



## **COUNTY PARK LIFT STATION REPLACEMENT 2024**

**MERIDIAN TOWNSHIP**

**DEPARTMENT OF PUBLIC WORKS & ENGINEERING**

**INGHAM COUNTY, MICHIGAN**

# COUNTY PARK LIFT STATION REPLACEMENT 2024

FOR  
MERIDIAN TOWNSHIP

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MERIDIAN TOWNSHIP  
**COUNTY PARK LIFT STATION REPLACEMENT 2024**  
ADVERTISEMENT FOR BIDS

Sealed proposals will be received by Meridian Township, Ingham County, Michigan, at the Meridian Township Clerk's Office, Municipal Building, 5151 Marsh Road, Okemos, Michigan, 48864-1198, Ph. (517) 853-4000, up to 11:00 a.m., local time on Tuesday, April 16<sup>th</sup>, 2024 for the replacement of a sanitary lift station, after which time, proposals will be publicly opened and read aloud.

Bids are solicited on a unit price basis. The work involves the following major bid items:

- Removal of an existing Lift Station including all hardware and plumbing;
- Installation of a new Lift Station including:
  - Valve Vault, Control Panel, Antenna, Pumps, Generator and all plumbing, conduits, etc;
- Installation of a new 750 gallon Oil and Grease interceptor;
- Installation of a new 48" Sanitary Manhole;
- Connection of the Existing Gravity Sewers (8" and 12") and Pressure Sewer (6") to the Station;
- Connection of an existing 6" Sewer Service to existing 12" Gravity Sewer;
- Bypass Pumping of the Lift Station (250gpm); and,
- Dewatering of the construction zone.

Proposals shall include the furnishing of all labor, material, and some equipment to complete the project. Equipment to be furnished by Meridian Township includes:

- Two FLYGT Pumps, their lifting assembly, all check and gate valves.
- Control Panel and junction box.
- Generator: Natural Gas Standby Genset.

Work shall begin after seasonal closure of the Boat Launch.

**Work on the project may commence after issuing the Notice to Proceed and shall be substantially completed by April 1<sup>st</sup>, 2025. Restoration of the County Park parking lot shall be completed by May 1<sup>st</sup>, 2025. Final completion of the restoration shall be done by June 15<sup>th</sup>, 2025.**

Each proposal shall be accompanied by a certified check or a bid bond by a recognized surety company similar to a U.S. Government Standard form bid bond, in the amount of five percent (5%) of the bid, payable to the Meridian Township, Ingham County, Michigan as security for the acceptance of the Contract.

Insurance and bonds are required from the successful bidder for this project; please see pages GC-2 thru GC-3 for those requirements. *Please note Owner/Contractors Protective Liability is required for all of our contracts.*

The contract documents may be examined at the following location:

- Meridian Township, Dept of Public Works, 5151 Marsh Road, Okemos, MI 48864

Copies of the contract documents for the work may be obtained from the Department of Public Works & Engineering at 5151 Marsh Road, Okemos, Michigan, for a non-refundable fee of ten dollars (\$10). There is a five dollar (\$5.00) fee for mailing contract documents. Contract documents may be obtained via email free of charge. Questions regarding this contract may be addressed to Meridian Township Department of Public Works & Engineering by phone at (517) 853-4440, or by email at [DPW@meridian.mi.us](mailto:DPW@meridian.mi.us).

The Vendor's agreement to pay prevailing wage rates is one relevant consideration that Meridian Township may make in its determination of which bidder should receive this contract. Meridian Township may thus consider in awarding this contract whether any vendor voluntarily pays employees and sub-contractors, directly upon the site of work, at least the prevailing wages and fringe benefits as determined and published by the United States Department of Labor for the Ingham County area.

In submitting this bid, it is understood that the right is reserved by the Owner to reject any or all bids, to award the Contract to other than the low bidder, to award separate contracts for each project and/or phase, to waive irregularities and/or formalities, and in general, to make award in any manner deemed by it, in its sole discretion, to be in the best interest of the Owner.

## **INSTRUCTIONS TO BIDDERS**

### **1. PROPOSALS**

Proposals must be made upon the forms provided, without modifications or changes, and all other data submitted as required.

The proposal must be enclosed in a sealed envelope marked "**Bid Proposal – County Park Lift Station Replacement 2024**" clearly indicating the name and address of the bidder, and filed at the place and by the time specified in the Advertisement.

### **2. BASIS OF PROPOSALS**

Proposals may be submitted for any one or all of the projects or phases as may be applicable.

Proposals are solicited on the basis of unit prices for the entire work of the contract.

The right is reserved by the Owner to reject any and all bids, to award the Contract to other than the low bidder, to award separate Contracts for each project and/or phase, to waive irregularities and/or formalities, and in general, to make award in any manner deemed by it, in its sole discretion, to be in the best interest of the Owner.

### **3. BID DEPOSITS**

Each proposal shall be accompanied by a certified check, or bid bond from a recognized surety company, in the amount of five percent (5%) of the total amount of the bid, payable to the order of the Owner, to be forfeited to the Owner in case of failure on the part of the successful bidder to enter into the attached form of Contract to do the work covered by such Proposal at the price and within the time stated therein. The bid deposit of all except the successful bidder will be returned within four weeks after opening of bids. The bid deposit of the successful bidder will be returned within 48 hours after the executed Contract has been finally approved by the Owner.

### **4. QUALIFICATION OF BIDDERS**

It is the intention of the Owner to award the Contract(s) to contractor(s) fully capable, both financially and as regards experience to perform and complete all work in a satisfactory manner. Evidence of such competency must be furnished, including a listing of similar projects which the bidder has satisfactorily undertaken and completed.

### **5. INTERPRETATION OF DOCUMENTS**

If the bidder is in doubt as to the true meaning of any part of the plans, specifications or Contract Documents, he may submit to the Engineer a written request for an interpretation thereof. Any interpretation made in response to such query will be mailed or duly delivered to each prospective bidder. The Owner will not be responsible for any other explanation or interpretation of the Contract Documents.

### **6. REQUIREMENT OF SIGNING BIDS**

Bids which are not signed by the individual making them shall have attached thereto a power of attorney evidencing authority to sign the bid in the name of the person for whom it is signed.

Bids, which are signed by a partnership, shall be signed by all of the partners or by an attorney-in-fact. If signed by an attorney-in-fact, there shall be attached to the bid a power of attorney evidencing authority to sign the bid, executed by the partners.

Bids which are signed for a corporation shall have the correct corporate name thereof and the signature of the president or other authorized officers of the corporation manually written below the corporate name following the word "By". If such a bid is manually signed by an officer other than the president of the corporation, a certified copy of a resolution of the board of directors evidencing the authority of such official to sign the bid shall be attached to it. Such a bid shall also bear the attested signature of the secretary of the corporation and the impression of the corporate seal.

## **INSTRUCTIONS TO BIDDERS**

### **7. EXECUTION OF AGREEMENT**

The bidder to whom an award is made will be required to enter into the written contract included herein, within ten (10) calendar days after being notified of the acceptance of his bid and receipt by him of the copies of the documents to be executed. In case of failure to comply with this requirement, he may be considered to have abandoned all his rights and interests in the award and his certified check or amount of bidder's bond may be declared to be forfeited to the Owner and the Contract may be awarded to another bidder.

### **8. INSURANCE (Ref. General Conditions - GC.2)**

The contractor will be required to carry Worker's Compensation Insurance, Bodily Injury and Property Damage, Builder's Risk Insurance and Owner's Protective Liability in the amounts specified in the General Conditions. Certificates of such insurance must be attached to each copy of the executed Contract Documents.

### **9. BONDS (Ref. General Conditions - GC.1)**

The successful bidder will be required to furnish for each set of executed Contract Documents and conformed copies thereof an original completed Performance Bond, and Labor and Material Bond with surety acceptable to the Owner as set forth in the General Conditions.

### **10. BIDDER'S RESPONSIBILITY FOR EXAMINING PLANS AND SITE**

At the time of opening bids, each bidder will be presumed to have made a personal investigation of the site of the work and of existing structures, and to have read and be thoroughly familiar with the plans, specifications and Contract Documents (including all addenda). He shall determine to his own satisfaction the conditions to be encountered, the nature of the ground, difficulties involved in completing the Contract and all factors affecting the work proposed under this Contract.

The bidder to whom this contract is awarded will not be entitled to any additional compensation by reason of his failure to fully acquaint himself with the conditions at the site or by his failure to fully examine the plans, specifications and Contract Documents.

### **11. NON-DISCRIMINATION IN EMPLOYMENT**

The Contractor shall adhere to all applicable Federal, State and local laws, ordinances, rules and regulations prohibiting discrimination with regards to employees and applicants for employment. The contractor and his/her subcontractors shall not discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions or privileges of employment, including a benefit plan or system or a matter directly or indirectly related to employment, because of race, color, religion, national origin, sex, age, height, weight, condition of pregnancy, marital status, physical or mental limitation, disability, source of income, familial status, educational association, sexual orientation, gender identity or expression, or HIV status. Breach of this section shall be regarded as a material breach of this Contract.

**PROPOSAL**

**TO:** Meridian Township  
5151 Marsh Road  
Okemos, MI 48864

**RE: COUNTY PARK LIFT STATION REPLACEMENT 2024**

Board of Trustees:

The undersigned, as a bidder, hereby declares that these bids are made in good faith, without fraud or collusion with any person or persons bidding on the same Contract, that he has read and examined the Advertisement, Instruction to Bidders, Proposal, Contract, General Conditions, Specifications, Special Provisions and Plans and understands all of the same; that he or his representative has made personal investigation at the site and has informed himself fully with regard to the conditions to be met in the execution of the Contract.

In submitting this bid, it is understood that the right is reserved by the Owner to reject any or all bids, to award the Contract to other than the low bidder, to award separate contracts for each project and/or phase, to waive irregularities and/or formalities, and in general, to make award in any manner deemed by it, in its sole discretion, to be in the best interest of the Owner.

It is further understood and agreed by the undersigned that any qualifying statement or conditions made to this proposal as originally published, as well as any interlineation, erasures, omissions or entered wording obscure as to its meaning, may cause the bid to be declared irregular and may be cause for rejection of the bid.

The undersigned agrees to start work within ten (10) days of issuance of the Notice to Proceed. The undersigned further agrees to complete all work covered by this Proposal to the point of use of the project by the Owner by the completion date stated in the Advertisement or within the number of calendar days stated in the Advertisement; and that for all days thereafter until final acceptance, there will be charged, as liquidated damages, the sum of \$1,000.00 per calendar day per project for each and every day thereafter until final acceptance.

The bidder's agreement to pay prevailing wage rates is one relevant consideration that Meridian Township may make in its determination of which bidder should receive this contract. Meridian Township may thus consider in awarding this contract whether any bidder voluntarily pays employees and sub-contractors, directly upon the site of work, at least the prevailing wages and fringe benefits as determined and published by the United States Department of Labor for the Ingham County area.

Will the bidder voluntarily pay its employees and sub-contractors, directly upon the site of work, at least the prevailing wages and fringe benefits as determined and published by the United States Department of Labor for the Ingham County area. Please circle one below:

**Yes or No**

The undersigned hereby proposes to perform everything required to be performed and to furnish all labor, materials, tools, equipment and all utility and transportation services necessary to complete in a workmanlike manner all the work to be done under this Contract, including addenda thereto, for the sums set forth in the following Bidding Schedule:

**COUNTY PARK LIFT STATION REPLACEMENT 2024**  
**PROPOSAL**

<b><u>ITEM</u></b>	<b><u>DESCRIPTION</u></b>	<b><u>QTY</u></b>	<b><u>UNIT</u></b>	<b><u>UNIT PRICE</u></b>	<b><u>AMOUNT</u></b>
1.	Traffic Control	1	LSum	\$ _____	\$ _____
2a.	Pavement Replacement	1	LSum	\$ _____	\$ _____
7.	Dewatering	1	LSum	\$ _____	\$ _____
8a.	Pump Station, Structures	1	LSum	\$ _____	\$ _____
8b.	Pump Station, Mechanical Items	1	LSum	\$ _____	\$ _____
8c.	Pump Station, Concrete	1	LSum	\$ _____	\$ _____
8d.	Pump Station, Control Panel	1	LSum	\$ _____	\$ _____
8e.	Pump Station, Generator	1	LSum	\$ _____	\$ _____
8f.	Pump Station, Antenna Mast	1	LSum	\$ _____	\$ _____
8g.	Pump Station, Remove	1	LSum	\$ _____	\$ _____
8h.	Pump Station, Protective Coating	23	VFt	\$ _____	\$ _____
8i.	Oil and Grease Interceptor, 750 gal	1	LSum	\$ _____	\$ _____
10a.	Mobilization	1	LSum	\$ _____	\$ _____
10b.	Bypass Pumping	1	LSum	\$ _____	\$ _____
10c.	New Gas Service (Township Allowance)	1	LSum	\$ <u>9,500.00</u>	\$ <u>9,500.00</u>
10d.	Electric Service (Township Allowance)	1	LSum	\$ <u>25,100.00</u>	\$ <u>25,100.00</u>
10e.	Electrical Permit & Inspection (Township Allowance)	1	LSum	\$ <u>1,000.00</u>	\$ <u>1,000.00</u>
20a.	Sanitary Sewer, 8 inch, Connect to Lift Station Wetwell	1	Ea	\$ _____	\$ _____
20b.	Sanitary Sewer, 12 inch, Connect to Lift Station Wetwell	1	Ea	\$ _____	\$ _____
20c.	Sanitary Sewer, 6 inch, Connect to Lift Station Effluent	1	Ea	\$ _____	\$ _____
21.	Sanitary Manhole, 48 inch, 14ft	1	Ea	\$ _____	\$ _____
22.	Sewer Service, PVC, 6 inch	1	Ea	\$ _____	\$ _____
53a.	Soil Erosion and Sediment Control	1	LSum	\$ _____	\$ _____
54.	Site Restoration	1	LSum	\$ _____	\$ _____

**TOTAL BID: \$ \_\_\_\_\_**

Give the name of the Owners and dates of other projects which the Bidder has constructed or has had responsible charge of construction:

NAME

DATE

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The Bidder acknowledges that his bid is in accordance with the information contained in Addendum No. \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_.

The Bidder is hereby reminded that the Pay Items listed under the Bidding Schedule are the only items for which he will receive payment under this Contract. In the event that lesser or greater quantities of specific Pay Items are required to complete the work and place the system in operation, the total amount bid for the specific item will be adjusted by the unit price bid to the actual quantities utilized. In the event that an error is made in extending the unit prices, the Bidder is hereby notified that the unit prices as bid, will govern in determining the Total Base Bid. It is expressly understood and agreed that the Total Base Bid is the basis for establishing the amount of Bid Security on this Proposal and for comparison of bids only and is not to be constructed as a lump sum Proposal.

The undersigned attaches hereto a certified check or bidder's bond in the sum of not less than five percent (5%) of the Total Base Bid as required by the Advertisement and Instructions to Bidders and the undersigned agrees that in case he shall fail to fulfill his obligations under this Proposal and/or shall fail to furnish bonds, as specified, the Owner may, at its option determine that the certified check or amount of said certified check or bidder's bond accompanying this Proposal has been forfeited to the Owner, but otherwise the said certified check or bidder's bond shall be returned to the undersigned upon the execution of the Contract and acceptance of the bond.

The undersigned further agrees that this proposal shall be effective for a period of sixty (60) days from the date established for opening of all bids.

Date \_\_\_\_\_ Company Name \_\_\_\_\_

By \_\_\_\_\_ Address \_\_\_\_\_  
Signature

\_\_\_\_\_  
Printed Name

Title \_\_\_\_\_ Phone Number \_\_\_\_\_

## COUNTY PARK LIFT STATION REPLACEMENT 2024

**THIS CONTRACT**, dated \_\_\_\_\_, by and between \_\_\_\_\_, hereinafter called the "CONTRACTOR", and Meridian Township, 5151 Marsh Road, Okemos, MI 48864, hereinafter called the "OWNER".

**WITNESSETH**, that the CONTRACTOR and the OWNER for the consideration herein agree as follows:

### **ARTICLE I. SCOPE OF WORK.**

The CONTRACTOR shall perform everything required to be performed and shall provide and furnish all labor, materials, necessary tools, expendable equipment and all utility and transportation services required to perform and complete in a workmanlike manner all the work required for constructing the project as described in the Advertisement and Proposal and for performing all related work for the OWNER, required by and in strict accordance with the plans and specifications, including any and all addenda, and other Contract Documents mentioned and made a part hereof.

### **ARTICLE II. THE CONTRACT PRICE.**

The OWNER shall pay for constructing the project complete with all labor, materials, equipment, appurtenances, surface restoration and related work in strict accord with the Plans and Specifications, ready for use, the unit prices as listed in the Proposal and herein made a part of this Contract. Payment shall be made to the CONTRACTOR in accordance with and subject to the conditions specified under General Conditions.

### **ARTICLE III. TIME.**

Time is of the essence in the performance of this contract. The CONTRACTOR agrees to start work within ten (10) days of issuance of the Notice to Proceed and to fully complete the work so as to permit use of the project by the OWNER by the completion date stated in the Advertisement or within the number of calendar days listed in the Advertisement.

#### **ARTICLE IV. DELAYS AND DAMAGES.**

If the CONTRACTOR refuses or fails to prosecute the work, or any separate part thereof, with such diligence as will insure its substantial completion, ready for use by the OWNER by the completion date stated in the Advertisement or within the number of consecutive calendar days stated in the Advertisement, or any extension thereof, or fails to complete said work within such time, the OWNER may, by written notice to the CONTRACTOR, terminate the CONTRACTOR's right to proceed with the work or such part of the work as to which there has been delay. In such event, the OWNER may take over the work and prosecute the same to completion by contract or otherwise, and the CONTRACTOR and his sureties shall be liable to the OWNER for any excess cost occasioned thereby. If the CONTRACTOR's right to proceed is so terminated, the OWNER will take possession of and utilize in completing work such materials, appliances, and plant as may be on the site of the work and necessary therefore.

If the OWNER does not terminate the right of the CONTRACTOR to proceed, the CONTRACTOR shall continue to work, in which event the actual damages for the delay will be impossible to determine and in lieu thereof the CONTRACTOR shall pay the OWNER the sum of one thousand dollars (\$1,000.00) per day as fixed, agreed, and liquidated damages for each calendar day of delay until the work is substantially completed, ready for operation and the CONTRACTOR and his sureties shall be liable for the amount thereof. However, the right of the CONTRACTOR to proceed shall not be terminated or the CONTRACTOR charged with liquidated damages because of any delays in the completion of the work due to unforeseeable causes beyond control and without the fault or negligence of the CONTRACTOR, including, but not restricted to acts of God, or of the public enemy, acts of the OWNER, fires, floods, epidemics, quarantine restrictions, delays of subcontractors due to such causes, if the CONTRACTOR shall, within ten (10) days from the beginning of any such delay (unless the OWNER shall grant a further period of time prior to the date of final settlement of the Contract) notify the OWNER in writing of the cause of delay and extend the time for completing the work when, in OWNER's judgement, the finding of fact justify such an extension and OWNER's findings of fact thereon shall be final and conclusive on the parties thereto. In no event shall bankruptcy or labor disputes, or the like, either of CONTRACTOR or any of its subcontractors or suppliers, be considered as an unforeseeable cause beyond the control and without the fault or negligence of the CONTRACTOR.

#### **ARTICLE V. COMPONENT PARTS OF THIS CONTRACT.**

This Contract consists of the following component parts, all of which are as fully a part of the Contract as if herein set out verbatim, or, if not attached:

- |                            |   |
|----------------------------|---|
| 1. Advertisement           | 8. General Specifications                       |
| 2. Instructions to Bidders | 9. Ingham County Road Commission Specifications |
| 3. Proposal                | 10. Standard Specifications                     |
| 4. Addenda                 | 11. Special Provisions                          |
| 5. Contract                | 12. Plans                                       |
| 6. Bonds and Insurance     | 13. Notice of Award                             |
| 7. General Conditions      | 14. Notice to Proceed                           |

**IN WITNESS WHEREOF**, the parties hereto have caused this instrument to be executed in three (3) original counterparts the day and year first above written.

\_\_\_\_\_  
**CONTRACTOR**

**WITNESS:**

By: \_\_\_\_\_

\_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**Meridian Township**  
\_\_\_\_\_  
**OWNER**

**WITNESS:**

BY: \_\_\_\_\_

\_\_\_\_\_

Dan Opsommer

TITLE: Assistant Township Manager  
Director of Public Works & Engineering

DATE: \_\_\_\_\_

**NOTICE OF AWARD**  
**County Park Lift Station Replacement 2024**

**Dated:** \_\_\_\_\_

**TO:** \_\_\_\_\_  
\_\_\_\_\_

**ADDRESS:** \_\_\_\_\_  
\_\_\_\_\_

**CONTRACT: COUNTY PARK LIFT STATION REPLACEMENT 2024**

You are notified that your Bid dated \_\_\_\_\_ for the above Contract has been considered. You are the apparent Successful Bidder and have been awarded a Contract for **County Park Lift Station Replacement 2024.**

The Contract Price of your Contract is: \$ \_\_\_\_\_.

**Three** copies of each of the proposed Contract Documents accompany this Notice of Award.

You must comply with the following conditions within 10 days of the date you receive this Notice of Award.

1. Deliver to the OWNER **three** fully executed counterparts of the Contract Documents. (Each of the Contract Documents must bear your signature on page C-3.)
2. Deliver with the executed Contract Documents the Contract security (Bonds and Insurance) as specified in General Conditions (GC).

Failure to comply with these conditions within the time specified will entitle OWNER to consider your Bid in default, to annul this Notice to Award and to declare your Bid security forfeited.

Within ten days after you comply with the above conditions, OWNER will return to you one fully executed counterpart of the Contract Documents.

**MERIDIAN TOWNSHIP**

By: \_\_\_\_\_  
Dan Opsommer  
Assistant Township Manager  
Director of Public Works & Engineering

**NOTICE TO PROCEED**

Dated: \_\_\_\_\_

**TO:** \_\_\_\_\_  
\_\_\_\_\_

**ADDRESS:** \_\_\_\_\_  
\_\_\_\_\_

**CONTRACT:**        **COUNTY PARK LIFT STATION REPLACEMENT 2024**

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You are notified that the Contract Times under the above Contract will commence to run on \_\_\_\_\_, **2024** In accordance with Article III of the Contract, the date of Completion for the project is \_\_\_\_\_, **2025**.

Deliver to **OWNER** an acknowledged copy of this Notice to Proceed.

**MERIDIAN TOWNSHIP**

By: \_\_\_\_\_  
Younes Ishraidi, P.E.  
Township Engineer/  
Deputy Director of Public Works & Engineering

**ACKNOWLEDGEMENT OF ACCEPTANCE OF NOTICE TO PROCEED**

**CONTRACTOR** acknowledges acceptance of this Notice to Proceed this \_\_\_\_\_ day of \_\_\_\_\_.

By: \_\_\_\_\_

## GENERAL CONDITIONS

### INDEX

- GC.1 CONTRACT SECURITY
- GC.2 CONTRACTORS' AND SUBCONTRACTORS' INSURANCE
  - A. Policies, Coverages and Endorsements
  - B. ~~Builder's Risk Insurance (Fire and Extended Coverage)~~
  - C. Owner's Protective Liability
  - D. Insured Parties
  - E. Acceptable Insurance Companies
  - F. Indemnification and Hold Harmless
- GC.3 QUALIFICATION FOR EMPLOYMENT
- GC.4 PROGRESS SCHEDULE
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**GC.1 CONTRACT SECURITY**

The Contractor shall furnish a surety bond, by a duly authorized surety company satisfactory to the Owner, in an amount equal to 100 percent (100%) of the Contract price as security for the faithful performance of this Contract. The Contractor shall also furnish a separate surety bond, by a duly authorized surety company satisfactory to the Owner, in an amount equal to 100 percent (100%) of the Contract price as security for the payment of all persons performing labor and/or furnishing materials.

The surety company writing the bid, performance, labor and material, and maintenance bond shall be: 1) acceptable to the Owner, 2) be listed in the Federal Register as published by the U.S. Department of Treasury under most recently revised Circular 570; 3) have an A.M. Best Company’s Insurance reporting rating of no less than A- (Excellent); and 4) authorized to do business in the State of Michigan by the Michigan Department of Licensing & Regulatory Affairs Office of Financial and Insurance Regulations. Upon request, the Contractor shall submit evidence of such insurance.

**GC.2 CONTRACTORS' AND SUBCONTRACTORS' INSURANCE**

The Contractor shall not commence work under this Contract until he/she has obtained all the insurance required under this section and such insurance has been approved by the Owner, nor shall the Contractor allow any subcontractor to commence work on his/her subcontract until all similar insurance required of the subcontractor has been so obtained and approved. Contractors and subcontractors are required to file with the Owner completed certificates of insurance, as evidence that they carry adequate insurance to comply with the requirement of this section. New Certificates of Insurance shall be furnished to the Owner at the renewal date of all policies named on these certificates.

**A. Policies, Coverages, and Endorsements**

The Contractor agrees to maintain, or to cause its personnel providing services under this Contract to maintain, at its sole cost and expense or the cost and expense of his personnel, the following insurance policies, with the specified coverages and limits, to protect and insure the Owner and Contractor against any claim for damages arising in connection with Contractors responsibilities or the responsibilities of Contractors personnel under this Contract and all extensions and amendments thereto.

**1. Commercial General Liability**

- a. General Aggregate \$2,000,000
- b. Each Occurrence \$1,000,000

Such insurance shall include, but not be limited to, coverage for: Comprehensive form, Premises-operations, Explosion and collapse hazard, Underground hazard, Products/completed operations hazard, Contractual insurance, Broad form property damage, Independent contractor, Personal injury

**2. Workers' Compensation & Employer' Liability (if applicable)**

- a. Medical & Indemnity Statutory Requirements
- b. Bodily Injury by Accident \$500,000 Each Accident
- c. Bodily Injury by Disease \$500,000 Each Employee
- d. Bodily Injury by Disease \$500,000 Policy Limit
- e. Employers Liability \$500,000

**3. Automobile Liability**

Including hired and non-owned Automobiles \$1,000,000 (Combined Single Limit)  
Such insurance shall include, but not be limited to, coverage for:  
Comprehensive form, Owned vehicles, Hired vehicles, Non-owned vehicles

## **GC.2 CONTRACTORS' AND SUBCONTRACTORS' INSURANCE (Cont'd.)**

### **~~B. Builder's Risk Insurance (Fire and Extended Coverage)~~**

~~Until the project is completed and accepted by the Owner, the Contractor is required to maintain Builder's Risk Insurance (fire and extended coverage) on a 100 percent completed value basis on the insurable portion of the project for the benefit of the Owner, the Contractor, and subcontractors as their interests may appear.~~

### **C. Owner's Protective Liability**

The Contractor shall procure and shall maintain during the life of this Contract Owner's/Contractor's Protective Liability Insurance, listing the Owner as the named insured. The minimum limit of liability shall be not less than \$1,000,000.00 per occurrence/aggregate.

### **D. Insured Parties**

All policies shall contain a provision naming the Owner (and its officers, agents and employees) as Additional Insured parties on the original policy and all renewals or replacements during the term of this Contract.

### **E. Acceptable Insurance Companies**

All insurance companies required by this section shall be: 1) acceptable to the Owner; 2) authorized to do business in the State of Michigan by the Michigan Department of Licensing & Regulatory Affairs Office of Financial and Insurance Regulations, and 3) have an A.M. Best Company's Insurance reporting rating of no less than A- (Excellent). Upon request, the Contractor shall submit evidence of such insurance.

### **F. Indemnification and Hold Harmless**

The Contractor shall, at its own expense, protect, defend, indemnify and hold harmless the Owner and its elected and appointed officers, employees, and agents from all claims, damages, costs, lawsuits and expenses, including, but not limited to, all costs for administrative proceedings, court costs and attorney fees that they may incur as a result of any acts, omissions, or negligence of the Contractor, its subcontractors, sub-subcontractors or any of their officers, employees, or agents. This includes but is not limited to injury or death to any person or persons, including the contractors employees, and damage to property. The furnishing by the Contractor of any insurance required by this Contract, or the acceptance or approval thereof by the Owner as provided in this Contract, or otherwise, shall not diminish the Contractor's obligation to fully indemnify the Owner, its elected and appointed officers, employees, and agents as required in this section.

The Contractor shall not cancel or reduce the coverage of any insurance required by this section without providing 30-day prior written notice to the Owner. All such insurance must include an endorsement whereby the insurer shall agree to notify the Owner immediately of any reduction by the Contractor. The Contractor shall cease operations on the occurrence of any such cancellation or reduction, and shall not resume operations until new insurance is in force.

## **GC.3 QUALIFICATION FOR EMPLOYMENT**

The Contractor shall employ competent laborers and mechanics for the work under this Contract, and shall comply with all applicable regulations of the United States Department of Labor and any other agencies having jurisdiction.

## **GC.4 PROGRESS SCHEDULE**

The Contractor, if requested by the Owner, immediately after being awarded the Contract, shall prepare and submit to the Owner and its representative an estimated progress schedule for the work in relation to the entire project. This schedule shall indicate the dates for the starting and completion of the various stages of construction.

#### **GC.4 PROGRESS SCHEDULE (Cont'd.)**

If the Contractor chooses to work overtime, they will be backcharged for inspection. Overtime is any Township recognized holiday and/or any time other than 8:00 a.m. to 5:00 p.m., local time, Monday through Friday. No work will be allowed at the site prior to 7:00 a.m. or after 7:00 p.m., or dusk, of any working day. No work will be allowed on Sundays with the exception of work necessitated by an emergency.

#### **GC.5 ACCIDENT PREVENTION**

Precaution shall be exercised at all times for the protection of persons (including employees) and property, and hazardous conditions shall be guarded against or eliminated. The Contractor is entirely responsible for all aspects of job safety and shall execute the work under this Contract in strictest conformance with all state and local safety codes, rules and regulations.

#### **GC.6 CONTRACT PRICE SCHEDULE**

The Contractor, if requested by the Owner, shall submit to the Owner a cost breakdown for the various items of the work. The schedule shall be prepared in a manner acceptable to the Owner as to both form and completeness and supported by data as necessary to substantiate its correctness.

#### **GC.7 PAYMENT TO CONTRACTOR**

The Contractor shall submit semi-monthly, or at longer intervals, if he so desires, an invoice covering work previously performed for which he believes payment, under the Contract terms, is due, and shall deliver said invoice to the Owner. Each request for payment shall be accompanied by a statement certifying that all bills for labor and materials have been paid up for all previous pay requests.

Each progress payment request shall be paid within one of the following time periods, whichever is later:

- A. Thirty (30) days after the Owner has certified that the work is in place in the portion of the facility covered by the applicable request for payment in accordance with the documents.
- B. Fifteen (15) days after the Owner has received the funds with which to make the progress payment from a department or agency of the federal or state government, if any funds for the facility are to come from either of these sources.

To assure proper performance of the Contract by the Contractor, the Owner shall retain ten percent (10%) of the dollar value of all work in place until the work is fifty percent (50%) in place. After the work is fifty percent (50%) in place, additional retainage shall not be withheld unless the Owner determines that the Contractor is not making satisfactory progress, or for other specific cause relating to the Contractor's performance under the Contract. In the event of such a determination the Owner may retain up to but not to exceed ten percent (10%) of the dollar value of the work more than fifty percent (50%) in place.

Any funds retained by the Owner shall not exceed the prorated share of the Owner's matching requirement if the project is funded, in part, with federal or state funds. Any retained funds shall not be commingled with other funds of the Owner and shall be deposited in an interest-bearing account in a regulated financial institution.

At any time after ninety-four percent (94%) of the work under the Contract is in place, and at the request of the Contractor, the Owner shall release the retainage plus interest, only if the Contractor provides to the Owner an irrevocable letter of credit in the amount of the retainage plus interest, issued by a bank authorized to do business in the State of Michigan, containing terms mutually acceptable to the Contractor and Owner.

Retainage shall be released to the Contractor together with the final progress payment.

#### **GC.7 PAYMENT TO CONTRACTOR (Cont'd.)**

Owner and Contractor agree that disputes concerning retainage, at the option of the Owner, shall be submitted to the decision of the agent as provided in Section 4 of Act 524 of the Michigan Public Acts of 1980 (MCLA 125.1564; MSA 5.2949 (104)) and that interest earned on retainage shall be released to the Contractor together with the final progress payment except as provided in said Section 4 of 1980 PA 524.

The final progress payment request by the Contractor shall include:

- A. A final invoice in a form satisfactory to the Owner.
- B. A sworn statement certifying that all bills for labor and materials have been paid by the Contractor.
- C. A sworn statement waiving any further claims (other than the final payment, retainage and interest, if any) by the Contractor against the Owner.
- D. A certificate from Contractor's bonding company approving issuance of final payment.

All payments shall take due account of additions to or deductions from the Contract price as herein provided.

The acceptance by the Contractor of payment on the final progress payment request shall be conclusive evidence of Contractor's acceptance and approval of estimates, accounting and deductions, and of full payment by the Owner for all work, labor, materials and services done or furnished hereunder, and a full satisfaction, discharge, release and waiver of all claims and demands of or on behalf of the Contractor, its agents or employees against the Owner arising out of this agreement.

#### **GC.8 SUBCONTRACTING**

The Contractor shall not award any work to any subcontractor, supplier, manufacturer or fabricator without prior written approval of the Owner, which approval will not be given until the Contractor submits a written statement to the Owner concerning the proposed award to the subcontractor. Said statement shall contain such information as the Owner may require.

The Contractor shall be as fully responsible to the Owner for the acts and omissions of his subcontractors and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind subcontractors to the Contractor by the terms of the General Conditions and other Contract documents insofar as applicable to the work of the subcontractors, and to give the Contractor the same power of terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract documents.

Nothing contained in this Contract shall create any contractual relation between any subcontractor and the Owner.

#### **GC.9 ASSIGNMENTS**

The Contractor shall not assign the whole or any part of this Contract or any monies due or to become due hereunder without written consent of the Owner. In case the Contractor assigns all or any part of any monies due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the Contractor shall be subject to prior liens of all persons, firms and corporations for services rendered or materials supplied for the performance of the work called for in this Contract.

## **GC.10 EXTRAS**

Except as otherwise herein provided, no charge for any extra work or materials will be allowed unless the same has been ordered in writing by the Owner and the price stated in such order.

## **GC.11 CHANGES IN WORK/PAYMENT ADJUSTMENTS**

Adjustments, if any, in the amounts to be paid by the Contractor by reason of changes in, additions to, or deductions from the work to be performed or the materials to be furnished under this Contract, shall be made on the basis of the acceptable unit prices or lump sums submitted by the Contractor covering such changes, additions or deductions.

Failing an acceptable lump sum or unit price basis for extra work caused by changes or additions, the Contractor may be directed to proceed with extra work on the basis of actual total cost of:

- A. Labor, including foremen (including fringe benefits);
- B. Materials entering permanently into the work;
- C. The ownership or rental cost of construction plant and equipment during the time of use on the extra work at a rate not to exceed AGC rates;
- D. Power and consumable supplies for the operation of power equipment;
- E. Insurance;
- F. Social Security and unemployment contributions.

To the cost of the six items above, there shall be added a fixed fee, to be agreed upon but not to exceed fifteen percent (15%) of the actual cost of the work. The single fee shall be compensation to both the Contractor and/or subcontractor to cover the cost of supervision, overhead, bond, profit and any other general expenses.

Failing an acceptable lump sum or unit price basis for adjustment for any decrease in work caused by changes or deductions, the amount of such adjustment may be determined on a similar basis to that described for extra work, with the Contractor furnishing all pertinent cost data from his/her books and records that may be available and necessary for determination of the amount of adjustment.

All changes in, additions to, or deductions from the work specified shall be made only by written order by the Owner or by an authorized representative of the Owner. No claim for extra work will be allowed, unless ordered in writing as above stated, and the claim therefore presented in writing by the Contractor on or before the fifth (5th) day of the month following that in which the work was done.

## **GC.12 TIME OF MAKING CLAIMS**

If the Contractor shall claim compensation or extension of time for any losses, damages, or delays sustained by reason of the acts of the Owner or its agents or other causes, he/she shall make a written statement of the nature of the loss, damage, or delay sustained to the Owner, within ten (10) days after the sustaining of such loss, damage, or delay. At the time of delivery and as a part of the Contractor's Declaration as hereinafter provided, the Contractor shall file with the Owner an itemized statement of the details and amounts of the loss, damage, or delay, and unless the statement shall be made as thus required, the Contractor's claim for compensation or extension of time shall be forfeited and invalidated, and he/she shall not be entitled to payment or extension of time on account of any such loss, damage or delay.

### **GC.13 MATERIALS, SERVICES, AND FACILITIES**

It is understood that except as otherwise specifically stated in the Contract documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature and all construction facilities whatsoever necessary to execute, complete, and deliver the work within the specified time.

Any work necessary to be performed after regular working hours, or Sundays and legal holidays, shall be performed without additional expense to the Owner.

### **GC.14 TERMINATION FOR BREACH**

In the event that any of the provisions of this Contract are violated by the Contractor or by any of his subcontractors, the Owner may serve written notice upon the Contractor and the Surety of its intention to terminate the Contract, such notice to contain the reasons for terminating the Contract, and unless within ten (10) days after the serving of such notice upon the Contractor, the violation shall cease and satisfactory arrangements for correction be made, the Contract shall cease and terminate. In the event of a termination of the Contract, the Owner shall immediately serve notice thereof upon the Surety and the Contractor, and the Surety shall have the right to take over and perform the Contract.

However, if the Surety does not commence performance thereof within 30 days from the date of mailing said Notice of Termination to such Surety, the Owner may take over the work and prosecute the same to completion by contract for the account and at the expense of the Contractor. The Contractor and his Surety shall be liable to the Owner for any excess cost incurred by the Owner in completing the work, and Owner may take possession of and utilize in completing the work, all materials, appliances and plants as may be on the site of the work and necessary therefore.

### **GC.15 OWNER'S RIGHT TO WITHHOLD CERTAIN AMOUNTS AND MAKE APPLICATION THEREOF**

The Owner may withhold a sufficient amount of any payment otherwise due to the Contractor to cover:

- A. Payments that may be past due and payable for just claims for labor, materials, or equipment furnished in and about the performance of the work on the project under this Contract.
- B. For defective work not remedied.
- C. For failure of the Contractor to make proper payments to his subcontractors.

The Owner shall disburse and shall have the right to act as agent for the Contractor in disbursing such funds as have been withheld pursuant to this paragraph to the party or parties who are entitled to payment therefrom. Any payment so made by the Owner shall be considered as a payment made under the Contract by the Owner to the Contractor. The Owner will render to the Contractor a proper accounting of all funds disbursed in behalf of the Contractor.

### **GC.16 SUPERINTENDENCE**

The Contractor shall give his/her personal superintendence to the work or have a competent foreman or superintendent, satisfactory to the Owner, on the worksite at all times during work progress, with authority to act for the Contractor.

#### **GC.17 NOTICE AND SERVICE THEREOF**

Where in any of the Contract documents there is any provision in respect to the giving of any notice, such notice shall be deemed to have been given; as to the Owner, when written notice shall be delivered to the Owner, or shall have been placed in United States mails with first-class postage pre-paid addressed to the chief executive officer of the Owner at the place where the bids or proposals for the Contract were opened; as to the Contractor, when a written notice shall be delivered to the chief representative of the Contractor, at the site of the project or by mailing such written notice in the United States mails with first-class postage pre-paid addressed to the Contractor at the place stated in the papers prepared by him to accompany his proposal as to the address of his permanent place of businesses; as to the Surety, when a written notice is placed in the United States mails with first-class postage pre-paid addressed to the Surety at the home office of such Surety or to its agent or agents who executed bonds in behalf of such surety.

#### **GC.18 COMPLIANCE WITH LAW, APPLICABLE LAW, AND VENUE**

The Contractor shall comply with all applicable Federal, State, County, and Municipal laws, ordinances, rules and regulations.

This contract shall be construed according to the laws of the State of Michigan.

The venue for the bringing of any legal or equitable action under this contract shall be the County of Ingham, of the State of Michigan. In the event that any action is brought under this Contract in Federal Court, the venue for such action shall be the Federal Judicial District of Michigan, Western District, Southern Division.

#### **GC.19 PERMITS**

The Township will secure and pay for the Building Permit from the Meridian Township Building Department. All other permits or licenses which may be needed for prosecution of the work are to be obtained by the Contractor at the Contractor's expense.

#### **GC.20 ROYALTIES AND PATENTS**

The Contractor shall pay for all royalties and patents, and defend all suits or claims for infringement on any patent right, and shall save and hold harmless the Owner from loss on account thereof.

#### **GC.21 INSPECTIONS**

The Owner and its representative shall at all times have access to the work wherever it is in preparation or progress and the Contractor shall provide facilities for such access and for inspection.

The Owner and/or its representative shall have the right to reject materials and workmanship which are defective, or require their correction. Work on the project may be ordered terminated until correction is made. Rejected workmanship shall be satisfactorily corrected, and rejected materials shall be removed from the premises without charge to the Owner. If the Contractor does not correct condemned work and remove rejected materials within a reasonable time, fixed by written notice, the Owner may remove them and charge the expense to the Contractor.

Should it be considered necessary or advisable by the Owner at any time before final acceptance of the entire work to make an examination of work already completed, by removing or tearing out same, the Contractor shall on request promptly furnish all necessary facilities, labor, and materials. If the work is found to be defective in any material respect, due to fault of the Contractor or their subcontractors, they shall defray all the expenses of examination and satisfactory reconstruction. If, however, the work is found to meet the requirements of the Contract, the actual cost of labor and material necessarily involved in the examination and replacement, plus 15 percent (15%) shall be allowed the Contractor.

#### **GC.22 CORRECTION OF WORK AFTER FINAL PAYMENT**

Neither the final payment nor any provision in the Contract documents nor partial or entire occupancy of the premises by the Owner shall relieve the Contractor of the responsibility for negligence or faulty materials or workmanship within the extent and period provided by law, and, upon written notice, he/she shall repair any defects due thereto and pay for any damage due to other work resulting therefrom, which shall appear within **one year** after date of completion and acceptance.

#### **GC.23 PROTECTION OF WORK**

The Contractor shall continuously maintain adequate protection of all his/her work from damage and shall protect the Owner's and adjacent property from injury arising in connection with this Contract, and shall be responsible for all damage and/or injury caused by or arising out of his operations.

#### **GC.24 USE OF JOB SITE**

The Contractor shall confine his/her equipment apparatus, the storage of materials and operations of his/her workmen to limits indicated by law, ordinances, permits or directions of the Owner and shall not encumber the premises with his materials.

#### **GC.25 "OR EQUAL" CLAUSE**

Whenever in any of the Contract documents an article, material or equipment is defined by describing a proprietary product, or by using the name of a manufacturer or vendor, the term "or equal" if not inserted, shall be implied. The specific article, material or equipment mentioned shall be understood as indicating the type, function, minimum standard of design, efficiency, and quality desired and shall not be construed in a manner so as to exclude manufacturer's products of comparable quality, design and efficiency. The Contractor shall comply with the requirement of the Contract documents relative to the Owner's approval of materials and equipment before they are incorporated in the project.

#### **GC.26 PLANS AND SPECIFICATIONS**

The Contractor shall keep on the worksite a copy of the drawings and specifications and shall at all times give the Owner access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like affect as if shown or mentioned in both. In case of difference between drawings and specifications the specifications shall govern. In any case of discrepancy in the figures, drawings or specifications, the matter shall be immediately submitted to the Owner, without whose decision said discrepancy shall not be adjusted by the Contractor, save only at his/her own risk and expense.

The Owner shall furnish from time to time such detail drawings and other information as he/she may consider necessary, unless otherwise provided. The Contractor shall keep such drawings at the site of the work.

#### **GC.27 OWNER'S RIGHT TO DO WORK**

If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the Owner three (3) days after given written notice to the Contractor and his/her Surety may, without prejudice to any other remedy the Owner may have, make good such deficiencies and may deduct the cost thereof from the payment due to the Contractor.

**GC.28 CLEANING UP**

The Contractor shall at all times keep the premises free from accumulations of waste material or rubbish caused by his/her employees or work, and at the completion of the work he/she shall remove all his/her rubbish from and about the work and all his/her tools, equipment, scaffolding and surplus materials and shall leave his/her work clean and ready for use. In case of dispute, the Owner may remove the rubbish and surplus materials and charge the cost to the several Contractors in proportion to the amounts as shall be determined to be just.

**GC.29 REPORTS, RECORDS AND DATA**

The Contractor and each of his/her subcontractors shall submit to the Owner such schedules of quantities, costs, progress schedules, payrolls, reports, estimates, records, and other data as the Owner may request concerning work performed or to be performed under this Contract.

**GC.30 NON-DISCRIMINATION IN EMPLOYMENT**

The Contractor shall adhere to all applicable Federal, State and local laws, ordinances, rules and regulations prohibiting discrimination with regards to employees and applicants for employment. The Contractor, as required by law, shall not discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions or privileges of employment, or a matter directly or indirectly related to employment because of race, color, religion, national origin, age, sex, height, weight, marital status, or handicap that is unrelated to the individual's ability to perform the duties of a particular job or position. Breach of this section shall be regarded as a material breach of this Contract.

**GC.31 DEFINITIONS**

The following terms as used in these Contract documents are respectively defined as follows:

- (a) "Contractor" The person, firm or corporation to whom the within Contract is awarded by the Owner and who is subject to the terms hereof.
- (b) "Subcontractor" A person, firm or corporation other than a Contractor, supplying labor and materials or labor for work at the site of the project.
- (c) "Project" The total construction proposed by the Owner to be constructed in part or in whole pursuant to the within Contract.
- (d) "Work on the Project" Work to be performed, including work normally done, at the location of the project.
- (e) "Surety" Any person, firm or corporation that has executed, as surety, the Contractor's performance and/or labor and material bonds securing the attached Contract.
- (f) "Owner" The public body or authority for whom the work is to be performed and as identified in the advertisement and proposal.
- (g) "Engineer" The Director of Public Works and Engineering for the Meridian Township or their authorized representative.

## GENERAL SPECIFICATIONS

### **GENERAL SPECIFICATIONS**

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#### **GS.1 DEFINITION**

The Contractor shall furnish all materials specified herein, shown on the plans, and required to be incorporated in the work of the Contract. They shall furnish all labor, construction equipment, tools, supplies and facilities required to construct the elements designated by the Contract documents and shall construct all of the designated elements complete and in full conformance with the requirements of these documents. They shall comply with all regulatory provisions of the Contract, General Conditions and the Specifications.

#### **GS.2 ELEVATIONS**

All the elevations shown on the plans or referred to herein are in feet above mean sea level datum as established by the United States Geological Survey, unless otherwise noted. The Contractor shall verify all the existing structure locations and elevations at points of connection or possible interference between their work and the existing structures and shall report at once to the Engineer any interference's or discrepancies discovered.

#### **GS.3 QUALITY OF MATERIALS AND EQUIPMENT FURNISHED**

All materials and equipment furnished by the Contractor hereunder shall be new and conform to specifications herein.

Materials, supplies, and equipment, whether furnished by the Contractor or the Owner, shall be stored at the site of the work in such manner as not to interfere with traffic, convenience to public or other Contractors on the site or in the vicinity. The Contractor shall be responsible for any damage caused to new or existing structures by reason of such storage or handling of materials, supplies, or equipment.

Flammable materials in portable containers are not to be stored overnight on the site. This includes, but is not limited to, gasoline and diesel fuel for use in construction machinery. Portable containers suitably protected, will be allowed overnight at the site, if confined to permanent tanks which are a normal part of the construction machinery.

## **GENERAL SPECIFICATIONS**

### **GS.3 QUALITY OF MATERIALS AND EQUIPMENT FURNISHED** (Cont'd.)

Where the Contractor is required to do work within rights of way under the jurisdiction of governmental bodies, they shall meet the requirements of said governmental bodies for work and storage within their jurisdiction. Such requirements must be met as a minimum requirement, and if the specifications given herein impose further limitation on the work, they shall also be met as the required work standard.

The Contractor's attention is directed to the Ingham County Road Department permit specifications, Section 5. Restoration and Maintenance of Right-Of-Way (e.), for dust control requirements.

### **GS.4 CARE OF EXISTING STRUCTURES**

The Contractor shall be solely responsible for any damage to any existing underground services or structures, or to structures and roadway above ground caused by their operations or those of their subcontractors and suppliers.

### **GS.5 CARE OF NEW STRUCTURES**

The Contractor shall use every reasonable precaution to prevent injury to the new structures being constructed hereunder. They shall be responsible to correct all injury or damage resulting from their operations and/or occurring while the work is under their supervisory control. They shall furnish and install such guards, coverings and other protection as may be needed to insure that the structures remain undamaged prior to completion of the entire work.

In the event damage does occur to the finished portions of the work, or to the work in progress, the Contractor shall take such corrective action and measures as may be necessary to repair the damage to the satisfaction of the Engineer.

### **GS.6 EXISTING PUBLIC UTILITIES**

Existing public utilities and underground structures such as pipelines, electric conduits and sewers are shown on the drawings from available information. The Contractor shall, through Miss Dig and any other reasonable measures, verify the exact location of underground utilities for themselves.

The Contractor shall conduct their operations so as not to damage any existing utility whether or not shown on the plans. The Contractor shall correct, at their own expense, any damage or injury that may be caused by them during their operations or damage or injury caused during the operations of their subcontractors or suppliers.

The Contractor shall be responsible for coordinating relocation or repair of existing public and private utilities with the appropriate utility or owner. No extra payment will be allowed for repairs.

If the Contractor desires, or is required by the utility companies, to relocate any power or telephone poles to facilitate their work, any expense encountered from such relocation shall be borne by the Contractor.

### **GS.7 PROTECTION OF TREES AND SHRUBS**

All trees and shrubs encountered along the route of the project shall be protected from damage by the Contractor and saved from harm resulting from any of their operations or operations of their subcontractors and suppliers. Only those trees and shrubs marked for removal on the plans shall be removed. All others will be saved from damage by tunneling or by slightly adjusting the alignment of the project as directed by the Engineer.

## **GENERAL SPECIFICATIONS**

### **GS.8 SAFETY PRECAUTIONS**

During the progress of the work, the Contractor shall maintain adequate facilities for the protection and safety of all persons and property. The Contractor and all their subcontractors and suppliers shall comply with the "Construction Safety and Health Standards" as published by the Michigan Occupational Safety and Health Administration, and to all other local, state and federal laws, ordinances, rules and regulations pertaining to safety of persons or property.

### **GS.9 SANITARY REQUIREMENTS**

The Contractor shall provide adequate sanitary facilities for all persons employed on this Project. The sanitary facilities shall conform in every way to the requirements of the "Construction Health and Safety Standards" as published by the Construction Safety Standards Commission of the State of Michigan.

### **GS.10 UTILITIES**

The Contractor shall make all necessary arrangements for the provision of all utility services required to prosecute the work under this Contract. The Contractor shall pay the costs for such connections and service. Where the Owner has utility service at the site, the Contractor may obtain service by connection to the Owner's service, subject to reasonable regulation of its use and satisfactory agreement as to charges. In the event that the Contractor's use of any or all of the Owner's utility services causes the Owner to have an inadequate supply of such service, the Contractor shall disconnect said service and provide their own separate supply at no cost to the Owner.

All utility services shall be inspected by and meet the requirements of the applicable local codes and governmental bodies.

### **GS.11 PUMPING AND DRAINAGE**

Adequate pumping and drainage facilities shall be provided and water from whatever sources entering the work during any stage of construction shall be removed promptly and disposed of. All pumping and drainage shall be done with no damage to property or structures and without interference with the right of the public, owners of private property, pedestrians, vehicular traffic, or the work of other contractors. Dewatering shall be done in such a manner that the soil under or adjacent to existing structures shall not be disturbed, removed or displaced.

The overloading or obstructing of existing drainage facilities shall not be permitted, and the Contractor shall be solely responsible for damages caused to such existing drainage facilities by their operations. Additionally, sufficient measures shall be utilized to prevent migration of soil from the site due to any pumping or drainage activities.

### **GS.12 WINTER CONSTRUCTION**

The Engineer has authority over approving the prosecution of work which is proposed to be done during the winter months. The Contractor shall provide adequate weather protection, temporary heating and take any other measures which are necessary to ensure that work performed during the winter months is properly installed and protected against damage from freezing.

Reference is made in Division 4 of the Technical Specifications to the requirements for performing concrete construction and masonry construction in cold weather.

### **GS.13 USE OF FACILITIES BEFORE FINAL COMPLETION**

The Owner shall have the right to make use of, during construction, such portions of completed and acceptably tested facilities as it finds practicable. Such use by the Owner shall not relieve the Contractor from responsibility for any defective work which may be subsequently discovered.

## **GENERAL SPECIFICATIONS**

### **GS.14 TEST OF MATERIALS**

All laboratory tests, except as otherwise noted, are to be made at the expense of the Contractor as specified in the Technical Specifications. The Contractor shall furnish satisfactory containers for taking and shipping samples. The name of the laboratory making the test must be submitted by the Contractor to the Engineer for approval.

In all cases "laboratory" refers to an independent laboratory of recognized standing. Acceptance of materials tested shall be based upon compliance with the specifications hereinafter stated for the various items. Where no particular tests are specified, the tests shall be those normally made for determination of the fitness of the particular material. Certificates of tests shall be furnished by the testing laboratory or producer, in triplicate, to the Engineer.

The Owner may require, at its own option and expense, additional mill and/or shop inspection by competent parties. The Owner may require, at its own option and expense, additional field inspection by a qualified inspector.

All materials failing to meet the requirements of the specifications, as determined by test or otherwise, shall be rejected and not used in the work. The cost of testing materials which fail to meet requirements shall be paid by the Contractor. All follow-up testing required shall also be paid by the Contractor. Materials, if rejected at the site, shall be immediately removed therefrom and shall not be used in the work.

### **GS.15 OTHER WORK**

The Contractor shall cooperate with other Contractors on the site or adjoining work to the end that the entire Project may proceed with the utmost harmony and with a minimum of delay.

Where the work under this Contract is to involve work completed under other contracts or existing facilities or structures, the Contractor shall investigate the condition of such other work or facility to determine its suitability for incorporation into the work of this Contract. Any defect or discrepancy in other work of facility making it unsuitable for proper execution of this Contract shall be immediately reported to the Owner who shall order such adjustments in the work of the project as necessary for proper completion, and unless such defect or discrepancy is reported promptly, the Contractor shall be solely responsible for any adjustments in the work as shall be found necessary to properly complete the work on this project.

### **GS.16 LINES AND GRADES**

General control lines and grades will be established by the Owner. The Contractor shall notify the Engineer no less than 48 hours prior to requiring such control. The Contractor shall furnish all stakes and labor for driving them and rodmen to assist the Owner in this work. The Contractor shall carefully preserve the general control lines and grades established by the Engineer. The cost of replacement of stakes which are damaged or lost shall be borne by the Contractor.

Construction lines and grade shall be transferred and set by the Contractor from the control lines and grades established by the Engineer, and the Contractor shall furnish necessary instruments and competent personnel for performing such work, and they shall be responsible for the accuracy of the transferred line and grade. The Owner will check the work at intervals, as it deems necessary, and the Contractor shall make correction of error, if any, at their own expense, as may be required for the proper function and performance of the structure and installed equipment.

### **GS.17 COMPLETE WORK REQUIRED**

It is the intent of the Contract documents to provide that the Project to be constructed under this Contract will be complete and ready for use. Any minor items not specifically called for on the plans or specifications, but which are clearly necessary, are to be included.

## **GENERAL SPECIFICATIONS**

### **GS.18 PROPERTY MARKERS**

The Contractor shall take precautions not to move or destroy any monuments or stakes marking the boundaries of property along or near the work. A licensed surveyor shall reestablish property irons in the proper location if disturbed. Buried property irons shall be extended 1/2" diameter rods. The Contractor shall pay for reestablishment.

### **GS.19 RECORDS AND MEASUREMENTS**

The Contractor shall keep careful records showing measured overall length of underground facilities installed and distances of such from any available line as may be designated by the Engineer. Such records shall be turned over to the Engineer as the work progresses and the records must be accurate and complete.

### **GS.20 GUARANTEE**

The Contractor shall guarantee and shall secure from the manufacturer of each item of manufactured equipment used in the project a written guarantee that all materials and equipment furnished by them shall be first class and free from defects, and the guarantor agrees that they will, upon notice and without delay, make good or repair without expense to the Owner the whole or any part of the equipment furnished by them hereunder, which within a year from date of acceptance of that portion of completed work incorporating such equipment shall fail or develop unfitness for the purpose for which it is intended as a result of any defect in design, material, workmanship, erection or construction.

**INGHAM COUNTY ROAD DEPARTMENT  
SUPPLEMENTARY PERMIT SPECIFICATIONS  
FOR UTILITY INSTALLATIONS**

As referred to herein:

“Board” shall denote the Board of Ingham County Road Commissioners or its duly appointed agents.

“Utility” shall denote any cable, conduit, pipe, structure, or similar facility installed within the road right-of-way.

“Contractor” shall denote an individual or legal entity contracted to perform a proposed utility’s installation.

1. GENERAL

- a. All proposed utility installations within county road right-of-way shall be reviewed and approved by means of a permit issued by the Board, regardless of the type, size, location, or installation method. The Board shall have absolute authority over any work to be performed within the county road right-of-way and shall exercise said authority at its discretion. The Board reserves the right to impose, at its discretion, cash bond requirements for any permit granted. The cash bond may be used to reimburse the Board for work not performed by the Contractor, restoration of roadways caused by Contractor activities, costs associated with detour signing, and other reasonable expenses incurred by the road commission.
- b. The Board shall have the authority to direct any work or stop any work, permitted or not permitted, that in its opinion is not being performed to the Board’s satisfaction. All costs for corrective work or work stoppages shall be the responsibility of the Contractor.
- c. To issue a utility installation permit, the applicant must provide drawings that illustrate all the work to be performed, the method of installation, and materials to be used. If road or lane closures are proposed, along with the information required below, the approximate start and completion date shall be provided on the permit application.

2. ROAD CROSSINGS

- a. All proposed utility crossings of county roads shall be performed using methods other than open cut methods unless otherwise permitted by the Board. The following are general specifications or provisions to be followed when installing utilities using methods other than open cut methods.
  1. The methods of utility installation described in this section include, but are not limited to, tunneling, bore and jacking, and directional boring. These methods represent preferred installation methods and are employed to allow installation of utility road crossings without closing the road to through traffic or damaging the existing road pavement. The Board, at its discretion, may require that a particular installation method be employed by the Contractor.
  2. When a utility is to be installed by tunneling methods, the tunnel shall be adequately sheeted and shored to prevent the tunnel walls from collapsing and the road pavement from settling or cracking.
  3. When a utility is to be installed by bore and jacking methods, a casing pipe will be required with the utility to be installed inside the casing pipe. The annular space between the utility and the casing pipe shall be filled and sealed using pressure grouting or other approved methods.
  4. All shafts or pits not sheeted and shored shall be located, at least, 10 feet off the edge of road pavement in rural sections and 6 feet behind the back of curb in urban sections.

5. If any settlement or other changes in grade occur in the vicinity of the utility crossing within one year of the work, upon notification the road shall be immediately reconstructed to the proper grade at the Contractor's expense. In addition, damage to the roadway embankment, shoulder, and pavement shall also be immediately repaired to the Board's satisfaction.
  6. Unless otherwise approved by the Board, all utilities shall have a minimum cover of 4 feet below the road surface. Where approved construction plans indicate cover greater than 4 feet, the plan depth shall govern.
  7. All costs for maintaining traffic, including flagging operations, shall be the responsibility of the permitted party. Traffic control shall be erected in accordance with the current edition of the Michigan Manual of Uniform Traffic Control Devices (MMUTCD) or as directed by the Board. Modifications to traffic control measures may be ordered by the Board, at its discretion, and the cost of any modifications shall be the responsibility of the Contractor. Once work is completed for the day, traffic control signs which are not appropriate shall be covered or removed so that the motoring public is made aware of the road's condition and how to safely traverse through the work zone.
  8. If, in the opinion of the Board, traffic conditions warrant suspension of utility installation operations and restoration of a road's full capacity, the Contractor shall comply immediately. All costs associated with such an action shall be borne by the Contractor.
- b. If the Board permits a proposed utility crossing of a county road using open cut methods, the following general specifications or provisions shall be followed:
1. Large projects that involve many utility crossings and or may extend for several months shall be completed in "sections". The intent being, that once a particular crossing, of many, is completed or a 1/4 mile "section" of a multi-mile utility has been installed, the Contractor shall restore the road and right-of-way to the satisfaction of the Board before moving on to the next crossing or section of utility installation.
  2. In general, open cut utility crossings will not be allowed during winter months.
  3. Open cut utility crossings shall be performed during off-peak traffic hours unless specifically permitted by the Board. Off-peak hours vary, but they are typically between the hours of 9:00 am to 3:00 pm.
  4. Unless otherwise approved by the Board, all utilities shall have a minimum cover of 4 feet between the utility and the road surface. Where approved construction plans indicate cover greater than 4 feet, the plan depth shall govern.
  5. All costs for maintaining traffic, including flagging operations, shall be the responsibility of the permitted party. For road closures intended to last one or two days, the contractor will submit a deposit with the permit application, the Ingham County Road Department will set up, maintain, and dismantle the road closure, the actual costs incurred will be subtracted from the deposit and the remainder returned to the contractor. If incurred costs exceed the deposit, the contractor will be billed for the overage. For road closures intended to last an extended period of time, the Contractor shall set up, maintain, and dismantle the closure per the approved detour plan. Regardless, traffic control shall be erected in accordance with the current edition of the Michigan Manual of Uniform Traffic Control Devices (MMUTCD) or as directed by the Board. All traffic control schemes are to be approved prior to the beginning of work. Modifications to traffic control measures may be ordered by the Board, at its sole discretion, and the cost of any modifications shall be the responsibility of the Contractor.

6. If a proposed road closure is not permitted, at least one lane of traffic shall be maintained with proper flagging operations in effect throughout the work day. Road cuts shall be backfilled, flush with the driving surface at the end of each working day, appropriately signed, and opened for overnight traffic. Depending on traffic volumes and other conditions, the Board may require the permit applicant to provide by-pass lanes (either paved or unpaved) to maintain traffic.
7. Maintenance of open cut work zones is the responsibility of the Contractor and shall be in effect 24 hours a day for the duration of the work.

### 3. PAVEMENT AND GRAVEL SURFACE REMOVAL AND REPLACEMENT

- a. All proposed open cut utility installations or existing utility installations needing corrective reconstruction shall conform to the following specifications or provisions:
  1. All pavement to be removed shall be saw cut, full depth, to its removal limit and carefully removed as to not damage the saw cut edge. All damaged edges shall be subsequently saw cut and removed back to sound pavement. The pavement removal limit shall extend, at least, 1 foot beyond both sides of the open cut trench.
  2. Both bituminous and concrete pavement removal shall have a minimum width of 6 feet, be perpendicular to the centerline of the road, and extend the full width of existing lanes. Diagonal pavement removal and replacements will not be allowed unless approved by the Board.
  3. Concrete pavement removal limits are to utilize existing joints whenever possible. The minimum distance between a concrete replacement slab and an existing pavement joint shall be 5.5 feet unless approved by the Board. The Contractor shall verify concrete pavement removal limits with the Board prior to pavement replacement.
- b. Pavement replacement and gravel road surface restoration shall conform to the following specifications or provisions:
  1. Aggregate base material under pavement shall be a minimum of 8-inches thick and meet MDOT 21AA or 22A aggregate specifications, as determined by the Board. The proposed aggregate base material shall conform to the characteristics of the insitu aggregate base material as much as possible. Bituminous pavement replacement shall either match the existing pavement thickness or be 5-inches thick, whichever is greater, and utilize hot mix asphalt materials that meet or exceed MDOT 13A bituminous mix specifications. Concrete pavement replacement shall either match the existing pavement thickness or be 7-inches thick, whichever is greater, and utilize 4500 psi strength concrete that meets or exceeds MDOT specifications. Concrete pavement patch size and geometry shall be determined by the Board and shall be doweled into adjacent concrete pavement. Aggregate surfaced roads and shoulder material shall be a minimum of 6-inches thick and meet MDOT 22A or 23A aggregate specifications. Aggregate base shall be compacted to 95% of its maximum density, hot mix asphalt is to be compacted to 97% of its maximum density, and aggregate shoulder material shall be sufficiently graded and compacted to prevent standing water and erosion problems.
  2. The finished driving surface shall be installed to conform to the vertical profile of the existing roadway and not exhibit “dips” or “humps” that are noticeable to the motoring public. “Mounding” over excavations to allow for future settlement will not be permitted. If settling or upheavals occur at pavement replacement locations, the Contractor may be required to remedy the situation. Failure to do so may result in a stoppage of subsequent work or denial of subsequent permits.

3. Bituminous pavements shall not be replaced using lifts that exceed 250 lbs/syd (2 1/4 inches thick). A tack coat emulsion shall be applied between successive lifts of bituminous paving.
4. Replacement concrete pavement shall be doweled into adjacent pavement using 18-inch long by #9 and #5 epoxy coated deformed bars. The dowels shall be drilled, inserted 9-inches, and grouted in accordance with current MDOT specifications. Dowels installed along the pavement edge, parallel to the lane lines (#9), shall be spaced at 18-inches on center. Dowels installed along the pavement edge, perpendicular to the lane lines (#5), shall be spaced at 24-inches on center.
5. Composite pavements, such as asphalt overlaying concrete pavement shall be replaced to match the existing pavement structure using the same provisions described above. If approved by the Board, composite pavements may be replaced with full depth asphalt equal in thickness to the existing pavement structure.

4. BACKFILLING AND COMPACTION

- a. All utility trenches, holes, bore pits, and other excavations within the county road right-of-way shall be backfilled with granular material that meets or exceeds MDOT class II material. Excavation backfill shall be placed and compacted to 95% of its maximum density in successive layers that are no more than 12-inches thick. In-place backfill density shall be verified and reported to the Board by an independent testing laboratory. The cost of said verification and reporting shall be the responsibility of the Contractor. The above backfilling and compaction provisions shall apply to that portion of the subgrade that is within the influence of the roadway pavement structure, including the shoulder. Refer to MDOT Trench Detail "B". Failure to meet said backfill and compaction requirements may result in a stoppage of subsequent work, replacement of deficient backfill, and denial of subsequent permits.
- b. All under drain systems and similar facilities destroyed or disturbed due to the utility installation shall be rebuilt using similar materials and in a manner that completely restores their function.

