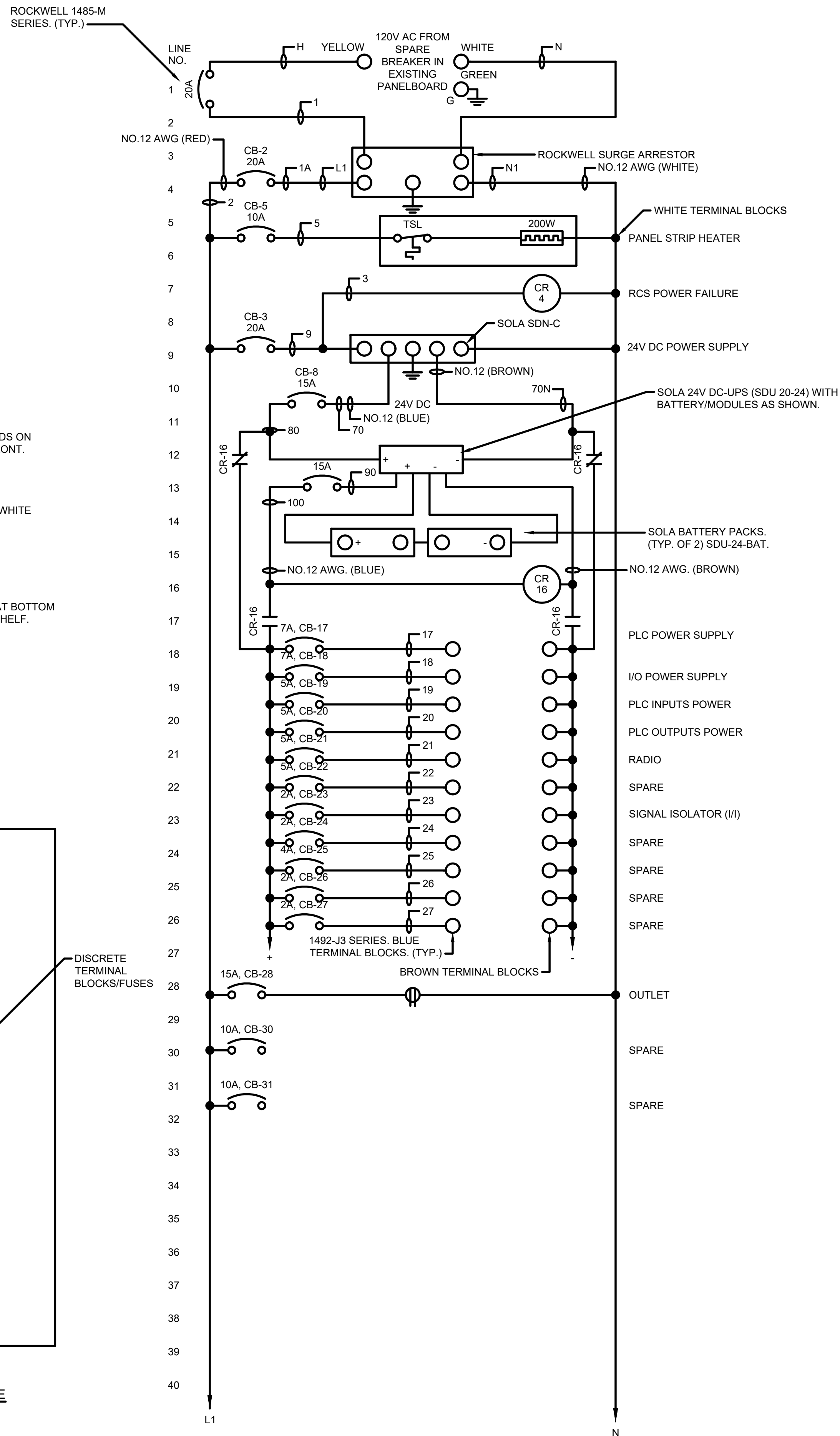


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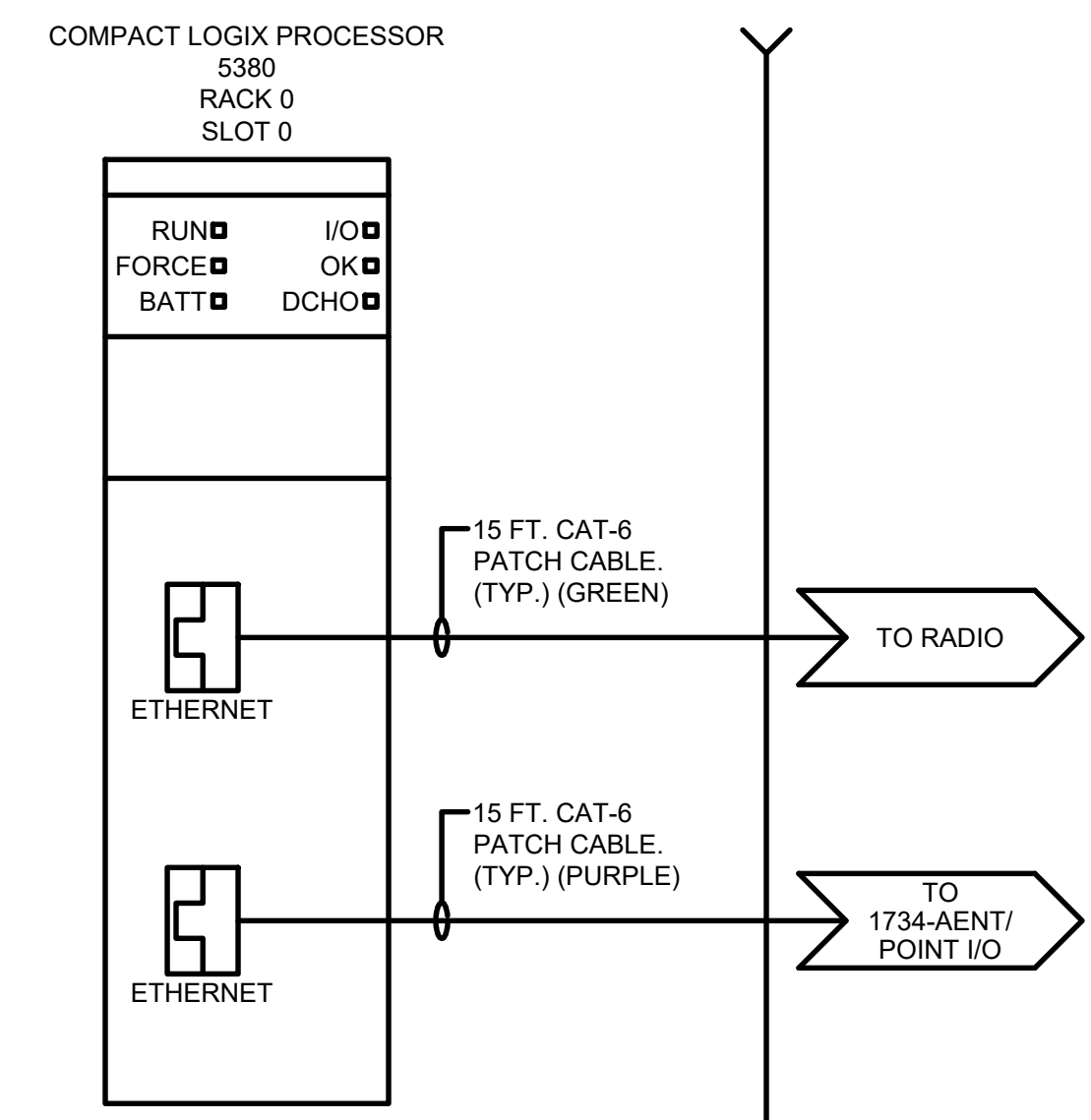
RIGHT SIDE

GENERAL SUBPLATE LAYOUT

PAINT INSIDE: GLOSS WHITE.
NOTE: NOT ALL SUBPLATE DEVICES ARE SHOWN.
SEE WIRING DIAGRAMS FOR ADDITIONAL REQUIREMENTS, (TYP.)



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ANN ARBOR, MI 48108
PHONE: (734) 665-6000 FAX: (734) 213-3003

BY	
MARK	DESCRIPTION
DATE	

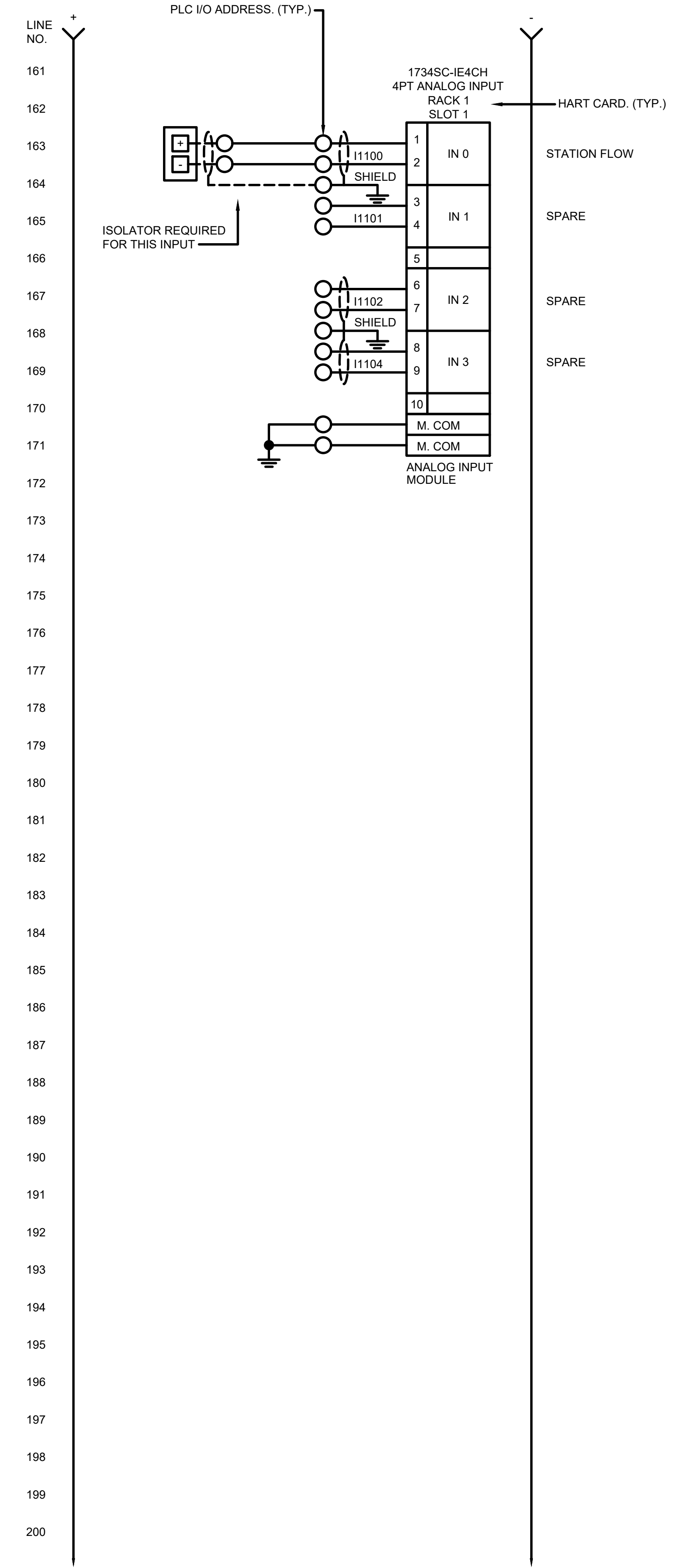
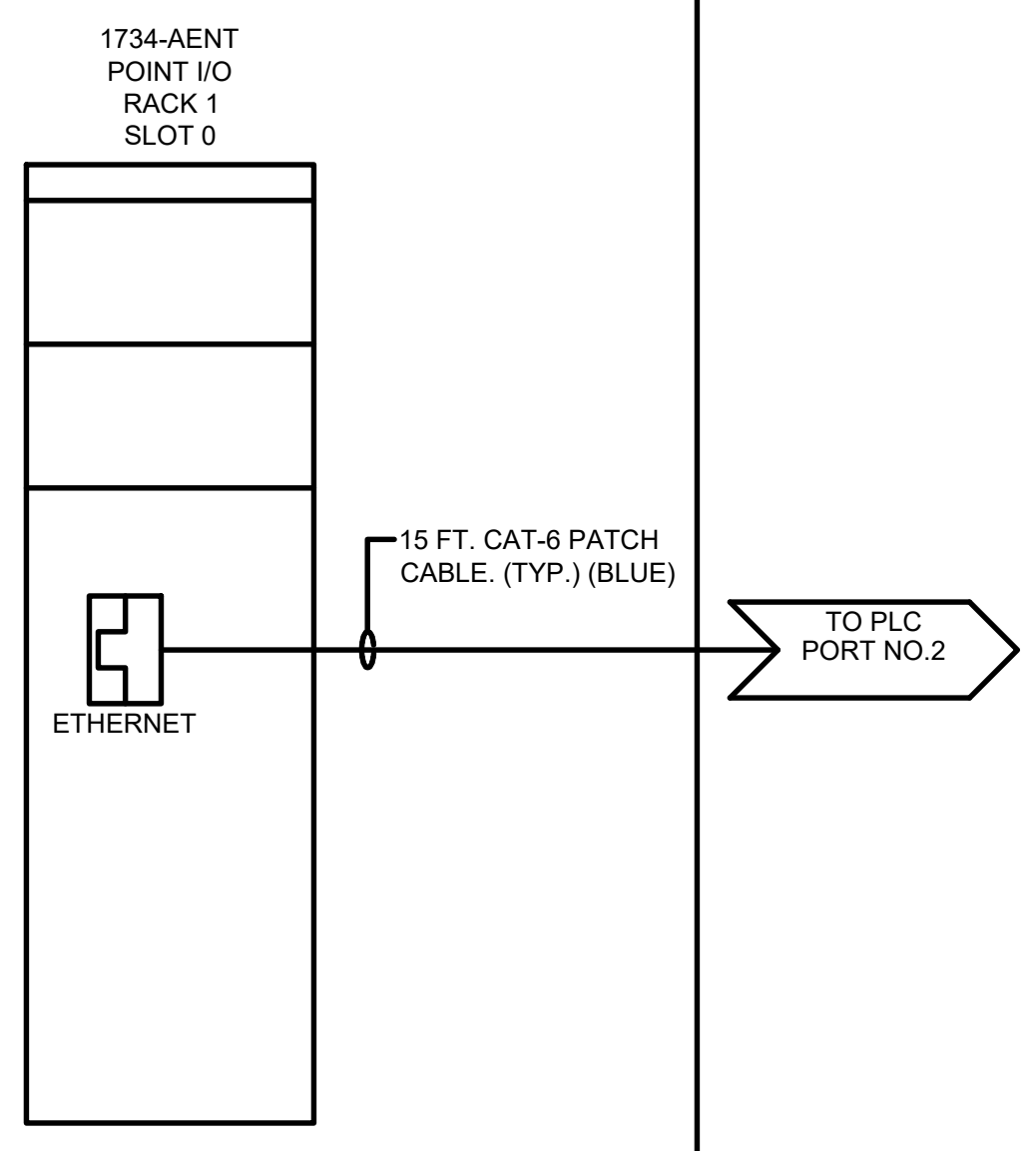
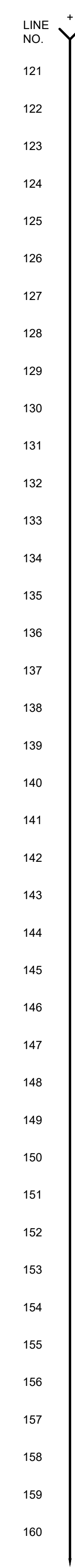
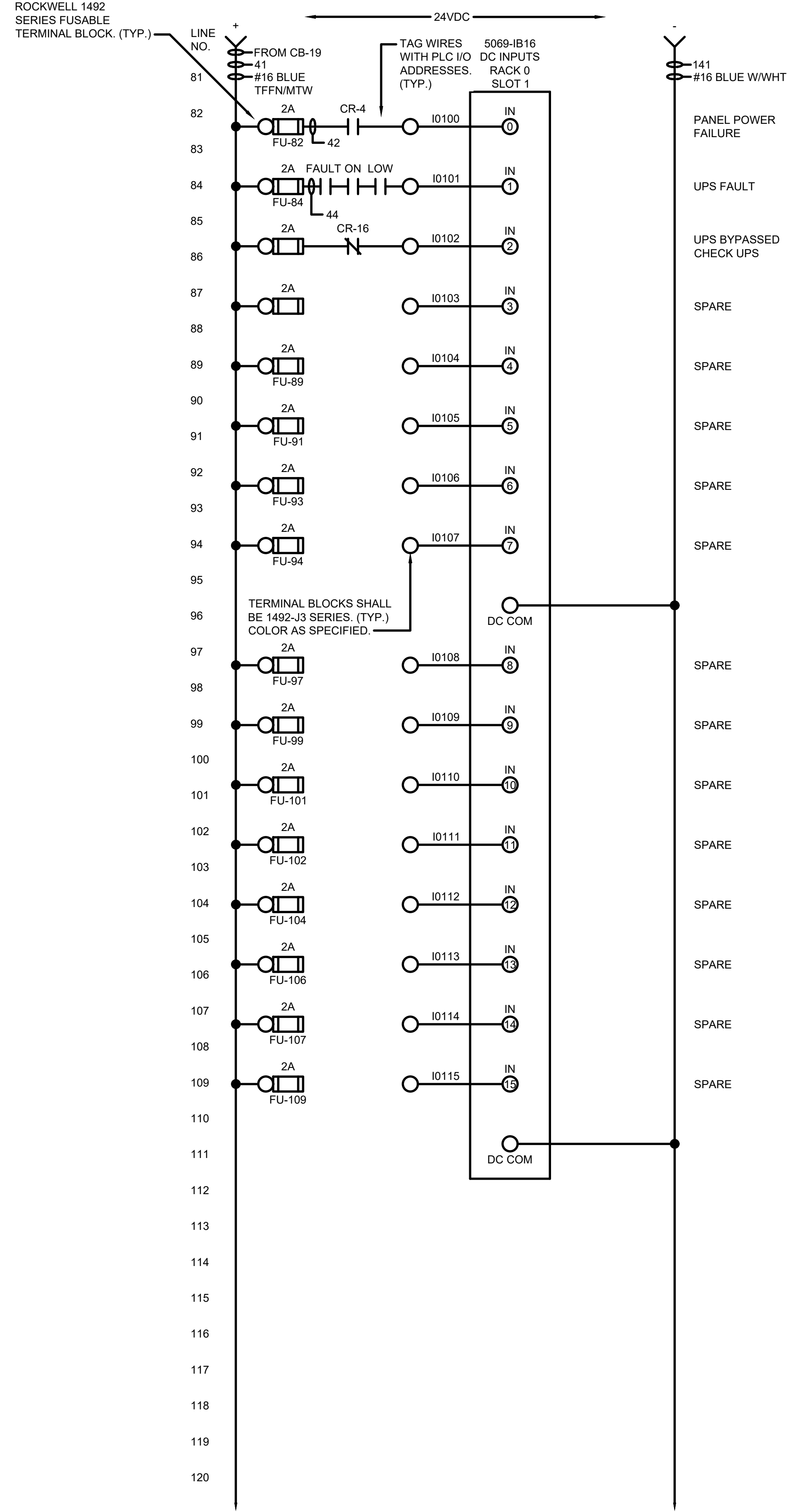
CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
**SOUTH COUNTY CONTROL PANEL
LAYOUT, WIRING DIAGRAM**

Project No.: 200-19743-21003
Designed By: G.C.J.
Drawn By: J.L.S.
Checked By: M.S.J./G.C.J.

15
OF 40
Bar Measures 1 inch

Copyright: Tetra Tech

4/27/2022 12:41:12 PM - \\ITT.LOCAL\IERPROJECTS\ANN ARBOR\IER\19743\200-19743-2\1003\CAD\SHEETFILES\METERING\16_SOUTH COUNTY_PANEL WIR DIAG.DWG - SHANK, JASON

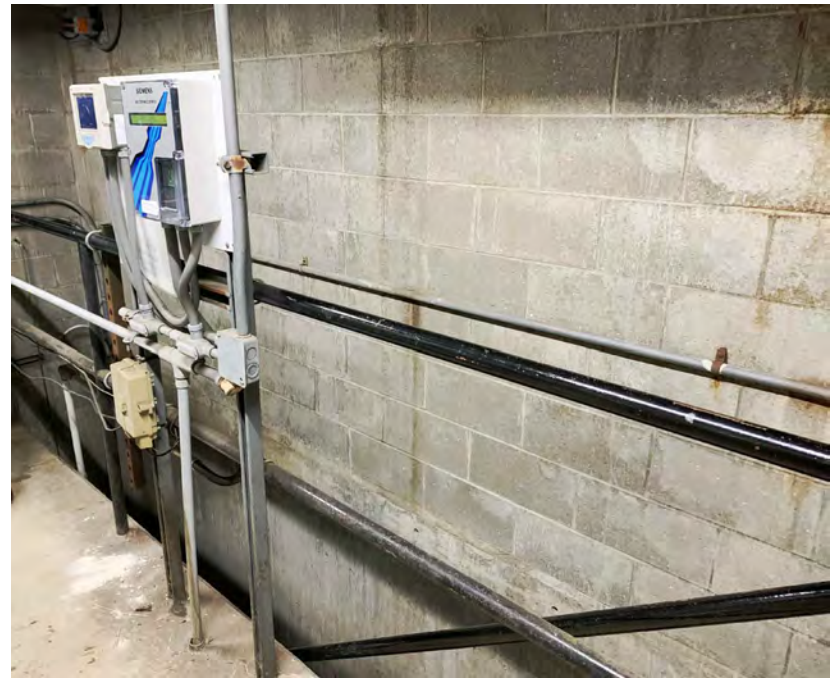


MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
**SOUTH COUNTY CONTROL PANEL
WIRING DIAGRAM**

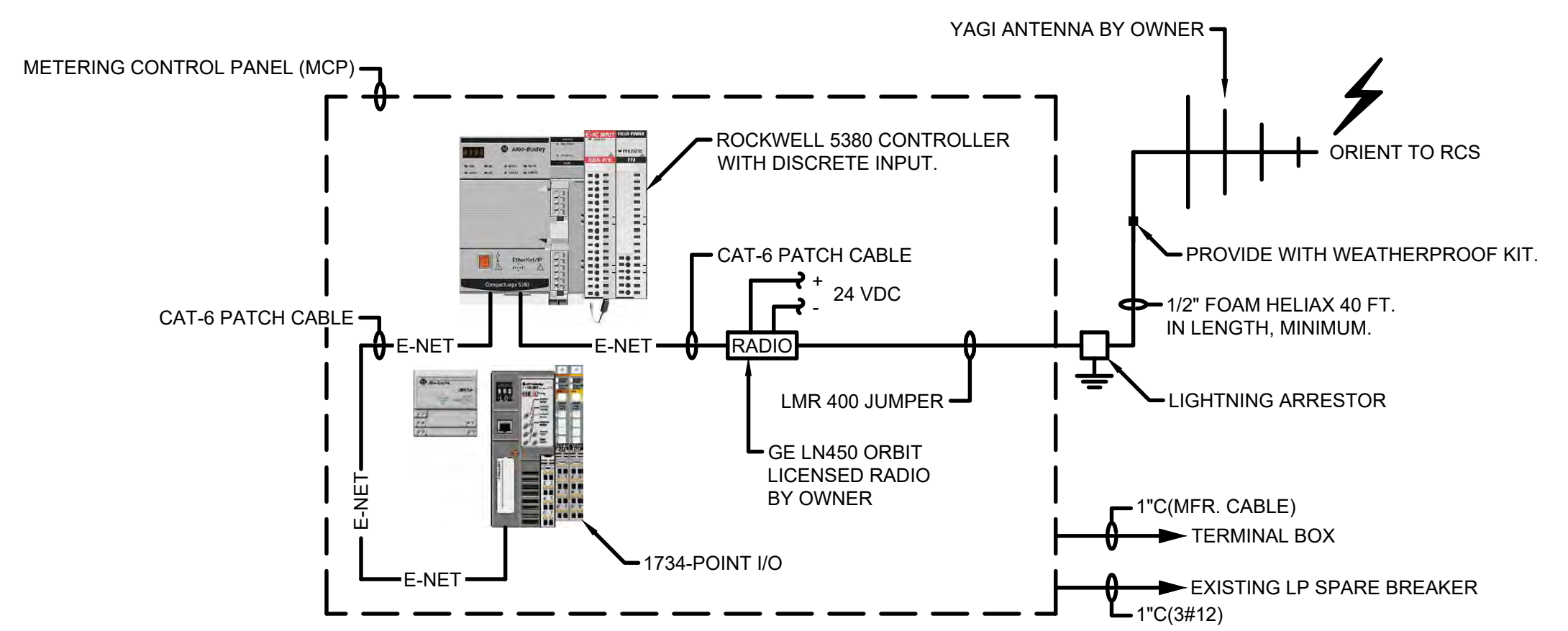
Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

4/27/2022 12:43:35 PM - \\T:\LOCAL\PROJECTS\ANN ARBOR\19743-21003\CAD\3\SHEET\METERING\17_PFIZER_ONE_LINE_DETAILS.DWG - SHANK, JASON

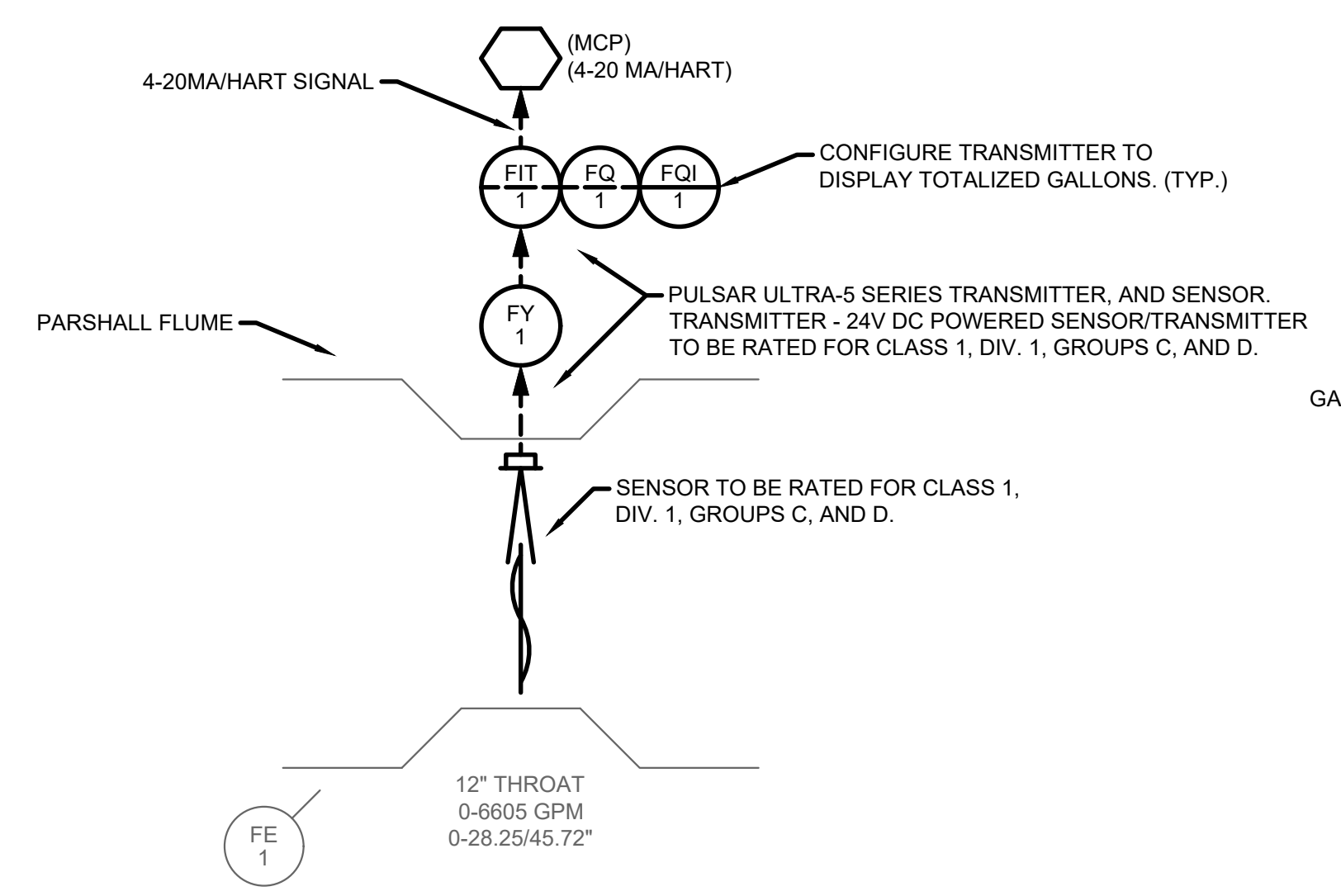


STATION PHOTOS

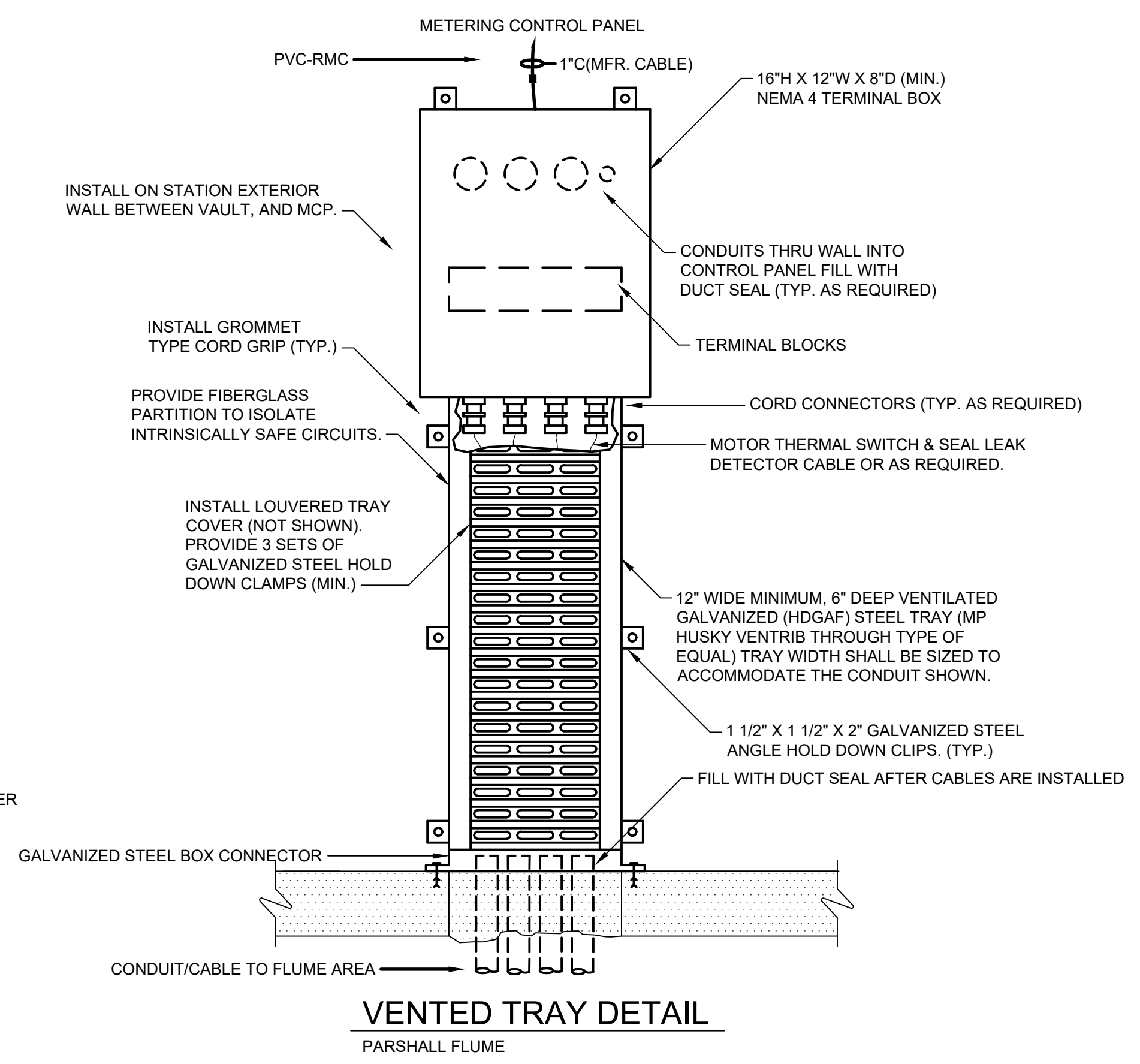
CONDUIT FROM FLUME AREA TO ENTER VENTED TRAY FIRST.



SYSTEM CONFIGURATION DRAWING
NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRATECH.



PARTIAL P&ID DIAGRAM



VENTED TRAY DETAIL
PARSHALL FLUME

NOTES:

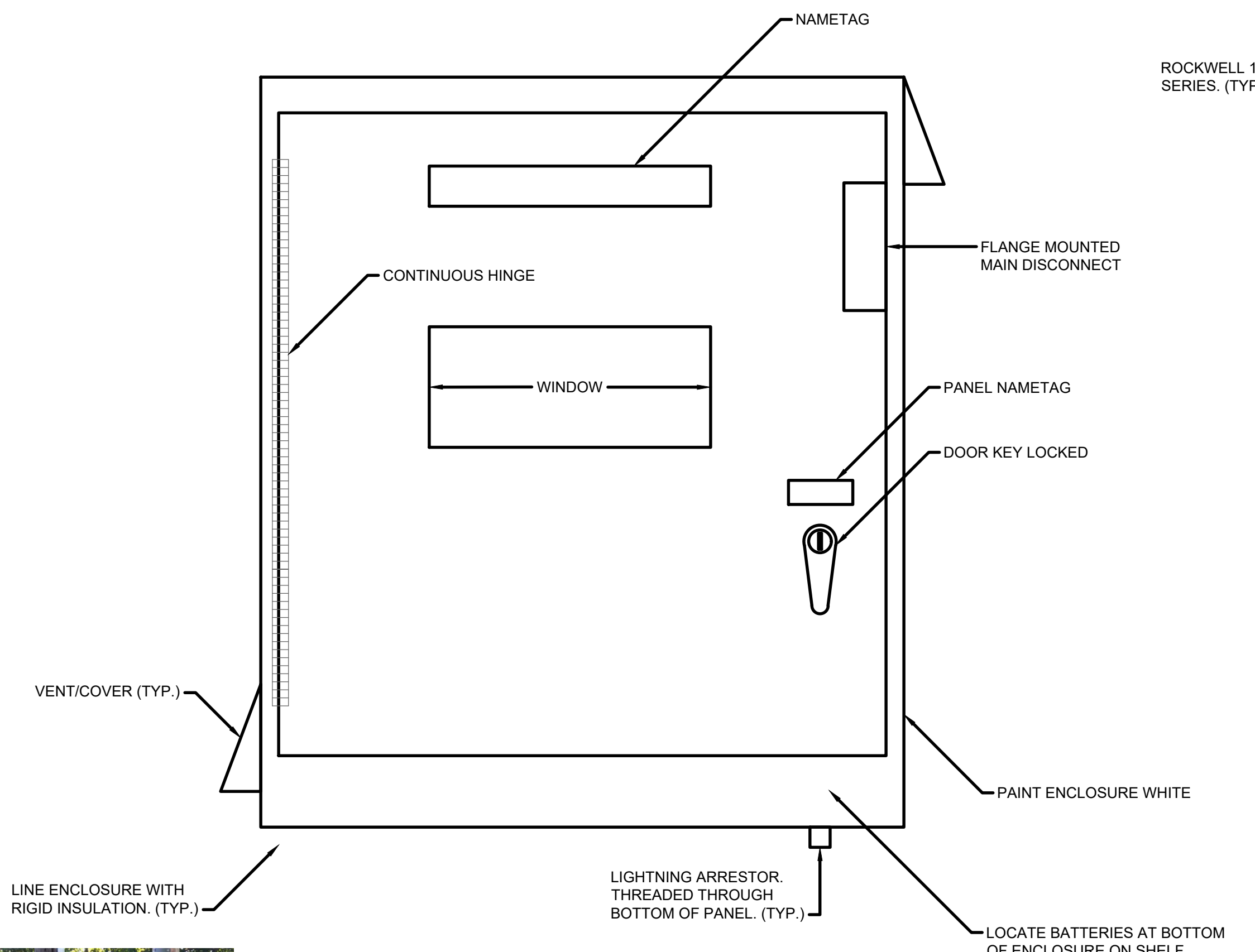
- INSTALL NEW MCP WITHIN EXISTING FLOW METERING BUILDING. MOUNT OFF EXISTING HANDRAIL. DEMOLISH THE EXISTING MILLETRONICS FLOW TRANSMITTER AND SENSOR. PROVIDE A 1 INCH CONDUIT WITH #12 WIRES AND POWER NEW MCP FROM EXISTING PANELBOARD. LABEL SPARE BREAKER IN PANELBOARD WITH NEW MCP DESIGNATION.
- MOUNT THE NEW PULSAR FLOW TRANSMITTER INSIDE THE EXISTING METERING CABINET. POWER FROM 24VDC POWER SUPPLY IN NEW MCP.
- FROM THE NEW MCP, INSTALL THE 1/2 INCH COAXIAL CABLE TO THE NEW YAGI ANTENNA. LOCATE NEW ANTENNA ON A NEW 24 FOOT LONG 2 INCH ALUMINUM SCHEDULE 40 MAST PIPE MOUNTED ON THE SIDE OF THE EXISTING FLOW METERING BUILDING. GROUND MAST PIPE WITH NO.6 AWG RHW-USE WIRE. INSTALL TWO GROUND RODS IN YARD AREA NEAR EXISTING FLOW MONITORING BUILDING AND BOND TO MAST PIPE. CONNECT NO.6 WIRE TO GROUNDS RODS.
- TURN OVER EXISTING MILLETRONICS FLOW TRANSMITTER AND SENSOR TO OWNER.
- OBTAIN THE SERVICES OF OUBBIER CALIBRATION SERVICES TO SET UP THE TRANSMITTER, CALIBRATE AND PLACE ON-LINE.
- INSTALL THE NEW FLOW SENSOR IN PLACE OF THE EXISTING MILLETRONICS SENSOR. INSTALL NEW 1 INCH PVC-RMC CONDUIT BETWEEN METERING BUILDING AND FLOW SENSOR VAULT/MANHOLE. ASSUME FOR 50 FEET OF PVC-RMC CONDUIT AND WIRE TO BE INSTALLED. FLOW SENSOR IS IN A NEMA 7 AREA. PROVIDE SEAL FITTINGS AS REQUIRED ON THIS CONDUIT. PROVIDE NEW STAINLESS STEEL MOUNTING HARDWARE FOR INSTALLING SENSOR OVER EXISTING FLUME. FIELD VERIFY CONDUIT ROUTING, AND INSTALLATION PRIOR TO BIDS. CORE HOLES AS REQUIRED TO SUIT CONDUIT INSTALLATION. PATCH BACK TO ORIGINAL CONDITION WITH NON-SHRINK GROUT.

MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
PFIZER METERING STATION ONE-LINES, DETAILS

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MSJ/G.C.J.

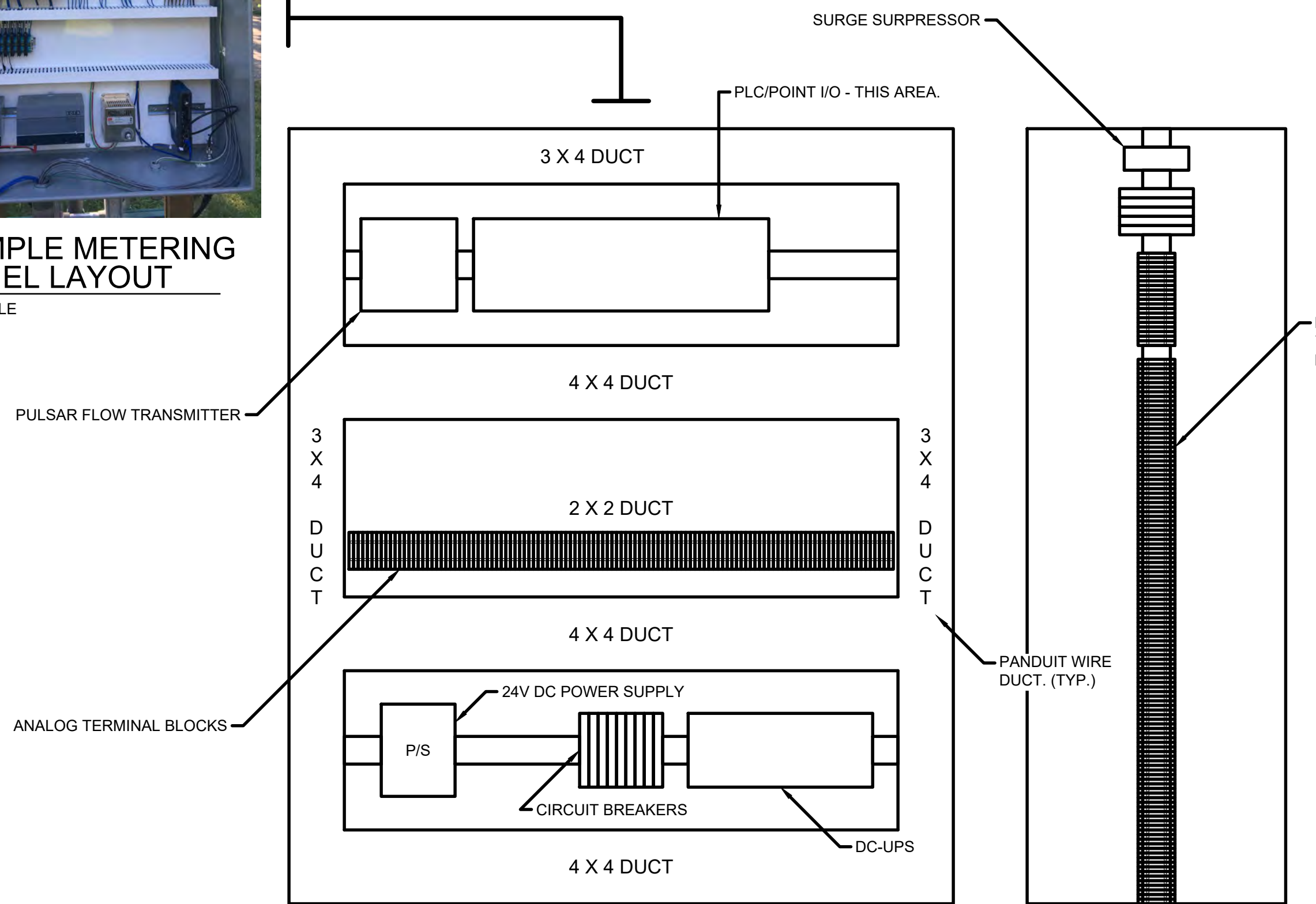
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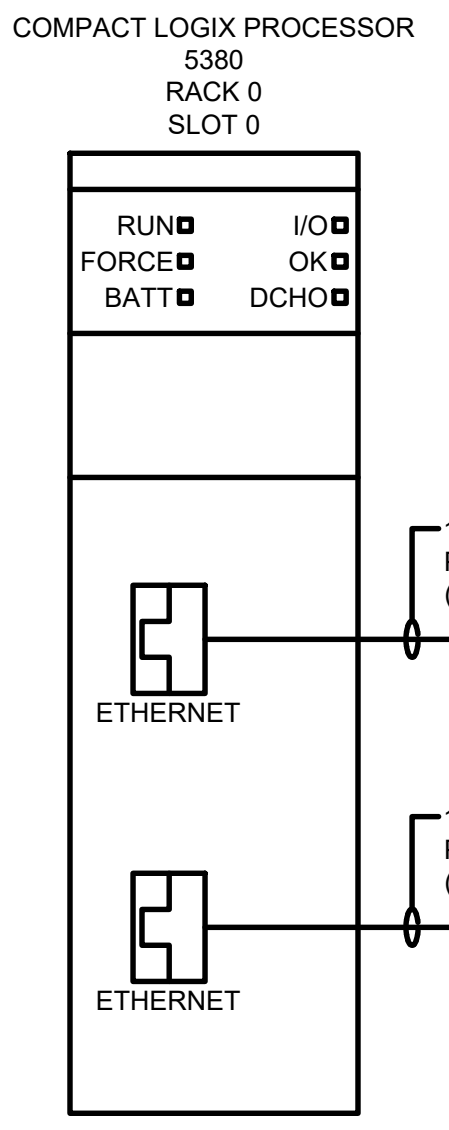
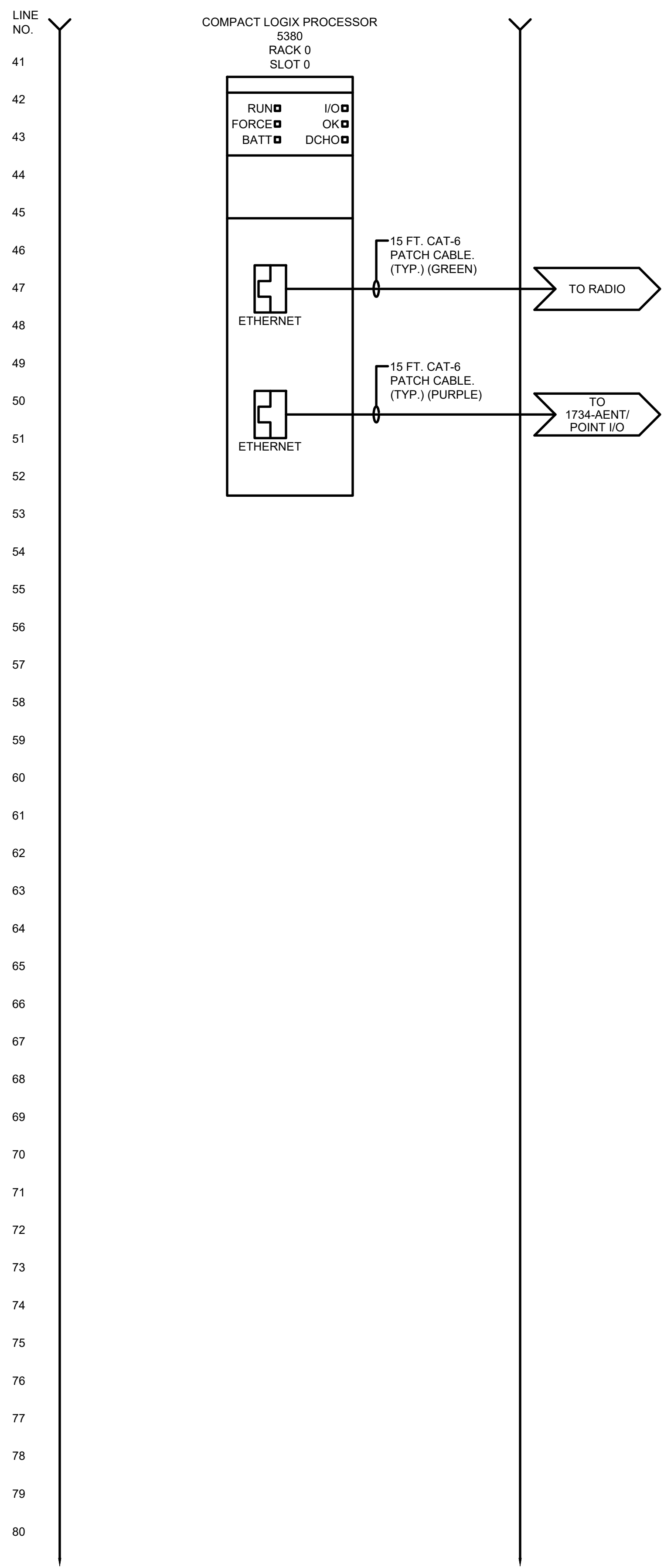
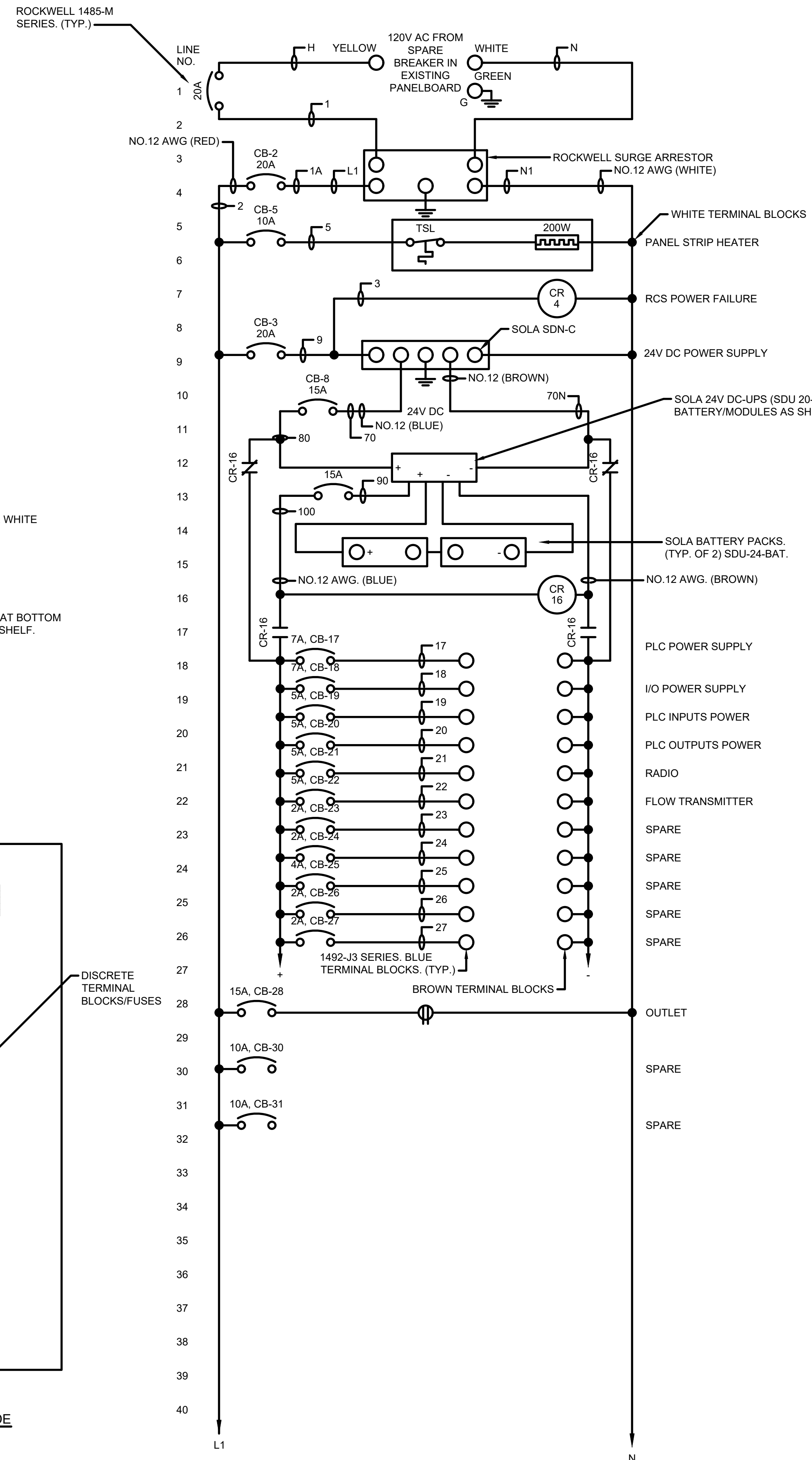
METERING STATION CONTROL PANEL LAYOUT
 NEMA 4 ENCLOSURE
 SIZE: 42"H X 36"W X 12"D (MIN.)
 PANEL TO BE CONSTRUCTED BY A UL LISTED PANEL SHOP.



SAMPLE METERING PANEL LAYOUT
 NO SCALE



GENERAL SUBPLATE LAYOUT
 PAINT INSIDE: GLOSS WHITE.
 NOTE: NOT ALL SUBPLATE DEVICES ARE SHOWN.
 SEE WIRING DIAGRAMS FOR ADDITIONAL REQUIREMENTS, (TYP.)



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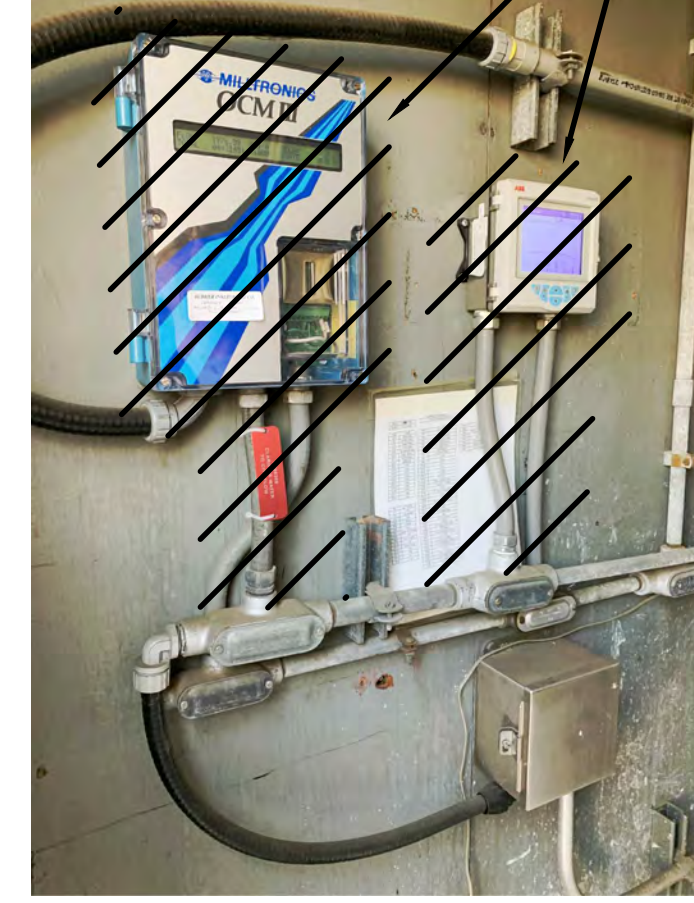
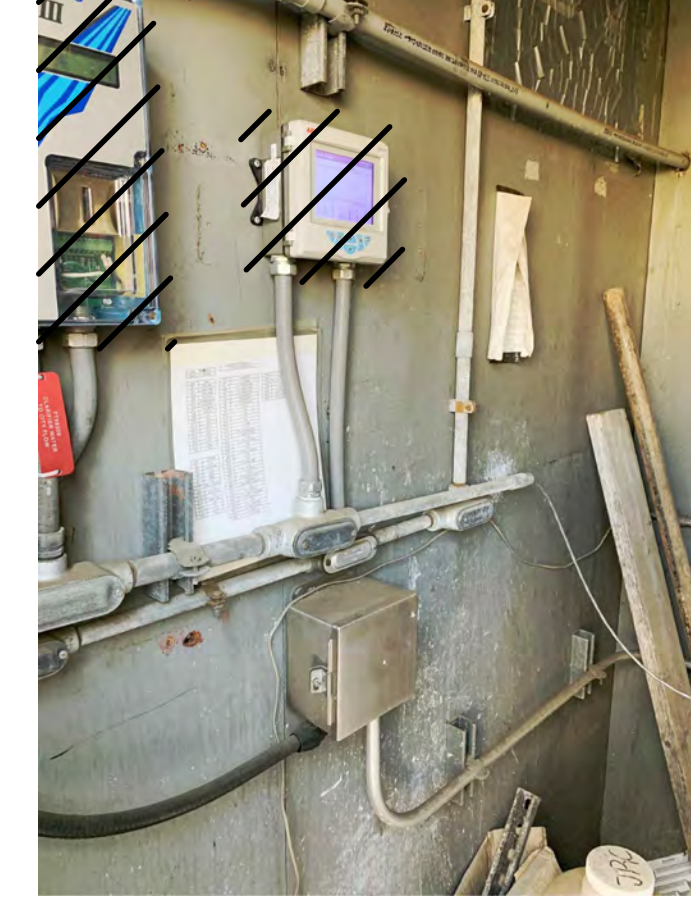
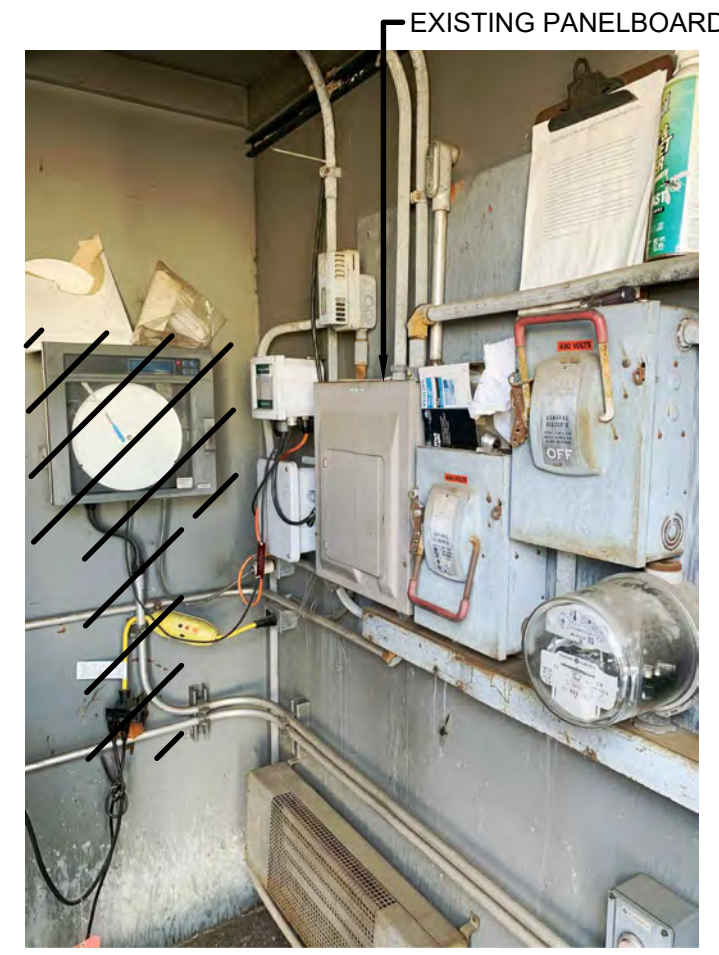
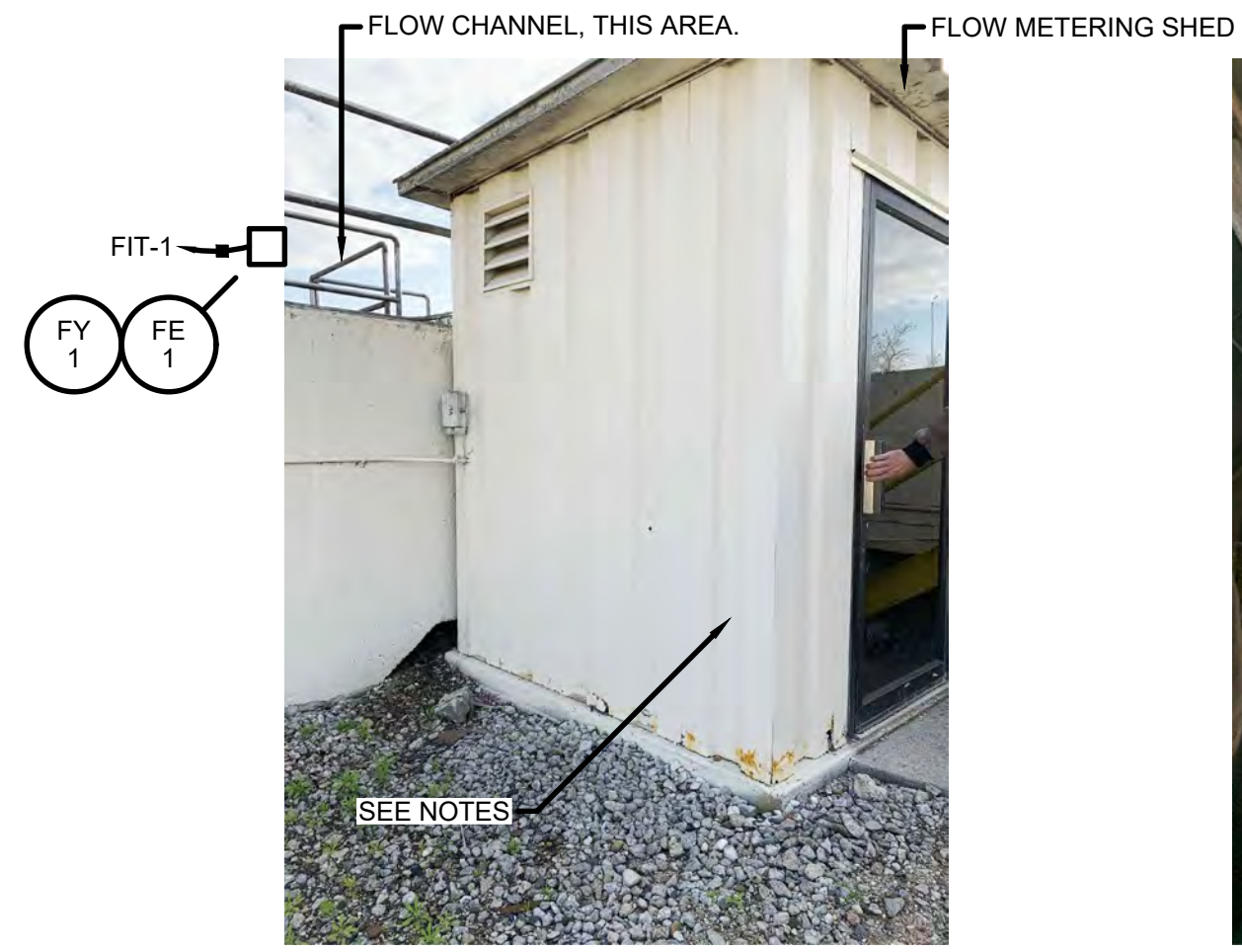
BY	DATE	DESCRIPTION

**CITY OF KALAMAZOO, MICHIGAN
 METERING STATIONS CONTROL UPGRADES
 PFIZER CONTROL PANEL
 LAYOUT, WIRING DIAGRAM**

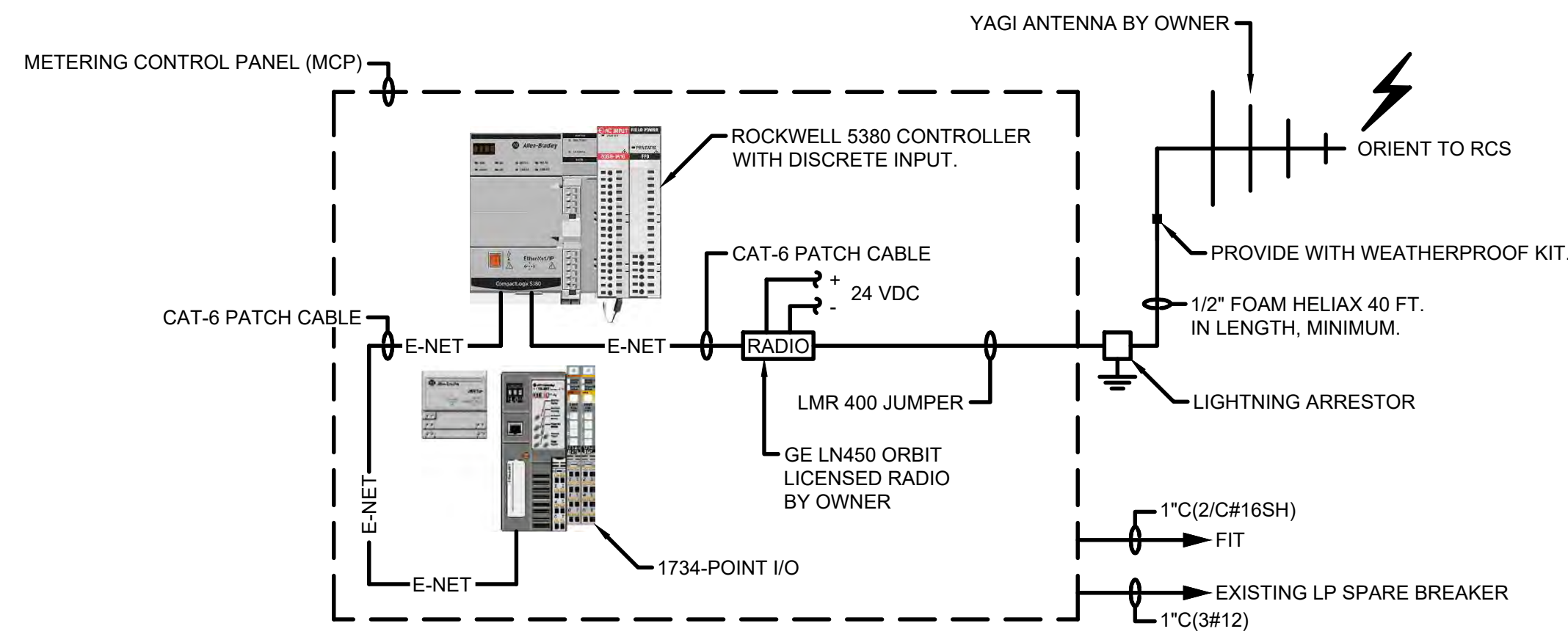
Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MSJ/G.C.J.

18
 OF 40
 Copyright: Tetra Tech
 Bar Measures 1 inch

4/27/2022 12:47:49 PM - \\TIT.LOCAL\PROJECTS\ANN ARBOR\IER19743\200-19743-2\1003\CAD\SHETS\METERING\20_GRAPHICS PACKAGING_ONELINE_DETAILS.DWG - SHANK, JASON

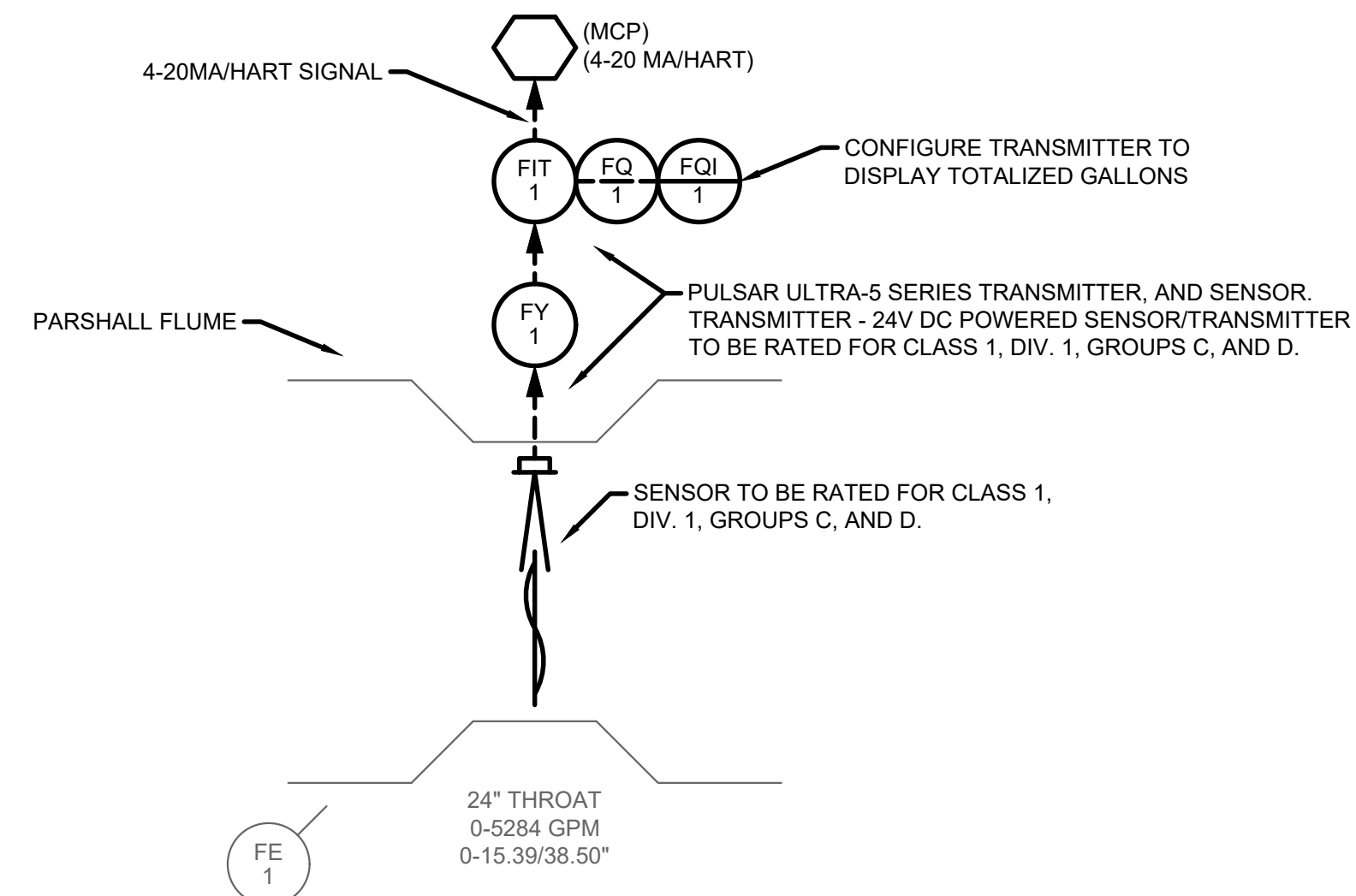


STATION PHOTOS



SYSTEM CONFIGURATION DRAWING

NOTE: PLC/RADIO'S PROGRAMMING BY OWNER/TETRATECH.



PARTIAL P&ID DIAGRAM

NOTES:

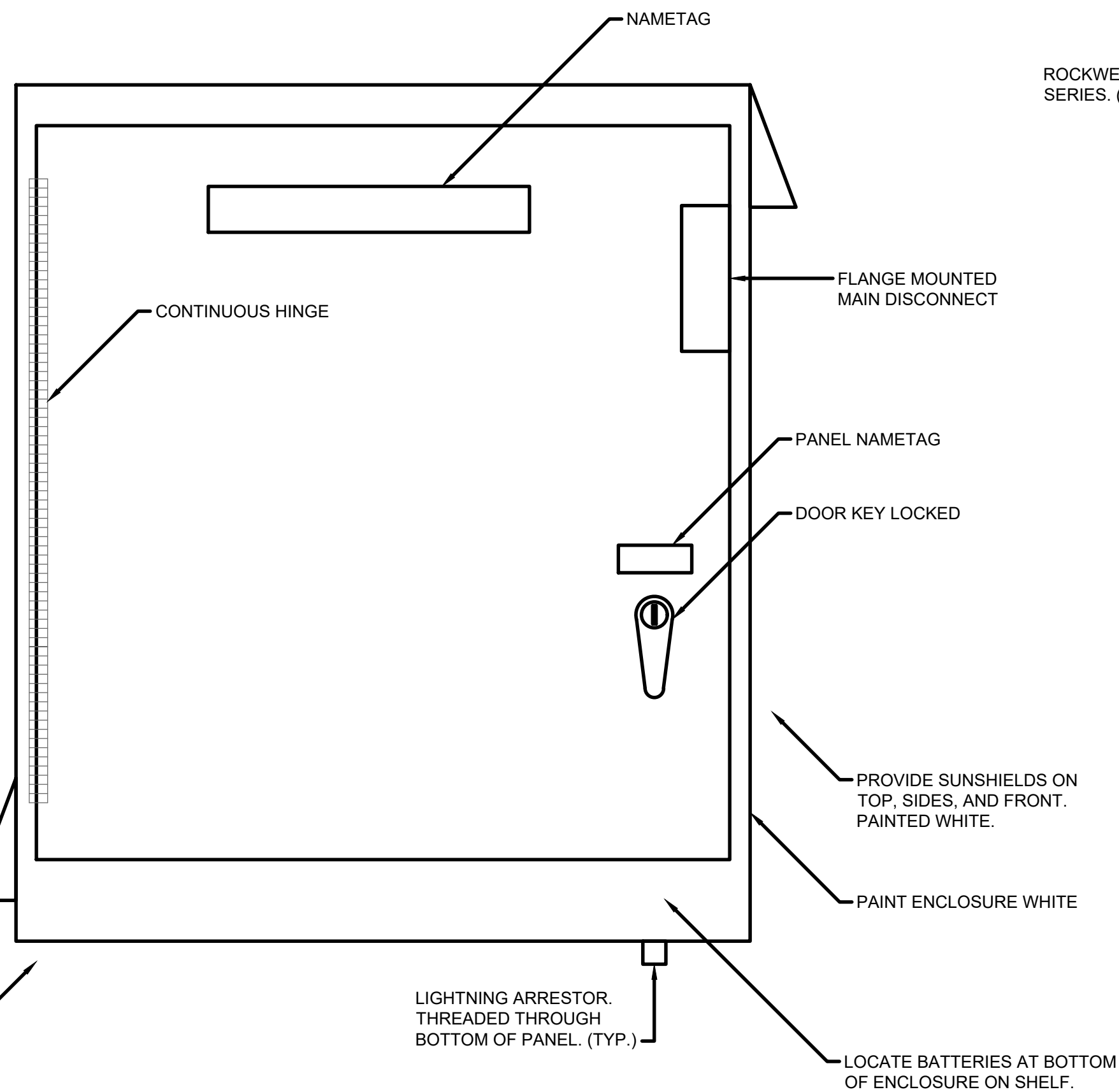
- INSTALL NEW MCP OUTSIDE EXISTING FLOW METERING SHED. PROVIDE A 1 INCH CONDUIT WITH 3#12 WIRES AND POWER FROM EXISTING PANELBOARD. LABEL SPARE BREAKER IN EXISTING PANELBOARD WITH NEW MCP DESIGNATION.
- MOUNT THE NEW PULSAR FLOW TRANSMITTER INSIDE THE EXISTING SHED. POWER FROM 24VDC POWER SUPPLY IN NEW MCP.
- INSTALL A 2 - 1 INCH CONDUITS WITH 3#12 WIRES AND 2/C#18SH CABLE TO THE NEW MCP FROM NEW FLOW TRANSMITTER.
- FROM THE NEW MCP, INSTALL THE 1/2 INCH COAXIAL CABLE TO THE NEW YAGI ANTENNA. LOCATE NEW ANTENNA ON A 24 FOOT LONG 2 INCH SCHEDULE 40 ALUMINUM MAST PIPE MOUNTED ON CONCRETE WALL NEAR EXISTING OUTDOOR METERING SHED. GROUND MAST PIPE WITH NO.6 AWG RHW-USE WIRE. INSTALL TWO GROUND RODS IN YARD AREA NEAR EXISTING FLOW MONITORING BUILDING AND EXTERIOR MOUNTED MCP. CONNECT NO.6 WIRE TO GROUND RODS.
- OBTAIN THE SERVICES OF OUBBIER CALIBRATION SERVICES TO SET UP THE TRANSMITTER, CALIBRATE AND PLACE ON-LINE.
- INSTALL THE NEW FLOW SENSOR IN PLACE OF THE EXISTING MILLETRONICS SENSOR. TURN OVER EXISTING FLOW TRANSMITTER AND SENSOR TO OWNER. INSTALL NEW 1 INCH CONDUIT BETWEEN METERING BUILDING AND FLOW SENSOR. ASSUME FOR 75 FEET OF 2\"/>

MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
**GRAPHICS PACKAGING
METERING STATION
ONE-LINES, DETAILS**

Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

4/27/2022 12:48:44 PM - I:\\T\\LOCAL\\PROJECTS\\ANN ARBOR\\R19743\\200-19743-21003\\CAD\\SHEETFILES\\METERING21_GRAPHICS PACKAGING_PANEL_LAYOUT_WIR.DWG - SHANK, JASON

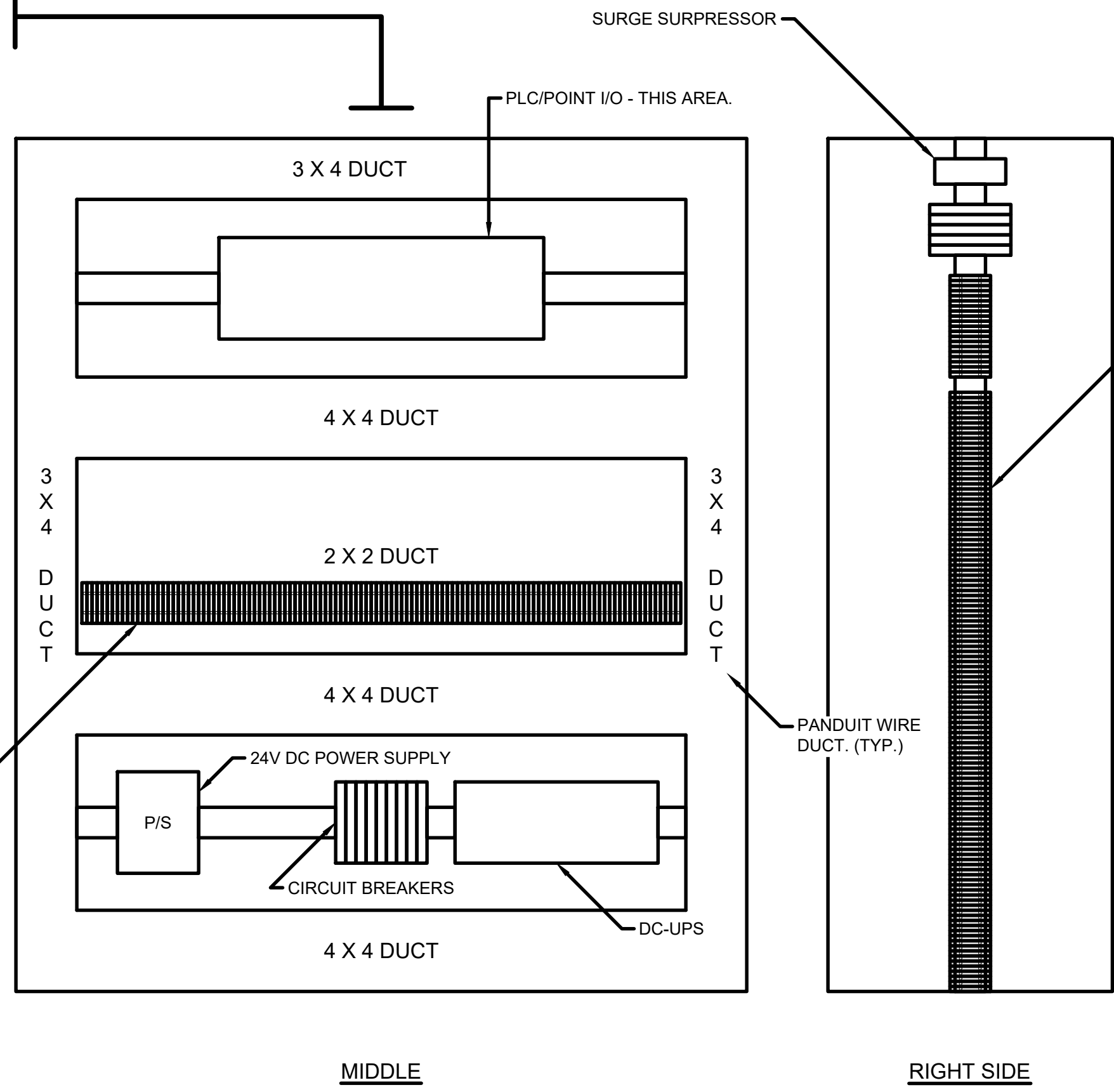


METERING STATION CONTROL PANEL LAYOUT

NEMA 4 ENCLOSURE
 SIZE: 42"H X 36"W X 12"D (MIN.)
 PANEL TO BE CONSTRUCTED BY A UL LISTED PANEL SHOP.