5. RESTORATION AND MAINTENANCE OF RIGHT-OF-WAY

- a. All drainage courses shall be restored with topsoil, seed, and mulch immediately after completion of utility installations. The Contractor shall employ and maintain soil erosion and sedimentation measures to stabilize all disturbed grounds per the Ingham County Drain Commissioner's (ICDC) standards. Disturbed drainage courses or backslopes that have steep grades, as determined by the Board, shall be stabilized with mulch blanket, rock check dams, or both. The Contractor shall follow ICDC and Michigan Department of Environmental Quality (MDEQ) Best Management Practices (BMS) for soil erosion and sedimentation control.
- b. All existing storm sewer, drainage structures, culverts, and similar facilities shall be protected during utility installation. If permitted by the Board and the structure owner, the Contractor may remove and replace said facilities if needed for utility installation. All replacement facilities shall be in accordance with current agency (owner) requirements for materials and construction standards, regardless of existing condition. Any damaged facilities left in place during utility installation shall be fully repaired to the satisfaction of the Board, or be replaced in accordance with current agency (owner) requirements. It is the responsibility of the contractor to research and obtain permission from the appropriate "owner" for the proposed work.
- c. All traffic signs requiring replacement or that need to be relocated due to utility installation shall be replaced or relocated by Ingham County Road Department personnel and their costs reimbursed by the Contractor.

- d. Encroachments (private installations) within the road right-of-way, such as fences, mailboxes, and hedges that must be removed due to utility installation may be replaced or re-installed, within the right-of-way, upon approval of the Board. In general, removed objects, other than mailboxes, cannot be re-installed within the road right-of-way. Please be aware that the Ingham County Road Department will not become involved with negotiations between the utility owner and property owners relative to encroachment removal and replacement, but the Board will ultimately approve or disapprove whether replacements are allowed, and their subsequent locations.
- e. The Contractor shall maintain a safe work area, free from dust and free from dirt and mud being tracked onto the adjacent roadway. The Contractor shall make arrangements to have paved roads swept and gravel roads treated with dust palliative for the duration of installation activities. If requested by the Board, the Contractor shall sweep roads or apply dust palliative within 4 hours of the request. Failure to do so may result in a stoppage of work.

6. MANHOLE CASTING, VALVE, AND FIRE HYDRANT LOCATIONS

- a. Permitted utility manhole structures and vaults shall conform to the following specifications or provisions:
  - 1. In general, proposed manhole castings and valve boxes shall be located outside the paved road surface and somewhere other than in the roadside ditch. If approved by the Board, manhole castings and valve boxes installed within a paved surface or parkway shall be located flush with the existing surface, manhole castings and valve boxes installed within the traveled portion of a gravel road shall be located 6-inches below the road's surface, and manhole castings and valve boxes installed in a ditch bottom shall be located, at least 12-inches below the ditch bottom. The contractor may be required to re-route the ditch around manhole castings and valve boxes, at the discretion of the Board.
  - 2. Manhole castings and valve boxes shall not protrude from the backslope of the road or above the normal ground contour by more than 6-inches. The contractor may be required to adjust a manhole casting or regrade the area, to the Board's satisfaction, at their expense.
  - 3. Proposed manhole casting and valve box type shall be approved by the Board prior to the start of installation. If at any future time it is determined that the type of casting or valve box must be changed due to road reconstruction, widening, resurfacing, etc., the utility owner agrees, by performing under permit, to bear all costs for the change
  - 4. Proposed fire hydrant installations shall be approved by the Board prior to the start of installation. If at any future time it is determined that the fire hydrant must be moved due to road reconstruction, widening, resurfacing, etc., the utility owner agrees, by performing under permit, to bear all costs for moving the fire hydrant.

7. TREE REMOVAL, TRIMMING, AND TUNNELING

- a. All tree removals, trimming, and tunneling within county road right-of-way shall be reviewed and approved by means of permit by the Board of Ingham County Road Commissioners. Any trees, regardless of their location, that cannot be protected due to utility installation or are in eminent danger of dying as a result of utility installation shall be removed by the Contractor. All stumps shall either be removed or ground flush with the average ground surface in the vicinity of the stump.
- b. Proposed tree removals, trimming, and tunneling shall be sufficiently illustrated on construction plans along with the tree's species and size so that a proper review and site visit can be performed.
- c. Trees that are located close to proposed utility installations, in the county road right-of-way, and reside within maintained lawn areas shall be protected from above ground and below ground

damage. Any trees, as described above, that are to be removed due to utility installation, shall only be removed after the Contractor has given notice to the adjacent property of the intent to remove the tree(s) and offered replacement trees. In general, the Board will require the Contractor to replace “lawn” trees removed due to utility installation. Replacement trees shall be planted outside the road right-of-way or at locations approved by the Board.

- d. All stumps, logs, limbs, and litter shall become the property of the utility installation contractor and be properly disposed of. The adjacent property owners have the right of ownership of wood felled within the right-of-way, therefore the Contractor shall offer to leave the felled wood for the property owners use. Wood requested by the property owner shall be left outside of the county road right-of-way.

## 8. CONDUCT OF OPERATIONS

- a. The Contractor shall control and ensure that trucking operations related to utility installations adhere to the current Michigan Vehicle Code and restrictions imposed by the Board, including spring weight restrictions. Failure to do so will result in the truck operator being ticketed and may also result in a stoppage of work.
- b. Contractors, permitted or not permitted, who conduct utility installation operations in a manner detrimental to the Board’s statutory obligation to maintain county roads reasonably safe for the public will be required to cease utility installation activities and correct all detrimental conditions immediately. If deemed necessary by the Board, cash deposits to cover the cost of a full-time ICRD inspector to ensure proper operations may have to be submitted to the Board before utility installation continues.
- d. Dewatering water disposed of by the Contractor within the county road right-of-way must be approved by the Board in advance of any discharge and conform to Michigan Department of Environmental Quality (MDEQ) Best Management Practices (BMS) for soil erosion and sedimentation control. In general, discharge of water into roadside ditches for more than a couple of hours will not be allowed. If the Board deems it necessary that dewatering activities be modified or discontinued altogether, the Contractor shall comply and devise another method to complete their work. The Contractor, by performing under permit, accepts the responsibility of restoring the road right-of-way and affected drainage system to the satisfaction of the Board and the Ingham County Drain Commissioner after dewatering system removal.
- e. The Contractor shall store construction materials as far off the road so that the materials do not pose a hazard nor block the vision of the traveling public and those seeking egress and ingress to private property. Only materials to be installed immediately can be stored within the right-of-way. All other materials and equipment shall be stored outside of the right-of-way.
- e. For location of underground utilities, the Contractor shall call Miss Dig at 1-800-482-7171 a minimum of three working days prior to utility installation.

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MERIDIAN TOWNSHIP  
TECHNICAL SPECIFICATION  
**LIFT STATION ELECTRICAL AND CONTROL SPECIFICATIONS**

**External Enclosures:**

The external enclosure shall be a back-to-back pair of dual rated NEMA 12/3R enclosures on legs of 36 inch height.

One side of the enclosure package will contain the pump control equipment and the other side will contain the service entrance components. Interconnections between the enclosures shall be made by means of 2 inch conduits and elbows mounted under the ends of the enclosures, connected through the walls of the leg kits. High voltage wiring shall be carried through one conduit, all 120 VAC and lower wiring shall be connected through the other conduit.

A drip kit that maintains the NEMA rating of the enclosure shall be provided for each of the two enclosures.

Door stop kits shall be installed on all four doors. These kits shall maintain the NEMA rating of the enclosure when installed.

Enclosure width and height shall be 60 inches wide by 42 inches tall. Depth will vary between the control and the service entrance side.

External enclosures shall be equipped with pad-lockable door handles.

Enclosures and hardware shall be from the same manufacturer and shall be Hoffman, Saginaw Controls or equal.

**Internal Control Enclosures:**

All components mounted inside exterior enclosures shall be in NEMA 1 enclosures or otherwise protected against falling or dripping water.

**External Junction Box:**

A NEMA 4 external junction box shall be provided to allow connection of all wiring from the wet well, including the motor leads, motor sensor leads and float switches. The cable from the ultrasonic transducer shall be pulled through the junction box without termination. All low voltage signals shall be isolated from the high voltage circuits with a metal barrier separating the intrinsically safe terminals from other terminals. This junction box shall be mounted on the end of the control enclosure ~~nearest the wet well~~ a **minimum** of 24 inches above the ground.

**Service Entrance Disconnect:**

A main circuit breaker suitable for the voltage and current requirements of the station shall be provided. The load side of this device will feed power to the line side of the manual transfer switch.

The circuit breaker shall be in a NEMA 1 enclosure and shall be suitable for service entrance use.

A solid neutral and ground block shall be provided in the service entrance enclosure.

**Automatic Transfer Switch:**

The transfer switch shall match the voltage and current requirements of the station. It shall be provided as part of the overall automatic backup generator package and shall be purchased from the same source to ensure compatibility. The switch shall be NEMA 1 rated ~~and shall be provided to the panel builder by the contractor for installation in the service entrance side of the control panels. See Transfer Switch Specifications for details.~~

**Generator Interlocks:**

The control panel shall be equipped to handle the following functions:

120 VAC Power to the battery charger for the standby system

120 VAC Power to the block heater in the generator

120 VAC Power to a pair of dry contacts in the generator. The first of these contacts will report generator running, the second will report a generator failure. These inputs will be sent back to the SCADA system via radio. ~~See Standby Generator Specification for more detail.~~

**Generator Receptacles:**

One Crouse Hinds, AR1041-S22 receptacle shall be provided.

**Manual Transfer Switches:**

Each panel shall be equipped with a 3 position manual transfer switch to allow switching between the main line power, off position, or the generator receptacle.

Square D, non-fusible switches suitable for the voltage and current requirements shall be provided.

**Power Distribution Blocks:**

Power distribution blocks shall be provided to allow multiple loads to connect to single supply wires. Voltage and current ratings shall be suitable for the station. Two 3-phase blocks and one single phase block are required. Blocks shall be Bussmann, Marathon or approved equal.

**Shore Power Monitoring:**

The incoming power shall be monitored with a phase monitor circuit picked off the primary power distribution block. The signal from the phase monitor at this location shall be wired to the PLC and transmitted back to the SCADA system where presence or shore power will be annunciated on the station screen. The phase monitor shall be protected with high interrupting capacity fuses with no more than a 2 amp rating such as Bussmann FNQ-R-2, or approved equal.

**Motor Circuit Protection:**

Motor circuit protection shall be provided by means of a combined overcurrent/overload device such as an Allen-Bradley Bulletin 140M device. This shall provide traditional motor overload protection as well as motor circuit over-current and phase loss or imbalance detection. The device shall have an auxiliary contact that opens if the built-in circuit breaker is tripped but not if it is turned off.

**Motor Control Devices:**

The motors shall be controlled by variable frequency drives (VFDs). The VFDs shall be of the Allen Bradley 400 series with the specific type depending upon horsepower and voltage ratings.

**Motor Current Sensing:**

Motor current shall be sensed in all panels. The motor current shall be read directly from the drive, either by means of an analog output signal or a 1769-SM2 module.

**Control Power Transformer:**

A dry type transformer shall be used to reduce the incoming line power down to 120 VAC for control and utility usage in the panel. This transformer shall be sized to match the station load, with a minimum rating of 3 KVA. If a large generator is present, the block heater current may require a larger transformer.

**Power Panel:**

The power from the control transformer shall feed into a 2 pole power distribution block. From there it will be fed into an 8 pole circuit breaker box for primary distribution.

**Control Power UPS:**

A UPS shall be provided to maintain power on the PLC and alarm system in the event of an alarm failure. The power shall be maintained for a minimum of 10 minutes with the PLC and radio operational and the alarm light active. There is no intent to operate the station in this condition, simply to annunciate the alarm status locally and via the radio back to the SCADA system.

**Level Sensing:**

The level sensor shall be a Pulsar Black Box transmitter together with an appropriate Pulsar transducer. Typical wells will utilize a DB15 series transducer, however, the range must be verified for every system individually. A suitable Zener diode barrier shall be incorporated in series with the transducer to ensure intrinsic safety.

**Primary Level Control:**

The primary level control (PLC) for the station shall be an Allen Bradley Micro 1400 processor with dual serial ports. The first port will be utilized to communicate with the station's radio, the second will be used for programming and troubleshooting the system. All set points used in the level control shall be monitored and set from the SCADA system at the Township's Service Center with local storage of the data to allow the station to operate properly in the case of a communication failure.

The PLC shall be an Allen Bradley 1764-LRP mounted in a 1764-24AWA base.

An Allen Bradley 1764-MM1 memory module shall be installed in the PLC and the final operating version of the program shall be copied into the module, with the proper bits set to cause the processor to load from the EEPROM if the PLC's RAM is corrupted.

The PLC shall monitor all signals relevant to proper station operation including but not limited to control power, phase loss, pump 1 and 2 mode selections, pump 1 and 2 status, pump 1 and 2 circuit breaker trip, pump 1 and 2 current, pump 1 and 2 seal leakage, pump 1 and 2 over-temperature, low level float, high level float, the analog

signal from the level transducer and a rain gauge input. A local alarm silence and fault reset button shall be supplied as part of the operators in the control panel's interior door.

The PLC shall provide outputs for operating pump 1 and 2 as well as setting alarms. If the PLC faults, the common station alarm shall be tripped.

**Secondary Level Control:**

In the event of a PLC failure a secondary relay override connected into the high and low level float systems shall operate the pumps from high to low level.

**SCADA Radio:**

The radio shall operate in the 900 MHz range and be of the spread spectrum, frequency hopping type. No license shall be required.

**Antenna Cable:**

~~The antenna cable shall be LMR400 of a length suitable for the location of the antenna relative to the panel and taking into account the height of the tower. A lightning arrester shall be provided and a three (3) foot superflex cable shall be used to connect between the lightning arrester and the radio. Suitable connectors shall be provided for use with the cable along with grounding and weatherproofing kits.~~

**Antenna Tower:**

An antenna tower shall be provided to elevate the SCADA system antenna to a suitable level. ~~The tower shall include:~~

- ~~• A tilt base to be buried in the ground, anchored in a cement base.~~
- ~~• A 10 foot tower section.~~
- ~~• A 9 foot top section.~~
- ~~• A section of conduit anchored in the top section to elevate the antenna another four or five feet above the tower top.~~

**PLC Program and Memory Mapping:**

The PLC program and I/O mapping will be set up by IDC in accordance with the Township's current standards.

**Quality Control:**

The entire control panel assembly shall be UL Listed. The service entrance side shall be listed as a UL508A system, the level control shall be listed as a UL689 control panel.

**Drawings and Documentation:**

~~Prior to fabrication a complete set of shop drawings shall be submitted to the Township for review. The shop drawings may be submitted via e-mail.~~

Upon completion of the startup process a set of as-built drawings shall be placed in the enclosure and another set submitted to the Township to be placed in their files.

A CD containing all pertinent documentation, including cut sheets on major items used in the panel, shall also be provided to the Township.

A final version of the PLC program shall be placed on the Township's SCADA computer or server for electronic storage.

Configuration files for any additional programmable items such as the submersible level monitor and variable frequency drives shall also be placed on the Township's computer or submitted on CD.

## **SYSTEM INSTALLATION REQUIREMENTS AND NOTES**

### **Control Panel Supplier:**

The control panel shall be supplied by:  
IDC Corporation  
5100 N. Canal Road  
Dimondale, MI 48821

Contact Eric Alspaugh or Ken Black for information at 517-646-0358, [ealspaugh@idccorporation.com](mailto:ealspaugh@idccorporation.com) or [KBlack@idccorporation.com](mailto:KBlack@idccorporation.com).

IDC Corporation will supply the complete control panel, external junction box, and all equipment and wiring inside the control panel ~~except the automatic transfer switch. The contractor shall supply the properly rated switch in a NEMA 1 enclosure to IDC for incorporation into the final control panel. See Transfer Switch Specifications for details.~~

IDC Corporation will also provide the level control and transducer, ~~float switches, radios, antenna, tower, and cables.~~

The contractor is responsible for mounting all power and control equipment, including the transducer and the antenna tower, meter socket, gas lines for generator, interlocks and power wires to and from the generator and all wiring to and from the wet well.

### **Vented Tray Installation:**

The contractor shall supply a vented tray to contain the cables from the well. The conduits from the well shall be stubbed into the bottom of the tray, then seal-off fittings provided with cord grips installed. The cables from the conduits shall then be exposed within the tray, above the seal-off fittings to allow any gases to escape into the vented tray. The tray shall be of a width and depth suitable to contain all conduits and cables but smaller than the base of the junction box into which the wiring will connect. This tray is not part of the control panel equipment.

### **Conduit:**

All conduit used shall be vinyl coated rigid steel conduit ANSI C80.1.

### **Flexible conduit:**

Any flexible conduit required shall be flexible steel conduit with PVC jacket.

MERIDIAN TOWNSHIP  
TECHNICAL SPECIFICATION  
**DEWATERING**

**1.0 GENERAL**

1.1 Description

- A. The CONTRACTOR shall furnish all labor, tools, equipment and materials necessary to dewater the sewer trench excavations, in accordance with the requirements of the contract documents.

1.2 Submittals

- A. The contractor shall submit a dewatering plan to be reviewed by the Owner prior to the beginning of construction activities requiring dewatering.

1.3 Quality Control

- A. It shall be the responsibility of the contractor to control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.
- B. All dewatering operations shall be adequate to assure the integrity of the finished product and shall be the responsibility of the contractor.
- C. Where any critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement which may develop. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures, roads and other facilities rests solely with the contractor. The costs of repairing any damage to adjacent structures, roads and other facilities shall be the responsibility of the contractor.

**2.0 PRODUCTS**

2.1 Equipment

- A. Dewatering, where required, may include the use of well points, sump pumps, temporary pipelines for water disposal, rock or gravel placement, and other means. Standby pumping equipment shall be maintained on the jobsite.

**3.0 EXECUTION**

3.1 Dewatering

- A. The contractor shall provide all equipment necessary for dewatering. The contractor shall have on hand, at all times, sufficient pumping equipment and machinery in good working condition and shall have available, at all times, competent workers for the operation of the pumping equipment. Adequate standby equipment shall be kept available at all times

- to insure efficient dewatering and maintenance of dewatering operation during power failure.
- B. Dewatering for pipelines shall commence when groundwater is first encountered, and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this section or other requirements.
  - C. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.
  - D. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the proposed bottom of excavation.
  - E. The contractor shall maintain the water level below the bottom of excavation in all work areas where groundwater occurs during excavation construction, backfilling, and up to acceptance.
  - F. Dewatering systems shall be designed and operated so as to prevent removal of natural soils and so that the ground water level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property.
  - G. Flotation shall be prevented by the contractor by maintaining a positive and continuous removal of water. The contractor shall be fully responsible and liable for all damages which may result from failure to adequately keep excavations dewatered.
  - H. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sandpacked and/or other means used to prevent pumping of fine sands or silts from the subsurface. A continual check by the contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.
  - I. The contractor shall dispose of water from the work in a suitable manner without damage to the environment or adjacent property. The Owner shall be responsible for obtaining any permits that may be necessary to dispose of water. No water shall be drained into work built or under construction without prior consent of the Owner. Water shall be filtered using an approved method to remove sand and fine sized soil particles before disposal into any drainage system.
  - J. The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures, pipelines and sewers.
  - K. Dewatering of trenches and other excavations shall be considered as incidental to the construction of the work and all costs thereof shall be included in the various contract prices in the bid forms.

**END OF SECTION**

EARTHWORK (DIVISION 1)

**MERIDIAN TOWNSHIP TECHNICAL SPECIFICATIONS  
DIVISION 1**

**EARTHWORK**

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**1.02 CONSTRUCTION METHODS**

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2. PROTECTION OF TREES
3. EROSION CONTROL
4. EXCAVATION
5. BACKFILLING & ROUGH GRADING
6. EXTRA SAND BACKFILL
7. EXTRA STONE BEDDING
8. RESTORATION & CLEAN UP

**1.01 SCOPE**

The Contractor shall furnish all labor, materials, tools and equipment for all excavation and backfilling required for work under this contract, including all sheeting, shoring and bracing, dewatering of excavation, and other work as herein specified. All work shall be done in accordance with the current Michigan Department of Transportation Standard Specifications for Construction, except as stated within this specification.

**1.02 CONSTRUCTION METHODS**

**1. Clearing the Site**

The Contractor shall clear the site of all brush and debris which may be present and interfering with construction operations and shall remove and dispose of the same. No trees or shrubs are to be removed unless shown on the plans or permitted by the Engineer. Concrete, asphalt, trees, and shrubs shown on the plans to be removed shall be disposed of at a suitable location off the site of the work.

**2. Protection of Trees**

All trees which are to be preserved or which, in the opinion of the Engineer, might be subject to damage by the Contractor's operations, shall be adequately protected against damage to the bark by 2-inch thick vertical planking securely wired or tied completely around the tree trunk. Such protection shall not be removed until authorized by the Engineer.

No excavation greater than 1 foot in depth shall be made by machine within 5 feet of any tree. If the excavation cuts within the canopy (dripline) of a tree, the Contractor shall tunnel under roots and protect them from injury throughout the work. All roots greater than 2" shall be cleanly cut, if removed.

Trees which interfere with the work, and the removal of which is permitted, shall be removed by the Contractor in a safe manner and incidental to construction unless otherwise noted on plans and proposal. No trees are to be removed without the expressed approval of the governmental body or property owner having jurisdiction thereof, and of the Engineer.

## EARTHWORK (DIVISION 1)

### 1.02 **CONSTRUCTION METHODS (CONT'D.)**

#### 2. **Protection of Trees (Cont'd.)**

Trees, trunks, and limbs to be removed that are greater than six inches in diameter shall be trimmed and cut into lengths less than eight feet and piled outside of the right of way for use if the abutting property owner so desires. If the property owner does not desire the timber, the timber becomes the property of the Contractor. All other timber, brush, limbs, and stumps shall be disposed of by the Contractor. Onsite burning will not be allowed.

#### 3. **Erosion Control**

Erosion Control devices shall be installed as shown on the plans and as needed to eliminate the migration of soil from the worksite. Typical devices include catch basin fabric drops (silt sacks) and silt fence. Additional requirements, as necessary, can be found in the Special Provisions.

Fabric drops shall be designed and constructed for use in the specified structure. Drops shall be installed prior to construction, cleaned and maintained in a working state for the duration of the project, and removed and disposed of upon final completion and restoration of the construction site.

Silt fence shall be a product in accordance with the MDOT 2012 SSC, Section 910.

Grass shall be growing before the erosion control measures are removed. Retainage will not be released until the sediment guards are removed.

#### 4. **Excavation**

##### A. General

Trench excavation shall be by open cut, except as otherwise shown or permitted. Excavation may be performed by any practical method consistent with the integrity and protection of the work, adjoining structures, and the protection of workers and the public.

Excavation of trenches for piping shall provide a minimum net clearance of six inches outside the barrel of the pipe and, in all cases, shall be of sufficient width to permit the convenient placing of pipe and making of joints. The bottom of the trench shall be shaped so as to conform as nearly as possible to the outside of the pipe, particular care being taken to recess the bottom of the trench in such a manner as to relieve the bell of all load and to provide continuous soil bedding under the lower quadrant of the pipe.

Excavation for structures shall be extended sufficiently beyond the limits of the structure to provide ample room for practical construction methods to be followed.

If excess excavation is made or the material becomes disturbed so as to require removal beyond the prescribed limits, the resulting space shall be refilled with selected material. It shall be thoroughly tamped into place in not more than six inch layers, to the satisfaction of the Engineer, before the construction work proceeds. Alternatively it may be filled with Class B Concrete or Flowable Fill.

## EARTHWORK (DIVISION 1)

### 1.02 **CONSTRUCTION METHODS**

#### 4. **Excavation**

##### A. General (Cont'd.)

Foreign materials such as slabs of wood, boulders, etc. which obstruct the excavation, shall be removed with other excavation; and where such obstructions occur at or near the bottom, requiring excavation below grade for their removal, the excavated area shall be brought back to grade as in the previous paragraph, and incidental to construction. Unnecessary excavation below grade by the Contractor shall be refilled to grade as in previous paragraph, and at the Contractor's expense.

##### B. Existing Utilities and Structures

The Contractor shall cooperate with all utility firms, in advance, to locate and avoid interference with and damage to existing facilities, insofar as possible. Means for elimination of interference and correction of damage shall be subject to the instruction or approval of the Engineer. Where any apparent conflicts with underground utilities become evident, the Contractor shall excavate the utility in advance of working in the area. The Engineer shall then determine if any conflict exists and, if so, shall determine the action to be taken. Exploration for underground utilities is incidental to the other work performed.

Underground pipes or structures encountered in excavation shall be adequately supported during the Contractor's operations. Before backfilling, the structure shall receive a permanent support of a suitable material approved by the Engineer, extending from the bottom of the excavation to the underside of the pipe or other structure.

The Contractor shall use care not to damage adjoining structures and existing underground utilities. Existing underground pipes and cables are shown on the plans insofar as information is reasonably available. The Contractor shall be responsible to ascertain the locations of all utilities, whether shown on the plans or not.

Work within MDOT and Ingham County Road Department (ICRD) rights of way is done under separate permit from the agency involved. In addition, to these specifications, the Contractor shall adhere to all conditions contained in such permits.

When excavating along paved roads, extreme care shall be taken that the existing pavement and structures will not be damaged or undermined. All sheeting, bracing, and other equipment necessary to prevent damage shall be furnished by the Contractor. Where a trench must be cut through a roadway or driveway, particular care shall be taken not to unnecessarily damage adjoining areas of pavement. Existing pavement shall be sawcut prior to excavation.

Sheeting or other suitable protection, as required, shall be provided wherever excavation is performed adjacent to an existing structure. Any material removed from beneath the foundation of an existing structure shall be replaced with Class B concrete. Sheeting, bracing, and shoring required to support the sides of excavation shall be removed with care after completion of the work. Any injury to the work or to adjacent property resulting from the removal shall be repaired by the Contractor.

## EARTHWORK (DIVISION 1)

### 1.02 **CONSTRUCTION METHODS**

#### 4. **Excavation**

##### B. Existing Utilities and Structures (Cont'd.)

The Contractor shall be responsible for any damage caused by their operations to pipes, structures, poles and accessories, and the like above or below ground, whether shown on the plans or not. They shall make good and repair any such damage to the satisfaction of the Engineer. Particular care shall be exercised where excavation or other work is being prosecuted near electric or telephone lines.

##### C. Ground Water

Excavations shall be kept dry during placing of pipe and initial backfill. The Contractor shall supply stone sumps and pumps as necessary to maintain satisfactory conditions. This work is considered incidental to the pipe cost.

The Contractor shall take all necessary precautions to prevent the accumulation of water to such a level as might cause damaging uplift pressure to partially completed structures. The Contractor shall be responsible for any damage to partially completed structures because of inadequate or improper protection from uplift pressure, and shall repair or remove and replace at their own expense, to the satisfaction of the Engineer, all work so damaged.

##### D. Wells/Well Points

The Engineer may direct the installation of wells/well points if they deem it necessary to lower the adjacent water table. This is a pay item which includes all costs to furnish and operate the system, including down-time and remobilization. This method will be used only when normal methods, outlined in above paragraph (4C), prove to be insufficient.

#### 5. **Backfilling and Rough Grading**

##### A. Bedding and Initial Backfill

The backfilling and bedding of utilities shall not incorporate frozen materials. Trench backfill shall be carefully placed such that pipeline and grade are not disturbed. Bedding and initial backfill shall be as specified for ductile iron, plastic, and concrete pipe in Division 2 and for ductile iron pipe in Division 3 of the Technical Specifications.

##### B. Final Backfill Outside Right of Way

The remainder of the trench, if not in a roadway, may be backfilled with excavated material unless it contains peat, muck, cinders, stones larger than 6" in diameter, or other undesirable material as determined by the Engineer. This undesirable material shall, upon written order of the Engineer, be removed and replaced with Extra Sand Backfill or material approved by the Engineer.

## EARTHWORK (DIVISION 1)

### 1.02 **CONSTRUCTION METHODS**

#### 5. **Backfilling and Rough Grading**

##### B. Final Backfill Outside Right of Way (Cont'd.)

In a field, above a point 12-inches over the pipe, water main trenches may be backfilled completely with loose material and compacted from the top of the trench. Sewer trenches shall be backfilled and compacted in layers of 3'. In lawn areas the layers in each case shall not exceed 12".

Excavated material, above a point 12-inches over the top of the pipe, shall be compacted by running the wheel or track of excavation equipment along the trench or by methods and equipment approved by the Engineer. At least 30" cover over the top of pipe is required for wheeled or tracked vehicles and 48" cover for machine mounted compactors. Temporary mounding of excess material over the trench will be allowed only until such time as lawn repairs are completed.

##### C. Backfill within Roadway Zone of Influence

Where excavation cuts through a road, drive, or sidewalk, or is in the zone of influence of a pavement, the trench shall be backfilled with granular material and compacted in accordance with MDOT or ICRD specifications, whichever is applicable. Road crossings are incidental to pipe installation. Longitudinal trenches will be paid as the bid item Extra Sand Backfill, unless otherwise specified.

##### D. Rough Grading

At the end of each working day, all excavations shall be completely backfilled up to existing grade with all excess excavated material being removed from the site. The excavation at the point where pipe installation is to start on the next working day need not be backfilled if it is greater than 6 feet deep, adequately protected, fenced, and lighted. However, in all cases, roadways and driveways should be made accessible overnight.

Excessive soil settlement and any resulting damage which occurs within one year of final approval shall be repaired by the Contractor at no cost to the owner.

#### 6. **Extra Sand Backfill**

When the Engineer deems the native backfill material above the pipe to be unsuitable (such as rocks, peat or landfill outside the right of way or clay within the right of way) they may order extra sand backfill.

The unsuitable material shall be removed from the site and replaced with an approved granular material. This granular material shall be compacted as previously specified for excavated material.

Sand used under paved driveways, for road crossings, for pavement sub-base or for pipe bedding and backfill to a point 12" over the pipe is considered incidental to the project and does not qualify as Extra Sand Backfill, unless it is the result of a plan change.

## EARTHWORK (DIVISION 1)

### 1.02 **CONSTRUCTION METHODS** (Cont'd.)

#### 7. **Extra Stone Bedding**

This item is used, as directed by the Engineer, to replace any unsuitable earth foundation, (such as muck, landfill or rubble), below the pipe bedding or trench bottom. The unsuitable material shall be removed from the site and replaced with one-inch crushed stone.

Stone used for dewatering purposes and for pipe bedding and backfill is considered incidental to the project and does not qualify as Extra Stone Bedding.

#### 8. **Restoration & Clean-Up**

As construction operations proceed, the Contractor shall follow their operations with a general clean-up which shall include rough grading, removal of debris, temporary replacement of mailboxes, temporary restoration of driveways, etc. The general clean-up shall follow construction such that no more than 1000 feet shall remain uncompleted at any time. Access to individual homes and parcels shall remain uninterrupted during construction operations with all driveways temporarily restored to use at the end of each working day. Temporary driveways and roads shall be maintained by the Contractor during the period of construction.

After all construction has been completed, the Contractor shall finish, grade and rake all areas disturbed by construction. Topsoil shall then be spread on the prepared areas to a depth of 3-inches. All stones and lumps larger than 1-inch diameter plus all roots, litter and other foreign material shall be raked out prior to seeding or sodding.

Lawn areas and vacant land shall be repaired with seeding, fertilizer and mulch. 12-12-12 fertilizer shall be evenly applied at a rate of 200 lbs./acre. Seed shall be MDOT "THM" mixture and shall be sown following or in conjunction with the fertilizer and while topsoil is in a friable condition. Seed shall be evenly sown at a rate of 220 pounds per acre and shall not be sown through mulch. Mulch blankets shall be installed immediately after seeding and shall be pinned in place, unless otherwise specified.

If called for, lawn areas shall be repaired with first-quality commercial lawn sod. The existing sod in the excavated areas shall be cut, trimmed and removed as necessary to accept a minimum 12-inch width of new sod without overlapping new sod onto the existing or without leaving gaps between the new sod and existing. Watering of new sod shall be the responsibility of individual property owners.

Driveways and approaches shall be repaired with material of the same quality, width and thickness as that which existed prior to construction, but shall not be less than the following:

- A. Concrete shall be 6-sack, transit-mixed; formed, jointed and finished to match existing. Slabs less than 24-inches wide shall be removed and replaced with new concrete – see Division 4 of the Technical Specifications for additional requirements.

## EARTHWORK (DIVISION 1)

### 1.02 **CONSTRUCTION METHODS**

#### 8. **Restoration & Clean-Up** (Cont'd.)

- B. Asphalt shall be MDOT HMA 13A, three inches compacted thickness and rolled to a uniform, dense surface. Prior to placing of new asphalt, the existing asphalt shall be trimmed with a concrete saw to straight edges which are parallel with the adjoining roadway. Overlays shall be preceded by an asphalt primer. Thicknesses greater than two inches shall be placed in two layers that have cooled between courses.

It is the intent that upon completion of the work all surfaces will be returned to the standard of profile and conditions that existed prior to this work. All gravel, top soil, seeding, sodding, surface restoration, paving, etc., shall be performed under this contract. Surface restoration shall include replacement of mailboxes, posts, fences, signs, culverts, ditches and other miscellaneous improvements. No deviations from existing conditions will be allowed without the written permission of both the Engineer and the affected property owner.

SANITARY SEWER COLLECTION SYSTEM (DIVISION 2)

**MERIDIAN TOWNSHIP TECHNICAL SPECIFICATIONS  
DIVISION 2**

**SANITARY SEWER COLLECTION SYSTEM**

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**2.01 SCOPE**

The Contractor shall furnish all labor, equipment and materials to completely construct, test and place in operation the sanitary sewer systems as shown on the plans and specified herein.

## SANITARY SEWER COLLECTION SYSTEM (DIVISION 2)

### 2.02 PIPE MATERIALS

#### A. Sanitary Service Pipe

The pipe used for risers and house services shall be constructed of the following material:

1. House Service

4-inch pipe shall be one of the following:

- a) PVC conforming to ASTM D 2665 with 0.237-inch wall thickness (Schedule 40).
- b) ABS conforming to ASTM D 2751 with 0.180-inch wall thickness (SDR 23.5).

2. Stubs, Risers, and House Services

6-inch pipe shall be one of the following:

- a) PVC conforming to ASTM D 3033 or D 3034 with 0.180-inch wall thickness (SDR-35) or ASTM D2729 with a 0.280" wall thickness (schedule 40).
- b) ABS conforming to ASTM D 2751 with 0.180-inch wall thickness (SDR-35).

Joints for PVC and ABS shall be either glued or bell and spigot with a rubber gasket. Glue shall be as recommended by the manufacturer of the pipe.

#### B. Sanitary Main Pipe

1. Polyvinyl Chloride (PVC) Pipe

- a) Pipe and Fittings – All PVC sewer pipe and fittings shall be manufactured in accordance with one of the following Standard Specifications:
  - i. ASTM D3034, "Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings"
  - ii. ASTM F679, "Standard Specification for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings"

All fittings shall be compatible with the pipe to which they are attached.

- b) Joints – All PVC pipe joints shall be gasketed, bell-and-spigot, push-on type conforming to ASTM D3212, "Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals." Since each pipe manufacturer has a different design for push-on joints, gaskets shall be part of a complete pipe section and purchased as such. Gaskets may be factory installed or field installed as recommended by the pipe manufacturer. Lubricant shall be as recommended by the pipe manufacturer.
- c) Pipe Stiffness – All PVC sewer pipe shall have a minimum pipe stiffness that equals or exceeds 46 lbs / in-in.
- d) Acceptance – Pipe or fittings may be rejected for failure to comply with any requirement of this specification.

2. Reinforced Concrete Pipe

Sewers 15" and larger shall be reinforced concrete, of a class heavy enough to withstand live and dead loads imposed. This class shall be as shown on the plans.

## SANITARY SEWER COLLECTION SYSTEM (DIVISION 2)

### 2.02 PIPE MATERIALS

#### 2. Reinforced Concrete Pipe (Cont'd.)

All reinforced concrete pipe used in this work shall be made by or under the direct supervision of some well-known and reputable manufacturer, whose type of pipe has been used for at least three years. It shall be furnished in sections not less than eight feet in length.

All reinforced concrete pipe shall conform to ASTM C76 or latest revision of Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

The joints for reinforced concrete sewer pipe shall be of the rubber gasket type meeting the requirements of ASTM C443, latest revision.

#### 3. Ductile Iron (DI) Pipe

Ductile iron pipe used for sanitary sewers shall be equal to the following:

General - All pipe used shall meet the requirements of ANSI/AWWA C151/A21.51 except as stated below.

- a) Joints - The bell of each length of pipe shall provide for the seating of a single rubber gasket, suitable for use with sanitary sewage. The gasket shall be self-centering when the plain end of a pipe enters the bell. Sufficient lubricant shall be furnished to provide a coating on each plain end of pipe. The lubricant shall be non-toxic and have no deleterious effect on the rubber gasket. The lubricant shall be of a consistency that can be easily applied to the pipe in any weather and shall adhere to either wet or dry pipe.
- b) Cement Mortar Lining - Cement mortar lining of pipe shall conform to ANSI/AWWA C151/A21.4, except for the following items. The minimum thickness of lining shall be 3/21-inch. Care shall be taken to insure that no mortar remains in the joint surface of the bell. If mortar is found in the joint surface or lining of greater thickness than allowed, the pipe will be returned.
- c) Length of Pipe - Because of the need to provide uniform spacing of any piling, all pipe furnished shall have a nominal laying length of 18 feet.
- d) Pipe Class - The pipe shall be Class 54. Tolerances will be as allowed in ANSI/AWWA C151/A21.51.
- e) Coating - The inside and outside of the pipe shall be coated with a bituminous coating of either coal-tar or asphalt base one mil thick.
- f) Independent Tests - The supplier shall furnish reports of all tests and inspections as required in ANSI/AWWA C151/A21.51.
- g) Polyethylene Encasement - All ductile iron pipe shall be encased with an eight mil thick polyethylene tube conforming to ANSI/AWWA C105/A21.5. Installation shall be in accordance with manufacturers recommendations. Closures and damaged areas shall be sealed with 1-1/2" by 12 mil polyethylene adhesive tape.

## SANITARY SEWER COLLECTION SYSTEM (DIVISION 2)

### 2.03 INSTALLATION OF MAINS

#### A. **Trenching** (Ref sec 1.02)

The trench shall be dry during the pipe laying operation. The trench bottom shall be prepared as stated in Division 1 and as hereinafter specified. Bell holes shall be excavated so that after placement, the barrel of the pipe will have full bearing on the trench bottom.

The installation, handling, and storage of all pipe shall be in accordance with manufacturer's recommendations. Pipe shall be protected at all times against impact shocks and free fall. Stock piling of pipe at the job site shall be in such a location as to minimize handling.

Trenches shall be excavated so that there will be a minimum clearance of six inches on each side of the barrel of the pipe and a maximum width of trench at the top of the pipe of not more than sixteen inches greater than the O.D. of pipe thirty inch I.D. or smaller and not more than twenty-four inches greater than the O.D. of pipe thirty inch I.D. or larger. They shall be at all times of sufficient width to permit the pipe to be laid and to permit first-class construction methods to be used. Sufficient space shall be provided in the trench to permit the joint to be properly made.

The trench bottom shall be undercut four inches below the final location of the pipe barrel and the trench then filled with sharp sand, fine gravel, or crushed stone bedding compacted with hand tampers to provide a cushion for bedding the pipe. The Contractor shall provide sand, gravel, or stone from off the site, except when the trench passes through well-defined strata of sand, gravel, or both.

Excavation for structures shall be extended sufficiently beyond the limits of the structure to provide ample room for other construction as necessary.

In case unsuitable material, in the opinion of the Engineer, is encountered in the bottom of a sewer trench or underneath a structure, the Engineer may order the removal of this material and its replacement as stated in Division 1 (Earthwork).

#### B. **Installation of Pipes**

The laying of the pipe shall commence at the outlet and proceed upgrade with spigot ends pointing in the direction of flow.

The socket of the pipe last laid shall be wiped clean and the spigot end of the pipe to be laid shall then be centered and pushed home against the base of the socket. The pipe shall be centered so that they will form a sewer with a uniform invert.

Joints shall be made in accordance with the manufacturer's requirements. All surfaces of the joint shall be clean and dry before the lubricant is applied. Care shall be taken in laying, that the pipe does not shift and it must remain in a home position after assembling.

All pipe shall be laid to the line and grade called for on the plans, utilizing an in-line laser beam system for vertical and horizontal control. Each pipe, as laid, shall be checked by the Contractor with a suitable target to insure that this result is obtained. Vertical and horizontal alignment shall, at any point, be within 0.04 foot (½-inch) of plan location.

## SANITARY SEWER COLLECTION SYSTEM (DIVISION 2)

### 2.03 INSTALLATION OF MAINS

#### B. Installation of Pipes (Cont'd.)

After the pipe is laid, sharp sand, fine gravel, or crushed stone shall be placed the entire width of the trench up to the springline of the pipe. Backfill shall be carefully tamped under the haunches of the pipe. Care shall be taken during backfilling and tamping so that the line and grade of the pipe are not disturbed. If concrete is being laid, additional fill shall then be placed until the entire width of the trench is not less than one foot above the top of the pipe. If sand is used for backfill around and over the pipe, it shall be thoroughly compacted with a vibratory compactor; hand compaction will not be acceptable.

If concrete pipe is being laid, fine excavated material free of large stones or lumps may be used for backfill above the springline. The remainder of the backfilling may be done as previously specified in Division 1 (Earthwork).

All pipe shall be so laid that the center of the pipe shall not depart from a straight line from manhole to manhole, by more than twelve inches, or one half the diameter of the pipe, whichever is the smaller.

Main sewer line stubs for future connections shall be furnished and placed by the Contractor according to details shown on the drawings and as directed by the Engineer.

The end of the stub for future connections shall be properly supported on crushed stone and braced when not resting on original ground so that any settlement will not disturb the connection. The end of the main sewer line stub shall be witnessed and marked in the manner described for sanitary sewer leads.

### 2.04 BUILDING SERVICES

#### A. Stub or Service Connections

Stub is defined as that portion of the service between the main and the property line. Stubs to the property line fitted with suitable stoppers shall be provided at such points as are shown on the plans or as directed by the Engineer. The connection shall be made using standard "Y" or "T" fittings as shown on the plans. On vacant lots, the stub connections will generally be located at approximately the mid-point of the front lot line, unless the Owner requests another location.

In order to properly record the locations, the Contractor shall make accurate measurements of all "Y" or "T" fittings before the sewer trench is completely backfilled.

The measurements shall indicate the distance from each "Y" or "T" to the center of the nearest downstream manhole. The Contractor shall furnish the Engineer with a copy of these measurements immediately upon the completion of any block of sewer.

In addition to measurements, the Contractor shall furnish and place a two inch by four inch (2x4) marking stick at each stub of such length that it will reach from the pipe up to a minimum of six inches above the ground surface. Each marker shall be set in a vertical position and held vertical while backfilling the trench.

## SANITARY SEWER COLLECTION SYSTEM (DIVISION 2)

### 2.04 BUILDING SERVICES (Cont'd.)

#### B. Riser Pipe

Where shown on the plans or where directed by the Engineer, the Contractor shall put in 6-inch pipe risers extending from the stub connection in the sewer up to within 9 feet of the ground surface or to a depth adequate to serve the house service elevation shown at the property line. These pipes shall be laid up with a joint as specified and the top pipe shall be closed with a stopper. All risers shall be laid up and held securely in place and the backfill shall be carefully placed around them so as not to disturb them. Crushed stone or concrete six inches thick shall be placed under and around the T or Y fitting and over it to a height of six inches above the sewer main to furnish an adequate support for the riser pipe.

The top of each riser pipe shall be measured and marked by the Contractor in the same manner as specified in paragraph (A) above.

#### C. House Service Line

House services shall be installed at the locations and elevations as are shown on the plans or as directed by the Engineer. The house services shall connect to the 6-inch stub or riser and generally extend to the house. Fernco® style flexible couplings shall be used when extending a house service from the stub.

Clean-outs shall be installed in a straight run of pipe at a maximum spacing of 90 feet and at all pre-formed bends. Standard wyes must be used to construct clean-outs. Clean-outs must extend to within six inches of finish grade and be securely capped. Clean-outs shall be marked with a minimum 36" length of ½" diameter steel pipe or reinforcing rod or shall have a cast iron cap.

In order to properly mark the location of every house service, the Contractor shall make accurate measurements of each installation. The measurements shall indicate the distance from each house service to the side property line and to two fixed reference points, i.e. power poles, fire hydrants, manholes, or buildings. The Contractor shall furnish the Engineer with a copy of these measurements immediately upon the completion of each street.

#### D. Tapping Existing Mains

Where existing main sewer lines are to be tapped, the Contractor shall use a preformed saddle approved by the Engineer. A hole shall be cut to the proper size in the main line and all rough edges smoothed to prevent obstructions. The exterior of the main line pipe shall be thoroughly cleaned in order to provide a prepared surface for gluing the saddle onto the main line. Glue shall meet manufacturer requirements. The Contractor shall clean the main line of all debris which may have entered during their tapping operation.

The Contractor shall notify the Township Engineer prior to making any connection to the main line and shall not backfill the connection prior to approval of the Township Engineer. If the pipe becomes covered with water or backfill material, the Contractor shall remove the water or material to facilitate the inspection.

## SANITARY SEWER COLLECTION SYSTEM (DIVISION 2)

### 2.04 BUILDING SERVICES (Cont'd.)

#### E. Guarantee

The Contractor shall be responsible indefinitely for the correct elevation and measurements of stub connections and house services. If a stub connection or house service cannot be found, is not at the correct elevation, or has not been installed properly, the Contractor will be notified of the situation. They will then be required to pay for finding the stub connection or house service and fixing or reinstalling, as necessary.

### 2.05 MANHOLES

#### A. Precast Sections

Manholes shall be constructed of circular precast concrete units with circular reinforcement and shall conform to the requirements of the current Specifications for Precast Reinforced Concrete Manhole Risers and Tops ASTM C478, with the following exceptions and additions:

Standard cylinders for compression tests will be required during the manufacturing of the manhole sections. Tests results from the cylinders will be the basis for determining the strength requirements of that days' output of manhole sections and depending on the results, may lead to additional testing of manhole sections.

Marking of the sections shall be done within six days after manufacture.

Cone sections shall be the eccentric type.

Joints between sections shall use a rubber O-ring gasket and a layer of one (1) inch butyl rope. The interior and exterior of the joints shall be treated with a non-shrink cement mortar with a smooth brushed finish. Additionally, the exterior of the joints shall be sealed with a product such as Boa Tape™, Infi-Shield®, EZ WRAP, or approved equal.

Pipe connections into manholes shall be made with an integrally-cast seal boot such as "Kor-N-Seal", "Lock-Joint Flexible Manhole Sleeve" or an approved equal.

#### B. Manhole Steps

Manhole steps shall be plastic-coated steel. They shall be placed sixteen inches apart unless otherwise shown and shall be cast in the manhole walls. It will not be acceptable to grout more than one step in place after the manhole section is poured.

Plastic-coated steel steps shall consist of a 3/8-inch diameter deformed steel reinforcing rod covered with a copolymer polypropylene plastic. The steel rod shall be grade 60 and conform to ASTM-615. The plastic shall conform to ASTM 2146-68, Type II, Grade 49108. The steps shall also conform to ASTM C478.

## SANITARY SEWER COLLECTION SYSTEM (DIVISION 2)

### 2.05 MANHOLES (Cont'd.)

#### C. Castings

1. The joints between the casting and cone shall be treated as shown on the Meridian Township Sanitary Sewer Detail Sheet.
2. Bolt-down covers and frames are required when not in a pavement surface. They shall be Neenah R-1916-F or East Jordan Iron Works 1045-ZPT. Covers shall have "Sanitary" cast into the surface and shall be equipped with (4) stainless steel cap screws. Base flange shall be furnished with (4) anchor bolt holes.
3. Standard frames and cover shall be East Jordan Iron Works 1045 or approved equal with solid, gasketed, self-sealing cover with concealed pick holes. Covers shall have "Meridian Sanitary Sewer" with the tree logo cast into the surface.
4. Top of casting shall be set as follows:
  - (a) Flush with paved or grass surfaces
  - (b) 6-inches below gravel road surface
  - (c) 6-inches above ditch grade

#### D. Mortar Castings

Mortar for block and brick work in manholes and other appurtenances shall be mixed in the proportion of one part Portland Cement to three parts sand. Hydrated lime may be added in proportions not to exceed 10 percent of the volume of the cement.

Mortars mixed by hand shall be prepared in a suitable clean water tight box. The ingredients, except water, shall first be thoroughly mixed dry until of uniform color; then water added and the mixing continued until mortar of proper consistency and uniform texture is produced.

No re-tempered mortar or mortar that has been mixed for more than thirty minutes shall be used in the work. No cement mortar shall be mixed when temperature is below 32 degrees Fahrenheit without properly heating the sand and water. New placed mortar shall be protected from freezing for the first 72 hours.

#### E. Adjusting Rings

Casting adjustment shall be accomplished with pre-cast concrete grade rings conforming to ASTM C478. Each ring shall have an ID not less than 24-inches nor greater than 25-inches, a minimum thickness of 2-inches and a minimum OD of 40-inches. A 1" butyl rope gasket shall be used between all rings and the top ring & casting. Total ring adjustment shall not exceed 12". Longer cone sections shall be used if more than a 12" adjustment is needed.

#### F. Concrete

Class A concrete used in manhole flow line construction shall be transit-mixed with a minimum 28-day compressive strength of 3,500 psi. The approximate proportions of the mix shall be 1 part cement, 2 parts fine aggregate and 3 parts coarse aggregate. The mix shall contain six sacks of cement per cubic yard with a maximum allowable slump of 3 ½ inches.

## SANITARY SEWER COLLECTION SYSTEM (DIVISION 2)

### 2.05 MANHOLES (Cont'd.)

#### G. Installation

Sanitary sewer manholes are to be constructed as shown on the detailed drawings. Precast concrete manhole sections shall be installed in a plumb position.

All manholes shall be finished so that all visible leakage is repaired. The interior and exterior joints between manhole sections and adjusting rings shall be plastered with at least 1/2 inch thick mortar. All plastered areas shall have a brushed finish. All lift holes shall be mortared and finished. The bottom of the manhole, the flow line of the sewer and the steps shall be clean of all mortar, concrete, dirt and other debris.

The flow channels shall be constructed with a minimum depth of one-half the pipe diameter. The flow channel and manhole bottom shall be sloped to prevent accumulation of sewage and shall have a brushed finish.

No sanitary sewer services shall be connected to a sanitary manhole, unless specified on the plans. Standard sanitary sewer services shall connect to the main sewer line.

Where shown on the plans, new sewers shall be connected into existing manholes. In such cases, new channels shall be constructed using concrete. Where required, existing manholes shall be demolished. This work is incidental to the project, unless a separate pay item is explicitly detailed.

### 2.06 CLEANING AND TESTING

#### A. Cleaning

Before the sewer may be tested, the Contractor shall clean the sewer with a hydraulic system consisting of a high pressure pump feeding water to a nozzle which directs the water against the walls and flowline of the pipe, dislodging the debris and flushing it toward a manhole. All debris shall be removed at the nearest downstream manhole.

#### B. Testing

The Contractor shall furnish all equipment and personnel to conduct an acceptance test using low pressure air. The test shall be conducted under the supervision of the Engineer.

All house services shall be securely plugged with suitable stoppers that will withstand the internal test pressures. The section of line being tested shall also be securely plugged at each manhole. All stoppers shall be adequately braced.

Air shall be slowly supplied to the plugged pipe line until the internal air pressure reaches 4.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe. At least two minutes shall be allowed for temperature stabilization before proceeding further.

The rate of air loss shall be determined by measuring the time interval for the 1.0 psi pressure drop is not less than the holding time as specified in ASTM F1417 (PVC) or ASTM C924 (DI).

## SANITARY SEWER COLLECTION SYSTEM (DIVISION 2)

### 2.06 CLEANING AND TESTING

#### B. Testing (Cont'd.)

If the sewer installation fails to meet these requirements the Contractor shall determine the source or sources of the leakage and they shall repair or replace all defective materials or workmanship. The completed sewer installation shall meet the requirement of this test.

For plastic sewer main, the Contractor shall test the pipe for deflection by pulling a mandrel through the sewer after all backfill has been placed and compacted over the pipe. The maximum allowable deflection shall not exceed 5% of the pipe's inside diameter. The outside diameter of the test mandrel shall be equal to the inside diameter of the pipe less 5%. The initial test shall be performed at least 30 days after pipe installation. A second test shall be performed after 10 months of pipe installation or just before line's intended use.

Inspection and testing of the sanitary system shall also include video inspection by CCTV method of sanitary main, air testing of sanitary main, and vacuum testing of sanitary manholes. All inspections and testing shall be performed in the presence of Township inspectors.

CONCRETE WORK (DIVISION 4)

**MERIDIAN TOWNSHIP TECHNICAL SPECIFICATIONS  
DIVISION 4**

**CONCRETE WORK**

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<b>4.01</b>	<b>SCOPE</b>
<b>4.02</b>	<b>MATERIALS</b> 1. SUPPLIER 2. CONCRETE MIXTURE 3. REINFORCING
<b>4.03</b>	<b>CONSTRUCTION METHODS</b> 1. SUBGRADE PREPARATION 2. FORMWORK 3. PLACEMENT 4. FINISHING 5. JOINTS 6. CURING & PROTECTION
<b>4.04</b>	<b>TESTING</b>

**4.01**      **SCOPE**

This work shall consist of furnishing all labor, materials and equipment necessary for the proper mixture and placement of concrete. The current MDOT Standard Specifications for Construction (SSC) shall be followed, unless otherwise specified.

**4.02**      **MATERIALS**

**1. Supplier**

The use of transit-mix concrete is required. The Contractor shall notify the Engineer who the supplier will be prior to beginning work. The Engineer must approve the concrete supplier and the mixer trucks used to transport the concrete.

**2. Concrete Mixture**

Batching and mixing operations shall conform to ASTM C94. Water shall not be added to the mix after the trucks leave the batching plant. The mix for sidewalk shall be MDOT P1 with approximated proportions of one part cement; two parts fine aggregate, and three parts coarse aggregate. The mix shall contain 6 sacks of cement per cubic yard, with a maximum allowable slump of 3½" (three and one-half inches).

Coarse aggregate shall conform to MDOT 6AA. Fine aggregate shall conform to MDOT 2NS. Cement shall be Type 1A air-entraining Portland cement conforming to ASTM Specification C150 or Type 1 with an air entrainment admixture. Air shall be 6% plus or minus 1%.

The compressive strength of Class A concrete shall not be less than 3,500 pounds per square inch (psi) after 28 days. The compressive strength of Class B concrete shall not be less than 3,000 psi after 28 days.

## CONCRETE WORK (DIVISION 4)

### 4.02 **MATERIALS**

#### 2. **Concrete Mixture** (Cont'd.)

Water shall be clean and free from deleterious substances such as oil, alkali and organic matter. Potable water shall be used from sources approved by the Engineer.

No admixtures will be used unless approval is received from the Engineer, or is specified. Admixtures, if approved, shall be used in strict accordance with manufacturer's directions and shall conform with applicable ASTM Standards.

#### 3. **Reinforcing**

Concrete slabs, walls and footings shall be reinforced with steel bars or mesh as shown on the plans. Bars shall be rust-free, new deformed billet-steel conforming to ASTM A615, Grade 60 and mesh shall conform to ASTM A1064.

The Contractor shall prepare and submit to the Engineer shop drawings showing bending and assembly diagrams, splicing, laps of bars, shapes, dimensions and details of bars. Scaled dimensions from drawings shall not be used in determining the lengths of reinforcing bars.

### 4.03 **CONSTRUCTION METHODS**

#### 1. **Subgrade Preparation**

The earthgrade shall be prepared by removing the topsoil, vegetative cover and root mat. The base shall then be prepared by excavating and/or placing of embankment material to achieve the grade and cross-section required. All soft and yielding material shall be removed and replaced with acceptable material.

When a pathway is benched into cut or fill slopes, grading shall be done in accordance with the MDOT SSC, Section 205, Roadway Earthworks. Subgrade density shall be not less than 95% of Maximum Unit Weight in fills. In cuts, the Engineer will visually inspect the grade and may order additional compaction to achieve the desired subgrade density.

A minimum of three (3) inches of Class II granular material shall be used under all pathway construction. The base shall be smoothed, trimmed and compacted prior to placement of forms. The Engineer may order additional compaction to achieve the desired subgrade density after visual inspection.

#### 2. **Formwork**

All concrete work shall be accurately formed to the lines and grade shown on the plans. Forms shall extend to the full depth and width of the specified concrete surface. Forms shall be shored and braced from the outside to maintain ¼" tolerance in thickness, line and grade. All formwork shall be oiled with an approved non-staining form oil before placing concrete. Formwork shall be left in place until the concrete is sufficiently hard so as to not be damaged upon removal.

Construct all formwork to provide continuous, straight, smooth surfaces and edges. Exposed edges to have ½" chamfer. Curved walks shall be formed on a radius with flexible forms.

CONCRETE WORK (DIVISION 4)

**4.03 CONSTRUCTION METHODS (Cont'd.)**

**3. Placement**

All formwork and reinforcement placement shall be inspected by the Engineer prior to placement of concrete. The Contractor shall give ample notice and time so that such inspection can be made.

No concrete shall be deposited until the area has been dewatered and not until after the Contractor has made satisfactory provisions to eliminate all possibility of water entering or flowing through the concrete while it is being poured or is curing.

Subgrades shall be wetted and forms shall be oiled prior to concrete placement. All debris shall be removed from forms and reinforcement.

<b>Time Between Charging Mixer and Placing Concrete (minutes)</b>			
<b>Type of Unit</b>	<b>Concrete Temperature (ASTM C1064)</b>		
	<b>&lt;60°F</b>	<b>60°F - 85°F</b>	<b>&gt;85°F</b>
Truck Mixers	90	60	45
Truck Mixers with Concrete containing Water-Reducing Retarding Admixture	120	90	70

Exposed concrete shall not be poured when the atmospheric temperature is below 40°F or when the concrete temperature is below 55°F as placed. Concrete shall not be poured on frozen ground. Concrete shall not be cast if the temperature of the concrete is above 90°F.

Tickets shall be prepared in accordance with the MDOT SSC, Section 1001, Concrete Production Equipment and Facilities.

When placement of concrete is started, it shall be carried on as a continuous operation until the placement of the section is completed. Concrete in walls shall be placed in 24-inch lifts keeping surface of concrete level throughout. Concrete shall be deposited to the full depth of the forms in one pour. Drops of greater than 5' shall use tubes.

Reinforced concrete greater than six inches in finished thickness shall be compacted by high frequency internal vibrators. The concrete shall be thoroughly worked around the reinforcement and into the corners of the forms, using procedures which minimize air pockets and honeycombs. Care shall be taken in vibrating concrete so as not to move reinforcement out of place.

Concrete less than six inches in finished depth shall be compacted by spading along all edges and joints and by alternately tamping and striking off the surface until all voids are removed.

**4. Finishing**

Horizontal, exposed surfaces shall be floated and troweled just enough to produce a smooth, dense surface, free from irregularities. All joints and edges shall be rounded to a radius of one-quarter inch by the use of an approved edging tool. After completion of floating and finishing, a fine brush shall be drawn across the finished surface to remove tool marks, and provide a non-slip surface.

## CONCRETE WORK (DIVISION 4)

### 4.03 CONSTRUCTION METHODS

#### 4. **Finishing** (Cont'd.)

Formwork panels are intended to provide a satisfactory finish for vertical, exposed surfaces. Finishing shall be limited to minor rubbing, removal of fins and patching of honeycombed areas. Unexposed surfaces need not be finished except for patching of honeycombed areas.

All concrete sidewalk and driveway approaches shall be legibly stamped with the name of the Contractor and the year, with figures 1½" to 2½" tall. The stamps shall be used at the ends of each segment, each truck load, and at intervals no greater than 100 feet in length.

#### 5. **Joints**

1. Construction cold joints not indicated on the plans shall be so made and located so as to least impair the strength of the structure. The location of all construction joints shall be approved by the Engineer. Slabs shall have a cold joint at the end of each truck load.
2. Transverse expansion joints ½" thick shall be placed in sidewalk at approximately 100 foot intervals. ½" thick expansion joints shall be placed anywhere that the walk meets the back of curb, and where the walk meets the edge of concrete driveways or building walls.

Expansion joints material shall be pre-molded of bitumen filled fiber placed at right angles to the line of the walk, perpendicular to the surface and shall extend from ¼" below the surface of the walk to the subgrade.

3. Contraction (plane of weakness) joints shall be placed at a minimum distance equal to the width of the sidewalk. Contraction joints for bicycle pathways (7-foot width) shall be spaced approximately nine feet apart. The joint shall be sawed to a width of 1/8" and to a depth of ¼ of the slab thickness.

Sawing must be accomplished as soon as the concrete has hardened such that no excess raveling or spalling occurs, but before any random cracks develop. Joints shall be at right angles to the line of the walk, and perpendicular to its surface. Tooled joints are not allowed.

#### 6. **Curing and Protection**

Sidewalks and other slabs on grade shall be treated with a curing compound conforming to the requirements of ASTM C309. The compound shall be sprayed or rolled on to provide a continuous film over the entire surface of the walk after completion of finishing, and as soon as all free water has left the surface. Compound shall be applied at the rate of not less than one gallon per 200 square feet. Immediately upon removing sidewalk forms, the exposed concrete edge shall be sprayed with curing compounds or backfilled with earth. The final grading of topsoil will be such that the mature sod will be ½" below the concrete.

All concrete shall be protected from vehicles for the first 72 hours after placing. The period of protection will increase to 7 days as the temperature decreases to 40°F. Any concrete found to be defective or damaged due to weather, vandalism, or other causes shall be removed and replaced, at the Contractor's expense. Damaged sections of sidewalk and curb and gutter shall be removed back to the nearest joint or as indicated by the Engineer.

Freshly placed concrete shall be protected from rain by covering with polyethylene film.

## CONCRETE WORK (DIVISION 4)

### 4.03 **CONSTRUCTION METHODS**

#### 6. **Curing and Protection** (Cont'd.)

Concrete shall not be allowed to freeze for 72 hours. Protection must be provided when there is a forecast for freezing.

Barricades shall be placed at the areas under repair from the time the damaged section is removed until it is ready for use. Lighted barricades will be required for intersection areas left under repair overnight.

### 4.04 **TESTING**

The Contractor shall make arrangements for and coordinate various concrete tests as ordered by the Engineer. The testing company will be selected by the Township and the Township will pay for the tests. The Contractor will be charged for any waiting time suffered by the testing company. All tests will be done according to ASTM standards.

**MERIDIAN TOWNSHIP TECHNICAL SPECIFICATIONS  
DIVISION 7**

**PAY ITEMS, METHOD OF MEASUREMENT & BASIS OF PAYMENT**

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## PAY ITEMS (DIVISION 7)

### 7.01 **SCOPE**

It is intended that payment for all work done under the Contract Documents including the furnishing of all labor, equipment and materials and the performing of all operations in connection with the construction of the project, will be made under the following pay items. Other work for which there is not a specific pay item will be considered included in the Contract Unit Price for the various specified pay items and no additional compensation will be allowed.

The Owner reserves the right to alter the plans, extend or shorten the improvement and increase or decrease the quantities of work to be performed to accord with such changes, including the deduction or cancellation of any one or more of the Pay Items. Such changes shall not be considered as a waiver of any conditions of the Contract nor to invalidate any of the provisions thereof. A supplemental agreement between the Contractor and the Owner will be required when such changes involve a net increase or decrease in the total amount of the original contract of more than 25 percent. For a net increase or decrease of less than 25 percent, the Contractor will accept payment according to contract prices for such items of work as appear in the original contract.

The work will be done in compliance with the Contract Documents and paid for under the Pay Items or Contract Items herein listed. The Contractor shall take no advantage of any apparent error or omission in the plans or specifications, and the Engineer shall be permitted to make such corrections and interpretations as may be deemed necessary for the fulfillment of the intent of the Contract.

### 7.02 **SPECIFIC PAY ITEMS**

#### **1-19 GENERAL**

##### **1. Traffic Control**

- A. **Description:** The Contract Unit Price on this item includes labor, equipment, and material necessary to complete traffic control for this project in accordance with the Michigan Manual of Uniform Traffic Control Devices and, as applicable, Michigan Department of Transportation (MDOT) or Ingham County Road Department (ICRD) requirements.
- B. **Method of Measurement & Basis of Payment:** This item will be paid for at the Contract Unit Price on the following basis: after first use of traffic control measures, 25% will be paid; once 50% of the original contract price is completed, 50% will be paid; once 75% of the original contract price is completed, 75% will be paid; once the contract work is complete, 100% will be paid.

##### **2. Road Repair**

- A. **Description:** The Contract Unit Price on this item includes restoration of all public roads to at least their conditions as existed prior to the start of construction. Specific examples are furnishing and placing of subbase, gravel or asphalt base and gravel, asphalt or concrete surface plus all other miscellaneous work associated with the complete restoration of all public roads including shoulders. All work shall be done in accordance with the plans and specifications.
- B. **Method of Measurement & Basis of Payment:** This item will be paid for at the Contract Unit Price when all public roads have been restored to their original condition.

PAY ITEMS (DIVISION 7)

**7.02 SPECIFIC PAY ITEMS**

**1-19 GENERAL** (Cont'd.)

**3. Extra Sand Backfill** [Ref. Sec. 1.02 (E)]

- A. Description: When the Engineer deems the native backfill material above the pipe to be unsuitable (such as rocks, peat or landfill outside the right of way and clay within the right of way) the Engineer may order extra sand backfill. It includes the excavation and disposal of the unsuitable material. Fill material shall be Class II granular material and placed at the direction of and to the satisfaction of the Engineer.

Sand used under paved driveways, for pavement subbase at road crossings, or for pipe bedding and initial backfill is considered incidental to sewers or water main and will not be paid for under this item.

- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price for the total volume actually furnished and placed. Volume will be determined compacted-in-place (CIP) by measurements obtained at the site unless otherwise stated.

**4. Extra Stone Bedding** [Ref. Sec. 1.02 (F)]

- A. Description: The Contract Unit Price on this item includes the furnishing and placing of crushed stone bedding material to replace unsuitable subgrade material under the pipe. This work shall be done at the direction of, and to the satisfaction of, the Engineer.

Stone used for dewatering purposes or to stabilize water sand is considered incidental to sewers or water main and will not be paid for under this item.

- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price for the total volume actually furnished and placed. Volume will be determined in place by measurements obtained at the site unless otherwise stated.

**5. Road and Railroad Crossing**

- A. Description: The Contract Unit Price on this item includes all extra work over and above that described under Sewers, Site Restoration, and Road Repair herein. Specific work includes furnishing and installing the steel casing pipe (by methods other than open cut), placing crushed stone around the carrier pipe, sealing the casing ends plus all miscellaneous related work.

- B. Method of Measurement & Basis of Payment: This item will be paid for the Contract Unit Price after the work is completed. The lineal footage of pipe installed inside the casing will be paid for under the pay item sewer or water main in addition to this item.