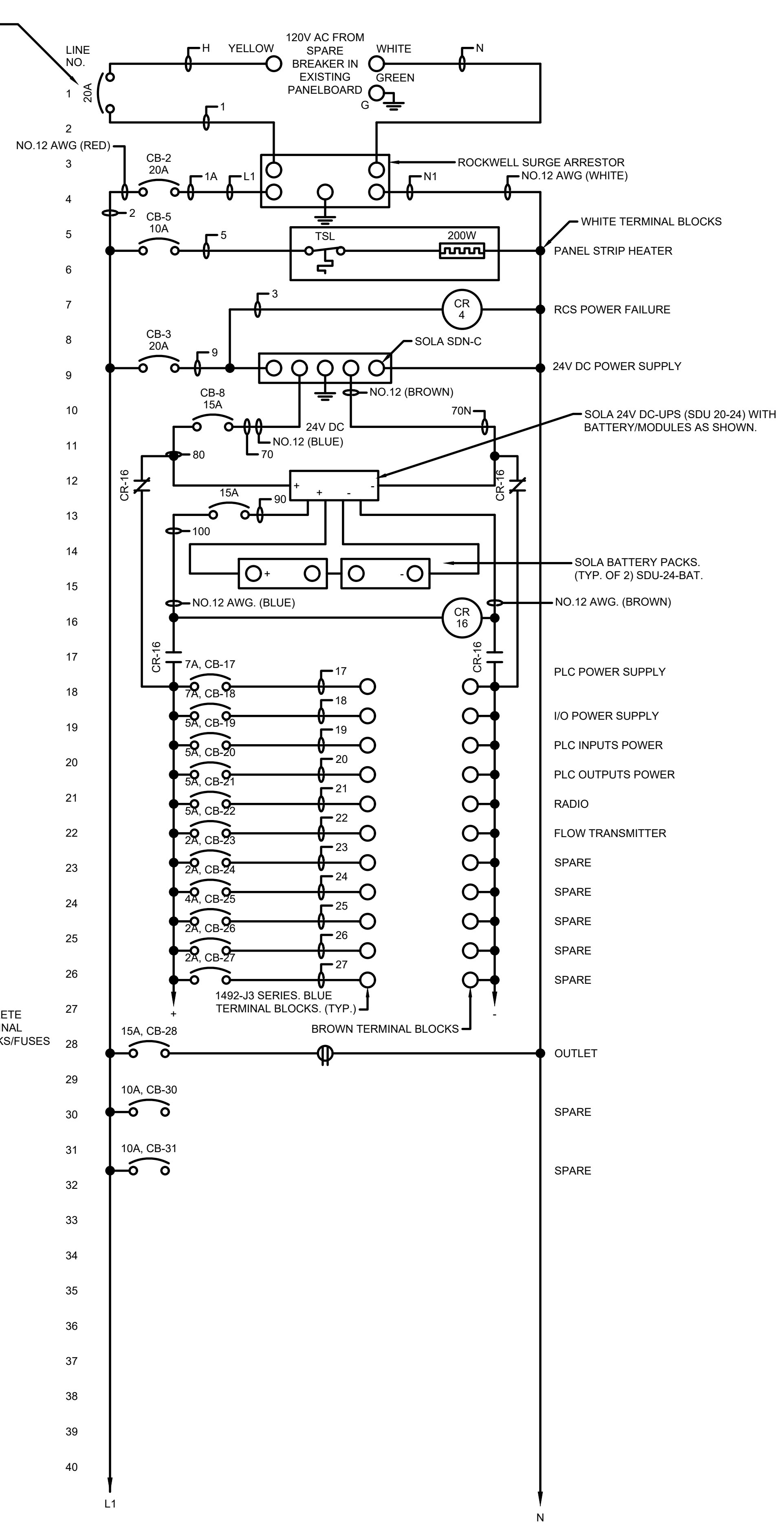


SAMPLE METERING PANEL LAYOUT
 NO SCALE

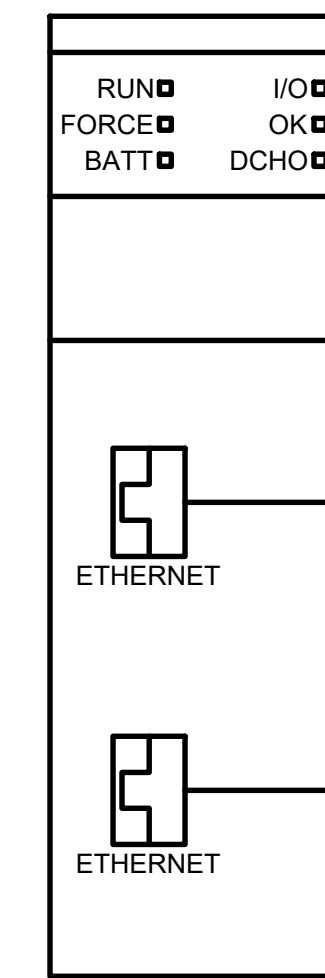


GENERAL SUBPLATE LAYOUT

PAINT INSIDE: GLOSS WHITE.
 NOTE: NOT ALL SUBPLATE DEVICES ARE SHOWN.
 SEE WIRING DIAGRAMS FOR ADDITIONAL REQUIREMENTS. (TYP.)



COMPACT LOGIX PROCESSOR 5380 RACK 0 SLOT 0



15 FT. CAT-6 PATCH CABLE (TYP.) (GREEN)

15 FT. CAT-6 PATCH CABLE (TYP.) (PURPLE)

TO RADIO

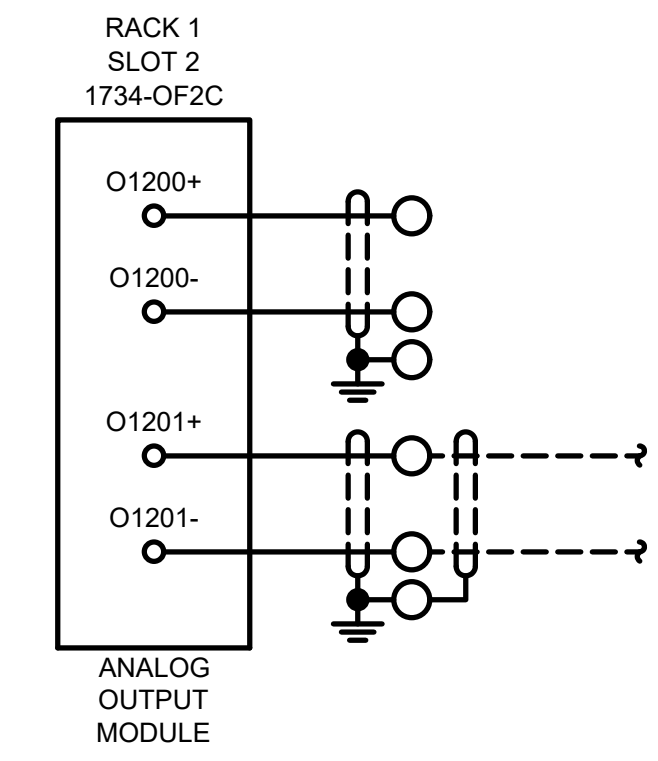
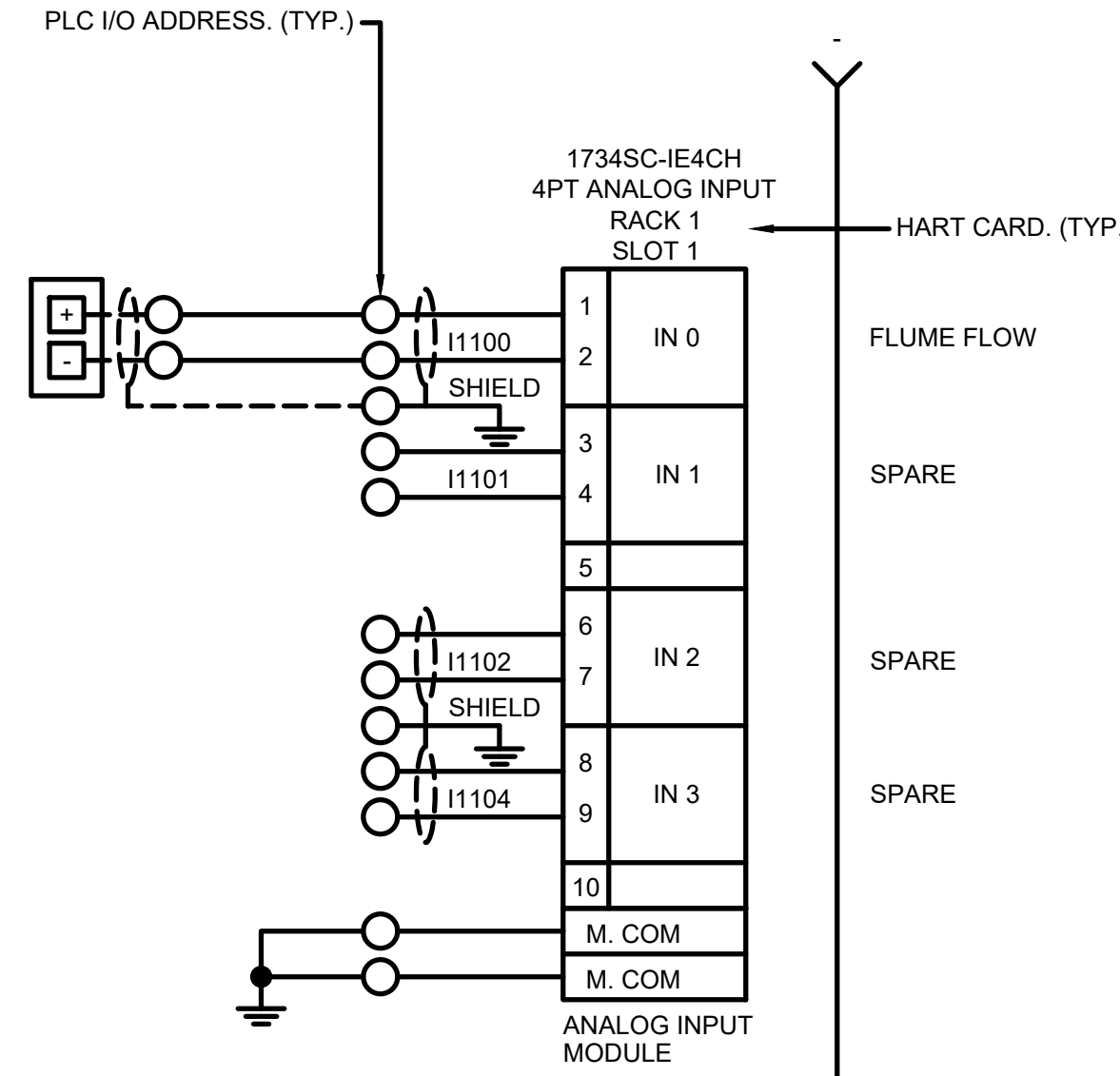
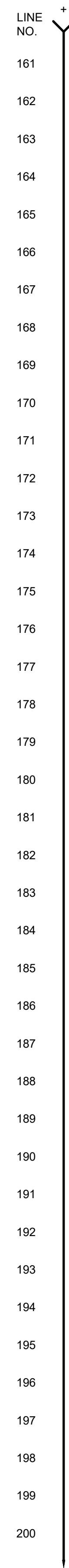
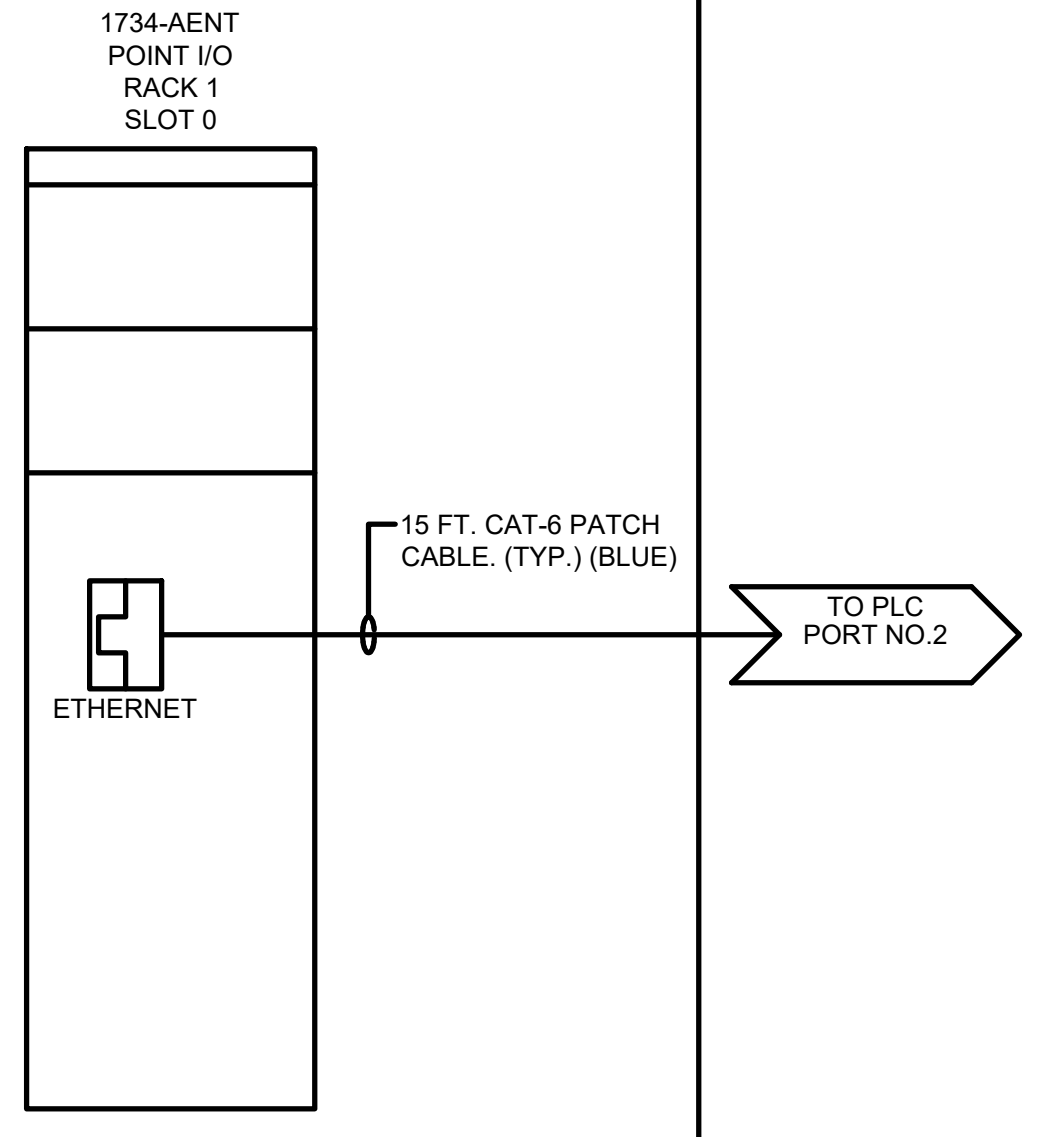
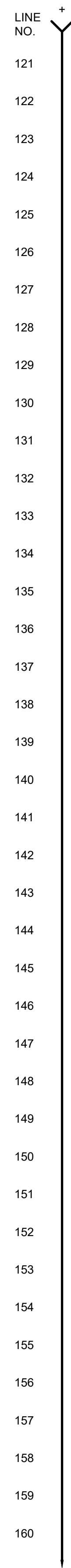
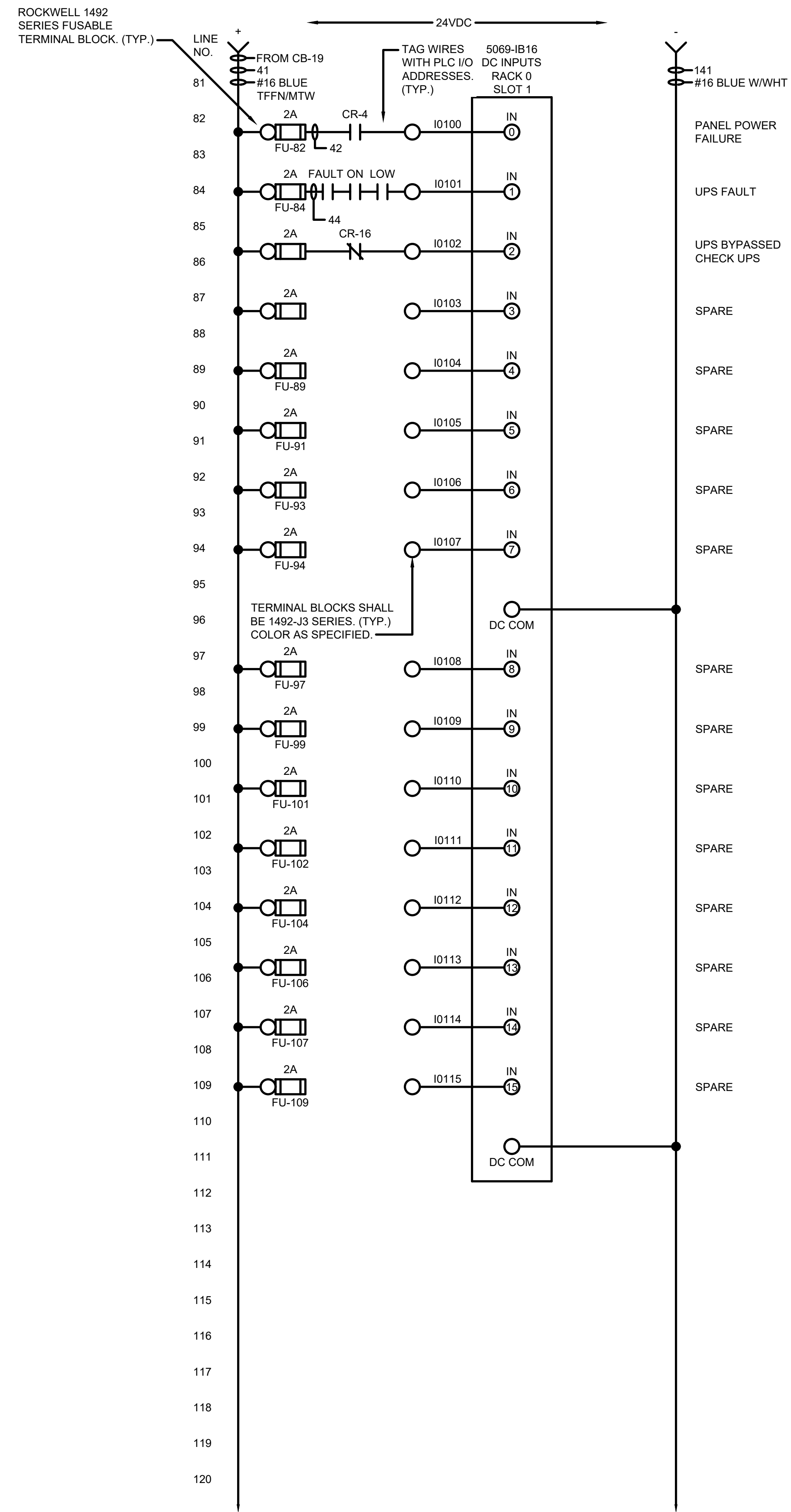
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LINE NO. 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

BY	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
 METERING STATIONS CONTROL UPGRADES
GRAPHICS PACKAGING CONTROL PANEL LAYOUT, WIRING DIAGRAM

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MSJ/G.C.J.



BY	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
GRAPHICS PACKAGING CONTROL PANEL WIRING DIAGRAM

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MS.J/GC.J.

4/27/2022 12:50:47 PM - \\TIT.LOCAL\PROJECTS\ANN ARBOR\19743\200-19743-2\1003\CAD\SHETS\METERING\23_BELLS BREWERY_ONELINE_DETAILS.DWG - SHANK, JASON



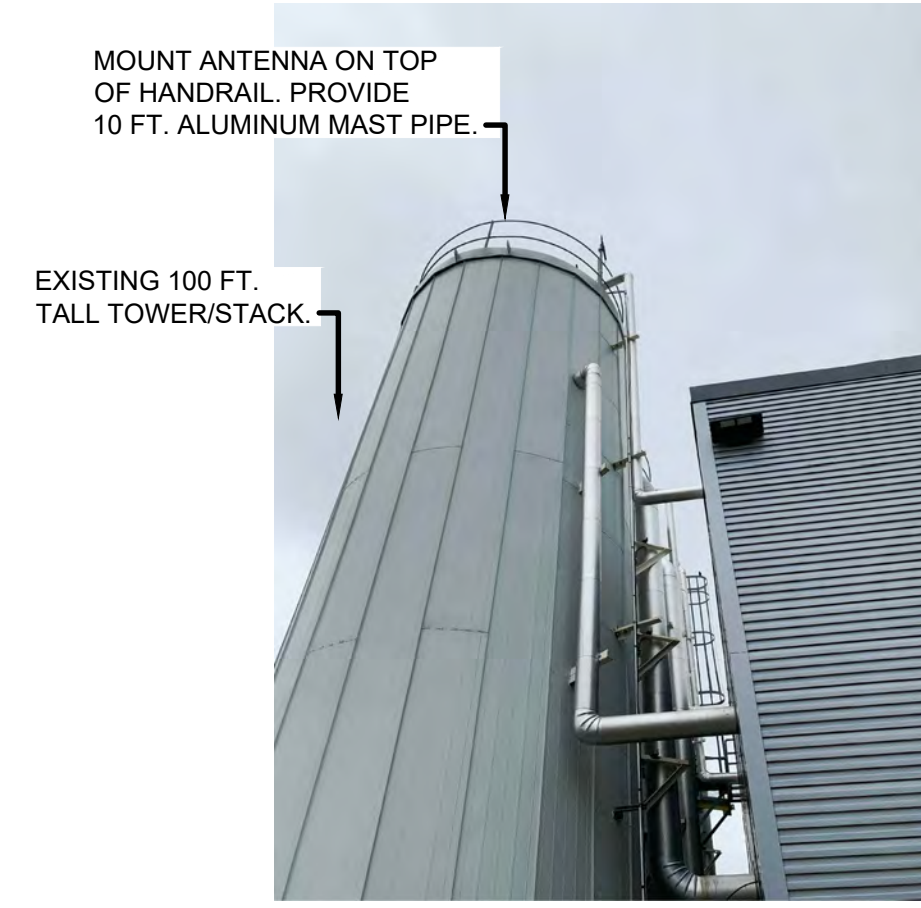
METERING CONTROL PANEL
1" C(2/C#16SH)



METERING CONTROL PANEL
1" C(2/C#16SH)



TRANSMITTER PANEL
DEMOLISH EXISTING PULSAR FLOW TRANSMITTER.

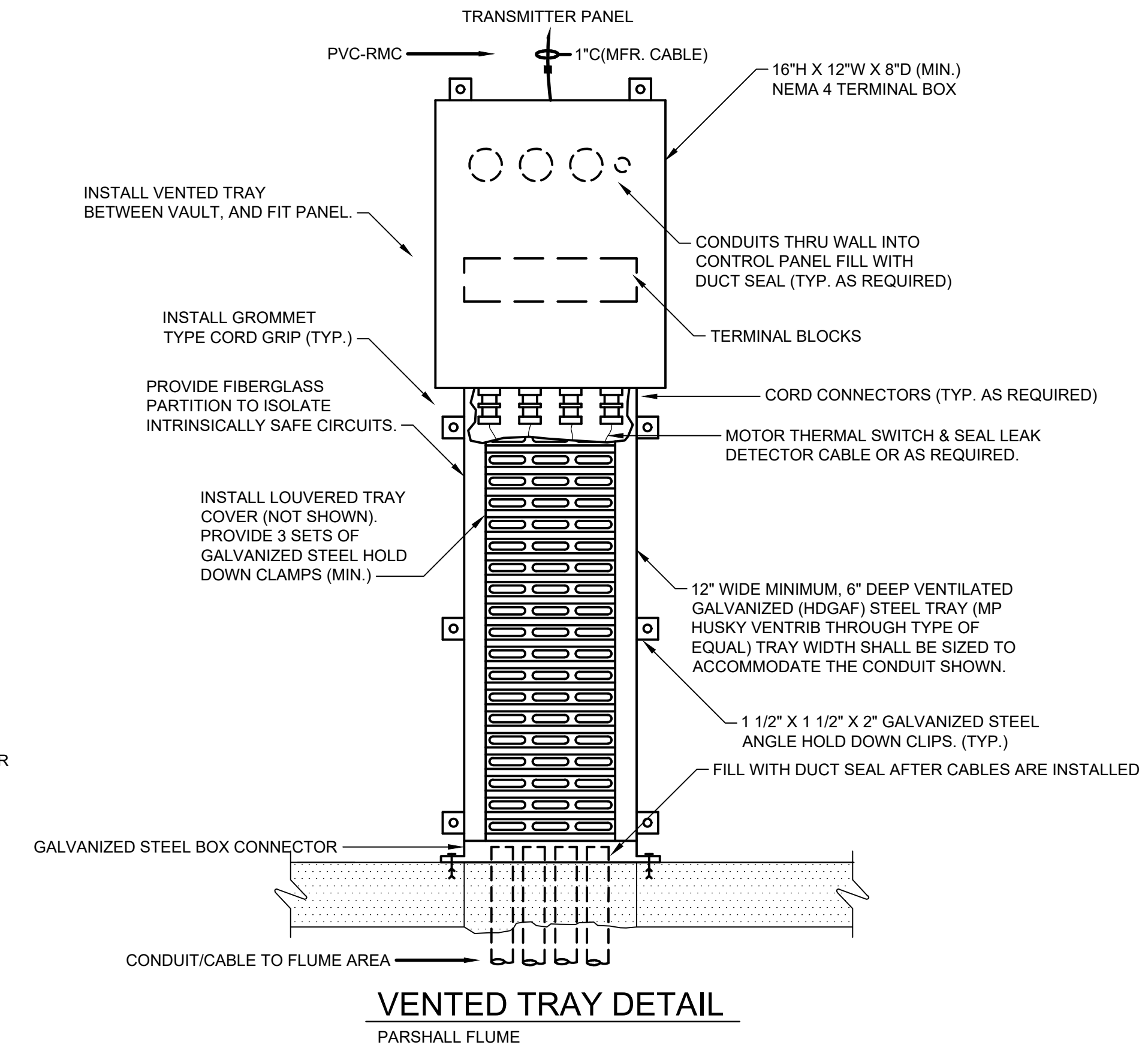
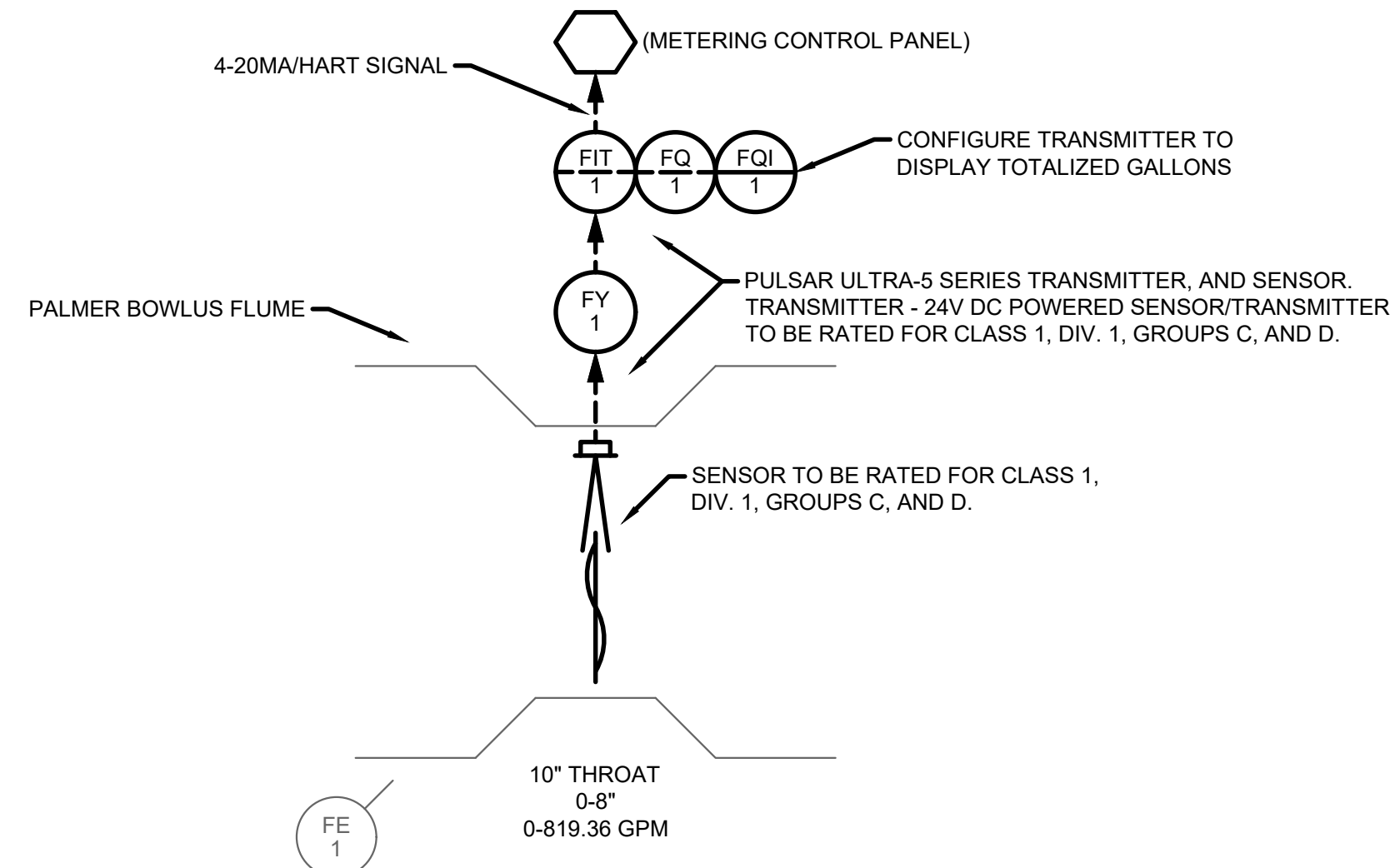
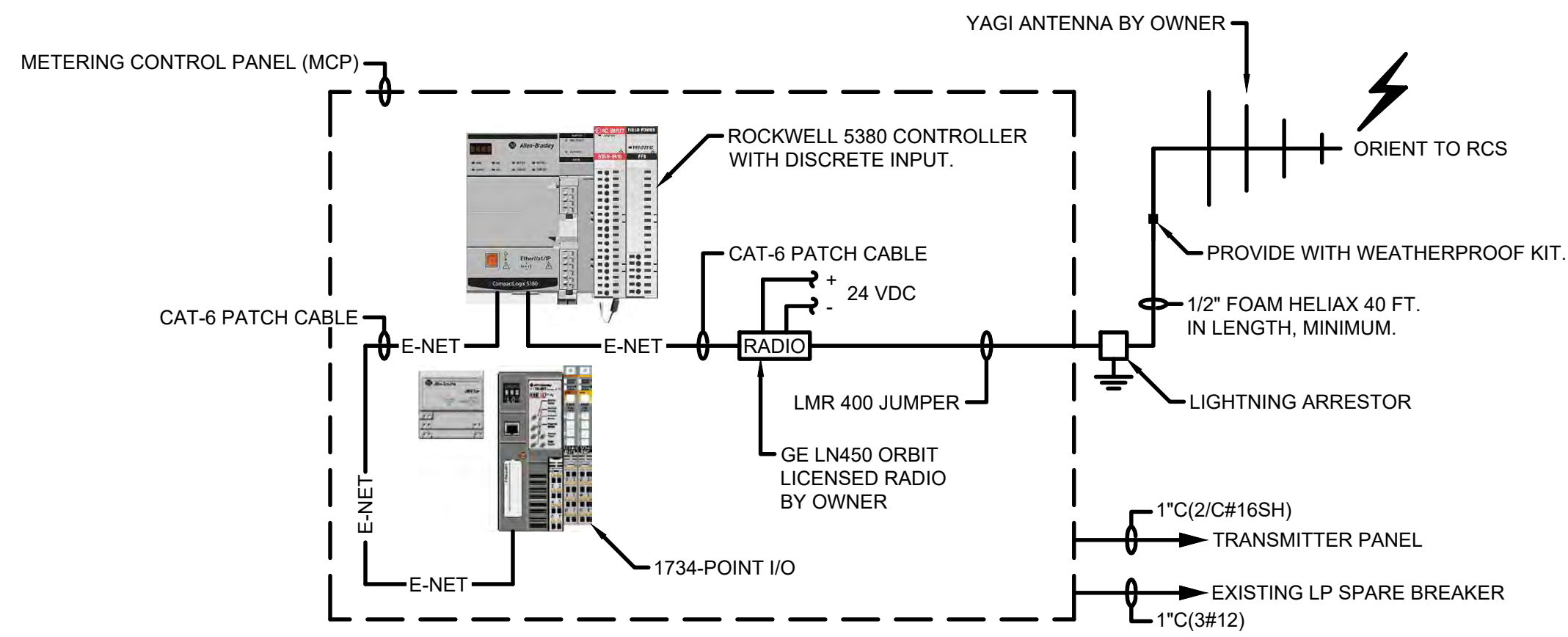


MOUNT ANTENNA ON TOP OF HANDRAIL. PROVIDE 10 FT. ALUMINUM MAST PIPE.

EXISTING 100 FT. TALL TOWER/STACK



STATION PHOTOS



NOTES:

- INSTALL NEW MCP OUTSIDE EXISTING FLOW METERING SHED. PROVIDE A 1 INCH CONDUIT WITH 3#12 WIRES AND POWER FROM EXISTING PANELBOARD. LABEL SPARE BREAKER IN PANELBOARD WITH NEW MCP DESIGNATION. ASSUME FOR 100 FT. OF PVC-RMC CONDUIT TO BE INSTALLED TO EXISTING PANELBOARD.
- MOUNT THE NEW PULSAR FLOW TRANSMITTER INSIDE THE EXISTING METERING CABINET. POWER FROM 24VDC POWER SUPPLY IN NEW MCP.
- INSTALL 2 - 1 INCH PVC-RMC CONDUITS WITH 3#12 WIRES, AND 2/C#18SH CABLE TO THE NEW MCP, FROM THE NEW FLOW TRANSMITTER. ASSUME DISTANCE OF 75 FT. FOR EACH CONDUIT.
- FROM THE NEW MCP, INSTALL THE 1/2 INCH COAXIAL CABLE TO THE NEW YAGI ANTENNA. LOCATE NEW ANTENNA ON TOP OF THE EXISTING OUTDOOR STORAGE TANKS. GROUND MAST PIPE WITH NO.6 AWG RHW-USE WIRE. INSTALL TWO GROUND RODS IN YARD AREA NEAR EXISTING FLOW MONITORING BUILDING AND EXTERIOR MOUNTED MCP. CONNECT NO.6 WIRE TO GROUNDS RODS.
- OBTAIN THE SERVICES OF OUBBIER CALIBRATION SERVICES TO SET UP THE TRANSMITTER, CALIBRATE AND PLACE ON-LINE.

BY	DATE	DESCRIPTION

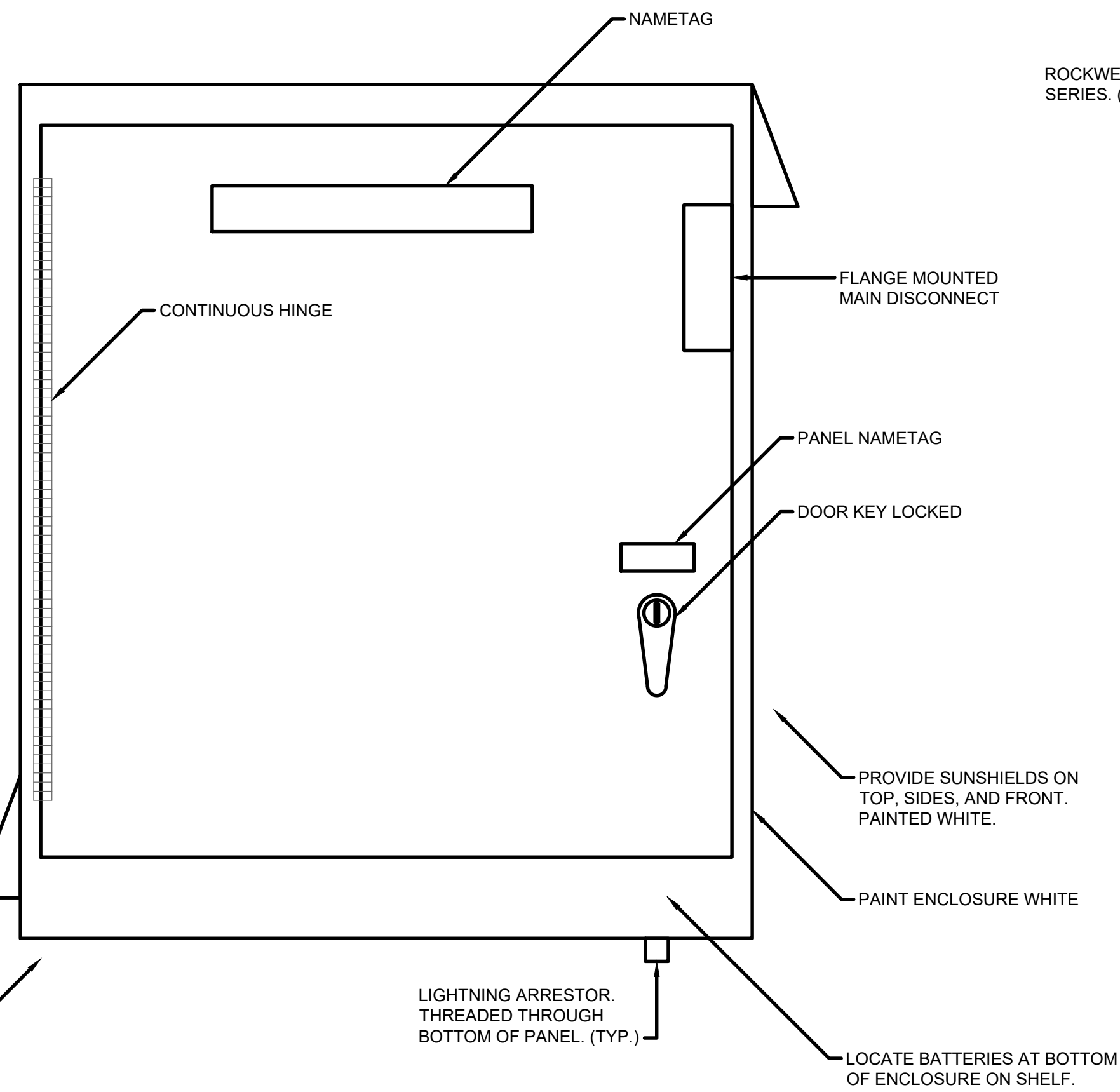
MARK	DATE	DESCRIPTION

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MSJ/G.C.J.

4/27/2022 12:51:47 PM - \\ITT.LOCAL\IER\PROJECTS\ANN ARBOR\IER\19743\200-19743-2\1003\CAD\SH\FILES\METERING\24_BELLS BREWERY_PANEL_LAYOUT_WIR.DWG - SHANK, JASON

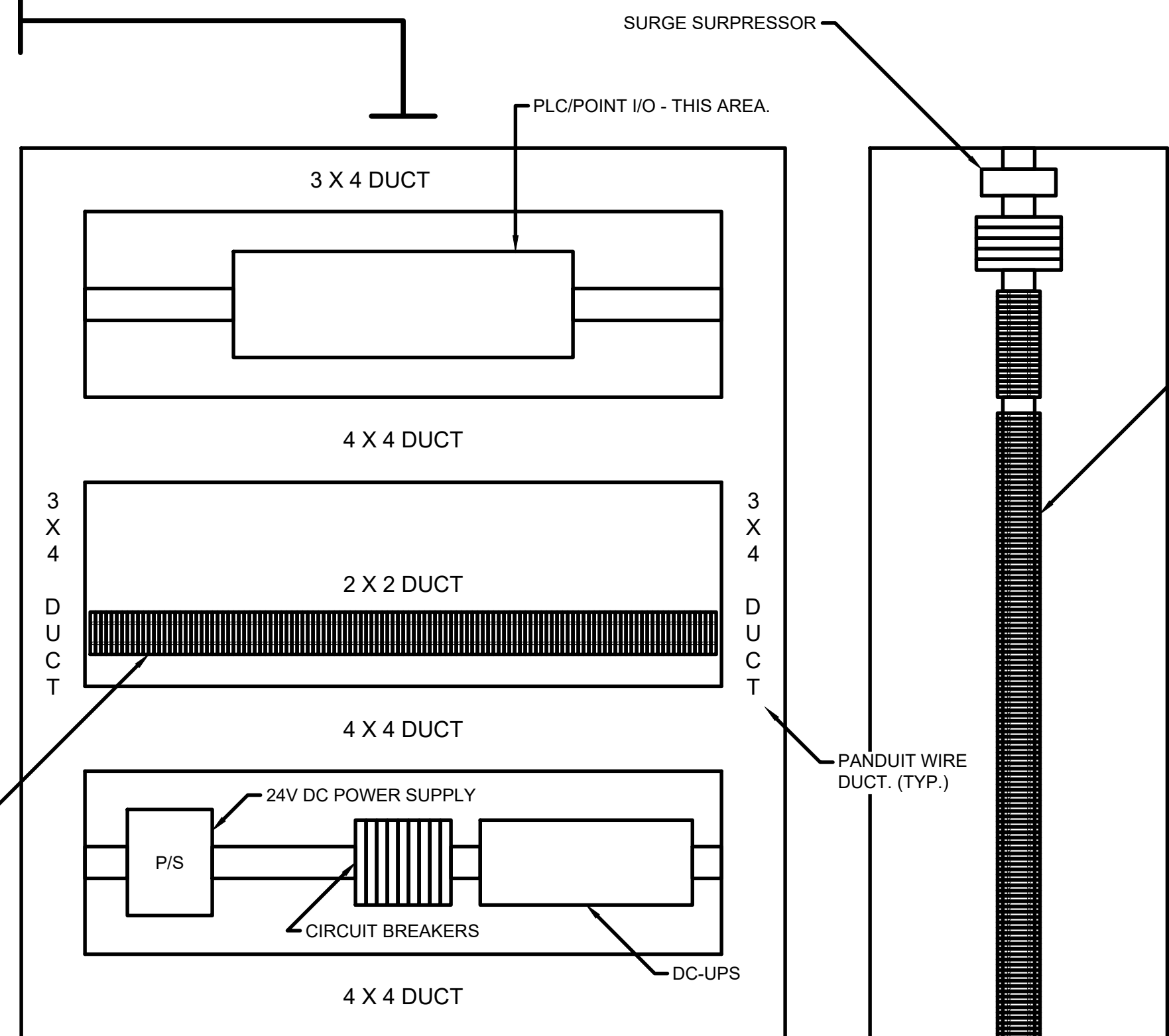


**SAMPLE METERING
PANEL LAYOUT**
NO SCALE



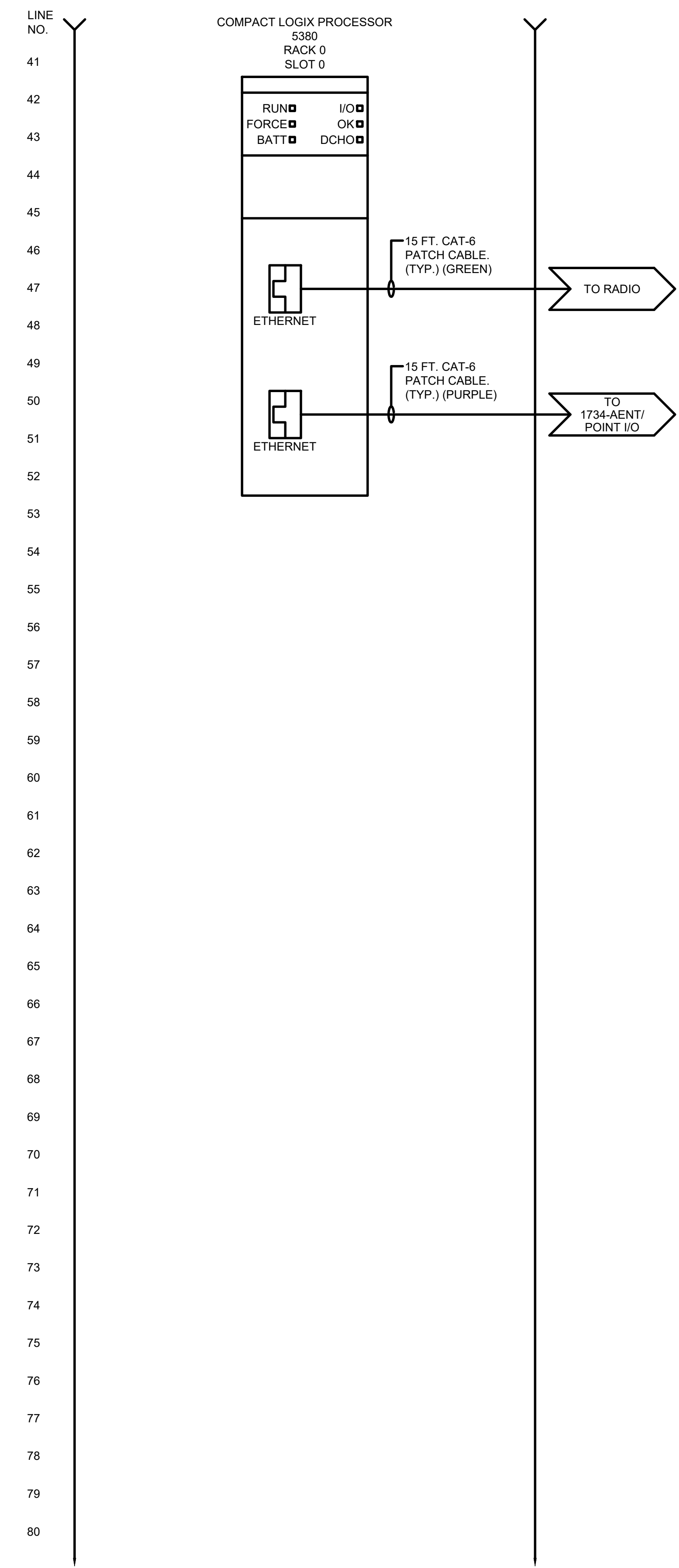
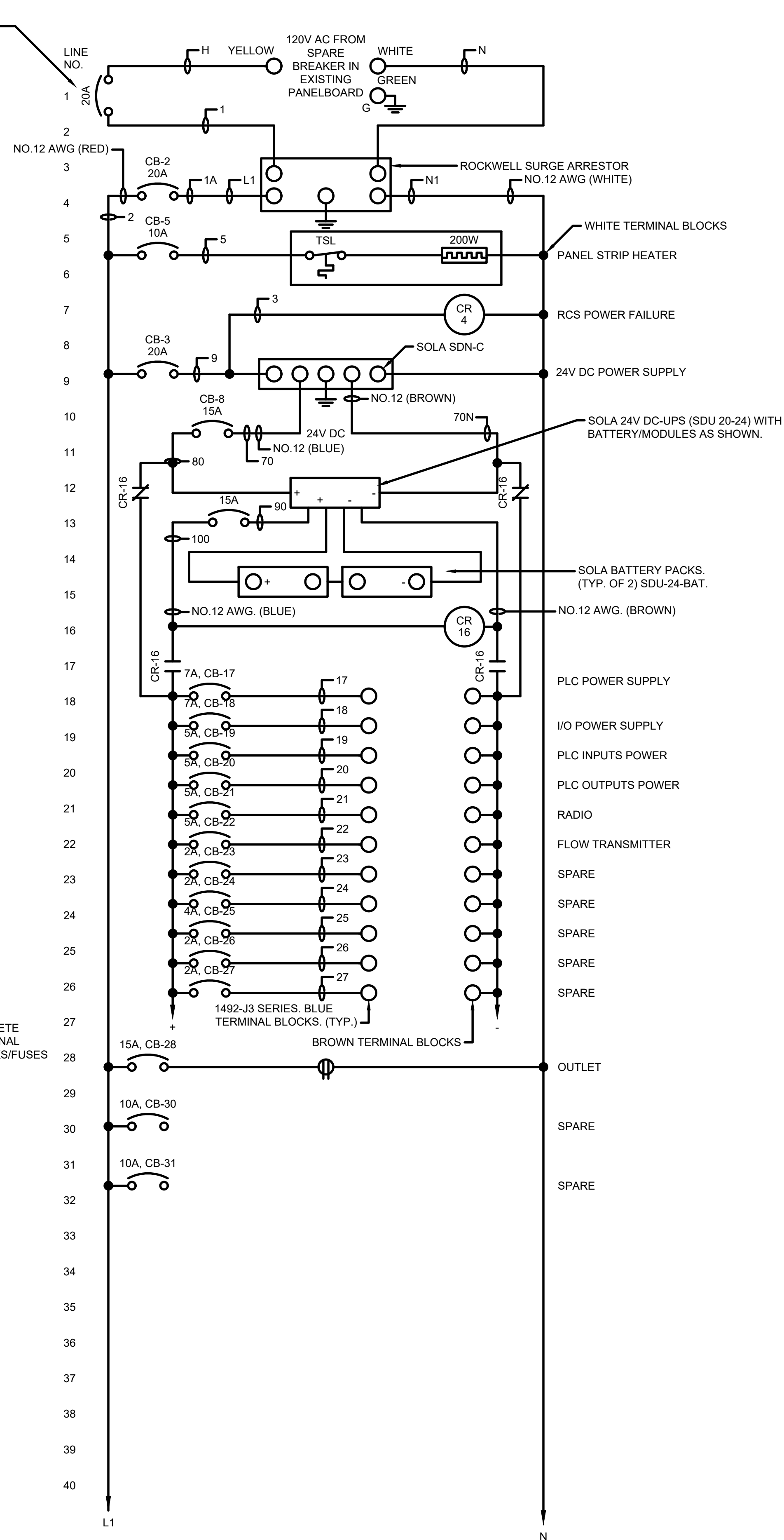
**METERING STATION
CONTROL PANEL LAYOUT**

NEMA 4 ENCLOSURE
SIZE: 42"H X 36"W X 12"D (MIN.)
PANEL TO BE CONSTRUCTED BY A UL LISTED PANEL SHOP.



GENERAL SUBPLATE LAYOUT

PAINT INSIDE: GLOSS WHITE.
NOTE: NOT ALL SUBPLATE DEVICES ARE SHOWN.
SEE WIRING DIAGRAMS FOR ADDITIONAL REQUIREMENTS. (TYP.)

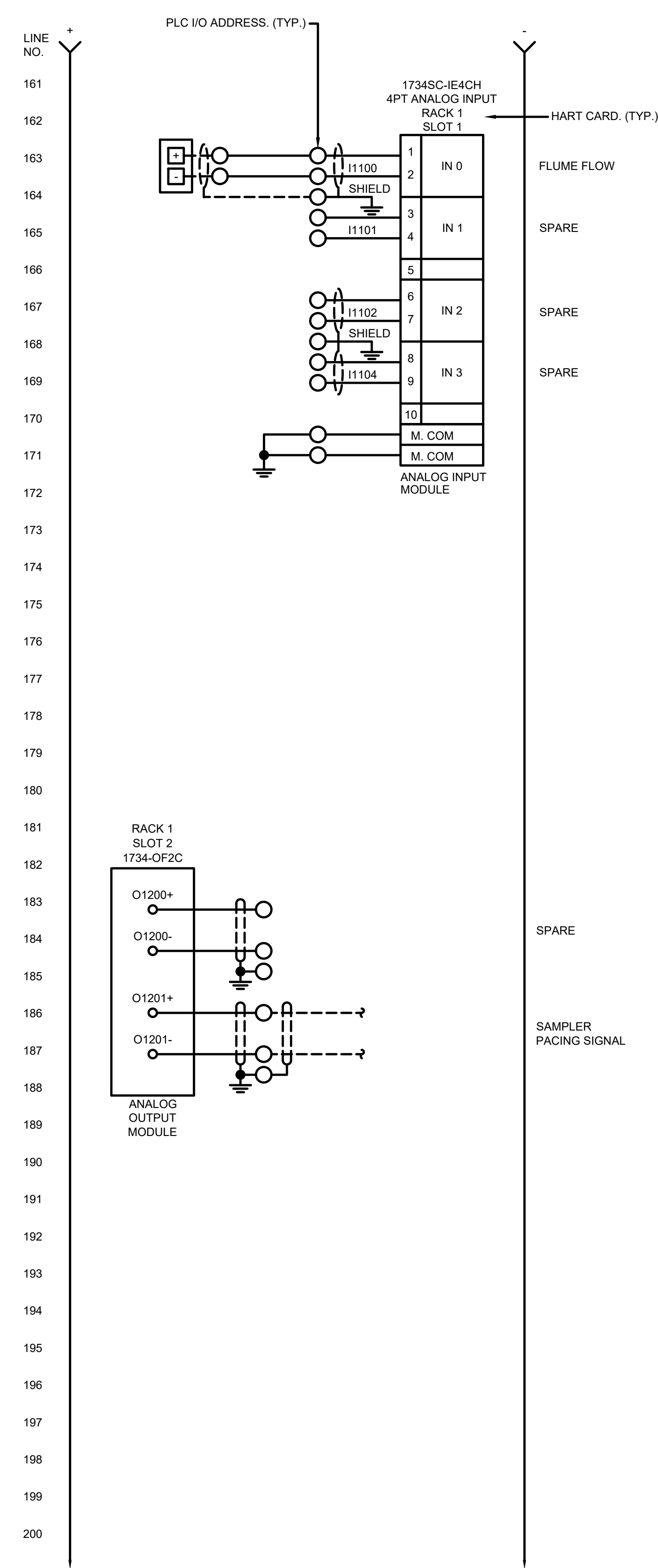
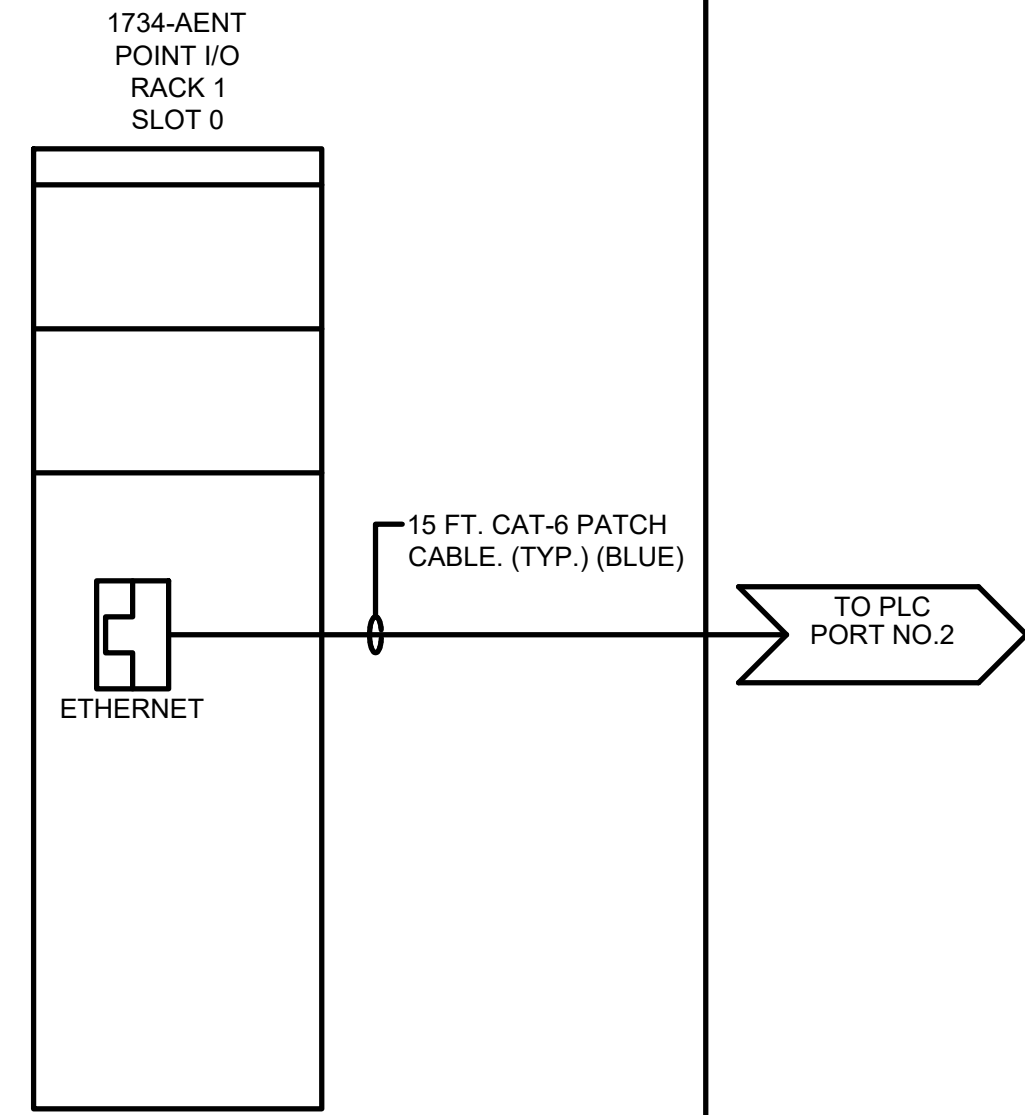
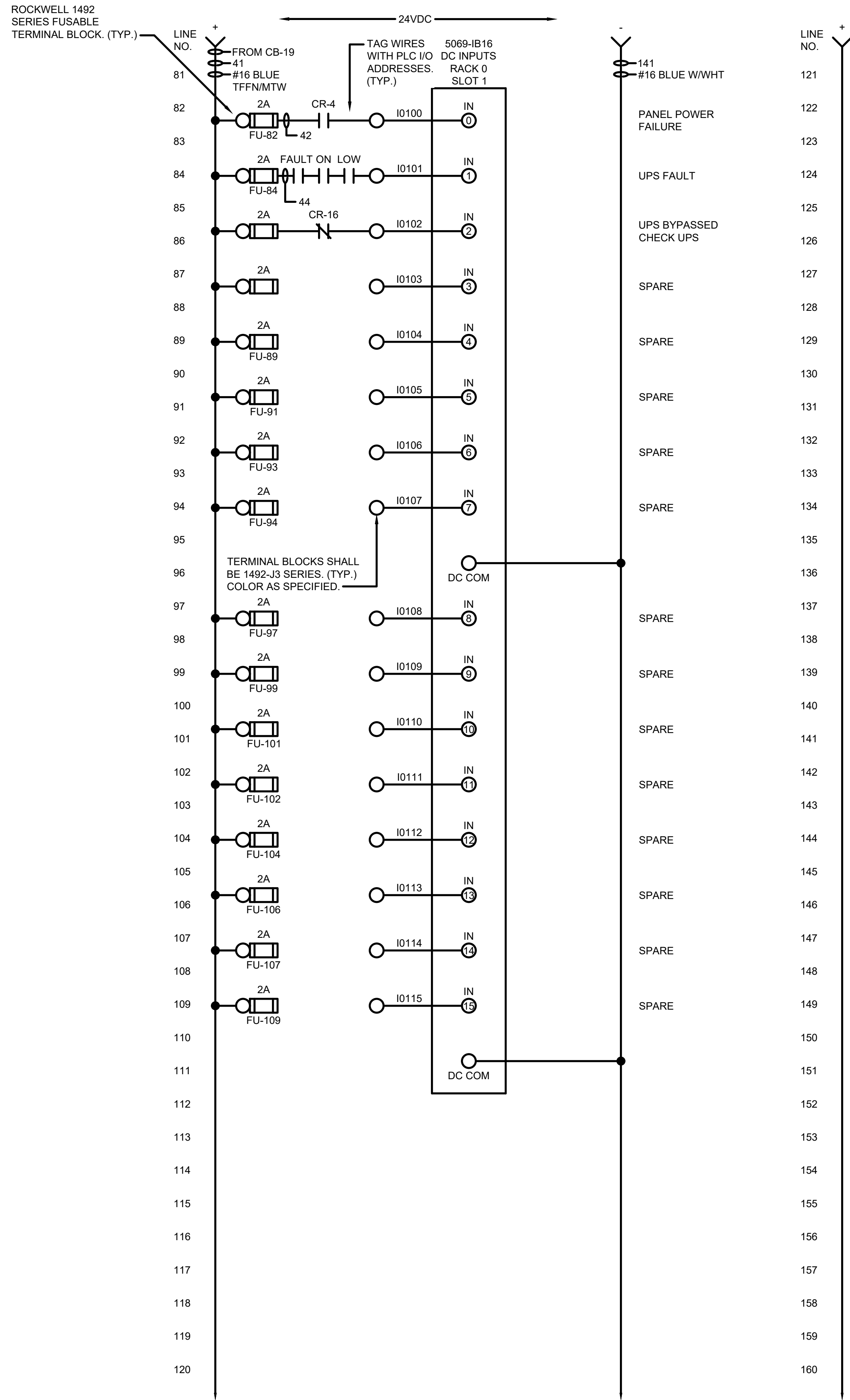


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MARK	DATE	DESCRIPTION
BY		

CITY OF KALAMAZOO, MICHIGAN
BELLS BREWERY
METERING STATIONS CONTROL UPGRADES
CONTROL PANEL
LAYOUT, WIRING DIAGRAM

Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ



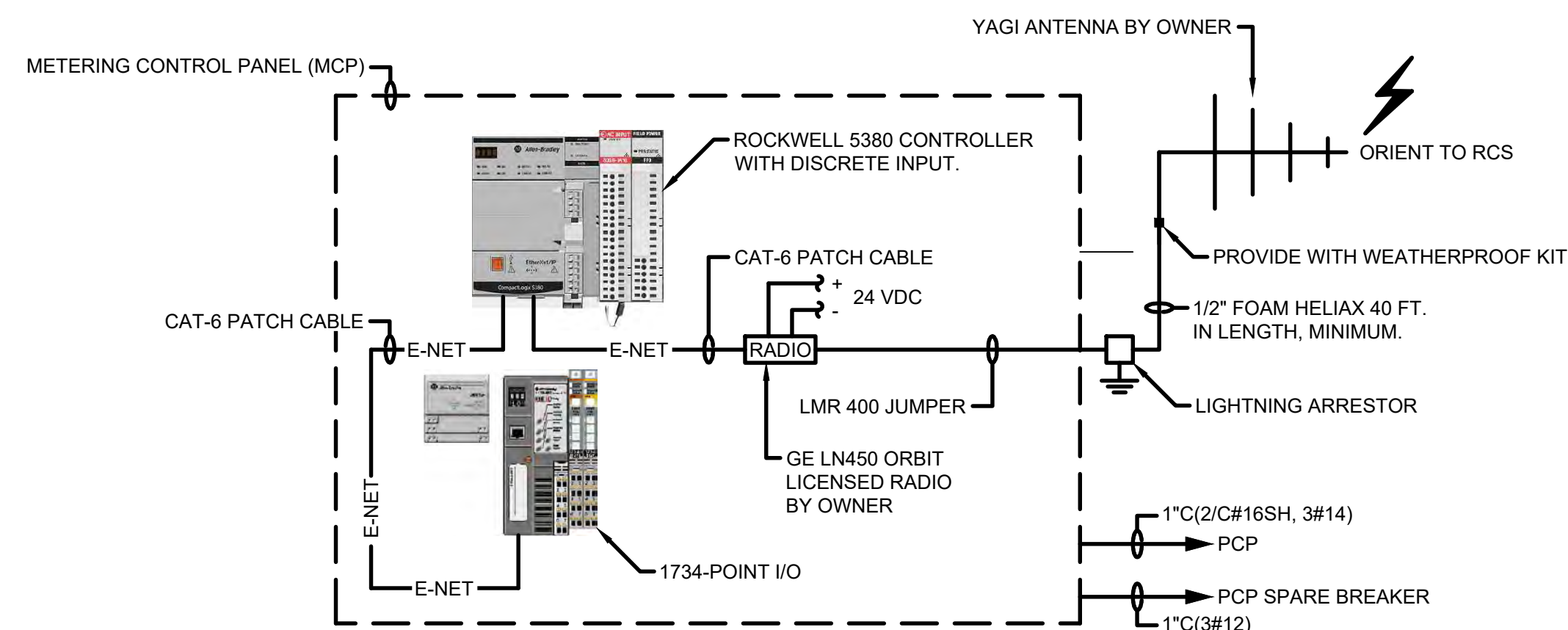
MARK	DATE	DESCRIPTION	BY

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
BELLS BREWERY CONTROL PANEL WIRING DIAGRAM

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	JLS
Checked By:	MSJ/GCJ

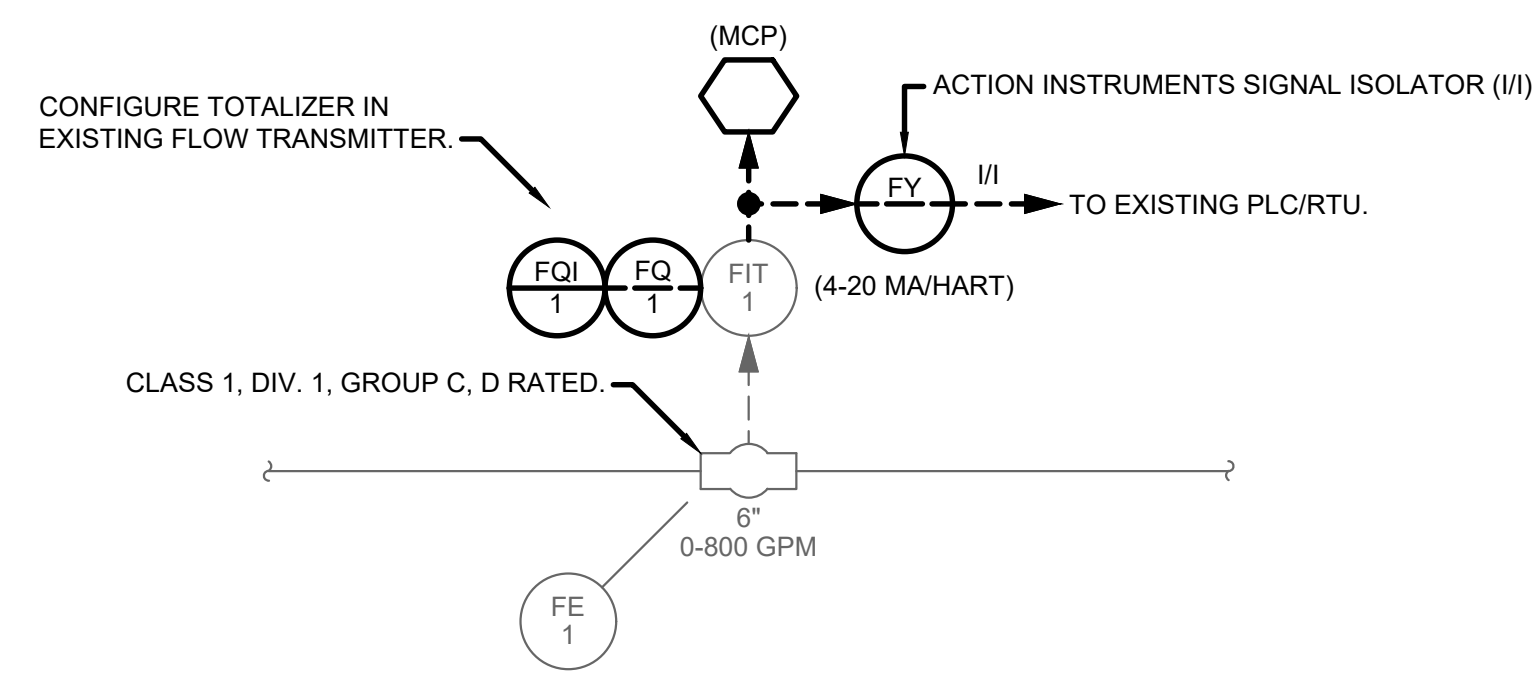


STATION PHOTOS



SYSTEM CONFIGURATION DRAWING

NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRA TECH.



PARTIAL P&ID DIAGRAM

NOTES:

1. INSTALL NEW MCP OUTSIDE NEAR EXISTING OUTDOOR EQUIPMENT/PANEL. PROVIDE NEW 3/16 STAINLESS STEEL STRUT AND MOUNT NEW PANEL. PROVIDE A 1 INCH CONDUIT WITH 3#12 WIRES AND POWER FROM EXISTING PANELBOARD. LABEL SPARE BREAKER IN PANELBOARD WITH NEW MCP DESIGNATION.
2. INSTALL A 1 INCH CONDUIT WITH 2/C#18SH CABLE TO THE NEW MCP FROM THE EXISTING MAGNETIC FLOW TRANSMITTER INSIDE THE EXISTING CONTROL PANEL.
3. FROM THE NEW MCP, INSTALL THE 1/2 INCH COAXIAL CABLE TO THE NEW YAGI ANTENNA. LOCATE NEW ANTENNA ON A NEW 24 FOOT LONG 2 INCH SCHEDULE 40 ALUMINUM MAST PIPE MOUNTED ON THE BACKSIDE OF THE EXISTING PANEL ON A NEW STRUT RACK. GROUND MAST PIPE WITH NO.6 AWG RHW-USE WIRE. INSTALL TWO GROUND RODS IN YARD AREA NEAR EXISTING STRUT SUPPORT RACK. CONNECT NO.6 WIRE TO GROUNDS RODS
4. OBTAIN THE SERVICES OF OUBBIER CALIBRATION SERVICES TO SET UP THE TRANSMITTER, CALIBRATE AND PLACE ON-LINE.
5. INSTALL A SIGNAL ISOLATOR (I/I) TO FEED THE EXISTING 4-20 MA FLOW SIGNAL TO THE NEW MCP, AND THEN RE-TRANSMIT TO EXISTING PLC/RTU.

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710 AVIS DRIVE
ANN ARBOR, MI 48108
PHONE: (734) 665-6000 FAX: (734) 213-3003

MARK	DATE	DESCRIPTION	BY

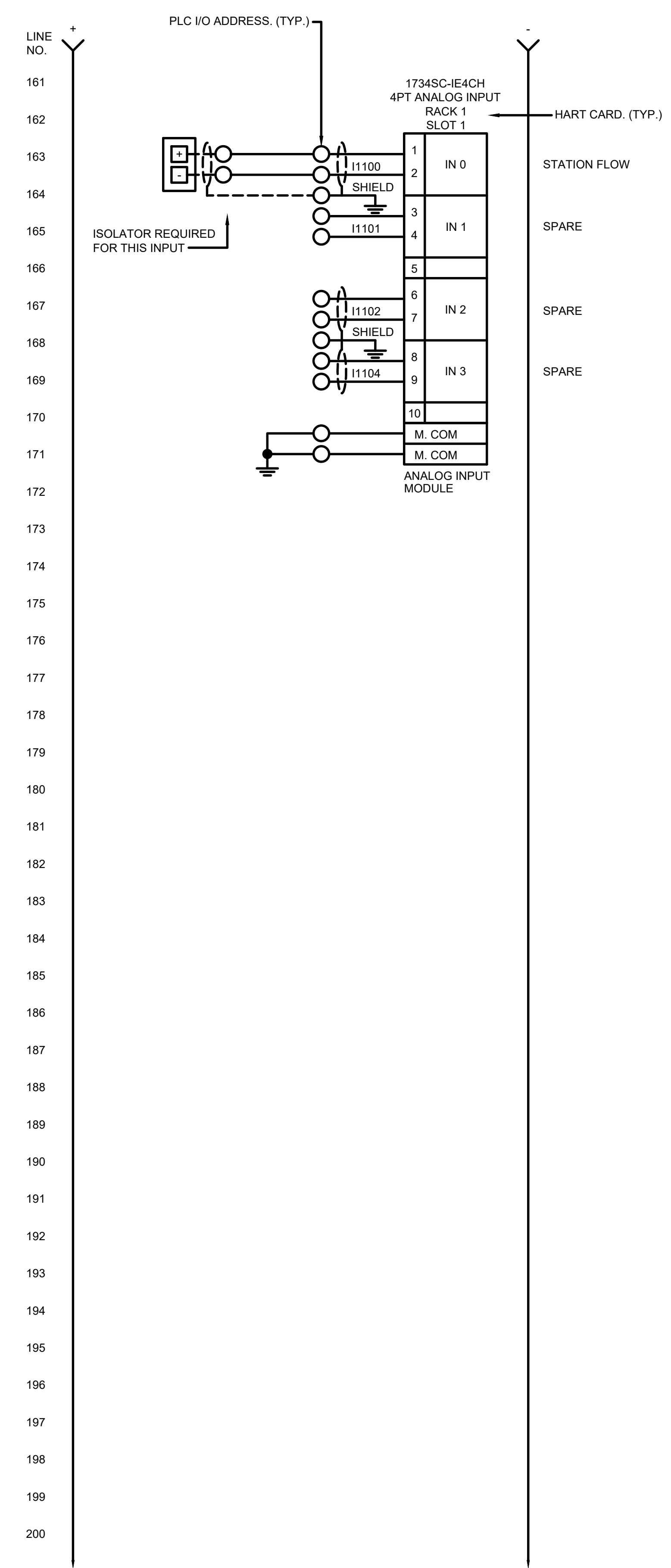
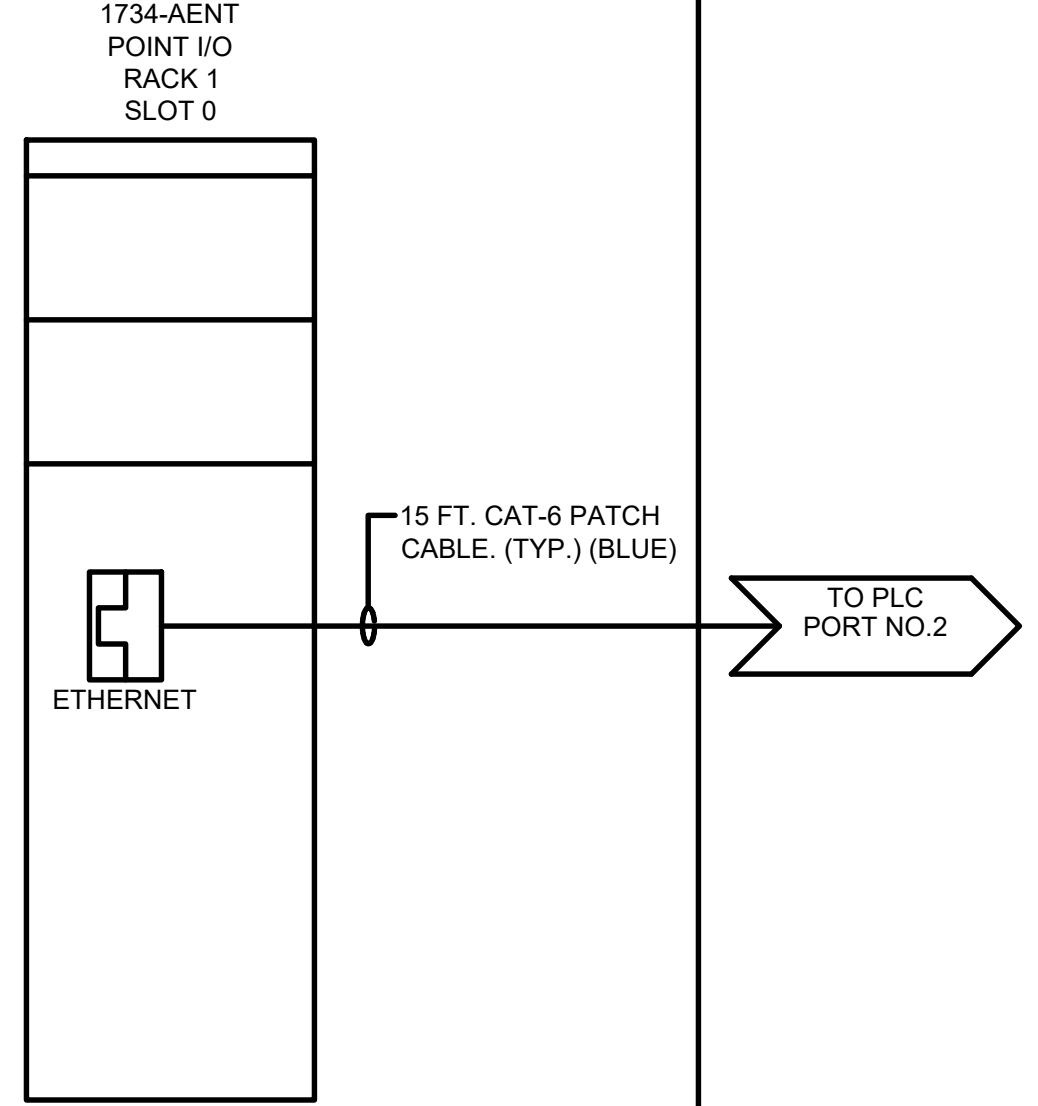
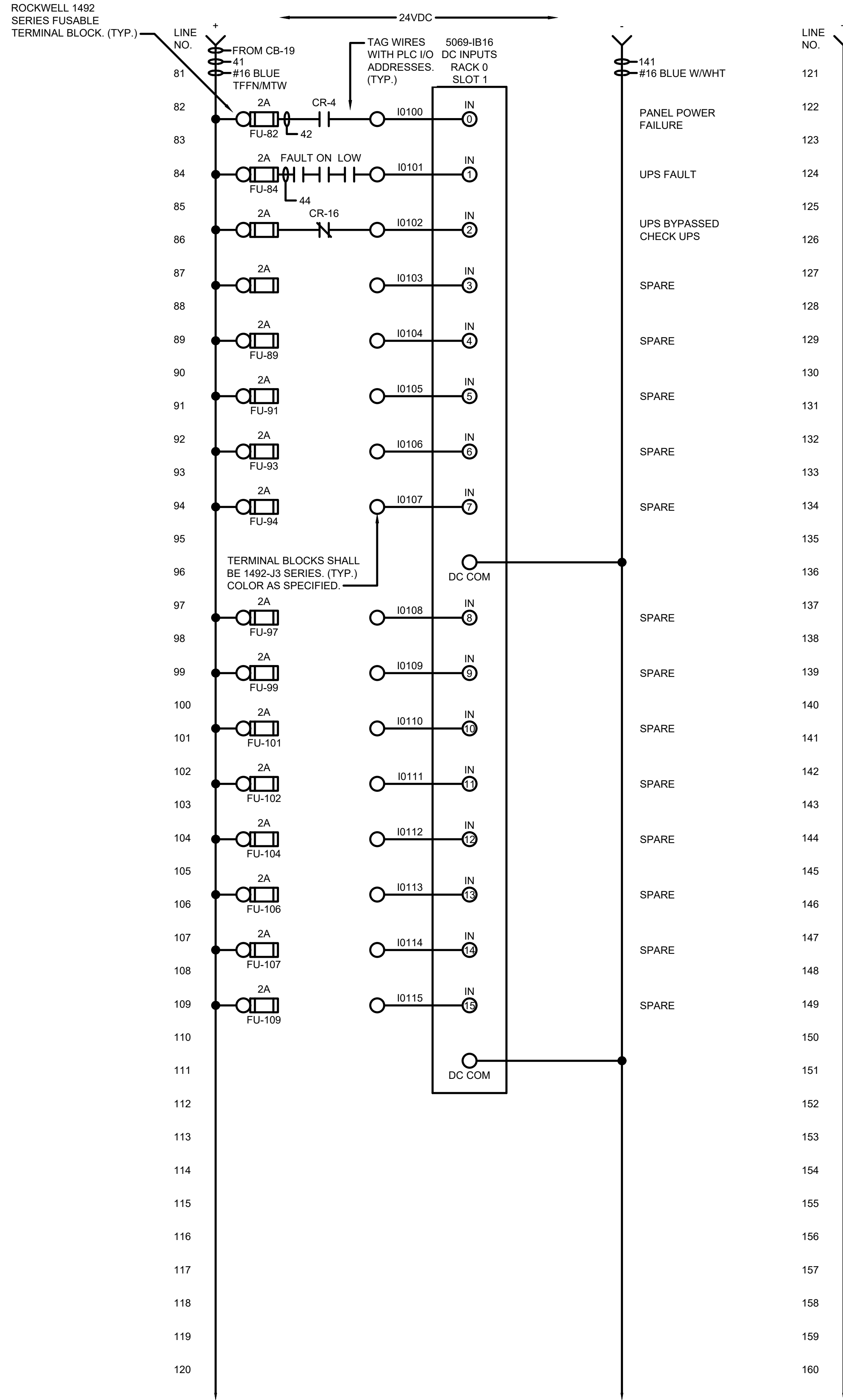
CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
COOPER
METERING STATION
ONE-LINES, DETAILS

Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

26
OF 40
Bar Measures 1 inch

Copyright: Tetra Tech

4/27/2022 12:59:26 PM - \\TT.LOCAL\IERPROJECTS\ANN ARBOR\IER19743\200-19743-2\1003\CAD\SHEETFILES\WIRING\28_COOPER_PANEL_WIR.DWG - SHANK, JASON



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ANN ARBOR, MI 48108
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BY	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
COOPER
METERING STATIONS CONTROL UPGRADES
CONTROL PANEL
WIRING DIAGRAM

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MS.J/GC.J.