**6. Abandonment**

- A. Description: The Contract Unit Price on this item includes everything necessary to abandon the structure or facility as described in the contract.

- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price per pile set for the actual number placed and incorporated into the finished work.

**7. Dewatering** [Ref. Sec. 1.02 (4.D)]

- A. Description: The Contract Unit Price on this item includes the furnishing, installation, operation and removal of all materials and equipment to lower the groundwater level adjacent to the construction area to expedite the excavation for and installation of the work.

PAY ITEMS (DIVISION 7)

**7.02 SPECIFIC PAY ITEMS**

**1-19 GENERAL**

**7. Dewatering (Cont'd.) [Ref. Sec. 1.02 (4.D)]**

- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price per lineal foot of excavation actually dewatered or as lump sum. Measurement will be along the centerline of the pipeline.

**8. Special Structure**

- A. Description: The Contract Unit Price on this item includes the furnishing and installation of labor and materials to complete the structure as shown on the plans, including excavation, backfilling, access openings and covers, floor drains and associated piping, pre-cast concrete sections, poured-in-place concrete, waterproofing, vent piping, removal of surplus excavated material and restoration of surface to within three inches of finished grade.
- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price for each special structure as actually installed.

**9. Pavement Removal**

- A. Description: The Contract Unit Price on this item includes all labor, equipment, and material necessary to remove and dispose of existing concrete or asphalt as marked in the field by the Engineer and as described herein. The Contractor shall **SAWCUT** the existing pavement to the full depth to ensure clean and proper removal. Any additional sawcutting, removal, and replacement necessitated by damage caused by the Contractor shall be incidental.
- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price as measured in the field.

**10. Miscellaneous Items**

- A. Description: This item includes the complete labor, equipment, and materials for constructing and/or placing in service a bid item not found elsewhere in this division.
- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price.

**20-29 SANITARY**

**20. Sewer Mains**

- A. Description: The Contract Unit Price on this item includes clearing the work site of all trees, brush, structures and other objects which interfere with the placement of the sewer under construction, all excavation, the furnishing and placing of sewer pipe complete including wyes or tees, bedding material, backfilling, removal of surplus excavated material, testing, concrete work, protection and replacement or repair of existing utilities, and restoration of the surface to within three inches of original grade or to bottom of pavement base course. All work shall be done in accordance with the plans and specifications.

**20. Sewer Mains**

- B. Method of Measurement & Basis of Payment: The length of sewers to be paid for at the Contract Unit Price will be determined by measurement along the centerline of the various diameters, classes and depths of pipe as actually furnished and installed. Diameters, classes and depths shall be as shown on the proposal. Measurements shall be from center to center of adjacent manholes with no deduction for manhole diameter. Depth shall be determined by measuring the distance from sewer invert to existing grade at each manhole plus at a point midway between manholes; the average of the three measurements shall be the average depth of the sewer.

PAY ITEMS (DIVISION 7)

**7.02 SPECIFIC PAY ITEMS**

**20-29 SANITARY** (Cont'd.)

**21. Manholes**

- A. Description: The Contract Unit Price on this item includes all excavation, the furnishing and placing of precast sections and cast iron frame and cover, concrete work, drop pipes, connection of existing and new pipes, backfilling, removal of surplus excavated material, and restoration of surface to within three inches of original grade. All work shall be in accordance with the plans and specifications.
- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price per manhole for the various depths as actually installed. The depth shall be determined by measuring the distance from sewer invert to top of casting.

**22. Sewer Services**

- A. Description: The Contract Unit Price on this item includes all the work and materials (~~excepting wyes and tees but~~ including necessary bends) as described in sewer main above.
- B. Method of Measurement & Basis of Payment: The length of sewers to be paid for at the Contract Unit Price will be determined by measurement along the centerline of the pipe including risers as actually furnished and installed. Measurement shall be from end of tee or wye to end of service.

**23. Bypass Pumping**

- A. Description: The Contract Unit Price on this item includes everything necessary to provide bypass pumping sufficient to complete the contract work.
- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price.

**30-39 WATER**

**30. Ductile Iron Water Mains**

- A. Description: The Contract Unit Price on this item includes clearing the work site of all trees, brush, structures and other objects which interfere with the placement of the water main under construction, all excavation, the furnishing and placing of water main testing, concrete work, disinfecting, backfilling and the removal of surplus excavated material, protection and replacement or repair of existing utilities, and restoration of the surface to within three inches of original grade or to bottom of pavement base course. All work shall be done in accordance with the plans and/or specifications.
- B. Method of Measurement & Basis of Payment: The length of water mains will be paid for on a lineal foot basis for pipe measured along the centerline of the various diameters and classes of pipe actually furnished and installed. There will be no deductions for fitting lengths. Unit price includes all labor and materials and related work described above.

**31. Water Main Fittings**

- A. Description: The contract unit price includes the furnishing and installation of the fittings delineated in the proposal.
- B. Method of Measurement & Basis of Payment: Fittings will be paid for at the Contract Unit Price for each piece, complete with restraints, thrust block, and required appurtenances.

PAY ITEMS (DIVISION 7)

**7.02 SPECIFIC PAY ITEMS**

**30-39 WATER** (Cont'd.)

**32. Water Valves and Boxes**

- A. Description: The Contract Unit Price on this item includes the furnishing and installation of valves and valve boxes. All work shall be done in accordance with the Plans and/or Specifications and result in an operating valve.
- B. Method of Measurement & Basis of Payment: This work will be paid for at the Contract Unit Price per valve specified by size of valve on the proposal, which price includes all labor, materials, and related work as described above.

**33. Fire Hydrants**

- A. Description: The Contract Unit Price on this item will consist of furnishing and installing fire hydrants. It shall also include the furnishing and installation of the tee, auxiliary valve, valve box, connecting piping, thrust block, drainage pit, and miscellaneous appurtenances. All work shall be done in accordance with the plans and/or specifications and result in an operating hydrant.
- B. Method of Measurement & Basis of Payment: Fire hydrants will be paid for at the Contract Unit Price per complete Fire Hydrant assembly, which payment includes the furnishing and placing of all materials, the labor, and all related work necessary to complete the work as described above.

**34. Live Tap**

- A. Description: The Contract Unit Price on this item will consist of furnishing and installing tapping sleeves and valves on existing mains without loss of pressure in the existing main. It shall also include the installation of a valve box and a thrust block. All work shall be done in accordance with the plans and/or specifications.
- B. Method of Measurement & Basis of Payment: This work will be paid for at the Contract Unit Price per live tap as specified on the proposal, which price includes all labor, materials, and related work as described above.

**35. Water Services**

- A. Description: The Contract Unit Price on this item includes the furnishing and installation of corporation stops, curb stops, curb boxes and service pipe in accordance with the plans and or specifications. Work includes all excavation, backfill, furnishing and replacement of sand backfill, tapping of main, and removal of surplus excavated material. Long side service leads includes crossing of roads. Short side service leads are those which do not cross roads.
- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price for each service lead completely installed.

**40-49 PAVEMENT**

**40. Concrete Sidewalk**

- A. Description: The Contract Unit Price on this item includes furnishing all labor, equipment, and materials required in connection with forming, placing, and curing of the concrete sidewalk to the lines and grade shown on the plans or as directed. All work shall be done in accordance with the plans and specifications.

PAY ITEMS (DIVISION 7)

**7.02 SPECIFIC PAY ITEMS**

**40-49 PAVEMENT**

**40. Concrete Sidewalk (Cont'd.)**

- B. Method of Measurement: Concrete sidewalk will be measured and paid for in square feet, determined by multiplying the actual length as measured along the centerline of the surface of the pathway, by the actual width. The area of fillets and odd shaped sidewalk will be computed separately. Deductions will be made for structures, crossroads, sidewalk ramps, and other discontinuities in the sidewalk. Sidewalk ramps and other appurtenances included in the contract as pay items will be paid for separately.

**41. Sidewalk Ramps**

- A. Description: Sidewalk Ramps consist of several different pay items, the combination of which include all labor, equipment, and material necessary to construct an ADA compliant curb ramp, in accordance with MDOT Special Detail R-28. The ramp pay items are depicted below in **7.04 RAMP PAY ITEMS**. All work shall be done in accordance with the plans and specifications.
- B. Method of Measurement & Basis of Payment: The ramp components will be measured and paid for at each Contract Unit Price.

**42. Bituminous Construction**

- A. Description: The Contract Unit Price on this item includes all labor, equipment, and material necessary for the construction of a bituminous surface, on a prepared foundation, at the specified application rate. If the bituminous mixture is not specified, the type used shall meet the approval of the Engineer. Construction methods shall conform to the latest edition of the MDOT Standard Specifications for Construction (SSC). All work shall be done in accordance with the plans and specifications.
- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price as verified at the site through load tickets from the supplier or by field measurements.

**43. Embankment**

- A. Description: The Contract Unit Price on this item includes all labor, equipment, and materials required in connection with delivery and placement of granular embankment material. Embankment includes areas requiring fill as called for on the plans and the 3" of base for concrete sidewalk. All work shall be done in accordance with the plans and specifications. Granular material as noted shall mean Class II material per the MDOT 2020 SSC, Section 902.
- B. Method of Measurement & Basis of Payment: Embankment material shall be as measured in the vehicle transporting the material to the site. Load tickets from the supplier are required to verify the delivered amount.

**44. Aggregate Base or Surface Course**

- A. Description: The Contract Unit Price for this item includes all labor, equipment, and materials required in connection with the delivery and placement of the material. This work includes the required shaping, grading, and compacting of the material for the foundation of the asphalt ramps and driveway approaches.

The material shall be 21AA or 22A aggregate per the MDOT 2020 SSC, Section 902, unless otherwise specified. All work shall be done in accordance with the plans and specifications.

- B. Method of Measurement & Basis of Payment: Aggregate Surface Course shall be as measured in the vehicle transporting the material to the site. Load tickets from the supplier are required to verify the delivered amount.

PAY ITEMS (DIVISION 7)

**7.02 SPECIFIC PAY ITEMS**

**40-49 PAVEMENT** (Cont'd.)

**45. Curb and Gutter**

- A. Description: The Contract Unit Price on this item includes furnishing all labor, equipment, and materials required for forming, placing, and curing of the concrete curb and gutter to the line and grade as shown on the plans, including excavation, backfill, reinforcing steel, removal of existing curb and gutter, and all joints and joint materials. All work shall be done in accordance with the plans and specifications.
- B. Method of Measurement & Basis of Payment: The length of curb and gutter to be paid for at the Contract Unit Price will be determined by measurement along the face of the curb as actually installed, with no deductions in length for catch basins, inlet castings or gutters through concrete driveway openings.

**46. Subgrade Preparation**

- A. Description: The work of subgrade preparation includes furnishing all labor, equipment, and material necessary for clearing and grubbing, including all tree and bush removal, tree trimming, topsoil stripping, grading to shape the earth to develop the typical cross section shown on the plans, and any additional excavation required to construct the pavement to the grade shown on the plans.
- B. Method of Measurement & Basis of Payment: This item will be paid on a basis of lineal feet of pathway for work completed according to the specifications.

**50-59 LANDSCAPE**

**50. Retaining Wall**

- A. Description: The Contract Unit Price for this item includes all labor, equipment, and materials required in connection with the construction of a retaining wall, as shown on the plans. All work shall be done in accordance with the plans and specifications.
- B. Method of Measurement & Basis of Payment: Retaining walls will be measured by the square foot of the exposed face, above the pathway/sidewalk.

**51. Fence**

- A. Description: The Contract Unit Price for this item includes all labor, equipment, and materials required in connection with the construction of a fence, as shown on the plans. All work shall be done in accordance with the plans and specifications.
- B. Method of Measurement & Basis of Payment: The fence will be measured along the centerline of the fence, from centerline to centerline of the end posts.

**52. Ditching**

- A. Description: The Contract Unit Price on this item includes all excavation, and grading to develop the cross sections such that upon completion of site restoration the final grade shall be within plus or minus 0.1 foot of the required lines and grade. This item will also include clearing the work site of all trees, brush, structures and other objects which interfere with the performance of the work. All work shall be done in accordance with the plans and specifications. Final restoration will be paid for separately.
- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price when the required cross section has been obtained. Measurement will be made along the centerline of the ditch. Payment for any final trimming of the subgrade required prior to site restoration is included in this pay item.

PAY ITEMS (DIVISION 7)

**7.02 SPECIFIC PAY ITEMS**

**50-59 LANDSCAPE** (Cont'd.)

**53. Erosion Control**

- A. Description: The Contract Unit Price on these items includes all labor, equipment, and material necessary to install and maintain the specified erosion control device(s).
- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price for each erosion control item used.

**54. Site Restoration**

- A. Description: The Contract Unit Price on this item includes restoration of the ground surface to at least its preconstruction state. Specific examples are final grading of the top three inches of ground surface, furnishing and installation of seed and mulch, driveway and parking area repair, culvert replacement, sidewalk repair, replacement of signs, mailboxes, and fences, plus all other miscellaneous work associated with the complete restoration of the project site. The slope between new sidewalks and a lawn shall not exceed 1:3. All work shall be done in accordance with the plans and specifications.
- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price when the complete project site has been restored to its original condition.

**55. Drainage Pipe**

- A. Description: The Contract Unit Price on these items includes all labor, equipment, and material necessary to install drainage pipe of the type and size specified, as shown on the plans.
- B. Method of Measurement & Basis of Payment: This item will be paid for at the Contract Unit Price for the length installed, as measured along the ground surface.

## COUNTY PARK LIFT STATION REPLACEMENT 2024

### SPECIAL PROVISIONS

*These Special Provisions are in addition to those in the General and Technical Specifications, and supersede the General and Technical Specifications in the event of a conflict.*

#### GENERAL

**NOTIFICATION** – The Contractor shall notify homeowners to mark private utilities seven (7) days prior to work in front of their property. If access to a resident's drive is to be disrupted as much notice as possible is to be given to the resident with a minimum of 24 hour notice being provided.

**TESTING** – The Contractor will be responsible for scheduling concrete and compaction testing. Testing will be done by Soil and Materials Engineers, Inc. (SME), (517) 887-9181. The cost will be paid by Meridian Township, except for any wait time. Concrete testing will be required for the first load of the job, and thereafter only at the direction of the Engineer.

**ROAD RIGHT-OF-WAY** – All work in the right-of-way is done under permit and approval of the Ingham County Road Department (ICRD). The Contractor shall secure the necessary permit(s).

**BARRICADING** – All excavation left open overnight shall be completely encircled with snow fence and include lighted barricades.

**PAVEMENT REMOVAL** – Any pavement removal is incidental to the contract.

**MAINTAINING ACCESS** – Access must be maintained to residences at all times during construction, unless excavation is occurring immediately in front of the drive. This includes, at a minimum, a gravel-type road surface using either new aggregate or existing road material.

**ASSOCIATED SUPPLIERS** – These companies are providing the major equipment for this project. A point of contact is listed below for coordination during installation of each component.

- Control Panel - IDC Corporation
  - Eric Alspaugh or Ken Black at 517-646-0358
  - [ealspaugh@idccorporation.com](mailto:ealspaugh@idccorporation.com) or [KBlack@idccorporation.com](mailto:KBlack@idccorporation.com)
- Pumps & Valves – Kennedy Industries
  - Rick Alvarez, [ralvarez@kennedyind.com](mailto:ralvarez@kennedyind.com)
- Natural Gas Standby Genset - Cummins Inc.
  - Breanna M. OKopski, [breanna.okopski@cummins.com](mailto:breanna.okopski@cummins.com)
- Antenna – Drew Wireless
  - Andrew Felde, 616-453-7200 or [andrew@drewwireless.com](mailto:andrew@drewwireless.com)
- 480VAC Transformer & Natural Gas Service – Consumers Energy
  - Robert Beagan, 517-282-2106 or [Robert.Beagan@cmsenergy.com](mailto:Robert.Beagan@cmsenergy.com)

**STATION START UP** – A representative from Cummins, Kennedy and IDC shall be coordinated with to check the installation of the station, and check and adjust the controls and equipment for actual operating conditions. The representatives will be present to place the station in initial operation and instruct the regular operating personnel in the proper care and maintenance, at no additional cost to the Owner. The Owner may elect to have a representative return within 90 days to readjust the operations of the station at no cost to the Owner.

## PAY ITEMS

- 1. TRAFFIC CONTROL** – This pay item includes all labor, equipment, and material necessary to provide and maintain traffic control as described herein, in accordance with the Michigan Manual of Uniform Traffic Control Devices and ICRD permit requirements. All barrels remaining in the road overnight must be lighted. All traffic control must be accomplished under permit from ICRD. All necessary traffic control devices are included. See Appendix C for general traffic control details. Traffic Control is only expected to be utilized while Manhole 2-2 on E Lake Dr is accessed for Bypassing. See Appendix A for Location.

Traffic Control shall be paid for at the Contract Unit Price on the following basis: after first use of traffic control measures, 50% of Traffic Control will be paid; once all traffic control measures have been removed from the jobsite, 100% of Traffic Control will be paid.

- 2a. PAVEMENT REPLACEMENT** – This pay item includes all labor, equipment, and material necessary to replace all pavements disturbed or damaged as part of the contract work on the County Park Boat Launch Parking Lot. If construction is completed before the asphalt plants are open, backfill and compact, then place 8" of 21AA aggregate road base or Millings to serve as a temporary substitute pavement surface. The contractor may draw millings from the Township's stockpile at 2100 Gaylord C. Smith, East Lansing, 48823. The contractor is responsible for all loading and transportation of said millings. When the asphalt plants open for the year, replace this temporary substitute surface by restoring the disturbed areas to their original 6" gravel base with 4" HMA placed on top.

- 7. DEWATERING** – This pay item includes all labor, equipment, and material necessary to design, install, operate, maintain and remove an adequate dewatering system. The contractor shall provide all dewatering necessary to keep the construction and work areas dry. The system shall be of sufficient size and capacity to maintain a dry condition without delays to construction operations. The dewatering system must include adequate filtration to prevent sediment from contaminating the nearby lake. The Contractor shall submit a detailed dewatering plan for review and approval prior to starting dewatering activities. See Sheet 4 of the Plans for specifications and Appendix B - "Geotechnical Report" for soil boring information and dewatering guidance.

A suggested discharge point is at the south eastern corner of the County Park Boat Launch property, spaced at least six feet away from the shoreline. Restoration of any disturbed surfaces to their original state is included in this contract.

Dewatering shall be paid for at the Contract Unit Price on the following basis: after installation of Dewatering hardware, 25% of dewatering will be paid; once 50% of the original contract price is completed, 50% of Dewatering will be paid; once 75% of the original contract price is completed, 75% of Dewatering will be paid; once the contract work is complete and all dewatering items have been removed from the jobsite, 100% of Dewatering will be paid.

- 8a. PUMP STATION, STRUCTURES** – This pay item includes all labor, material and equipment necessary to install an eight (8) foot diameter concrete Wetwell and six (6) foot diameter concrete Valve Vault as shown on the plans and as detailed herein. The Contractor shall submit copies of the shop drawings to the Township Engineer for review and approval. The Township Engineer retains the final approval of all material submitted. The preferred vendor for the Wetwell and Valve Vault is Northern Concrete Pipe Inc. John Washabaugh may be contacted at [jwashabaug@aol.com](mailto:jwashabaug@aol.com) for details and shop drawings prepared by Eric Katje ([erick@ncp-inc.com](mailto:erick@ncp-inc.com)). It will be paid for at the Contract Unit Price after both structures are successfully installed.

The Wetwell and Valve Vault shall house all pumps, valves, piping, and other equipment and shall be constructed of 4,000 psi concrete, and shall be pre-cast complying with ASTM C478. The Wetwell's concrete walls shall be H<sub>2</sub>S gas corrosion resistant by means of admix similar to "ConShield" or approved equal, as determined by Meridian Township. The base of the Wetwell and Valve Vault will be integral to the bottom section.

Joints between sections must use a rubber O-ring gasket, and be sealed internally and externally using non-shrink, cementitious mortar. A product such as BoaTape™, Infi-Shield®, EZ WRAP or an approved equal will be applied on top of the exterior mortar. Lifting holes shall be filled with Portland cement mortar and pre-formed concrete plugs. Discharge pipes and electrical conduit shall be cemented in place using non-shrink grout.

This pay item includes all shoring necessary to install the pump station structures to the elevations shown on the plans. A 12 inch layer of 1-to 3-inch crushed stone shall be placed beneath the wet well with a layer of geotextile separator placed on top of the stone. Backfill around and under the structures shall be class II granular material as defined and described in the MDOT 2020 Standard Specifications for Construction, Section 902. All granular material must be compacted to at least 98% of maximum density and tested by SME. The stone, granular material and geotextile are incidental to this pay item. The granular material used underneath the Valve Vault may be substituted for millings drawn from the Township stockpile located at 2100 Gaylord C. Smith, East Lansing, 48823. The contractor is responsible for all loading and transportation of said millings.

Roof slabs for both chambers shall be constructed of pre-cast concrete to the dimensions shown on the plans. Thickness and reinforcing shall be as shown on the shop drawings and approved by the Township Engineer. Access door frames and vent pipe openings shall be cast-in-place; they shall not be added after the roof slab is poured. The lifting hooks shall be cast into the side of the roof section; no lifting hooks will be allowed in the top of the slab. The top of the roof slab shall be brushed smooth and all exposed edges shall be rounded to a 1/4-inch radius with an edging tool.

#### Access Doors:

The access door to the Wetwell shall be a Bilco Type JD-1AL, or approved equal, with safe grate of aluminum construction, and designed for a minimum live load of 300 pounds per square foot. The access door to the Valve Vault shall be a Bilco Type J-3AL, or approved equal. Door and frame shall have mill finish with bituminous coating on the frame exterior. Doors shall be hinged and equipped with torsion bars, and shall open to 90 degrees or more, locking automatically in the open position. The doors shall be equipped with a snap lock, removable exterior handle and permanently mounted inside handle. Hardware shall be stainless steel. The access door to the Valve Vault shall be positioned above the Check valves and two Gate valves so that they may be operated from the surface.

**8b. PUMP STATION, MECHANICAL ITEMS** - This pay item includes all labor, material and some equipment necessary to install all mechanical components and fittings of the lift station as described herein. It will be paid for at the Contract Unit Price after all items are successfully installed. The submersible pumps and all of the associated parts shall be installed with the following items, purchased by Meridian Township and provided by Kennedy Industries:

- (2) FLYGT explosion proof, submersible sewage pumps, model NP6020.091-242 with high chrome impeller and insert rings. Rated for 426 gpm @ 63' TDH, 10 hp, 3 phase, 460 volt with 3" discharge and 50 ft. Motor and sensor cables. Pumps equipped with seal fail/high temp cables.
- (2) Guide rail systems with 3" discharge elbows, stainless steel guide rails, upper brackets, lifting chain and quick links. (21' lengths)
- (2) 6" APCO check valves with flanged end connection and lever/weight operator.
- (3) 6" Kennedy gate valves with flanged end connection and handwheel operator.
- (2) DP gateway *to be installed by IDC Corporation* in new control panel.
- (2) 7" touchscreen HMI *to be installed by IDC Corporation* in new control panel.

#### Pump Assembly:

Pumping units shall include complete lift-out cables and guide-rail system to allow pump removal and replacement without the need for personnel to enter the pump chamber. Moreover, no nuts, bolts, or other fasteners shall be required to connect the pump to the discharge piping.

Pumping units shall be designed to automatically connect to the discharge piping when lowered into place. A self-centering mechanism shall be provided to facilitate this connection. A sliding guide bracket shall be an integral part of the pumping unit and the pump casting shall have a machined connecting flange to connect with the discharge connection, which shall be bolted to the floor of the sump and so designed as to receive the pump connecting flange without the need of any bolts or nuts. Sealing of the pumping unit to the discharge connection shall be accomplished by a simple linear downward motion of the pump.

The lifting cable shall be capable of raising the pump and be of stainless steel (S.S.) with S.S. 3-inch rings connected to the cables with S.S. clamps at 8-foot intervals to raise the pumps. Guide-rails shall be Schedule 80 galvanized, welded joints, steel pipe with smooth butt weld joints, or equal, and shall be supported at intervals not to exceed 12 feet. Supports shall be constructed of stainless steel. The upper guide-rail holder shall be attached to the access door frame and the lower guide-rail holder shall be integral with the discharge fittings.

#### Valves & Fittings:

The gate and check valves shall be located as shown on the plans. The gate valves shall be six (6) inch and shall be right-hand close. The check valves shall be six (6) inch flanged, swing check valves with outside lever and weight. A hole shall be cored above the gate valve leading to the Bypass Assembly and a valve riser box securely installed such that this gate valve can be manipulated without entering the valve vault. All valve box tops shall be manufactured with the word "SEWER" on the top.

The bypass assembly will be positioned as shown on the plans. It will include a 1" tap and corporation stop inside the valve vault as well as a 2½ inch male quick connect coupler with dust cap on the external portion of the assembly.

Fittings and valves within the Wetwell and valve vault shall be ductile iron in accordance with ANSI A21.10 or ANSI B16.1. Fittings shall be rated for 250 psi water working pressure. Fittings outside the pumping chamber and valve vault shall be mechanical joints with retainer glands.

#### Pipes:

All of the piping in and around the lift station shall be installed as shown on the plans and specified herein. All pipe and pump openings and passages shall be large enough to permit the passage of a sphere 3 inches in diameter and any trash or stringy material which can pass through a 6-inch house collection system. All ductile iron piping shall have an H<sub>2</sub>S resistant interior lining. Piping beyond the valve vault shall be D.I. Class 350 pipe.

Flange faces shall be coated with a rust inhibitor immediately after drilling. Flanges shall be firmly bolted with machine, stud or tap bolts of the proper size and number meeting the requirements of ASTM A 307, Grade B. Joints made with bolts or bolt studs shall have a nut on each side. Bolt projection through nuts shall be equal, and where studs are used, bolt projection on each side of the flange shall be equal. All nuts and bolts shall be cadmium plated or hot-dip galvanized except on stainless steel flanges shall be 316L stainless steel. Pipe shall be in accordance with the ANSI A21.51 and flanges shall be 125 pounds in accordance with ANSI B16.1. Gaskets shall be asbestos composition and shall be of the full-face design.

Pipe within the wet well and the valve vault shall be coated with two coats of a coal-tar epoxy finish at 8.0 to 10.0 dry mils per coat. Spray application is necessary to obtain required film thickness. Spray application shall be made in crosshatches to achieve required dry film thickness. Brush or roller application will require additional coats to obtain the required film thickness at no additional expense to OWNER. Additional coats to meet the dry film thickness requirements must be applied within 24 hours of application of first coat of coal-tar epoxy. CONTRACTOR shall provide adequate protection of adjacent areas to protect against overspray.

Ductile iron pipe and fittings to be ground-buried shall be coated by manufacturer on the outside with an asphaltic coating, 1 mil thick, in accordance with AWWA C151 and C110 (ANSI A 21.51) and cement-lined, standard thickness, in accordance with AWWA C104/ANSI 21.4. The pipe shall be supplied with and wrapped in polyethylene encasement in accordance with AWWA C105 (ANSI 21.5) and shall be installed following Method "A".

Discharge pipes through the wall shall be installed after the hole has been re-cored, if necessary, to allow installation of a watertight wall sleeve, boot and/or link seal. The wall sleeve shall be of the same material as the pipe. All loose rust, scale, grease, or oil shall be removed prior to pouring of the concrete. Rubber link seals shall be identical rubber links interconnected with bolts and elongated nuts and washers. The sealing element shall be made of synthetic rubber material especially compounded to resist aging, ozone, sunlight, and chemical action. Bolts and metal parts shall be made of galvanized or cadmium-plated steel to resist corrosion. Rubber link seal joints shall be submitted to Township Engineer for approval.

**8c.** **PUMP STATION, CONCRETE** - This pay item includes all labor, equipment, and materials necessary to install the concrete pad as shown on the plans. An expansion joint shall be installed between the concrete around the lift station and the pavement of the parking lot. If construction occurs during cold weather, take necessary precautions to ensure a proper temperature is maintained during the curing process. It will be paid for at the Contract Unit Price after being successfully installed.

**8d.** **PUMP STATION, CONTROL PANEL** - This pay item includes all labor, materials, and some equipment necessary to install a new control panel as depicted and described in the contract. The Control Panel and External Junction Box (Terminal Box) has been purchased by Meridian Township and fabricated by IDC Corporation. It will be paid for at the Contract Unit Price after being successfully installed and tested.

Transportation of the Control Panel and Junction Box from IDC Corporation to the Project Site will be the responsibility of the contractor. Follow all manufacturer specifications and guidance during transport and installation of the Control Panel. Installation of conduit and wiring to the Generator, Wetwell and Pumps is included in this item. See the "Lift Station Electrical and Control Specifications" Technical Specification and Appendix D for control panel details and address of IDC Corporation. Consumers Energy will install the power supply for this project and plans to re-use the meter, meter socket, wiring and conduit from the existing transformer to the meter socket.

The contractor shall furnish and place a Unistrut rack, or approved equal, on the north side of the Control Panel to mount the existing Electrical Meter. The Antenna mast will also be secured to this via bracket as shown in Appendix D. The contractor shall furnish and install two (2) mercury float switches at the elevations shown on the Plans. The float switches shall be Conery 2900-B1S1C1 types of the appropriate length.

**Electrical Wiring:**

All wiring shall be done in accordance with the National Electrical Code. Conduit shall be full size, vinyl-coated, rigid, galvanized steel and sized according to the NEC, unless larger sizes are shown on

the plans. All wire shall be plastic-coated, solid copper. Conduit ends inside the pump chamber and control panel shall be sealed to exclude gases formed in the chamber.

Conduit and wiring to the meter and between the meter and pumps shall be sized for the pump motors. Leads to the pump motors shall be factory-installed, flexible cable to allow removal of the pumps.

Level Controls:

The wiring channel shall provide cord grip holders for the pump and pump cords and the control cords. The channel box shall have a removable cover for easy adjustment of cords to pumping and alarm levels shown in the plans. All cords shall extend from one end of the box and be taken through conduit to the outside control panel. No splices shall be made in the wiring channel. Continuous cords must be used from the control panel to the pumps and floats. Wiring channel shall mount on supports fastened to the access frame.

**8e. PUMP STATION, GENERATOR** - This pay item includes all labor, materials and some equipment necessary to install a new concrete pad and standby generator as shown on the plans. The generator will be a C45N6, 45kW, 60Hz, Standby, Natural Gas/Propane Genset manufactured by Cummins and provided by the Township. See Appendix E for specific dimensions and requirements. The Contractor is responsible for loading and transport of the Genset from the Township Service Center (2100 Gaylord C. Smith, East Lansing, 48823) to the Lift Station. Follow all manufacturer specifications and guidance during transport and installation of the pad and generator. If construction occurs during cold weather, take necessary precautions to ensure a proper temperature is maintained during the concrete curing process.

The Contractor is to coordinate the gas service with Consumers Energy, whose crews will be responsible for installing the meter and natural gas service line. The Contractor shall install the underground gas service from the back-side of the meter to the new generator. The Contractor shall also install two (2) 3" galvanized posts as described and located on the plans, near the fuel-inlet, for Consumers Energy to mount the meter. It will be paid for at the Contract Unit Price after being successfully installed and tested.

The genset and its installation and on-site testing shall conform to the requirements of the following codes and standards:

- A. CSA C22.2, No. 14 - M91 Industrial Control Equipment.
- B. CSA 282, 1989 Emergency Electrical Power Supply for Buildings.
- C. IEC 8528 Part 4. Control Systems for Generator Sets.
- D. IEEE 446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
- E. NEMA ICS10-1993 - AC Generator sets.
- F. NFPA 70 - National Electrical Code. Equipment shall be suitable for use in systems in compliance with Article 700, 701, and 702.
- G. NFPA 110 - Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.
- H. UL 2200. The genset shall be listed to UL 2200 or submit to an independent third party certification process to verify compliance as installed.

Installation

- A. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the

authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

- B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.
- C. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.
- D. Equipment shall be initially started and operated by representatives of the manufacturer.
- E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

#### On-Site Acceptance Test

- A. The complete installation shall be tested for compliance with specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by the Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.
- B. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a four hour full load test, and a one-step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.
- C. Perform a NFPA 110 Level 1 test and fill out the appropriate forms.

**8f.** **PUMP STATION, ANTENNA MAST** - This pay item includes all labor, equipment, and materials necessary to install a new antenna mast per the manufacturer's recommendations, the Technical Specification "Lift Station Electrical and Control Specifications", and as shown on the plans and in Appendix D. Installation of the mast will be the responsibility of the Contractor. Installation of the Radio and Antenna is to be coordinated with Andrew Felde at Drew Wireless, who may be reached at 616-453-7200 or [andrew@drewwireless.com](mailto:andrew@drewwireless.com). The Radio will be taken from the existing station and re-used in the new Control Panel once it has been placed. Drew wireless will supply the new Antenna and cable. It will be paid for at the Contract Unit Price after being successfully installed.

Components for the Antenna include:

- a. 1 ½ inch Standard Fitting Rigid Type-LB Threaded Conduit Body
  - i. (Appleton SLB-150 or approved equal)
- b. 1 ½ inch Standard Fitting Service Entrance (SE) Cap
  - i. (Hubbell/Raco catalog #2406 or approved equal)
- c. 1 ½ inch x 10 ft. Rigid Aluminum Conduit

Antenna mast shall be securely mounted to the north side of the Control Panel using the LB at the base and Unistrut bracket on top. See Appendix D for proposed layout.

**8g.** **PUMP STATION, REMOVE** - This pay item includes all labor, equipment, and materials necessary to excavate and remove the existing sanitary sewer pump station as described herein. Remove and properly dispose of all of the concrete around the top of the existing pump station, including the wet well and pump station flat tops. Remove any trees or shrubs interfering with the excavation. This item will be paid for at the Contract Unit Price after removal of the existing concrete structures.

**8h.** **PUMP STATION, PROTECTIVE COATING** - This pay item includes all labor, equipment, and materials necessary to protectively coat the new pump station wet well using SpectraShield®. Substrate shall be free of any foreign particles that may inhibit protective coating bonding to the

underlayment. Any necessary surface preparation is incidental to this pay item. Coating shall be applied to all vertical surfaces of the structure as well as the top and bottom. Whenever possible, coating should be applied in one mobilization to minimize disruption, bypassing, traffic control, and other inconveniences. Appropriate personal protection shall be provided for all workers in direct contact with the spray atmosphere, in accordance to all applicable OSHA requirements. Apply the coating according to the manufacturer specifications.

Corrosion resistant coating shall be specifically designed to protect concrete structures subjected to municipal wastewater service conditions, including associated abrasive physical attack and chemical attack mechanisms related to hydrogen sulfide and organic acids generated by microbial sources. Coating shall exhibit the following properties at a minimum:

Compressive strength	ASTM D 695	5000 psi
Tensile strength	ASTM D 638	2000 psi
Flexural strength	ASTM D 790	3500 psi
Bond strength	ASTM D 4541	Substrate failure

The contractor shall provide all accessory components such as sealants, hardeners or other compounds as recommended by the manufacturer for maximum protective coating adherence to substrate, and long-term service performance. Coating shall be allowed proper curing time prior to activating lift station for operation. The contractor installing the finished protective coating will be a certified, trained applicator of the specified process. Protective coating shall be warranted from defects for a minimum period of five (5) years. The contractor shall warranty the installed protective coating system as free from material and workmanship defects. All coatings shall have a minimum five (5) year labor and materials warranty including all costs necessary and related to the repair or replacement of the defective application. High voltage spark testing and pull testing of coating will be required.

**8i. OIL AND GREASE INTERCEPTOR, 750 GAL** - This pay item includes all labor, equipment, and materials necessary to install a new 750 gallon Oil and Grease interceptor as shown on the plans. It will be placed downstream of the Boat Wash and connected to its existing sanitary service on the upstream and downstream sides. Connection to the existing 6" sanitary service is included in this item. The Contractor shall submit copies of the shop drawing to the Township Engineer for review and approval. The Township Engineer retains the final approval of all material submitted. The preferred vendor for the Interceptor is Northern Concrete Pipe Inc. John Washabaugh may be contacted at [jwashabaug@aol.com](mailto:jwashabaug@aol.com) for details and shop drawings prepared by Eric Katje ([erick@ncp-inc.com](mailto:erick@ncp-inc.com)). It will be paid for at the Contract Unit Price for each interceptor successfully installed.

**10a. MOBILIZATION** – The Contract Unit Price for this pay item includes all labor, equipment, and materials necessary for the Contractor to mobilize for the specified lift station replacements in accordance with the MDOT 2020 Standard Specifications for Construction (SSC), Section 110. Payment for this item will be made according to said Section 110.

**10b. BYPASS PUMPING** – The Contract Unit Price for this pay items include all labor, equipment, and material necessary to bypass pump sewage around the work area, as necessary. The bypass pumps and bypass lines shall be sufficiently sized for peak flow conditions. The Contractor shall have adequate standby equipment available and ready for immediate operation and use including an extra pump and generator. The maximum effluent level in the influent sewer cannot exceed the crown of the influent sewer. Generators used to provide the electrical service shall be housed in sound attenuating enclosures with critical-area-type silencers. An automatic call box is required for all overnight bypass pumping. Additionally, a backup generator must be provided. The backup generator must be installed and ready for immediate use, including all cabling, disconnect panels,

and switch gear. The Contractor shall submit a detailed bypass procedure for review and approval by the Township prior to construction. The following flows reflect measured or estimated flows and capacities:

**Lift Station:** Recorded Peak Flow – 248 GPM. Design Flow – 250 GPM

A suggested bypass procedure is described below. See Appendix A for Manhole Locations.

- 1) Bypass the 12" Gravity Sewer from Manhole 2-2 on E Lake Dr to the Lift Station Wetwell.  
~275ft.
- 2) Install Proposed Manhole 2-1 on the 12" Gravity Sewer at the location shown on Plans.
- 3) Relocate the Bypassing Setup from Manhole 2-2 to Proposed Manhole 2-1.
- 4) Bypass the 12" Gravity Sewer from Prop. Manhole 2-1 to Manhole 2-42 by #6269 Quail St.  
~420ft.
- 5) Bypass the 8" Gravity Sewer from Manhole 2-42 to Manhole 2-48 by #6363 E Reynolds Rd.  
~1130ft. This bypass will carry the sewage from both the 12" and 8" sewers. The piping can be combined into a common manifold or remain two separate assemblies.

The bypass piping is recommended to run along the north side of Quail St and E Reynolds Rd with ramps to protect it at three driveways and the Milenz St intersection. If snow plowing needs to be performed during construction, the Bypass pipes will instead be buried at these crossings. The road surface is scheduled for replacement in the Summer of 2024. In order to not disturb this new surface, the bypass pipes will need to be buried under residential driveways outside of the roadway of E Reynolds Rd or Quail St. Restoration of any disturbed surfaces to their original state is included in this contract. Bypass Pumping shall be paid for at the Contract Unit Price on the following basis: upon successful startup of the bypass system 50% of Bypass Pumping will be paid; after the successful return of the lift station to service 100% of Bypass Pumping will be paid.

**10c.d. GAS SERVICE, ELECTRIC SERVICE (Township Allowance)** – These pay items are to cover the cost of installing a new gas service, a new 480VAC Transformer and a new electric service, as necessary, by Consumers Energy. The existing electric service to the Lift Station will be left intact during construction and re-used when connecting the new Transformer to the Lift Station Control Panel. A new electric service will be installed to provide the Restrooms with power from an existing utility pole.

The contact person is Robert Beagan, 517-282-2106. The Contractor shall coordinate all gas and electric work with Consumers. Consumers expects a lead time of one month for this work after it has been scheduled. These allowances are only to pay for the work performed by Consumers, excluding any extra work caused by the Contractor. Any additional costs incurred, including, but not limited to, the Contractor's time and travel expenses, are considered incidental. Additionally, the amounts listed in the Proposal section of this contract are estimates. The Contractor will be reimbursed for the actual amounts paid to Consumers, upon verification.

**10e. ELECTRICAL PERMIT AND INSPECTION (Township Allowance)** – This pay item is to cover the cost of the electrical permitting and inspection process through Meridian Township (MT) and East Lansing (EL). Contact the MT Building Department at 517-853-4500. The Contractor shall coordinate all of the necessary electrical work with MT building personnel. This allowance is only to pay for the electrical permit and inspection fees through MT and EL, excluding any extra charges incurred by the Contractor. Any additional costs incurred, including, but not limited to, the Contractor's time and travel expenses, are considered incidental. Additionally, the amounts listed in the Proposal section of this contract are estimates. The Contractor will be reimbursed for the actual amounts paid to MT and EL, upon verification.

- 20a. SANITARY SEWER, 8 INCH, CONNECT TO LIFT STATION WETWELL** – The Contract Unit Price on this pay item includes all labor, equipment, and material necessary to core into the proposed 8 foot diameter Lift Station Wetwell and connect it to the existing 8” gravity sewer from Quail St, as shown on the plans, in accordance with Technical Specification 2, “Sanitary Sewer Collection System”, and as described herein. A Kor-N-Seal style device, or an approved equal, shall be used at the pipe penetration into the Wetwell. A Fernco ® style flexible coupling, or an approved equal, shall be used at the sewer connection. It will be paid for at the Contract Unit Price after the connection is successfully made.
- 20b. SANITARY SEWER, 12 INCH, CONNECT TO LIFT STATION WETWELL** – The Contract Unit Price on this pay item includes all labor, equipment, and material necessary to core into the proposed 8 foot diameter Lift Station Wetwell and connect it to the existing 12” VCP gravity sewer from E Lake Dr, as shown on the plans, in accordance with Technical Specification 2, “Sanitary Sewer Collection System”, and as described herein. A Kor-N-Seal style device, or an approved equal, shall be used at the pipe penetration into the Wetwell. A Fernco ® style flexible coupling, or an approved equal, shall be used at the sewer connection. It will be paid for at the Contract Unit Price after the connection is successfully made.
- 20c. SANITARY SEWER, 6 INCH, CONNECT TO LIFT STATION EFFLUENT** – The Contract Unit Price on this pay item includes all labor, equipment, and material necessary to attach the existing 6” pressure sewer to the effluent connection of the Lift Station as shown on the plans and in accordance with Technical Specification 2, “Sanitary Sewer Collection System”. It will be paid for at the Contract Unit Price after the connection is successfully made.
- 21. SANITARY MANHOLE, 48 INCH, 14FT** – This pay item includes all labor, equipment, and materials necessary to install a new 48 inch diameter, precast sanitary sewer manhole as described in Technical Specification 2, “Sanitary Sewer Collection System”. It will be installed at the location shown on the Plans to an expected depth of 14 ft. Connection to the existing 12” VCP gravity sewer is included in this pay item. It will be paid for at the Contract Unit Price for each Manhole successfully installed.
- 22. SEWER SERVICE, PVC, 6 INCH** – This pay item includes all labor, equipment, and material necessary to install a new 6” sanitary sewer service connecting the existing Restroom and Boat Wash combined service lateral to the existing 12” VCP gravity sewer as shown on the plans, in accordance with Technical Specification 2, “Sanitary Sewer Collection System”, and as described herein. Connection to the existing service will be made with a Fernco ® style flexible coupling or approved equal. Connection to the existing gravity sewer will be made with a saddle and riser and is included in this item. A cleanout is also included in this item and will be installed where the proposed sewer service joins the existing service, as shown on the plans. This item will be paid for at the Contract Unit Price for the total number of sanitary services furnished, placed and connected.
- 53a. SOIL EROSION AND SEDIMENT CONTROL** – This pay item includes all labor, equipment, and material required to install, maintain, and remove the specified soil erosion and sediment control measures in accordance with the MDOT 2020 SSC, Section 208. Silt Fencing will be used on natural ground. On pavement, in lieu of Silt Fencing, Silt Socks are to be used along the south construction boundary to protect the lake from runoff. A Silt Sock is a cylindrical mesh bag of filter fabric filled with organic material. They will be placed and secured in a way allowing water to flow through at a controlled rate while trapping sediment. Socks placed in a row will have their ends interlocked. Construction staff should inspect compost filter socks regularly, including after each rainfall event, to ensure proper function. Excessive upstream ponding or overtopping indicates that the current configuration is not adequate. In these cases, the contractor should place an additional filter sock

further up the slope. Contractor should remove accumulated sediment when it reaches one half the height of the filter sock. All soil erosion measures shall be removed prior to the release of the contract retainage.

Soil Erosion and Sediment Control will be paid for at the Contract Unit Price on the following basis: after first use of control measures 50% of Soil Erosion and Sediment Control will be paid; once the contract work is complete, 100% of Soil Erosion and Sediment Control will be paid.

**54. SITE RESTORATION** – This pay item includes all labor, equipment, and material necessary to restore disturbed areas in accordance with the MDOT 2020 Standard Specifications for Construction (SSC), Section 816, and as described herein. The disturbed areas shall be restored to grade with three (3) inches of screened topsoil. Seed and mulch shall be secured either through the use of mulch anchoring (including hydro-seeding) or mulch blankets. Use mulch anchoring on slopes less than 1:3; use mulch blankets on all slopes greater than 1:3.

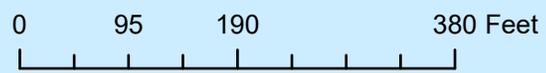
Any areas of settlement or washout shall be repaired promptly after discovery. Such spot repairs are incidental to this pay item. If the seeded turf is not well established at the end of the first growing season, the Contractor is responsible to re-seed until the turf is well established and approved by the Engineer.

**NOTE:** *The pay items detailed in this contract are intended to provide for the complete scope of work as depicted on the plans. Any and all work not covered under a specific pay item, but necessary to complete the project, is considered incidental.*

# APPENDIX A - Location Map



 Sewer Manholes  
Sewer Gravity Mains  
Diameter  
— 8-12"





**MATERIALS TESTING CONSULTANTS**

**REPORT OF GEOTECHNICAL INVESTIGATION  
COUNTY PARK LIFT STATION AND SANITARY SEWER REPLACEMENT  
MERIDIAN TOWNSHIP, MICHIGAN**

**Prepared For:**

MERIDIAN TOWNSHIP  
Okemos, Michigan

**Prepared By:**

MATERIALS TESTING CONSULTANTS, INC.

June 2023  
MTC Project No. 231111



June 19, 2023  
Project No. 231111

Meridian Township  
5151 Marsh Road  
Okemos, Michigan 48864

Attention: Mr. Jack Hughes  
Project Engineer

Reference: Report of Geotechnical Investigation  
County Park Lift Station and Sanitary Sewer Replacement  
Meridian Township, Michigan

Dear Mr. Hughes:

We have completed a geotechnical investigation for the above-referenced project. The purpose of this investigation has been to identify the general subsurface soil conditions in the vicinity of the proposed construction, analyze the conditions relative to the planned construction and to provide recommendations for the design of a replacement lift station and adjacent sanitary sewer. This work has been performed as described in our proposal (No. 17016) dated February 5, 2023, with our geotechnical scope of study based on Request for Quotation received on February 3, 2023, including requested boring locations and depths.

Presented herein are descriptions of our understanding of the design considerations, the geotechnical investigation, encountered conditions and engineering recommendations. The Appendix contains the report limitations and data collected during this investigation. As noted herein, we feel that additional geotechnical investigation is warranted to optimize the design which could be completed by Meridian Township or the Contractor through a delegated design.

## DESIGN CONSIDERATIONS

### Available Information

We have been provided the following documents and information for use in this investigation:

- Sanitary gravity and pressure main as-builts, drawn by G. Evans, Ayres, Lewis Norris & May Consulting Engineers, November 1960, received as a part of the request for quotation from Meridian Township received on February 3, 2023 (2 pages).
- Quail Street Water System As-builts, drawn by George E. Snyder Associates, October 1971, received as a part of the request for quotation from Meridian Township received on February 3, 2023 (3 pages).



- Email correspondence with Jack Hughes of Meridian Township regarding the type of construction, bid schedule, and County Park North Lift Station Plans drawn by Meridian Township, 2007.
- Conference call occurring on March 30, 2023, with Jack Hughes of Meridian Township, Jon O’Brock, and Mark DeHoog regarding known issues, possible concerns with construction, and proposing a phase 2 investigation to further delineate the encountered organic materials discovered in the initial investigation.
- Conference call occurring on May 3, 2023, with Jack Hughes and Younes Ishraidi of Meridian Township, Jon O’Brock, and Mark DeHoog to discuss the draft report.
- Project plan and profile sheets for the gravity sanitary sewer and forcemain, dated June 1, 2023, received in an email from Mr. Jack Hughes with Meridian Township on June 2, 2023.

### Location and Type of construction

The proposed project consists of reconstructing an existing lift station (referred to as County Park North Lift Station) and replacement of approximately 1,500 ft of sanitary sewer and an adjacent forcemain along Quail Street and East Reynolds Road. The lift station is located at 6271 E Lake Dr, in Haslett, Michigan at the Lake Lansing Boat Launch. The project area is shown in Figure No. 1.

We understand the existing sanitary sewer in this area has progressively settled causing performance issues with the settlement believed to be the result of poor soils. Based on a conference call on March 30, we understand that the most pronounced settlement has been observed in the vicinity of Borings B-3 and B-5. The existing gravity sanitary sewer is primarily 8 inch and buried on the order of 5 to 10 ft below grade based on the provided plan and profile and as built sheets. Based on the provided as built plans, it appears that manhole 2-43 is supported on piling with the sewer between Milenz Street and the lift station and from address #6355 to approximately 300 ft east being bedded in stone (no details shown on piling or stone geometry). Outside of these areas, no remarks about pipe support are visible and it is assumed the pipe is supported on grade. The existing forcemain is a 6-inch diameter cast iron pipe based on the provided plans and is installed parallel to the existing gravity sewer, likely in the same trench.

Based on the most recent available drawings, the proposed gravity sewer and forcemain will be constructed to the south of the existing sewers with the proposed gravity sewer invert generally on the order of 1 to 2 ft below that of the existing gravity sewer. The proposed offset from the southern right of way line is variable with a minimum of approximately a 7 to 10 ft offset based on scaled dimensions from the provided drawings. The new forcemain will be installed in the same trench and with the same support procedures as the gravity sewer. The current design indicates the use of piling to support several manholes as well as a detail for pile support of the proposed sewers, although the details do not indicate pile type or installation depth. Based on our discussions, we understand the township intends to utilize a non-vibratory piling system, such as helical piers, considering the proximity to existing residences in some areas.



Based on the provided as built plans, the existing lift station is a cylindrical structure with a bottom of slab approximately 22 ft below the surface grade (approximate bottom elevation 831). The provided drawings do not indicate the size of the existing lift station but based on scaled measurements it appears to be on the order of 8 to 10 ft in diameter. Based on the geometry of the lift station and the buried pump chamber, it appears likely that the existing structure was constructed using a dewatered open excavation, potentially also using earth retention. The lift station also services a 12-inch gravity sewer entering from the north that is not being replaced and has not been included in our investigation. We understand that the proposed replacement lift station will be lowered by approximately 3 ft to accommodate modern submersible pumps.

We should be informed of any changes between the actual design conditions and those described herein as this information may affect our recommendations.

#### INVESTIGATION METHODOLOGY

Conventional soil test borings and sampling along with field engineering reconnaissance were used to investigate the subsurface conditions with boring depths selected by Meridian Township. Boring B-5 was drilled an additional 4 ft beyond the requested depth to penetrate encountered organic soils. Boring locations are shown in Figure No. 1. Investigation procedures, soil classification information and boring logs are provided in the Appendix.

Table 1 – Boring Depth Summary

Number of Borings	6
Boring Depth Range, ft.	16.5 to 30

Borings were drilled and other sampling was conducted solely to obtain indications of subsurface conditions as part of a geotechnical exploration program. No services were performed to evaluate subsurface environmental conditions.

#### Laboratory

Soil samples were reviewed by one of our engineers and technically classified according to the methods of ASTM D2488 "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)". Calibrated penetrometer tests were performed on cohesive samples to obtain an indication of unconfined compressive strength values.

Selected samples were subjected to various laboratory tests, including:

- ASTM D422 "Test Method for Particle-Size Analysis of Soils"
- ASTM D2216 "Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass"



- ASTM D1140 "Test Methods for Determining the Amount of Material Finer than 75- $\mu$ m (No. 200) Sieve in Soils by Washing"
- ASTM D2974 "Test Methods for Determining the Water (Moisture) Content, Ash Content, and Organic Material of Peat and Other Organic Soils"

The samples subjected to grain-size testing were reclassified according to ASTM D2487 procedures "Standard Test Method for Classifications of Soils for Engineering Purposes". The ASTM D2487 and D2488 classifications are included on the boring logs. Results of the laboratory tests are provided in the Appendix.

## INVESTIGATION RESULTS

### Regional Geology

The *Map of the Surface Formations of the Southern Peninsula of Michigan*, published by the State of Michigan, indicates the site is in an area of moraines and ground moraines (till plains). Soil conditions typically are found to consist of a mixture of silt, clay and sand in this type of geologic area. More locally, the site is located adjacent to Lake Lansing and associated marsh areas which are likely to present non uniform deposits of organic and other water deposited soils. It is anticipated that initial development consisted of the placement of fill directly over wetland deposits based on the encountered subsurface conditions and reports of historical utility settlement with little to no remediation of unsuitable subgrade performed below utility inverts. The *Map of Bedrock Topography of the Southern Peninsula of Michigan* indicates bedrock to be at approximately el 750-800 feet, on the order of 50-100 feet below the ground surface elevation within our investigation area.

### Site Conditions

At the time of our field study, the area under investigation was an existing parking lot near the current lift station at the county park. Additional areas included the existing sanitary gravity and pressure mains existing beneath the right of way of Quail Street and Reynolds Road and on the east side of the grassy area in the county park. The present shoreline of Lake Lansing is approximately 175 to 250 ft south, southwest of the study area. The surface water elevation of Lake Lansing was approximately 851 feet during the time of our investigation. A wetland area was present in the general area of Boring B-5 on the opposite side of the roadway from the lake. Figure 1 shows the roadway in the vicinity of Boring B-5.

The existing HMA pavement in these roadways was noted to be in poor condition exhibiting frequent areas of alligator cracking and potholes. The roadway pavement was noted to be around 17 to 20 ft wide with the limits of right of way and utility easements unknown to us. The majority of the existing residences appear to be around 30-40 ft from the edge of pavement at a minimum with a few exceptions for sheds, decks and garages that are located closer. Most residential lots appeared to be relatively level with the roadway although a few



exceptions were noted with retaining walls near the edge of pavement on the order of 1-2 ft high. In general, no obvious structural distress was observed on the residences as visible from the road in the vicinity of our investigation; however, distress may have been obscured by vinyl siding or otherwise not visible to us and could be present based on the subsurface soils.

Figure 1 – Roadway in the vicinity of B-5



#### Subsurface Conditions

In general, borings encountered 1 to 4 inches of HMA overlying 6 to 12 inches of gravel base within the pavement areas of Quail Street, Reynolds Road, and the County Park parking lot. Boring B-2, drilled in the grassy area at the County Park, encountered 8 inches of topsoil. Beneath the pavement section or the topsoil, borings encountered 5.5 to 8.0 feet of very loose to medium dense silty sand (SM) to sandy silt (ML) fill which exhibited SPT N values ranging from less than 1 to 20. Below the fill, Borings B-1, B-2, and B-5 encountered fibrous peat (PT) overlying very loose organic silt (OL) to 10.5 to 15.5 feet below the ground surface. Beneath the organic soils, Borings B-1, B-2, and B-5 generally encountered loose to medium dense variable granular material (SP, SP-SM, SM, ML) to the end of exploration based on uncorrected SPT N values ranging from 7 to 15. Borings B-3, B-4, and B-6 generally did not encounter organic soils, and beneath the fill encountered loose to medium dense variable granular material (SP, SP-SM, SM, ML) to the end of exploration which exhibited uncorrected SPT N values ranging from 5 to 19. The relative density of granular soil is based on recorded SPT N-values while the consistency of cohesive soil is based on both recorded SPT N-values and on estimates of the unconfined compressive strength obtained with a calibrated penetrometer.

Groundwater was encountered near elevation 851 matching the adjacent lake and wetland water surface. Groundwater levels may fluctuate due to seasonal variations such as precipitation, snowmelt, nearby river or lake levels and other factors that may not be evident at the time of measurement. Groundwater levels may be different at the time of construction.



This section has provided a generalized description of the encountered subsurface soil conditions. The boring logs located in the Appendix should be reviewed for detailed soil descriptions. Some variation between boring locations may be expected.

## CONCLUSIONS AND RECOMMENDATIONS

Overall, this project is expected to present various challenges considering the encountered groundwater and organic soils along with the narrow right of way and nearby structures. We have addressed these challenges by providing recommendations for two options for construction of the sewers and lift station, respectively. As the design progresses, we remain open to providing additional design input, as requested.

### Sanitary Gravity and Pressure Mains

Considering the above referenced past performance issues as well as the presence of organic materials encountered in our soil borings, support of the proposed piping on grade in all areas will not be possible without significant risk of future settlement as has been experienced previously. Borings B-3, B-4 and B-6 encountered inorganic soils which may be suitable for support for piping on grade although the vicinity of Boring B-3 is also reported to be the area of most severe settlement which suggests that there is additional variability including the presence of buried organic soil that may not have been directly sampled due to the non-continuous sampling utilized. We have addressed two options for reconstructing these areas including overexcavation and deep foundation support.

Both of these options may be feasible in some areas and selecting the limits of support will be a key design objective. In general, the use of a properly designed deep foundation support system is expected to present a lower risk of long-term settlement than overexcavation and as a default could be used in all areas where the subgrade support is a concern. Considering the expected cost of deep foundation support, the use of overexcavation in select areas where it is feasible may still be beneficial.

### Overexcavation

Considering the encountered depth of organics in our soil borings, overexcavation to remove the organics and other unsuitable subgrade soils is expected to be feasible to achieve an acceptable utility support condition in some project areas to reduce the risk of future settlement. Also, based on our borings, it appears that some areas are present where significant over excavation below the pipe invert may not be needed to achieve an acceptable subgrade bearing condition.

Challenges relating to overexcavation will include, but not be limited to, dewatering and protection of surrounding structures, utilities, etc. Earth retention may be needed in some areas to complete the installation of sewers including any required overexcavation. The cost



of earth retention is expected to be a factor in determining feasibility of overexcavation. Where utilized, we recommend that non vibratory earth retention be specified due to the proximity to existing structures and utilities.

To perform overexcavation, the contractor should be prepared to temporarily lower groundwater to a minimum of 2 ft below the depth of excavation required for overexcavation and utility installation to account for subgrade preparation, subgrade inspection and engineered fill placement.

Overexcavation should encompass soil within the stress influence region of the utility, defined as a region bordered by 2V:1H planes extending down and away from the bottom edge of the utility trench to the approved bearing stratum. The subgrade should be inspected and tested by qualified geotechnical personnel familiar with the geotechnical recommendations. As part of the inspection and testing, the subgrade should be verified to be consistent with the conditions encountered in this investigation and be free of organic soil below the bearing elevation. Additional soil borings should be performed, as necessary, as part of this verification to confirm the limits of organic soil. This testing should include the verification of acceptable unconfined compressive strengths in cohesive soil and a dynamic cone penetrometer (ASTM STP 399) to verify minimum relative densities and equivalent N-values in granular soil. Care should be taken to maintain the natural moisture content of clayey subgrade soil which may become soft when saturated from rainfall, etc.

We understand that Meridian Township desires to explore the use of geotextile or geogrid to stabilize the subgrade beneath the pipe as an additional precaution. In this situation, considering the relatively widespread settlement, it appears that use of a geotextile or geogrid would provide little to no resistance to this type of settlement but could help to make settlement more gradual at soil transitions. In this case, we are not opposed to using these products for additional subgrade stabilization provided the subgrade is also addressed as recommended herein.

#### *Bedding and Backfill*

The following materials are recommended for the sanitary gravity and pressure mains upon confirmation of suitable and approved subgrade:

- Sand for backfilling – should meet the requirements for Granular Materials Class II as specified in the MDOT 2020 Standard Specifications for Construction Manual
- Sand for bedding – should meet the requirements for MDOT Class II except 100% shall pass a 3/8 inch sieve as specified in the MDOT 2020 Standards Specifications for Construction Manual

Much of the granular soil encountered in the upper 5.5 to 8 feet in our borings is expected to have excessive fines for use as sand bedding based upon visual classification. Provided the excavation spoils do not contain organics, debris or other deleterious materials, they may be



suitable for reuse as backfill but are likely to be difficult to compact efficiently and may lead to future settlement concerns. We suggest that the budget consider all bedding and backfill (fulfilling MDOT specifications) be imported, although it may be feasible to utilize existing material in the green space of the county park as long as moisture and density requirements are satisfied.

### Deep Foundation Support

As an alternative to removing the underlying organic soils and to control the risk of future settlement due to unsuitable organic subgrade soil, deep foundations could be utilized to support the proposed sanitary sewer and forcemain. Additionally, as the existing subgrade condition is expected to vary between our borings, use of deep foundations would reduce the risk of unidentified organic soil deposits impacting the constructed sewer.

We expect deep foundation support to include saddles or other suitable structural elements to be placed periodically along the sewer to sufficiently support the pipe and prevent settlement. Based on a provided detail, we understand that Meridian Township has experience working with saddle systems composed of treated timbers supported on driven timber piles. In this case, we understand that Meridian Township intends to use a non-vibratory system such as helical piers. We have provided recommendations related to helical piers but would be able to evaluate alternate foundations systems upon request, such as non-vibratory augercast piles. The structural design of the saddle system and permissible span distance along the pipeline is beyond the scope of our services and should be completed by a structural engineer.

A helical pier foundation system is a segmental deep foundation system consisting of steel bearing plates (helices) welded to a central steel shaft. The central steel shaft is typically manufactured in 5 ft lengths with a wide array of shapes and sizes. Specialized galvanized coatings or sacrificial anodes may be used to increase the corrosion resistance of the pier materials. After the helices are welded onto the shaft sections at predetermined locations, the pier is "screwed" into the ground by applying a torque and adding steel extensions until the desired ultimate capacity is reached. Helical piers can be installed with minimal ground disturbance using relatively lightweight equipment and construction machinery, such as excavators outfitted with specialized torque attachments.

Corrosion protection should be evaluated by the Helical Pier Contractor and submitted to the Engineer in a shop submittal. Corrosion protection of helical piers is commonly accomplished through specialized metal such as hot dip galvanizing, dielectric coatings, sacrificial steel or a bituminous coating. At a minimum hot dip galvanizing, or an approved equivalent, should be applied to all helical pier components considering the presence of buried organic material. We also recommend that consideration be given to accounting for an appropriate sacrificial steel thickness to account for corrosion loss in the even these coatings are compromised.



The work should be performed by a Contractor with at least 5 years of experience installing similar foundation systems. The lead section should be installed at least 3 ft or three helix diameters, whichever is greatest, into competent bearing soil while achieving the minimum required torque over the last 3 ft of installation. Helical piers should be installed such that the uppermost helix plate bears below any organic or fill materials which were found to extend to approximately elevation 835 in Boring B-5. This elevation is likely to vary throughout the project limits and may require additional investigation to confirm in other areas. Applicable downdrag loads should be considered in helical pier design.

The Contractor's installation equipment should be calibrated and calibration charts should be submitted to the Engineer before the start of work equating installation torque or pressure to pier ultimate capacity (in kips). The Contractor's submittal should indicate the proposed layout of the helical pier locations, helical pier type, typically pier-to-saddle connection details as well as ultimate bearing capacity and shaft buckling design calculations. The submittal should be prepared by a Professional Engineer licensed in the State of Michigan and submitted at least two weeks before construction. The Contractor's submittal should consider the potential corrosion, such as annual corrosion losses, buckling, and should provide calculations supporting a minimum design life of 50 years or greater as specified by the construction documents.

The pier capacity should be confirmed by the Contractor at the start of the work by a static load test to verify the Contractor's torque conversion relating applied torque to axial capacity. Before the installation of production piers, the Contractor should complete one successful static load test (ASTM D 1143). Standard loading procedures should be followed with the exception that the maximum load should be held at least 4 hours. The test pier should be installed by the Contractor with the same equipment, means, and methods as the production piers. Test reports for each installed pier should be provided by the Owner and should include pier number, pier length, installed torque, torque factor considered, observations of installation including difficult drilling and installation date. The contractor should be aware of the potential for buried obstructions which may require pre-excavation to install piers or, alternatively, installation of additional piers to accommodate the design intent.

The design of the overall support system would need to be performed by a structural engineer. We expect that helical pier foundations would gain capacity in the loose to medium dense soil strata based on Boring B-1 which was completed at the lift station considering appropriate downdrag (negative skin friction) loading from organic material and fill above. Additional soil borings would be beneficial to further quantify bearing conditions and to reduce risk which could either be completed by Meridian Township as the Owner or by the Contractor as a delegated design. In the absence of additional borings, the installation of selected test piers may be beneficial to help reduce risk and assist the Contractor with correctly ordering materials considering there may be some variability in installation depth, although care will still be needed to ensure that piers are installed to an approved bearing elevation below any organic soil layers.



### Lift Station Wet Well

We understand that the lift station will be constructed to approximately 25 feet below the existing ground surface (approximately elevation 830), extending roughly 3 ft deeper than the existing structure. Additional structure depth may be needed to provide ballast to resist uplift loading which would increase the overall depth. Should plans become available, we would be able to review and provide additional comments as warranted.

We expect the encountered medium dense silty sand and poorly graded sand encountered at the bearing elevation to be suitable for support of the proposed structure considering a net zero or negative stress increase due to the removal of soil as part of construction. Care should be taken to avoid disturbing the subgrade during construction through adequate groundwater management and construction procedures.

A minimum 12 inches of MDOT 21AA dense-graded aggregate is recommended below mat slab foundations constructed below groundwater to assist with limiting disturbance to underlying subgrade while also providing an ability to facilitate localized dewatering within the gravel. Depending on groundwater flow into excavations, it may be favorable to utilize an open-grade drainage aggregate in lieu of MDOT 21AA, such as MDOT 6A (80 percent crushed), MDOT 34R, MDOT 34G or approved equivalent. If open-graded aggregate is utilized, it should be fully wrapped in a non-woven geotextile fabric to minimize soil migration into the aggregate.

Based on the location within the boat launch and county park, we feel that construction via either a dewatered open cut with earth retention (as needed) or use of the sinking caisson method would be feasible. In this case, we feel that the sinking caisson likely presents the lowest risk of construction related issues although this may vary given the contractor experience and the final design of the lift station. We understand that the design team is currently considering the use of a Pro-Tec Equipment slide rail system utilizing a dewatered excavation although this has not been confirmed.

An open cut excavation with earth retention should consider protection of surrounding structures, which in this case, is expected to consist of the existing lift station (assumed to be left in place during construction) and the existing influent sewers and forcemain. The exact location of the proposed lift station has not been provided to us and we are unaware of the offset from these existing structures.