28

OF 40

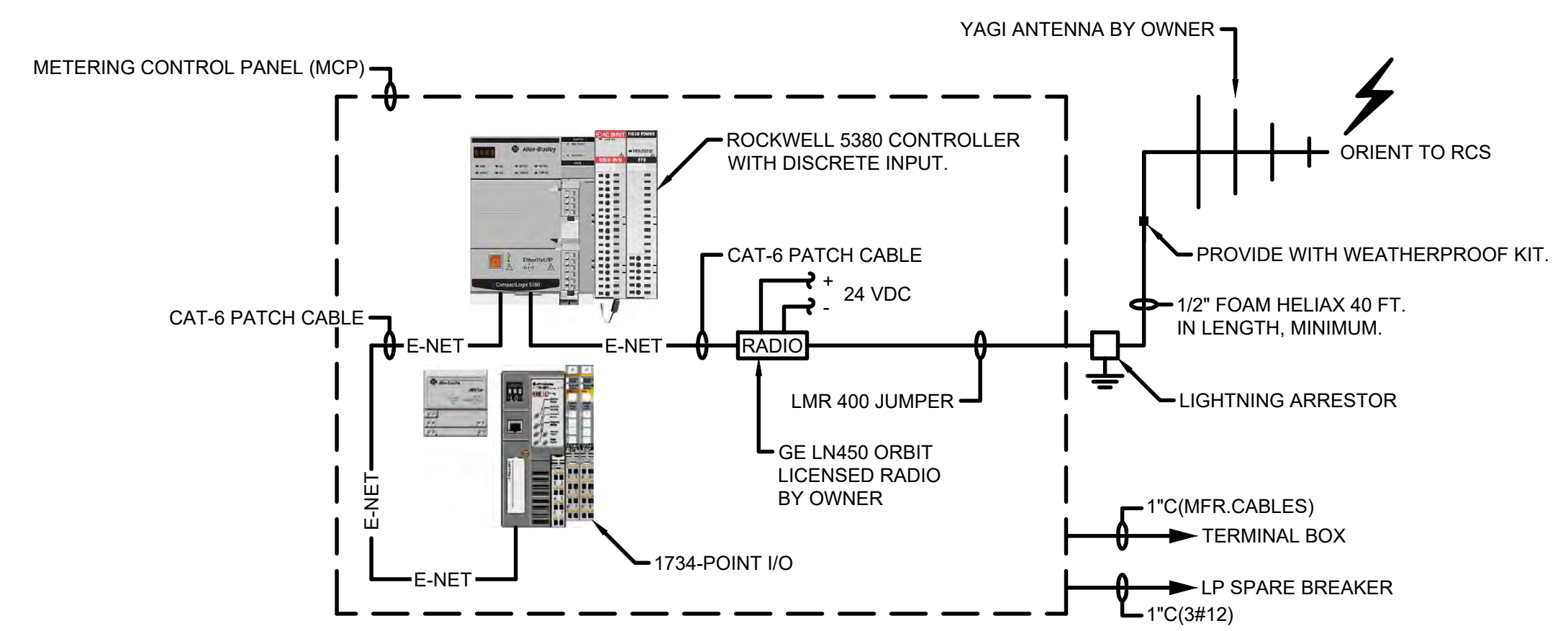
Bar Measures 1 inch

Copyright: Tetra Tech

4/27/2022 1:01:48 PM - \\TT.LOCAL\IER\PROJECTS\ANN ARBOR\ER\19743\200-19743-21\003\CAD\SHEET\METERING\99_PARCHMENT_ONLINE_DETAILS.DWG - SHANK, JASON

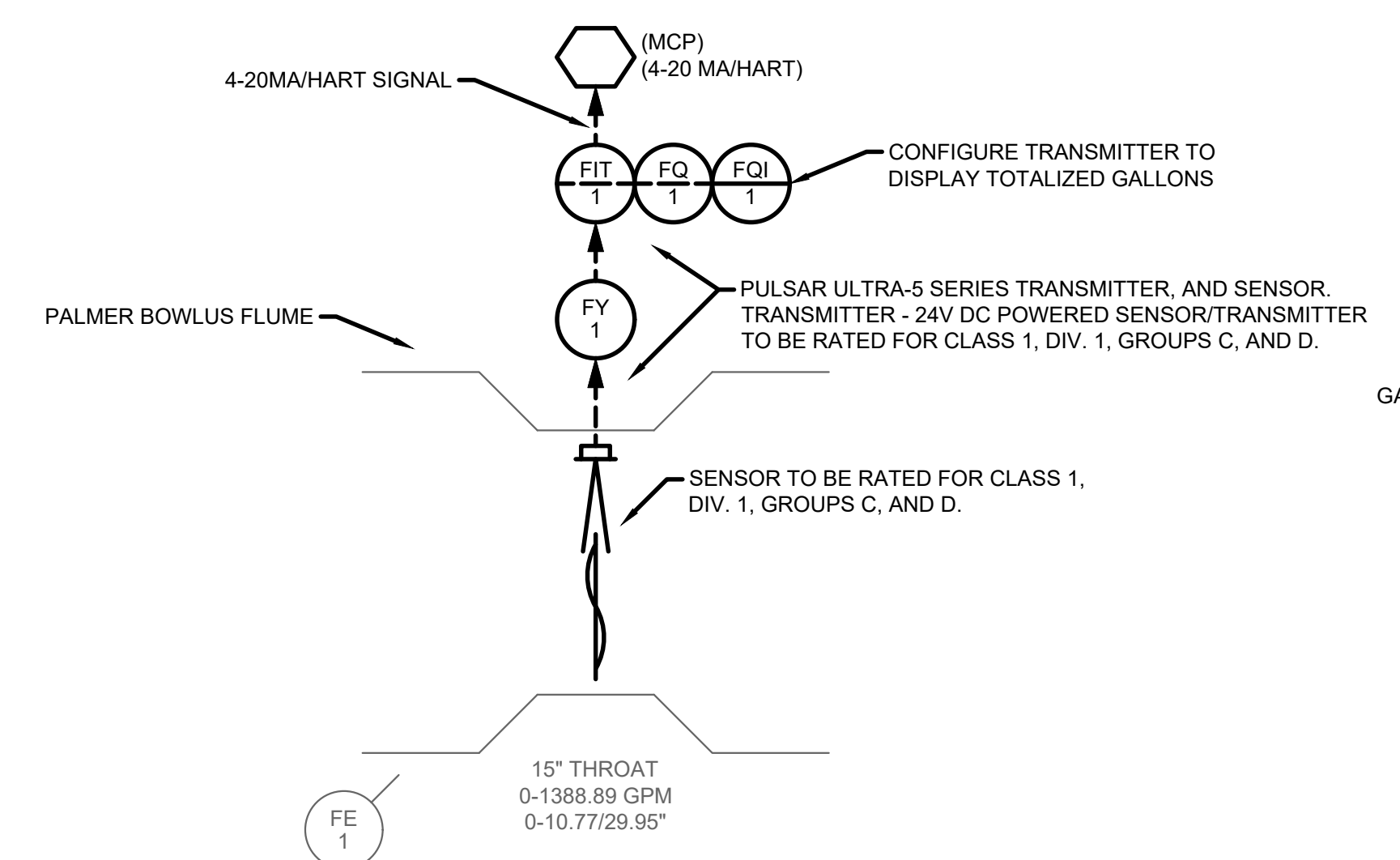


STATION PHOTOS

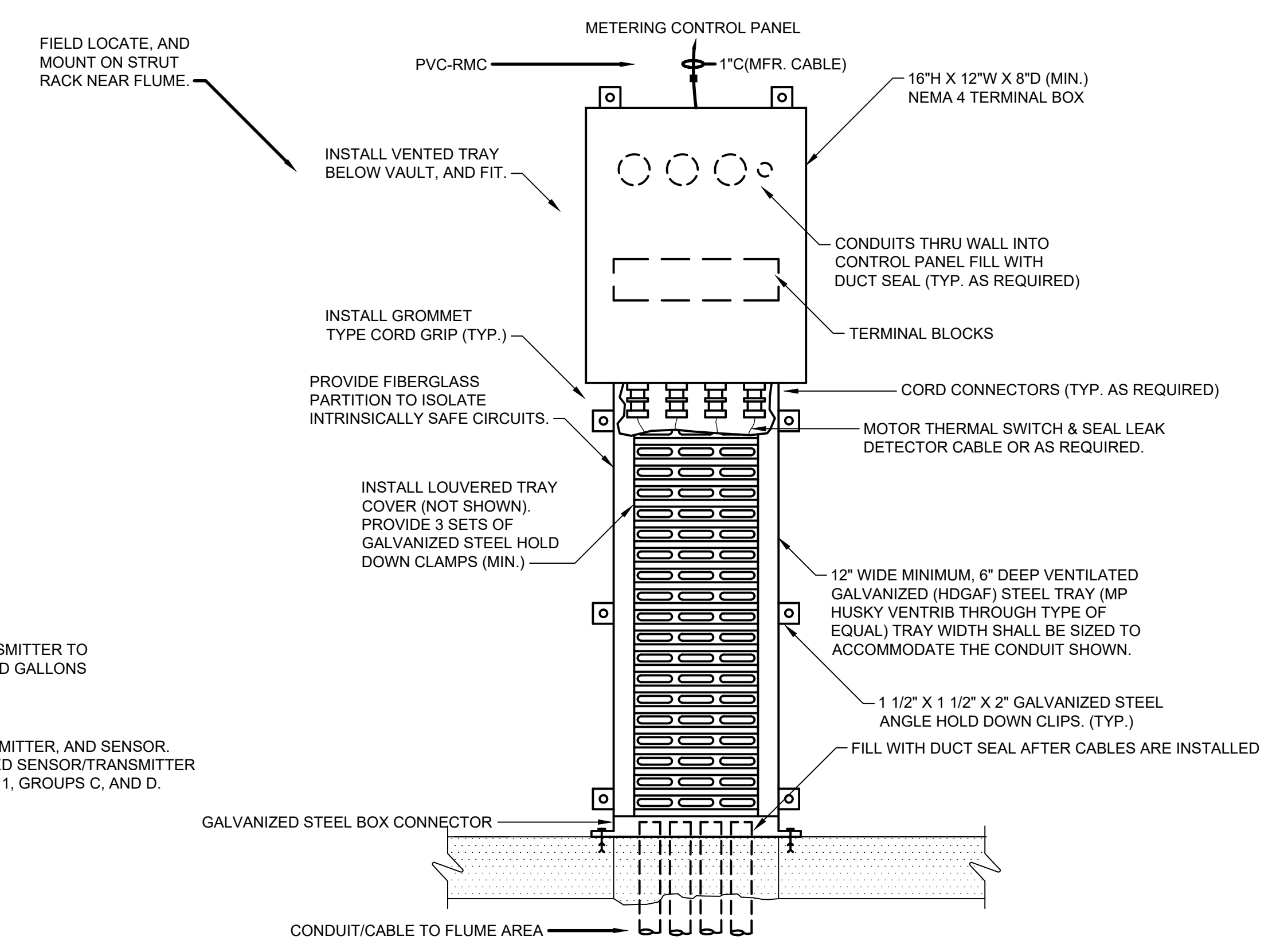


SYSTEM CONFIGURATION DRAWING

NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRA TECH.



PARTIAL P&ID DIAGRAM



VENTED TRAY DETAIL

NOTES:

- 1. INSTALL NEW MCP ON NEW STRUT RACK BESIDE EXISTING FLOW METERING PANEL. PROVIDE A 1 INCH CONDUIT WITH #12 WIRES AND POWER FROM EXISTING PANELBOARD. LABEL SPARE BREAKER IN PANELBOARD WITH NEW MCP DESIGNATION.
2. MOUNT THE NEW PULSAR FLOW TRANSMITTER INSIDE THE NEW METERING CABINET. POWER FROM 24VDC POWER SUPPLY IN NEW MCP.
3. FROM THE NEW MCP, INSTALL THE 1/2 INCH COAXIAL CABLE TO THE NEW YAGI ANTENNA. LOCATE NEW ANTENNA ON A NEW 8 FOOT LONG 2 INCH SCHEDULE 80 MAST PIPE MOUNTED ON THE BACKSIDE OF THE NEW STRUT RACK THAT SUPPORTS THE NEW FLOW MONITORING PANEL. GROUND MAST PIPE WITH NO.6 AWG RHW-USE WIRE. INSTALL TWO GROUND RODS IN YARD AREA NEAR EXISTING POWER POLE. CONNECT NO.6 WIRE TO GROUND RODS. LOCATE MAST PIPE AWAY FROM EXISTING POWER LINES.
4. SUPPORT PANEL WITH A NEW STRUT RACK, CONCRETE ENCASED.
5. OBTAIN THE SERVICES OF OUBBIER CALIBRATION SERVICES TO SET UP THE TRANSMITTER, CALIBRATE AND PLACE ON-LINE.
6. INSTALL THE NEW FLOW SENSOR IN PLACE OF THE EXISTING MILLETRONICS SENSOR. TURN OVER EXISTING FLOW TRANSMITTER AND SENSOR TO OWNER. INSTALL NEW 1 INCH PVC-RMC CONDUIT BETWEEN NEW CONTROL PANEL AND FLOW SENSOR/METER VAULT. ASSUME FOR 60 FEET OF PVC-RMC CONDUIT AND WIRE TO BE INSTALLED. FLOW SENSOR IS IN A NEMA 7 AREA. PROVIDE SEAL FITTINGS AS REQUIRED ON THIS CONDUIT. PROVIDE NEW STAINLESS STEEL MOUNTING HARDWARE FOR INSTALLING SENSOR OVER EXISTING FLUME. FIELD VERIFY CONDUIT ROUTING, AND EXCAVATION PRIOR TO BIDS. PATCH YARD AREA BACK TO ORIGINAL CONDITION.

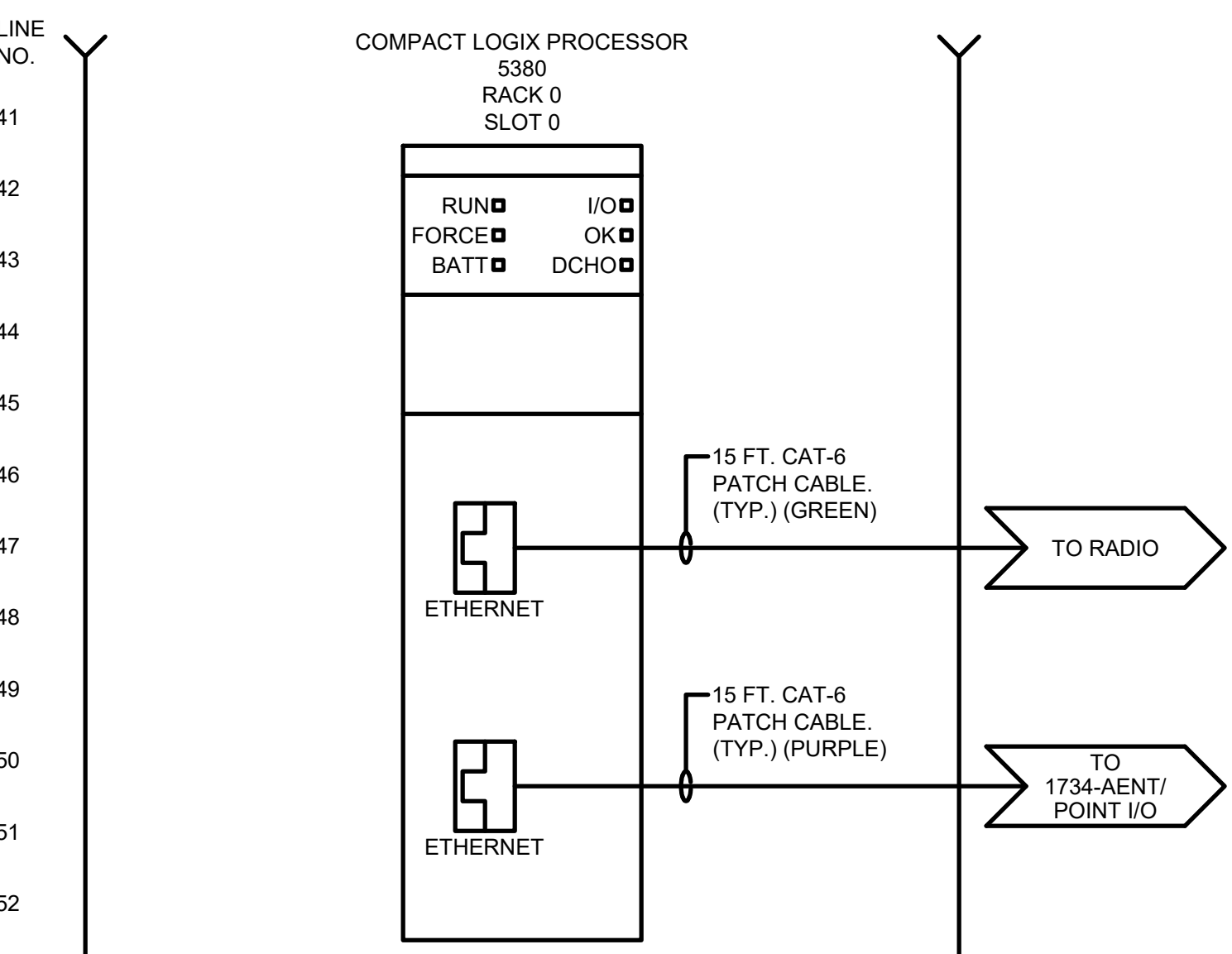
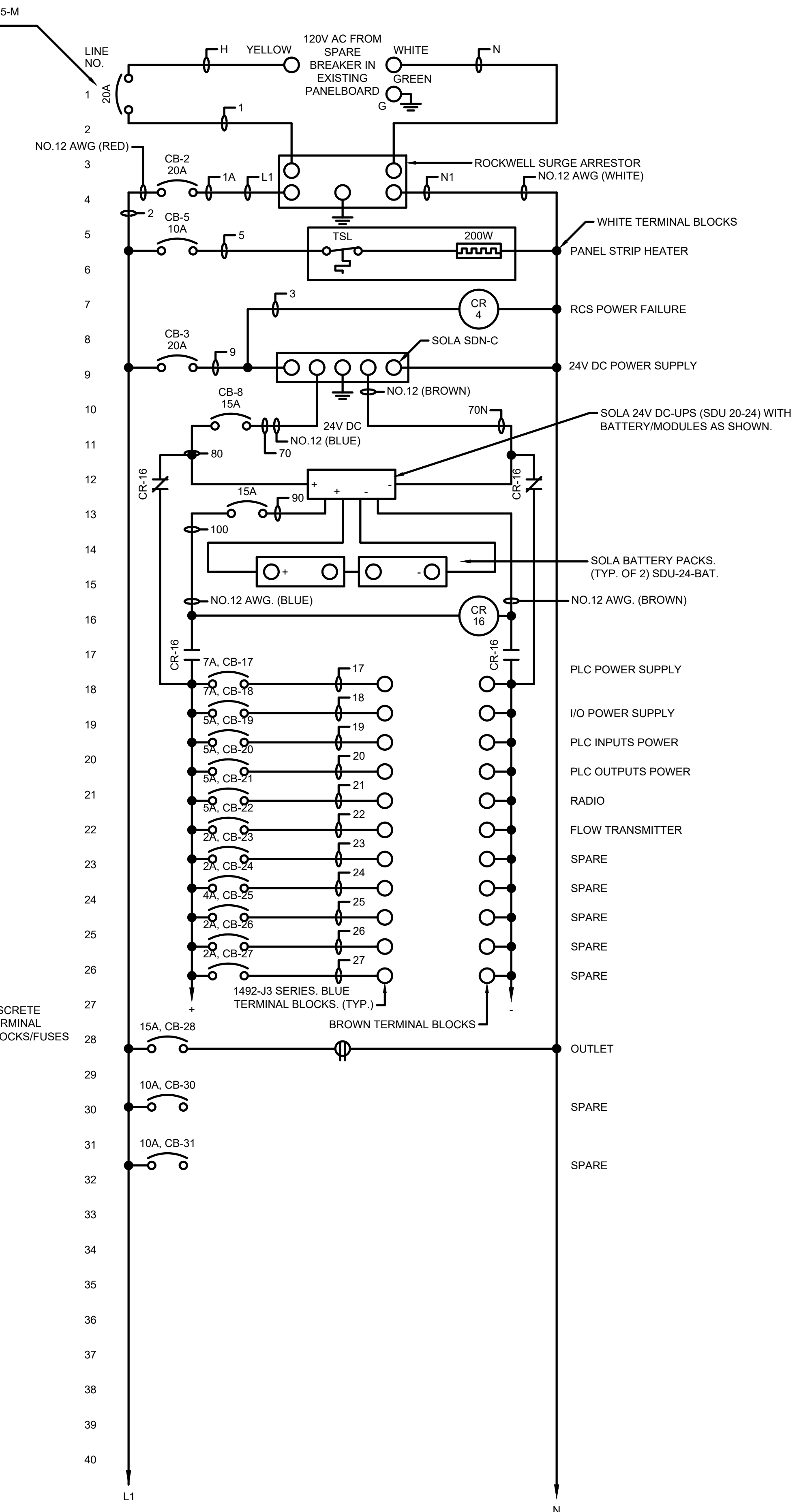
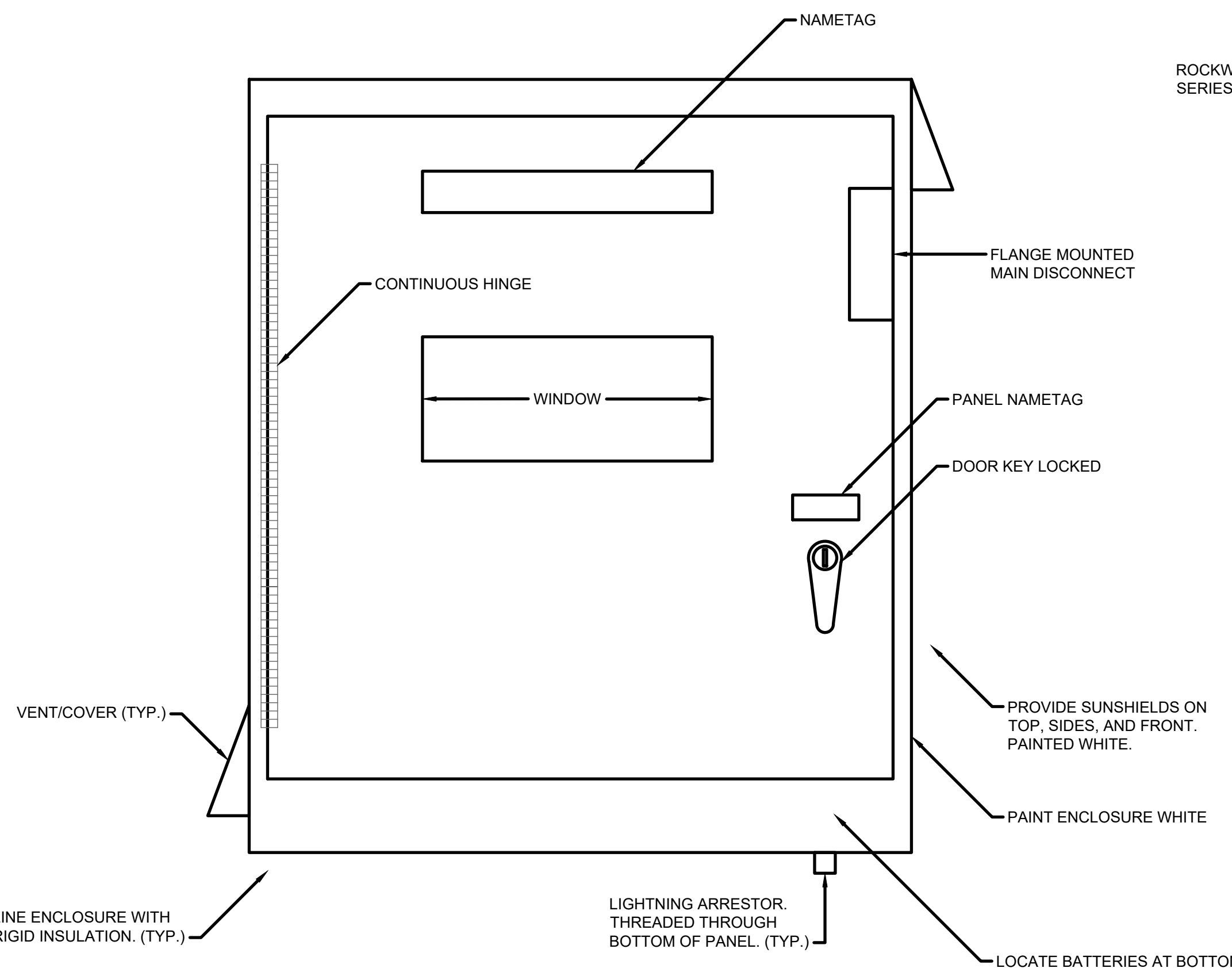
TETRA TECH logo and contact information: www.tetratech.com, 710 AVIS DRIVE, ANN ARBOR, MI 48108, PHONE: (734) 665-6000, FAX: (734) 213-3003

Table with columns: MARK, DATE, DESCRIPTION, BY

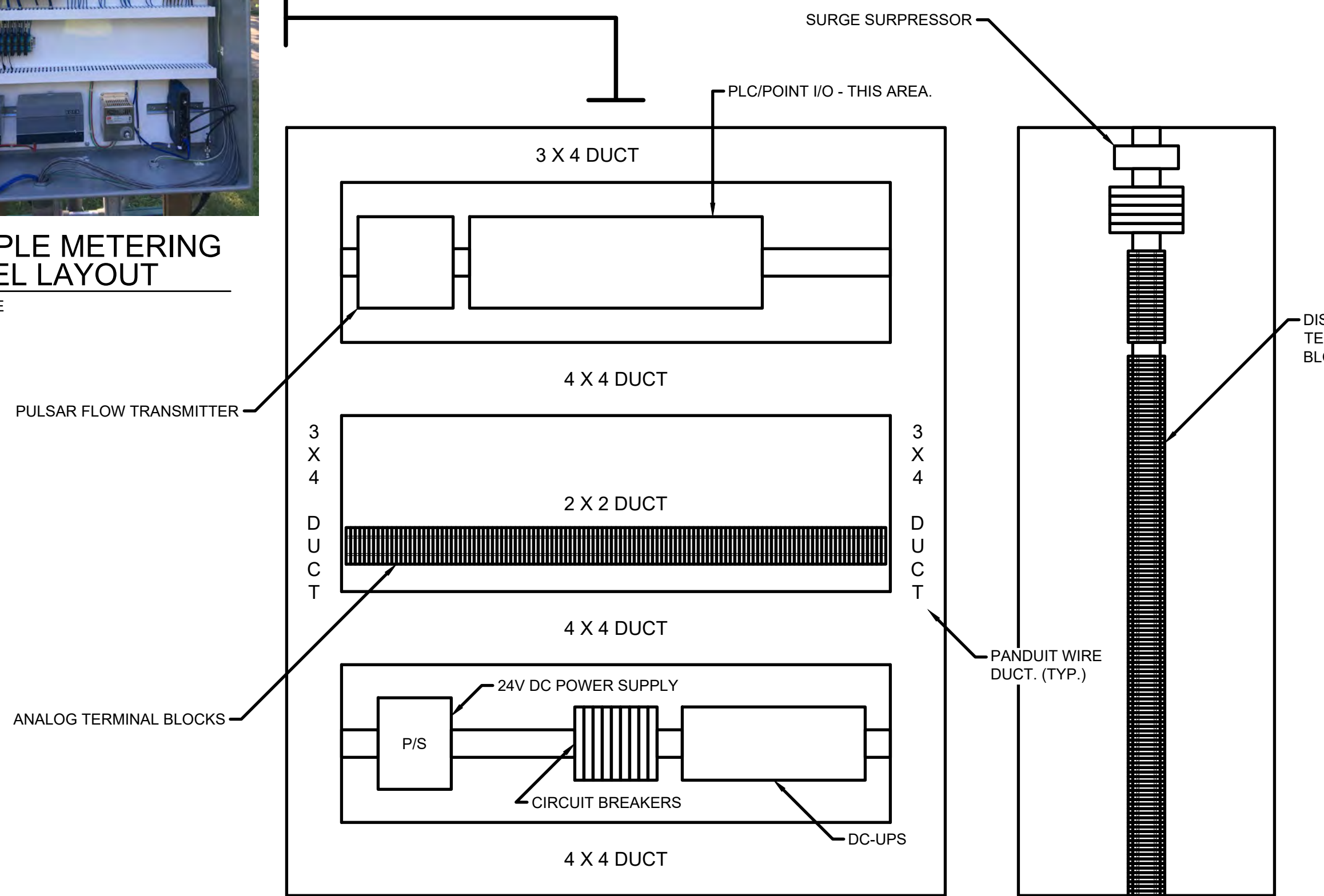
CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
PARCHMENT
METERING STATION
ONE-LINES, DETAILS

Table with columns: Project No., Designed By, Drawn By, Checked By

2/21/2022 3:14:44 PM - \\T:\LOCAL\PROJECTS\ANN ARBOR\IER\19743\200-19743-21003\CAD\SHEET\METERING\METERING30_PARCHMENT_PANEL_LAYOUT_WIR.DWG - SHANK, JASON



METERING STATION CONTROL PANEL LAYOUT
NEMA 4 ENCLOSURE
SIZE: 42"H X 36"W X 12"D (MIN.)
PANEL TO BE CONSTRUCTED BY A UL LISTED PANEL SHOP.



GENERAL SUBPLATE LAYOUT
PAINT INSIDE: GLOSS WHITE.
NOTE: NOT ALL SUBPLATE DEVICES ARE SHOWN.
SEE WIRING DIAGRAMS FOR ADDITIONAL REQUIREMENTS. (TYP.)

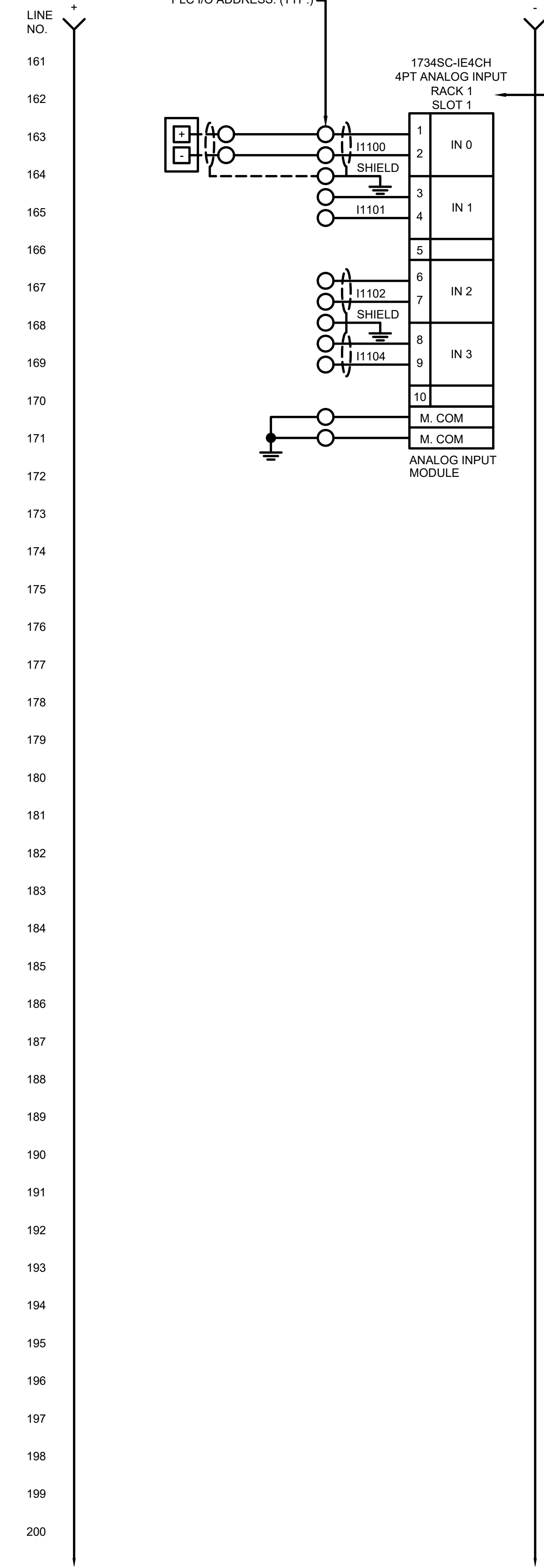
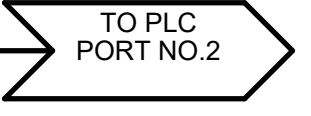
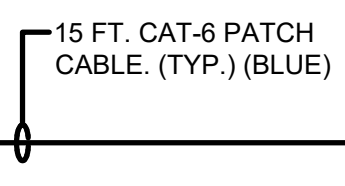
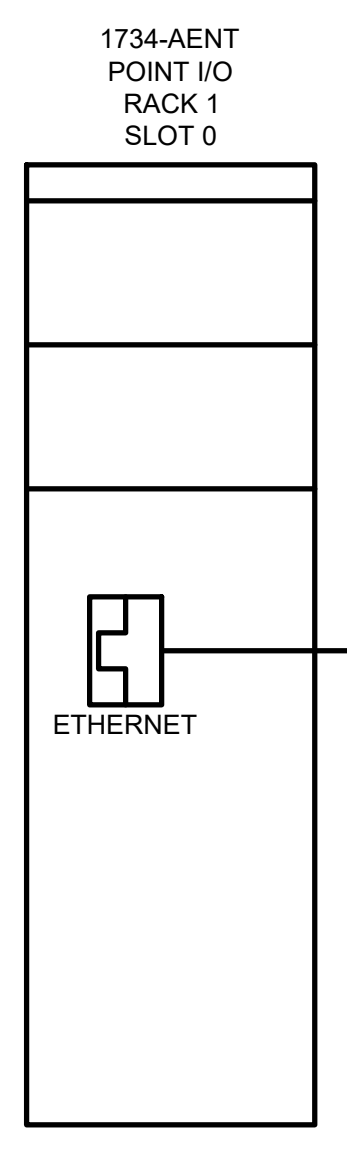
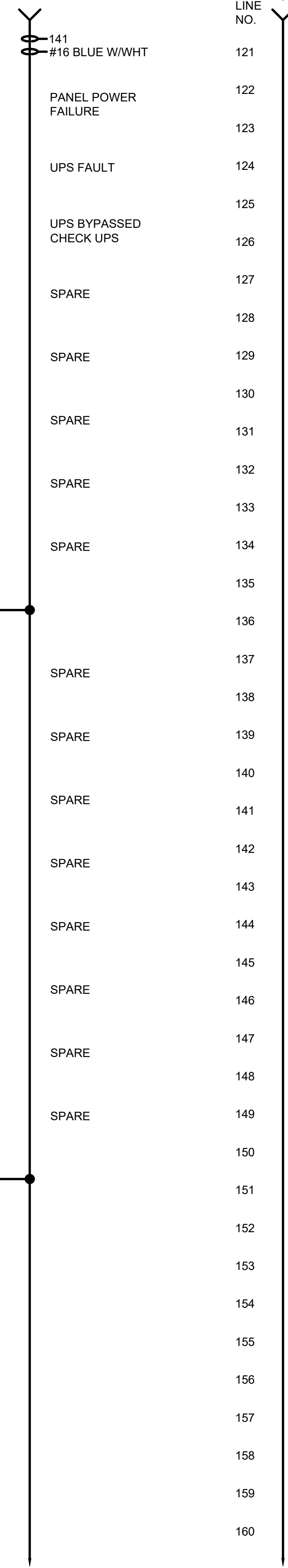
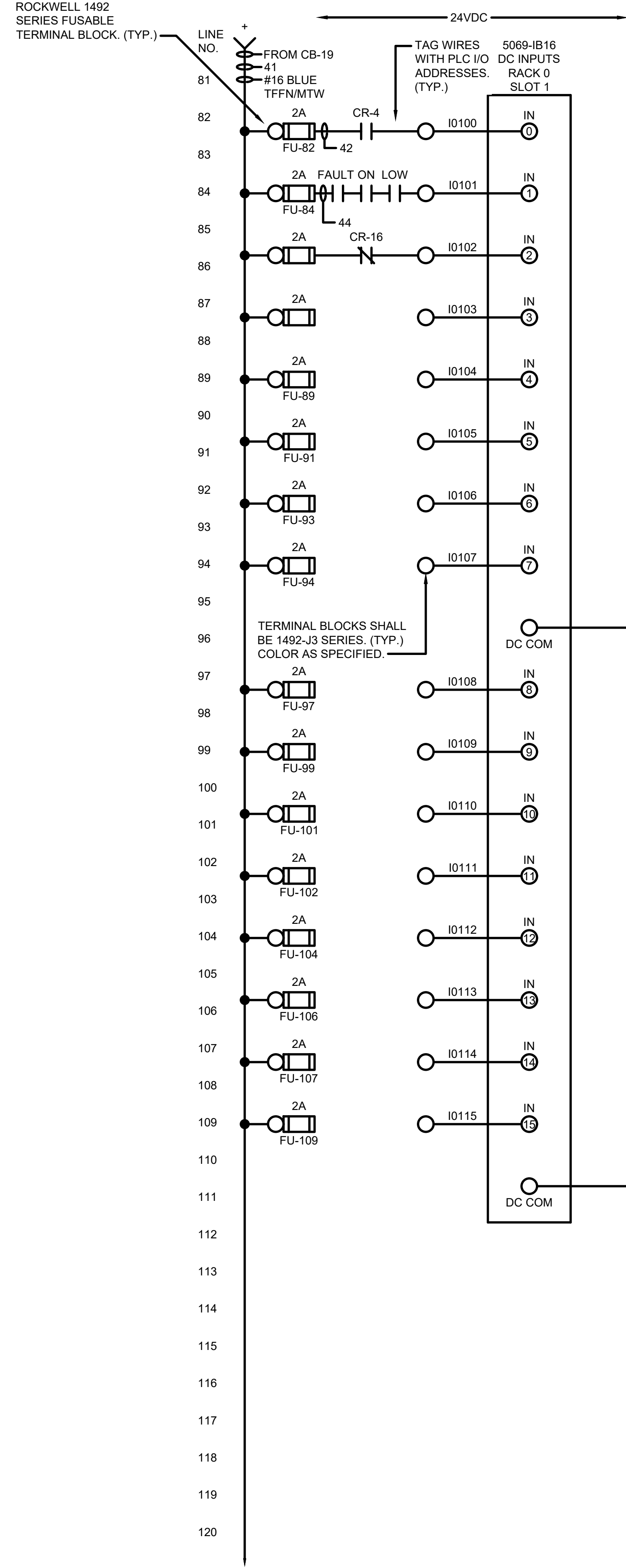


BY	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
PARCHMENT CONTROL PANEL LAYOUT, WIRING DIAGRAM

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MS.J/G.C.J.

2/21/2022 3:14:50 PM - \\TT.LOCAL\IERPROJECTS\ANN ARBOR\IER\19743\200-19743-21003\CAD\SHEETFILES\METERING\31_PARCHMENT_PANEL_WIR.DWG - SHANK, JASON



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ANN ARBOR, MI 48108
PHONE: (734) 665-6000 FAX: (734) 213-3003

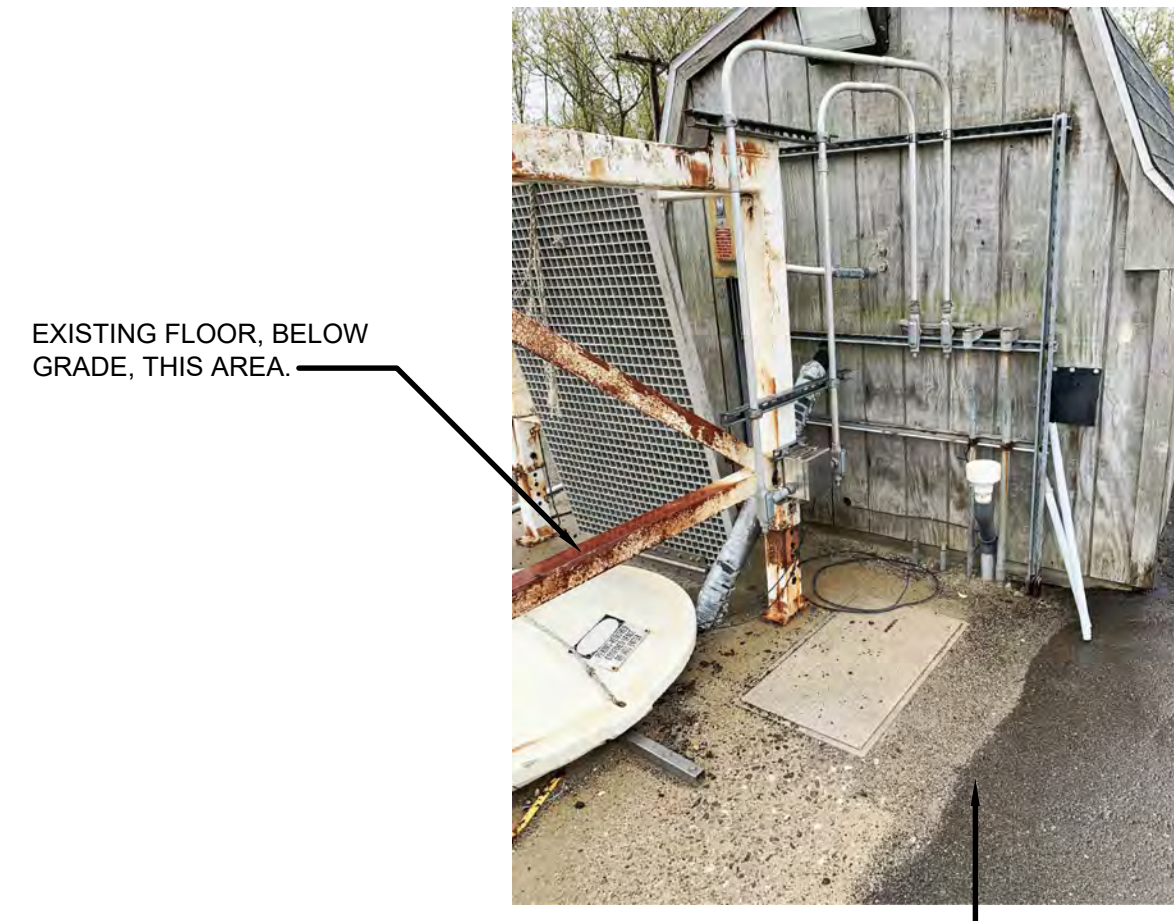
MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES

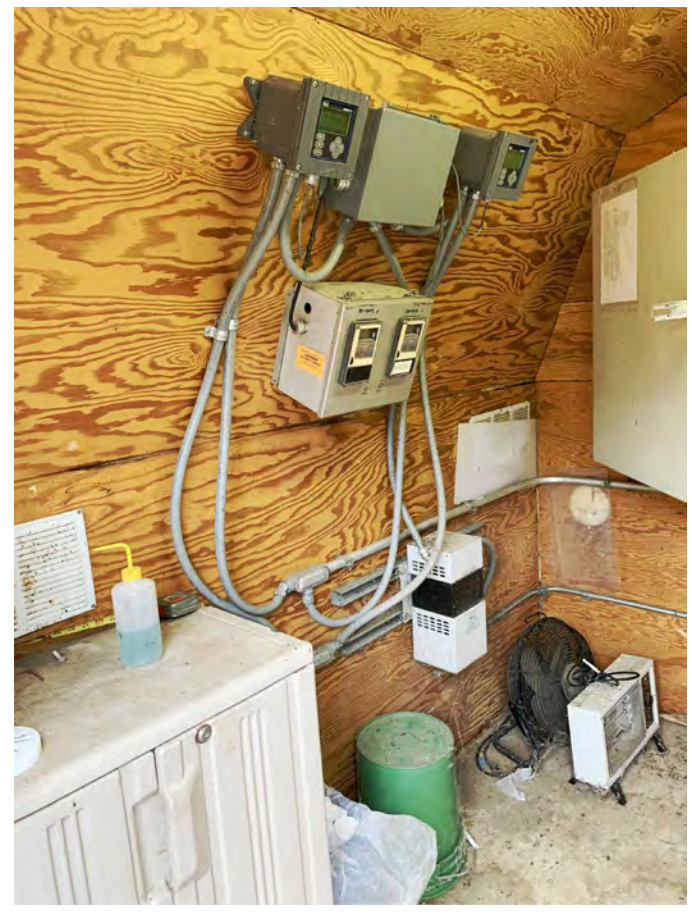
**PARCHMENT
CONTROL PANEL
WIRING DIAGRAM**

Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

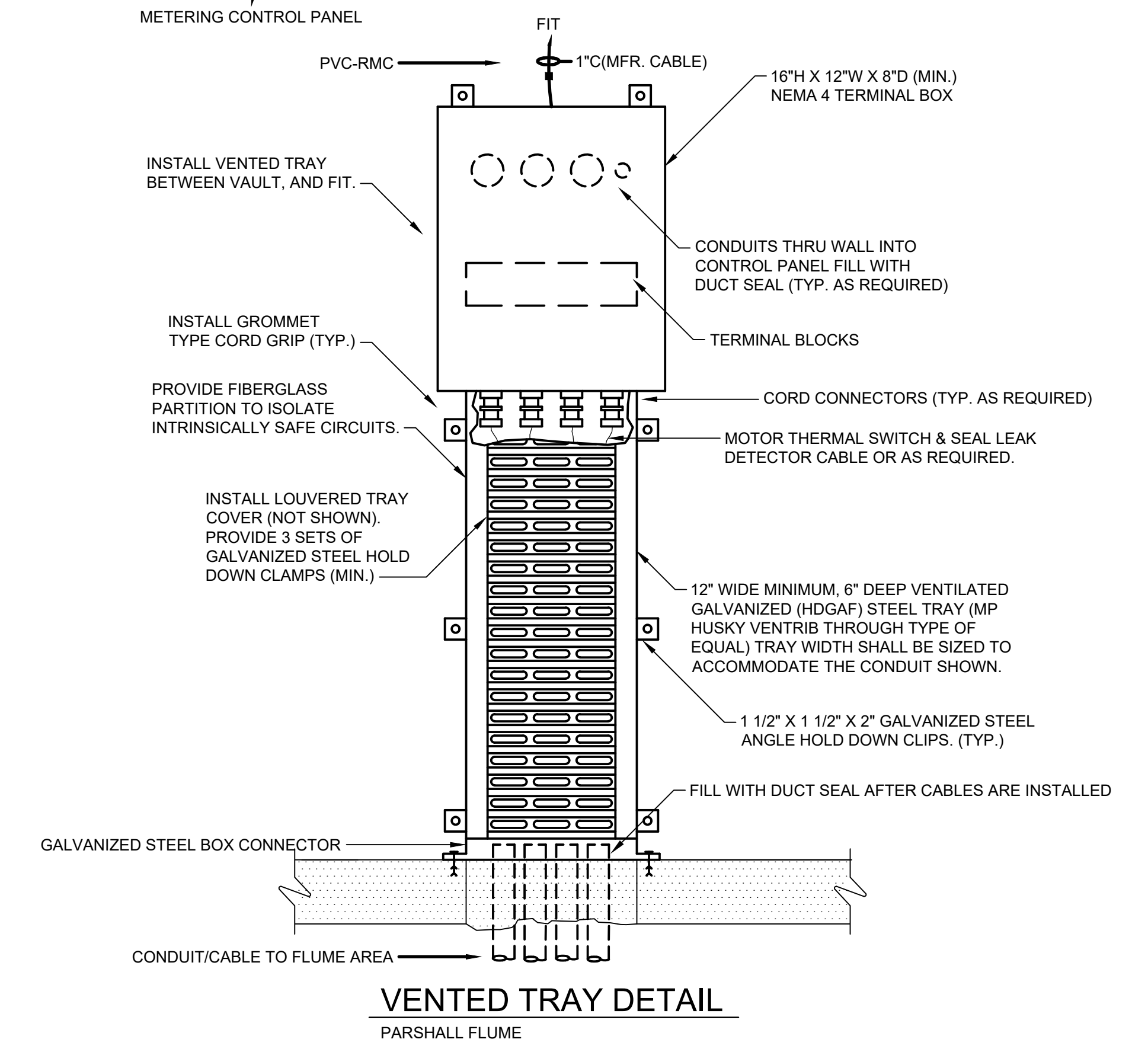
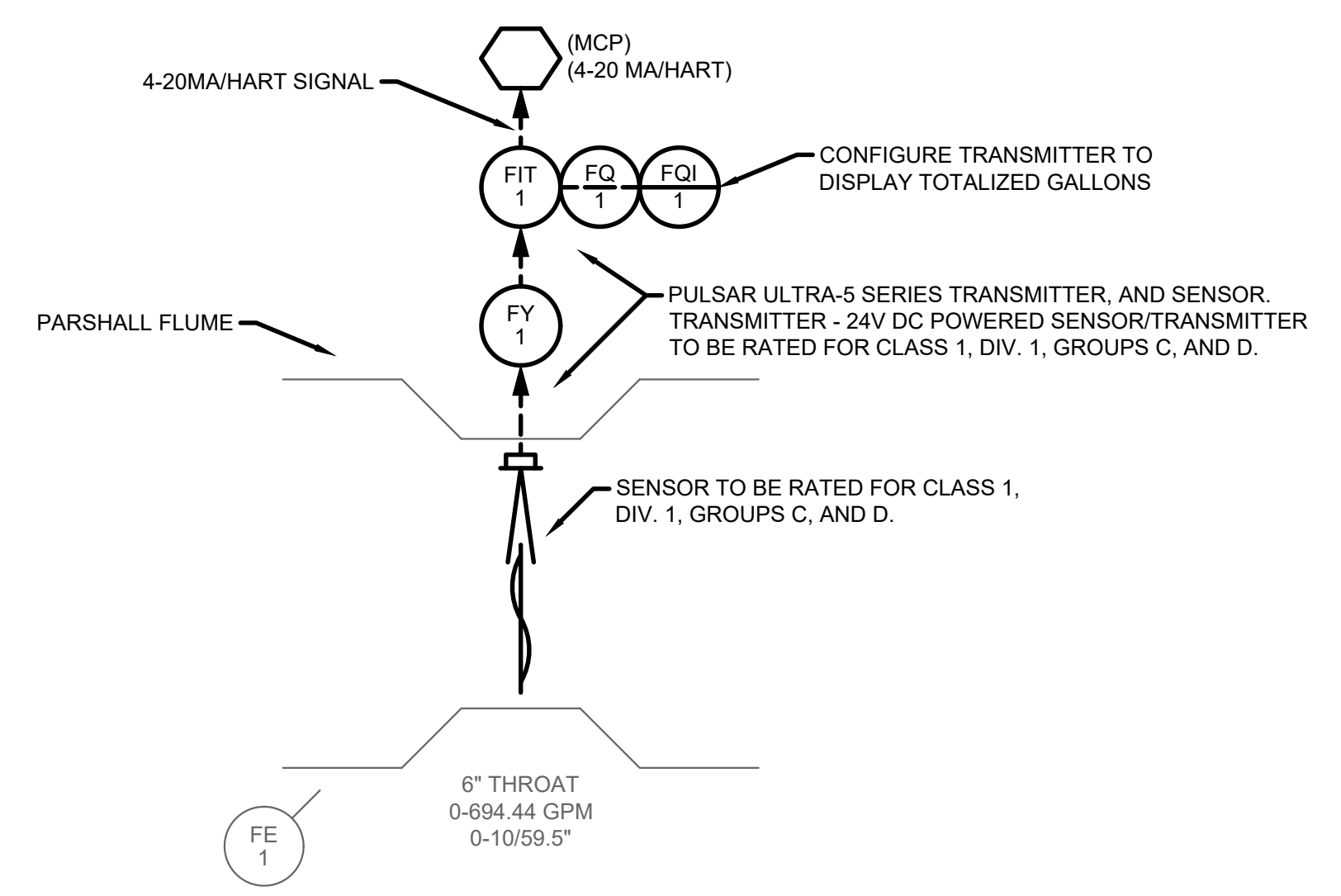
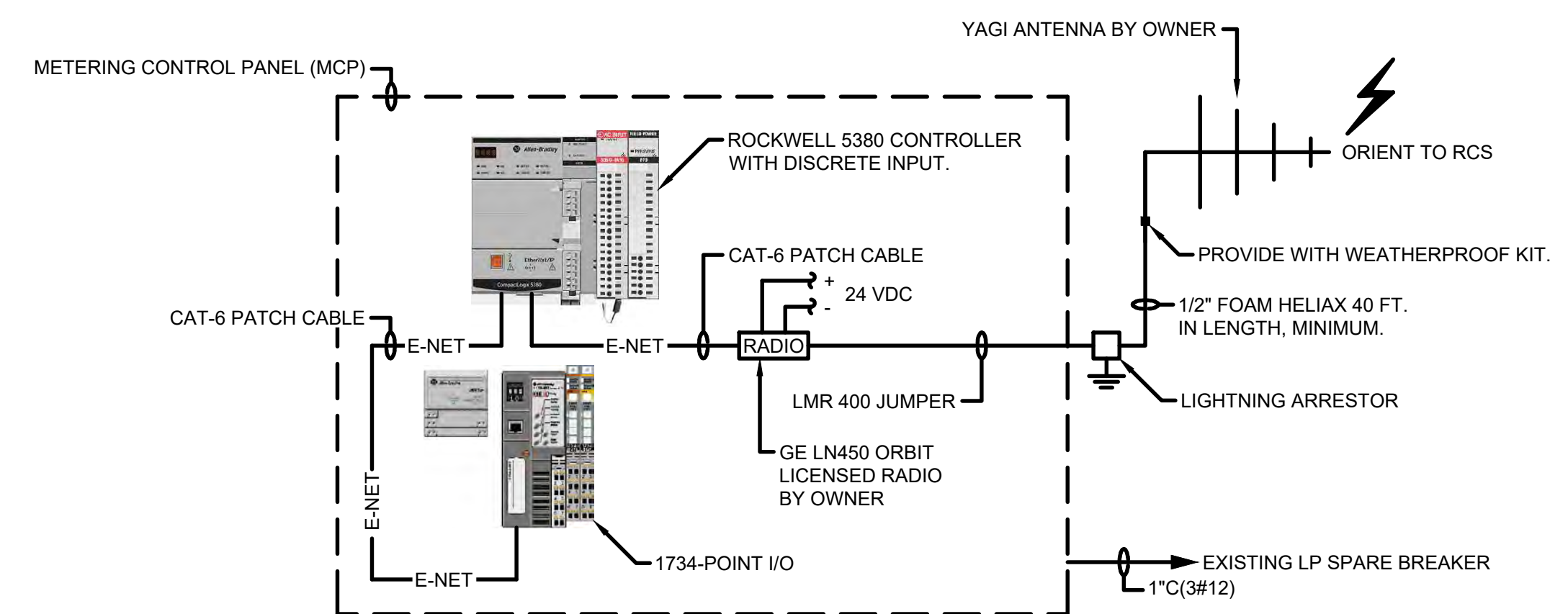
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FIELD LOCATE, AND INSTALL VENTED TRAY/TERMINAL BOX, THIS AREA.



STATION PHOTOS

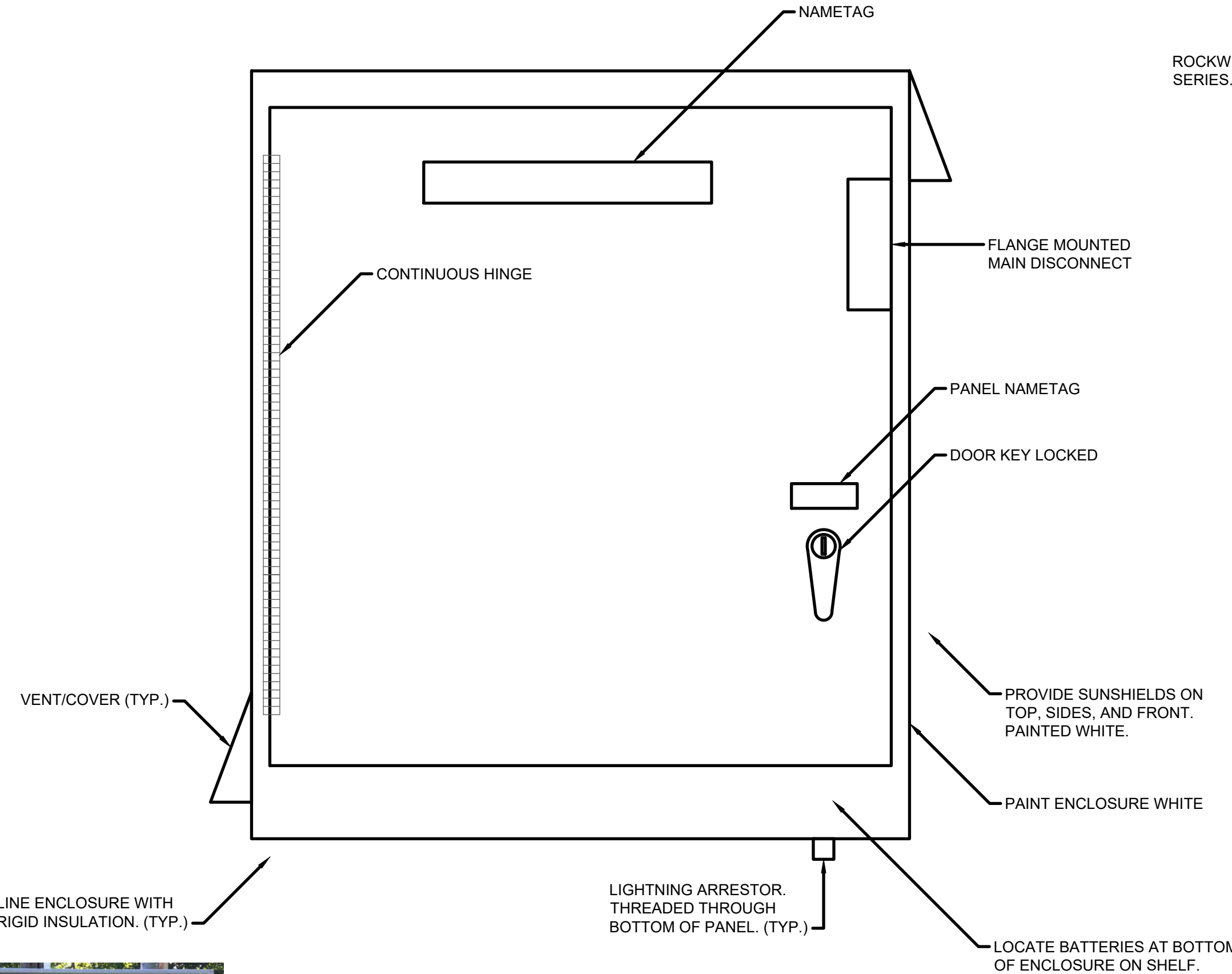


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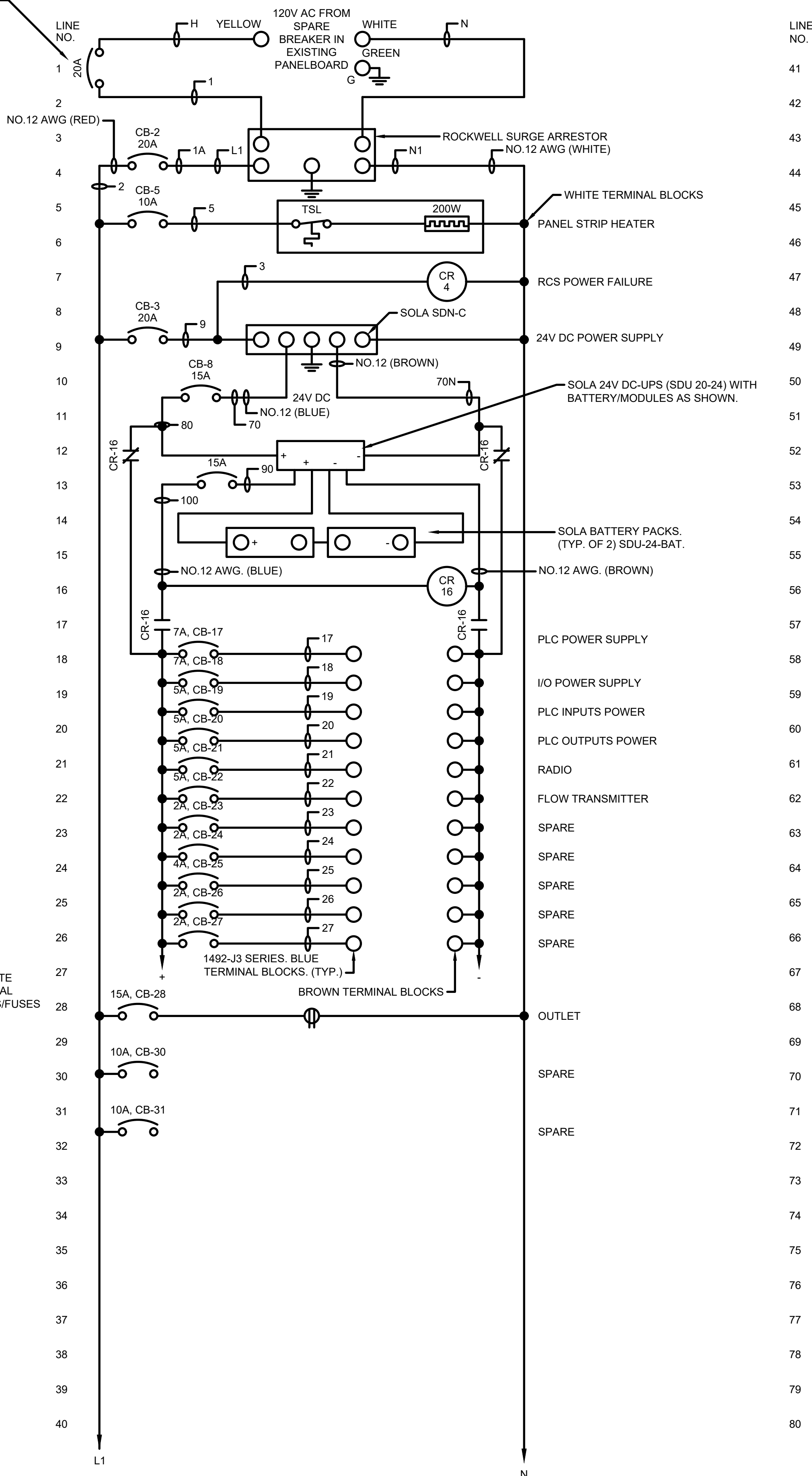
- INSTALL NEW MCP OUTSIDE EXISTING FLOW METERING SHED. MOUNT ON A 316 STAINLESS STEEL STRUT RACK. SUPPORT RACK AS REQUIRED. PROVIDE A 1 INCH CONDUIT WITH 3#12 WIRES FROM EXISTING PANELBOARD INSIDE SHED AND POWER FROM SPARE BREAKER AT EXISTING PANELBOARD. LABEL SPARE BREAKER IN PANELBOARD WITH NEW MCP DESIGNATION.
- MOUNT THE NEW PULSAR FLOW TRANSMITTER INSIDE THE EXISTING SHED. POWER FROM 24VDC POWER SUPPLY IN NEW MCP.
- INSTALL 2 - 1 INCH PVC-RMC CONDUITS WITH 3#12 WIRES AND 2/C#18SH CABLE TO THE NEW MCP FROM NEW FLOW TRANSMITTER.
- FROM THE NEW MCP, INSTALL THE 1/2 INCH COAXIAL CABLE TO THE NEW YAGI ANTENNA. LOCATE NEW ANTENNA ON A NEW 24 FOOT LONG 2 INCH SCHEDULE 40 ALUMINUM MAST PIPE MOUNTED ON THE BACKSIDE OF THE EXISTING BUILDING. SUPPORT AS REQUIRED. GROUND MAST PIPE WITH NO. 6 AWG RHW-USE WIRE. INSTALL TWO GROUND RODS IN YARD AREA NEAR EXISTING FLOW MONITORING BUILDING AND EXTERIOR MOUNTED MCP. CONNECT NO. 6 WIRE TO GROUNDS RODS.
- OBTAIN THE SERVICES OF OUBBIER CALIBRATION SERVICES TO SET UP THE TRANSMITTER, CALIBRATE AND PLACE ON-LINE.
- INSTALL A 1 INCH PVC-RMC CONDUIT WITH MANUFACTURER CABLE, AND SEAL FITTING FROM THE EXISTING FLUME LOCATION TO THE NEW FLOW TRANSMITTER. ASSUME FOR 125 FT. OF PVC-RMC CONDUIT TO BE INSTALLED. MOUNT NEW TRANSMITTER OVER EXISTING FLOOR. FLOOR AREA IN NEMA 7. PROVIDE SEAL FITTING AS REQUIRED. PROVIDE NEW 316 STAINLESS STEEL MOUNTING HARDWARE FOR NEW SENSOR. FIELD VERIFY CONDUIT ROUTING, AND PAVEMENT CUTTING AND PATCHING PRIOR TO BIDS. PATCH WALKWAY AND YARD AREAS BACK TO ORIGINAL CONDITION.

MARK	DATE	DESCRIPTION

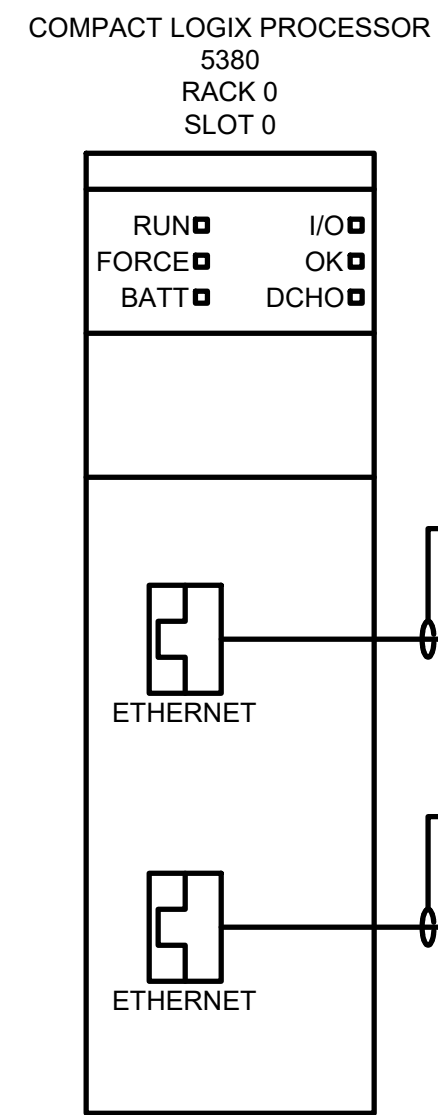
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ROCKWELL 1485-M SERIES, (TYP.)



LINE NO. 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80



TO RADIO

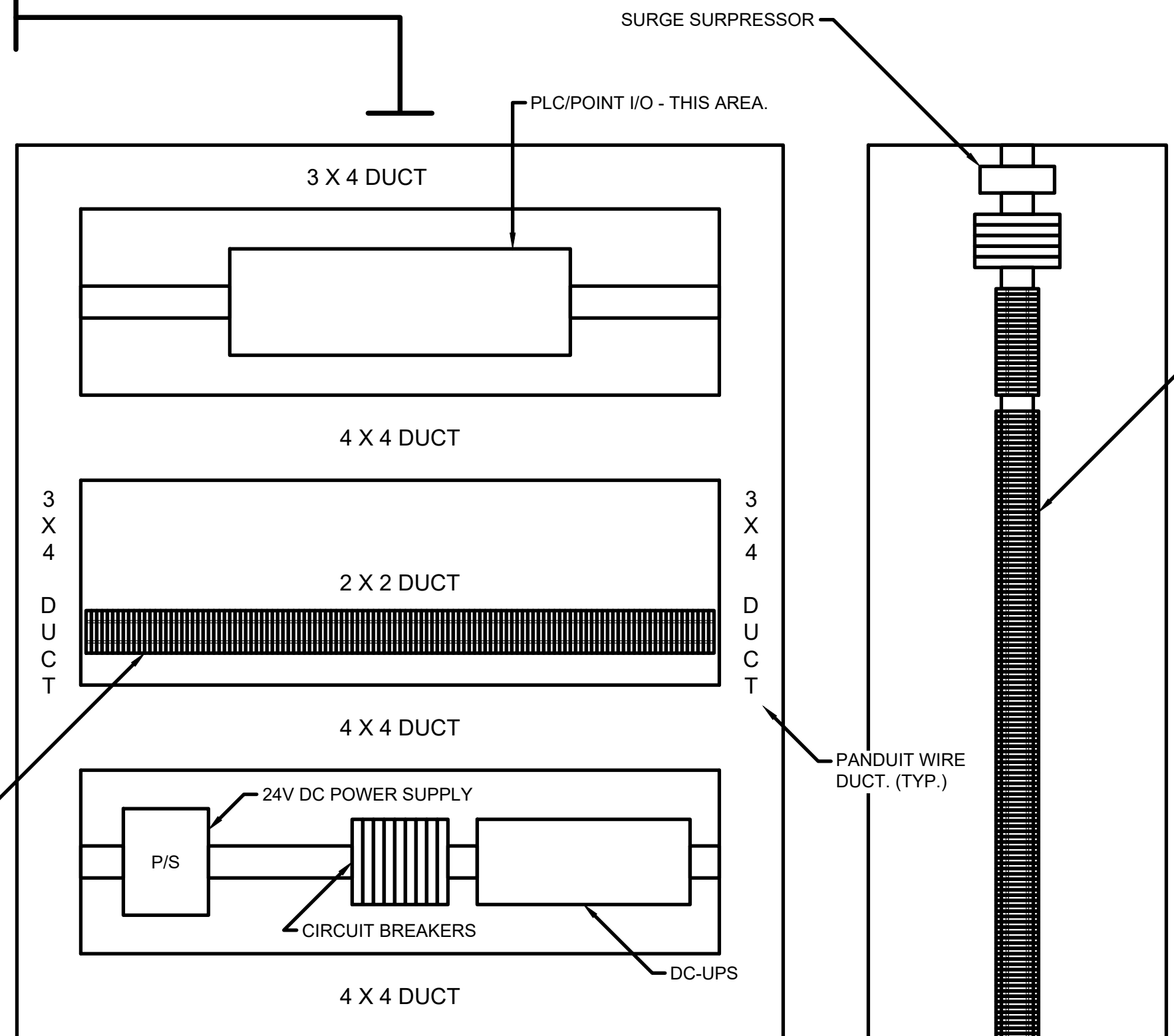
TO 1734-AENT/ POINT I/O



SAMPLE METERING PANEL LAYOUT
NO SCALE

METERING STATION CONTROL PANEL LAYOUT

NEMA 4 ENCLOSURE
SIZE: 42"H X 36"W X 12"D (MIN.)
PANEL TO BE CONSTRUCTED BY A UL LISTED PANEL SHOP.



MIDDLE

RIGHT SIDE

GENERAL SUBPLATE LAYOUT

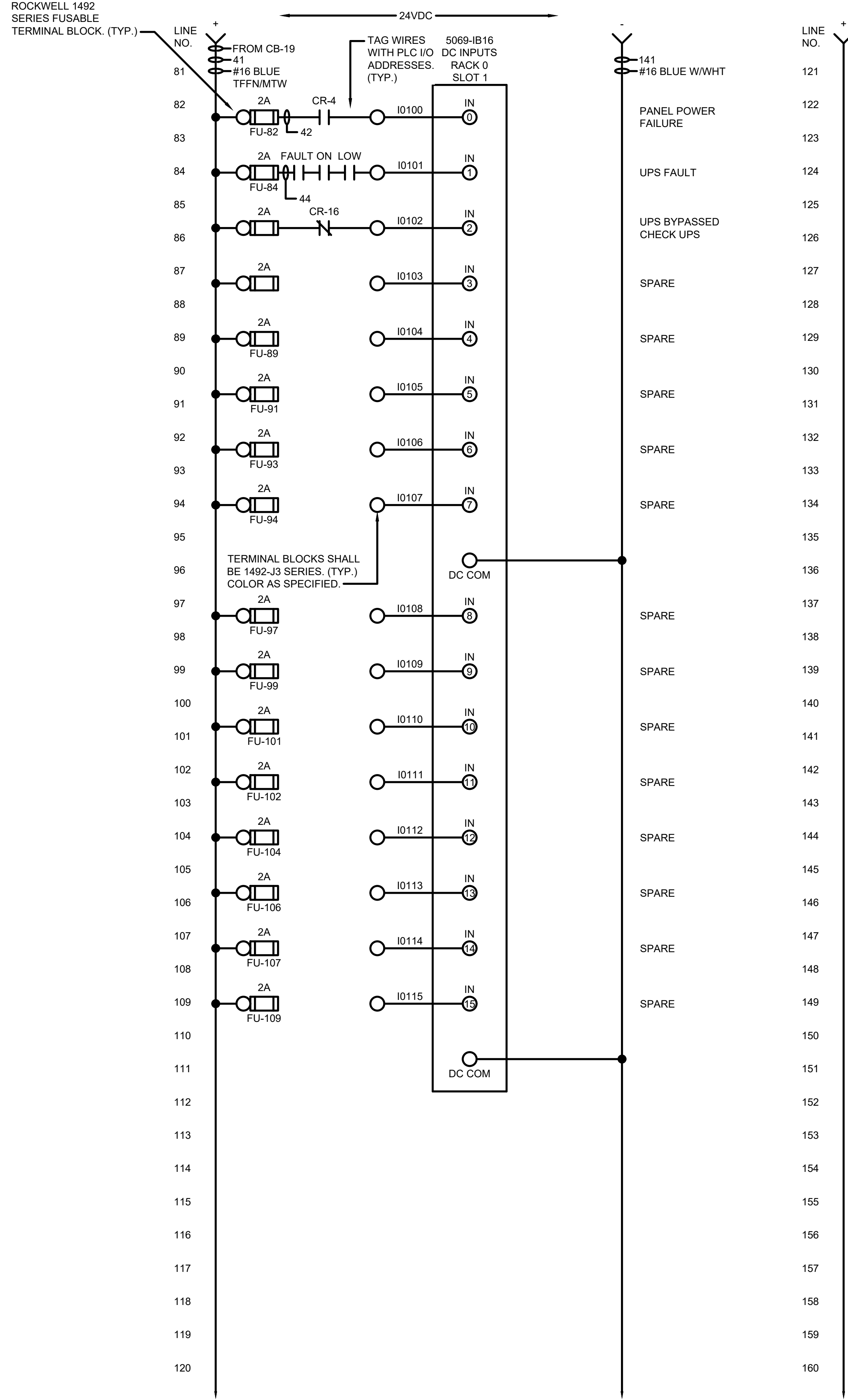
PAINT INSIDE: GLOSS WHITE.
NOTE: NOT ALL SUBPLATE DEVICES ARE SHOWN.
SEE WIRING DIAGRAMS FOR ADDITIONAL REQUIREMENTS, (TYP.)