A sinking caisson installation involves constructing the wet well using precast concrete rings which are pushed into the ground while removing material from within the rings. Following advancement of the structure to the required depth, a base slab is placed using underwater concrete placement methods after which the interior of the structure can be pumped of water to allow construction to continue. Benefits of this method primarily center around being able to construct the deepest portion of the structure without dewatering. Dewatering would still be necessary to a lesser extent to perform overexcavation below and construct the adjacent sewer which would be cored through the lift station structure after installation.



The Contractor should have successfully completed other lift station excavation/construction with similar conditions. The contractor should submit an alternate method for review by the Engineer if deemed appropriate if in contrast to those discussed herein. The Contractor should determine the means and methods for constructing below grade structures. Additionally, we feel that the boring depth requested at the lift station may be inadequate for design of the proposed construction with respect to the structure depth and suggest additional soils information be obtained prior to bidding, particularly if significant additional structure depth is needed to provide ballast. Alternatively, the Contractor could be required to obtain additional soils information as part of their bid.

The Contractor shall employ a geotechnical/structural professional engineer licensed and insured in the State of Michigan to prepare the wet well construction work plan and to document conformance to the accepted work plan. The Contractor shall submit the work plan to the Owner's engineer in a timely manner for review, comment, and acceptance. As a minimum, the detailed work plan should include:

- Construction method for installation of the wet well and all structures to be located within the resulting area of disturbance.
- Construction schedule, sequence and staging for installation of the wet well, and all structures to be located in the resulting area of disturbance.
- Dewatering plan and groundwater level monitoring plan during all stages of the construction.
- Design calculations supporting all aspects of this work plan including temporary earth retention.
- Construction quality control monitoring plan, and
- All other details pertinent to the complete review of the submittal by the Owner and its engineer. The Contractor's professional engineer should document the critical quality control aspects of the work to be in conformance with the construction quality control in the submittal.

The contractor will be responsible for implementing a suitable dewatering system depending on the installation method chosen. Where temporary earth retention and excavation are utilized for lift station construction, groundwater shall be lowered to a minimum of 2 ft below the bottom of proposed excavation with suitable groundwater monitoring wells installed by the Contractor to verify function of the dewatering system. The excavation should provide an adequate excavation sidewall angle per OSHA standards while protecting all surrounding utilities and structures.

The design should provide a suitable factor of safety against uplift of the lift station, for either caisson or open-cut with earth retention construction methods, at the maximum design groundwater/flood elevation. The flotation concern should be addressed with an appropriate factor of safety by extending the footing horizontally at the base of the structure (if open-cut construction methods are used) or by providing sufficient ballast within the caisson. The base slab and walls of the lift station should also be designed to resist the maximum design



groundwater/flood elevation hydrostatic pressure. We recommend the design groundwater elevation for structural and buoyant uplift be set to the higher of the ground surface or appropriate design flood elevation considering the adjacent lake.

Based on the encountered organic soil in Boring B-1, support of adjacent structures on grade surrounding the lift station is not recommended unless significant settlement can be tolerated. Additionally, the existing influent sewers (particularly the second influent sewer not being replaced) may be supported within organic soil requiring special support considerations. While likely beyond the scope of the project in some areas, we recommend consideration be given to improving the support condition by overexcavating underlying organic soils in areas where existing sewers are exposed.

#### General Site and Subgrade Preparation

All topsoil, vegetation, roots, and any other miscellaneous debris should be removed from within the proposed construction areas. The limits of the proposed construction area, prior to the placement of any structures or engineered fill material, should be proofrolled and compacted in the upper 12 inches using suitable compaction equipment to at least 95 percent of the soil's maximum ASTM D1557 dry density by the Contractor. Proofrolling is defined as the passing of relatively heavy construction equipment over the soil subgrade under observation by the Geotechnical Engineer. The response of the soil, when subjected to the applied load, is subjectively evaluated by our staff with respect to its ability to support the overlying soil or structure. In areas where excessive deflection is observed, special subgrade preparation measures may be recommended to provide an acceptable subgrade condition. These measures may consist of compaction of the subgrade at moisture contents close to the optimum value, undercutting affected areas and replacing with engineered fill, use of a geotextile separation fabric or some combination of these measures.

Engineered fill is approved on-site or imported soil placed in uniform layers and compacted to a minimum required density. Generally, on-site soil with a group symbol of SP or SP-SM is expected to be suitable for engineered fill. Imported fill should meet the requirements for MDOT Class II granular material. MDOT Class II soil or approved on-site soil meeting the requirements of SP-SM should be used as backfill against below-grade walls and foundations.

Granular engineered fill and backfill should be compacted to at least 95 percent of the soil's maximum dry density as determined by the Modified Proctor test (ASTM D1557). Vibratory compaction methods are typically found to be most effective in granular soils; however, relatively light equipment should be used adjacent to utilities or sensitive structures to avoid damage. The fill should be placed and compacted in horizontal layers not exceeding 9 inches. Field density tests (ASTM D2922) should be taken on each lift, as the fill is being placed, to verify compliance with compaction specifications. If the earthwork takes place during winter months, fill must not be placed on frozen ground and fill with frozen conglomerations of soil must not be used.



### Pre-Construction Survey and Monitoring

The presence of surrounding structures, particularly high-end homes, presents a risk of claims to the project as a result of damage. Further, many of these structures potentially may be supported above organic soil which both places them at an elevated risk of damage and also increases the likelihood that existing structural distress could be incorrectly attributed to the project after the fact.

To protect against this, we recommend a pre-construction survey be performed at all structures within 100 ft of the proposed construction area. The pre-construction survey should be performed by the Contractor's professional videographer and include an assessment of the existing structural condition and photo or video-documentation of existing cracks and structural defects. Crack monitors capable of measuring crack displacement and rotation to the nearest 1 mm and settlement monitoring points should be set prior to construction and monitored throughout construction. Additional preconstruction monitoring may be warranted in some situations to document if existing movement is ongoing.

We recommend the bid documents include an allowance for a minimum of 15 crack monitors and 15 settlement markers to be set by the Contractor at locations agreed upon by the Engineer after the performance of the pre-construction survey. Crack monitor and settlement marker readings should be obtained at least one week before construction and every 2 hours during construction. Settlement readings shall be by optical or laser level having an accuracy of 0.01 ft. Results of the monitoring program shall be submitted to the Engineer daily for review. If crack or structural movement of the existing facilities is detected, the contractor shall immediately notify appropriate parties and develop a corrective action plan to prevent further damage and repair all damages.

### Groundwater and Dewatering

Groundwater was encountered near the surface water elevation of Lake Lansing (approximately elevation 851), with existing sanitary inverts on the order of 5 ft below the encountered depth of groundwater. Because groundwater was encountered at or above the anticipated excavation depth, the control of groundwater for construction is expected to be of concern on this project. Groundwater will be encountered during construction and suitable control of groundwater should be anticipated and planned for accordingly before the start of construction. Groundwater may or may not be higher at the time of construction based on adjacent lake levels, precipitation, etc. with piezometers recommended to evaluate over time and plan dewatering efforts appropriately.

The Contractor will be responsible for evaluating all dewatering requirements on the project. We have provided test boring logs with groundwater levels recorded while drilling for the Contractor's use in evaluating dewatering requirements. The contractor should be responsible for selecting and implementing an appropriate groundwater control system. The Contractor should take all necessary means to provide protection to existing structures during



dewatering. The Contractor should have previous dewatering experience on projects with similar conditions. Suitable silt and sediment traps should be incorporated into the dewatering system. We recommend the groundwater be temporarily lowered a minimum of 2 ft below the deepest excavation to allow for appropriate subgrade observation and testing as well as appropriate pipe bedding placement. It will be necessary for the Contractor to control storm water during rain events and to prevent the wash-out of excavation slopes and potential undermining of utilities or structures.

The Contractor should consider installation of piezometers to evaluate the groundwater elevations at the time of construction and to assist in selection of appropriate dewatering and groundwater control measures.

Dewatering systems may consist of well point, deep wells or other approved methods and should be designed and installed by a qualified dewatering Contractor with at least 5 years of experience successfully dewatering sites in similar subsurface conditions with a design submittal prepared and signed by a State of Michigan licensed Professional Engineer, submitted at least 2 weeks prior to mobilization for review by the Engineer. The design should take into account the potential for existing structure settlement due to lowered groundwater levels and an associated increase in vertical effective stress of existing foundation subgrade.

#### Slopes and Temporary Excavations

The Owner and the Contractor should make themselves aware of and become familiar with applicable local, state, and federal safety regulations, including current OSHA excavation and trench safety standards. Construction site safety generally is the sole responsibility of the Contractor. The Contractor shall also be solely responsible for the means, methods, techniques, sequences and operations of construction operations. We are providing the following information solely as a service on this project and, under no circumstances, should our provision of the following information be construed to mean that we are assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not implied and should not be inferred.

The Contractor should be aware that slope height, slope inclination, and excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, or federal safety regulations; e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations. For this site, the overburden soil encountered in our exploratory program is a sandy silt to silty sand (saturated at or above the invert elevations). We anticipate that OSHA will classify these materials as Type C. OSHA recommends a maximum slope inclination of 1½H:1V for this type of soil under ideal conditions. If any excavation, including a utility trench, is extended to a depth of more than 20 ft, OSHA requires that the side slopes of such excavation be designed by a professional engineer registered in the State of Michigan. Temporary slopes in organic soils should be evaluated by the Contractor and their professional engineer registered in the State of Michigan for appropriate slope angles and need for lateral support.



Excavations ranging up to approximately 30 ft may be needed to complete installation of the proposed lift station with varying depths needed in areas of overexcavation, where this is performed. Earth retention will be needed at the lift station location and is also likely to be needed in areas along the sewer route due to proximity to the southern right of way line as well as other utilities.

The contractor or the specialty subcontractor should be responsible for the design of the temporary shoring in accordance with applicable regulatory requirements. We recommend the use of vibrationless systems to reduce the risk to surrounding structures.

MBC Seismic Considerations

The seismic design category can be determined with noted exceptions following Section 1613 of the 2015 Michigan Building Code. The Risk Category under Section 1613.3.5 shall be determined by a licensed structural engineer. Based on the subsurface conditions identified in the soil borings, our experience with the geological conditions in the site vicinity and the procedures outlined in Section 1613 of the 2015 Michigan Building Code and Chapter 20, Table 20.3-1 of ASCE 7, we recommend assigning a Site Class D to this site. A Site Class D designates a stiff soil profile in the upper 100 ft with average SPT uncorrected N-values between 15 and 50 in granular soil and average undrained shear strengths,  $s_u$ , between 1,000 and 2,000 psf in cohesive soil. Recommended seismic ground motion values are provided in the Table 2 below:

Table 2 - Recommended Seismic Ground Motion Values

2015 Michigan Building Code Values	Short Period (0.2 sec)	Long Period (1 sec)
Spectral Response Acceleration, Figure 1613.3.1(1 and 2), %g	$S_s = 8.7$	$S_l = 4.8$
Seismic Site Coefficient, Table 1613.3.3(1 and 2)	$F_a = 1.6$	$F_v = 2.4$
Maximum Considered Spectral Response Acceleration, Equations 16-37 and 16-38	$S_{MS} = 0.139g$	$S_{MI} = 0.115g$
5% Damped Spectral Response Acceleration, Equations 16-39 and 16-40	$S_{DS} = 0.093g$	$S_{DI} = 0.077g$

CLOSURE

In this report, descriptions of the geotechnical investigation, encountered conditions, and recommendations for the design of foundations and earth-related structures have been presented. The limitations of this study are described in the Appendix.

The recommendations presented in this report are based upon a limited number of subsurface samples obtained from various sampling locations. The samples may not fully indicate the nature and extent of the variations that actually exist between sampling locations. For that



reason, among others, we strongly recommend that a qualified geotechnical firm be retained to observe earthwork construction. If variations or other latent conditions become evident during construction, it will be necessary for us to review these conditions and our recommendations as appropriate.

We appreciate the opportunity to provide this service to you on this project. Should you have any questions or require further assistance, please contact our office.

Sincerely,

**MATERIALS TESTING CONSULTANTS, INC.**

Mark DeHoog, E.I.T.  
Senior Staff Engineer

Jonathan E. O'Brock, P.E.  
Project Manager

- Attachments: Figure No. 1 - Boring Location Plan  
Appendix
- Limitations
  - Test Drilling and Sampling Procedures
  - Boring Log Terminology and Classification Outline
  - Boring Logs
  - Laboratory Summary Table
  - Laboratory Results

**LEGEND**

● BORING LOCATION (TYP)

NOTE: AERIAL IMAGE FROM GOOGLE EARTH



TITLE: BORING LOCATION PLAN		PROJECT: MERIDIAN TOWNSHIP – COUNTY PARK LIFT STATION AND SANITARY SEWER MAIN REPLACEMENT	
SCALE: AS SHOWN	DATE: 3/24/2023	PROJECT NO.: 231111	
FIG. NO.: 1	DR. BY: JM	REV. BY: JO	



## *APPENDIX*

- Limitations
- Test Drilling and Sampling Procedures
- Boring Log Terminology and Classification Outline
- Boring Logs
- Laboratory Summary Table
- Laboratory Results



## LIMITATIONS

### Soil Variations

The recommendations in this report are based upon the data obtained from the soil borings. This report does not reflect variations which may occur between these borings, and which would not become evident until construction. If variations then become evident, it would be necessary for a re-evaluation of recommendations of this report, after performing on-site observations.

### Warranties

We have prepared this report in accordance with generally accepted soil and foundation engineering practices. We make no other warranties, either expressed or implied, as to the professional advice provided under the terms of our agreement and included in this report. This report is prepared exclusively for our client and may not be relied upon by other parties without written consent from our office.

### Boring Logs

In the process of obtaining and testing samples and preparing this report, we follow reasonable and accepted practice in the field of soil engineering. Field logs maintained during drilling describe field occurrences, sampling locations, and other information. The samples obtained in the field are subjected to additional testing in the laboratory and differences may exist between the field logs and the final logs. The engineer reviews the field logs and laboratory test data, and then prepares the final boring logs. Our recommendations are based on the contents of the final logs.

### Review of Design Plans and Specifications

In the event that any changes in the design of the building or the location, however slight, are planned, our recommendations shall not be considered valid unless modified or approved in writing by our office. We recommend that we be provided the opportunity to review the final design and specifications in order to determine whether changes in the original concept may have affected the validity of our recommendations, and whether our recommendations have, in fact, been implemented in the design and specifications.

Test Drilling Methods:

- Hollow stem auger, ASTM D6151
- Mud rotary, ASTM D5783
- Casing advancer, ASTM D5872
- Rock coring, ASTM D2113
- Hand Auger
- 4-inch Portable Pavement Core Drill

*Note: Cone penetration test data can be used to interpret subsurface stratigraphy and can provide data on engineering properties of soils. The ASTM procedure does not include a procedure for determining soil classification from CPT testing. Soil classifications shown on CPT logs are based on published procedures and are not based on physical ASTM soil classification tests.*

Sampling Methods:

- SPT, ASTM D1586, Auto hammer (140 lb., 30" drop, 2" OD split spoon sampler)
- Thin-walled tube sampler (Shelby), ASTM D1587

*Note: The number of hammer blows required to drive the SPT sampler 12 inches, after seating 6 inches, is termed the soil N-value and provides an indication of the soil's relative density and strength parameters at the sample location. SPT blow counts in 6 inch increments are recorded on the boring logs.*

Drill Rig:

- Acker Renegade (ATV)
- CME 55 (ATV)
- CME 45 Truck
- Geoprobe 7822
- Geoprobe Rotary Sonic

Boreholes Backfilled With:

- Excavated soil
- Cold patch at surface in HMA roadway/parking lot
- Cement bentonite grout
- Piezometer or Monitoring Well (see notes on logs)
- Concrete or asphalt patch where appropriate

Sample Handling and Disposition:

- Samples labeled, placed in sample bags, returned to MTC Laboratory
- Discard after 60 days



# LOG OF BORING

**Project No.:** 231111

**Boring No.:** B-1

**Sheet:** 1 of 1

**Project:** Meridian Township - County Park Lift Station and Sanitary Sewer Main Replacement

**Client:** Meridian Township

**Date Begin:** 03/15/2023

**Date End:** 03/15/2023

**Location:** Meridian Township, Michigan

**Drill Type:** Geoprobe 7822

**Crew Chief:** MS      **Field Eng.:** ES      **Rev. By:** JO

**Coordinates:** N=460717.9 E=13115938.7 (MI South 11ft)

**Elevation:** 854.5 ft      **Datum:** NAVD 88 (GPS Observation)

**Notes:**

**Plugging Record:** Backfilled borehole with bentonite hole plug, pavement sealed with asphalt coldpatch. Cave in at 17.0 ft.

**Depth Drilled:** 30.0 ft.

Tooling	Type	Dia.	Groundwater, ft.	
Casing	HSA	3 1/4"	During	3.5
Sampler	SPT	2"	End	4.0
Core			Seepage	
Tube	Shelby	3"	Date	Depth, ft.
SPT Hammer	Auto			

**Component Percentages:** Trace < 5%, Few 5-10%, Little 15-25%, Some 30-45%, Mostly 50-100%

**QP =** Calibrated Penetrometer (tons/sq. ft.)

Elev. FT.	Depth FT.	Sample Number	Recov. FT.	Penetration (Blows Per 6") ASTM D 1586	*USCS Group Symbol	*DESCRIPTION	QP tsf	MST %	P200 %	REMARKS
853.5	1					4" HMA, 6" Gravel Base	0.8			Fill: 0' to 5.5'
852.5	2	S-1	1.5	2-2-2 N=4	SM	Brown silty SAND; mostly coarse to fine sand, little silty fines, few fine gravel, moist with occasional sand partings and occasional clay lenses, occasional organic partings	3.0			
851.5	3									
850.5	4					Gray silty SAND; mostly coarse to fine sand, little silty fines, wet	5.5			
849.5	5	S-2	1.5	3-3-6 N=9	SM					
848.5	6					Black fibrous PEAT, wet				
847.5	7	S-3	1.5	1-2-4 N=6	PT					
846.5	8					Shelby				
845.5	9									
844.5	10	U-4	1.4							
843.5	11									
842.5	12					Gray poorly graded SAND; mostly coarse to fine sand, trace silty fines, wet	12.0			
841.5	13									
840.5	14					4-4-3 N=7	SP			
839.5	15	S-5	0.3							
838.5	16					Gray silty SAND; mostly coarse to fine sand, little silty fines, wet.				
837.5	17									
836.5	18					Grades with clayey sand with fibrous peat lens at 18.8' Grades with fine sand at 19.0'		14.8	17.6	
835.5	19									
834.5	20	S-6	1.5	5-5-5 N=10	SM					
833.5	21									
832.5	22					Brown poorly graded SAND with silt; mostly coarse to fine sand, few silty fines, few fine gravel, wet				
831.5	23									
830.5	24					6-7-7 N=14	SP-SM			
829.5	25	S-7	1.5							
828.5	26					Gray silty SAND; mostly fine sand, some silty fines, trace fine gravel, wet				
827.5	27									
826.5	28					SM				
825.5	29									
824.5	30	S-8	1.5	6-8-7 N=15		Grades with coarse to fine sand	30.0			
End of Boring										

\* Visual estimate following ASTM D 2488 unless laboratory testing has been performed. Stratification changes are approximated between samples.



# LOG OF BORING

**Project No.:** 231111

**Boring No.:** B-2

**Sheet:** 1 of 1

**Project:** Meridian Township - County Park Lift Station and Sanitary Sewer Main Replacement

**Client:** Meridian Township

**Date Begin:** 03/15/2023

**Date End:** 03/15/2023

**Location:** Meridian Township, Michigan

**Drill Type:** Geoprobe 7822

**Crew Chief:** MS      **Field Eng.:** ES      **Rev. By:** JO

**Coordinates:** N=460728.5 E=13115843.6 (MI South 1ft)

**Elevation:** 852.8 ft      **Datum:** NAVD 88 (GPS Observation)

**Notes:**

**Plugging Record:** Backfilled borehole with bentonite hole plug, pavement sealed with asphalt coldpatch. Cave in at 7.3 ft.

**Depth Drilled:** 16.5 ft.

Tooling	Type	Dia.	Groundwater, ft.	
Casing	HSA	3 1/4"	During	6.5
Sampler	SPT	2"	End	7.0
Core			Seepage	
Tube			Date	Depth, ft.
SPT Hammer	Auto			

**Component Percentages:** Trace < 5%, Few 5-10%, Little 15-25%, Some 30-45%, Mostly 50-100%

**QP =** Calibrated Penetrometer (tons/sq. ft.)

Elev. FT.	Depth FT.	Sample Number	Recov. FT.	Penetration (Blows Per 6") ASTM D 1586	*USCS Group Symbol	*DESCRIPTION	QP tsf	MST %	P200 %	REMARKS
851.8	1	S-1	1.5	3-6-6 N=12	SM	8" Topsoil	0.7			Fill: 0' to 7.1' WOH: Weight of Hammer
850.8	2					Brown to gray silty SAND; mostly coarse to fine sand, little silty fines, few fine gravel, moist with occasional clay lenses				
849.8	3									
848.8	4	S-2	1.5	2-2-2 N=4	SM	Grades with occasional black peat lenses / partings				
847.8	5									
846.8	6	S-3	1.5	2-2-1 N=3	PT	Grades wet	7.1			
845.8	7									
844.8	8					Black fibrous PEAT, occasional woody fragments, wet	8.0			
843.8	9	S-4	0.5	WOH-1/12"	OL	Brown organic SILT, mostly silty fines, wood fragments common, wet	10.5		S-4: Poor recovery; possible coarse gravel / COBBLE	
842.8	10									
841.8	11	S-5	1.5	3-4-5 N=9	SP	Gray poorly graded SAND; mostly fine sand, trace silty fines, wet				
840.8	12									
839.8	13									
838.8	14	S-6	1.5	5-6-7 N=13	SP					
837.8	15									
836.8	16	S-7	1.5	4-6-6 N=12					Charged augers with water following S-6	
End of Boring										

\* Visual estimate following ASTM D 2488 unless laboratory testing has been performed. Stratification changes are approximated between samples.



# LOG OF BORING

**Project No.:** 231111

**Boring No.:** B-3

**Sheet:** 1 of 1

**Project:** Meridian Township - County Park Lift Station and Sanitary Sewer Main Replacement

**Client:** Meridian Township

**Date Begin:** 03/15/2023

**Date End:** 03/15/2023

**Location:** Meridian Township, Michigan

**Drill Type:** Geoprobe 7822

**Crew Chief:** MS      **Field Eng.:** ES      **Rev. By:** JO

**Coordinates:** N=460732.6 E=13115574.6 (MI South 11ft)

**Elevation:** 853.4 ft      **Datum:** NAVD 88 (GPS Observation)

**Notes:**

**Plugging Record:** Backfilled borehole with bentonite hole plug, pavement sealed with asphalt coldpatch. Cave in at 8.3 ft.

**Depth Drilled:** 16.5 ft.

Tooling	Type	Dia.	Groundwater, ft.	
Casing	HSA	3 1/4"	During	6 ±
Sampler	SPT	2"	End	4.0
Core			Seepage	
Tube			Date	Depth, ft.
SPT Hammer	Auto			

**Component Percentages:** Trace < 5%, Few 5-10%, Little 15-25%, Some 30-45%, Mostly 50-100%

QP = Calibrated Penetrometer (tons/sq. ft.)

Elev. FT.	Depth FT.	Sample Number	Recov. FT.	Penetration (Blows Per 6") ASTMD 1586	*USCS Group Symbol	*DESCRIPTION	QP tsf	MST %	P200 %	REMARKS
852.4	1					2" HMA, 6" Gravel Base	0.7			Fill: 0' to 6.0'
851.4	2	S-1	1.5	12-10-9 N=19	SM	Brown silty SAND; mostly coarse to fine sand, little silty fines, few fine gravel, moist, Fill				S-2: Poor recovery; possible coarse gravel / COBBLE
850.4	3									
849.4	4				SM					
848.4	5	S-2	0.5	1-1/12"						
847.4	6				SP	Gray poorly graded SAND; mostly coarse to fine sand, trace silty fines, wet				Charged augers with water following S-4
846.4	7	S-3	1.5	2-3-3 N=6						
845.4	8				SP					
844.4	9	S-4	1.5	3-2-3 N=5						
843.4	10				ML	Gray sandy SILT; mostly silty fines, some fine sand, wet				
842.4	11	S-5	1.5	3-6-6 N=12						
841.4	12				ML					
840.4	13	S-6	1.5	3-4-4 N=8						
839.4	14				ML					
838.4	15	S-7	1.5	3-4-5 N=9						
837.4	16						16.5			

End of Boring

\* Visual estimate following ASTM D 2488 unless laboratory testing has been performed. Stratification changes are approximated between samples.



# LOG OF BORING

**Project No.:** 231111

**Boring No.:** B-4

**Sheet:** 1 of 1

**Project:** Meridian Township - County Park Lift Station and Sanitary Sewer Main Replacement

**Client:** Meridian Township

**Date Begin:** 03/16/2023

**Date End:** 03/16/2023

**Location:** Meridian Township, Michigan

**Drill Type:** Geoprobe 7822

**Crew Chief:** MS      **Field Eng.:** ES      **Rev. By:** JO

**Coordinates:** N=460825.6 E=13115279.4 (MI South 11ft)

**Elevation:** 859.6 ft      **Datum:** NAVD 88 (GPS Observation)

**Notes:**

**Plugging Record:** Backfilled borehole with compacted cuttings, patched pavement with cold patch. Cave in at 6.0 ft.

**Depth Drilled:** 16.5 ft.

Tooling	Type	Dia.	Groundwater, ft.	
Casing	HSA	3 1/4"	During	5.5 ±
Sampler	SPT	2"	End	NA
Core			Seepage	3 ±
Tube			Date	Depth, ft.
SPT Hammer	Auto			

**Component Percentages:** Trace < 5%, Few 5-10%, Little 15-25%, Some 30-45%, Mostly 50-100%

**QP =** Calibrated Penetrometer (tons/sq. ft.)

Elev. FT.	Depth FT.	Sample Number	Recov. FT.	Penetration (Blows Per 6") ASTM D 1586	*USCS Group Symbol	*DESCRIPTION	QP tsf	MST %	P200 %	REMARKS	
858.6	1	S-1	1.5	5-6-6 N=12	ML	2" HMA, 6" Gravel Base	0.7	22.7	97.8	Charged augers with water following S-3	
857.6	2										Brown sandy SILT; mostly silty fines, little fine sand, moist with occasional peat lenses / partings
856.6	3										
855.6	4										
854.6	5	S-2	1.5	3-4-4 N=8	Grades with medium to fine sand lenses						
853.6	6										
852.6	7	S-3	1.5	7-8-10 N=18	Grades with trace sand and wet, without medium to fine sand lenses	8.0					
851.6	8										
850.6	9	S-4	1.5	6-6-6 N=12	ML	Gray SILT, mostly silty fines, few fine sand, wet					
849.6	10										
848.6	11										
847.6	12										
846.6	13										
845.6	14	S-5	1.5	5-6-6 N=12	ML						
844.6	15										
843.6	16	S-6	1.5	4-6-13 N=19		16.5					

End of Boring

\* Visual estimate following ASTM D 2488 unless laboratory testing has been performed. Stratification changes are approximated between samples.



# LOG OF BORING

**Project No.:** 231111

**Boring No.:** B-5

**Sheet:** 1 of 1

**Project:** Meridian Township - County Park Lift Station and Sanitary Sewer Main Replacement

**Client:** Meridian Township

**Date Begin:** 03/16/2023

**Date End:** 03/16/2023

**Location:** Meridian Township, Michigan

**Drill Type:** Geoprobe 7822

**Crew Chief:** MS      **Field Eng.:** ES      **Rev. By:** JO

**Coordinates:** N=461013.3 E=13114945.2 (MI South 11ft)

**Elevation:** 853.3 ft      **Datum:** NAVD 88 (GPS Observation)

**Notes:**

**Plugging Record:** Backfilled borehole with compacted cuttings, patched pavement with cold patch. Cave in at 4.5 ft.

**Depth Drilled:** 20.0 ft.

Tooling	Type	Dia.	Groundwater, ft.	
Casing	HSA	3 1/4"	During	5.5 ±
Sampler	SPT	2"	End	3.0
Core			Seepage	
Tube			Date	Depth, ft.
SPT Hammer	Auto			

**Component Percentages:** Trace < 5%, Few 5-10%, Little 15-25%, Some 30-45%, Mostly 50-100%

QP = Calibrated Penetrometer (tons/sq. ft.)

Elev. FT.	Depth FT.	Sample Number	Recov. FT.	Penetration (Blows Per 6") ASTM D 1586	*USCS Group Symbol	*DESCRIPTION	QP tsf	MST %	P200 %	REMARKS
852.3	1					1" HMA, 12" Gravel Base	1.1			Fill: 0' to 5.5'
851.3	2	S-1	1.5	11-11-9 N=20	SM	Brown silty SAND; mostly coarse to fine sand, some silty fines, moist with occasional black organic seams				
850.3	3									
849.3	4				SM	Grades with few fine gravel				S-2, S-4: Poor recovery; possible coarse gravel / COBBLE
848.3	5	S-2	1.2	9-5-4 N=9						
847.3	6				PT	Dark brown fibrous PEAT, with few coarse to fine sand, wet				Driller noted coarse gravel / COBBLE at 5.0'
846.3	7	S-3	1.5	WOH/18"						
845.3	8				SP	Brown poorly graded SAND; mostly coarse to fine sand, few coarse to fine gravel, wet				Charged augers with water following S-3
844.3	9									
843.3	10	S-4	0.1	WOH/18"	OL	Brown organic SILT, mostly silty fines, some fine sand, few fine gravel, with frequent organic seams and occasional roots, wet				S-5: Organic Content 3.2%
842.3	11									
841.3	12	S-5	1.5	WOH/18"	OL	Brown organic SILT, mostly silty fines, some fine sand, few fine gravel, with frequent organic seams and occasional roots, wet				
840.3	13									
839.3	14				SM	Gray silty SAND; mostly coarse to fine sand, some silty fines, wet				
838.3	15	S-6	1.5	1-1/12"						
837.3	16	S-7	1.5	WOH-2-6 N=8	SM	Gray silty SAND; mostly coarse to fine sand, some silty fines, wet				
836.3	17									
835.3	18				SP-SM	Gray poorly graded SAND with silt; mostly fine sand, few silty fines, wet				
834.3	19									
833.3	20	S-8	1.5	5-5-7 N=12			20.0			
End of Boring										

\* Visual estimate following ASTM D 2488 unless laboratory testing has been performed. Stratification changes are approximated between samples.



# LOG OF BORING

**Project No.:** 231111

**Boring No.:** B-6

**Sheet:** 1 of 1

**Project:** Meridian Township - County Park Lift Station and Sanitary Sewer Main Replacement

**Client:** Meridian Township

**Date Begin:** 03/16/2023

**Date End:** 03/16/2023

**Location:** Meridian Township, Michigan

**Drill Type:** Geoprobe 7822

**Crew Chief:** MS      **Field Eng.:** ES      **Rev. By:** JO

**Coordinates:** N=461184.3 E=13114589.2 (MI South 1ft)

**Elevation:** 859.0 ft      **Datum:** NAVD 88 (GPS Observation)

**Notes:**

**Plugging Record:** Backfilled borehole with compacted cuttings, patched pavement with cold patch. Cave in at 7.8 ft.

**Depth Drilled:** 16.5 ft.

Tooling	Type	Dia.	Groundwater, ft.	
Casing	HSA	3 1/4"	During	5.5 ±
Sampler	SPT	2"	End	6.2
Core			Seepage	
Tube			Date	Depth, ft.
SPT Hammer	Auto			

**Component Percentages:** Trace < 5%, Few 5-10%, Little 15-25%, Some 30-45%, Mostly 50-100%

**QP =** Calibrated Penetrometer (tons/sq. ft.)

Elev. FT.	Depth FT.	Sample Number	Recov. FT.	Penetration (Blows Per 6") ASTMD 1586	*USCS Group Symbol	*DESCRIPTION	QP tsf	MST %	P200 %	REMARKS
858.0	1					2" HMA, 8" Gravel Base	0.8			Fill: 0' to 6.5'
857.0	2	S-1	1.5	6-6-5 N=11		Brown poorly graded SAND with silt; mostly fine sand, few silty fines, moist, with black organic lenses / partings				
856.0	3									
855.0	4									
854.0	5	S-2	1.2	3-2-2 N=4	SP-SM	Grades with clayey sand lens, organic partings				S-2: Poor recovery; possible coarse gravel / COBBLE
853.0	6									
852.0	7	S-3	1.5	1-1-1 N=2	ML	Brown sandy SILT; mostly silty fines, some fine sand, wet	6.5			
851.0	8									
850.0	9									
849.0	10	S-4	1.5	1-3-4 N=7		Brown poorly graded SAND with silt; mostly coarse to fine sand, few silty fines, wet	9.4			
848.0	11									
847.0	12									
846.0	13									
845.0	14									
844.0	15	S-5	1.5	4-5-7 N=12	SP	Brown poorly graded SAND; mostly coarse to fine sand, trace silty fines, wet	12.0			
843.0	16	S-6	1.5	5-7-8 N=15			16.5			
						End of Boring				

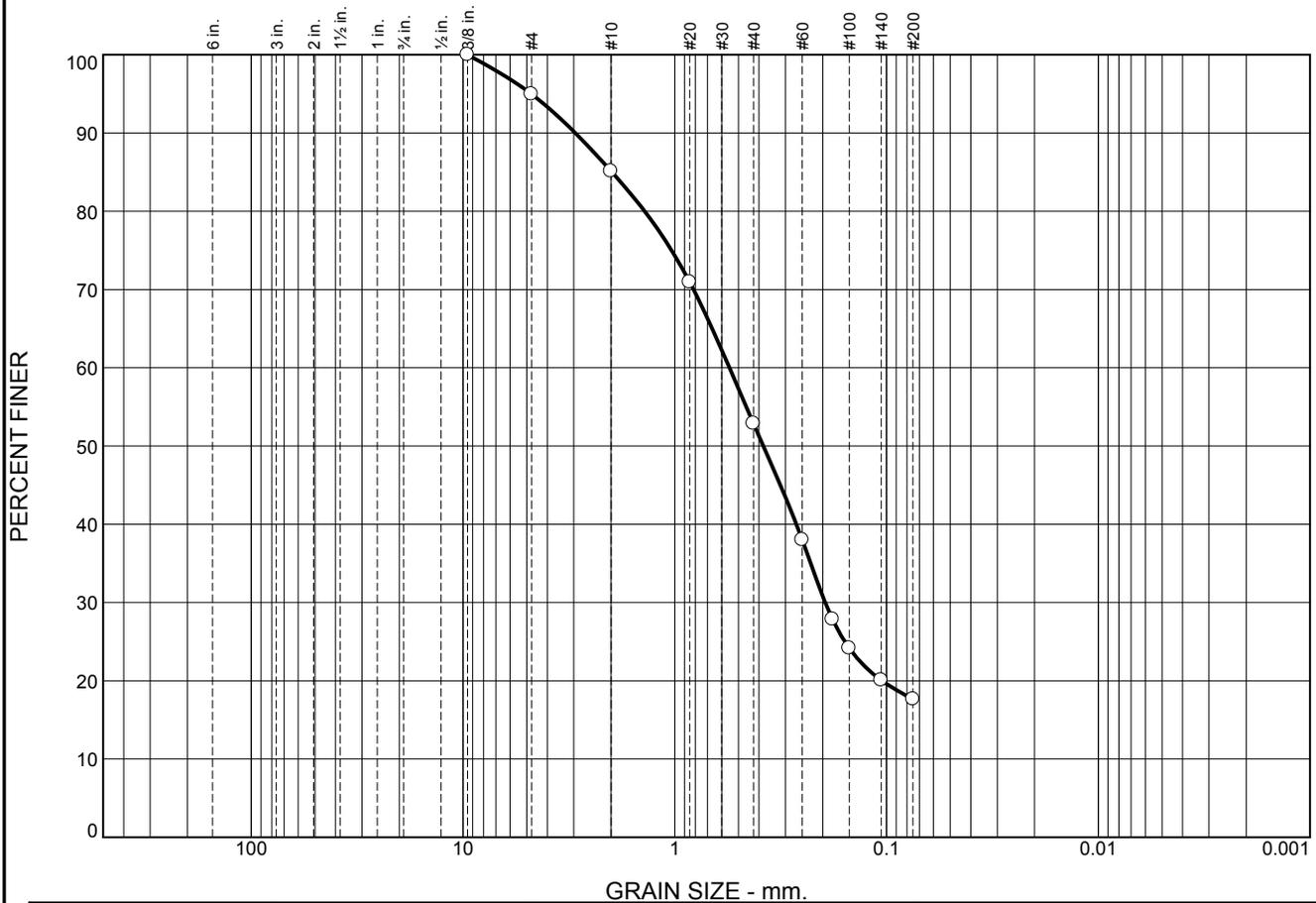
\* Visual estimate following ASTM D 2488 unless laboratory testing has been performed. Stratification changes are approximated between samples.



## SUMMARY OF LABORATORY TEST DATA

Boring Number	Sample Number	Depth (ft)	Sample Description and USCS Classification	Natural Moisture Content (ASTM D2216) (%)	Percent Passing No. 200 (ASTM D6913) (%)	Organic Content (ASTM D2974) (%)
B-1-S-6	161993	19.0-20.0	SC	14.8	17.6	
B-4-S-3	161994	6.0-7.5	ML	22.7	97.8	
B-5-S-5	161995	11.0-12.5	SM	37.8		3.2

# Particle Size Distribution Report



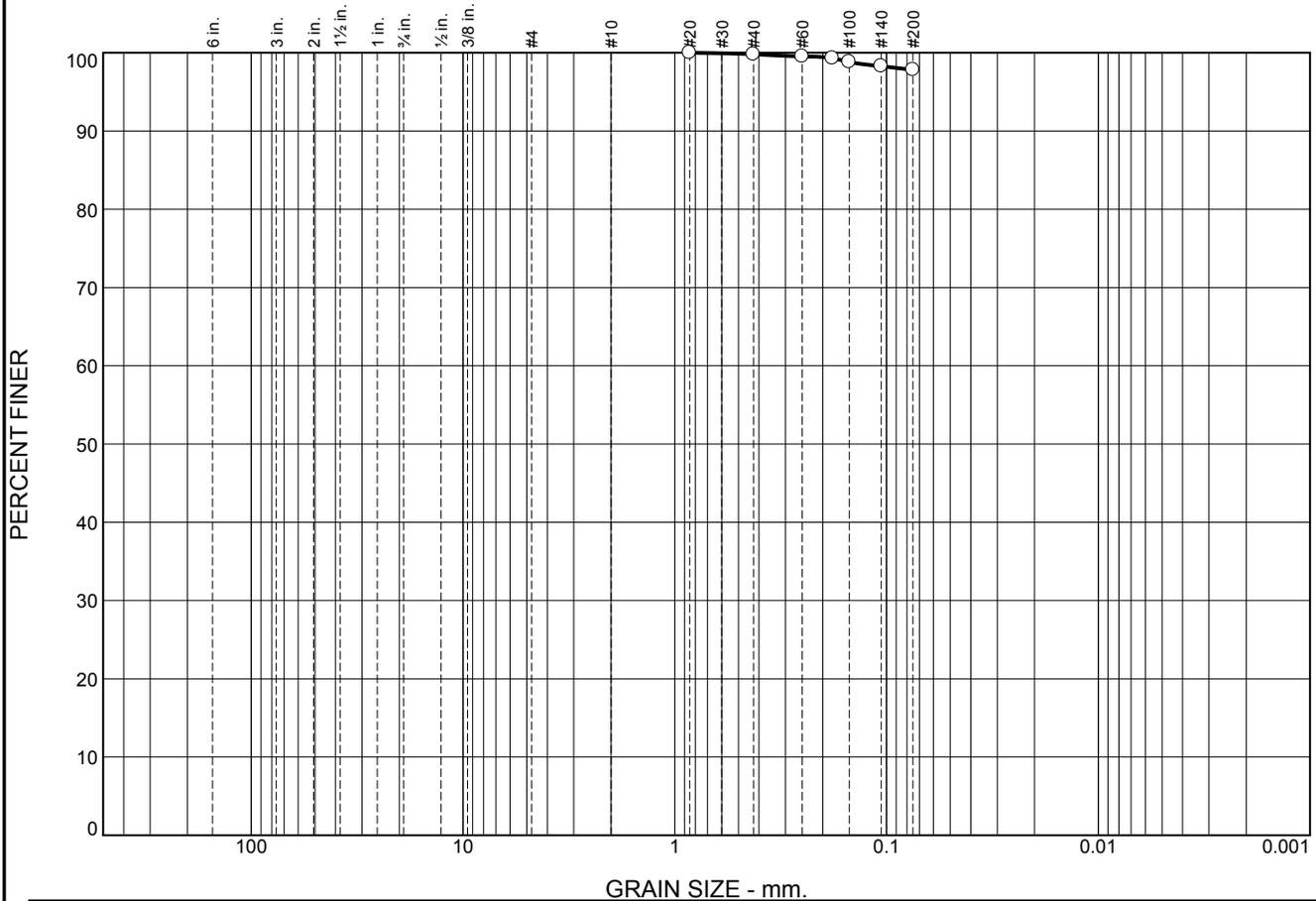
	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
<input type="radio"/>	0.0	0.0	5.0	9.9	32.2	35.3	17.6			
<input checked="" type="checkbox"/>	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
<input type="radio"/>			1.9796	0.5521	0.3817	0.1947				

Material Description	USCS	AASHTO
<input type="radio"/> Brown Silty Sand	SM	

<p><b>Project No.</b> 231111      <b>Client:</b> Meridian Township</p> <p><b>Project:</b> Meridian Township - County Park Lift Station and Sanitary Sewer Main Replacement</p> <p><input type="radio"/> <b>Location:</b> B-1 S-6      <b>Depth:</b> 19.0-20.0 ft      <b>Sample Number:</b> 161993</p>	<p><b>Remarks:</b></p>
<p><b>MATERIALS TESTING CONSULTANTS, INC.</b></p> <p><b>Grand Rapids, MI</b></p>	

Figure

# Particle Size Distribution Report



	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt	Clay	
○	0.0		0.0	0.0	0.0	0.2	2.0	97.8		
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○										

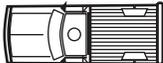
Material Description	USCS	AASHTO
○ Brown Silt	ML	

<p><b>Project No.</b> 231111      <b>Client:</b> Meridian Township</p> <p><b>Project:</b> Meridian Township - County Park Lift Station and Sanitary Sewer Main Replacement</p> <p>○ <b>Location:</b> B-4 S-3      <b>Depth:</b> 6.0-7.5 ft      <b>Sample Number:</b> 161994</p>	<p><b>Remarks:</b></p>
<p><b>MATERIALS TESTING CONSULTANTS, INC.</b></p> <p><b>Grand Rapids, MI</b></p>	

Figure



**Table 6H-2. Meaning of Symbols on Typical Application Diagrams (MI)**

	Arrow panel
	Arrow panel support or trailer (shown facing down)
	Changeable message sign or support trailer
	Channelizing device
	Crash Cushion
	Direction of temporary traffic detour
	Direction of traffic
	Traffic Regulator
	High level warning device (Flag tree)
	Luminaire
	Pavement markings that should be removed for a long term project
	Sign (shown facing left)
	Surveyor
	Temporary barrier
	Temporary barrier with warning lights
	Traffic or Pedestrian signal
	Truck mounted attenuator
	Type III Barricade
	Warning lights
	Work space
	Work vehicle

**Table 6H-3. Meaning of Letter Codes on Typical Application Diagrams**

Road Type	Distance Between Signs**		
	A	B	C
Urban (low speed)*	30 (100)	30 (100)	30 (100)
Urban (high speed)*	100 (350)	100 (350)	100 (350)
Rural	150 (500)	150 (500)	150 (500)
Expressway / Freeway	300 (1,000)	450 (1,500)	800 (2,640)

\* Speed category to be determined by highway agency

\*\* Distances are shown in meters (feet). The column headings A, B, and C are the dimensions shown in Figures 6H-1 through 6H-46. The A dimension is the distance from the transition or point of restriction to the first sign. The B dimension is the distance between the first and second signs. The C dimension is the distance between the second and third signs. (The third sign is the first one in a three-sign series encountered by a driver approaching a TTC zone.)

**Table 6H-4. Formulas for Determining Taper Lengths**

Speed Limit (S)	Taper Length (L) Meters	Speed Limit (S)	Taper Length (L) Feet
60 km/h or less	$L = \frac{WS^2}{155}$	40 mph or less	$L = \frac{WS^2}{60}$
70 km/h or more	$L = \frac{WS}{1.6}$	45 mph or more	$L = WS$

Where: L = taper length in meters (feet)

W = width of offset in meters (feet)

S = posted speed limit, or off-peak 85th-percentile speed prior to work starting, or the anticipated operating speed in km/h (mph)

**Notes for Figure 6H-18—Typical Application 18 (MI)**  
**Lane Closure on Minor Street**

**Standard:**

1. This TTC shall be used only for low-speed facilities having low traffic volumes.

Option:

2. Where the work space is short, where road users can see the roadway beyond, and where volume is low, vehicular traffic may be self-regulating.

**Standard:**

3. Where vehicular traffic cannot effectively self-regulate, one or two **traffic regulators** shall be used as illustrated in Figure 6H-10.

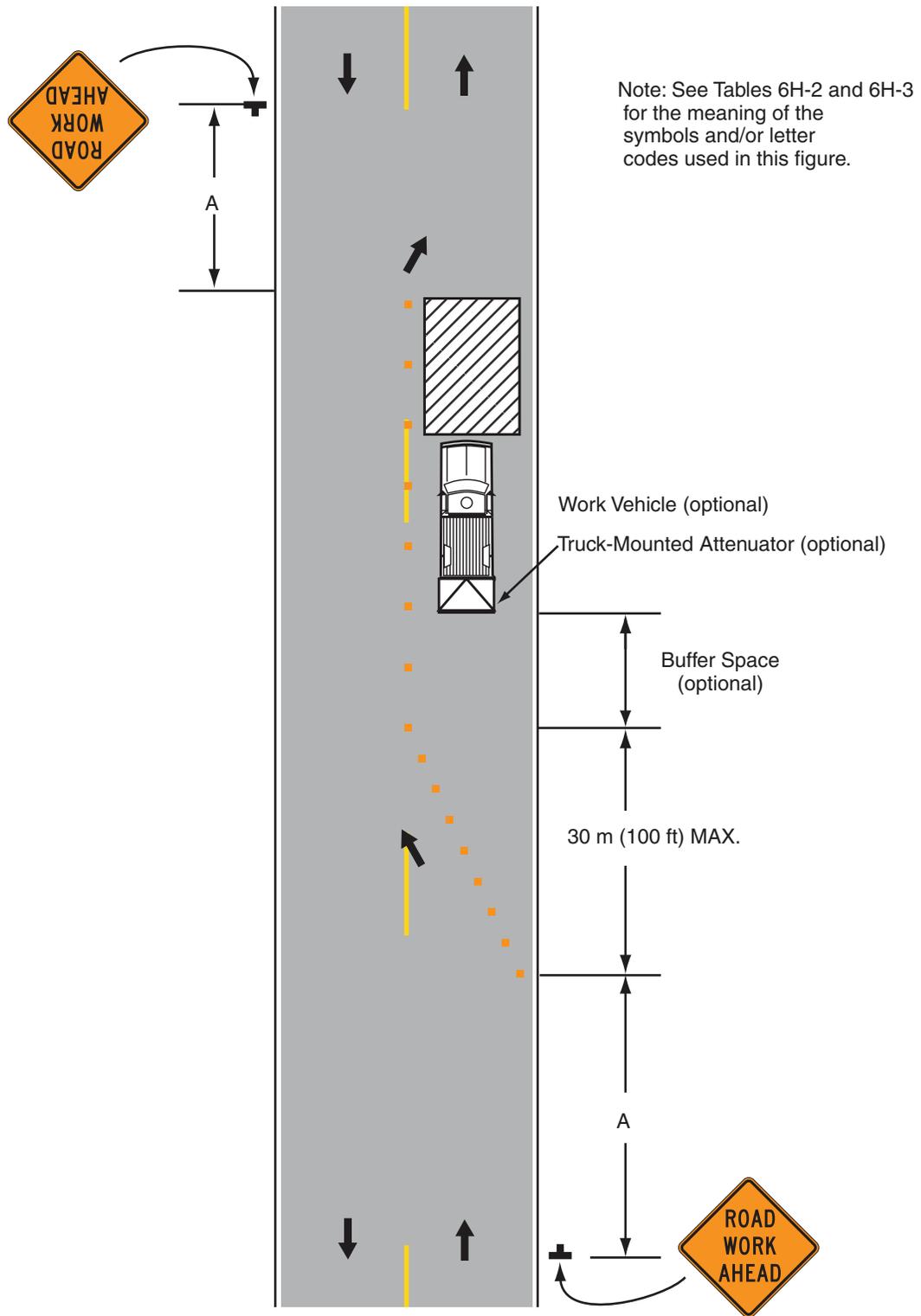


Option:

4. Flashing warning lights and/or flags may be used to call attention to the advance warning signs.
5. A truck-mounted attenuator may be used on the work vehicle and the shadow vehicle.



**Figure 6H-18. Lane Closure on Minor Street (MI) (TA-18)**



**Typical Application 18**

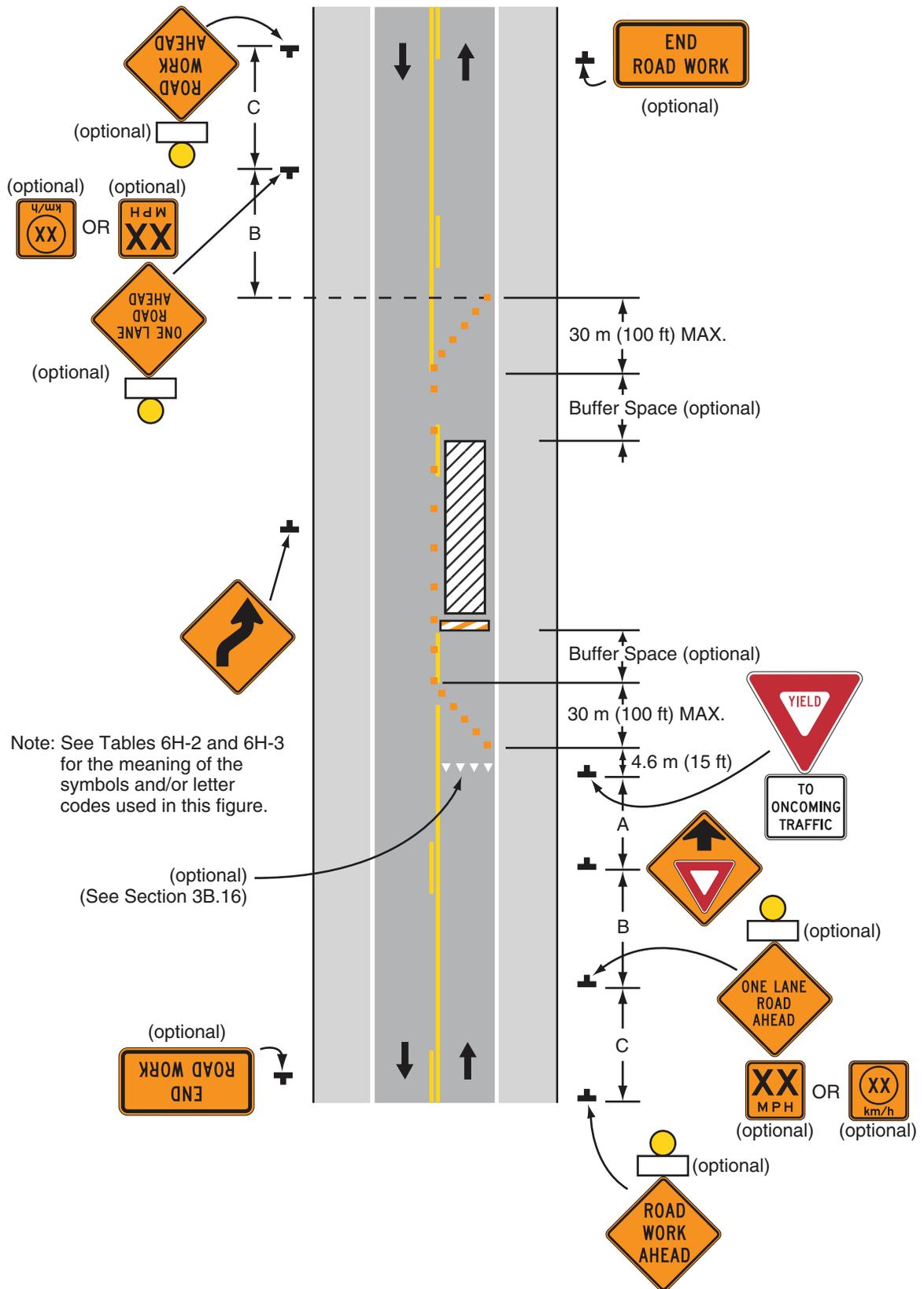
**Notes for Figure 6H-11—Typical Application 11 (MI)**  
**Lane Closure on Two-Lane Road with Low Traffic Volumes**

## Option:



1. This TTC zone application may be used as an alternate to the TTC application shown in Figure 6H-10 (using [traffic regulators](#)) when the following conditions exist:
  - a. Vehicular traffic volume is such that sufficient gaps exist for vehicular traffic that must yield.
  - b. Road users from both directions are able to see approaching vehicular traffic through and beyond the work site and have sufficient visibility of approaching vehicles.
2. The Type B flashing warning lights may be placed on the ROAD WORK AHEAD and the ONE LANE ROAD AHEAD signs whenever a night lane closure is necessary.

**Figure 6H-11. Lane Closure on Two-Lane Road with Low Traffic Volumes (MI)**

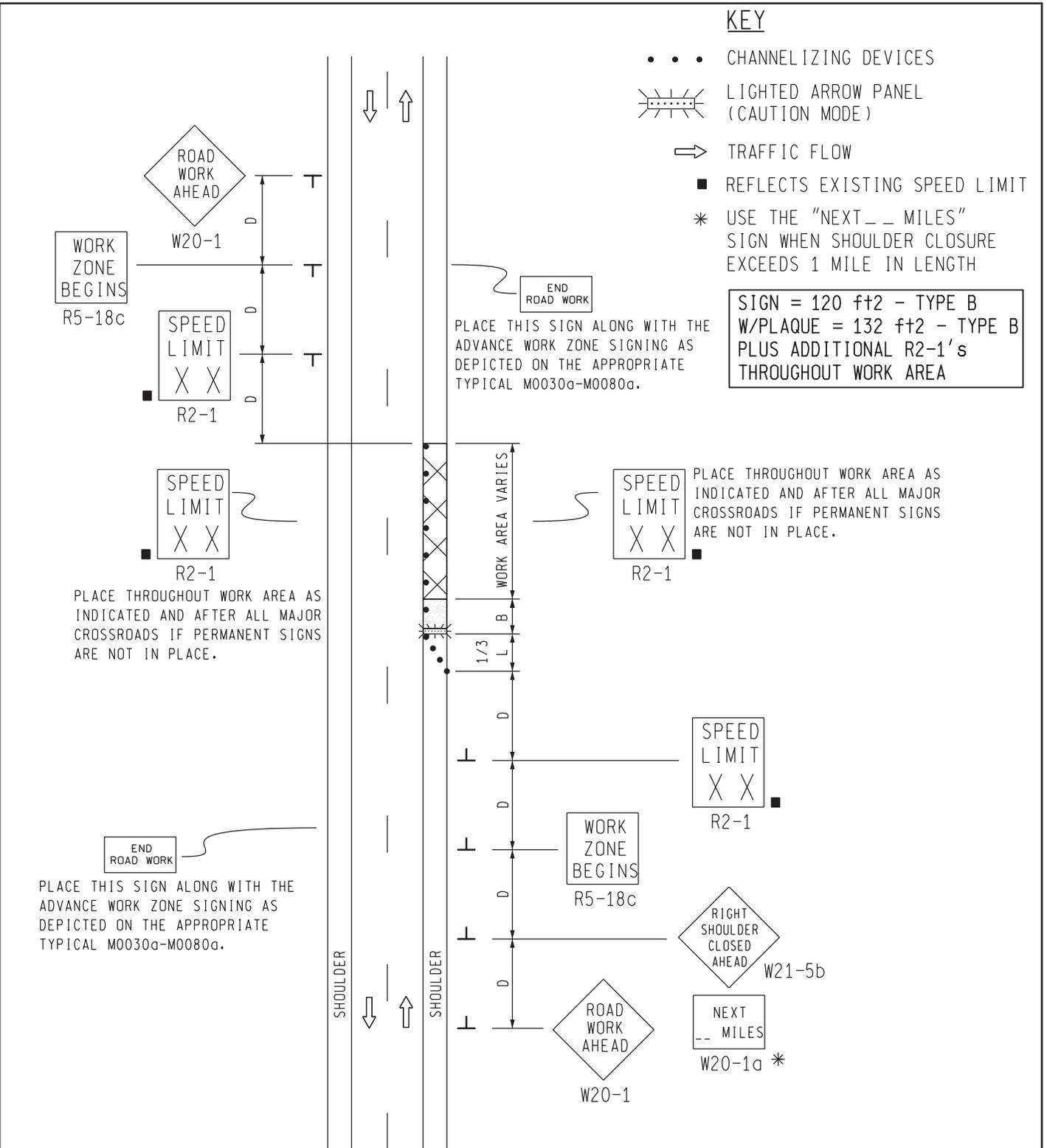


**Typical Application 11**

**KEY**

- • • CHANNELIZING DEVICES
-  LIGHTED ARROW PANEL (CAUTION MODE)
-  TRAFFIC FLOW
- REFLECTS EXISTING SPEED LIMIT
- \* USE THE "NEXT -- MILES" SIGN WHEN SHOULDER CLOSURE EXCEEDS 1 MILE IN LENGTH

SIGN = 120 ft± - TYPE B  
 W/PLAQUE = 132 ft± - TYPE B  
 PLUS ADDITIONAL R2-1's  
 THROUGHOUT WORK AREA



PLACE THROUGHOUT WORK AREA AS INDICATED AND AFTER ALL MAJOR CROSSROADS IF PERMANENT SIGNS ARE NOT IN PLACE.

PLACE THROUGHOUT WORK AREA AS INDICATED AND AFTER ALL MAJOR CROSSROADS IF PERMANENT SIGNS ARE NOT IN PLACE.

PLACE THIS SIGN ALONG WITH THE ADVANCE WORK ZONE SIGNING AS DEPICTED ON THE APPROPRIATE TYPICAL M0030a-M0080a.

PLACE THIS SIGN ALONG WITH THE ADVANCE WORK ZONE SIGNING AS DEPICTED ON THE APPROPRIATE TYPICAL M0030a-M0080a.

**MDOT**  
 Michigan Department of Transportation  
 TRAFFIC AND SAFETY  
 MAINTAINING TRAFFIC  
 TYPICAL

TYPICAL TEMPORARY TRAFFIC CONTROL  
 FOR A SHOULDER CLOSURE ON A TWO  
 LANE TWO-WAY ROADWAY  
 NO SPEED REDUCTION

APX - C-7  
 NOT TO SCALE

DRAWN BY: CON:AE:djf  
 CHECKED BY: BMM:CRB

OCTOBER 2011  
 PLAN DATE:

M0110a

SHEET  
 1 OF 2

FILE: PW RD/TS/Typicals/Signs/MT NON FWY/M0110a.dgn REV. 10/04/2011

## NOTES

1. D = DISTANCE BETWEEN TRAFFIC CONTROL DEVICES  
 $1/3 L$  = MINIMUM LENGTH OF TAPER  
 B = LENGTH OF LONGITUDINAL BUFFER  
 SEE M0020a FOR "D," "L," AND "B" VALUES
2. ALL NON-APPLICABLE SIGNING WITHIN THE CIA SHALL BE MODIFIED TO FIT CONDITIONS, COVERED OR REMOVED.
3. DISTANCES BETWEEN SIGNS, THE VALUES FOR WHICH ARE SHOWN IN TABLE D, ARE APPROXIMATE AND MAY NEED ADJUSTING AS DIRECTED BY THE ENGINEER.
- 3A. THE "WORK ZONE BEGINS" (R5-18c) SIGN SHALL BE USED ONLY IN THE INITIAL SIGNING SEQUENCE IN THE WORK ZONE. SUBSEQUENT SEQUENCES IN THE SAME WORK ZONE SHALL OMIT THIS SIGN AND THE QUANTITIES SHALL BE ADJUSTED APPROPRIATELY.
- 4E. THE MAXIMUM RECOMMENDED DISTANCE(S) BETWEEN CHANNELIZING DEVICES SHOULD BE EQUAL IN FEET TO THE POSTED SPEED IN MILES PER HOUR ON TAPER(S) AND TWICE THE POSTED SPEED IN THE PARALLEL AREA(S).
5. FOR OVERNIGHT CLOSURES, TYPE III BARRICADES SHALL BE LIGHTED.
6. WHEN CALLED FOR IN THE FHWA ACCEPTANCE LETTER FOR THE SIGN SYSTEM SELECTED, THE TYPE A WARNING FLASHER, SHOWN ON THE WARNING SIGNS, SHALL BE POSITIONED ON THE SIDE OF THE SIGN NEAREST THE ROADWAY.
7. ALL TEMPORARY SIGNS, TYPE III BARRICADES, THEIR SUPPORT SYSTEMS AND LIGHTING REQUIREMENTS SHALL MEET NCHRP 350 CRASHWORTHLY REQUIREMENTS STIPULATED IN THE CURRENT EDITION OF THE MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION, THE STANDARD PLANS AND APPLICABLE SPECIAL PROVISIONS. ONLY DESIGNS AND MATERIALS APPROVED BY MDOT WILL BE ALLOWED.
8. WHEN BUFFER AREAS ARE ESTABLISHED, THERE SHALL BE NO EQUIPMENT OR MATERIALS STORED OR WORK CONDUCTED IN THE BUFFER AREA.
- 29A. THE TYPE OF REFLECTIVE SHEETING USED FOR THE W20-1a PLAQUE SHALL BE THE SAME AS THE TYPE USED FOR THE PARENT SIGN.

### SIGN SIZES

DIAMOND WARNING	- 48" x 48"
W20-1a PLAQUE	- 48" x 36"
R2-1 REGULATORY	- 48" x 60"
R5-18c REGULATORY	- 48" x 48"

APX - C-8

NOT TO SCALE

 TRAFFIC AND SAFETY MAINTAINING TRAFFIC TYPICAL	TYPICAL TEMPORARY TRAFFIC CONTROL FOR A SHOULDER CLOSURE ON A TWO LANE TWO-WAY ROADWAY NO SPEED REDUCTION
DRAWN BY: CON:AE:djf CHECKED BY: BMM:CRB	OCTOBER 2011 PLAN DATE:
FILE: PW RD/TS/Typicals/Signs/MT NON FWY/M0110a.dgn REV. 10/04/2011	M0110a SHEET 2 OF 2

PLACE THROUGHOUT WORK AREA AS INDICATED AND AFTER ALL MAJOR CROSSROADS IF PERMANENT SIGNS ARE NOT IN PLACE.

PLACE THIS SIGN ALONG WITH THE ADVANCE WORK ZONE SIGNING AS DEPICTED ON THE APPROPRIATE TYPICAL M0030a-M0080a.

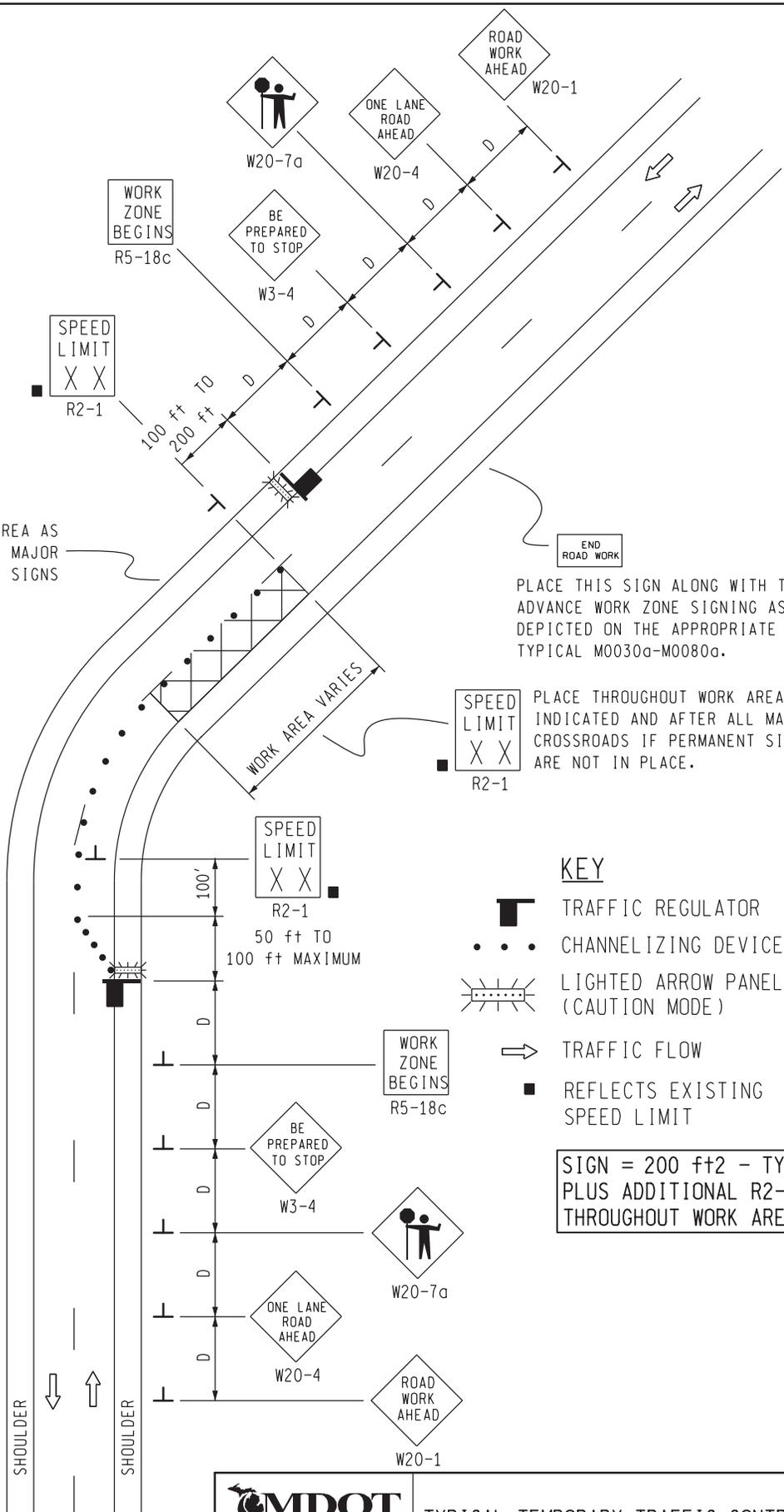
PLACE THROUGHOUT WORK AREA AS INDICATED AND AFTER ALL MAJOR CROSSROADS IF PERMANENT SIGNS ARE NOT IN PLACE.