BY	DATE	DESCRIPTION

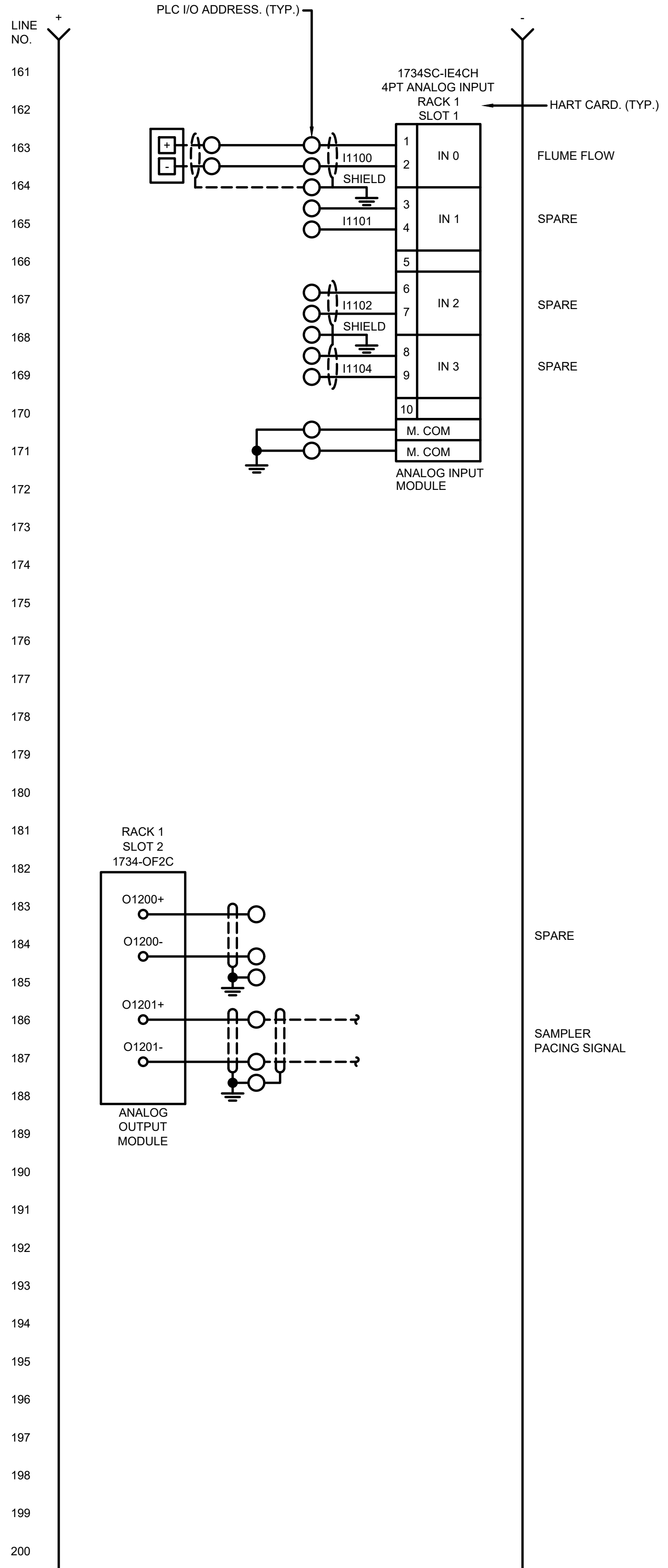
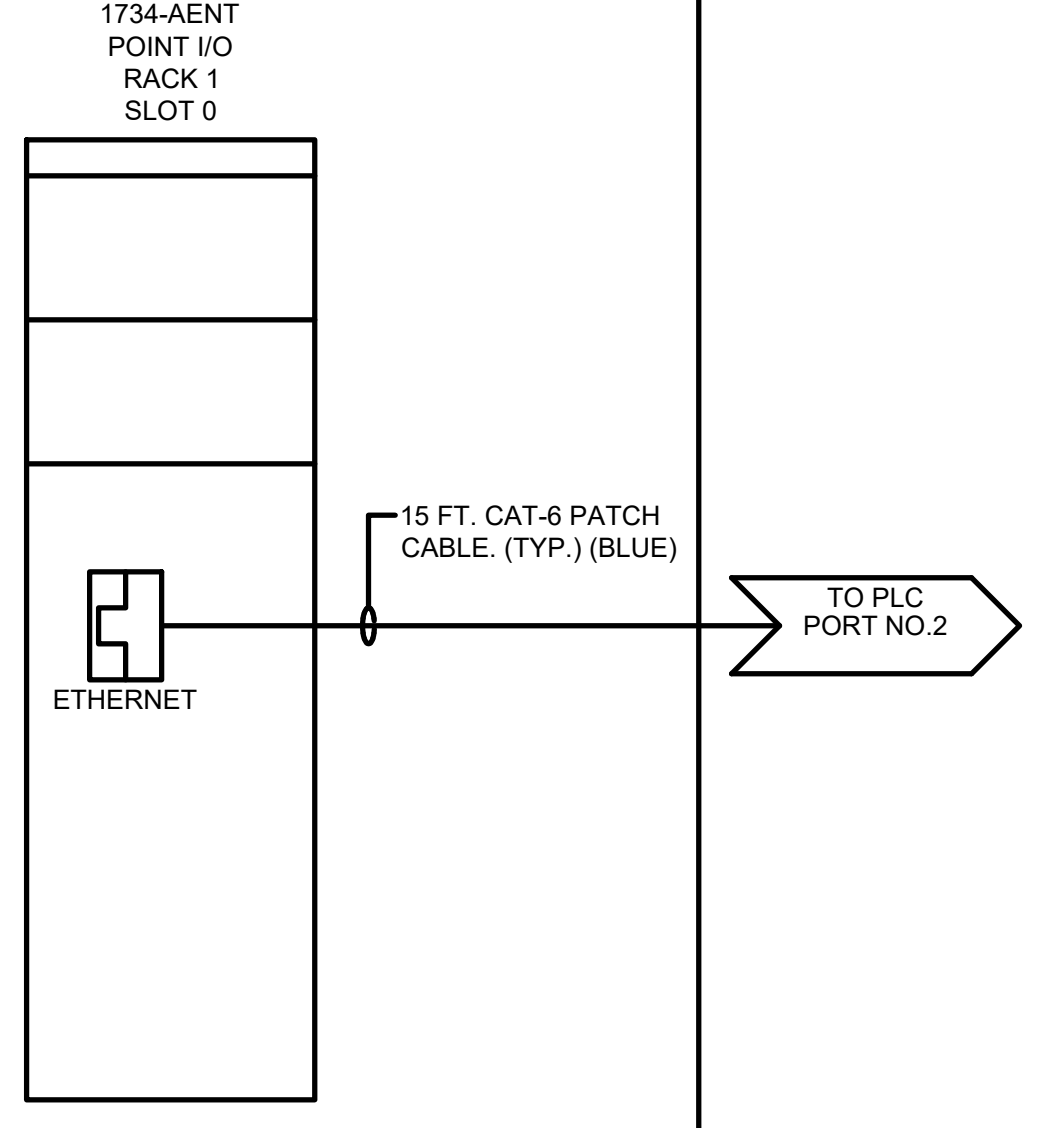
CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES
ALLNEX CONTROL PANEL LAYOUT, WIRING DIAGRAM

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	M.S.J./G.C.J.

2/21/2022 3:15:18 PM - \\TT.LOC\ALI\PROJECTS\ANN ARBOR\RI\19743\200-19743-21003\CAD\SHEETFILES\METERING\34_ALLNEX_PANEL_WIR DIA.DWG - SHANK, JASON



- LINE NO. 121
- LINE NO. 122
- LINE NO. 123
- LINE NO. 124
- LINE NO. 125
- LINE NO. 126
- LINE NO. 127
- LINE NO. 128
- LINE NO. 129
- LINE NO. 130
- LINE NO. 131
- LINE NO. 132
- LINE NO. 133
- LINE NO. 134
- LINE NO. 135
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- LINE NO. 137
- LINE NO. 138
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- LINE NO. 142
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- LINE NO. 145
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- LINE NO. 151
- LINE NO. 152
- LINE NO. 153
- LINE NO. 154
- LINE NO. 155
- LINE NO. 156
- LINE NO. 157
- LINE NO. 158
- LINE NO. 159
- LINE NO. 160



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MARK	DATE	DESCRIPTION

BY

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES

**ALLNEX
CONTROL PANEL
WIRING DIAGRAM**

Project No.: 200-19743-21003
Designed By: G.C.J.
Drawn By: J.L.S.
Checked By: M.S.J/G.C.J.

34
OF 40

Copyright: Tetra Tech

Bar Measures 1 inch

4/27/2022 1:24:14 PM - \\TT.LOCAL\PROJECTS\ANN ARBOR\19743-21003\CAD\SHEETFILES\METERING\35_PORTAGE CREEK_ONELINE_DETAILS.DWG - SHANK, JASON

EXISTING FLOW TRANSMITTER/RECORDER.



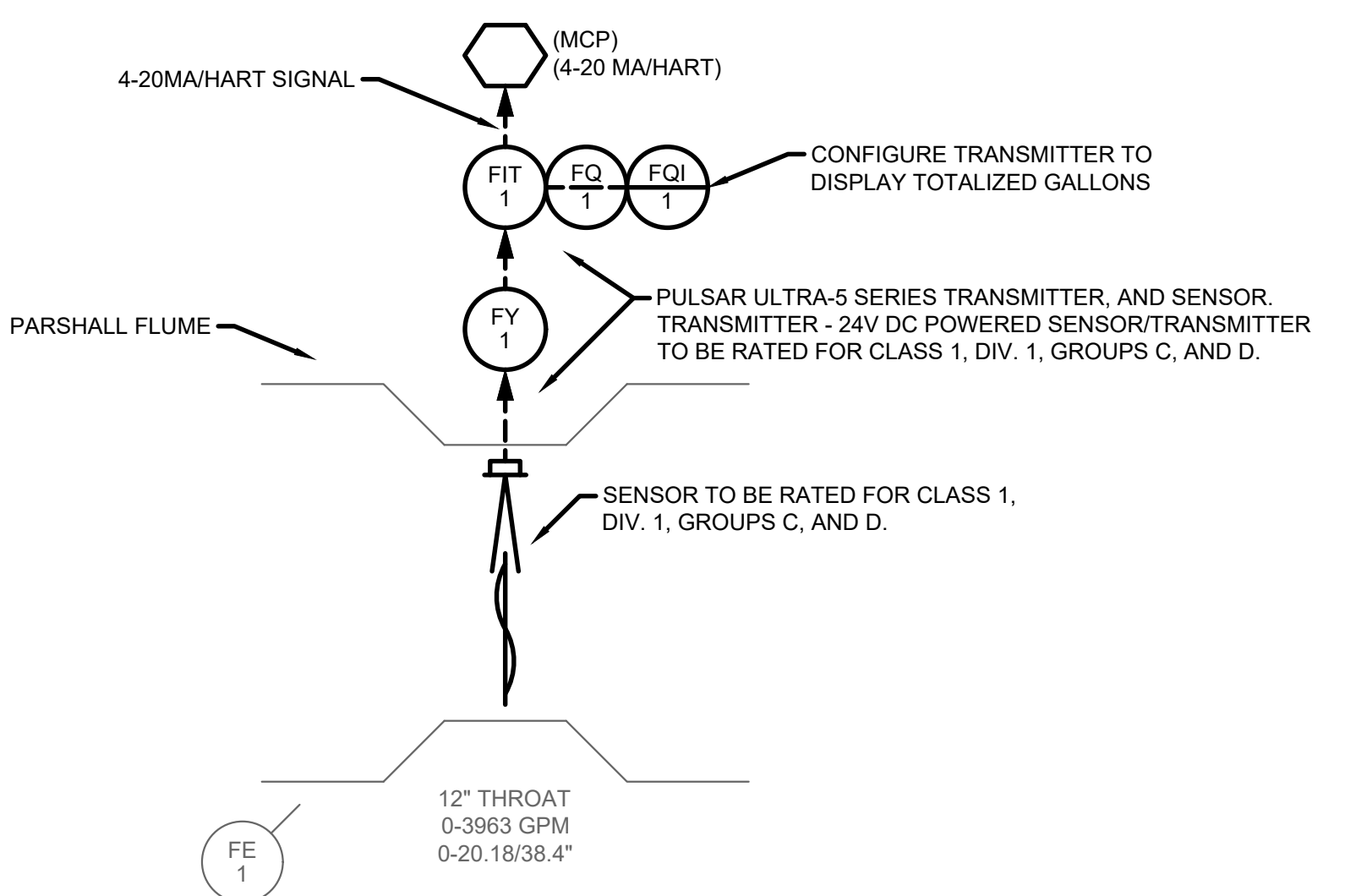
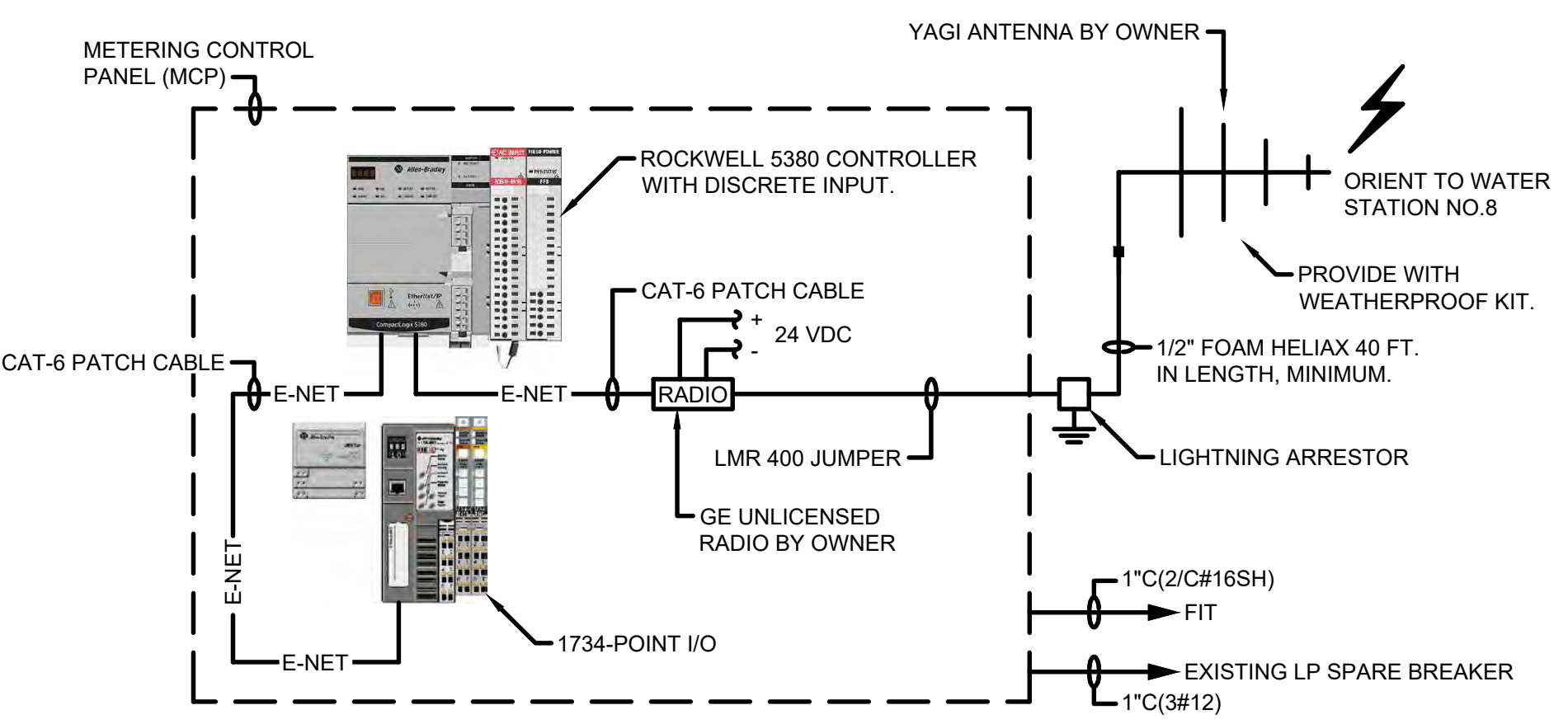
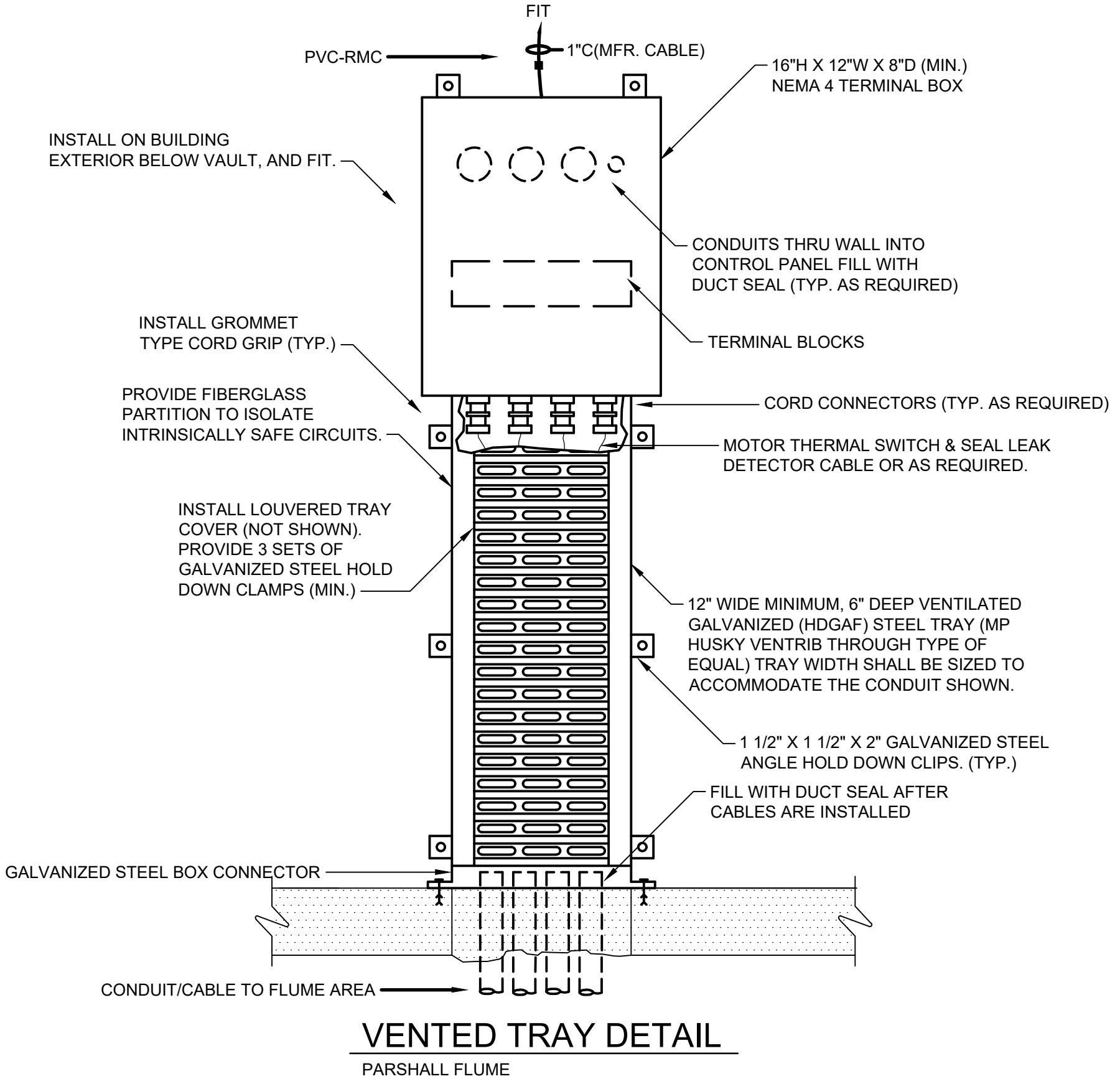
METERING CONTROL PANEL
1" C(2/C#16SH)



EXISTING PANELBOARD

STATION PHOTOS

FIELD LOCATE VENTED TRAY/TERMINAL BOX.



NOTES:

- INSTALL NEW MCP INSIDE EXISTING FLOW METERING SHED. PROVIDE A 1 INCH CONDUIT WITH 3#12 WIRES AND POWER FROM SPARE BREAKER WITHIN EXISTING PANELBOARD INSIDE FLOW MONITORING SHED. LABEL SPARE BREAKER IN PANELBOARD WITH NEW MCP DESIGNATION.
- MOUNT THE NEW PULSAR FLOW TRANSMITTER ON EXISTING PLYWOOD BACKBOARD. POWER FROM 24VDC POWER SUPPLY IN NEW MCP. TURN OVER EXISTING TRANSMITTER, AND SENSOR TO OWNER.
- INSTALL 2 - 1 INCH CONDUITS WITH 3#12, AND 2/C#18SH CABLE TO THE NEW MCP.
- FROM THE NEW MCP, INSTALL THE 1/2 INCH COAXIAL CABLE TO THE NEW YAGI ANTENNA. LOCATE NEW ANTENNA ON A NEW 24 FOOT LONG 2 INCH ALUMINUM SCHEDULE 40 MASTPIPE MOUNTED ON BACKSIDE OF EXISTING STRUCTURE. GROUND MAST PIPE WITH NO.6 AWG RHW-USE WIRE. INSTALL TWO GROUND RODS IN YARD AREA NEAR EXISTING FLOW MONITORING BUILDING AND EXTERIOR MOUNTED MCP. CONNECT NO.6 WIRE TO GROUND RODS.
- OBTAIN THE SERVICES OF OUBBIER CALIBRATION SERVICES TO SET UP THE TRANSMITTER, CALIBRATE AND PLACE ON-LINE.
- INSTALL THE NEW FLOW SENSOR IN PLACE OF THE EXISTING MILLETRONICS SENSOR. TURN OVER EXISTING FLOW TRANSMITTER AND SENSOR TO OWNER. INSTALL NEW 1 INCH PVC-RMC CONDUIT, AND SEAL FITTING BETWEEN METERING BUILDING AND FLOW SENSOR/METER VAULT. ASSUME FOR 75 FEET OF CONDUIT AND WIRE TO BE INSTALLED. FLOW SENSOR IS IN A NEMA 7 AREA. PROVIDE SEAL FITTINGS AS REQUIRED ON THIS CONDUIT. PROVIDE NEW STAINLESS STEEL MOUNTING HARDWARE FOR INSTALLING SENSOR OVER EXISTING FLUME. FIELD VERIFY CONDUIT ROUTING, AND PAVEMENT CUTTING AND PATCHING PRIOR TO BIDS. PATCH WALKWAY AND YARD AREAS BACK TO ORIGINAL CONDITION.

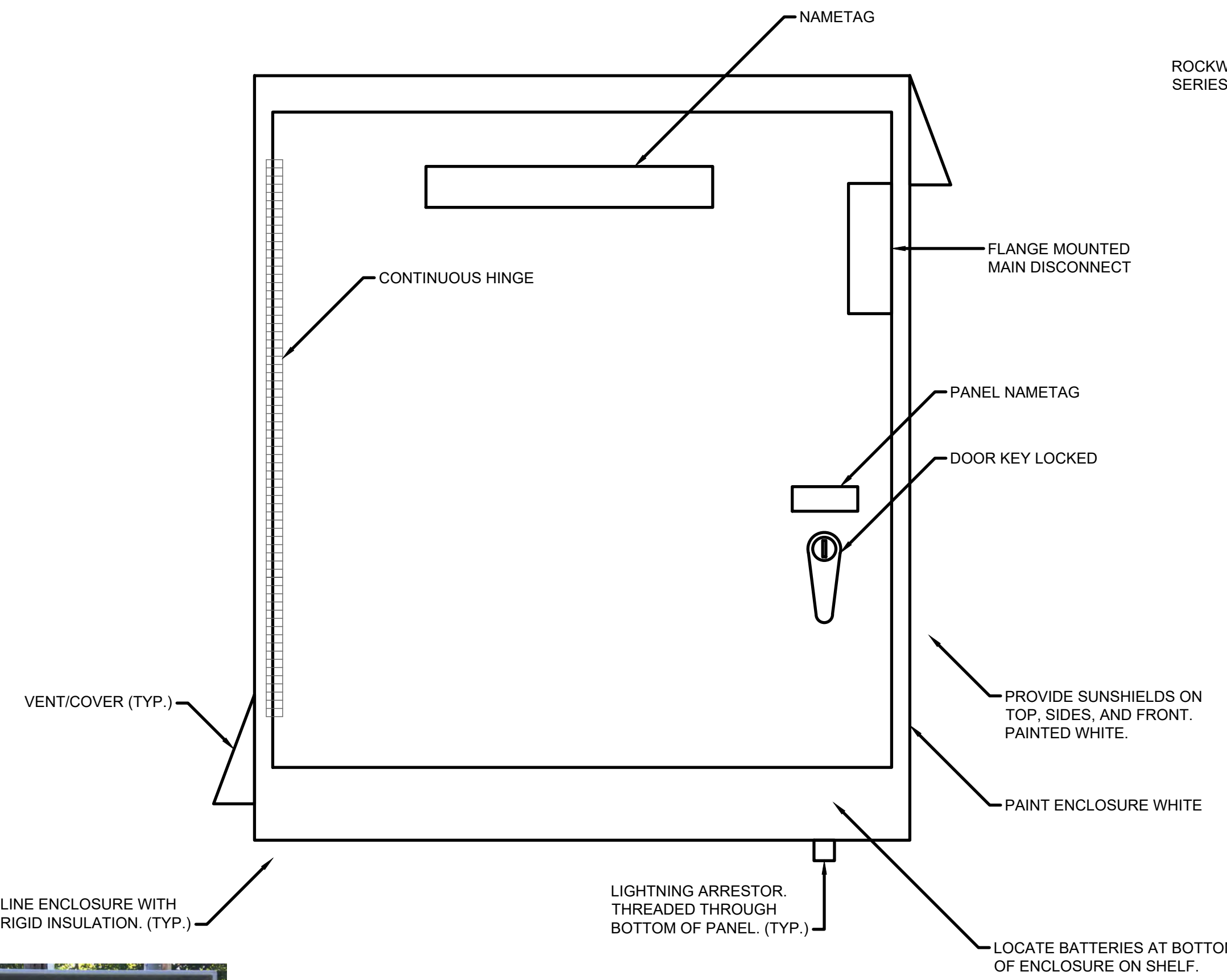
MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
PORTAGE CREEK METERING STATION ONE-LINES, DETAILS

Project No.: 200-19743-21003
Designed By: GCJ
Drawn By: JLS
Checked By: MSJ/GCJ

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2/21/2022 3:15:50 PM - \\TTL\LOCAL\PROJECTS\ANN ARBOR\19743\200-19743-21003\CAD\SHEET\METERING\36_PORTAGE CREEK_PANEL_LAYOUT_WIR.DWG - SHANK, JASON



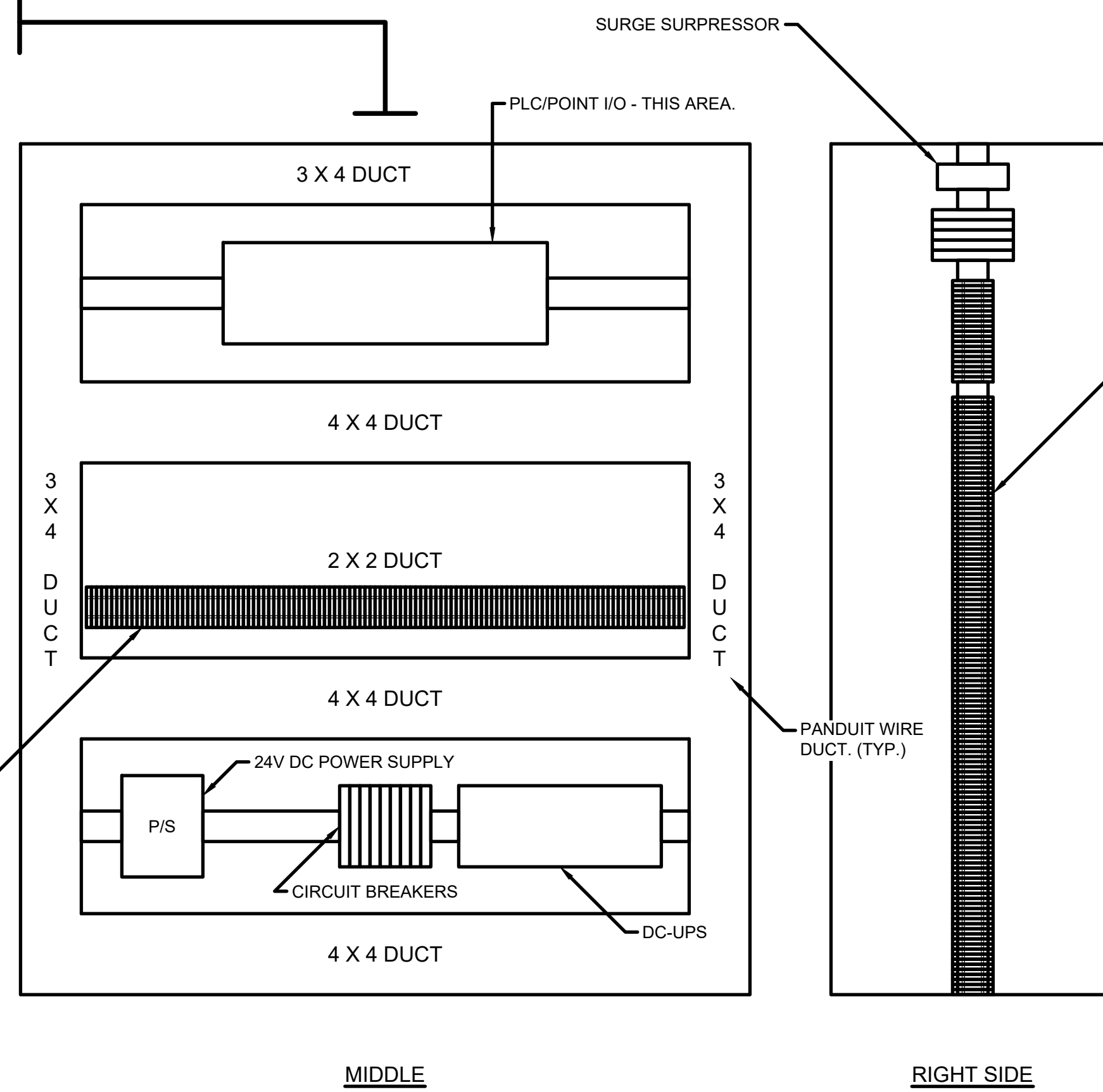
METERING STATION CONTROL PANEL LAYOUT

NEMA 4 ENCLOSURE
 SIZE: 42"H X 36"W X 12"D (MIN.)
 PANEL TO BE CONSTRUCTED BY A UL LISTED PANEL SHOP.



SAMPLE METERING PANEL LAYOUT

NO SCALE

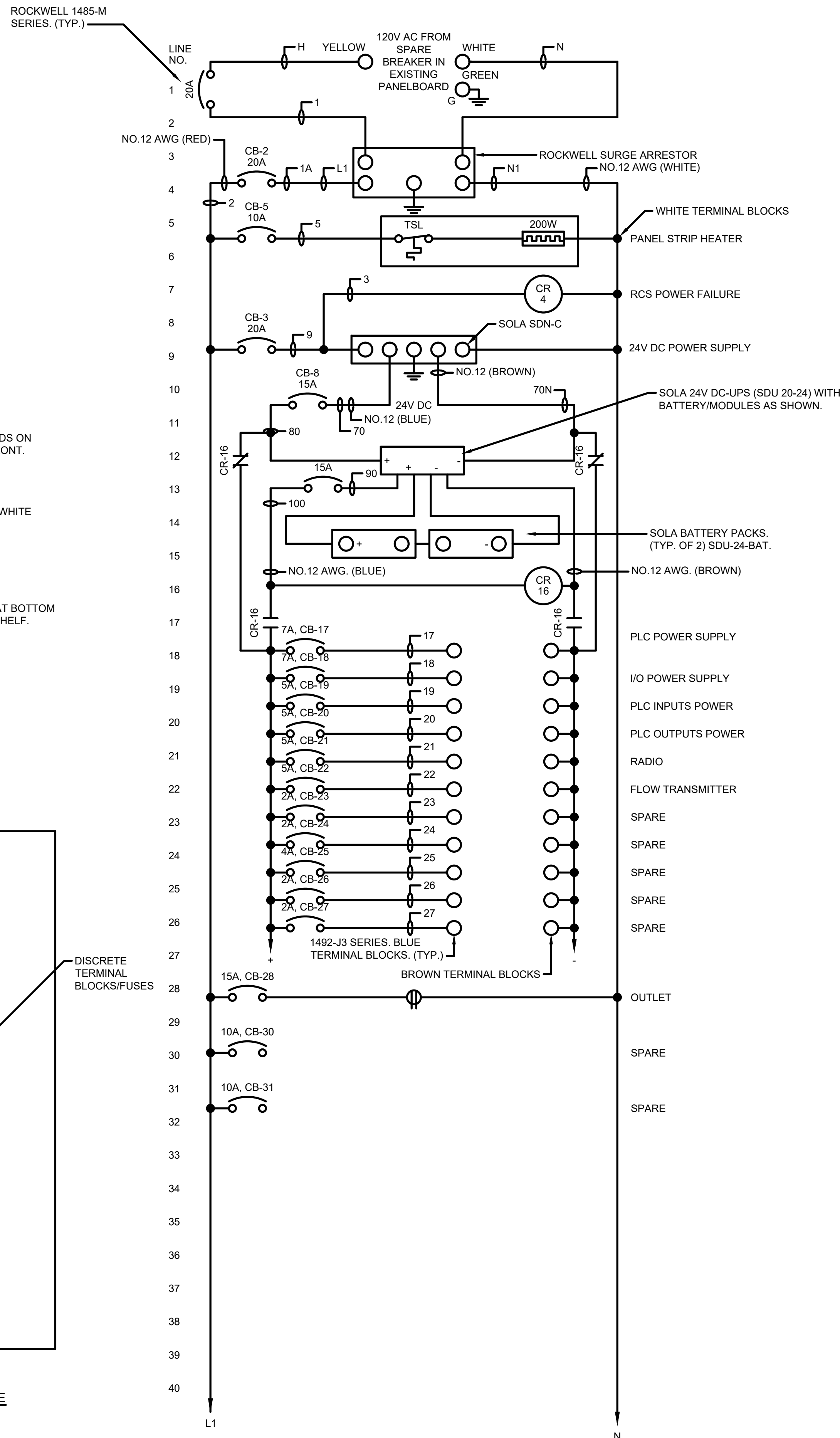


MIDDLE

RIGHT SIDE

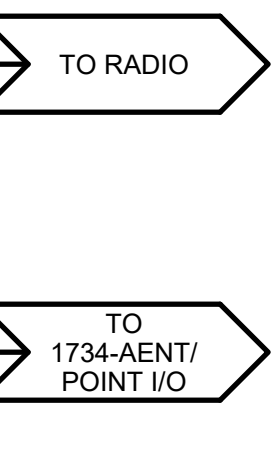
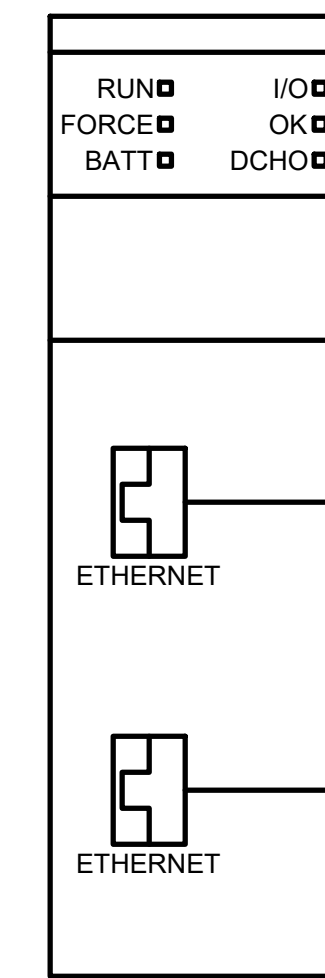
GENERAL SUBPLATE LAYOUT

PAINT INSIDE: GLOSS WHITE.
 NOTE: NOT ALL SUBPLATE DEVICES ARE SHOWN.
 SEE WIRING DIAGRAMS FOR ADDITIONAL REQUIREMENTS. (TYP.)