PLACE THIS SIGN ALONG WITH THE ADVANCE WORK ZONE SIGNING AS DEPICTED ON THE APPROPRIATE TYPICAL M0030a-M0080a.

**KEY**

-  TRAFFIC REGULATOR
-  CHANNELIZING DEVICES
-  LIGHTED ARROW PANEL (CAUTION MODE)
-  TRAFFIC FLOW
-  REFLECTS EXISTING SPEED LIMIT

SIGN = 200 ft± - TYPE B PLUS ADDITIONAL R2-1's THROUGHOUT WORK AREA



**MDOT**  
Michigan Department of Transportation  
TRAFFIC AND SAFETY  
MAINTAINING TRAFFIC  
TYPICAL

TYPICAL TEMPORARY TRAFFIC CONTROL FOR A TWO-LANE TWO-WAY ROADWAY WHERE ONE LANE IS CLOSED UTILIZING TRAFFIC REGULATORS, NO SPEED REDUCTION

DRAWN BY: CON:AE:djf  
CHECKED BY: BMM:CRB

OCTOBER 2011  
PLAN DATE:

M0140a

SHEET  
1 OF 2

APX - C-9  
NOT TO SCALE

## NOTES

- 1H. D = DISTANCE BETWEEN TRAFFIC CONTROL DEVICES AND LENGTH OF LONGITUDINAL BUFFERS  
SEE **M0020a** FOR "D" VALUES.
2. ALL NON-APPLICABLE SIGNING WITHIN THE CIA SHALL BE MODIFIED TO FIT CONDITIONS, COVERED OR REMOVED.
3. DISTANCES BETWEEN SIGNS, THE VALUES FOR WHICH ARE SHOWN IN TABLE D, ARE APPROXIMATE AND MAY NEED ADJUSTING AS DIRECTED BY THE ENGINEER.
- 3A. THE "WORK ZONE BEGINS" (R5-18c) SIGN SHALL BE USED ONLY IN THE INITIAL SIGNING SEQUENCE IN THE WORK ZONE. SUBSEQUENT SEQUENCES IN THE SAME WORK ZONE SHALL OMIT THIS SIGN AND THE QUANTITIES SHALL BE ADJUSTED APPROPRIATELY.
- 4A. THE MAXIMUM RECOMMENDED DISTANCE(S) BETWEEN CHANNELIZING DEVICES IN THE TAPER AREA(S) SHOULD BE 15 FEET AND SHOULD BE EQUAL IN FEET TO TWICE THE POSTED SPEED IN MILES PER HOUR IN THE PARALLEL AREA(S).
5. FOR OVERNIGHT CLOSURES, TYPE III BARRICADES SHALL BE LIGHTED.
6. WHEN CALLED FOR IN THE FHWA ACCEPTANCE LETTER FOR THE SIGN SYSTEM SELECTED, THE TYPE A WARNING FLASHER, SHOWN ON THE WARNING SIGNS, SHALL BE POSITIONED ON THE SIDE OF THE SIGN NEAREST THE ROADWAY.
7. ALL TEMPORARY SIGNS, TYPE III BARRICADES, THEIR SUPPORT SYSTEMS AND LIGHTING REQUIREMENTS SHALL MEET NCHRP 350 CRASHWORTHLY REQUIREMENTS STIPULATED IN THE CURRENT EDITION OF THE MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION, THE STANDARD PLANS AND APPLICABLE SPECIAL PROVISIONS. ONLY DESIGNS AND MATERIALS APPROVED BY MDOT WILL BE ALLOWED.
9. ALL TRAFFIC REGULATORS SHALL BE PROPERLY TRAINED AND SUPERVISED.
- 9A. IN ANY OPERATION INVOLVING MORE THAN ONE TRAFFIC REGULATOR, ONE PERSON SHOULD BE DESIGNATED AS HEAD TRAFFIC REGULATOR.
10. ALL TRAFFIC REGULATORS' CONDUCT, THEIR EQUIPMENT, AND TRAFFIC REGULATING PROCEDURES SHALL CONFORM TO THE CURRENT EDITION OF THE MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MMUTCD) AND THE CURRENT EDITION OF THE MDOT HANDBOOK ENTITLED "TRAFFIC REGULATORS INSTRUCTION MANUAL."
11. WHEN TRAFFIC REGULATING IS ALLOWED DURING THE HOURS OF DARKNESS, APPROPRIATE LIGHTING SHALL BE PROVIDED TO SUFFICIENTLY ILLUMINATE THE TRAFFIC REGULATOR'S STATIONS.
- 12E. THE MAXIMUM DISTANCE BETWEEN THE TRAFFIC REGULATORS SHALL BE NO MORE THAN 2 MILES IN LENGTH UNLESS RESTRICTED FURTHER IN THE SPECIAL PROVISIONS FOR MAINTAINING TRAFFIC. ALL SEQUENCES OF MORE THAN 2 MILES IN LENGTH WILL REQUIRE WRITTEN PERMISSION FROM THE ENGINEER BEFORE PROCEEDING.
13. WHEN INTERSECTING ROADS OR SIGNIFICANT TRAFFIC GENERATORS (SHOPPING CENTERS, MOBILE HOME PARKS, ETC.) OCCUR WITHIN THE ONE-LANE TWO-WAY OPERATION, INTERMEDIATE TRAFFIC REGULATORS AND APPROPRIATE SIGNING SHALL BE PLACED AT THESE LOCATIONS.
14. ADDITIONAL SIGNING AND/OR ELONGATED SIGNING SEQUENCES SHOULD BE USED WHEN TRAFFIC VOLUMES ARE SIGNIFICANT ENOUGH TO CREATE BACKUPS BEYOND THE W3-4 SIGNS.
15. THE HAND HELD (PADDLE) SIGNS REQUIRED BY THE MMUTCD TO CONTROL TRAFFIC WILL BE PAID FOR AS PART OF FLAG CONTROL.
- 28E. THE TRAFFIC REGULATORS SHOULD BE POSITIONED AT OR NEAR THE SIDE OF THE ROAD SO THAT THEY ARE SEEN CLEARLY AT A MINIMUM DISTANCE OF 500 FEET. THIS MAY REQUIRE EXTENDING THE BEGINNING OF THE LANE CLOSURE TO OVERCOME VIEWING PROBLEMS CAUSED BY HILLS AND CURVES.

### SIGN SIZES

DIAMOND WARNING - 48" x 48"  
R2-1 REGULATORY - 48" x 60"  
R5-18c REGULATORY - 48" x 48"

**APX - C-10**

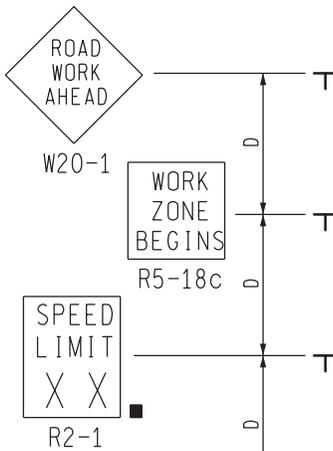
**NOT TO SCALE**

 <b>TRAFFIC AND SAFETY</b> <b>MAINTAINING TRAFFIC</b> <b>TYPICAL</b>	<b>TYPICAL TEMPORARY TRAFFIC CONTROL FOR  A TWO-LANE TWO-WAY ROADWAY WHERE ONE  LANE IS CLOSED UTILIZING TRAFFIC  REGULATORS, NO SPEED REDUCTION</b>		
	DRAWN BY: CON:AE:djf	OCTOBER 2011	<b>M0140a</b>
CHECKED BY: BMM:CRB	PLAN DATE:	SHEET 2 OF 2	
FILE: PW RD/TS/Typicals/Signs/MT NON FWY/M0140a.dgn REV. 10/04/2011			

**KEY**

- • • CHANNELIZING DEVICES
- ⚡ LIGHTED ARROW PANEL
- ➡ TRAFFIC FLOW
- REFLECTS EXISTING SPEED LIMIT

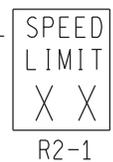
SIGN = 136 ft±2 - TYPE B PLUS ADDITIONAL R2-1's THROUGHOUT WORK AREA



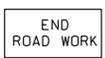
END ROAD WORK  
PLACE THIS SIGN ALONG WITH THE ADVANCE WORK ZONE SIGNING AS DEPICTED ON THE APPROPRIATE TYPICAL M0030a-M0080a.



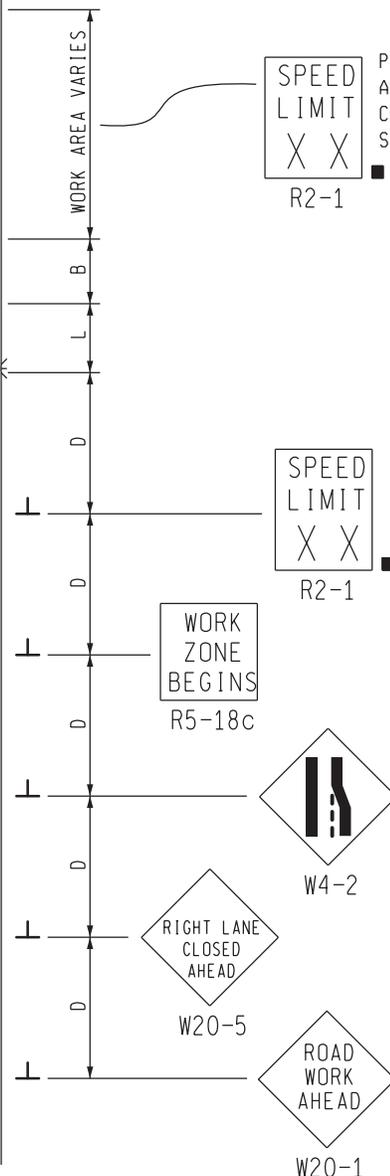
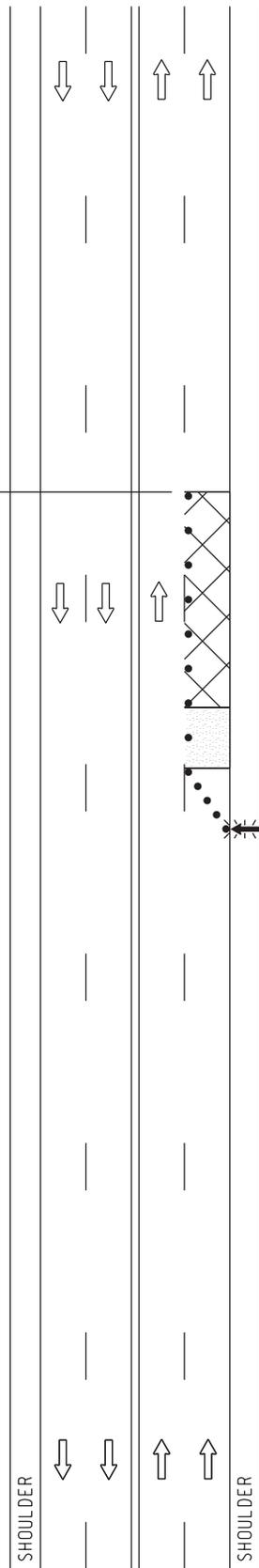
PLACE THROUGHOUT WORK AREA AS INDICATED AND AFTER ALL MAJOR CROSSROADS IF PERMANENT SIGNS ARE NOT IN PLACE.



PLACE THROUGHOUT WORK AREA AS INDICATED AND AFTER ALL CROSSROADS IF PERMANENT SIGNS ARE NOT IN PLACE.



PLACE THIS SIGN ALONG WITH THE ADVANCE WORK ZONE SIGNING AS DEPICTED ON THE APPROPRIATE TYPICAL M0030a-M0080a.



**MDOT**  
Michigan Department of Transportation  
TRAFFIC AND SAFETY  
MAINTAINING TRAFFIC  
TYPICAL

TYPICAL TEMPORARY TRAFFIC CONTROL  
FOR A ONE-LANE CLOSURE ON AN  
UNDIVIDED MULTI-LANE ROADWAY,  
NO SPEED REDUCTION

APX - C-11  
NOT TO SCALE

DRAWN BY: CON:AE:djf	OCTOBER 2011	M0240a	SHEET 1 OF 2
CHECKED BY: BMM:CRB	PLAN DATE:		
FILE: PW RD/TS/Typicals/Signs/MT NON FWY/M0240a.dgn REV.		10/11/2011	

## NOTES

- 1B. D = DISTANCE BETWEEN TRAFFIC CONTROL DEVICES  
L = MINIMUM LENGTH OF TAPER  
B = LENGTH OF LONGITUDINAL BUFFER  
SEE **M0020a** FOR "D," "L," AND "B" VALUES
2. ALL NON-APPLICABLE SIGNING WITHIN THE CIA SHALL BE MODIFIED TO FIT CONDITIONS, COVERED OR REMOVED.
3. DISTANCES BETWEEN SIGNS, THE VALUES FOR WHICH ARE SHOWN IN TABLE D, ARE APPROXIMATE AND MAY NEED ADJUSTING AS DIRECTED BY THE ENGINEER.
- 3A. THE "WORK ZONE BEGINS" (R5-18c) SIGN SHALL BE USED ONLY IN THE INITIAL SIGNING SEQUENCE IN THE WORK ZONE. SUBSEQUENT SEQUENCES IN THE SAME WORK ZONE SHALL OMIT THIS SIGN AND THE QUANTITIES SHALL BE ADJUSTED APPROPRIATELY.
- 4E. THE MAXIMUM RECOMMENDED DISTANCE(S) BETWEEN CHANNELIZING DEVICES SHOULD BE EQUAL IN FEET TO THE POSTED SPEED IN MILES PER HOUR ON TAPER(S) AND TWICE THE POSTED SPEED IN THE PARALLEL AREA(S).
5. FOR OVERNIGHT CLOSURES, TYPE III BARRICADES SHALL BE LIGHTED.
6. WHEN CALLED FOR IN THE FHWA ACCEPTANCE LETTER FOR THE SIGN SYSTEM SELECTED, THE TYPE A WARNING FLASHER, SHOWN ON THE WARNING SIGNS, SHALL BE POSITIONED ON THE SIDE OF THE SIGN NEAREST THE ROADWAY.
7. ALL TEMPORARY SIGNS, TYPE III BARRICADES, THEIR SUPPORT SYSTEMS AND LIGHTING REQUIREMENTS SHALL MEET NCHRP 350 CRASHWORTHLY REQUIREMENTS STIPULATED IN THE CURRENT EDITION OF THE MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION, THE STANDARD PLANS AND APPLICABLE SPECIAL PROVISIONS. ONLY DESIGNS AND MATERIALS APPROVED BY MDOT WILL BE ALLOWED.
8. WHEN BUFFER AREAS ARE ESTABLISHED, THERE SHALL BE NO EQUIPMENT OR MATERIALS STORED OR WORK CONDUCTED IN THE BUFFER AREA.
21. ALL EXISTING PAVEMENT MARKINGS WHICH ARE IN CONFLICT WITH EITHER PROPOSED CHANGES IN TRAFFIC PATTERNS OR PROPOSED TEMPORARY TRAFFIC MARKINGS, SHALL BE REMOVED BEFORE ANY CHANGE IS MADE IN THE TRAFFIC PATTERN. EXCEPTION WILL BE MADE FOR DAYTIME-ONLY TRAFFIC PATTERNS THAT ARE ADEQUATELY DELINEATED BY OTHER TRAFFIC CONTROL DEVICES.
26. THE LIGHTED ARROW PANEL SHALL BE LOCATED AT THE BEGINNING OF THE TAPER AS SHOWN. WHEN PHYSICAL LIMITATIONS RESTRICT ITS PLACEMENT AS INDICATED, THEN IT SHALL BE PLACED AS CLOSE TO THE BEGINNING OF THE TAPER AS POSSIBLE.

### SIGN SIZES

DIAMOND WARNING - 48" x 48"  
R2-1 REGULATORY - 48" x 60"  
R5-18c REGULATORY - 48" x 48"

**APX - C-12**

**NOT TO SCALE**

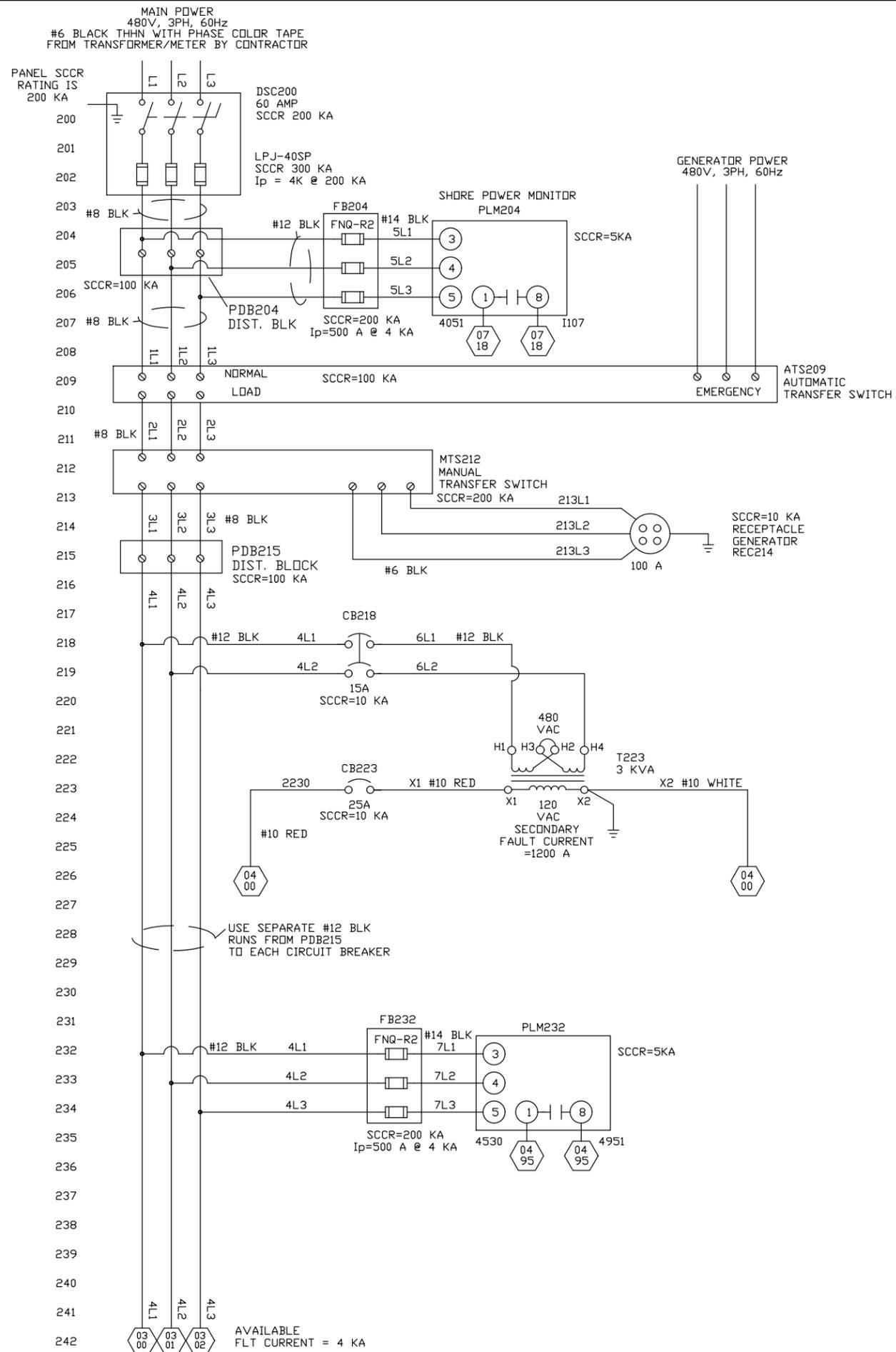
 <b>MDOT</b> Michigan Department of Transportation TRAFFIC AND SAFETY MAINTAINING TRAFFIC TYPICAL	TYPICAL TEMPORARY TRAFFIC CONTROL FOR A ONE-LANE CLOSURE ON AN UNDIVIDED MULTI-LANE ROADWAY, NO SPEED REDUCTION		
	DRAWN BY: CON:AE:djf	OCTOBER 2011	<b>M0240a</b>
CHECKED BY: BMM:CRB	PLAN DATE:	2 OF 2	
FILE: PW RD/TS/Typicals/Signs/MT NON FWY/M0240a.dgn REV. 10/11/2011			



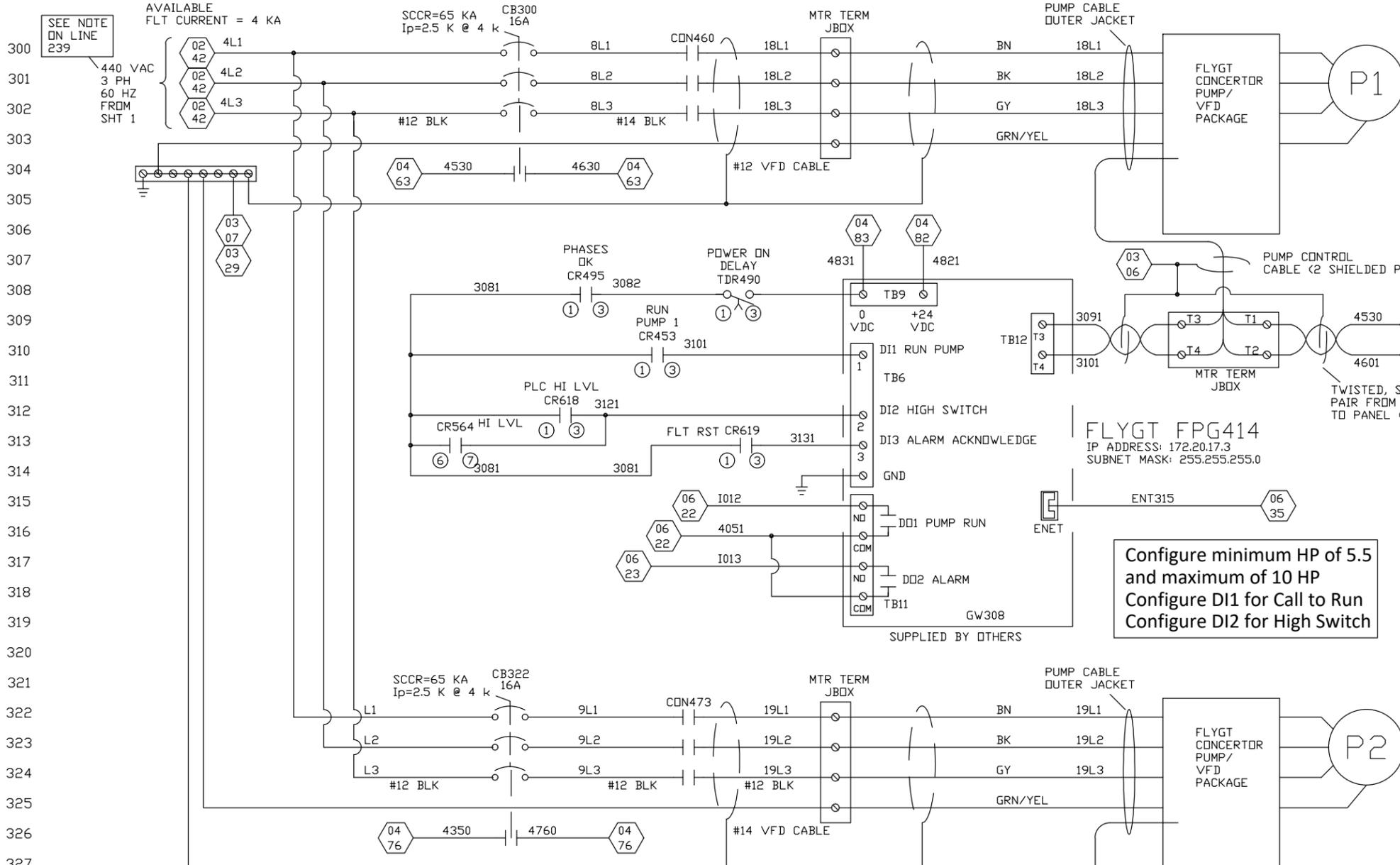
Meridian Township  
County Park Sewage Lift Station

SHEET NO.	DESCRIPTION
1	INDEX
2	480 VAC WIRING
3	VFD WIRING
4	120VAC WIRING
5	TELEMETRY POWER & FLOAT SW. WIRING
6	MICROLOGIX 1400 WIRING
7	INPUT WIRING
8	SPARE
9	PANEL LAYOUT - POWER DISTRIBUTION
10	PANEL LAYOUT - PLC AND CONTROLS
11	CONTROL PANEL BUTTON LAYOUT
12	STOCKLIST

IDC CORPORATION 5100 N. CANAL ROAD DIMONDALE, MI 48821		
FILE:13821-01.DWG		
JOB: 13821	DWG. TITLE	COUNTY PARK
DATE:09/14/23	SEWAGE LIFT	
DRAWN: KRB	SHT. TITLE	INDEX
CHECK: TAC		
SHOP	REV. □	SHT. 001 OF 012

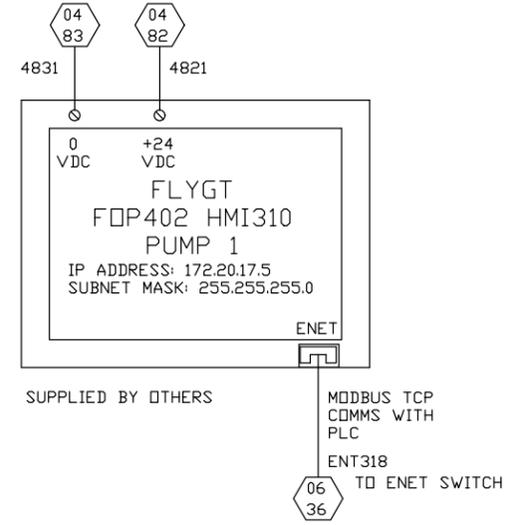


IDC CORPORATION 5100 N. CANAL ROAD DIMONDALE, MI 48821		
FILE:13821-02.DWG		
JOB: 13821	DWG. TITLE	COUNTY PARK
DATE:09/14/23	SEWAGE LIFT	
DRAWN: KRB	SHT. TITLE	3 PHASE POWER
CHECK: TAC	WIRING	
SHOP	REV. 2	SHT. 002 OF 012

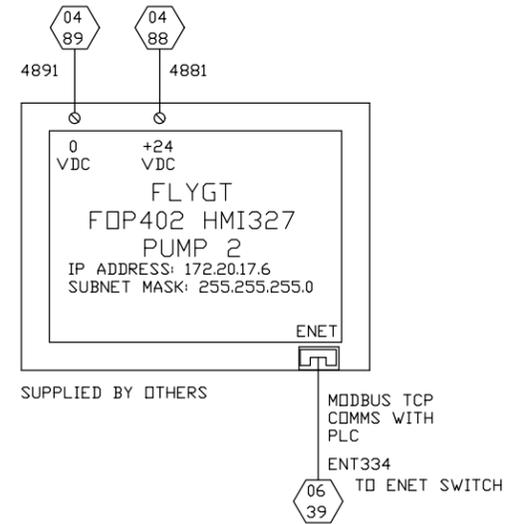


PUMP 1  
5.5 HP TO 10 HP 6.2 FLA TO 10.5 FLA

NOTE: ALL LEADS IN THE PUMP CABLES MUST BE PREPARED AND CONNECTED AS SPECIFIED IN THE FLYGT CONCERTOR INSTALLATION AND OPERATION MANUAL



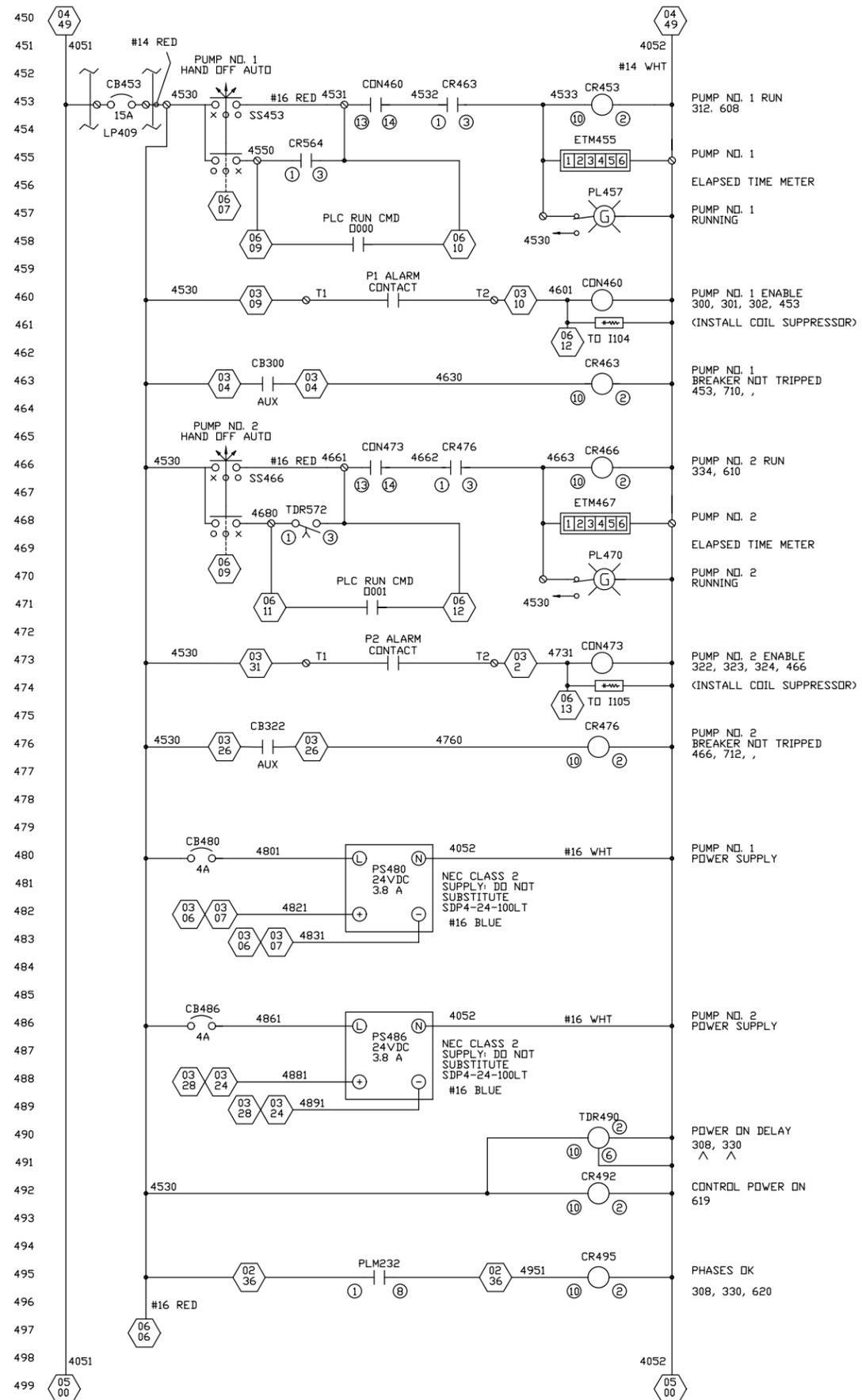
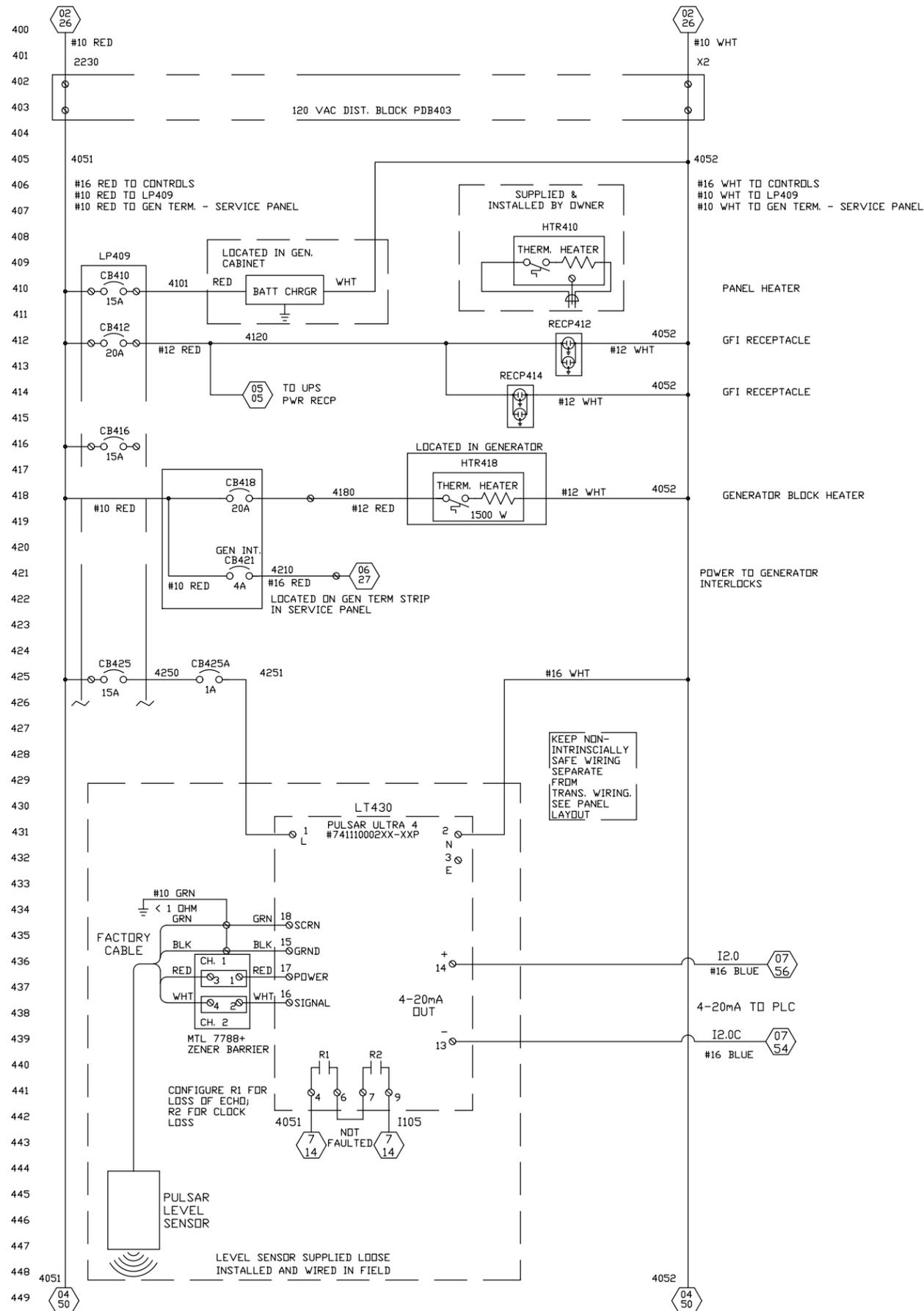
Configure minimum HP of 5.5 and maximum of 10 HP  
Configure DI1 for Call to Run  
Configure DI2 for High Switch



Configure minimum HP of 5.5 and maximum of 10 HP  
Configure DI1 for Call to Run  
Configure DI2 for High Switch

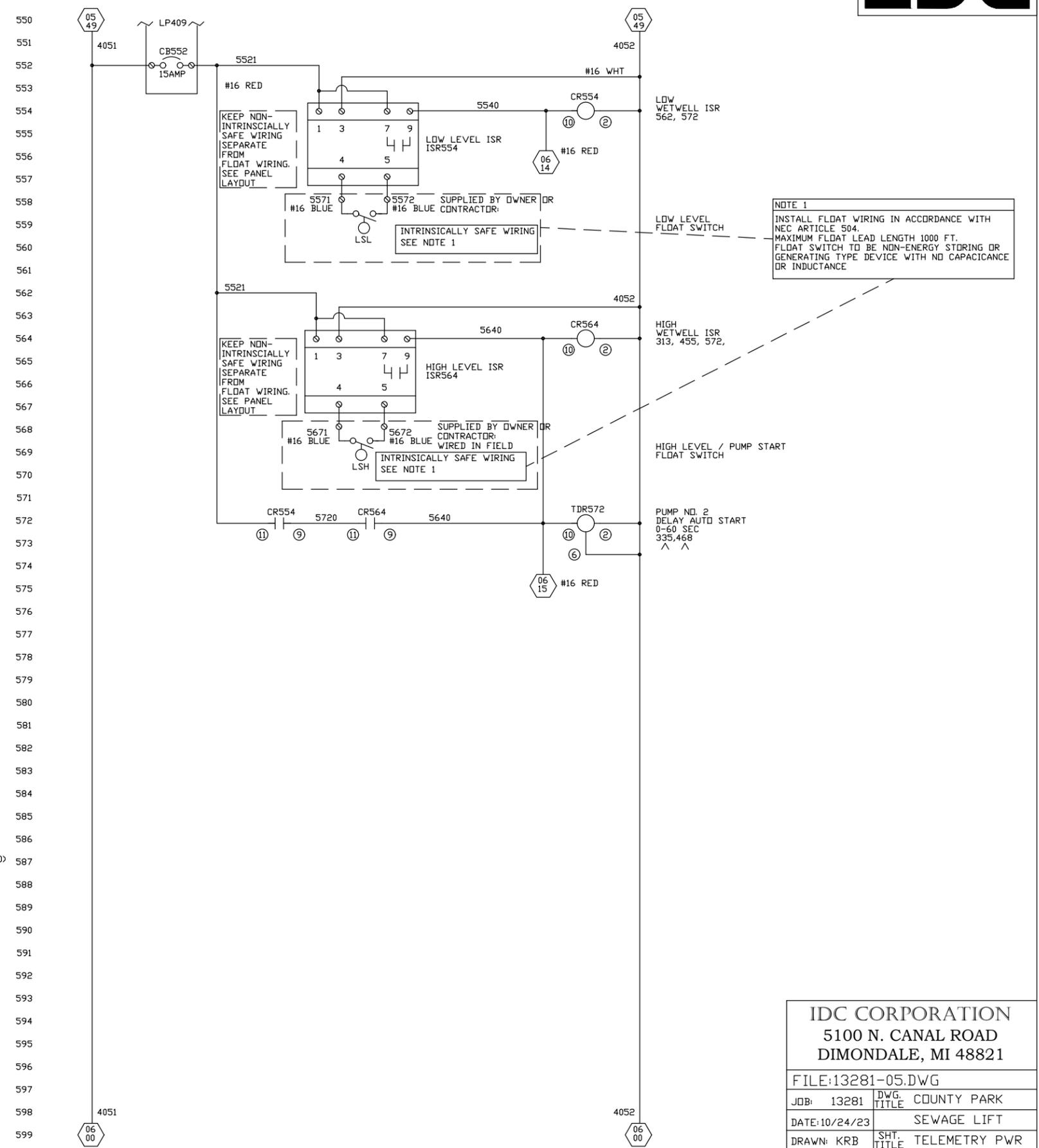
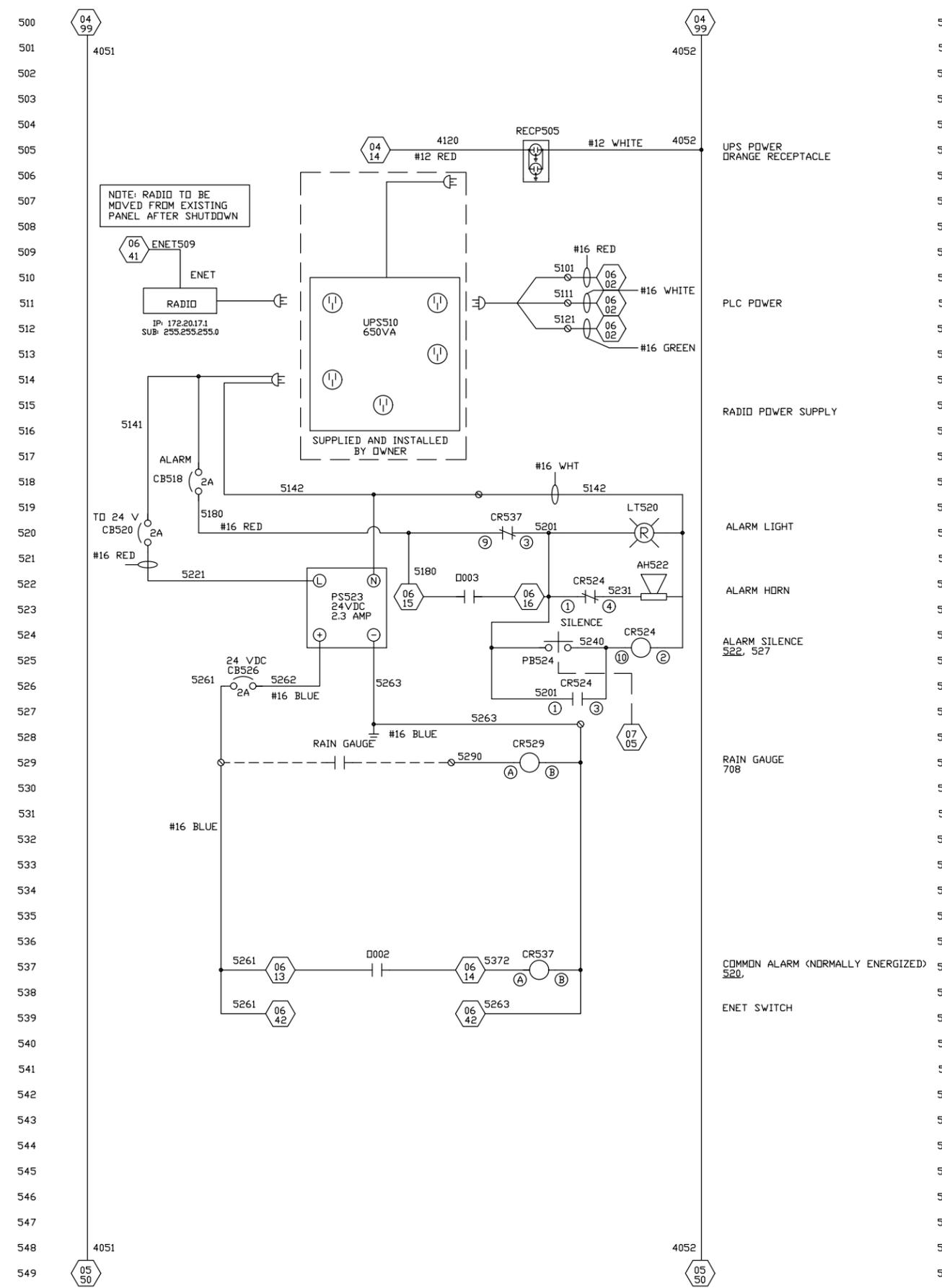
NOTE: MOTOR WIRING BETWEEN CONTACTORS AND REMOTE TERMINAL BOX MUST USE #12 AWG SHIELDED VFD CABLE

IDC CORPORATION	
5100 N. CANAL ROAD	
DIMONDALE, MI 48821	
FILE:13821-03.DWG	
JDB: 13821	DWG TITLE MERIDIAN TWP
DATE: 11/29/23	COUNTY PARK PUMP STA.
DRAWN: KRB	SHT. TITLE VFD WIRING
CHECK: TAC	
SHOP	REV. <input type="checkbox"/> SHT. 003 OF 012

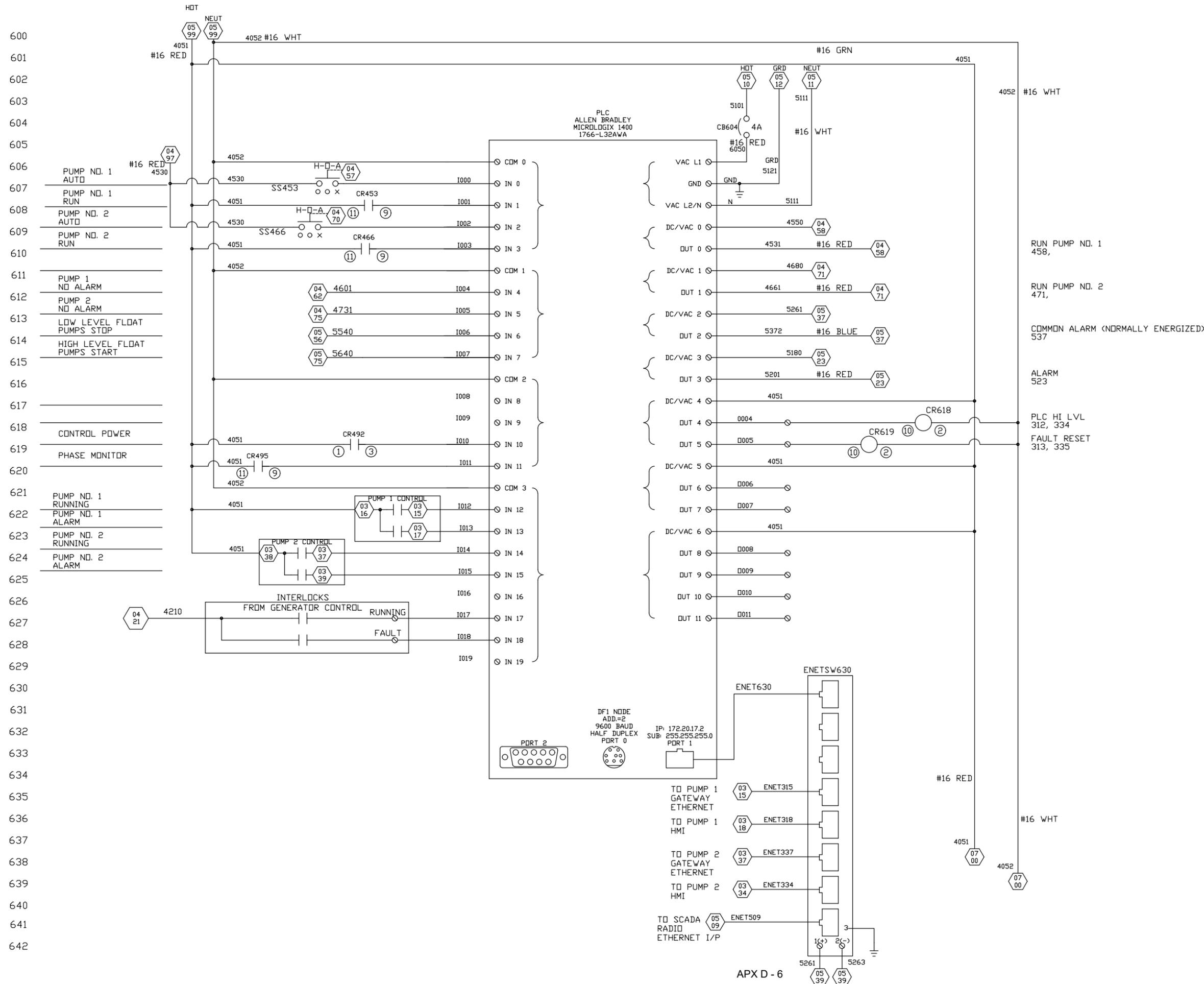


APX D - 4

IDC CORPORATION 5100 N. CANAL ROAD DIMONDALE, MI 48821	
FILE:13831-04.DWG	
JDB: 13831	DWG. TITLE COUNTY PARK
DATE: 12/5/23	SEWAGE LIFT
DRAWN: KRB	SHT. TITLE 120VAC POWER
CHECK: TAC	WIRING
SHOP	REV. □ SHT. 004 OF 012



IDC CORPORATION			
5100 N. CANAL ROAD			
DIMONDALE, MI 48821			
FILE:13281-05.DWG			
JOB: 13281	DWG. TITLE	COUNTY PARK	
DATE: 10/24/23	SEWAGE LIFT		
DRAWN: KRB	SHT. TITLE	TELEMETRY PWR	
CHECK: TAC	WIRING		
SHOP	REV. □	SHT. 005 OF 012	



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4052 #16 WHT

RUN PUMP NO. 1 458,

RUN PUMP NO. 2 471,

COMMON ALARM (NORMALLY ENERGIZED) 537

ALARM 523

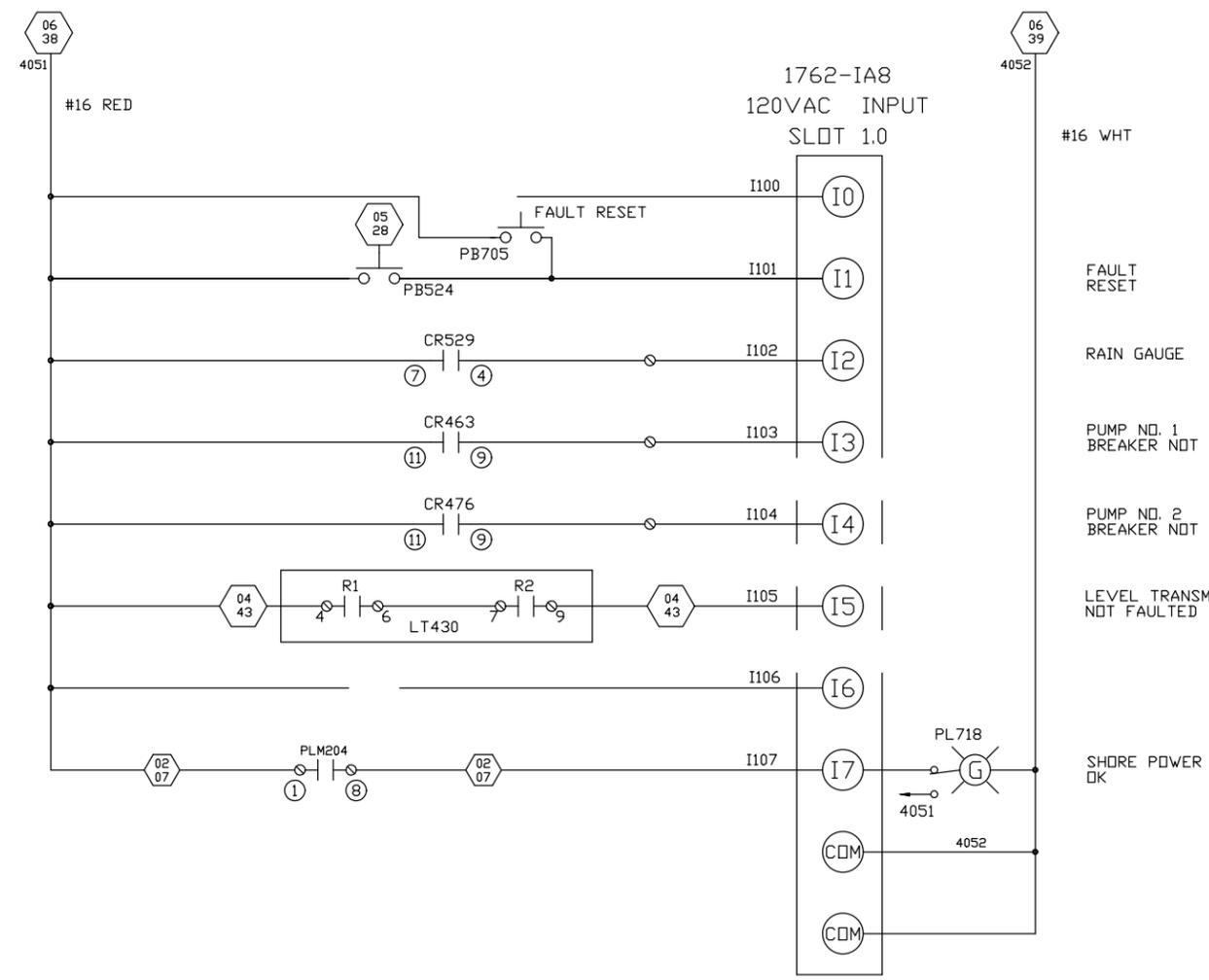
PLC HI LVL 312, 334

FAULT RESET 313, 335

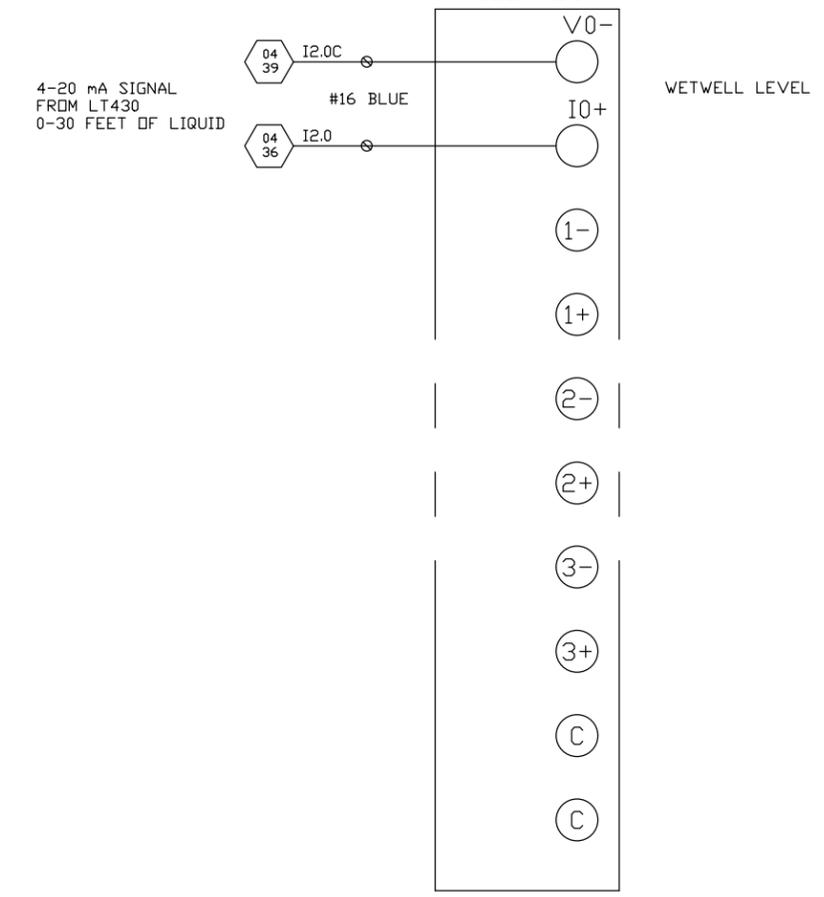
IDC CORPORATION	
5100 N. CANAL ROAD	
DIMONDALE, MI 48821	
FILE:13821-06.DWG	
JOB: 13821	DWG. TITLE COUNTY PARK
DATE: 11/28/23	SEWAGE LIFT
DRAWN: KRB	SHT. TITLE MICRO 1400
CHECK: TAC	WIRING
SHOP	REV. <input type="checkbox"/> SHT. 006 OF 012



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<b>IDC CORPORATION</b> 5100 N. CANAL ROAD DIMONDALE, MI 48821	
FILE:13821-07.DWG	
JOB: 13821	DWG. TITLE: MERIDIAN TWP
DATE:12/05/23	COUNTY PARK PUMP STA.
DRAWN: KRB	SHT. TITLE: MICROLOGIX 1400
CHECK: TAC	INPUT WIRING
SHOP	REV. <input type="checkbox"/> SHT. 007, OF 012



INSTALL DRIP KIT PER MANUFACTUER'S INSTRUCTIONS

SERVICE ENTRANCE SEE DWG SHT 13821-11 FOR CONNECTIONS BETWEEN LEVEL CONTROL AND SERVICE ENTRANCE

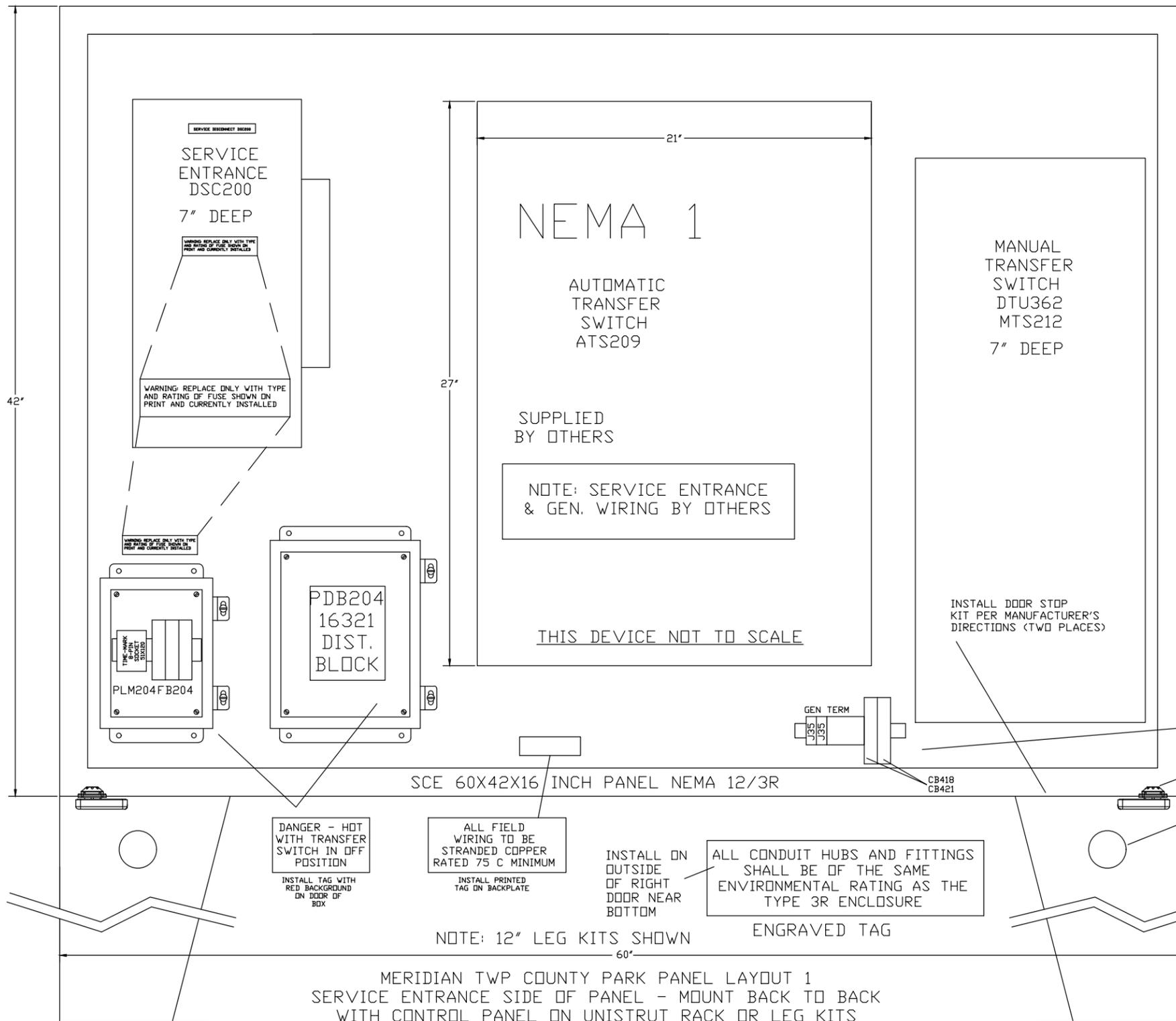
ENGRAVED TAG LOCATED ON DOOR OF EXTERIOR PANEL

COUNTY PARK SERVICE ENTRANCE PANEL

NOTE: ENCLOSURE EXTERIOR TO BE PAINTED RAL6021 GREEN

MANUFACTURED BY IDC CORPORATION  
UL FILE: E122737  
JOB #13821, SERIAL #13821, DWG SET #13821  
460 VAC, 3 PHASE, 60 HZ, 35 FLA  
LARGEST MOTOR 10 HP  
200 KA INTERRUPTING CAPACITY

INSTALL TAGS ON OUTSIDE PANEL DOOR



WIRING BETWEEN PANELS		
480 VAC		
Grd	#6 GRN	
3L1	#4 BLK	
3L2	#4 BLK	
3L3	#4 BLK	
120 VAC		
4052	#10 WHT	TO GEN TRM
4051	#10 RED	TO GEN TRM
I017	#16 RED	
I018	#16 RED	
I107	#16 RED	
SP1	#16 RED	
SP2	#16 RED	
SP3	#16 RED	
SP4	#16 RED	

INSTALL ON INSIDE OF L.H. EXTERIOR DOOR

PRINTED TERMINAL TORQUE TAG

REC214  
100 A

GEN INTERLOCK HARNESS	GEN POWER HARNESS
4101 #12 RED	PH1 #4 BLACK
4052 #12 WHT	PH2 #4 BLACK
4180 #12 RED	PH3 #4 BLACK
SPARE #16 RED	GRD #4 BLACK
4210 #16 RED	USE STANDARD COLOR TAPE
I017 #16 RED	BANDS TO MARK PHASING
I018 #16 RED	
SPARE #16 RED	
SUPPLIED AND INSTALLED BY CONTRACTOR	SUPPLIED AND INSTALLED BY CONTRACTOR

GEN TERM SPARE  
4052  
4180 (CB)  
4210 (CB)  
I017  
I018  
4101  
SPARE

DANGER - HOT WITH TRANSFER SWITCH IN OFF POSITION  
INSTALL TAG WITH RED BACKGROUND ON DOOR OF BOX

ALL FIELD WIRING TO BE STRANDED COPPER RATED 75 C MINIMUM  
INSTALL PRINTED TAG ON BACKPLATE

INSTALL ON OUTSIDE OF RIGHT DOOR NEAR BOTTOM

ALL CONDUIT HUBS AND FITTINGS SHALL BE OF THE SAME ENVIRONMENTAL RATING AS THE TYPE 3R ENCLOSURE

INSTALL DRAIN/BREATHER TWD PLACES.

CONDUIT THROUGH LEGS. (TYP.)

SCE 60X42X16 INCH PANEL NEMA 12/3R

GEN TERM  
CB418  
CB421

INSTALL DOOR STOP KIT PER MANUFACTURER'S DIRECTIONS (TWO PLACES)

NOTE: SERVICE ENTRANCE & GEN. WIRING BY OTHERS

AUTOMATIC TRANSFER SWITCH  
ATS209

MANUAL TRANSFER SWITCH  
DTU362  
MTS212  
7" DEEP

NEMA 1

SERVICE ENTRANCE  
DSC200  
7" DEEP

WARNING: REPLACE ONLY WITH TYPE AND RATING OF FUSE SHOWN ON PRINT AND CURRENTLY INSTALLED

WARNING: REPLACE ONLY WITH TYPE AND RATING OF FUSE SHOWN ON PRINT AND CURRENTLY INSTALLED

WARNING: REPLACE ONLY WITH TYPE AND RATING OF FUSE SHOWN ON PRINT AND CURRENTLY INSTALLED

PDB204  
16321  
DIST. BLOCK

PLM204FB204

NOTE: 12" LEG KITS SHOWN

MERIDIAN TWP COUNTY PARK PANEL LAYOUT 1  
SERVICE ENTRANCE SIDE OF PANEL - MOUNT BACK TO BACK WITH CONTROL PANEL ON UNISTRUT RACK OR LEG KITS

IDC CORPORATION 5100 N. CANAL ROAD DIMONDALE, MI 48821		
FILE:13281-09.DWG		
JOB: 13281	DWG. TITLE	COUNTY PARK
DATE:12/05/23	SEWAGE LIFT	
DRAWN: KRB	SHT. TITLE	PANEL LAYOUT
CHECK: TAC	PWR DISTRIBUTION	
SHOP	REV. □	SHT. 002 OF 012



INSTALL DRIP KIT PER MANUFACTURER'S INSTRUCTIONS

LABEL LEFT HAND DOOR MOTOR CONTROLS

PRINTED TAG MOUNTED NEAR FUSE BLOCK  
WARNING: REPLACE ONLY WITH TYPE AND RATING OF FUSE SHOWN ON PRINT AND CURRENTLY INSTALLED

ALARM LIGHT ON TOP OF ENCL.  
LT520

PUMP LTS & SS IN PANEL DOOR  
SEE SHEET 11

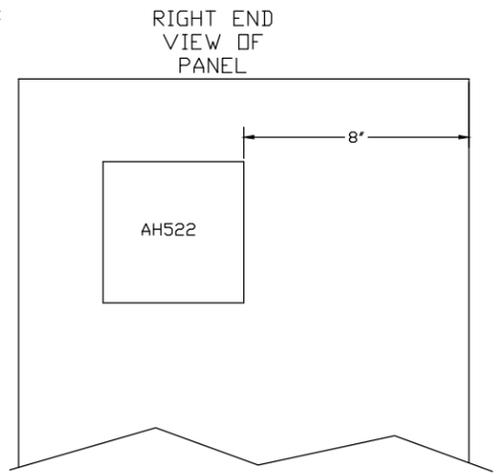
LEVEL CONTROL SECTION  
SEE DWG SHT 13821-9 FOR CONNECTIONS BETWEEN LEVEL CONTROL AND SERVICE ENTRANCE

ENGRAVED TAG LOCATED ON DOOR OF EXTERIOR PANEL

NOTE: ENCLOSURE EXTERIOR TO BE PAINTED RAL6021 GREEN

- 120 VAC TERM LIST
- 4051 3141
- 4051 3351
- 4052 3361
- 4052 5261
- 4052 5261
- 4052 5263
- 4120 5263
- 4120 5263
- 4180 5290
- 4470 SPARE
- 4530
- 4530
- 4531
- 4533
- 4550
- 4661
- 4663
- 4680
- GND
- 5142
- 5101
- 5111
- 5121
- 5201
- 5231
- 5240
- 5521
- 5640
- SPARE
- I000
- I001
- I002
- I003
- I004
- I005
- I006
- I007
- I008
- I009
- I010
- I011
- I012
- I013
- I014
- I015
- I016
- I017
- I018
- I019
- I100
- I101
- I102
- I103
- I104
- I105
- I106
- I107
- SPARE
- 004
- 005
- 006
- 007
- 008
- 009
- 0010
- 0011

- 24 VDC TERM LIST
- 3141
- 3351
- 3361
- SPARE
- 5261
- 5261
- 5263
- 5263
- 5290
- SPARE
- FLDAT TERM LIST
- 5571
- 5572
- 4663
- 4680
- 5142
- 5101
- 5111
- 5121
- 5201
- 5231
- 5240
- 5521
- 5640
- SPARE
- I000
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- 0010
- 0011



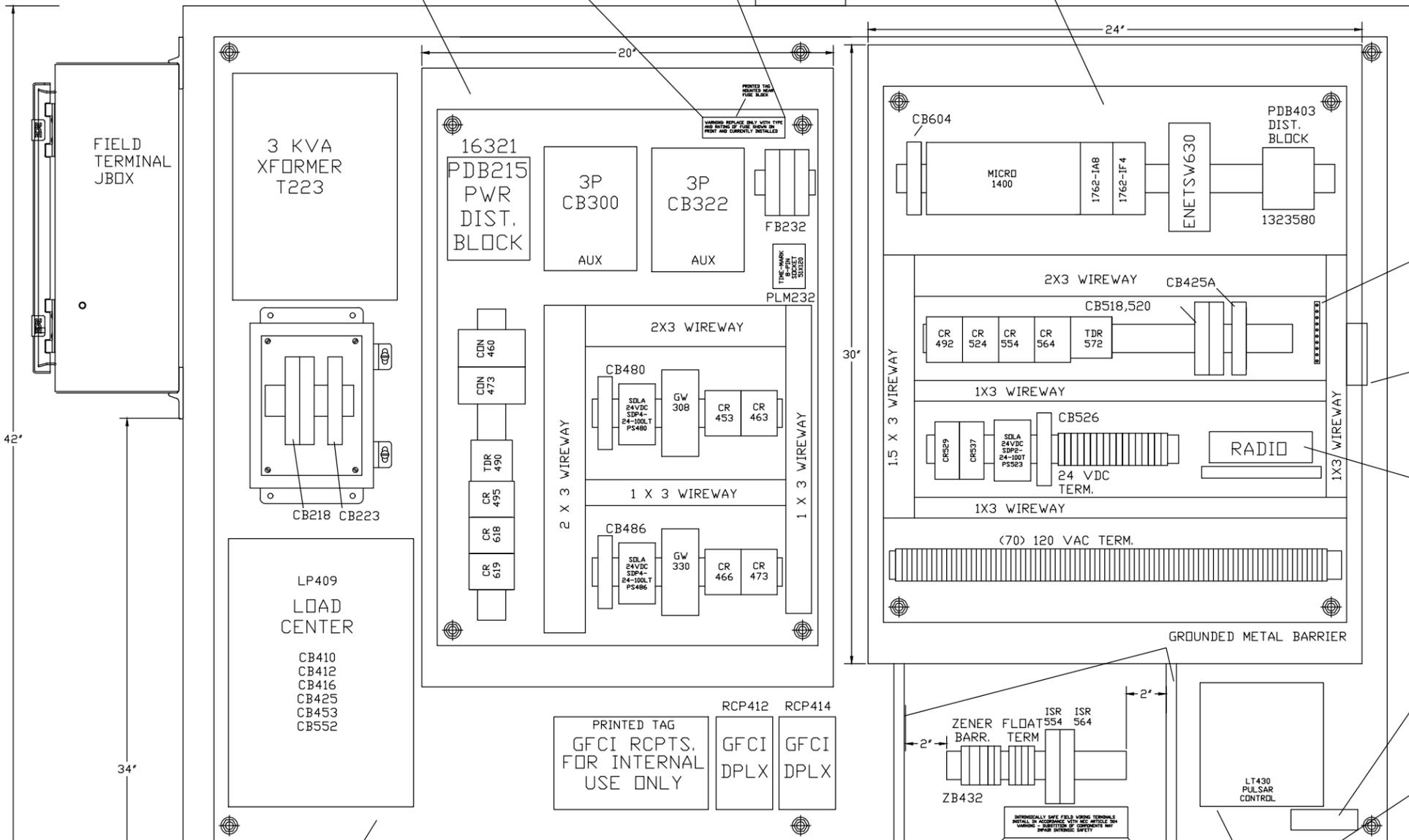
INSTALL ON INSIDE OF L.H. EXTERIOR DOOR

PRINTED TERMINAL TORQUE TAG

UPS510

HTR410

950 W HEATER & T'STAT



NOTE: SCRAPE PAINT UNDER BUS

GRD LUG/BUS

DRNG DPLX

DO NOT PLUG POWER TOOLS INTO THIS OUTLET

NOTE: RADIO TO BE MOVED INTO THIS PANEL FROM THE EXISTING PANEL AT THE SITE WHEN READY FOR OPERATION

ALL FIELD WIRING TO BE STRANDED COPPER RATED 75 C MINIMUM

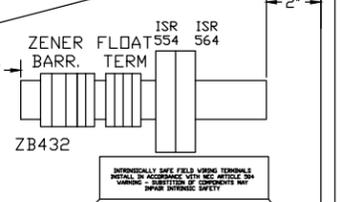
INSTALL PRINTED TAG ON BACKPLATE

INSTALL DOOR STOP KIT PER MANUFACTURER'S DIRECTIONS (TWO PLACES)

INSTALL DRAIN/BREATHER TWO PLACES.