LINE NO. 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80

COMPACT LOGIX PROCESSOR
 5380
 RACK 0
 SLOT 0

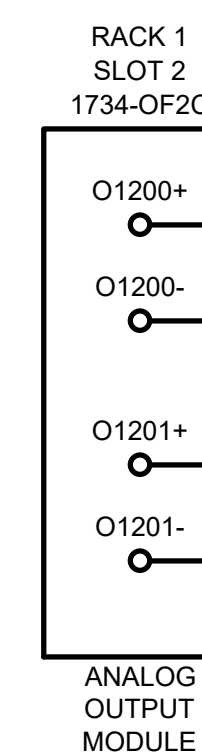
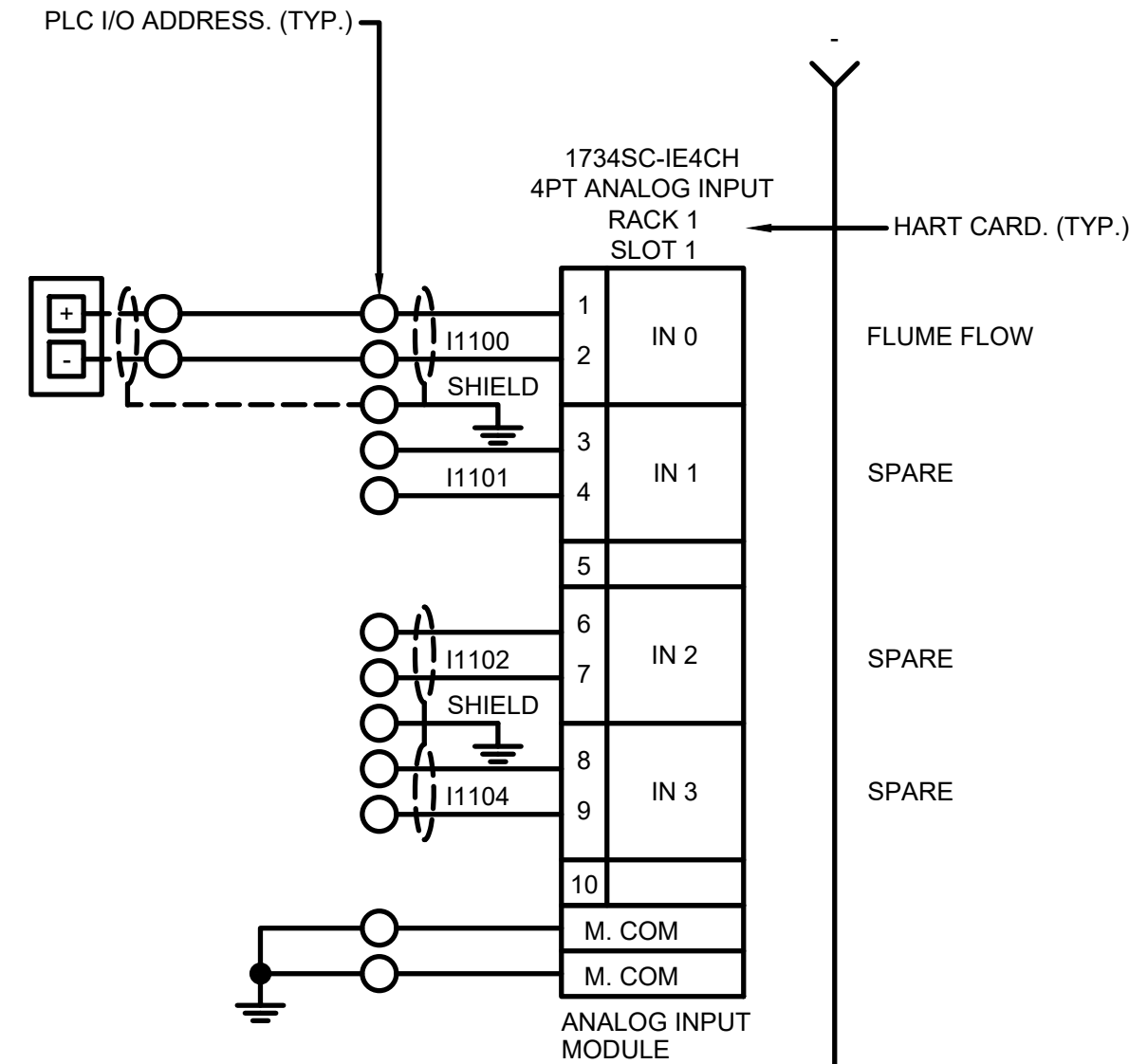
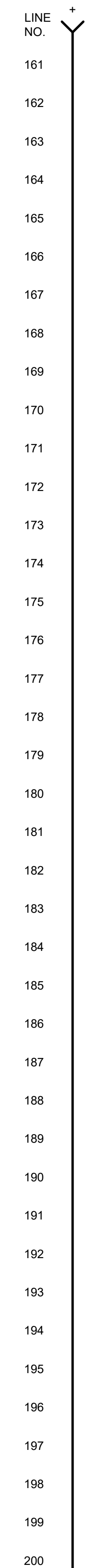
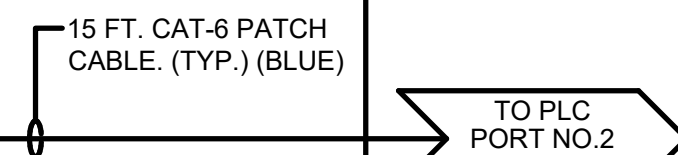
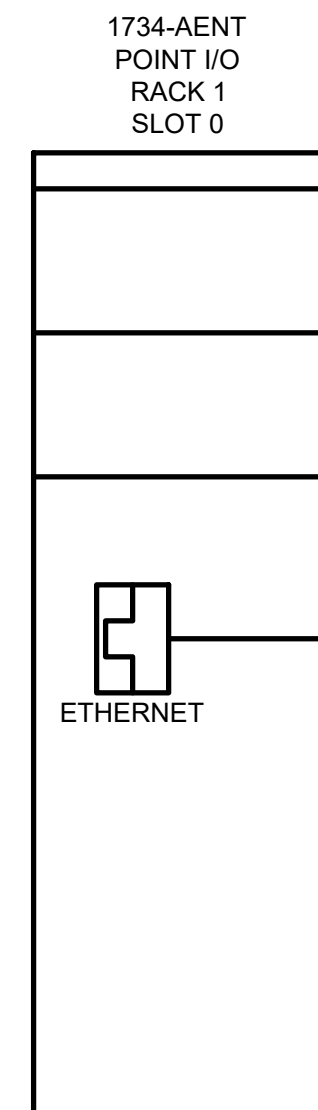
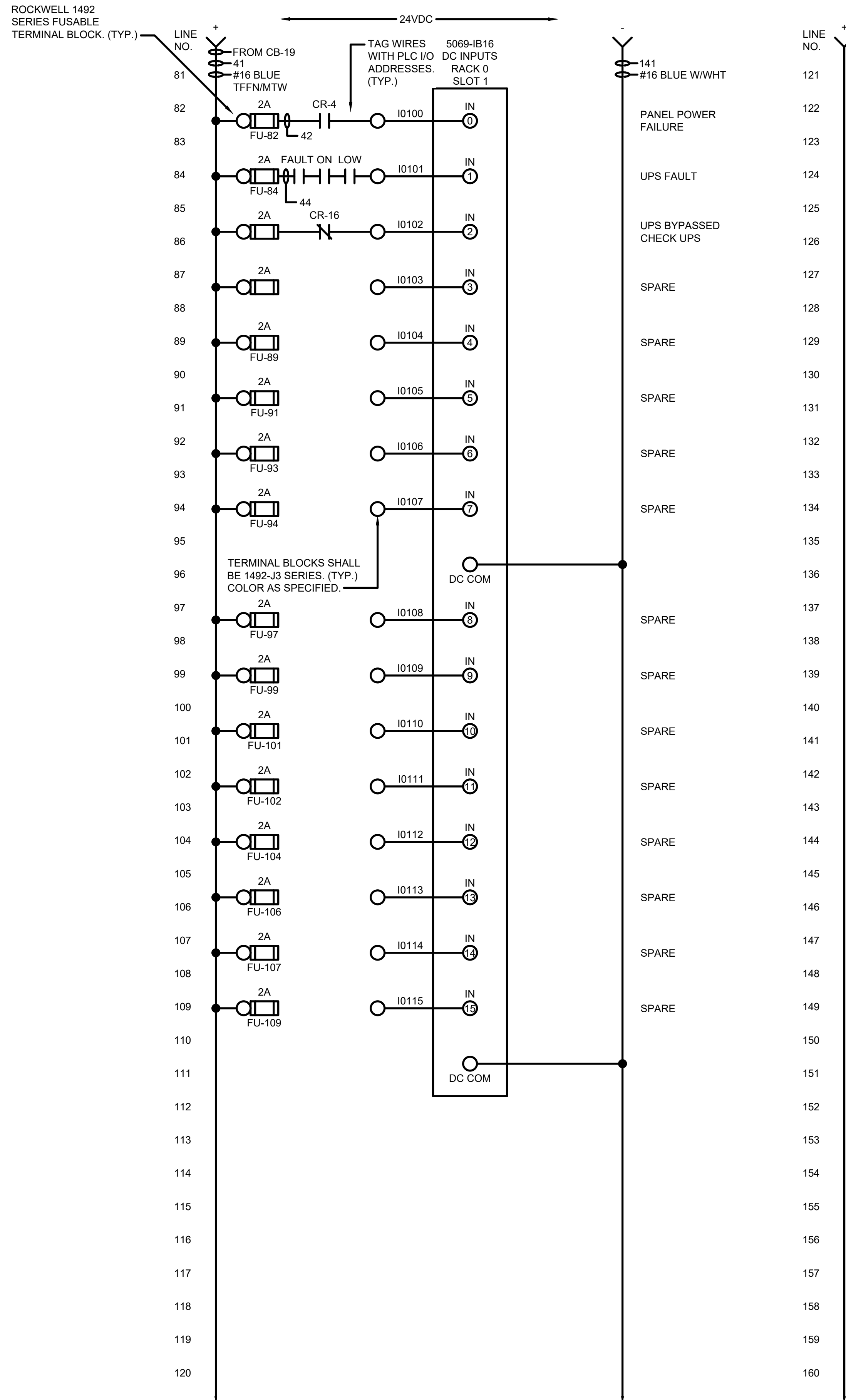


BY	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
 PORTAGE CREEK
 METERING STATIONS CONTROL UPGRADES
 CONTROL PANEL
 LAYOUT, WIRING DIAGRAM

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MS.J/G.C.J.

2/21/2022 3:15:57 PM - \\TT.LOC\AL\PROJECTS\ANN ARBOR\19743\200-19743-21\003\CAD\SHEET\FILES\METERING\37_PORTAGE_CREEK_PANEL_WIR.DWG - SHANK, JASON



SPARE

SAMPLER PACING SIGNAL

TETRA TECH

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ANN ARBOR, MI 48108
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MARK	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
PORTAGE CREEK CONTROL PANEL WIRING DIAGRAM

Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MS.J/G.C.J.

37
OF 40

Copyright: Tetra Tech
Bar Measures 1 inch

4/27/2022 11:10:03 PM - \\TT.LOCAL\PROJECTS\ANN ARBOR\19743\200-19743-21003\CAD\SHEET\METERING\38_MEREDITH_ONLINE_DETAILS.DWG - SHANK, JASON



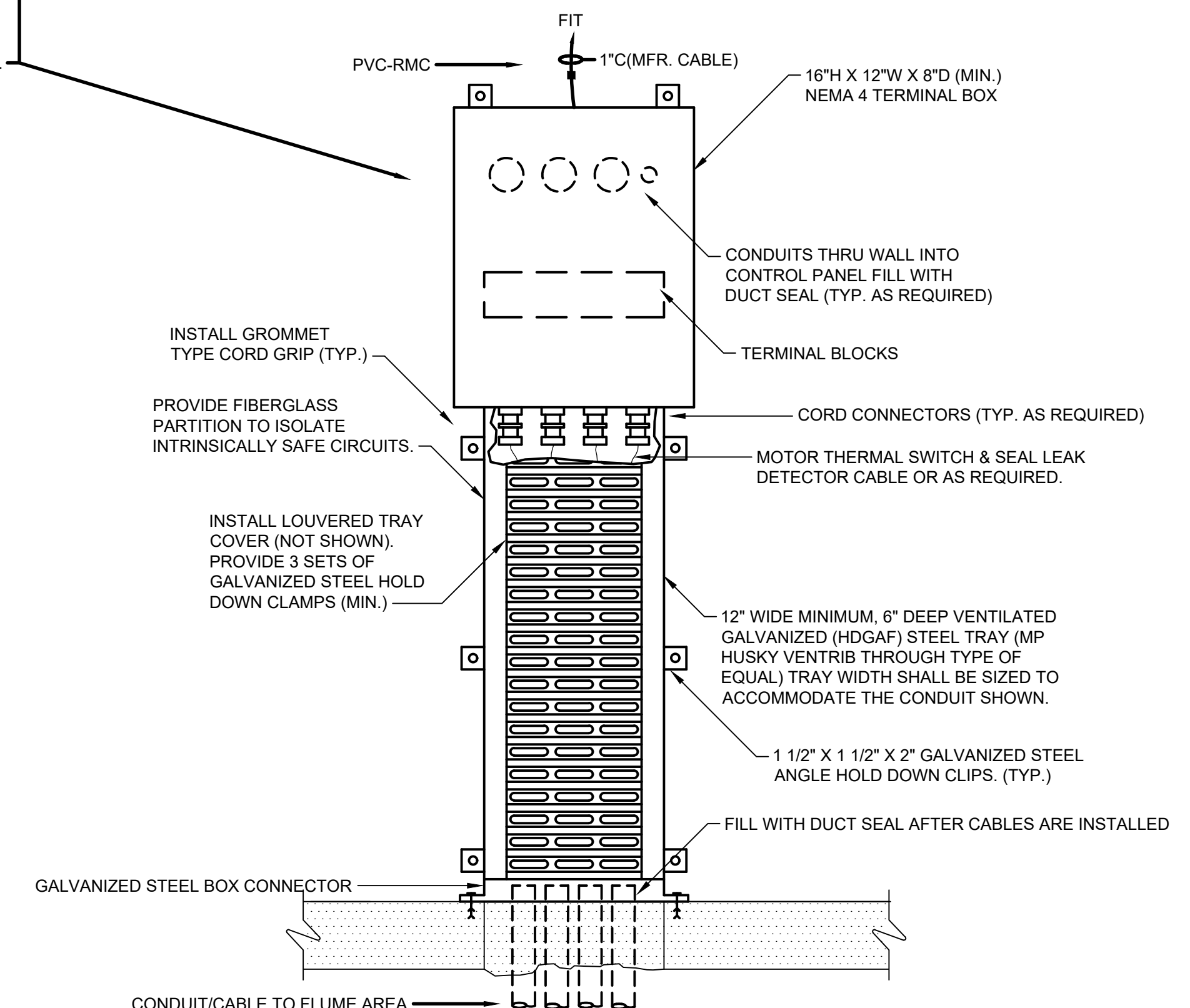
DEMOLISH EXISTING CONDUIT/WIRE TO EXISTING FLOW SENSOR IN EXISTING FLUME CHAMBER BELOW GRADE.



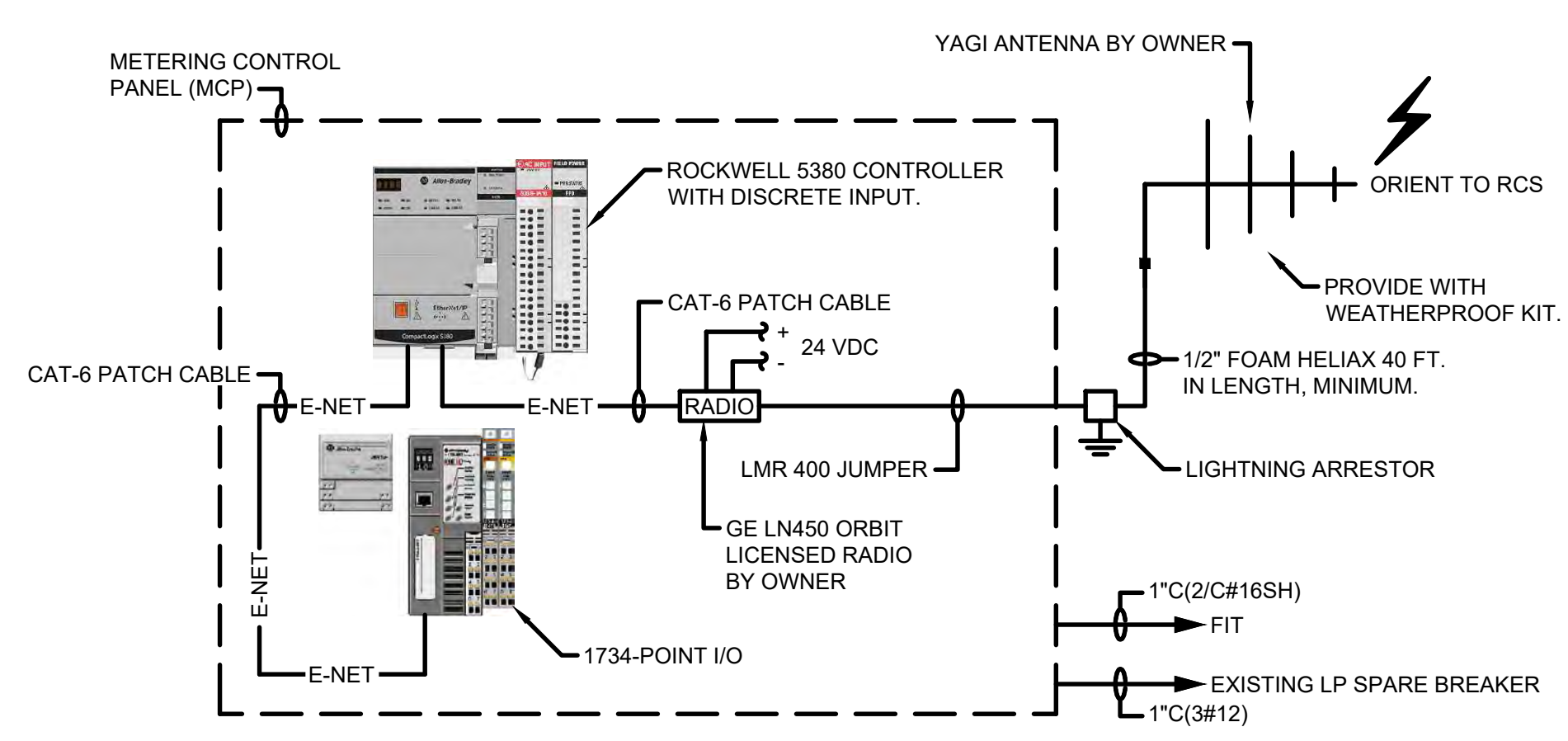
STATION PHOTOS



FIELD LOCATE VENTED TRAY/TERMINAL BOX. MOUNT ON STRUT SUPPORT RACK.

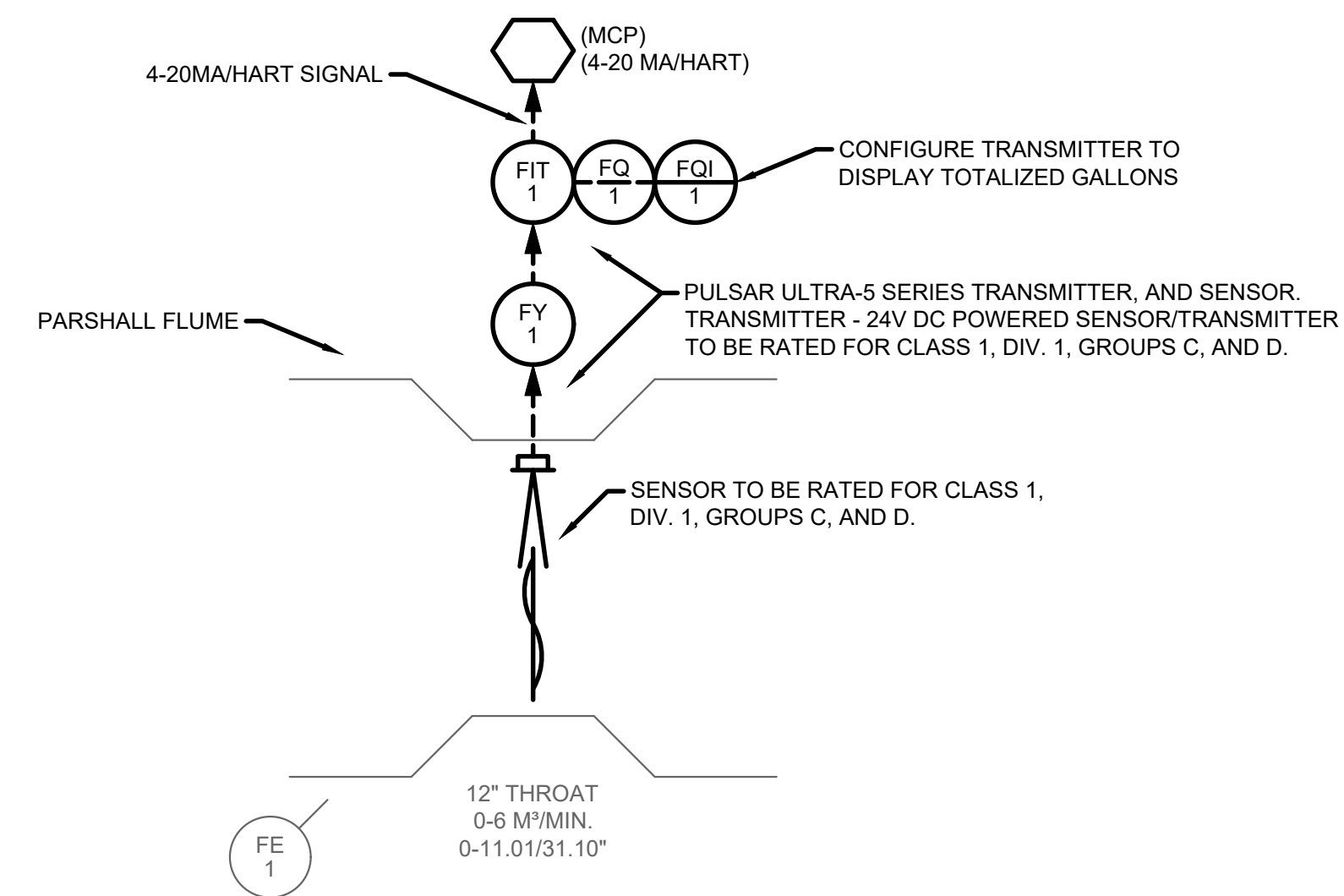


VENTED TRAY DETAIL
PARSHALL FLUME



SYSTEM CONFIGURATION DRAWING

NOTE: PLC/RADIO PROGRAMMING BY OWNER/TETRA TECH.



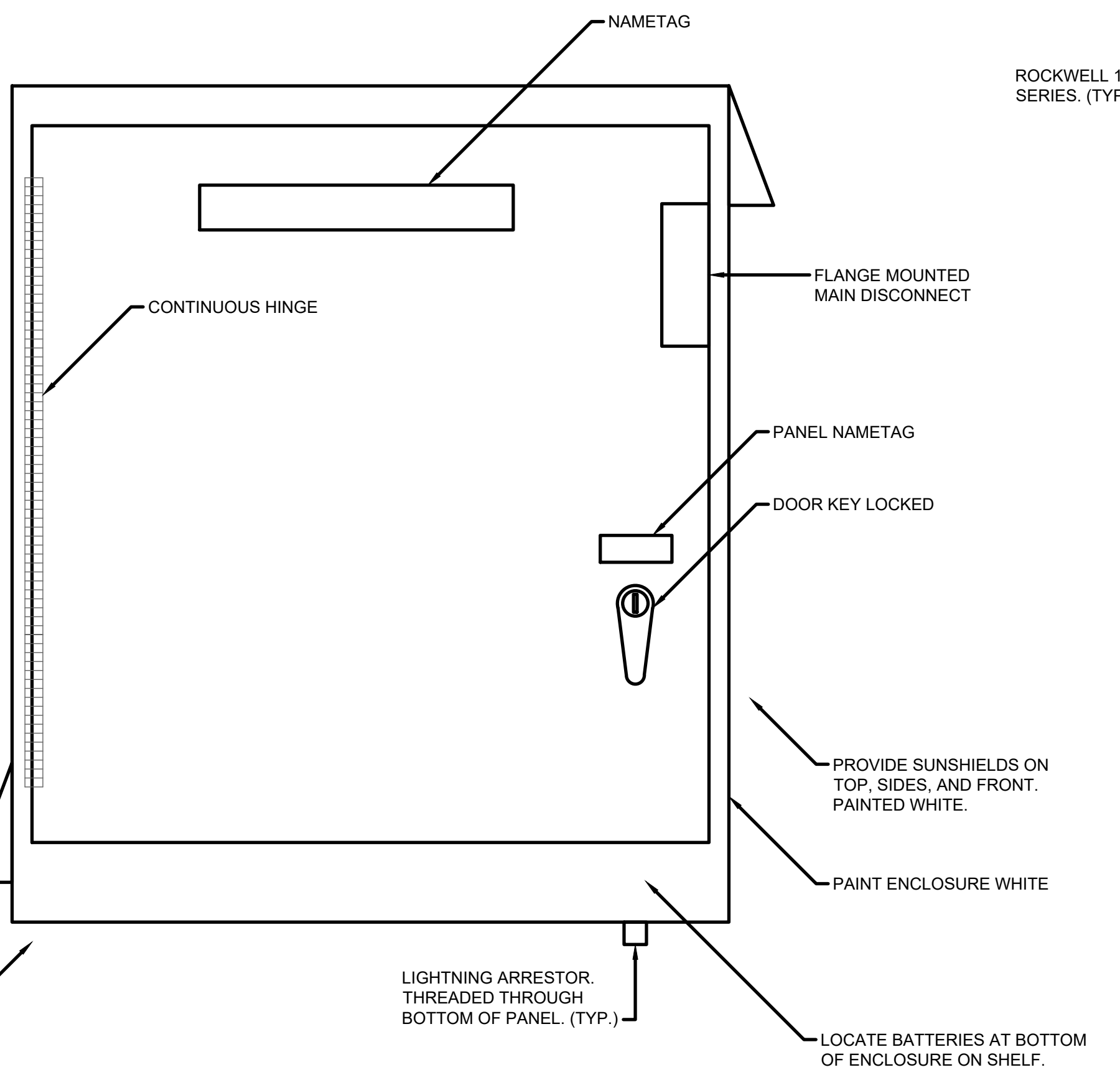
PARTIAL P&ID DIAGRAM

NOTES:

1. INSTALL NEW MCP OUTSIDE ON A NEW 316 STAINLESS STEEL STRUT SUPPORT RACK. SECURE RACK TO CONCRETE PAD. PROVIDE A 1 INCH CONDUIT WITH 3#12 WIRES AND POWER FROM EXISTING PANELBOARD. LABEL SPARE BREAKER IN PANELBOARD WITH NEW MCP DESIGNATION.
2. MOUNT THE NEW PULSAR FLOW TRANSMITTER INSIDE THE NEW METERING CABINET. POWER FROM 24VDC POWER SUPPLY IN NEW MCP.
3. FROM THE NEW MCP, INSTALL THE 1/2 INCH COAXIAL CABLE TO THE NEW YAGI ANTENNA. LOCATE NEW ANTENNA ON A NEW 24 FOOT LONG 2 INCH SCHEDULE 80 ALUMINUM MAST PIPE MOUNTED ON THE BACKSIDE OF THE NEW STRUT SUPPORT RACK. GROUND MAST PIPE WITH NO.6 AWG RHW-USE WIRE. INSTALL TWO GROUND RODS IN YARD AREA NEAR EXISTING FLOW CHAMBER. CONNECT NO.6 WIRE TO GROUNDS RODS.
4. SUPPORT PANEL WITH A NEW STRUT RACK, CONCRETE ENCASED.
5. OBTAIN THE SERVICES OF OUBBIER CALIBRATION SERVICES TO SET UP THE TRANSMITTER, CALIBRATE AND PLACE ON-LINE.
6. INSTALL THE NEW FLOW SENSOR IN PLACE OF THE EXISTING ULTRASONIC SENSOR. TURN OVER EXISTING FLOW TRANSMITTER AND SENSOR TO OWNER. INSTALL NEW 1 INCH PVC-RMC CONDUIT BETWEEN NEW CONTROL PANEL AND FLOW SENSOR. ASSUME FOR 75 FEET OF CONDUIT AND WIRE TO BE INSTALLED. FLOW SENSOR IS IN A NEMA 7 AREA. PROVIDE SEAL FITTINGS AS REQUIRED ON THIS CONDUIT. PROVIDE NEW STAINLESS STEEL MOUNTING HARDWARE FOR INSTALLING SENSOR OVER EXISTING FLUME. FIELD VERIFY CONDUIT ROUTING, AND EXCAVATION PRIOR TO BIDS. PATCH YARD AREA BACK TO ORIGINAL CONDITION.
7. INSTALL NEW VENTED TRAY BETWEEN CONTROL PANEL, AND FLUME.

MARK	DATE	DESCRIPTION

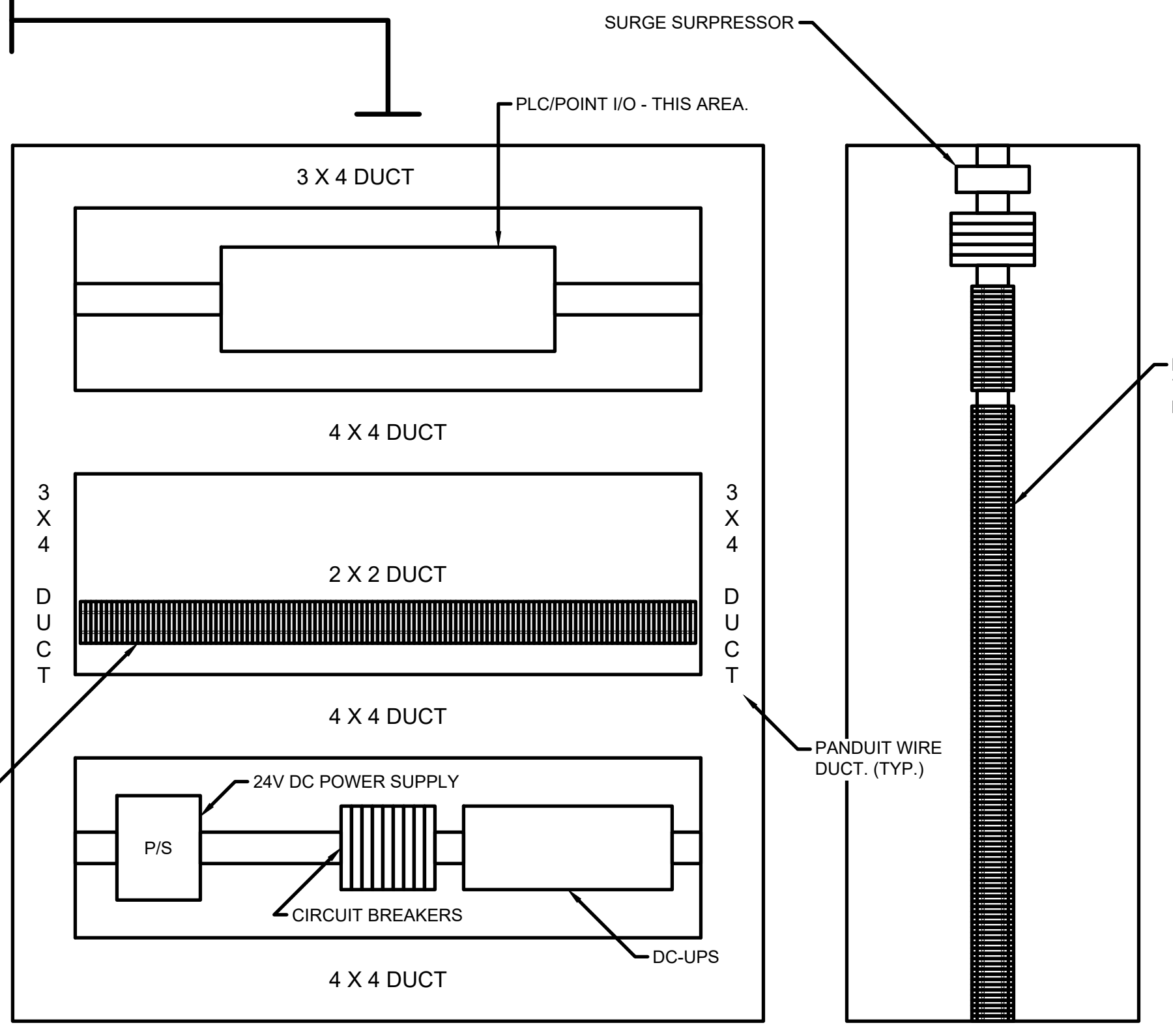
Project No.:	200-19743-21003
Designed By:	G.C.J.
Drawn By:	J.L.S.
Checked By:	MSJ/G.C.J.



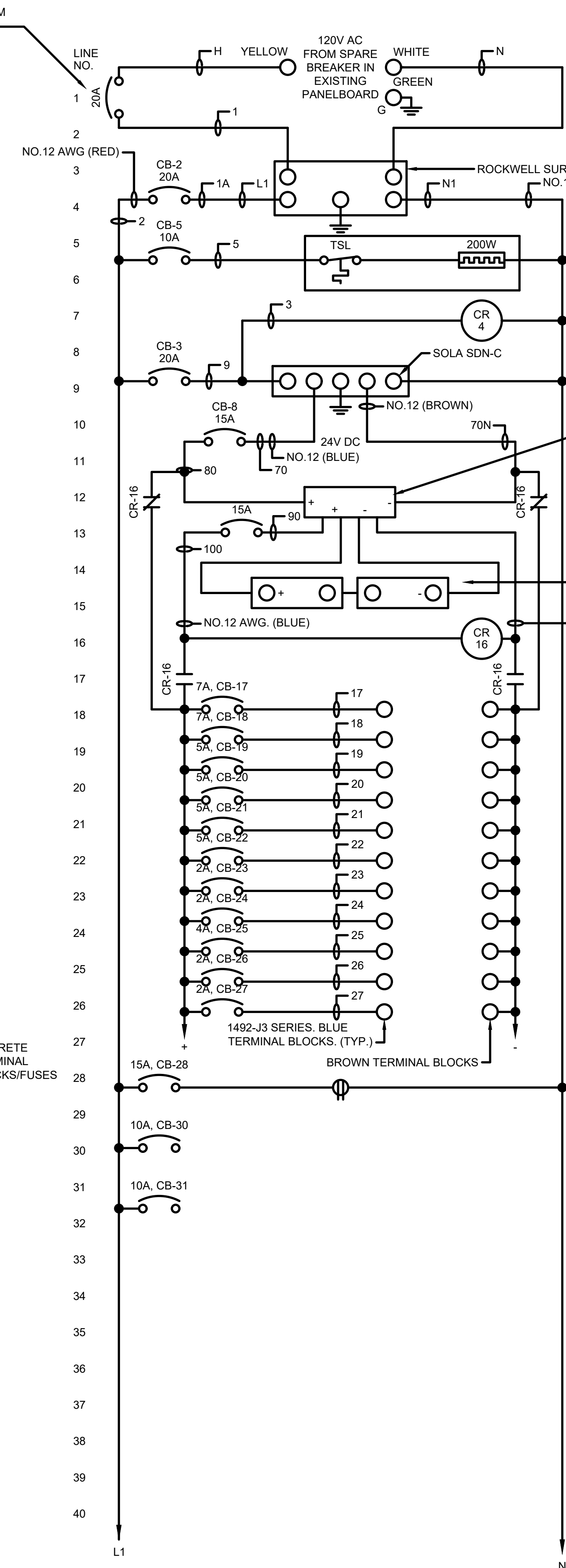
METERING STATION CONTROL PANEL LAYOUT
 NEMA 4 ENCLOSURE
 SIZE: 42"H X 36"W X 12"D (MIN.)
 PANEL TO BE CONSTRUCTED BY A UL LISTED PANEL SHOP.



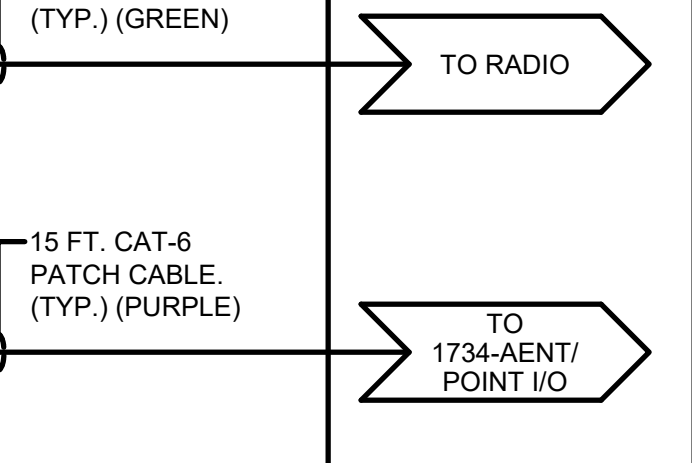
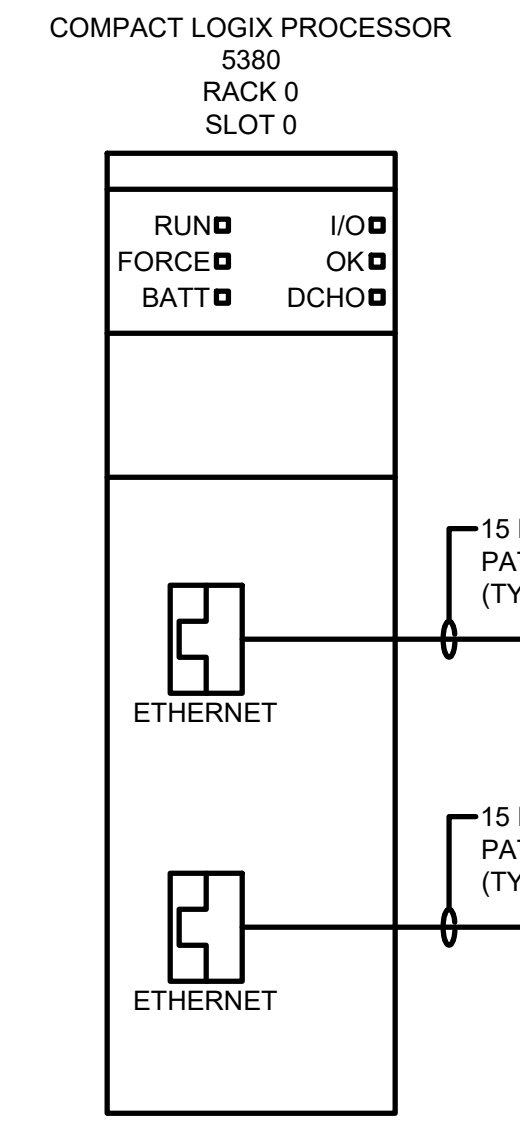
SAMPLE METERING PANEL LAYOUT
 NO SCALE



GENERAL SUBPLATE LAYOUT
 PAINT INSIDE: GLOSS WHITE.
 NOTE: NOT ALL SUBPLATE DEVICES ARE SHOWN.
 SEE WIRING DIAGRAMS FOR ADDITIONAL REQUIREMENTS. (TYP.)



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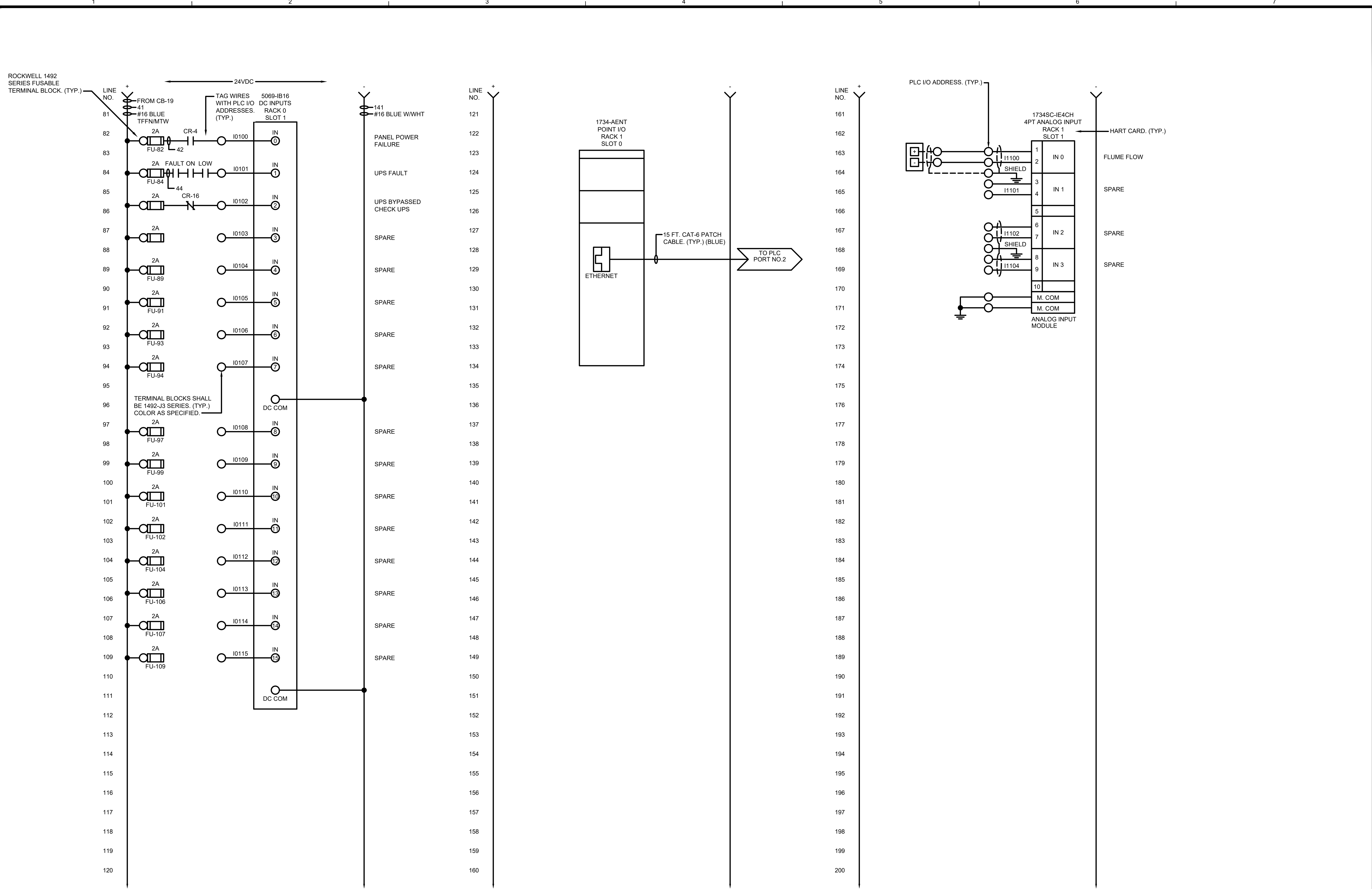


BY	DATE	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
 METERING STATIONS CONTROL UPGRADES
MEREDITH CONTROL PANEL LAYOUT, WIRING DIAGRAM

Project No.: 200-19743-21003
 Designed By: G.C.J.
 Drawn By: J.L.S.
 Checked By: M.S.J./G.C.J.

2/21/2022 3:16:30 PM - \\TETRALI\PROJECTS\ANN ARBOR\19743-21003\CAD\WORKSHEETS\METERING\MEREDITH_PANEL_LAYOUT_WIR.DWG - SHANK, JASON



MARK	DATE	DESCRIPTION

BY	DESCRIPTION

CITY OF KALAMAZOO, MICHIGAN
METERING STATIONS CONTROL UPGRADES

**MEREDITH
CONTROL PANEL
WIRING DIAGRAM**

Project No.:	200-19743-21003
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