CONDUIT THROUGH LEGS. (TYP.)

PRINTED TAG GFCI RCPTS. FOR INTERNAL USE ONLY  
RCP412 GFCI DPLX  
RCP414 GFCI DPLX



INTRINSICALLY SAFE FIELD WIRING TERMINALS INSTALL IN ACCORDANCE WITH NEC ARTICLE 504 WARNING - SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY

ALL CONDUIT HUBS AND FITTINGS SHALL BE OF THE SAME ENVIRONMENTAL RATING AS THE TYPE 3R ENCLOSURE

INSTALL ON OUTSIDE OF LEFT DOOR NEAR BOTTOM

ENGRAVED TAG NOTE: 12" LEG KITS SHOWN

PRINTED TAG: RED BACKGROUND W/ BLACK TEXT

MERIDIAN TWP COUNTY PARK PANEL LAYOUT 2 CONTROL SIDE OF PANEL - MOUNT BACK TO BACK WITH SERVICE ENTRANCE ON UNISTRUT RACK OR LEG KITS

WHITE BACKGROUND W/ BLACK TEXT

PROVIDES INTRINSICALLY SAFE CIRCUIT EXTENSIONS FOR USE IN CLASS I, GROUPS A,B,C & D HAZARDOUS LOCATIONS WHEN CONNECTED PER WIRING DIAGRAM, 13821 - SHTS 4 & 5 INCLUDED IN PANEL

RED BACKGROUND W/ WHITE TEXT

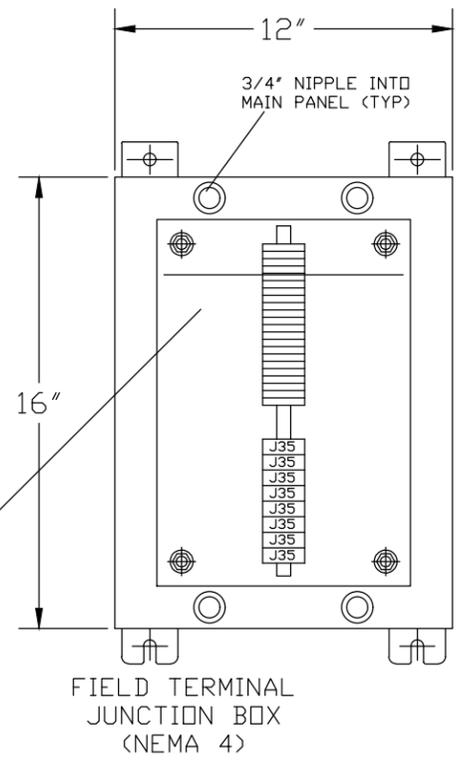
WARNING - TO PREVENT IGNITION OF FLAMMABLE GASES OR COMBUSTIBLE ATMOSPHERES, DISCONNECT POWER BEFORE SERVICING

INSTALL ON EXTERIOR DOOR

IDC CORPORATION	
5100 N. CANAL ROAD	
DIMONDALE, MI 48821	
FILE:13281-10.DWG	
JOB: 13281	DWG. COUNTY PARK
DATE: 11/01/23	SEWAGE LIFT
DRAWN: KRB	SHT. PANEL LAYOUT
CHECK: TAC	PLC AND CONTROLS
SHOP	REV. 2 SHT. 010 OF 012

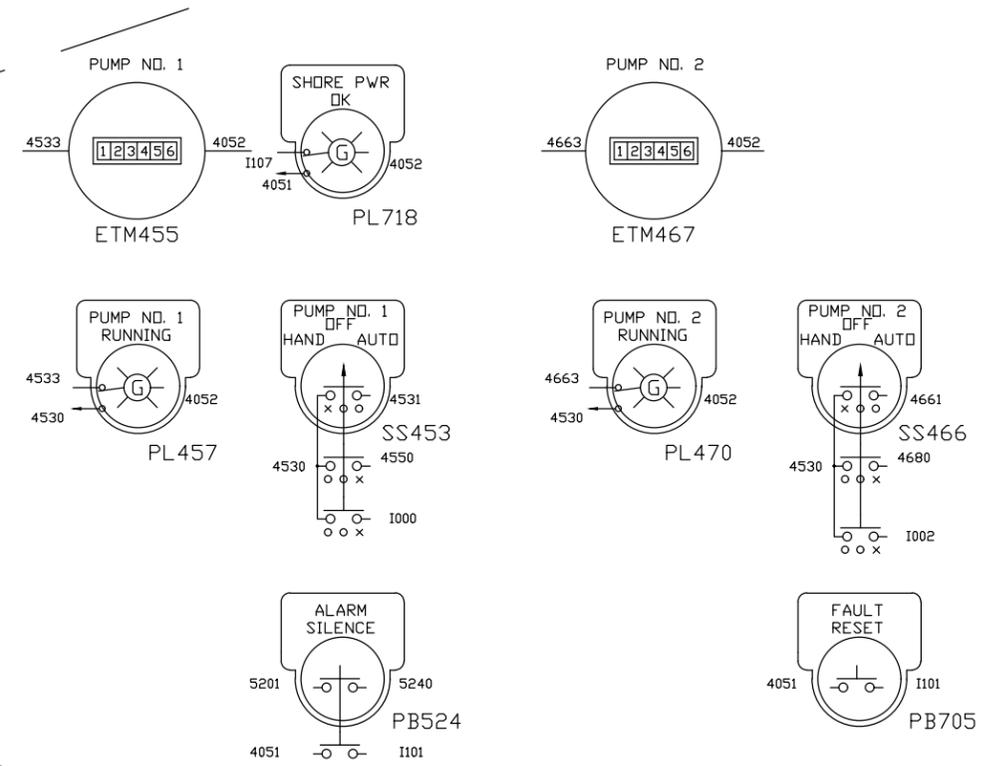
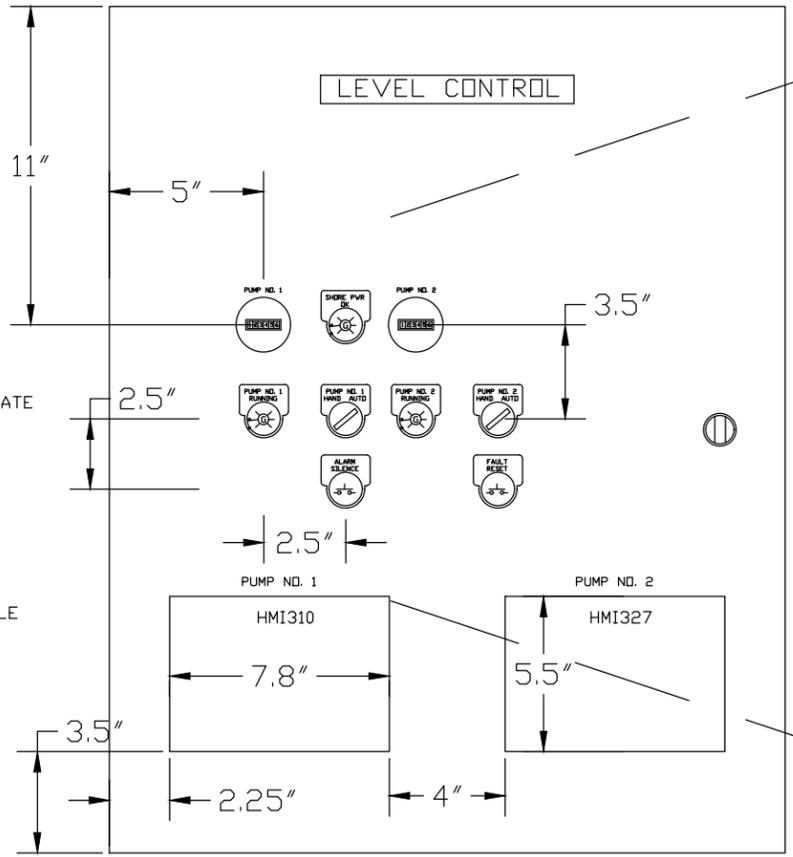
NOTE: ALL LEADS IN THE PUMP CABLES MUST BE PREPARED AND CONNECTED AS SPECIFIED IN THE FLYGT CONCERTOR INSTALLATION AND OPERATION MANUAL

LIGHTS AND BUTTONS IN INSIDE PANEL DOOR



- |         |  |
|---------|--|
| 4311    | } INTRINSICALLY SAFE - SEPARATE CONDUIT                        |
| 4321    |  |
| 5571    |  |
| 5572    |  |
| 5671    |  |
| 5672    | } 1492-HM1   |
| BARRIER |  |
| 3091    |  |
| 3101    |  |
| SHLD    |  |
| 3311    | } SHIELDED PAIR CABLES - SEPARATE CONDUIT                      |
| 3321    |  |
| SHLD    |  |
| 4530    |  |
| 4601    |  |
| 4530    | } 1492-J35   |
| 4731    |  |
| SHLD    |  |
| SPARE   |  |
| 1T1     |  |
| 1T2     | } MOTOR LEADS: VFD SHIELDED CABLE RUN THROUGH SEPARATE CONDUIT |
| 1T3     |  |
| GRD     |  |
| 2T1     | } 1492-J35   |
| 2T2     |  |
| 2T3     |  |
| GRD     |  |

INSTALL GROUNDED METAL BARRIER BETWEEN INTRINSICALLY SAFE TERMINALS & REMAINING TERMINALS ON STRIP



IDC CORPORATION 5100 N. CANAL ROAD DIMONDALE, MI 48821		
FILE:13821-11.DWG		
JOB: 13821	DWG. TITLE	COUNTY PARK
DATE: 11/07/23	SEWAGE LIFT	
DRAWN: KRB	SHT. TITLE	INTERIOR PANEL
CHECK: TAC	BUTTON LAYOUT	
SHOP	REV. □	SHT. 011 OF 012



Qty	Part #	Description	Designation
2	SCE-426016WFALP	Saginaw Controls dual rated 12/3R enclosure painted RAL6021	
2	SCE-60BFP42	Saginaw Controls Backplate (White)	
4	SCE-BVK	Saginaw Controls Breather Kit	
2	SCE-DS60N4	Saginaw Controls Drip Kit painted RAL6021	
2	SCE-FK1216	Saginaw Controls 12" Floor Stand Kit Painted RAL6021	
1		Paint setup charge	
4	SCE-DSTOPK	Saginaw Controls Door stop kit	
1	SCE-30EL2010LP	Saginaw Controls Enclosure Ansi 61 Gray	
1	SCE-30P20	Saginaw Controls Backplate (White)	
1	SCE-30EL2412LP	Saginaw Controls Enclosure Ansi 61 Gray	
1	SCE-30P24	Saginaw Controls Backplate (White)	
1	SCE-16H1206LP	Saginaw Controls Enclosure Painted RAL6021	
1	SCE-16P12	Saginaw Controls Backplate (White)	
2	D866IS	Hoffman Instrumentation Enclosure	
2	A8P6	Hoffman Backplate	
1	A10086CH	Hoffman CH box	
1	A10P8	Hoffman Backplate	
1	03059.9-00	Thermal Edge CR 030 950 W Heater 6.3 W x 7.2 L x 3.9 H	
1	H362N	Sq D 60 A Fusible Disconnect with viewing window	
1	GTK0610	Sq D Ground Kit	DSC200
1	DTU362	Sq. D transfer switch 60 A, 600 VAC, 3 phase	MTS212
1	SN0310	SQ D Solid Neutral assembly	MTS212
1	AR1041-S22	Crouse Hinds 100 A, 480 V, 4 wire Gen. Recp.	REC214
2	16321-3	Bussmann Power Distribution block	PDB204, PDP215
2	CPDB-3	Bussmann Power Distribution block cover	PDB204, PDP215
1	1323580	Marathon power distribution block	PDB403
1	CH1323	Marathon power distribution block cover	PDB403
1	80-1050	Dongan 3 KVA transformer (or Equiv)	T223
1	QO816L100S	Square D Load Center	LP409
5	QO115	Square D Circuit Breaker	CB410,416,425,453,552
1	QO120	Square D Circuit Breaker	CB412
1	PK7GTA	Square D Ground Kit	LP409
1	GBKP21	Eaton Ground Bar	
6	LPJ40SP	Bussmann 40 Amp fuses	DSC200
9	FNQ-R2	Buss Fuses	FB204,242
2	1492-FB3C30L	AB 3 pole fuseholder with indicator	FB204,242
2	A257B	Time Mark phase monitor	PLM204,242
2	5X120	Time Mark socket	PLM204,242
1	1489M-A1D200	AB Circuit Breaker (20 A)	CB418
5	1489M-A1C040	AB Circuit Breaker (4 A)	CB421,425A,480,486,604
3	1489M-A1C020	AB Circuit Breaker (2 A)	CB518,520,526
1	1489M-A2D150	AB Circuit Breaker ( 2 pole, 15 amp)	CB218
1	1489M-A1D250	AB Circuit Breaker (25 A)	CB223
2	140MT-D9E-C16	AB Motor Circuit Protection Circuit Breakers	CB300,322
2	140MT-CAFAR10A10	AB Aux Contacts 1 N.O. 1 N.O. closed only on trip	CB300,322
2	100-C30D10	AB 30 AMP CONTACTORS	CON460, 473
2	100-FSC280	AB Surge suppressors	CON460, 473

Qty	Part #	Description	Designation
16	1492-J35	AB motor terminals (#12-1/0 range)	
120	1492-HM1	AB Terminals	
3	199-DR1	AB terminal track	
4	1492-NM36	AB end barrier	
36	1492-EAHJ35	AB End Anchor	
11	700HA33A1-4	AB Relays	CR453,463,466,476,492,495,524,554,564,618,619
13	700HN101	AB Relay sockets	CR453,463,466,476,492,495,524,554,564,618,619,TDR490.572
2	700HR52TA17	AB Timer	TDR490.572
2	700-HB33Z24-4	AB Relays	CR529,537
2	700-HN154	AB Relay sockets	CR529,537
4	800FP-SM32PX10	AB 3 pos. Selector Switch	SS453,466
7	800F-X10	AB N.O. contact blocks	SS453,466,PB524
4	800F-X01	AB N.C. contact blocks	SS453,466
3	800FP-LF3	AB Green Illuminated PB	PL457,470,718
3	800F-PN3W	AB White LED with latch	PL457,470,718
2	800FP-F2	AB Black Pushbutton	PB524,705
2	800F-PX11	AB mounting latch - 1 N.O./1 N.C. contact	PB524,705
1	1766-L32AWA	AB Micro1400 PLC	
1	1762-IA8	AB input module	
1	1766-MM1	AB Memory Module	
1	1762-IF4	AB Analog Input Module	
1	1783-US8T	AB 8 port Stratix switch	ENETSW630
1	RL-3K-120 V	Ohio Electric Alarm Light	LT520
2	ISEUR1	Macromatic ISR relays (Grainger #55ER60)	ISR554,564
1	9620-13-11-10S	Stahl Intriinscally Safe Barrier	LT425
2	1492-JG4	AB Grounding terminals	LT425
1	SDP06-24-100T	Sola Power supply 24 VDC, 0.6 A NEC CLASS 2	PS425
2	SPD4-24-100LT	Sola Power Supply 24 VDC, 3.8 A NEC CLASS 2	PS480, 486
1	SDP2-24-100T	Sola Power supply	PS523
1	Back-UPS BE650G1 (Grainger #26NS8)	Neider Electric UPS	UPS510
1	876-N5	Edwards alarm horn	AH522
2	Grainger #36C757	Trumeter 711-0160 ETM	ETM455, 467
2	6720005422	Weidmuller GFCI outlet	RECP412,414
1	Grainger #5A075	Hubbell Orange Outlet	RECP505
1	CUT VFD 14/4	20' VFD Cable	
1	IS-B50LN-C2	Polyphaser Lightning Arrestor	

<b>IDC CORPORATION</b>			
5100 N. CANAL ROAD			
DIMONDALE, MI 48821			
FILE:13821-12.DWG			
JOB#:	13821	DWG. TITLE	TOWAR GARDENS
DATE:	11/07/23	SHT. TITLE	SEWAGE LIFT
DRAWN:	KRB	SHT. TITLE	STOCKLIST
CHECK:	TAC		
<i>SHOP</i>	REV. □	SHT. 012	OF 012

INSTALL A 1 1/2" WEATHERHEAD AT THE TOP END OF THE CONDUIT.

1 1/2" RIGID CONDUIT FOR ANTENNA, MOUNTED AT NORTHERN END OF PANELS AS DETERMINED BY RADIO AND TOWNSHIP ENGINEERS

EXTEND TOP UNISTRUT TO SUPPORT BRACKET FOR CONDUIT AT TOP OF OR ABOVE CONTROL PANEL. DO NOT PENETRATE THE ENCLOSURE IN THIS AREA.

SERVICE ENTRANCE, ETC.

LEVEL CONTROL, ETC.

ABOVE CURRENT SURFACE

57"

54"

ALARM HORN

EXISTING POWER METER RELOCATED ONTO A STAINLESS STEEL UNISTRUT RACK AT NORTH END OF PANELS

5"

INSTALL GASKETED 1 1/2" SERVICE ENTRANCE FITTING THROUGH PANEL WALL FOR ANTENNA CABLE

**NOTES:**

RELATIVE HEIGHT OF THE TOP OF THE PANELS TO THE TOP OF THE METER WILL DEPEND ON THE ELEVATION OF THE NEW SLAB'S SURFACE IN RELATION TO THE CURRENT GROUND LEVEL.

IT WOULD BE BEST IF THE NEW STAINLESS STEEL UNISTRUT RACK WAS FREE-STANDING, WITH THE PANELS SLID AGAINST IT, BUT IF NECESSARY, IT CAN BE ATTACHED TO THE PANELS.

SOME DETAILS ARE NOT TO SCALE, OR HAVE NOT BEEN MEASURED (SUCH AS THE DIAMETER AND EXACT LOCATION OF THE METER FACE)

FOR CLARITY, THE UNISTRUT RACK WAS SHOWN WITH 1 5/8" X 1 5/8" STRUT. THE CONTRACTOR AND TOWNSHIP ENGINEER SHOULD COLLABORATE TO DECIDE THE PROPER SIZE.

DETAILED DRAWINGS OF THE STRUT WERE NOT DOWNLOADED, NOR WERE THE OVERALL DIMENSIONS VERIFIED AS IT WAS FELT THAT THE EXAMPLE WAS ADEQUATE FOR UNDERSTANDING THE CONCEPT.

THIS VIEW IS SHOWN LOOKING AT THE NORTH END OF THE INSTALLED PANELS.

TOP OF NEW SLAB

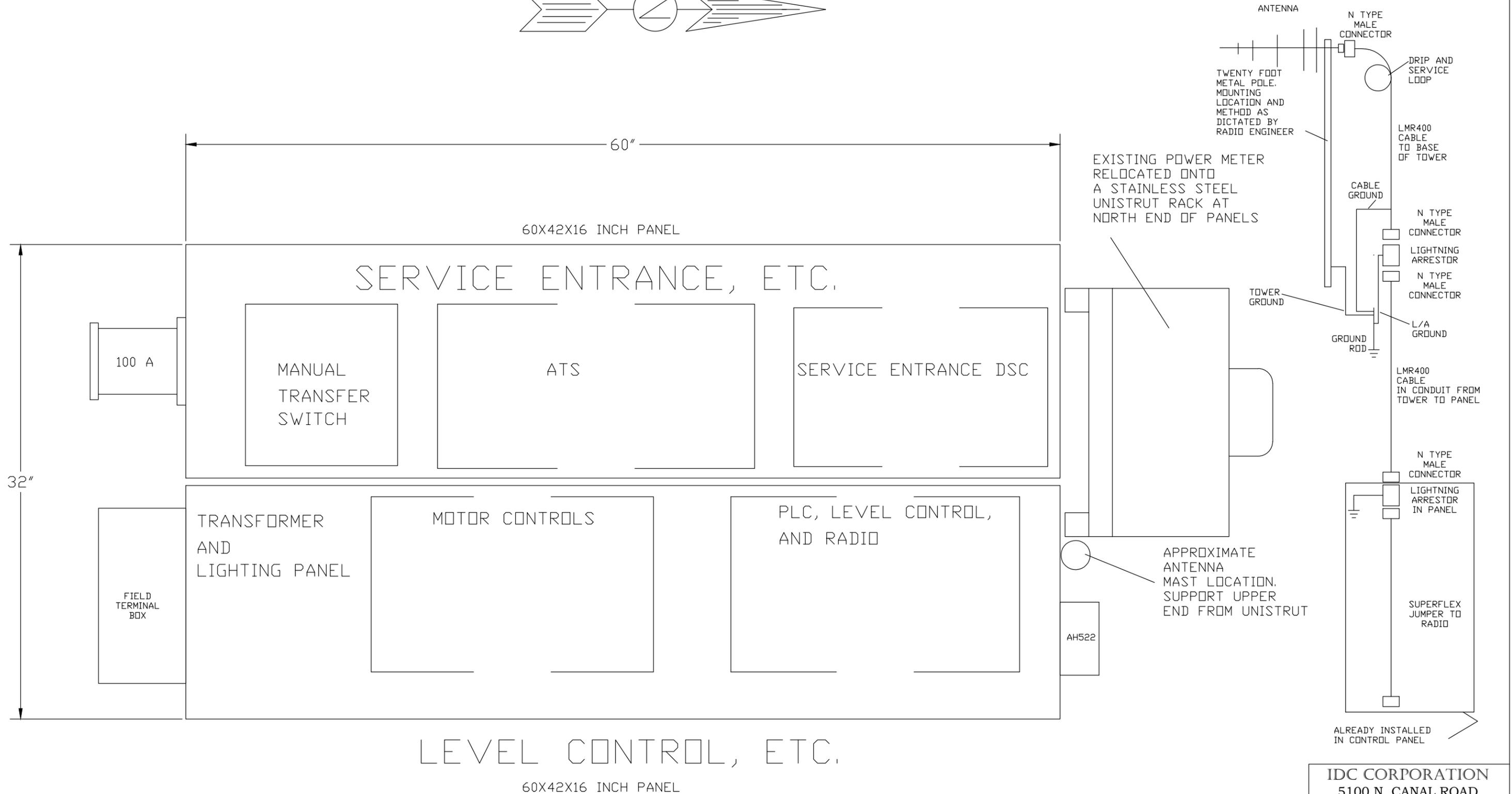
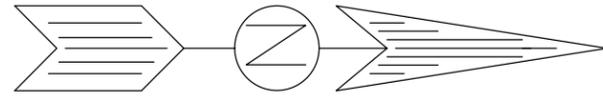
APXD - 12

SIDE ELEVATION OF ASSEMBLED PANELS AND METER

IDC CORPORATION  
5100 N. CANAL ROAD  
DIMONDALE, MI 48821

FILE:13821END ELEV Dec 6 23.DWG	
JOB: 13821	DWG. TITLE COUNTY PARK
DATE:12/06/23	SEWAGE LIFT
DRAWN: KRB	SHT. TITLE PANEL SIDE ELEV
CHECK: TAC	SERVICE AND CONTROLS
PRELIM	REV. □ SHT. 001 OF 001

NOTE: DIRECTION ARROW IS APPROXIMATE



PLAN VIEW OF ASSEMBLED CONTROL PANELS

APX D - 13

IDC CORPORATION		
5100 N. CANAL ROAD		
DIMONDALE, MI 48821		
FILE:13821-PLANVIEW Dec 6 23.DWG		
JOB: 13821	DWG. TITLE	COUNTY PARK
DATE: 12/06/23	SEWAGE LIFT	
DRAWN: KRB	SHT. TITLE	PANEL PLAN VIEW
CHECK: TAC	SERVICE AND CONTROLS	
PRELIM	REV. □	SHT. 001 OF 001



# Meridian Township - County Park Lift Station

Prepared for:

Meridian Township Service Center  
2100 GAYLORD C. SMITH CT  
EAST LANSING, Michigan 48823

Cummins Project Manager:

Breanna Okopski breanna.okopski@cummins.com 248-410-9501

**PLEASE COMPLETE THIS SECTION OR PROVIDE SIGNOFF TO PROCEED**

**Revise with corrections provided**

**Date:** 11/28/23

**Approved and released for production**

**By (name and company):** Jack Hughes, Meridian Township

**Requested delivery date:** August 2024

**Requested delivery address:** 2100 Gaylord C. Smith Court, Haslett, MI 48840

**Contact person and phone # for deliveries:** Rob MacKenzie, 517-853-4662

Salesforce O# 442432

BMS # 429744

Customer PO# 000057626

9/28/23

Rev \_

# Serving Cummins Customers

Cummins power solutions are supported by the largest and best-trained worldwide-certified sales/distributor network in the industry. This network will help you select and install the critical power solution to meet the requirements of your specific application. This same network provides experts with advanced technology to make your life easier while providing a seamless support experience.

***IMPORTANT:*** *The critical power solution information and specifications included in this pdf can be used by the site contractor(s) and/or engineer(s) to assist with planning for and accomplishing the overall power solution installation. Please forward this document to the appropriate personnel, as necessary.*

*It is the obligation of the electrical contractor and reviewing engineer to determine that the item quantities and accuracy of this submittal is correct as required for the job. Any inaccuracies or deviations must be addressed with Cummins Inc. before release to manufacturing. Any releases of material to manufacturing by the above parties constitute an acceptance of the accuracy of the submittal. Any changes after release will be viewed as a change order, subject to pricing changes. Please take the time to review this package for accuracy to prevent any after-shipment problems that could cause delay in energization.*

*Cummins certifies that these drawings, material lists, specification and datasheets have been checked prior to submittal and they:*

- accurately depict the proposed equipment*
- provide current information to the date of the submittal and*
- present true and accurate equipment information.*

*This Approval Drawing Package is submitted as our interpretation of the project requirements and/or the specifications for this job. Please note that issuance of these submittals shall not be deemed or interpreted as performance nor acceptance of your purchase order terms and conditions.*

*For questions or comments regarding this submittal, please contact the Cummins Project Manager listed on the title page.*



## Section 1 - Project Information

Project Bill of Material C45N6/OTEC70

## Section 2 - GENERATOR SPEC SHEETS

Generator Specification Sheet NAS-6092-EN  
Generator Data Sheet NAD-6093-EN  
PowerCommand Control (PCC) Specification Sheet PDS-1569  
Alternator Data Sheet ADS-202  
Sound Data Sheet MSP-1250b  
Cooling System Data Sheet MCP-1120  
EPA Certificate EPA-1300i  
Prototype Test Summary PTS-420

## Section 3 - GENERATOR ACCESSORIES

Circuit Breaker Data Sheet and Information NAS-6236-EN  
Battery Charger Specification Sheet NAAC-5943-EN  
Battery AC-150  
E-Stop GS120  
Fuel Strainer AC-188

## Section 4 - GENERATOR DRAWINGS & INTERCONNECT

Foundation Outline drawing A050P698  
Enclosure Outline Drawing A051P365  
Sound Level 2 Baffle A052M018  
Generator Outline Drawing A051E736  
Generator Options A051E744  
Circuit Breaker Installation Drawing A049J918  
Circuit Breaker Outline Drawing A043W056  
Interconnect Wiring Diagram PCC2.3 Interconnection  
Generator Wiring Diagram 630-3440

## Section 5 - ATS SPEC SHEETS & DRAWINGS

ATS Specification Sheet S-6556  
PC40 Control Spec Sheet S-6560  
ATS Outline Drawing 310-0544  
Withstand and Close Ratings A050J441/A048J566  
Interconnection Wiring Drawing A065H780  
Schematic Wiring Drawing A065K034

## Section 6 - STARTUP & WARRANTY

Pre-Start up checklist CSS  
Generator Warranty Statement A028U870  
Transfer Switch Warranty Statement 1118-0003

# **SECTION 1**

## **PROJECT INFORMATION**

September 18, 2023

Bill of Material

Feature Code	Description	Qty
C45N6 Install-US-Stat C45 N6 A331-2 L155-2 L090-2 L193-2 B184-2 R002-2 BB95-2 A292-2 F217-2 P176-2 F252-2 F253-2 F179-2 H609-2 H703-2 H012-2 H720-2 K796-2 KS52-2 H536-2 KV03-2 KV36-2 A366-2 C284-2 A422-2 D041-2 A333-2 BB89-2 E125-2 H389-2 E089-2 H669-2 E154-2 H487-2 H706-2 L028-2 L050-2 A322-2 H268-2 L260-2	C45N6, 45kW, 60Hz, Standby, Natural Gas/Propane Genset U.S. EPA, Stationary Emergency Application C45N6, 45kW, 60Hz, Standby, Natural Gas/Propane Genset Duty Rating - Standby Power (ESP) Emissions Certification - SI, EPA, Emergency, Stationary, 40CFR60 Listing - UL 2200 NFPA 110 Type 10 Level 1 Capable Exciter/Regulator - Permanent Magnet Generator, 3 Phase Sensor Voltage - 277/480, 3 Phase, Wye, 4 Wire Alternator - 60Hz, 12L, 480/277V, 105C, 40C Ambient, Increased Motor Starting (IMS) Alternator Heater, 120 Volt AC Aluminum Sound Attenuated Level 2 Enclosure, with Exhaust System Enclosure Color - Green, Aluminum Enclosure - Wind Load 180 MPH, ASCE7-10 Larger Battery Rack Skidbase - Housing Ready Control Mounting - Left Facing PowerCommand 2.3 Controller Gauge - Oil Pressure AmpSentry™ UL Listed Protective Relay Stop Switch - Emergency Relays - Auxiliary, Qty 2, 25A - 15V DC/10A - 30V DC Control Display Language - English Load Connection - Single Circuit Breaker, Location A, 60A, 3P, 600 Volts AC, 80%, UL Engine Governor - Electronic, Isochronous Single Gas Fuel - NG or LP Vapor Engine Starter - 12 Volt DC Motor Engine Air Cleaner - Normal Duty Battery Charging Alternator Battery Charger - 6 Amp, Regulated Engine Cooling - Radiator, High Ambient Air Temperature, Ship Fitted Shutdown - Low Coolant Level Extension - Coolant Drain Engine Coolant - 50% Antifreeze, 50% Water Mixture Coolant Heater, Extreme Cold Ambient Engine Oil Heater - 120 Volts AC, Single Phase Engine Oil Genset Warranty - 2 Years Base Literature - English Packing - Skid, Poly Bag Extension - Oil Drain Green Sound Level 2 Intake Baffle - Ship Loose	1
OTECA OTEC70 A046-7 A035-7 B001-7 A028-7 A044-7 A042-7 R026-7 M033-7 C110-7 L202-7 M081-7 G004-7	OTECA, OTEC Transfer Switch-Electronic Control: 40A/70A/125A OTEC70, Transfer Switch-Electronic Control, 70 Amp Listing - UL 1008/CSA Certification Application - Utility to Genset Cabinet - Type 1 Poles - 3 (Solid Neutral) Frequency - 60 Hz System - 3 Phase, 3 or 4 Wire Voltage - 480 Volts AC Genset Starting Battery - 12V DC PC40 Control Aux Relay - Emergency Position - 12 Volts DC Interface - Communications Network, MODBUS RTU Module Transfer Switch Warranty - 2 Year Comprehensive	1
		1
0149-0624	Fuel Strainer-Natural Gas, 1 1/4"NPT Inlet/Outlet	1

Feature Code	Description	Qty
PD GS120SN4X	Remote Emergency Stop Station in a NEMA 4X Enclosure	1
PD GP003-2	Manual - Operator/Maintenance, Parts and Service	1
NSBOP21	Service - start up & testing	1
BE MT34-2	12VDC Engine Starting Battery - 700CCA	1
AO 5000	Oil and Antifreeze Installed, Plus One (1) Set of O & M Manuals unless noted otherwise.	1
A052M018	Sound Level2 Baffle, Shipped Loose	1

# **SECTION 2**

## **GENERATOR**

### **SPECIFICATIONS**



# Spark-ignited generator set

45–100 kW Standby  
EPA emissions



## Description

Cummins® generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary Standby applications.

## Features

**Gas engine** - Rugged 4-cycle Cummins QSJ5.9G spark-ignited engine delivers reliable power. The electronic air/fuel ratio control provides optimum engine performance and fast response to load changes.

**Alternator** - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

**Control system** - The PowerCommand® 1.1 electronic control is standard equipment and provides total generator set system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance. The PowerCommand 2.3 control is also optional and is UL 508 Listed and provides AmpSentry™ protection.

**Cooling system** - Standard cooling package provides reliable running at up to 50 °C (122 °F) ambient temperature.

**Enclosures** - The aesthetically appealing enclosure incorporates special designs that deliver one of the quietest generators of its kind. Aluminium material plus durable powder coat paint provides the best anti-corrosion performance. The generator set enclosure has been evaluated to withstand 180 MPH wind loads in accordance with ASCE7 -10. The design has hinged doors to provide easy access for service and maintenance.

**NFPA** - The generator set accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

**Warranty and service** - Backed by a comprehensive warranty and worldwide distributor network.

Model	Natural gas		Propane		Data sheets
	Standby		Standby		
	kW	kVA	kW	kVA	
C45 N6	45	56	45	56	NAD-6093-EN
C50 N6	50	63	50	63	NAD-6094-EN
C60 N6	60	75	60	75	NAD-6095-EN
C70 N6	70	88	70	88	NAD-6096-EN
C80 N6	80	100	80	100	NAD-6097-EN
C100 N6	100	125	100	125	NAD-6098-EN

## Generator set specifications

Governor regulation class	ISO8528 Part 1 Class G3
Voltage regulation, no load to full load	± 1.0%
Random voltage variation	± 1.0%
Frequency regulation	Isochronous
Random frequency variation	± 0.25% @ 60 Hz
Radio frequency emissions compliance	Meets requirements of most industrial and commercial applications

## Engine specifications

Design	Naturally aspirated or turbocharged (varies by generator set model)
Bore	102.1 mm (4.02 in.)
Stroke	119.9 mm (4.72 in.)
Displacement	5.9 liters (359 in <sup>3</sup> )
Cylinder block	Cast iron, in-line 6 cylinder
Battery capacity	850 amps at ambient temperature of 0 °F to 32 °F (-18 °C to 0 °C)
Battery charging alternator	52 amps
Starting voltage	12 volt, negative ground
Lube oil filter type(s)	Spin-on with relief valve
Standard cooling system	50 °C (122 °F) ambient cooling system
Rated speed	1800 rpm

## Alternator specifications

Design	Brushless, 4 pole, drip proof, revolving field
Stator	2/3 pitch
Rotor	Direct coupled, flexible disc
Insulation system	Class H per NEMA MG1-1.65
Standard temperature rise	120 °C (248 °F) Standby
Exciter type	Torque match (shunt) with PMG as option
Alternator cooling	Direct drive centrifugal blower
AC waveform Total Harmonic Distortion (THDV)	< 5% no load to full linear load, < 3% for any single harmonic
Telephone Influence Factor (TIF)	< 50 per NEMA MG1-22.43
Telephone Harmonic Factor (THF)	< 3%

## Available voltages

1-phase	3-phase
• 120/240	• 120/208
• 120/240	• 277/480
• 347/600	• 127/220

## Generator set options

### Fuel system

- Single fuel - natural gas or propane vapor, field selectable
- Dual fuel – natural gas and propane vapor auto changeover
- Low fuel gas pressure warning

### Engine

- Engine air cleaner
- Shut down – low oil pressure
- Extension – oil drain
- Engine oil heater

### Alternator

- 120 °C temperature rise alternator
- 105 °C temperature rise alternator
- PMG
- Alternator heater, 120 V
- Reconnectable full 1 phase output alternator

### Control

- AC output analog meters
- Stop switch – emergency
- Auxiliary output relays (2)
- Auxiliary configurable signal inputs (8) and relay outputs (8)

### Electrical

- One, two or three circuit breaker configurations
- 80% rated circuit breakers
- 100% rated LSI circuit breakers
- Battery charger

### Enclosure

- Sound Level 1 or Level 2 enclosure, sandstone or green color
- Weather protective enclosure with muffler installed, green color
- Winter protective enclosure, green color

### Cooling system

- Shutdown – low coolant level
- Warning – low coolant level
- Extension – coolant drain
- Coolant heater options:
  - <4 °C (40 °F) – cold weather
  - <-17 °C (0 °F) – extreme cold

### Exhaust system

- Exhaust connector NPT
- Exhaust muffler mounted

### Generator set application

- Base barrier – elevated genset
- Battery rack, standard battery
- Battery rack, larger battery
- Radiator outlet duct adapter

### Warranty

- Base warranty – 2 year/1000 hours, Standby
- 3 year Standby warranty options
- 5 year Standby warranty options

## Generator set accessories

- Coolant heaters – 1000 W/1500 W
- Battery rack, standard/larger battery
- Battery heater kit
- Engine oil heater
- Remote control displays
- Auxiliary output relays (2)
- Auxiliary configurable signal inputs (8) and relay outputs (8)
- Annunciator – RS485
- Remote monitoring device – PowerCommand 500/550
- Battery charger – stand-alone, 12 V
- Circuit breakers
- Enclosure Sound Level 1 to Sound Level 2 upgrade kit
- Base barrier – elevated generator set
- Mufflers – industrial, residential or critical
- Alternator PMG
- Alternator heater

## Control system PowerCommand 1.1



**PowerCommand control** is an integrated generator set control system providing voltage regulation, engine protection, operator interface and isochronous governing (optional). Major features include:

- Battery monitoring and testing features and smart starting control system.
- Standard PCCNet interface to devices such as remote annunciator for NFPA 110 applications.
- Control boards potted for environmental protection.
- Control suitable for operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and altitudes to 5000 meters (13,000 feet).
- Prototype tested; UL, CSA, and CE compliant.
- InPower™ PC-based service tool available for detailed diagnostics.

### Operator/display panel

- Manual off switch
- Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments (English or international symbols)
- LED lamps indicating generator set running, not in auto, common warning, common shutdown, manual run mode and remote start
- Suitable for operation in ambient temperatures from -40 °C to +70 °C
- Bargraph display (optional)

### AC protection

- Over current warning and shutdown
- Over and under voltage shutdown
- Over and under frequency shutdown
- Over excitation (loss of sensing) fault
- Field overload

### Engine protection

- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown

- Low coolant temperature warning
- High, low and weak battery voltage warning
- Fail to start (overcrank) shutdown
- Fail to crank shutdown
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown

### Alternator data

- Line-to-Line and Line-to-neutral AC volts
- 3-phase AC current
- Frequency
- Total kVa

### Engine data

- DC voltage
- Lube oil pressure
- Coolant temperature
- Engine speed

### Other data

- Generator set model data
- Start attempts, starts, running hours
- Fault history
- RS485 Modbus® interface
- Data logging and fault simulation (requires InPower service tool)

### Digital governing (optional)

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

### Digital voltage regulation

- Integrated digital electronic voltage regulator
- 2-phase Line-to-Line sensing
- Configurable torque matching

### Control functions

- Time delay start and cooldown
- Cycle cranking
- PCCNet interface
- (2) Configurable inputs
- (2) Configurable outputs
- Remote emergency stop
- Automatic Transfer Switch (ATS) control
- Generator set exercise, field adjustable

## Options

- Auxiliary output relays (2)
- Remote annunciator with (3) configurable inputs and (4) configurable outputs
- PMG alternator excitation
- PowerCommand 500/550 for remote monitoring and alarm notification (accessory)
- Auxiliary, configurable signal inputs (8) and configurable relay outputs (8)
- Digital governing
- AC output analog meters (bargraph)
  - Color-coded graphical display of:
    - 3-phase AC voltage
    - 3-phase current
    - Frequency
    - kVa
- Remote operator panel
- PowerCommand 2.3 control with AmpSentry protection

## Ratings definitions

### Emergency Standby Power (ESP):

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

### Limited-Time Running Power (LTP):

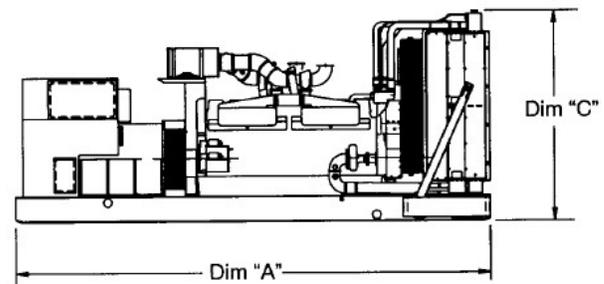
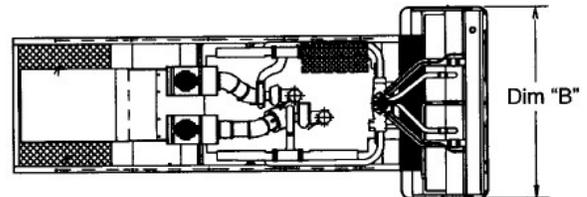
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

### Prime Power (PRP):

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

### Base Load (Continuous) Power (COP):

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.



This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.

**Do not use for installation design**

Model	Dim "A" mm (in.)	Dim "B" mm (in.)	Dim "C" mm (in.)	Set weight* kg (lbs.)
<b>Open set</b>				
C45 N6	2489 (98)	1016 (40)	1473 (58)	989 (2180)
C50 N6	2489 (98)	1016 (40)	1473 (58)	989 (2180)
C60 N6	2489 (98)	1016 (40)	1473 (58)	1103 (2431)
C70 N6	2489 (98)	1016 (40)	1473 (58)	1111 (2449)
C80 N6	2489 (98)	1016 (40)	1473 (58)	1173 (2587)
C100 N6	2489 (98)	1016 (40)	1473 (58)	1233 (2719)
<b>Weather protective enclosure</b>				
C45 N6	2489 (98)	1016 (40)	1473 (58)	1070 (2359)
C50 N6	2489 (98)	1016 (40)	1473 (58)	1070 (2359)
C60 N6	2489 (98)	1016 (40)	1473 (58)	1184 (2610)
C70 N6	2489 (98)	1016 (40)	1473 (58)	1192 (2628)
C80 N6	2489 (98)	1016 (40)	1473 (58)	1255 (2766)
C100 N6	2489 (98)	1016 (40)	1473 (58)	1315 (2898)
<b>Sound attenuated enclosure Level 1</b>				
C45 N6	3023 (119)	1016 (40)	1473 (58)	1114 (2455)
C50 N6	3023 (119)	1016 (40)	1473 (58)	1114 (2455)
C60 N6	3023 (119)	1016 (40)	1473 (58)	1227 (2706)
C70 N6	3023 (119)	1016 (40)	1473 (58)	1236 (2724)
C80 N6	3023 (119)	1016 (40)	1473 (58)	1298 (2862)
C100 N6	3023 (119)	1016 (40)	1473 (58)	1358 (2994)
<b>Sound attenuated enclosure Level 2</b>				
C45 N6	3454 (136)	<b>Refer to drawings for specific weights and dimensions</b>		1127 (2485)
C50 N6	3454 (136)			1127 (2485)
C60 N6	3454 (136)			1241 (2736)
C70 N6	3454 (136)	1016 (40)	1473 (58)	1249 (2754)
C80 N6	3454 (136)	1016 (40)	1473 (58)	1312 (2892)
C100 N6	3454 (136)	1016 (40)	1473 (58)	1372 (3024)
<b>Winter protective enclosure</b>				
C45 N6	3701 (146)	1016 (40)	1473 (58)	1152 (2535)
C50 N6	3701 (146)	1016 (40)	1473 (58)	1152 (2535)
C60 N6	3701 (146)	1016 (40)	1473 (58)	1266 (2786)
C70 N6	3701 (146)	1016 (40)	1473 (58)	1275 (2804)
C80 N6	3701 (146)	1016 (40)	1473 (58)	1337 (2942)
C100 N6	3701 (146)	1016 (40)	1473 (58)	1397 (3074)

\* Weights above are average. Actual weight varies with product configuration.

## Codes and standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

	<p>The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.</p>		<p>The generator set is available Listed to UL 2200, Stationary Engine Generator Assemblies.</p>
<p><b>International Building Code</b></p>	<p>The generator set is certified to International Building Code (IBC) 2012.</p>		<p>All low voltage models are CSA certified to product class 4215-01.</p>
	<p>This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.</p>	<p><b>U.S. EPA</b></p>	<p>Engine certified to U.S. EPA SI Stationary Emission Regulation 40 CFR, Part 60.</p>

**Warning:** Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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## Generator set data sheet



**Model:** C45 N6  
**Frequency:** 60 Hz  
**Fuel type:** Natural gas/propane  
**kW rating:** 45 natural gas Standby  
 45 propane Standby  
**Emissions level:** EPA Emissions

Fuel consumption	Natural gas Standby				Propane Standby			
	kW (kVA)				kW (kVA)			
Ratings	45 (56)				45 (56)			
Load	1/4	1/2	3/4	Full	1/4	1/2	3/4	Full
scfh	326.1	449.9	583.6	711.2	137.5	187.8	233.1	289.6
m <sup>3</sup> /hr	9.2	12.7	16.5	20.1	3.9	5.3	6.6	8.2

Engine	Natural gas Standby rating	Propane Standby rating
Engine model	QSJ5.9G-G1	
Configuration	Cast iron, in-line 6 cylinder	
Aspiration	Naturally aspirated	
Gross engine power output, kWm (bhp)	63.2 (84.7)	
Bore, mm (in.)	102.1 (4.02)	
Stroke, mm (in.)	119.9 (4.72)	
Rated speed, rpm	1800	
Compression ratio	8.5:1	
Lube oil capacity, L (qt)	14.2 (15)	
Overspeed limit, rpm	2250	

Fuel supply pressure	
Minimum operating pressure, kPa (in H <sub>2</sub> O)	1.5 (6.0)
Maximum operating pressure, kPa (in H <sub>2</sub> O)	3.2 (13.0)

Air	Natural gas Standby rating	Propane Standby rating
Combustion air, m <sup>3</sup> /min (scfm)	3.3 (115.3)	3.0 (107.3)
Maximum normal duty air cleaner restriction, kPa (in H <sub>2</sub> O)	0.4 (1.5)	
Maximum heavy duty air cleaner restriction, kPa (in H <sub>2</sub> O)	3.7 (15)	

<b>Exhaust</b>	<b>Natural gas Standby rating</b>	<b>Propane Standby rating</b>
Exhaust flow at rated load, m <sup>3</sup> /min (cfm)	11.1 (391.2)	10.6 (375.2)
Exhaust temperature, °C (°F)	735.3 (1355.6)	746.7 (1376.1)
Exhaust maximum back pressure, kPa (in H <sub>2</sub> O)	4 (16.1)	4 (16.1)

### Standard set-mounted radiator cooling<sup>1</sup>

Ambient design, °C (°F)	50 (122)
Fan load, kW (HP)	5.2 (7)
Coolant capacity (with radiator), L (US gal)	16 (4.2)
Cooling system air flow, m <sup>3</sup> /min (scfm)	158.6 (5600)
Maximum cooling air flow static restriction, kPa (in H <sub>2</sub> O)	0.12 (0.5)

### Weights<sup>2</sup>

Unit dry weight kgs (lbs)
Unit wet weight kgs (lbs)

**Refer to drawings for specific weights and dimensions**

#### Notes:

<sup>1</sup> For non-standard remote installations contact your local Cummins representative.

<sup>2</sup> Weights represent a set with standard features. See outline drawing for weights of other configurations.

### Alternator data

Standard alternators	Natural gas/propane single phase table	Natural gas/propane three phase table					Full single phase output, reconnectable
Maximum temperature rise above 40 °C ambient	120 °C	120 °C	120 °C	120 °C	120 °C	120 °C	120 °C
Feature code	BB90-2	B986-2	B946-2	B943-2	B952-2	BB86-2	BB88-2
Alternator data sheet number	ADS-203	ADS-202	ADS-202	ADS-202	ADS-202	ADS-202	ADS-203
Voltage ranges	120/240	120/240	120/208	277/480	347/600	127/220	120 - 480
Voltage feature code	R104-2	R106-2	R098-2	R002-2	R114-2	R020-2	Varies by voltage
Surge kW	49.5	51.3	51.3	51.9	51.9	51.5	Varies by voltage
Motor starting kVA (at 90% sustained voltage)	Shunt	188	163	163	163	163	188
	PMG	191	191	191	191	191	272
Full load current amps at Standby rating	188	135	156	68	54	148	Varies by voltage

## Alternator data (continued)

Optional alternators for improved starting capability	Natural gas/propane single phase table	Natural gas/propane three phase table					Full single phase output, reconnectable	
Maximum temperature rise above 40 °C ambient	105 °C	105 °C	105 °C	105 °C	105 °C	105 °C	105 °C	
Feature code	BB91-2	BB94-2	BB93-2	BB95-2	BB92-2	BB85-2	BB87-2	
Alternator data sheet number	ADS-203	ADS-203	ADS-203	ADS-202	ADS-202	ADS-203	ADS-204	
Voltage ranges	120/240	120/240	120/208	277/480	347/600	127/220	120 - 480	
Voltage feature code	R104-2	R106-2	R098-2	R002-2	R114-2	R020-2	Varies by voltage	
Surge kW	49.5	52.0	52.0	51.9	51.9	52.3	Varies by voltage	
Motor starting kVA (at 90% sustained voltage)	Shunt	181	188	188	163	163	163	231
	PMG	221	221	221	191	191	221	272
Full load current amps at Standby rating	188	135	156	68	54	148	Varies by voltage	

## Derating factors

### Natural gas/propane

Standby	Engine power available up to 670 m (2200 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations derate at 4% per 305 m (1000 ft) and 2% per 10 °C above 40 °C (104 °F).
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## Ratings definitions

Emergency Standby Power (ESP):	Limited-Time Running Power (LTP):	Prime Power (PRP):	Base Load (Continuous) Power (COP):
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528.	Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.

## Formulas for calculating full load currents:

Three phase output	Single phase output
$\frac{\text{kW} \times 1000}{\text{Voltage} \times 1.73 \times 0.8}$	$\frac{\text{kW} \times \text{SinglePhaseFactor} \times 1000}{\text{Voltage}}$

**Warning:** Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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# PowerCommand® 2.3 Control System



### Control System Description

The PowerCommand control system is a microprocessor-based generator set monitoring, metering and control system designed to meet the demands of today's engine driven generator sets. The integration of all control functions into a single control system provides enhanced reliability and performance, compared to conventional generator set control systems. These control systems have been designed and tested to meet the harsh environment in which gensets are typically applied.

### Features

- 320 x 240 pixels graphic LED backlight LCD.
- Multiple language support.
- AmpSentry™ protective relay - true alternator overcurrent protection.
- Real time clock for fault and event time stamping.
- Exerciser clock and time of day start/stop.
- Digital voltage regulation. Three phase full wave FET type regulator compatible with either shunt or PMG systems.
- Generator set monitoring and protection.
- 12 and 24 VDC battery operation.
- Modbus® interface for interconnecting to customer equipment.
- Warranty and service. Backed by a comprehensive warranty and worldwide distributor service network.
- Certifications - suitable for use on generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., CE, UKCA and CSA standards.

# PowerCommand Digital Genset Control PCC 2300



## Description

The PowerCommand generator set control is suitable for use on a wide range of generator sets in non-parallel applications. The PowerCommand control is compatible with shunt or PMG excitation style. It is suitable for use with reconnectable or non-reconnectable generators, and it can be configured for any frequency, voltage and power connection from 120-600 VAC Line-to-Line.

Power for this control system is derived from the generator set starting batteries. The control functions over a voltage range from 8 VDC to 30 VDC.

## Features

- 12 and 24 VDC battery operation.
- Digital voltage regulation - Three phase full wave FET type regulator compatible with either shunt or PMG systems. Sensing is three phase.
- Full authority engine communications (where applicable) - Provides communication and control with the Engine
- due to thermal Control Module (ECM).
- AmpSentry™ protection provides industry-leading alternator overcurrent protection:
  - Time-based generator protection applicable to both line-to-line and line-to-neutral, that can detect an unbalanced fault condition and swiftly react appropriately. Balanced faults can also be detected by AmpSentry and appropriate acted upon.
- ◆ Reduces the risk of Arc Flash overload or electrical faults by inverse time protection
- Common harnessing - with higher feature Cummins controls. Allows for easy field upgrades.
- Generator set monitoring - Monitors status of all critical engine and alternator functions.
- Digital genset metering (AC and DC).
- Genset battery monitoring system to sense and warn against a weak battery condition.
- Configurable for single or three phase AC metering.
- Engine starting - Includes relay drivers for starter, Fuel Shut Off (FSO), glow plug/spark ignition power and switch B+ applications.
- Generator set protection – Protects engine and alternator.
- Real time clock for fault and event time stamping.
- Exerciser clock and time of day start/stop.
- Advanced serviceability - using InPower™, a PC-based software service tool.

- Environmental protection - The control system is designed for reliable operation in harsh environments. The main control board is a fully encapsulated module that is protected from the elements.
- Modbus interface for interconnecting to customer equipment.
- Configurable inputs and outputs - Four discrete inputs and four dry contact relay outputs.
- Warranty and service - Backed by a comprehensive warranty and worldwide distributor service network.
- Certifications - Suitable for use on generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., CE and CSA standards.

## Base Control Functions

### HMI Capability

Operator adjustments - The HMI includes provisions for many set up and adjustment functions.

Generator set hardware data - Access to the control and software part number, generator set rating in kVA and generator set model number is provided from the HMI or InPower.

Data logs - Includes engine run time, controller on time, number of start attempts, total kWh, and load profile (control logs data indicating the operating hours at percent of rated kW load, in 5% increments. The data is presented on the operation panel based on total operating hours on the generator.)

Fault history - Provides a record of the most recent fault conditions with control date and time stamp. Up to 32 events are stored in the control non-volatile memory.

### Alternator data

- Voltage (single or three phase Line-to-Line and Line-to-Neutral)
- Current (single or three phase)
- kW, kVar, power factor, kVA (three phase and total)
- Frequency

AmpSentry: 3x current regulation for downstream tripping/motor inrush management. Thermal damage curve (3-phase short) or fixed timer (2 sec for 1- Phase Short or 5 sec for 2-Phase short).

### Engine data

- Starting battery voltage
- Engine speed
- Engine temperature
- Engine oil pressure
- Engine oil temperature
- Intake manifold temperature
- Comprehensive Full Authority Engine (FAE) data (where applicable)

Service adjustments - The HMI includes provisions for adjustment and calibration of generator set control functions. Adjustments are protected by a password. Functions include:

### Service adjustments (continued)

- Engine speed governor adjustments
- Voltage regulation adjustments
- Cycle cranking
- Configurable fault set up
- Configurable output set up
- Meter calibration
- Display language and units of measurement

### **Engine Control**

SAE-J1939 CAN interface to full authority ECMs (where applicable). Provides data swapping between genset and engine controller for control, metering and diagnostics.

12 VDC/24 VDC battery operations - PowerCommand will operate either on 12 VDC or 24 VDC batteries.

Temperature dependent governing dynamics (with electronic governing) - modifies the engine governing control parameters as a function of engine temperature. This allows the engine to be more responsive when warm and more stable when operating at lower temperature levels.

Isochronous governing - (where applicable) Capable of controlling engine speed within +/-0.25% for any steady state load from no load to full load. Frequency drift will not exceed +/-0.5% for a 33 °C (60 °F) change in ambient temperature over an 8 hour period.

Droop electronic speed governing - Control can be adjusted to droop from 0 to 10% from no load to full load.

Remote start mode - It accepts a ground signal from remote devices to automatically start the generator set and immediately accelerate to rated speed and voltage. The remote start signal will also wake up the control from sleep mode. The control can incorporate a time delay start and stop.

Remote and local emergency stop - The control accepts a ground signal from a local (genset mounted) or remote (facility mounted) emergency stop switch to cause the generator set to immediately shut down. The generator set is prevented from running or cranking with the switch engaged. If in sleep mode, activation of either emergency stop switch will wake up the control.

Sleep mode - The control includes a configurable low current draw state to minimize starting battery current draw when the genset is not operating. The control can also be configured to go into a low current state while in auto for prime applications or applications without a battery charger.

Engine starting - The control system supports automatic engine starting. Primary and backup start disconnects are achieved by one of two methods: magnetic pickup or main alternator output frequency. The control also supports configurable glow plug control when applicable.

Cycle cranking - Is configurable for the number of starting cycles (1 to 7) and duration of crank and rest periods. Control includes starter protection algorithms to prevent the operator from specifying a starting sequence that might be damaging.

Time delay start and stop (cooldown) - Configurable for time delay of 0-300 seconds prior to starting after receiving a remote start signal and for time delay of 0-600 seconds prior to shut down after signal to stop in normal operation modes. Default for both time delay periods is 0 seconds.

### **Alternator Control**

The control includes an integrated three phase Line-to-Line sensing voltage regulation system that is compatible with shunt or PMG excitation systems. The voltage regulation system is a three phase full wave rectified and has an FET output for good motor starting capability.

Major system features include:

Digital output voltage regulation - Capable of regulating output voltage to within +/-1.0% for any loads between no load and full load. Voltage drift will not exceed +/- 1.5% for a 40 °C (104 °F) change in temperature in an eight hour period. On engine starting or sudden load acceptance, voltage is controlled to a maximum of 5% overshoot over nominal level. The automatic voltage regulator feature can be disabled to allow the use of an external voltage regulator.

Droop voltage regulation - Control can be adjusted to droop from 0-10% from no load to full load.

Torque-matched V/Hz overload control - The voltage roll-off set point and rate of decay (i.e. the slope of the V/Hz curve) is adjustable in the control.

Fault current regulation - PowerCommand will regulate the output current on any phase to a maximum of three times rated current under fault conditions for both single phase and three phase faults. In conjunction with a permanent magnet generator, it will provide three times rated current on all phases for motor starting and short circuit coordination purpose.

### **Protective Functions**

On operation of a protective function the control will indicate a fault by illuminating the appropriate status LED on the HMI, as well as display the fault code and fault description on the LCD. The nature of the fault and time of occurrence are logged in the control. The service manual and InPower service tool provide service keys and procedures based on the service codes provided.

Protective functions include:

#### **Battle Short Mode**

When enabled and the *battle short* switch is active, the control will allow some shutdown faults to be bypassed. If a bypassed shutdown fault occurs, the fault code and description will still be annunciated, but the genset will not shutdown. This will be followed by a *fail to shutdown* fault. Emergency stop shutdowns and others that are critical for proper operation are not bypassed. Please refer to the control application guide or manual for list of these faults.

## Derate

The derate function reduces output power of the genset in response to a fault condition. If a derate command occurs while operating on an isolated bus, the control will issue commands to reduce the load on the genset via contact closures or modbus.

## Configurable Alarm and Status Inputs

The control accepts up to four alarm or status inputs (configurable contact closed to ground or open) to indicate a configurable (customer-specified) condition. The control is programmable for warning, shutdown or status indication and for labeling the input.

## Emergency Stop

Annunciated whenever either emergency stop signal is received from external switch.

## Full Authority Electronic Engine Protection

Engine fault detection is handled inside the engine ECM. Fault information is communicated via the SAE-J1939 data link for annunciation in the HMI.

## General Engine Protection

**Low and high battery voltage warning** - Indicates status of battery charging system (failure) by continuously monitoring battery voltage.

**Weak battery warning** - The control system will test the battery each time the generator set is signaled to start and indicate a warning if the battery indicates impending failure.

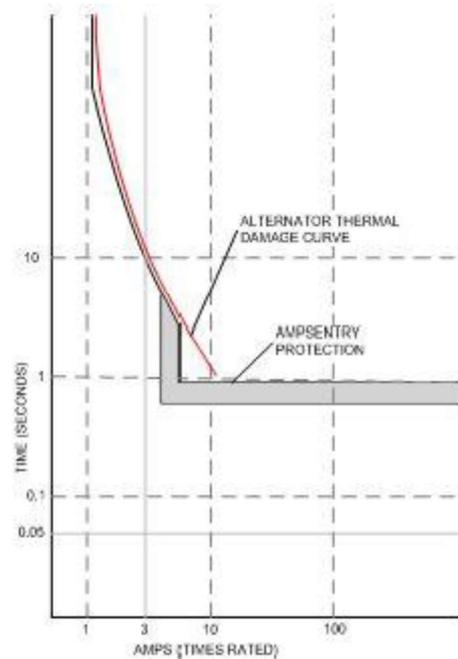
**Fail to start (overcrank) shutdown** - The control system will indicate a fault if the generator set fails to start by the completion of the engine crank sequence.

**Fail to crank shutdown** - Control has signaled starter to crank engine but engine does not rotate.

**Cranking lockout** - The control will not allow the starter to attempt to engage or to crank the engine when the engine is rotating.

## Alternator Protection

**AmpSentry protective relay** - A comprehensive monitoring and control system integral to the PowerCommand Control System that guards the electrical integrity of the alternator and power system by providing protection against a wide array of fault conditions in the generator set or in the load. It also provides single and three phase fault current regulation so that downstream protective devices have the maximum current available to quickly clear fault conditions without subjecting the alternator to potentially catastrophic failure conditions. Thermal damage curve (3-Phase short) or fixed timer (2 sec for 1-Phase short, 5 sec for 2-Phase short). See document R1053 for a full-size time over current curve.



**AmpSentry Maintenance Mode (AMM)** - Instantaneous tripping, if AmpSentry Maintenance mode is active (50mS response to turn off AVR excitation/shutdown genset) for arc flash reduction when personnel are near genset.

**High AC voltage shutdown (59)** - Output voltage on any phase exceeds preset values. Time to trip is inversely proportional to amount above threshold. Values adjustable from 105-125% of nominal voltage, with time delay adjustable from 0.1-10 seconds. Default value is 110% for 10 seconds.

**Low AC voltage shutdown (27)** - Voltage on any phase has dropped below a preset value. Adjustable over a range of 50-95% of reference voltage, time delay 2-20 seconds. Default value is 85% for 10 seconds. Function tracks reference voltage. Control does not nuisance trip when voltage varies due to the control directing voltage to drop, such as during a V/Hz roll-off during synchronizing.

**Under frequency shutdown (81 u)** - Generator set output frequency cannot be maintained. Settings are adjustable from 2-10 Hz below reference governor set point, for a 5-20 second time delay. Default: 6 Hz, 10 seconds.

Under frequency protection is disabled when excitation is switched off, such as when engine is operating in idle speed mode.

**Over frequency shutdown/warning (81 o)** - Generator set is operating at a potentially damaging frequency level. Settings are adjustable from 2-10 Hz above nominal governor set point for a 1-20 second time delay. Default: 6 Hz, 20 seconds, disabled.

Overcurrent warning/shutdown - Thresholds and time delays are configurable. Implementation of the thermal damage curve with instantaneous trip level calculated based on current transformer ratio and application power rating.

Loss of sensing voltage shutdown - Shutdown of generator set will occur on loss of voltage sensing inputs to the control.

Field overload shutdown - Monitors field voltage to shutdown generator set when a field overload condition occurs.

Over load (kW) warning - Provides a warning indication when engine is operating at a load level over a set point.

Adjustment range: 80-140% of application rated kW, 0-120 second delay. Defaults: 105%, 60 seconds.

Reverse power shutdown (32) - Adjustment range: 5-20% of standby kW rating, delay 1-15 seconds. Default: 10%, 3 seconds.

Reverse Var shutdown - Shutdown level is adjustable: 15-50% of rated Var output, delay 10-60 seconds. Default: 20%, 10 seconds.

Short circuit protection - Output current on any phase is more than 175% of rating and approaching the thermal damage point of the alternator. Control includes algorithms to protect alternator from repeated over current conditions over a short period of time.

## Field Control Interface

**Input signals to the PowerCommand control include:**

- Coolant level (where applicable)
- Fuel level (where applicable)
- Remote emergency stop
- Remote fault reset
- Remote start
- Battleshort
- Rupture basin
- Start type signal
- Configurable inputs - Control includes (4) input signals from customer discrete devices that are configurable for warning, shutdown or status indication, as well as message displayed

**Output signals from the PowerCommand control include:**

- Load dump signal: Operates when the generator set is in an overload condition.
- Delayed off signal: Time delay based output which will continue to remain active after the control has removed the run command. Adjustment range: 0 – 120 seconds. Default: 0 seconds.

- Configurable relay outputs: Control includes (4) relay output contacts (3 A, 30 VDC). These outputs can be configured to activate on any control warning or shutdown fault as well as ready to load, not in auto, common alarm, common warning and common shutdown.

- Ready to load (generator set running) signal: Operates when the generator set has reached 90% of rated speed and voltage and latches until generator set is switched to off or idle mode.

## Communications Connections Include:

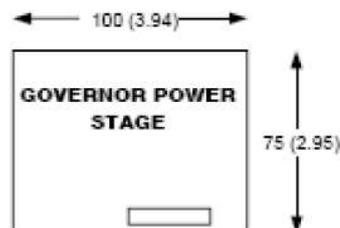
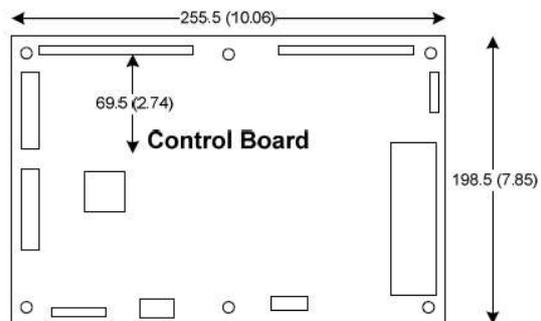
- PC tool interface: This RS-485 communication port allows the control to communicate with a personal computer running InPower software.

- Modbus RS-485 port: Allows the control to communicate with external devices such as PLCs using Modbus protocol.

Note - An RS-232 or USB to RS-485 converter is required for communication between PC and control.

- Networking: This RS-485 communication port allows connection from the control to the other Cummins products.

## Mechanical Drawings



# PowerCommand Human Machine Interface HMI320



## Description

This control system includes an intuitive operator interface panel that allows for complete genset control as well as system metering, fault annunciation, configuration and diagnostics. The interface includes five genset status LED lamps with both internationally accepted symbols and English text to comply with customer's needs. The interface also includes an LED backlit LCD display with tactile feel soft-switches for easy operation and screen navigation. It is configurable for units of measurement and has adjustable screen contrast and brightness.

The *run/off/auto* switch function is integrated into the interface panel.

All data on the control can be viewed by scrolling through screens with the navigation keys. The control displays the current active fault and a time-ordered history of the five previous faults.

## Features

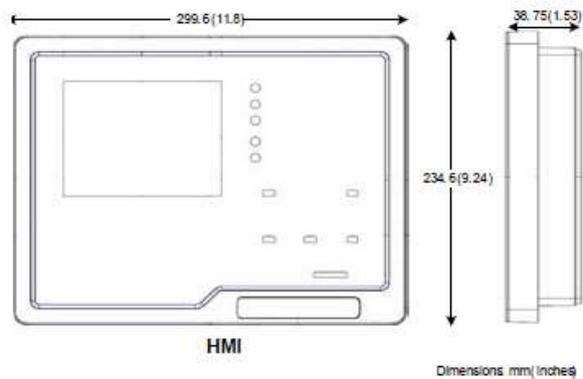
- LED indicating lamps:
  - Genset running
  - Remote start
  - Not in auto
  - Shutdown
  - Warning
  - Auto
  - Manual and stop
- 320 x 240 pixels graphic LED backlight LCD.
- Four tactile feel membrane switches for LCD defined operation. The functions of these switches are defined dynamically on the LCD.
- Seven tactile feel membrane switches dedicated screen navigation buttons for up, down, left, right, ok, home and cancel.
- Six tactile feel membrane switches dedicated to control for auto, stop, manual, manual start, fault reset and lamp test/panel lamps.

- Two tactile feel membrane switches dedicated to control of circuit breaker (where applicable).
- Allows for complete genset control setup.
- Certifications: Suitable for use on generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., CE and CSA standards.
- LCD languages supported: English, Spanish, French, German, Italian, Greek, Dutch, Portuguese, Finnish, Norwegian, Danish, Russian and Chinese Characters.

## Communications connections include:

- PC tool interface - This RS-485 communication port allows the HMI to communicate with a personal computer running InPower.
- This RS-485 communication port allows the HMI to communicate with the main control board.

## Mechanical Drawing



## Software

InPower (beyond 6.5 version) is a PC-based software service tool that is designed to directly communicate to PowerCommand generator sets and transfer switches, to facilitate service and monitoring of these products.

## Environment

The control is designed for proper operation without recalibration in ambient temperatures from -40 °C to +70 °C (-40 °F to 158 °F) and for storage from -55 °C to +80 °C (-67 °F to 176 °F). Control will operate with humidity up to 95%, non-condensing.

The HMI is designed for proper operation in ambient temperatures from -20 °C to +70 °C (-4 °F to 158 °F) and for storage from -30 °C to +80 °C (-22 °F to 176 °F).

The control board is fully encapsulated to provide superior resistance to dust and moisture. Display panel has a single membrane surface, which is impervious to effects of dust, moisture, oil and exhaust fumes. This panel uses a sealed membrane to provide long reliable service life in harsh environments.

The control system is specifically designed and tested for resistance to RFI/EMI and to resist effects of vibration to provide a long reliable life when mounted on a generator set. The control includes transient voltage surge suppression to provide compliance to referenced standards.

## Certifications

PowerCommand meets or exceeds the requirements of the following codes and standards:

- NFPA 110 for level 1 and 2 systems.
- ISO 8528-4: 1993 compliance, controls and switchgear.
- CE marking: The CE marking is only valid when equipment is used in a fixed installation application. Material compliance declaration is available upon request.
- UKCA marking: The UKCA marking is only valid when equipment is used in a fixed installation application. Material compliance declaration is available upon request.
- EN50081-1,2 residential/light industrial emissions or industrial emissions.
- EN50082-1,2 residential/light industrial or industrial susceptibility.
- ISO 7637-2, level 2; DC supply surge voltage test.
- Mil Std 202C, Method 101 and ASTM B117: Salt fog test.
- UL 6200 recognized and suitable for use on UL 2200 Listed generator sets.
- CSA C282-M1999 compliance
- CSA 22.2 No. 14 M91 industrial controls.
- PowerCommand control systems and generator sets are designed and manufactured in ISO 9001 certified facilities.

## Warranty

All components and subsystems are covered by an express limited one year warranty. Other optional and extended factory warranties and local distributor maintenance agreements are available.



**For more information contact your local Cummins distributor  
or visit [power.cummins.com](http://power.cummins.com)**

**Our energy working for you.™**





# Alternator data sheet

Frame size: **UC2D**

<b>Characteristics</b>			
<b>Weights:</b>	Wound stator assembly:	176 lb	80 kg
	Rotor assembly:	194 lb	88 kg
	Complete alternator:	595 lb	270 kg
<b>Maximum speed:</b>		2250 rpm	
<b>Excitation current:</b>	Full load:	2 Amps	
	No load:	0.5 Amps	
<b>Insulation system:</b>	Class H throughout		

1 Ø Ratings (1.0 power factor)  (Based on specific temperature rise at 40 °C ambient temperature)	60 Hz				50 Hz				
	Double delta		4 lead		Double delta				
	<u>120/240</u>		<u>120/240</u>		110-120 <u>220-240</u>				
125 °C rise ratings	kW/kVA	40/40	40/40		34/34				
105 °C rise ratings	kW/kVA	35/35	36/36		30/30				
3 Ø Ratings (0.8 power factor)  (Based on specified temperature rise at 40 °C ambient temperature)	Upper broad range		LBR*	347/600	Broad range				
	<u>120/208</u>	<u>139/240</u> <u>277/480</u>	<u>190-208</u> <u>380-416</u>	<u>347/600</u>	<u>110/190</u> <u>220/380</u>	<u>120/208</u> <u>240/415</u>	<u>127/220</u> <u>254/440</u>		
150 °C Rise ratings	kW	50	55	52	55	42	42	40	
	kVA	63	69	65	69	53	53	50	
125 °C Rise ratings	kW	48	52	50	52	40	40	38	
	kVA	60	65	63	65	50	50	48	
<b>105 °C Rise ratings</b>	<b>kW</b>	42	<b>46</b>	45	46	36	36	34	
	<b>kVA</b>	53	<b>58</b>	56	58	45	45	43	
80 °C Rise ratings	kW	36	40	39	40	32	32	32	
	kVA	46	50	48	50	40	40	40	
3 Ø Reactances (per unit, ±10%)  (Based on full load at 105 °C rise rating)	Synchronous		2.65	2.20	2.23	2.10	2.09	1.75	1.49
	Transient		0.18	0.15	0.16	0.14	0.15	0.13	0.11
	Subtransient		0.12	0.10	0.10	0.09	0.11	0.09	0.08
	Negative sequence		0.12	0.10	0.10	0.09	0.13	0.11	0.09
	Zero sequence		0.08	0.07	0.07	0.06	0.08	0.07	0.06
3 Ø Motor starting	Maximum kVA (Shunt)		163	163	163	111			
(90% sustained voltage)	(PMG)		191	191	191	139			
Time constants (Sec)	Transient		0.027	0.027	0.027	0.027			
	Subtransient		0.006	0.006	0.006	0.006			
	Open circuit		0.700	0.700	0.700	0.700			
	DC		0.005	0.005	0.005	0.005			



## Alternator data sheet

Frame size: **UC2D**

<b>Windings</b> (@ 20° C)					
Stator resistance	(Line to Line, Ohms)	0.2580	0.1760	0.4000	0.2580
Rotor resistance	(Ohms)	0.6400	0.6400	0.6400	0.6400
Number of leads		12	12	6	12

\* Lower broad range 110/190 thru 120/208, 220/380 thru 240/416.



**Sound Pressure Level @ 7 meters, dB(A)**

See Notes 2,5,7-11 listed below

Configuration		Position (Note 1)								8 Position Average
		1	2	3	4	5	6	7	8	
Standard Unhoused	Infinite Exhaust	75	78.7	76.9	79	75.6	78.6	77.1	77.3	77.5
F216-2 Weather protective Enclosure, Aluminium	Mounted	79.7	82.1	83.4	84.6	83	84.1	81.5	80.1	82.6
F231-2 Sound Attenuated Level 1 Enclosure, Aluminium	Mounted	75.8	74.4	69.4	69.9	69.9	70	68.3	74.3	72.4
F217-2 Sound Attenuated Level 2 Enclosure, Aluminium	Mounted	71.2	70.5	68	68.4	69	68.4	66.1	70.4	69.3

**Sound Power Level, dB(A)**

See Notes 1,3,6-11 listed below

Configuration		Octave Band Center Frequency (Hz)										Overall Sound Power Level
		31.5	63	125	250	500	1000	2000	4000	8000	16000	
Standard Unhoused	Infinite Exhaust	51.4	67.0	82.6	90.5	97.1	99.2	98.2	94.7	91.6	86.4	104.2
F216-2 Weather Protective Enclosure, Aluminium	Mounted	54.2	98.9	106.0	101.4	98.4	98.8	98.2	98.5	95.9	84.0	109.7
F231-2 Sound Attenuated Level 1 Enclosure, Aluminium	Mounted	62.2	77.5	85.4	89.0	92.6	93.9	91.6	90.3	84.5	75.8	99.2
F217-2 Sound Attenuated Level 2 Enclosure, Aluminium	Mounted	61.6	77.2	85.2	87.6	90.7	90.1	87.9	87.7	81.7	72.5	96.5

## Exhaust Sound Power Level, dB(A)

See Notes 4,6, 9 listed below

<b>Open Exhaust (No Muffler) @ Rated Load</b>	<b>Octave Band Center Frequency (Hz)</b>										<b>Overall Sound Power Level</b>
	<b>31.5</b>	<b>63</b>	<b>125</b>	<b>250</b>	<b>500</b>	<b>1000</b>	<b>2000</b>	<b>4000</b>	<b>8000</b>	<b>16000</b>	
	52.0	79.5	88.4	98.4	99.1	111.4	106.4	105.6	104.3	83.6	114.5

**Note:**

1. Sound pressure levels at 1 meter are measured per the requirements of ISO 3744, ISO 8528-10, ANSI S1.13, ANSI S12.1 and European Communities Directive 2000/14/EC as applicable. The microphone measurement locations are 1 meter from a reference parallelepiped just enclosing the generator set (enclosed or unenclosed).
2. Seven-meter measurement location 1 is 7 meters (23 feet) from the generator (alternator) end of the generator set, and the locations proceed counterclockwise around the generator set at 45° angles at a height of 1.2 meters (48 inches) above the ground surface.
3. Sound Power Levels are calculated according to ISO 3744, ISO 8528-10, and or CE (European Union) requirements.
4. Exhaust Sound Levels are measured and calculated per ISO 6798, Annex A.
5. Reference Sound Pressure Level is 20 µPa.
6. Reference Sound Power Level is 1 pW (10<sup>-12</sup> Watt).
7. Sound data for remote-cooled generator sets are based on rated loads without cooling fan noise.
8. Sound data for the generator set with infinite exhaust do not include the exhaust noise contribution.
9. Sound levels are subject to instrumentation, measurement, installation, and manufacturing variability.
10. Unhoused/Open configuration generator sets refers to generator sets with no sound enclosures of any kind.
11. Housed/Enclosed/Closed/Canopy configuration generator sets refer to generator sets that have noise reduction sound enclosures installed over the generator set and usually integrally attached to the skid base/base frame/fuel container base of the generator set.



### High ambient air temperature radiator cooling system

	Fuel type	Duty	Rating (kW)	Max cooling @ air flow static restriction, unboxed (inches water/mm water)					Housed in free air, no air discharge restriction		
				0.0/0.0	0.25/6.4	0.5/12.7	0.75/19.1	1.0/25.4	F216	F231	F217
				Maximum allowable ambient temperature, degree C							
60 Hz	Natural Gas	Standby	45	55	55	55	N/A	N/A	55	55	55

### High ambient air temperature radiator cooling system

	Fuel type	Duty	Rating (kW)	Max cooling @ air flow static restriction, unboxed (inches water/mm water)					Housed in free air, no air discharge restriction		
				0.0/0.0	0.25/6.4	0.5/12.7	0.75/19.1	1.0/25.4	F216	F231	F217
				Maximum allowable ambient temperature, degree C							
60 Hz	Propane	Standby	45	55	55	55	N/A	N/A	55	55	55

Notes:

1. Data shown are anticipated cooling performance for typical generator set.
2. Cooling data is based on 1000 ft (305 m) site test location.
3. Generator set power output may need to be reduced at high ambient conditions. Refer generator set data sheet for derate schedules.
4. Cooling performance may be reduced due to several factors including but not limited to: Incorrect installation, improper operation, fouling of the cooling system, and other site installation variables.



# 2023 EPA Exhaust Emission Compliance Statement C45 N6 Standby 60 Hz Spark Ignited Generator Set

**Compliance Information:**

The engine used in this generator set complies with U.S. EPA emissions regulations under the provisions of 40 CFR Part 60, Stationary Emergency Spark-Ignited emissions limits when tested on 6 mode cycle of Part 90.

Engine Manufacturer: Cummins Inc.  
 EPA Certificate Number: **PCEXB05.9ARC-005**  
 Effective Date: 07/21/2022  
 Date Issued: 07/21/2022  
 EPA Engine Family (Cummins Emissions Family): PCEXB05.9ARC

**Engine Information:**

Model:	QSJ5.9G-G1	Bore:	4.02 in. (102 mm)
Engine Nameplate HP:	76.9	Stroke:	4.72 in. (120 mm)
Type:	4 Cycle, In-Line, 6 Cylinder	Displacement:	359.0 cu. in. (6 liters)
Aspiration:	Naturally Aspirated	Compression Ratio:	8.5:1
Emission Control Device:	Electronic Air/Fuel Ratio Control and Closed-Loop Breather System	Exhaust Stack Diameter:	4.0 in (102 mm)

**U.S. Environmental Protection Agency Station Emergency SI Emission Limits**

Natural Gas	Grams per BHP-hr		Grams per kWm-hr	
	<u>NOx + NMHC</u>	<u>CO</u>	<u>NOx + NMHC</u>	<u>CO</u>
EPA Emissions Limit	10.0	387	13.4	519

Propane (LP)	Grams per BHP-hr		Grams per kWm-hr	
	<u>NOx + THC</u>	<u>CO</u>	<u>NOx + THC</u>	<u>CO</u>
EPA Emissions Limit	10.0	387	13.4	519

Tests conducted using alternate methods, instrumentation, fuel or reference conditions can yield different results.

Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.



## Prototype Test Support (PTS) 60 Hz test summary



<u>Generator set models</u>		<u>Representative prototype</u>	
<b>C45 N6</b>	C50 N6	Model:	C60 N6
C60 N6		Alternator:	UC224G
		Engine:	QSJ5.9G

The following summarizes prototype testing conducted on the designated representative prototype of the specified models. This testing is conducted to verify the complete generator set electrical and mechanical design integrity. Prototype testing is conducted only on generator sets not sold as new equipment.

**Maximum surge power: 62.6 kW**  
The generator set was evaluated to determine the stated maximum surge power.

**Maximum motor starting: 70 kVA**  
The generator set was tested to simulate motor starting by applying the specified kVA load at low lagging power factor (0.4 or lower). With this load applied, the generator set recovered to a minimum of 90% rated voltage.

**Alternator temperature rise:**  
The highest rated temperature rise (120 °C) test results are reported as follows to verify that worst case temperature rises do not exceed allowable NEMA MG1 limits for class H insulation. Tests were conducted per IEEE 115, rise by resistance and embedded detector, with the rated voltages. Only the highest temperatures are reported.

<u>Location</u>	<u>Maximum rise (°C)</u>
Alternator stator	72
Alternator rotor	81
Exciter stator	N/A
Exciter rotor	N/A

**Torsional analysis and testing:**  
The generator set was tested to verify that the design is not subjected to harmful torsional stresses. A spectrum analysis of the transducer output was conducted over the speed range of 1650 to 1950 RPM.

**Cooling system:** 50 °C ambient  
0.5 in. H<sub>2</sub>O restriction  
The cooling system was tested to determine ambient temperature and static restriction capabilities. The test was performed at full rated load in elevated ambient temperature under static restriction conditions.

**Durability:**  
The generator set was subjected to a minimum 1000 hour endurance test operating at variable load up to the Standby rating based upon MIL-STD-705 to verify structural soundness and durability of the design.

**Electrical and mechanical strength:**  
The generator set was tested to several single phase and three phase faults to verify that the generator can safely withstand the forces associated with short circuit conditions. The generator set was capable of producing full rated output at the conclusion of the testing.

**Steady state performance:**  
The generator set was tested to verify steady state operating performance was within the specified maximum limits.

Voltage regulation:	± 1%
Random voltage variation:	± 1%
Frequency regulation:	± 0.25%
Random frequency variation:	± 0.25%

**Transient performance:**  
The generator set was tested to verify single step loading capability as required by NFPA 110 and verify acceptable voltage and frequency response on load addition or rejection. The following results were recorded at 0.8 power factor:

Full load acceptance:

Voltage dip:	18.7%
Recovery time:	3.8 seconds
Frequency dip:	8.9%
Recovery time:	2.4 seconds

Full load rejection:

Voltage rise:	13.4%
Recovery time:	2.5 seconds
Frequency rise:	12.2%
Recovery time:	2.9 seconds

**Harmonic analysis:**  
(per MIL-STD-705B, method 601.4)

<u>Harmonic</u>	<u>Line to Line</u>		<u>Line to Neutral</u>	
	<u>No load</u>	<u>Full load</u>	<u>No load</u>	<u>Full load</u>
3	0.1	2.2	0.1	2.3
5	1.1	0.9	1.1	0.9
7	0.7	0.6	0.7	0.6
9	0.1	0.8	0.0	0.8
11	0.3	0.3	0.3	0.3
13	0.2	0.1	0.2	0.1
15	0.0	0.2	0.0	0.2

# **SECTION 3**

## **GENERATOR ACCESSORIES**



## Data Sheet

# Circuit Breakers

## Description

This Data sheet provides circuit breaker manufacturer part numbers and specifications. The Circuit breaker box description is the rating of that breaker box installation on a Cummins Generator. Please refer to the website of the circuit breaker manufacturer for breaker specific ratings and technical information.

## Applicable Models

Engine	Models					
Kubota	C10D6	C15D6	C20D6			
QSJ2.4	C20N6	C25N6	C30N6	C30N6H	C36N6	C36N6H
	C40N6	C40N6H	C50N6H	C60N6H		
B3.3	C25D6	C30D6	C35D6	C40D6	C50D6	C60D6
QSJ5.9G	C45N6	C50N6	C60N6	C70N6	C80N6	C100N6
QSJ8.9G	C125N6	C150N6	C175N6B	C200N6B		
QSB5	DSFAC	DSFAD	DSFAE	C50D6C	C60D6C	C80D6C
	C100D6C	C125D6C				
QSB7	DSGAA	DSGAB	DSGAC	DSGAD	DSGAE	
		C125D6D	C150D6D	C175D6D	C200D6D	
QSL9	DSHAD	DQDAA	DQDAB	DQDAC		
QSM11	DQHAB					
QSX15	DFEJ	DFEK				

## Instructions

1. Locate the circuit breaker feature code or part number and use the charts below to find the corresponding manufacturer circuit breaker catalog number.
2. Use the first letter of the circuit breaker catalog number to determine the "frame" of the breaker. If the first letter is an "N", use the second letter. Then follow the corresponding website link from the table below to find the breaker catalog number description.

Please refer to the catalog numbering systems page, which is given in the chart, to understand the nomenclature of the catalog number.

Frame	Catalog name*	Catalog number description page(s)
P	<a href="http://www.schneider-electric.us/en/download/document/0612CT0101/">0612CT0101</a> <a href="http://www.schneider-electric.us/en/download/document/0612CT0101/">http://www.schneider-electric.us/en/download/document/0612CT0101/</a>	16-17
H, J, and L	<a href="http://www.schneider-electric.us/en/download/document/0611CT1001/">0611CT1001</a> <a href="http://www.schneider-electric.us/en/download/document/0611CT1001/">http://www.schneider-electric.us/en/download/document/0611CT1001/</a>	8-9
Q	<a href="http://www.schneider-electric.us/en/download/document/0734CT0201/">0734CT0201</a> <a href="http://www.schneider-electric.us/en/download/document/0734CT0201/">http://www.schneider-electric.us/en/download/document/0734CT0201/</a>	4

\*The following link may also be used to search specifically by the breaker part number or for the catalog name listed above. <http://products.schneider-electric.us/technical-library/>

3. Search the catalog by using the first 3 letters of the breaker catalog number and the first 5 numbers to find information such as trip curves, accessories, and dimensional details regarding the circuit breaker.

\*If the catalog number starts with "N", skip the N and begin your search with the second letter.

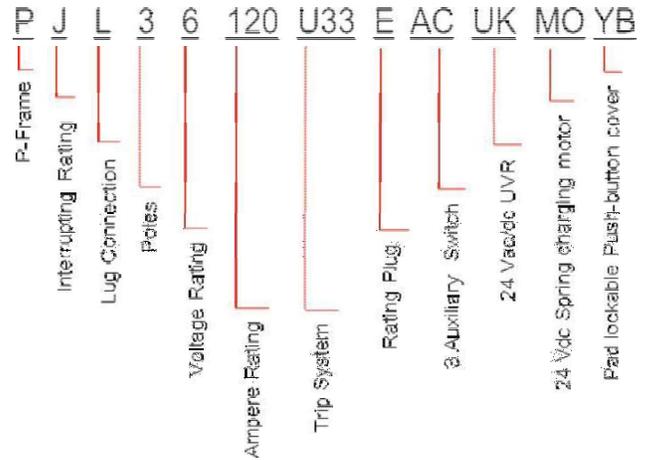
\*If the first 3 letters are "PJP," the search will not work. You will need to start with just "PJ" and use the description pages to obtain the information you are looking for on the "PJP."

### Example

After finding your circuit breaker catalog number to be "PJL36120U33EACUKMOYB," navigate to the P-frame catalog by using the link provided.

Look at pages 16-17 of the pdf catalog to find the nomenclature of the breaker.

Search the P-frame spec sheet using the search "PJL36120."



Feature Code	Breaker Box Description	Cummins Part #	Manufacturer	Breaker Catalog Number	Trip Unit	Plug Type
KV35-2	CB,Loc A,50A,3P,600VAC,80%,UL	A043L461	Schneider Electric	HDL36050	Thermal Magnetic	N/A
KV36-2	CB,Loc A,60A,3P,600VAC,80%,UL	A043L459	Schneider Electric	HDL36060	Thermal Magnetic	N/A
KV37-2	CB,Loc A,70A,3P,600VAC,80%,UL	A043L451	Schneider Electric	HDL36070	Thermal Magnetic	N/A
KV38-2	CB,Loc A,80A,3P,600VAC,80%,UL	A043L012	Schneider Electric	HDL36080	Thermal Magnetic	N/A
KV39-2	CB,Loc A,90A,3P,600VAC,80%,UL	A043K997	Schneider Electric	HDL36090	Thermal Magnetic	N/A
KV40-2	CB,Loc A,100A,3P,600VAC,80%,UL	A043L024	Schneider Electric	HDL36100	Thermal Magnetic	N/A
KV41-2	CB,Loc A,125A,3P,600VAC,80%,UL	A043K994	Schneider Electric	HDL36125	Thermal Magnetic	N/A
KV42-2	CB,Loc A,150A,3P,600VAC,80%,UL	A043K991	Schneider Electric	HDL36150	Thermal Magnetic	N/A
KV43-2	CB,Loc A,175A,3P,600VAC,80%,UL	A043L619	Schneider Electric	JDL36175	Thermal Magnetic	N/A
KV44-2	CB,Loc A,200A,3P,600VAC,80%,UL	A043L520	Schneider Electric	JDL36200	Thermal Magnetic	N/A
KV45-2	CB,Loc A,225A,3P,600VAC,80%,UL	A043L517	Schneider Electric	JDL36225	Thermal Magnetic	N/A
KV46-2	CB,Loc A,250A,3P,600VAC,80%,UL	A043L510	Schneider Electric	JDL36250	Thermal Magnetic	N/A
KV47-2	CB,Loc A,250A,3P,600VAC,100%,UL	A044C640	Schneider Electric	JDL36250U31XLC	MicroLogic 3.2S	N/A
KV55-2	CB,Loc B,15A,2P,600VAC,80%,UL	A043E189	Schneider Electric	HDL26015	Thermal Magnetic	N/A
KV57-2	CB,Loc B,25A,2P,600VAC,80%,UL	A043E191	Schneider Electric	HDL26025	Thermal Magnetic	N/A
KV58-2	CB,Loc B,30A,2P,600VAC,80%,UL	A043E185	Schneider Electric	HDL26030	Thermal Magnetic	N/A
KV59-2	CB,Loc B,40A,2P,600VAC,80%,UL	A043E183	Schneider Electric	HDL26040	Thermal Magnetic	N/A

# Product data sheet

Specifications

SQUARE D

Green Premium™



Circuit breaker, PowerPacT H,  
thermal magnetic, unit mount, 60A,  
3 pole, 14 kA, 600 VAC,

HDL36060

## Main

Range	PowerPact
Product name	PowerPact H
Product or component type	Circuit breaker
Device application	Distribution

## Complementary

Line Rated Current	60 A
Number of Poles	3P
Protected poles description	3t
Control type	Toggle
Breaking capacity code	D
Breaking capacity	25 kA 240 V AC 50/60 Hz UL 489 18 kA 480 V AC 50/60 Hz 14 kA 600 V AC 50/60 Hz 20 kA 250 V DC
[Ue] rated operational voltage	690 V AC 50/60 Hz IEC 60947-3
Network frequency	50/60 Hz
[Ics] rated service breaking capacity	25 kA 220/240 V AC 50/60 Hz IEC 60947-2 18 kA 380/440/415 V AC 50/60 Hz IEC 60947-2 14 kA 500/525 V AC 50/60 Hz IEC 60947-2 20 kA 250 V DC IEC 60947-2 20 kA 500 V DC IEC 60947-2
[Uimp] rated impulse withstand voltage	8 kV IEC 60947-2
Trip unit technology	Thermal-magnetic
Magnetic tripping current	1450 A
Magnetic hold current	800 A
[Ui] rated insulation voltage	750 V IEC 60947-2
Suitability for isolation	Yes IEC 60947-2
Utilisation category	Category A
AWG gauge	<b>Please see CB outline drawing for lug and termination details</b>

<b>Local signalling</b>	Switched off (OFF) 1 trip indicator green)
<b>Mounting mode</b>	Unit mount lug)
<b>Mounting support</b>	Lug
<b>Electrical connection</b>	Lugs line Lugs load
<b>Terminal identifier</b>	Please see CB outline drawing for lug and termination details
<b>Tightening torque</b>	44.25 lbf.in (5 N.m) 0.00...0.01 in <sup>2</sup> (2.5...6 mm <sup>2</sup> ) (AWG 14...AWG 10) 123.91 lbf.in (14 N.m) 0.02...0.15 in <sup>2</sup> (10...95 mm <sup>2</sup> ) (AWG 8...AWG 3/0)
<b>Number of slots</b>	2 auxiliary switch OF plug-in) 1 alarm switch SD plug-in) 1 overcurrent trip switch SDE plug-in) 1 voltage release MN or MX plug-in)
<b>Power wire stripping length</b>	0.63 in (16 mm)
<b>Color</b>	Black
<b>Height</b>	6.42 in (163 mm)
<b>Width</b>	4.09 in (104 mm)
<b>Depth</b>	3.39 in (86 mm)
<b>Net weight</b>	4.85 lb(US) (2.2 kg)
<b>Quantity per set</b>	1
<b>Communication interface</b>	Modbus Ethernet

## Environment

<b>Quality labels</b>	CE
<b>Standards</b>	UL CSA NEMA NOM-003-SCFI-2000 IEC 60947-2
<b>Product certifications</b>	UL CSA NOM
<b>IP degree of protection</b>	Front cover IP40 IEC 60529
<b>Pollution degree</b>	3 IEC 60947-1
<b>Ambient air temperature for operation</b>	28...158 °F (-2...70 °C)
<b>Ambient air temperature for storage</b>	-58...185 °F (-50...85 °C)
<b>Operating altitude</b>	< 6561.68 ft (2000 m) without derating 5000 m with derating

## Ordering and shipping details

<b>Category</b>	01110 - HD,JD UNIT MT BREAKER/SWITCH
<b>Discount Schedule</b>	DE2
<b>GTIN</b>	785901577959
<b>Nbr. of units in pkg.</b>	1
<b>Package weight(Lbs)</b>	4.15 lb(US) (1.882 kg)
<b>Returnability</b>	Yes
<b>Country of origin</b>	MX

## Packing Units

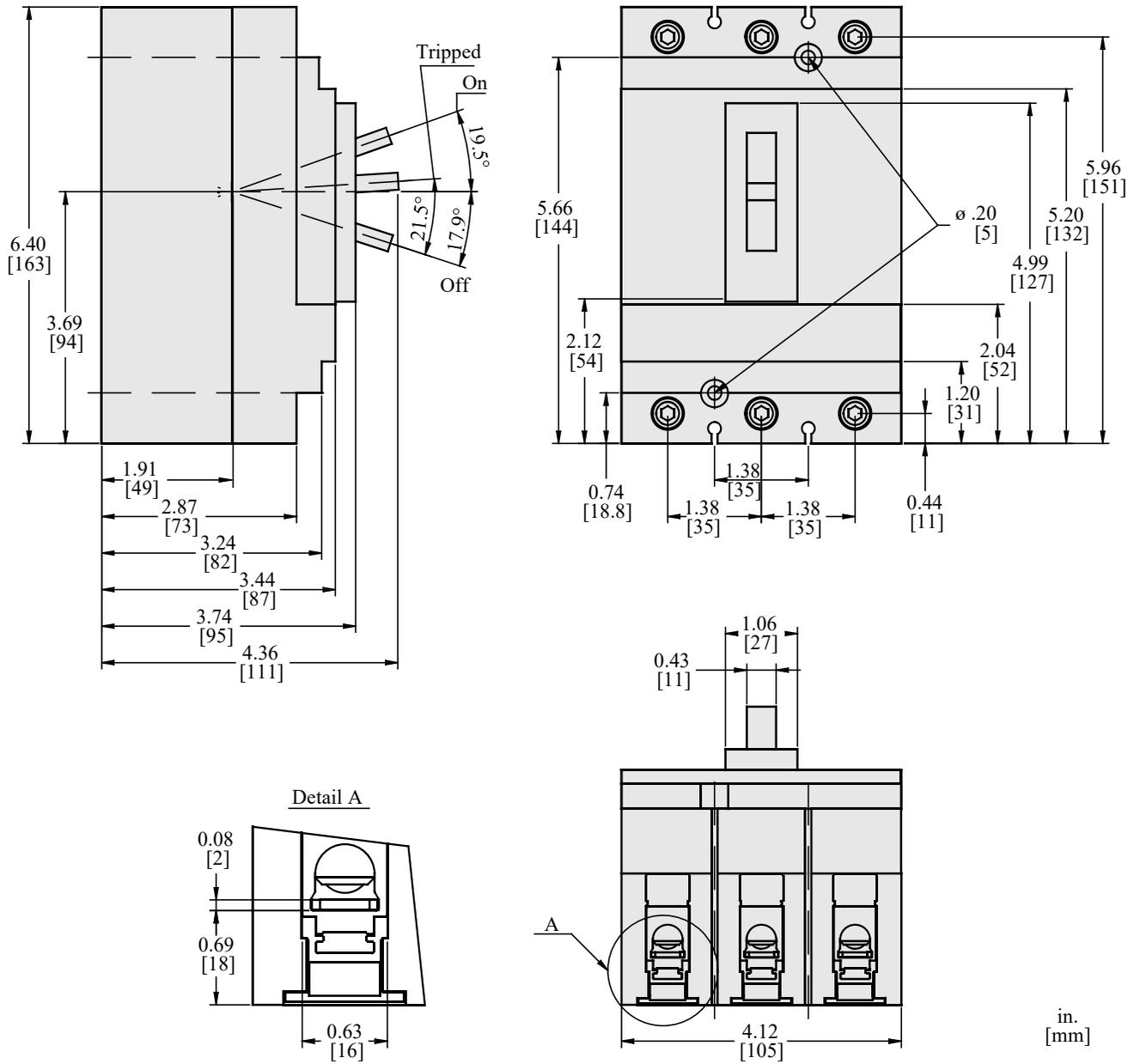
<b>Unit Type of Package 1</b>	PCE
-------------------------------	-----

<b>Package 1 Height</b>	5.70 in (14.478 cm)
<b>Package 1 width</b>	7.50 in (19.05 cm)
<b>Package 1 Length</b>	8.70 in (22.098 cm)

## Offer Sustainability

<b>Sustainable offer status</b>	Green Premium product
<b>California proposition 65</b>	WARNING: This product can expose you to chemicals including: DINP, which is known to the State of California to cause cancer, and DIDP, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to <a href="http://www.P65Warnings.ca.gov">www.P65Warnings.ca.gov</a>
<b>REACH Regulation</b>	<a href="#">REACH Declaration</a>
<b>EU RoHS Directive</b>	Compliant <a href="#">EU RoHS Declaration</a>
<b>Mercury free</b>	Yes
<b>RoHS exemption information</b>	Yes
<b>China RoHS Regulation</b>	<a href="#">China RoHS declaration</a> Product out of China RoHS scope. Substance declaration for your information.
<b>Environmental Disclosure</b>	<a href="#">Product Environmental Profile</a>
<b>Circularity Profile</b>	<a href="#">End of Life Information</a>
<b>PVC free</b>	Yes

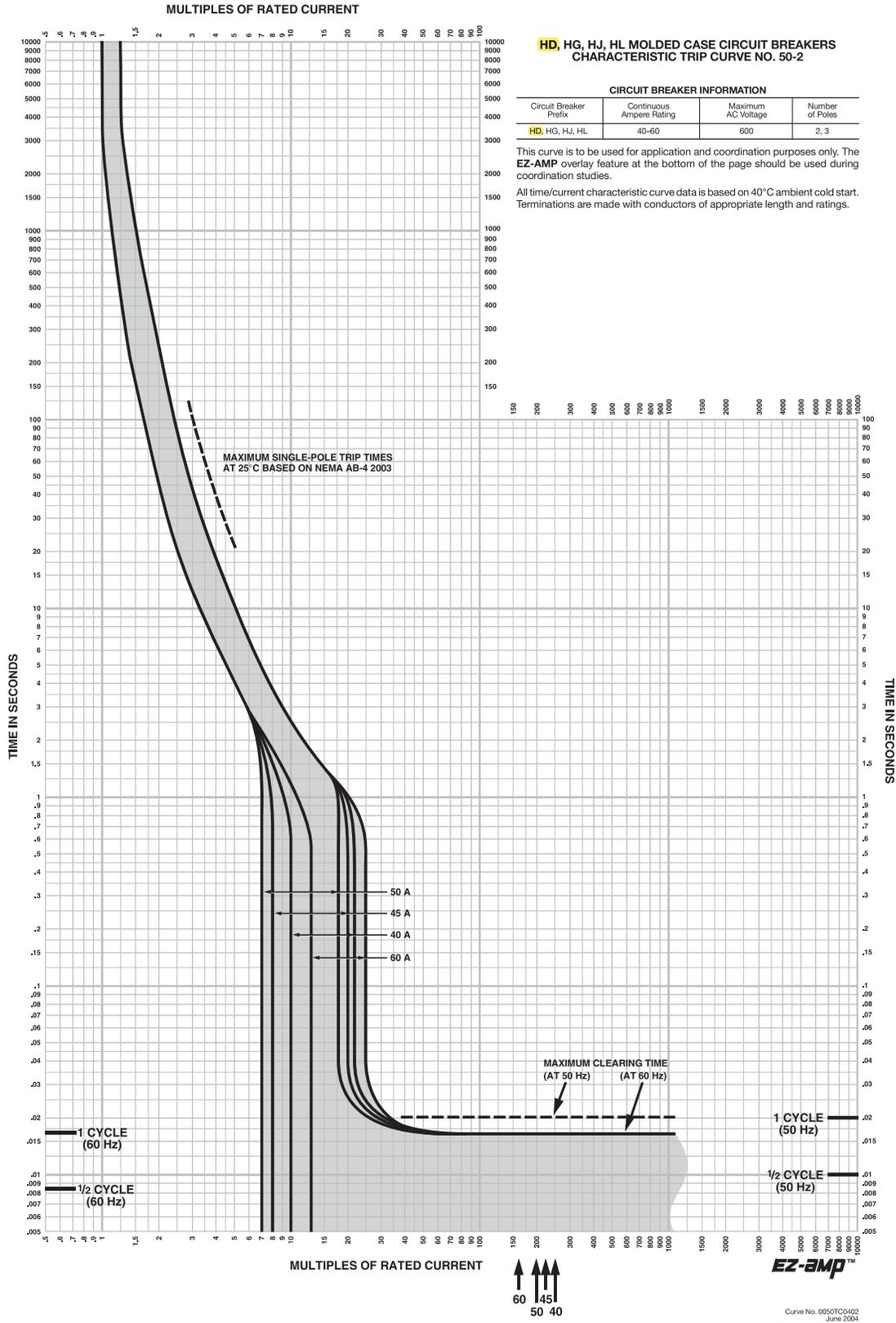
Dimensions



All dimensions are approximate. Also refer to technical drawings and documentation.

# PowerPact H-, J-, and L-Frame Circuit Breakers Trip Curves

Figure 71: H-Frame 40–60 A (HD, HG, HJ, and HL) Thermal-Magnetic Trip





## Battery Charger-6 Amp

A045D925 60Hz/50Hz



### Description

Cummins® fully automatic battery chargers are designed to both recharge your batteries, and extend your battery's life in applications where it is stored for long periods of time. This charger can handle poor power quality, exposure to extreme weather and rough handling.

To maximize battery life, a 3-stage charging cycle is implemented. The three charging stages are bulk stage, absorption stage and maintenance stage. During the bulk stage, the charger uses its full amp output to do the heaviest charging, quickly bringing your battery to about 75% of capacity. In the absorption stage, the current slows, adjusting for maximum charging efficiency while it gently tops off the battery to about 98% of capacity.

During the maintenance stage, a lower, closely-regulated, constant voltage is applied to maintain full charge and prevent discharge.

Unlike some "trickle chargers," the float charger won't apply more current than necessary to maintain full charge. Batteries can be connected indefinitely, without harm; in fact, the float charge extends battery life.

### Features

**Protection** – Surge protected to IEEE and EN standards. All models include single pole cartridge type fuses mounted on the printed circuit board to protect against input or output overcurrent.

**Lightweight and Silent** – Lighter than transformer types, completely silent but still provides full output when overloaded outlets drop AC voltage below the normal 115V.

**Monitoring** – Status LED indicators are provided to show the condition or charging status of the battery. When the red LED is on, it indicates that the battery is discharged and is recharging at the 'BULK' rate. When both the red and green LEDs are on, the battery is charging at the 'midrange' rate. When the green LED is on, the battery is 90% charged and ready for use.

**Construction** – Made using epoxy-potted cases making it the ultimate in durability, completely waterproof and able to withstand numerous caustic chemicals and gases, as well as being shockproof.

**Fault Indication** – The charger senses and indicates the following fault conditions: Defective or damaged cells, under-voltage at the battery, battery drawing more current than charger can replace, loss of power or extremely low AC voltage at the charger, other battery fault conditions and charger failure.

**Compatibility** – Works with Sealed Lead Acid (SLA), Absorbed Glass Mat (AGM) and Gel type batteries.

**Low Electromagnetic and Radio**

**Frequency Interference** – This product meets FCC class B for conducted and radiated emissions.

**Listed** – This product is UL listed according to the UL 1236 Standard.

**Warranty** – This product has a two year warranty

## Specifications

### Performance and Physical Characteristics

<b>Output:</b>	Nominal voltage	12 VDC
	Float voltage – 12 V batteries	13.0-13.6 VDC at 0-2 amps
	Maximum output current	6 A @ 12 VDC nom
<b>Input:</b>	Voltage AC	115, 208, 240 ±10%, 90-135
	Frequency	60 Hz ±5%
<b>Battery:</b>	Maximum battery size	150 Amp Hours
	Maximum recharge time	20 hours
<b>Approximate net weight</b>		4 lbs. (1.81 Kg)
<b>Approximate dimensions: height x width x depth-in(mm)</b>		2.25 x 6.4 x 3.5 (57 x 162 x 89)
<b>Ambient temperature operation: At full rated output</b>		-40°F to 122 °F (-40 °C to 50 °C)



**Warning:** Back feed to a utility system can cause electrocution and/or property damage. Do not connect generator sets to any building electrical system except through an approved device or after building main switch is open.

**Warning:** For professional use only. Must be installed by a qualified service technician. Improper installation presents hazards of electrical shock and improper operation, resulting in severe personal injury and/or property damage.

For more information contact your local Cummins distributor  
or visit [power.cummins.com](http://power.cummins.com)

**Our energy working for you.™**



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NAAC-5943-EN / PDA059R693 (06/21)



# Battery and Accessories



## Battery Specifications

Battery Part Number	Group Size	CCA	Reserve Capacity	Battery	Voltage	Length	Width	Height	Ship Weight lbs.	Quarts Electrolyte
0416-1330	24XL	810	146	Wet	12	10.3	9.0	6.6	43	5.9
0416-1051	26	530	80	Wet	12	8.2	6.8	8.1	31	3.7
0416-0796	31	725	150	Wet	12	12.7	6.0	9.3	62	4.2
0416-0980	31	1000	185	Wet	12	13.0	6.8	9.5	59	4.2
A045P632	34	850	NA	Wet	12	10.3	6.6	8.0	NA	NA
0416-1291	34	800	100	Sealed	12	10.0	6.9	7.9	38	4.0
A030Y976	4D	1050	290	Wet	12	20.7	8.7	10.0	100	NA
0416-0439	8D	1400	430	Dry	12	20.8	10.7	9.5	110	16.0
0416-1105	8D	1400	430	Wet	12	20.8	10.8	9.5	125	16.0
A062X621	24	800	135	Wet	12	10.1	6.8	8.7	42	N/A
<b>A062X662</b>	<b>34</b>	<b>800</b>	<b>120</b>	<b>Wet</b>	<b>12</b>	<b>10.2</b>	<b>6.9</b>	<b>7.9</b>	<b>38</b>	<b>N/A</b>

## Application – Diesel Continued

Model	Current Spec	Battery Size*	Supported Part Number*	Battery CCA*	Genset Minimum CCA	Battery Voltage	Starting (Genset) Voltage	Required Battery Quantity
DQKAA	D	8D	0416-0439	1400	1400	12	24	4
DQKAB	D	8D	0416-0439	1400	1400	12	24	4
DQKAD	F	8D	0416-0439	1400	2200	12	24	4
DQKAE	F	8D	0416-0439	1400	2200	12	24	4
DQKAF	F	8D	0416-0439	1400	2200	12	24	4
DQKAN	D	8D	0416-0439	1400	2200	12	24	4
DQLE	L	8D	0416-0439	1400	2200	12	24	6
DQLF	L	8D	0416-0439	1400	2200	12	24	6
DQPAA	D	8D	0416-0439	1400	1800	12	24	2
DQPAB	D	8D	0416-0439	1400	1800	12	24	2
DSGAB	M	24XL	0416-1330	810	1100	12	12	2
DSGAC	M	24XL	0416-1330	810	1100	12	12	2
DSGAD	E	24XL	0416-1330	810	1100	12	12	2
DSGAE	E	24XL	0416-1330	810	1100	12	12	2
DSHAD	F	24XL	0416-1330	810	1500	12	12	2

\* First line refers to *standby* battery size and the second line refers to *cold starting* battery size for C10 D6 – C360 D6.

## Application – Gas

Listed below, by set model, is the specific battery size designed to fit the skid mounted battery rack (larger batteries, if required, may not fit the standard skid mounted rack.)

Model	Current Spec	Battery Size*	Supported Part Number*	Battery CCA*	Genset Minimum CCA	Battery Voltage	Starting (Genset) Voltage	Required Battery Quantity*
<b>C20 N6</b>	A	26	0416-1051	545	545	12	12	1
		34	A045P632	850				
<b>C22 N6</b>	A	26	0416-1051	545	545	12	12	1
		34	A045P632	850				
<b>C25 N6</b>	A	26	0416-1051	545	545	12	12	1
		34	A045P632	850				
<b>C30 N6</b>	A	26	0416-1051	545	545	12	12	1
		34	A045P632	850				
<b>C30 N6H</b>	A	26	0416-1051	545	545	12	12	1
		34	A045P632	850				
<b>C36 N6</b>	A	26	0416-1051	545	545	12	12	1
		34	A045P632	850				
<b>C36 N6H</b>	A	26	0416-1051	545	545	12	12	1
		34	A045P632	850				
<b>C40 N6</b>	A	26	0416-1051	545	545	12	12	1
		34	A045P632	850				
<b>C45 N6</b>	A	24	A062X621	800	850	12	12	2
		34	A062X662	800				
<b>C40 N6H</b>	A	26	0416-1051	545	545	12	12	1
		34	A045P632	850				
<b>C45 N6H</b>	A	26	0416-1051	545	545	12	12	1
		34	A045P632	850				
<b>C50 N6</b>	A	24	A062X621	800	850	12	12	2
		34	A062X662	800				
<b>C50 N6H</b>	A	26	0416-1051	545	545	12	12	1
		34	A045P632	850				
<b>C60 N6</b>	A	24	A062X621	800	850	12	12	2
		34	A062X662	800				
<b>C60 N6H</b>	A	26	0416-1051	545	545	12	12	1
		34	A045P632	850				
<b>C70 N6</b>	A	24	A062X621	800	850	12	12	2
		34	A062X662	800				
<b>C80 N6</b>	A	24	A062X621	800	850	12	12	2
		34	A062X662	800				
<b>C100 N6</b>	A	24	A062X621	800	850	12	12	2
		34	A062X662	800				

\* First line refers to *standby* battery size and the second line refers to *cold starting* battery size for C20 N6 – C40 N6.



**GS120  
Emergency  
Generator Stop**

# EMERGENCY GENERATOR STOP

**PUSH BUTTON  
PILLA MODEL SERIES**

## GS120-Emergency Generator Stop



**CLEAR  
PROTECTIVE  
COVER  
PILCLHCOV1**

**For all industrial, institutional, and marine generator set applications including those under N.F.P.A. requirements 99 & 110. Full range of options available.**

**SERIES GS120 EMERGENCY GENERATOR STOP  
Push Button Station  
Maintained (Pull to Reset) 40mm mushroom operator is standard**

Description				
SURFACE MOUNT	NEMA 4X	NONMETALLIC BACKBOX	(SEE SUFFIX HB)	1-6 CONTACT BLOCK CAPACITY

### FEATURES

- Large heavy duty mushroom operator, maintained "Pull to Reset" (standard)
- **Maintained "Turn to Reset" mushroom model also available: Add model suffix TW**
- **Momentary mushroom model also available: Add suffix MO**
- Nonmetallic NEMA 4X enclosure with stainless steel machine screws (standard)
- Bold, silk screen legends on white enamel aluminium face plate (standard)
- Economy NEMA 1 metal backbox models also available for both surface and flush mount applications
- Standard depth 4 x 4x 2.375 inch nonmetallic enclosure holds two contact blocks
- Extra depth 4 x 4x 4.5 inch nonmetallic enclosure holds six contact blocks: **Add suffix XD**
- **Super depth 4 x 4x 6.5 inch nonmetallic enclosure holds ten contacts blocks: Add suffix SD**
- Metal backbox models(surface and flush mount)use 4 x 4x 3 inch enclosure holding four contacts blocks
- **All-metal models meet NYC, Chicago and other specific requirements: Add suffix MT1, MT4 or MS as needed**
- Illuminated models include 120V lamp (standard, specify if other voltage desired) in mushroom or round push button (Note 2 above): **Add model suffix IL**
- Restricted operator access available: See options available above for model suffix RP/RR/CP/CR
- Restricted operator access available: See Series PIL accessory PILCHCOV1
- **Key Release mushroom model restricts reset/release access only: Add suffix KR**
- Contact blocks rated 10 AMP continuous up to 600 volts\*

## PILCLHCOV1



**One clear Hinged cover fits all one device/push button model series and one-two device/Power Control series, provision for padlock/seal. Can be adapted for use with , and is same outside dimension as 4X4 wall box.**

## Fuel Strainers – Liquid or Vapor Withdrawal

LPG Vapor Part Number	Fitting Size
149-0558	3/4"
149-0752	1"
149-0624	1-1/4"
149-0751	2"
149-1241	3"

LPG Liquid Part Number	Fitting Size
149-0625	1/4"

## Solenoid Valves

For natural gas, LPG vapor, LPG liquid, diesel, or gasoline fuel (UL approved).

### Natural Gas or LPG Vapor

For Gas Pressures Not Exceeding	NPT Fitting Size (Female)	12 VDC Part Number	24 VDC Part Number
1.5 psi	3/4"	307-2930	N/A
5.0 psi	3/4"	307-2892	307-2895
5.0 psi	1"	307-2890	N/A
5.0 psi	1-1/4"	307-2891	N/A
5.0 psi	2"	307-2893	307-2894

### Natural Gas or LPG Vapor

Not to be used in temperature below 34 °F

For Gas Pressures Not Exceeding	NPT Fitting Size (Female)	12 VDC Part Number	24 VDC Part Number
25 psi	3/4"	307-0834	N/A
25 psi	1"	307-0836	N/A
25 psi	1-1/4"	307-0837	N/A
15 psi	2"	307-0840	307-0841

### LPG Liquid

Pipe Size	LPG	12 VDC Part Number	24 VDC Part Number
1/4"	Yes	307-0268	N/A

## LP Liquid Regulator/Converter

Part Number	Water Connection	LPG Inlet	Vapor Outlet
0148-0737	3/8"	1/4"	1/2"
0148-0625	3/8"	1/4"	1"
0148-1240	3/8"	1/4"	1"

### Americas

1400 73<sup>rd</sup> Avenue N.E.  
Minneapolis, MN 55432 USA  
Phone: 763 574 5000  
Fax: 763 574 5298

### Europe, CIS, Middle East and Africa

Manston Park Columbus Ave.  
Manston Ramsgate  
Kent CT 12 5BT United Kingdom  
Phone: 44 1843 255000  
Fax: 44 1843 255902

### Asia Pacific

10 Toh Guan Road #07-01  
TT International Tradepark  
Singapore 608838  
Phone: 65 6417 2388  
Fax: 65 6417 2399

**Warning:** Back feed to a utility system can cause electrocution and/or property damage. Do not connect generator sets to any building electrical system except through an approved device or after the building main switch is open.

**Warning:** For professional use only. Must be installed by a qualified service technician. Improper installation presents hazards of electrical shock and improper operation, resulting in severe personal injury and/or property damage.

For more information contact your local Cummins distributor  
or visit [power.cummins.com](http://power.cummins.com)

Our energy working for you.™

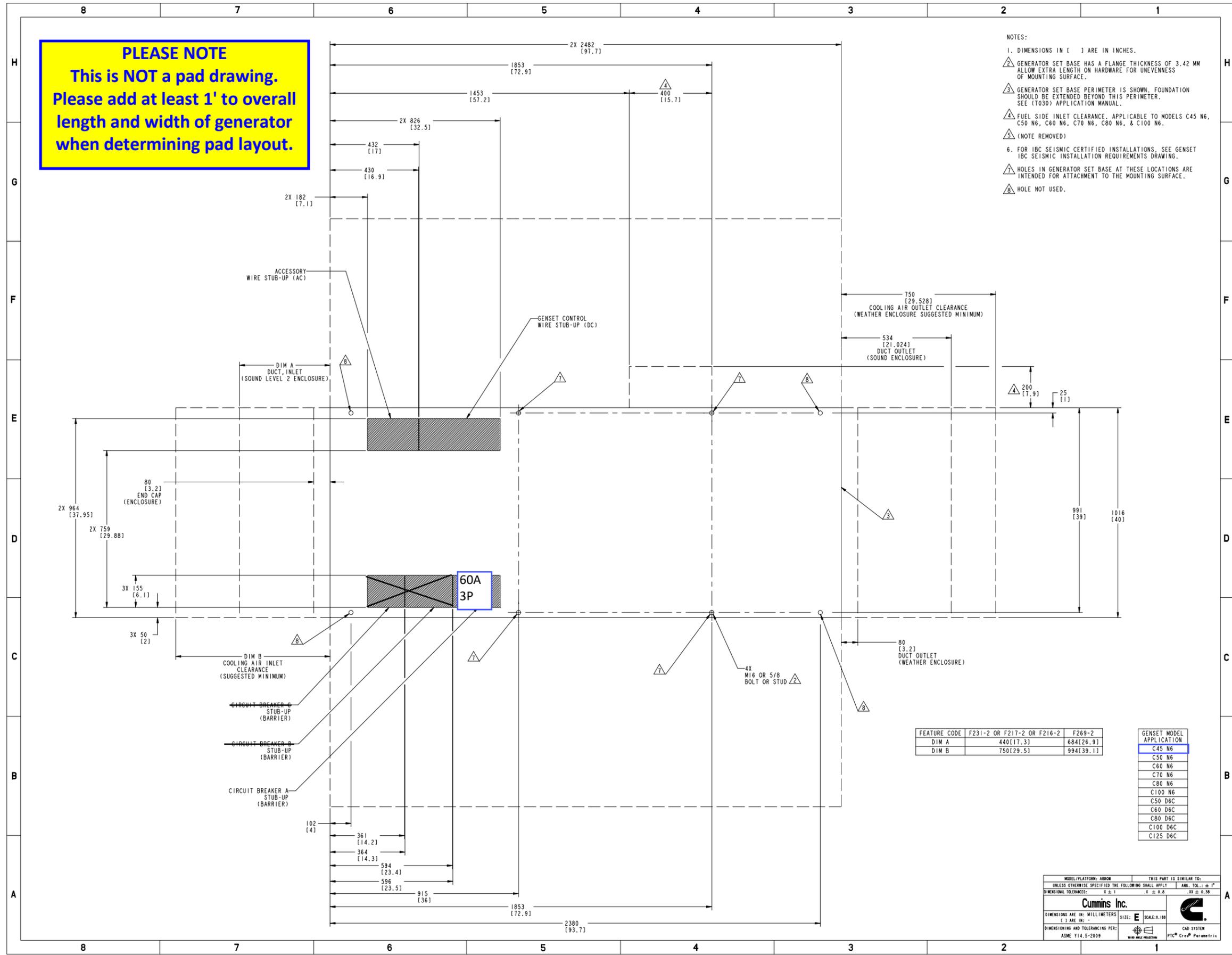


# **SECTION 4**

## **GENERATOR DRAWINGS AND INTERCONNECTS**

**PLEASE NOTE**  
**This is NOT a pad drawing.**  
**Please add at least 1' to overall length and width of generator when determining pad layout.**

- NOTES:
1. DIMENSIONS IN [ ] ARE IN INCHES.
  2. GENERATOR SET BASE HAS A FLANGE THICKNESS OF 3.42 MM. ALLOW EXTRA LENGTH ON HARDWARE FOR UNEVENNESS OF MOUNTING SURFACE.
  3. GENERATOR SET BASE PERIMETER IS SHOWN. FOUNDATION SHOULD BE EXTENDED BEYOND THIS PERIMETER. SEE (T030) APPLICATION MANUAL.
  4. FUEL SIDE INLET CLEARANCE, APPLICABLE TO MODELS C45 N6, C50 N6, C60 N6, C70 N6, C80 N6, & C100 N6.
  5. (NOTE REMOVED)
  6. FOR IBC SEISMIC CERTIFIED INSTALLATIONS, SEE GENSET IBC SEISMIC INSTALLATION REQUIREMENTS DRAWING.
- ▲ HOLES IN GENERATOR SET BASE AT THESE LOCATIONS ARE INTENDED FOR ATTACHMENT TO THE MOUNTING SURFACE.  
 ▲ HOLE NOT USED.



FEATURE CODE	F231-2 OR F217-2 OR F216-2	F269-2
DIM A	440(17.3)	684(26.9)
DIM B	750(29.5)	994(39.1)

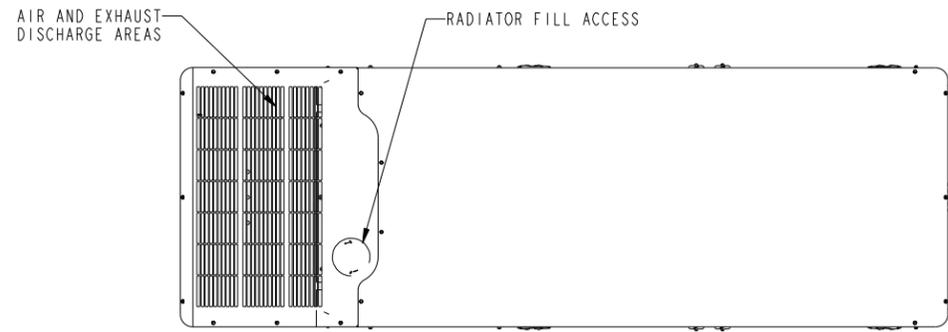
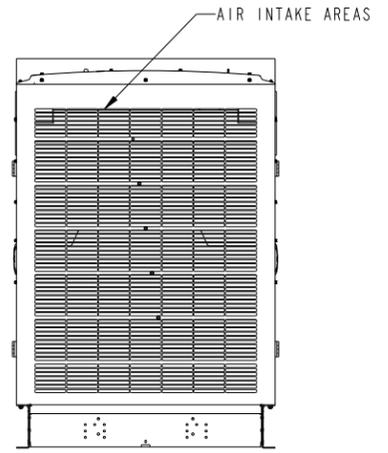
GENSET MODEL APPLICATION
C45 N6
C50 N6
C60 N6
C70 N6
C80 N6
C100 N6
C50 D6C
C60 D6C
C80 D6C
C100 D6C
C125 D6C

MODEL/PLATFORM: ARROW	THIS PART IS SIMILAR TO:
UNLESS OTHERWISE SPECIFIED THE FOLLOWING SHALL APPLY	ANG. TOL.: ± 1°
DIMENSIONAL TOLERANCES:	.X ± 0.8 .XX ± 0.38
<b>Cummins Inc.</b>	
DIMENSIONS ARE IN: MILLIMETERS [ ] ARE IN: -	SIZE: E SCALE: 1:100
DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009	CAD SYSTEM PTC® Creo® Parametric

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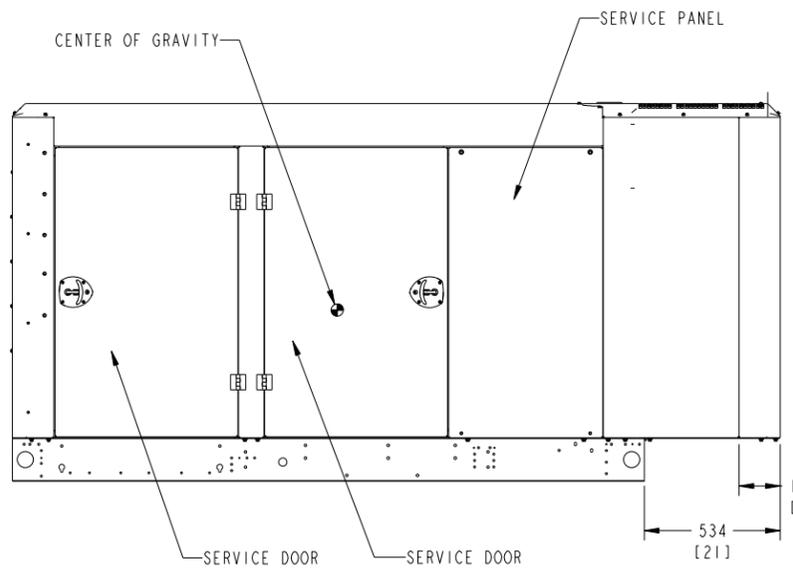
REL NO	LTR	NO	REVISION	OWN	CAD	APVD	DATE
ECO-152551	A	1	PRODUCTION RELEASE	CG	NK	M. WICKMANN	14MAY15

- NOTES:
- DIM [ ] IN INCHES
  - WHEN THE HOUSING INSTALLED ON AN OPEN GENERATOR SET, THE TOTAL WEIGHT WILL INCREASE BY 131.5 KG (290 LBS). THIS INCLUDES THE MUFFLER.
  - THE CENTER OF GRAVITY (CG) OF THE GENERATOR SET WHEN EQUIPPED WITH THIS HOUSING SHIFTS APPROXIMATELY 65mm (2.55 inch) TOWARDS THE AIR DISCHARGE END OF THE HOUSING AND 42MM (1.66 INCH) HIGHER FROM THE GROUND, COMPARED TO THE EQUIVALENT NON-HOUSED PRODUCT WITH THE F179 SKID. SEE HOUSING READY SKID BASE OUTLINE DRAWING FOR CG LOCATION OF NON HOUSED PRODUCT.

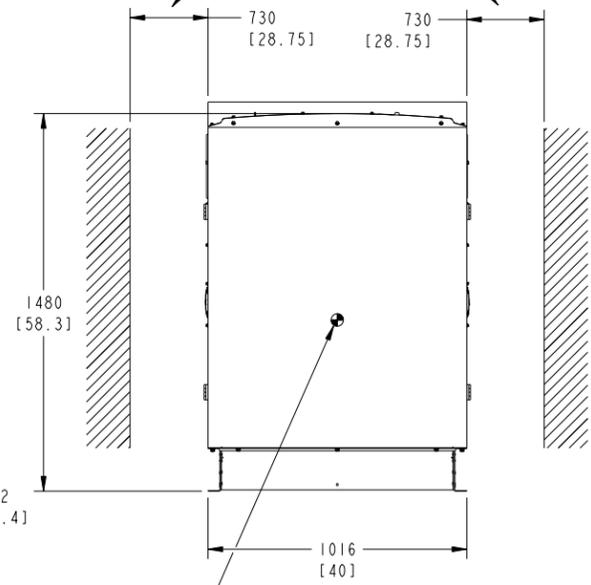


DISTANCE REQUIRED TO OPEN DOORS

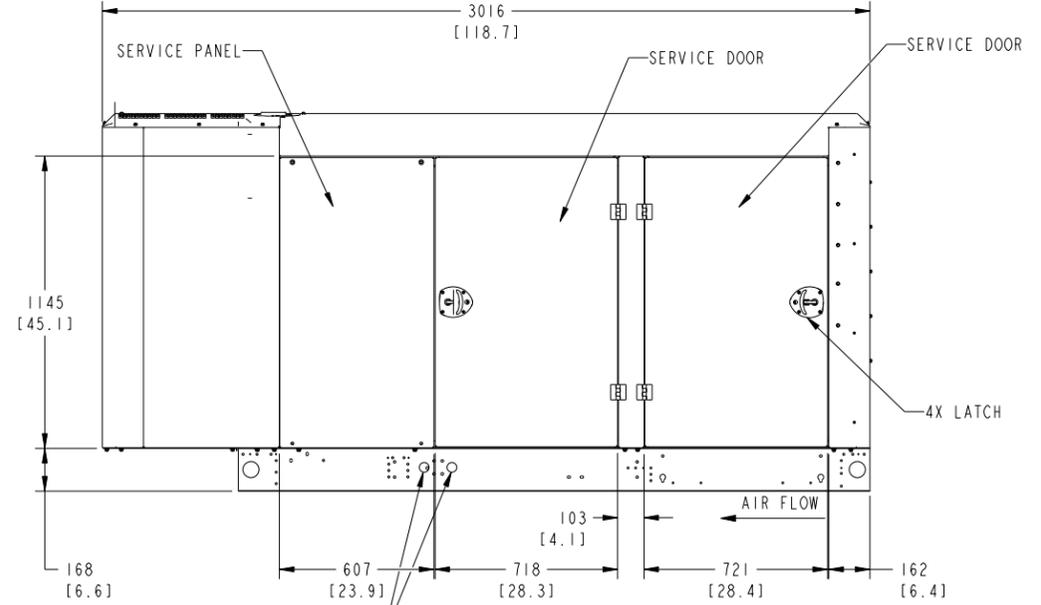
TOP VIEW



RIGHT SIDE VIEW



OUTLET VIEW



LEFT SIDE VIEW

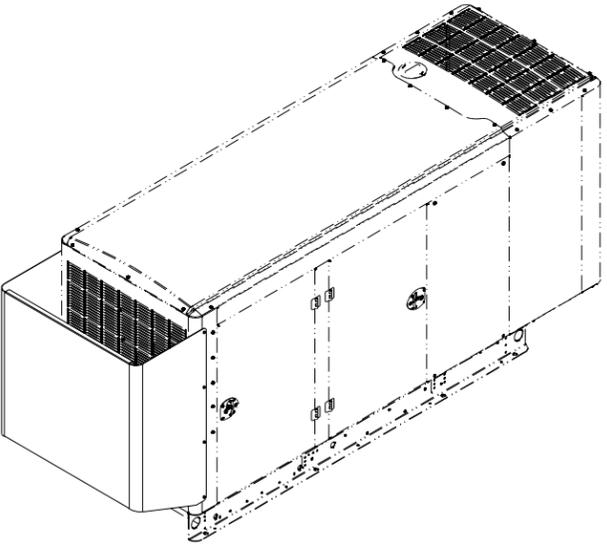
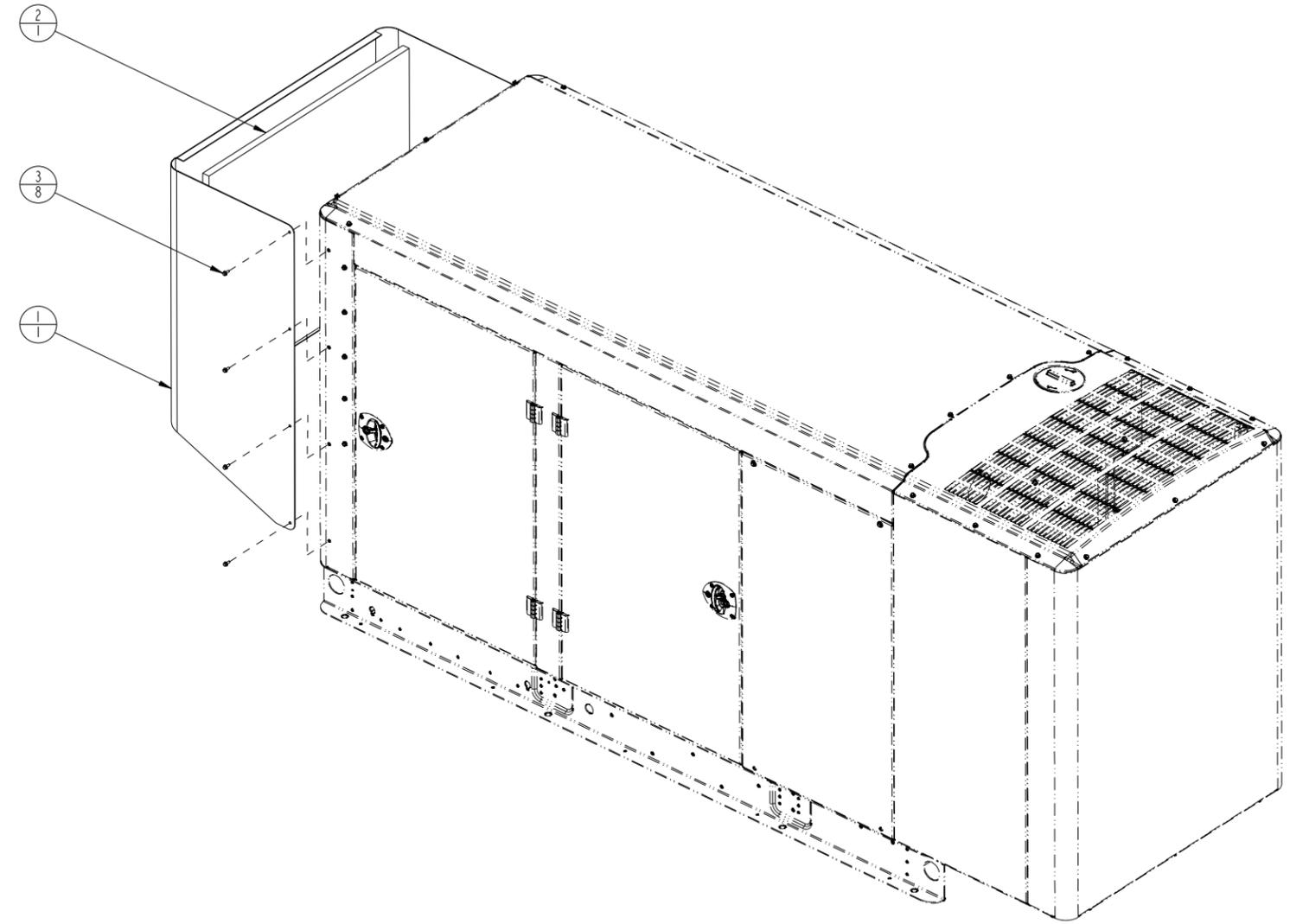
~~F231-2 ENCLOSURE CONFIGURATION~~

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIM 10 NONE	OWN C. GADE		CUMMINS POWER GENERATION	
DO NOT SCALE PRINT		DO NOT SCALE PRINT	CND N. KASIBHOTLA		OUTLINE, ENCLOSURE	
CH	X ± 1	0.00- 4.99 +0.15/-0.08	APVD M. WICKMANN		PGF	SHEET 1 OF 2
	.X ± 0.8	5.00- 9.99 +0.20/-0.10	DATE 14MAY15			
	.XX ± 0.38	10.00-17.49 +0.25/-0.13				
		17.50-24.99 +0.30/-0.13				
ANG TOL:	± 1.0°	SCALE: ~3/32	FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994	ARROW		



REL NO	LTR	NO	REVISION	DNW	CND	APVD	DATE
ECO-156396	C	1	A052M018 WAS A048C269 IN BOM	DKS	MMJ	M. JAWALE	19OCT15
		2	CHANGED APPLICATION STATUS TO	-	-	-	-
			'ACCESSORY ONLY' FROM 'PRODUCTION ONLY'	-	-	-	-
			IN MATRIX.	DKS	MMJ	M. JAWALE	19OCT15

NOTES:  
1. (NOTE REMOVED)



SCALE 1/16  
3D VIEW

**-THIS IS A CONTROLLED ITEM-**  
PER POLICY PROCEDURE PPG-1-01-01-116  
TO MAINTAIN COMPLIANCE WITH REQUIREMENTS OF THE CODES, STANDARDS, OR AGENCIES LISTED BELOW  
 CSA  IN  CE  NVIA  ABC  
 IBC  OTHER  OTHER  OTHER  
CHANGES, DEVIATIONS, OR SUBSTITUTIONS OF MATERIAL, PROCESS, OR PERFORMANCE CHARACTERISTICS MUST BE APPROVED BY THE FOLLOWING CONTROLLED ITEM APPROVER  
RESPONSIBLE CIA ROLE: STATIONARY GENSET CIA  
RESPONSIBLE CIA ROLE:

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

CH	TOL	ROUNDED	MIN	MAX
X	± 1		0.00- 4.99	+0.15/-0.08
.X	± 0.8		5.00- 9.99	+0.20/-0.10
.XX	± 0.38		10.00-17.49	+0.25/-0.13
			17.50-24.99	+0.30/-0.13

ANG TOL: ± 1.0° SCALE: 1/8

SIM 10	DNW C. GADE		<b>CUMMINS POWER GENERATION</b> INSTALLATION, ENCLOSURE
DO NOT SCALE PRINT	CND N. KASIBHOTLA		
	APVD M. WICKMANN	SITE CODE	
<b>- CONFIDENTIAL -</b> PROPERTY OF CUMMINS POWER GENERATION GROUP	DATE 06MAY15	PGF	
FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994	FIRST USED ON ARROW	D	A052M018
		SHEET 1 OF 1	REV C

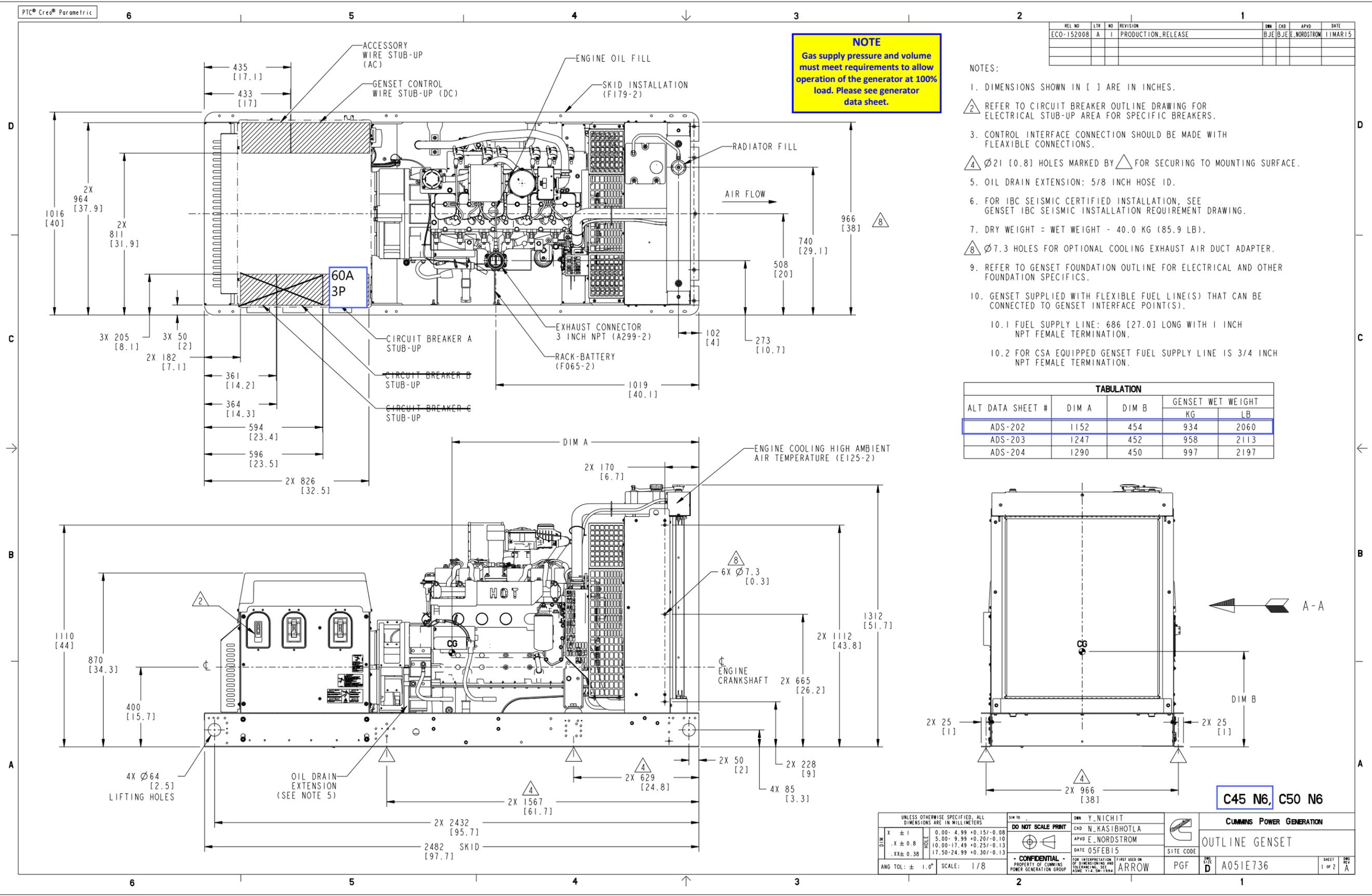
REL NO	LTR	NO	REVISION	DRN	CAD	APVD	DATE
ECO-152008	A	1	PRODUCTION RELEASE	BJE	BJE	E. NORDSTROM	11 MAR 15

**NOTE**  
Gas supply pressure and volume must meet requirements to allow operation of the generator at 100% load. Please see generator data sheet.

- NOTES:
- DIMENSIONS SHOWN IN [ ] ARE IN INCHES.
  - REFER TO CIRCUIT BREAKER OUTLINE DRAWING FOR ELECTRICAL STUB-UP AREA FOR SPECIFIC BREAKERS.
  - CONTROL INTERFACE CONNECTION SHOULD BE MADE WITH FLEXIBLE CONNECTIONS.
  - Ø21 [0.8] HOLES MARKED BY FOR SECURING TO MOUNTING SURFACE.
  - OIL DRAIN EXTENSION: 5/8 INCH HOSE ID.
  - FOR IBC SEISMIC CERTIFIED INSTALLATION, SEE GENSET IBC SEISMIC INSTALLATION REQUIREMENT DRAWING.
  - DRY WEIGHT = WET WEIGHT - 40.0 KG (85.9 LB).
  - Ø7.3 HOLES FOR OPTIONAL COOLING EXHAUST AIR DUCT ADAPTER.
  - REFER TO GENSET FOUNDATION OUTLINE FOR ELECTRICAL AND OTHER FOUNDATION SPECIFICS.
  - GENSET SUPPLIED WITH FLEXIBLE FUEL LINE(S) THAT CAN BE CONNECTED TO GENSET INTERFACE POINT(S).
    - FUEL SUPPLY LINE: 686 [27.0] LONG WITH 1 INCH NPT FEMALE TERMINATION.
    - FOR CSA EQUIPPED GENSET FUEL SUPPLY LINE IS 3/4 INCH NPT FEMALE TERMINATION.

**TABULATION**

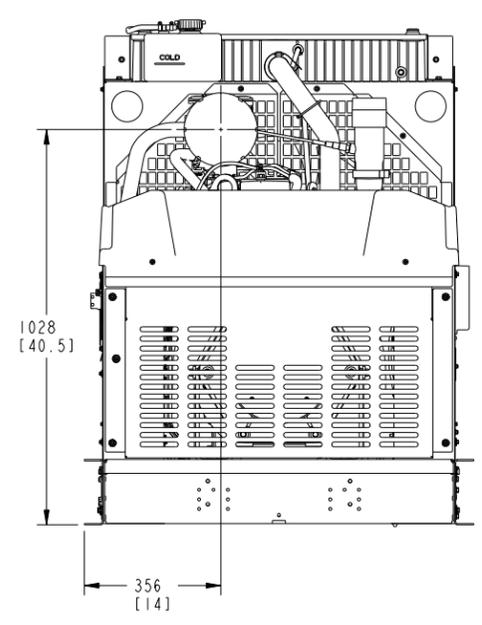
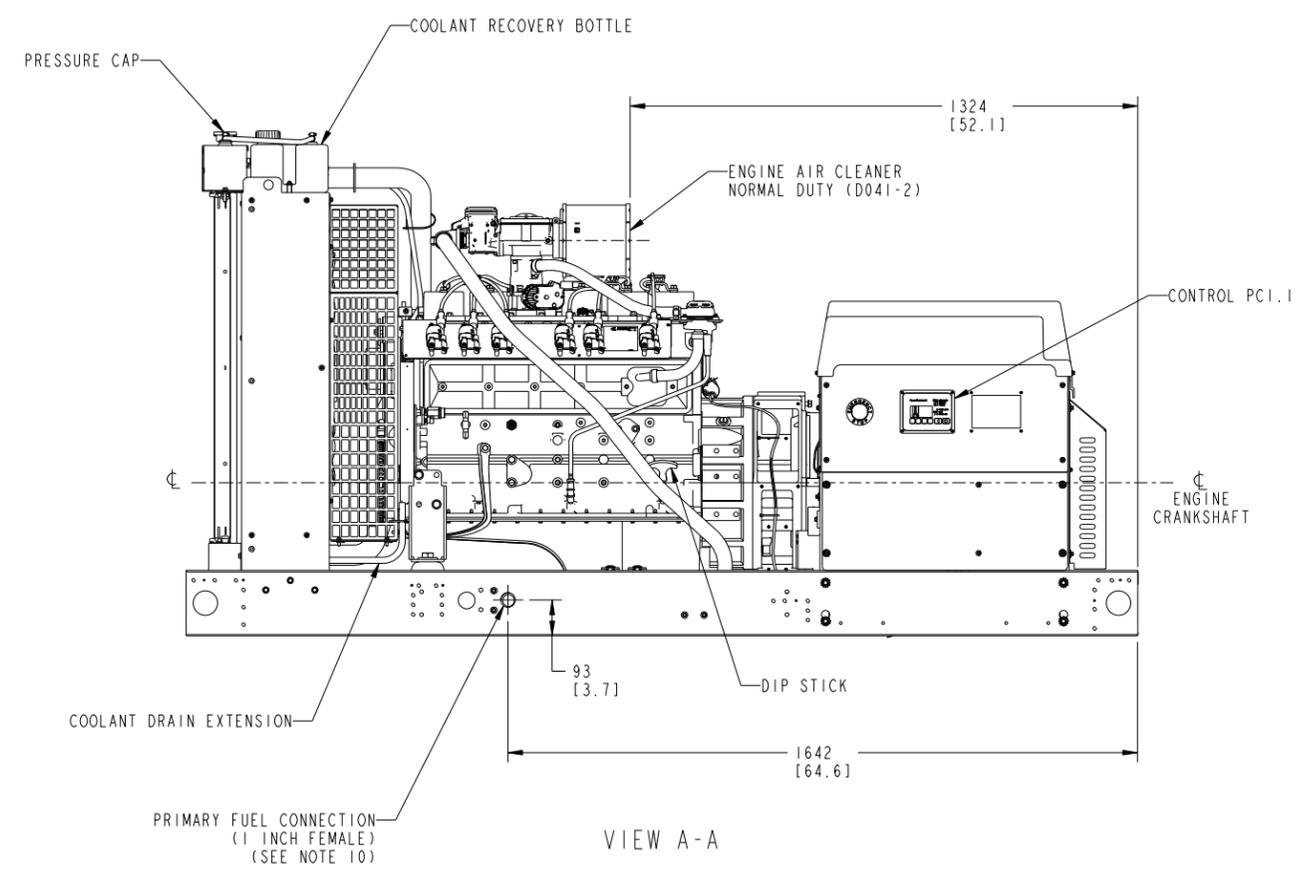
ALT DATA SHEET #	DIM A	DIM B	GENSET WET WEIGHT	
			KG	LB
ADS-202	1152	454	934	2060
ADS-203	1247	452	958	2113
ADS-204	1290	450	997	2197



UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIX 10	DRN Y. NICHIT		CUMMINS POWER GENERATION	
DO NOT SCALE PRINT		CND N. KASIBHOTLA	APVD E. NORDSTROM		OUTLINE GENSET	
ANG TOL: ± 1.0°		SCALE: 1/8	DATE 05FEB15	SITE CODE	SIZE D	A051E736
- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP		FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994		ARROW	PGF	SHEET 1 OF 2

C45 N6, C50 N6

REL NO	LTR	NO	REVISION	BY	CHKD	APVD	DATE
ECO-152008	A	1	PRODUCTION RELEASE	BJE	BJE	E. NORDSTROM	11 MAR 15

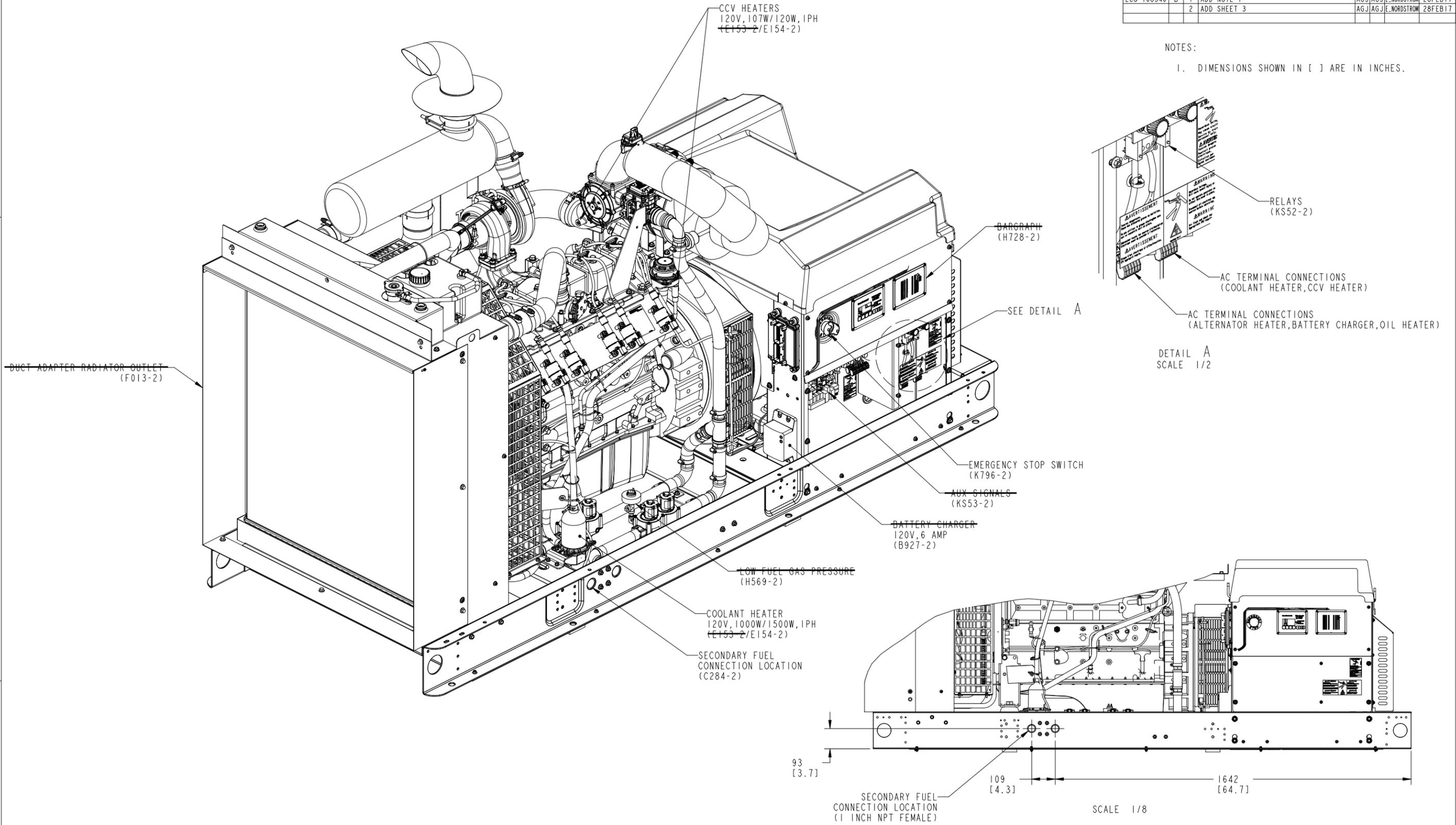


**C45 N6, C50 N6**

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SHEET NO		DWG Y. NICHIT		CUMMINS POWER GENERATION	
DO NOT SCALE PRINT		CND N. KASIBHOTLA		APVD E. NORDSTROM		OUTLINE GENSET	
DATE 05FEB15		SITE CODE		PGF		A051E736	
ANG TOL: ± 1.0°		SCALE: 1/8		ARROW		SHEET 2 OF 2	
- CONFIDENTIAL -		FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994		FIRST USED ON		REV A	

REL NO	LTR	NO	REVISION	DWN	CKD	APVD	DATE
ECO-168340	B	1	ADD NOTE 1	AGJ	AGJ	E_NORDSTROM	28FEB17
		2	ADD SHEET 3	AGJ	AGJ	E_NORDSTROM	28FEB17

NOTES:  
1. DIMENSIONS SHOWN IN [ ] ARE IN INCHES.



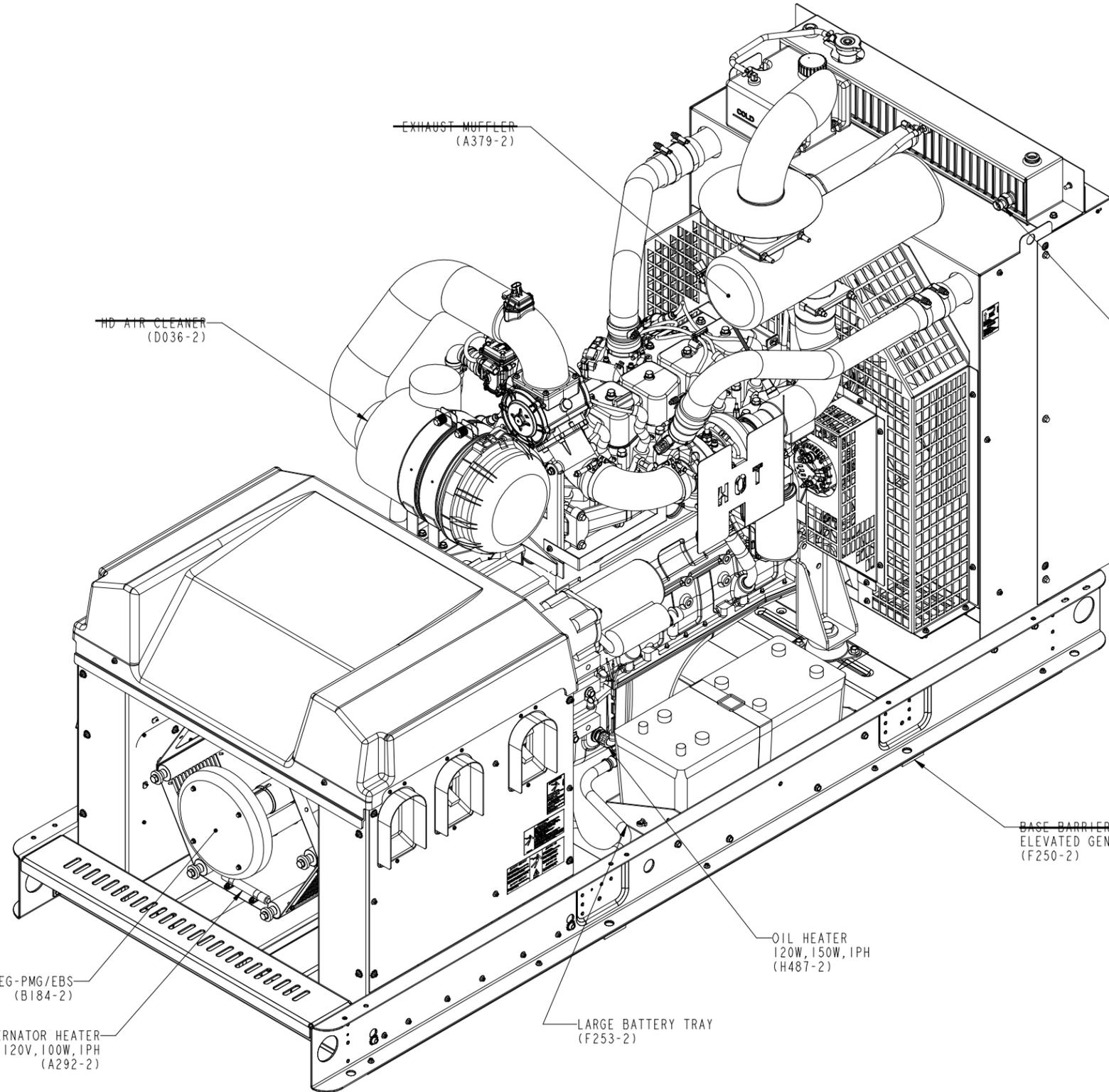
C45 N6, C50 N6,  
C60 N6, C70 N6,  
C80 N6, C100 N6

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	
DIM	TOLERANCE
X ± 1	0.00- 4.99 +0.15/-0.08
.X ± 0.8	5.00- 9.99 +0.20/-0.10
.XX ± 0.38	10.00-17.49 +0.25/-0.13
	17.50-24.99 +0.30/-0.13
ANG TOL: ±	1.0°
SCALE:	3/16

SIM TO	NONE
DO NOT SCALE PRINT	
DWN	R_HALVERSON
CKD	E_NORDSTROM
APVD	E_NORDSTROM
DATE	23APR15
FIRST USED ON	ARROW
FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ADME Y14.5A-1994	

CUMMINS POWER GENERATION	
OUTLINE, GENSET	
OPTIONS	
SITE CODE	PGF
REV	D
REV	A
DATE	A051E744
SHEET	1 of 3
DRG	REV A

REL NO	LTR	NO	REVISION	DWN	CKD	APVD	DATE
ECO-168340	B	-	-----	AGJ	AGJ	E_NORDSTROM	28FEB17



EXHAUST MUFFLER  
(A379-2)

HD AIR CLEANER  
(D036-2)

LOW COOLANT  
SHUTDOWN/WARNING (SENSOR)  
(H389-2/H527-2)

BASE BARRIER  
ELEVATED GENSET  
(F250-2)

OIL HEATER  
120W, 150W, 1PH  
(H487-2)

LARGE BATTERY TRAY  
(F253-2)

EXCITER/REG-PMG/EBS  
(B184-2)

ALTERNATOR HEATER  
120V, 100W, 1PH  
(A292-2)

C45 N6, C50 N6,  
C60 N6, C70 N6,  
C80 N6, C100 N6

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

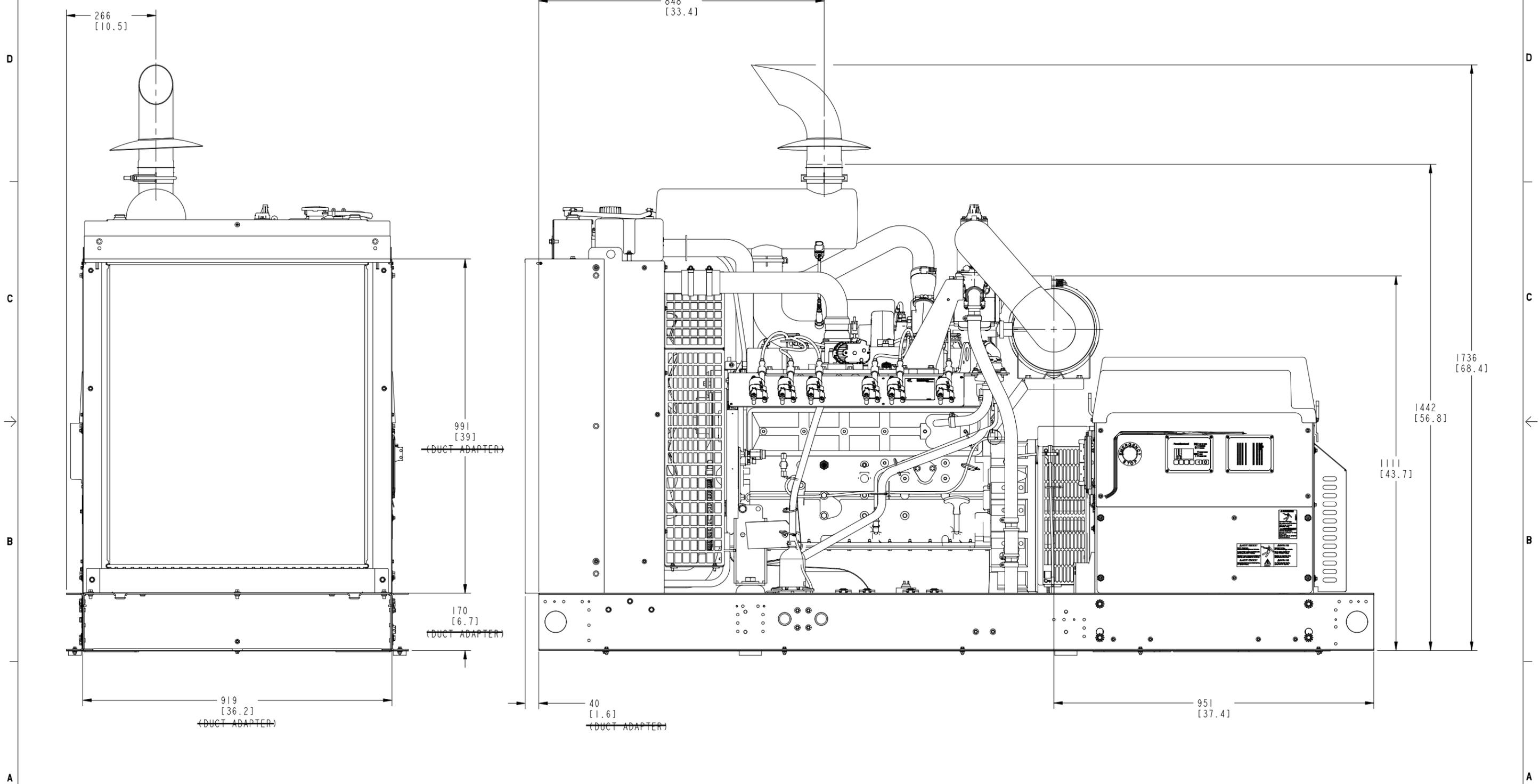
DIM	TOLERANCE	HOLE	TOLERANCE
X ± 1	0.00- 4.99	+0.15/-0.08	
.X ± 0.8	5.00- 9.99	+0.20/-0.10	
.XX ± 0.38	10.00-17.49	+0.25/-0.13	
	17.50-24.99	+0.30/-0.13	

ANG TOL: ± 1.0° SCALE: 3/16

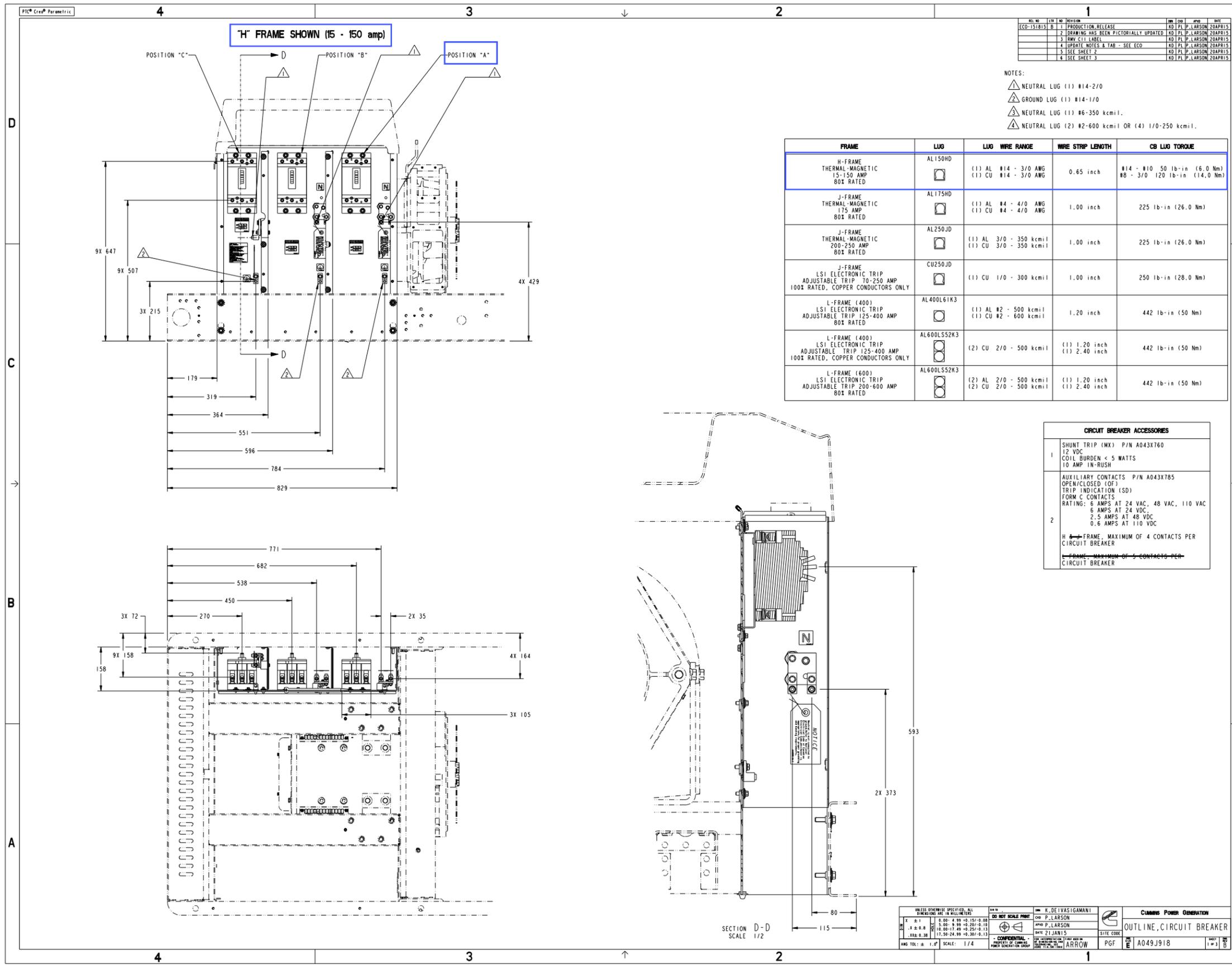
SIM TO: NONE	DWN: R_HALVERSON
DO NOT SCALE PRINT	CKD: E_NORDSTROM
	APVD: E_NORDSTROM
	DATE: 23APR15
	FIRST USED ON: ARROW

CUMMINS POWER GENERATION	
OUTLINE, GENSET	
OPTIONS	
SITE CODE	PGF
FILE: D	A051E744
SHEET: 2 of 3	REV: A

REL NO	LTR	NO	REVISION	DWN	CKD	APVD	DATE
ECO-168340	B	2	ADD SHEET 3	AGJ	AGJ	E_NORDSTROM	28FEB17



UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIM TO: NONE	DWN: R_HALVERSON		CUMMINS POWER GENERATION	
DO NOT SCALE PRINT		CKD: E_NORDSTROM	OUTLINE, GENSET			
DIM	TOLERANCE	DATE: 23APR15	APVD: E_NORDSTROM	SITE CODE	OPTIONS	
X ± 1	0.00-4.99 +0.15/-0.08	PROPERTY OF CUMMINS POWER GENERATION GROUP	DATE: 23APR15	PGF	A051E744	SHEET 3 OF 3
.X ± 0.8	5.00-9.99 +0.20/-0.10	FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ADME Y14.5A-1994	FIRST USED ON: ARROW	DWG REV: A		
.XX ± 0.38	10.00-17.49 +0.25/-0.13					
ANG TOL: ± 1.0°	17.50-24.99 +0.30/-0.13					
SCALE: 3/16						



REV. NO.	DATE	DESCRIPTION	BY	CHKD.	APP'D.
1	11/15/15	PRODUCTION RELEASE	RD FL P. LARSON	RD FL P. LARSON	RD FL P. LARSON
2		DRAWING HAS BEEN PICTORIALY UPDATED	RD FL P. LARSON	RD FL P. LARSON	RD FL P. LARSON
3		REV. C11 LABEL	RD FL P. LARSON	RD FL P. LARSON	RD FL P. LARSON
4		UPDATE NOTES & TAB - SEE ECO	RD FL P. LARSON	RD FL P. LARSON	RD FL P. LARSON
5		SEE SHEET 2	RD FL P. LARSON	RD FL P. LARSON	RD FL P. LARSON
6		SEE SHEET 3	RD FL P. LARSON	RD FL P. LARSON	RD FL P. LARSON

- NOTES:
- ▲ NEUTRAL LUG (1) #14-2/0
  - ▲ GROUND LUG (1) #14-1/0
  - ▲ NEUTRAL LUG (1) #6-350 kcmil.
  - ▲ NEUTRAL LUG (2) #2-600 kcmil OR (4) 1/0-250 kcmil.

FRAME	LUG	LUG WIRE RANGE	WIRE STRIP LENGTH	CB LUG TORQUE
H-FRAME THERMAL-MAGNETIC 15-150 AMP 80% RATED	AL150HD	(1) AL #14 - 3/0 AWG (1) CU #14 - 3/0 AWG	0.65 inch	#14 - #10 50 lb-in (6.0 Nm) #8 - 3/0 120 lb-in (14.0 Nm)
J-FRAME THERMAL-MAGNETIC 175 AMP 80% RATED	AL175HD	(1) AL #4 - 4/0 AWG (1) CU #4 - 4/0 AWG	1.00 inch	225 lb-in (26.0 Nm)
J-FRAME THERMAL-MAGNETIC 200-250 AMP 80% RATED	AL250JD	(1) AL 3/0 - 350 kcmil (1) CU 3/0 - 350 kcmil	1.00 inch	225 lb-in (26.0 Nm)
J-FRAME LSI ELECTRONIC TRIP ADJUSTABLE TRIP 70-250 AMP 100% RATED, COPPER CONDUCTORS ONLY	CU250JD	(1) CU 1/0 - 300 kcmil	1.00 inch	250 lb-in (28.0 Nm)
L-FRAME (400) LSI ELECTRONIC TRIP ADJUSTABLE TRIP 125-400 AMP 80% RATED	AL400L61K3	(1) AL #2 - 500 kcmil (1) CU #2 - 600 kcmil	1.20 inch	442 lb-in (50 Nm)
L-FRAME (400) LSI ELECTRONIC TRIP ADJUSTABLE TRIP 125-400 AMP 100% RATED, COPPER CONDUCTORS ONLY	AL600LS52K3	(2) CU 2/0 - 500 kcmil	(1) 1.20 inch (1) 2.40 inch	442 lb-in (50 Nm)
L-FRAME (600) LSI ELECTRONIC TRIP ADJUSTABLE TRIP 200-600 AMP 80% RATED	AL600LS52K3	(2) AL 2/0 - 500 kcmil (2) CU 2/0 - 500 kcmil	(1) 1.20 inch (1) 2.40 inch	442 lb-in (50 Nm)

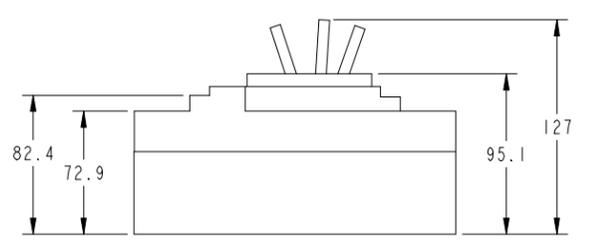
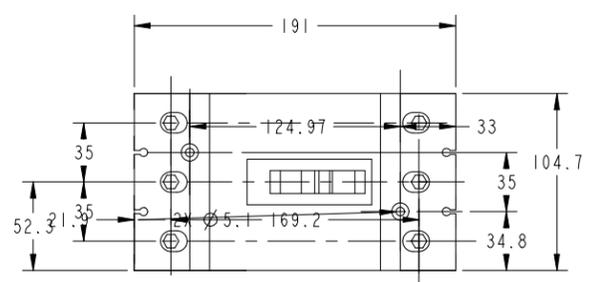
- CIRCUIT BREAKER ACCESSORIES**
- SHUNT TRIP (MX) P/N A043X760
  - 12 VDC
  - COIL BURDEN < 5 WATTS
  - 10 AMP 1N-RUSH
  - AUXILIARY CONTACTS P/N A043X785
  - OPEN/CLOSED (OP)
  - TRIP INDICATION (SD)
  - FORM C CONTACTS
  - RATING: 6 AMPS AT 24 VAC, 48 VAC, 110 VAC
  - 6 AMPS AT 24 VDC
  - 2.5 AMPS AT 48 VDC
  - 0.6 AMPS AT 110 VDC
  - H-FRAME, MAXIMUM OF 4 CONTACTS PER CIRCUIT BREAKER
  - ~~L-FRAME, MAXIMUM OF 5 CONTACTS PER CIRCUIT BREAKER~~

SECTION D-D  
SCALE 1/2

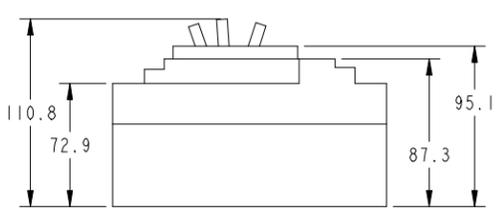
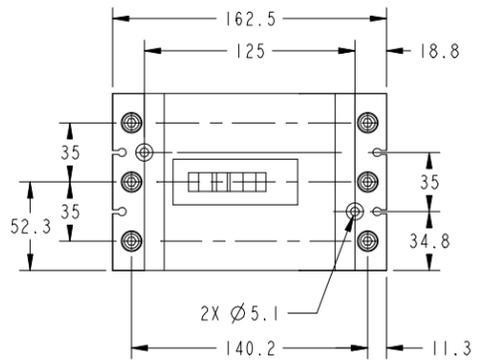
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	DO NOT SCALE PRINT	DESIGNED BY: K. DEIVASIGAMANI	CUMMINS POWER GENERATION
DATE: 21 JAN 15	SCALE: 1/4	CHKD: P. LARSON	OUTLINE, CIRCUIT BREAKER
ANG TOL: ± 1.0°	PROPERTY OF CUMMINS POWER GENERATION GROUP	DATE: 21 JAN 15	SITE CODE: A049J918
		PGF	

REL NO	LTR	NO	REVISION	DWN	CKD	APVD	DATE
ECO-176287	D	1	PART A050J727: "UPDATE MEP"	KSP	KAM	M.WINGFIELD	03APR18
		2	ZONE A3; RMV C11 LABEL	KSP	KAM	M.WINGFIELD	03APR18

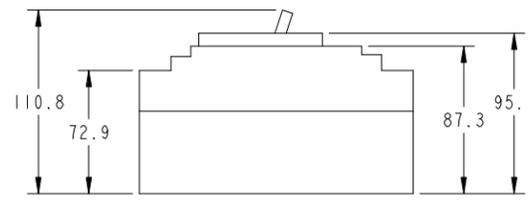
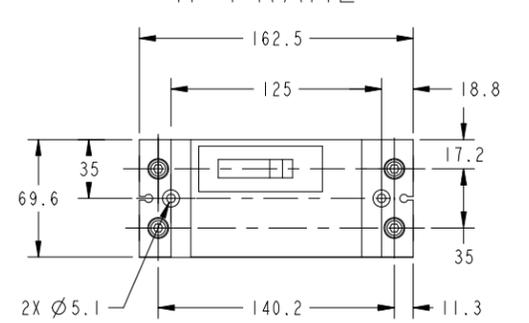
### 2 POLE & 3 POLE J-FRAME



### 3 POLE H-FRAME



### 2 POLE H-FRAME



NOTES:

- THIS PART IS MANUFACTURER SOURCE CONTROLLED.
- SUPPLIED WITH LINE & LOAD MECHANICAL LUGS :  
2.1 FOR THERMAL-MAGNETIC TRIP : AL/CU.  
2.2 FOR ELECTRONIC TRIP: CU FOR 90°C.

UL / CSA / NOM	INTERRUPTING RATINGS	
	240 Vac	KA
	25	25
	18	18
	14	14
IEC 947-2 Icu/Ics	220/240 Vac	25/25
	380/440/415 Vac	18/18
	500/525 Vac	14/14

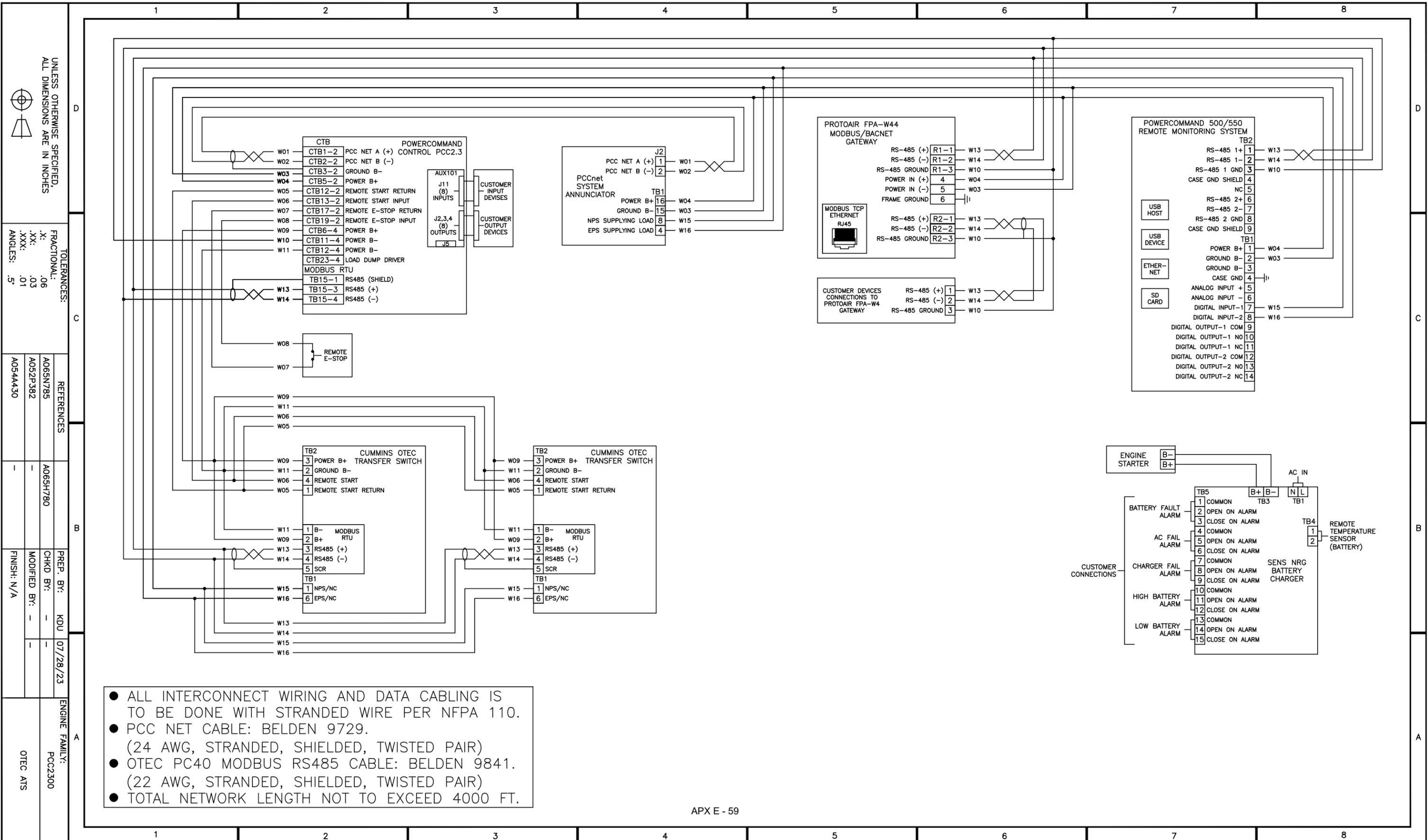
- H-FRAME: .65" WIRE STRIP LENGTH,  
LUG TORQUE= A : #14-#10 AWG 50 LB-IN, 75°C.  
B : #8-3/0 AWG 120 LB-IN, 75°C.
- J-FRAME: 1" WIRE STRIP LENGTH,  
LUG TORQUE= 1/0 AWG- 300 kcmil 250 LB-IN, 75°C.

TABULATION

PART NUMBER	CURRENT ER	AMP_RATING	VOLTS (UL/IEC)	FRAME_TYPE	POLES	BREAKER_TYPE	TRIP
A043E193	ECO-126169	250A	600	J-FRAME	2	JD	
A043E195	ECO-126169	225A	600	J-FRAME	2	JD	
A043E199	ECO-126169	200A	600	J-FRAME	2	JD	
A043E202	ECO-126169	175A	600	J-FRAME	2	JD	
A043L510	ECO-126169	250A	600	J-FRAME	3	JD	
A043L517	ECO-126169	225A	600	J-FRAME	3	JD	
A043L520	ECO-126169	200A	600	J-FRAME	3	JD	
A043L619	ECO-126169	175A	600	J-FRAME	3	JD	
A043C676	ECO-126169	150A	600	H-FRAME	2	HD	
A043D274	ECO-126169	125A	600	H-FRAME	2	HD	
A043D324	ECO-126169	100A	600	H-FRAME	2	HD	
A043D326	ECO-126169	90A	600	H-FRAME	2	HD	
A043D328	ECO-126169	80A	600	H-FRAME	2	HD	
A043E169	ECO-126169	70A	600	H-FRAME	2	HD	
A043E179	ECO-126169	60A	600	H-FRAME	2	HD	
A043E181	ECO-126169	50A	600	H-FRAME	2	HD	
A043E183	ECO-126169	40A	600	H-FRAME	2	HD	
A043E185	ECO-126169	30A	600	H-FRAME	2	HD	
A043E187	ECO-126169	20A	600	H-FRAME	2	HD	
A043E189	ECO-126169	15A	600	H-FRAME	2	HD	
A043E191	ECO-126169	25A	600	H-FRAME	2	HD	
A043K991	ECO-126169	150A	600	H-FRAME	3	HD	
A043K994	ECO-126169	125A	600	H-FRAME	3	HD	
A043K997	ECO-126169	90A	600	H-FRAME	3	HD	
A043L012	ECO-126169	80A	600	H-FRAME	3	HD	
A043L024	ECO-126169	100A	600	H-FRAME	3	HD	
A043L451	ECO-126169	70A	600	H-FRAME	3	HD	
A043L459	ECO-126169	60A	600	H-FRAME	3	HD	
A043L461	ECO-126169	50A	600	H-FRAME	3	HD	
A043L464	ECO-126169	40A	600	H-FRAME	3	HD	
A043L475	ECO-126169	30A	600	H-FRAME	3	HD	
A043L480	ECO-126169	20A	600	H-FRAME	3	HD	
A043L506	ECO-126169	15A	600	H-FRAME	3	HD	
A043L508	ECO-126169	25A	600	H-FRAME	3	HD	
A044C640	ECO-126169	SET TRIP: 70 TO 250 A	600	J-FRAME	3	JD	ELECTRONIC 50-60 Hz
A047W923	ECO-137891	225A Cu LUG	600	J-FRAME	3	JD	THERMAL-MAGNETIC 50-60 Hz
A050J725	ECO-145094	250A	600	J-FRAME	3	JD	LSI ELECTRONIC TRIP 80%
A050J727	ECO-145094	250A	600	J-FRAME	3	JD	LSI ELECTRONIC TRIP 100%

THERMAL-MAGNETIC  
50-60 Hz

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		DIM TO NONE		DWN S.GAMBHIRE	
DO NOT SCALE PRINT		CKD M.TULADHAR		CUMMINS POWER GENERATION	
DATE 24SEP12		SITE CODE		BREAKER, CIRCUIT	
ANG TOL: ± 1.0°		SCALE: 1/2		PGF	
PART NUMBER		DWG NO		SHEET	
A043W056		D		1 of 1	



UNLESS OTHERWISE SPECIFIED,  
ALL DIMENSIONS ARE IN INCHES.

TOLERANCES:

FRACTIONAL:	.06
.X:	.03
.XX:	.01
.XXX:	.01
ANGLES:	.5°

REFERENCES:

A065N785	A065H780
A052P382	-
A054A430	-

PREP. BY: KDU 07/28/23

CHKD BY: -

MODIFIED BY: -

FINISH: N/A

ENGINE FAMILY: PCC2300

OTEC ATS

- ALL INTERCONNECT WIRING AND DATA CABLING IS TO BE DONE WITH STRANDED WIRE PER NFPA 110.
- PCC NET CABLE: BELDEN 9729. (24 AWG, STRANDED, SHIELDED, TWISTED PAIR)
- OTEC PC40 MODBUS RS485 CABLE: BELDEN 9841. (22 AWG, STRANDED, SHIELDED, TWISTED PAIR)
- TOTAL NETWORK LENGTH NOT TO EXCEED 4000 FT.

APX E - 59

<b>CSSNA POWER GEN</b>	SITE NAME: -	CONTACT NAME: -	CUSTOMER PROJECT NO: -	TITLE: PCC2.3 CONTROL / OTEC ATS QSL9..QXS15..QSK23	
	CONTRACTOR NAME: -	CONTACT NO: -	CSSNA PROJECT NO: -	SCALE: NONE	DO NOT SCALE PRINT
				SIZE: B	DWG NO: PCC2.3 INTERCONNECT
				SCALE: NONE	DO NOT SCALE PRINT
				SHEET	1 OF 1

# PCC COMMON CONNECTOR SCHEME

## WIRING DIAGRAM INDEX

MODEL	OEM CONNECTIONS			CUSTOMER CONNECTIONS		
	MECHANICALLY GOVERNED	ECM BASED ENGINES	HYDRO-MECHANICAL BASED ENGINES	PCC NET	GENSET	PARALLELING
PS0600	SHEET 2	SHEET 4	SHEET 3	NOT APPLICABLE	SHEET 6	SHEET 5 (AMF ONLY)
POWER COMMAND 1.1/1.2	NOT APPLICABLE	SHEET 7	SHEET 8	SHEET 9	SHEET 10	NOT APPLICABLE
POWER COMMAND 2.2/2.3	NOT APPLICABLE	SHEET 11	NOT APPLICABLE	SHEET 12	SHEET 13	NOT APPLICABLE
POWER COMMAND 3.3	NOT APPLICABLE	SHEET 14	SHEET 15	SHEET 12	SHEET 13, 22	SHEET 16 - 21

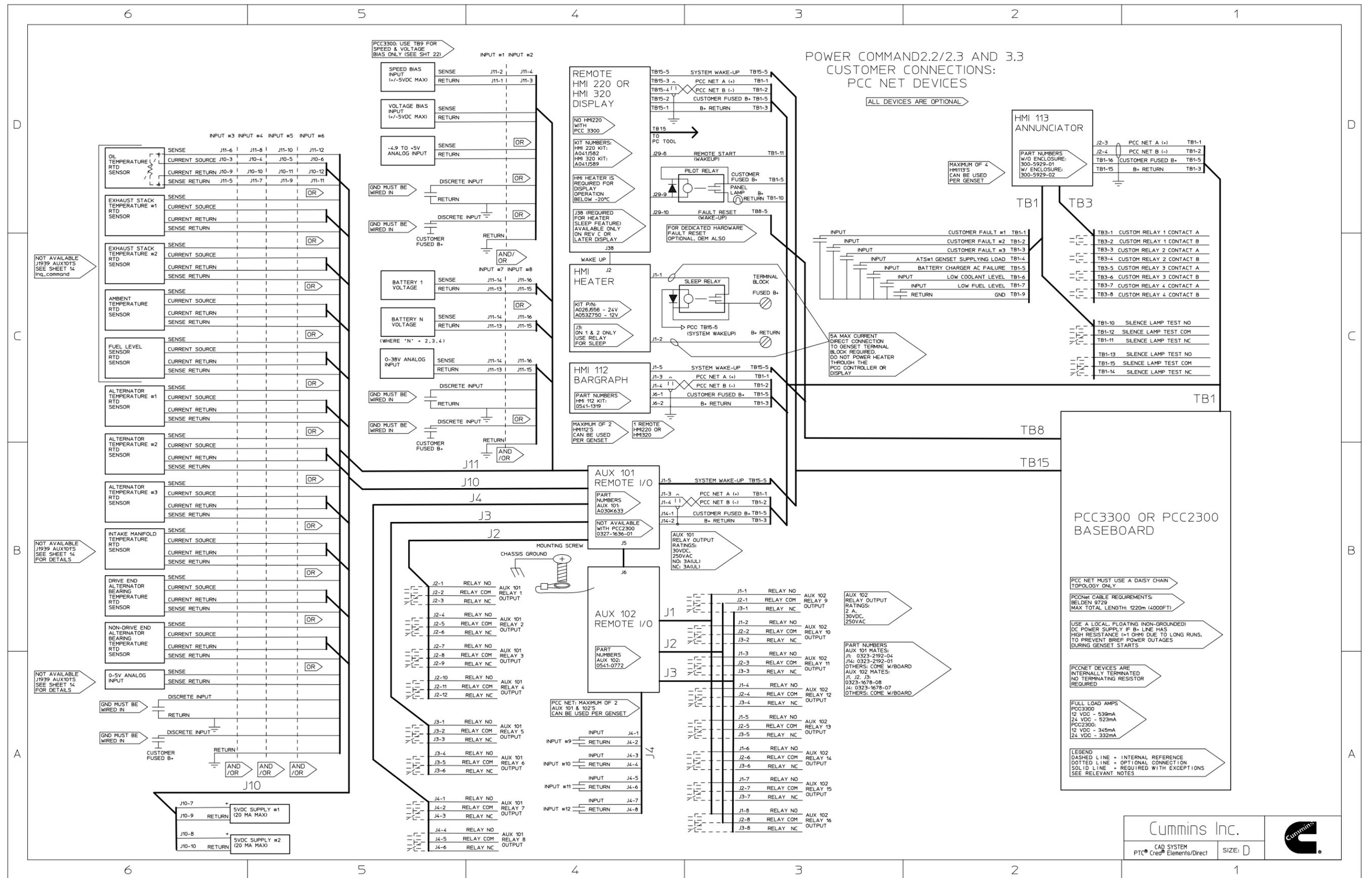
PCC UPGRADE DIAGRAMS		
LEGACY MODEL	OEM CONNECTIONS	CUSTOMER CONNECTIONS
PCC3100 - STANDARD DIESEL	SHEET 23	SHEET 24
PCC3100 - QST30 DIESEL	SHEET 25	SHEET 24

MODEL	NETWORK CONNECTIONS	CUSTOMER CONNECTIONS
POWER COMMAND 500/550	SHEET 26	SHEET 27

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CAD SYSTEM PTC® Creo® Elements/Direct	

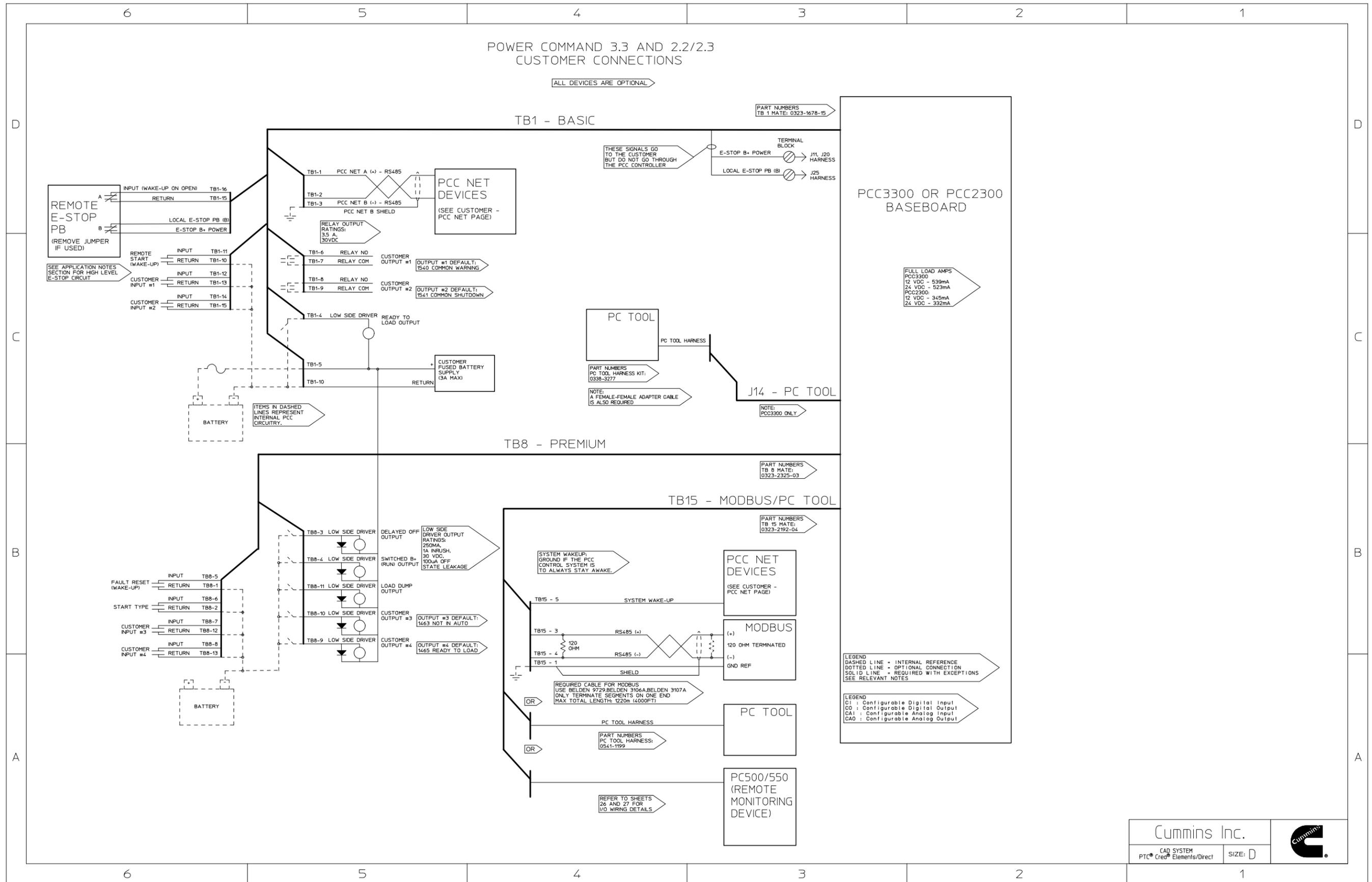
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PCC GENERAL INFORMATION

RECOMMENDED TWISTED PAIR CABLE

CABLE TYPE/MFG & PART NUMBER	PCCNet	s-CAN	RS-485 MODBUS	LOAD SHARE	FIRST START
TWISTED, SHIELDED PAIR, 22AWG OR LARGER				X	X
BELDEN 9729 (2 PAIR)	X 2)		X 2)		
BELDEN 3106A (1.5 PAIR)		X	X	X 1)	X
BELDEN 3107A (2 PAIR)		X 2)	X 2)	X	X 3)

NOTES:

- 1) TWO INDIVIDUAL CABLES ARE NEEDED TO MEET THE REQUIREMENT FOR THIS SIGNAL
- 2) SECOND PAIR USED FOR GND REFERENCE ONLY
- 3) SECOND PAIR NOT USED

GENERAL NOTE:

NO TWO SIGNALS LISTED ABOVE MAY BE COMBINED INTO A SINGLE CABLE WITH EXCEPTION TO kW AND KVARLOAD SHARE

CONTROL DEVICE COMPATIBILITY

CONTROL PLATFORM	CONTROL	BARGRAPH				LOCAL DISPLAY				REMOTE DISPLAY		
		HMI 112-01 KVA ONLY	HMI 112-02 KW + PF	HMI 114 KVA ONLY	HMI 114 KW + PF	HMI 211	HMI 220	HMI 320-01 W/O CB	HMI 320-02 W/ CB	HMI 211	HMI 220-03	HMI 320-03
POWER COMMAND 1.1/1.2	PCC1302	X		X		X	X			X	X	
POWER COMMAND 2.2/2.3	PCC2300		X		X		X	X			X	X
POWER COMMAND 3.3	PCC3300		X		X				X			X

MAXIMUM NUMBER OF EACH DEVICE ON PCCNet BY PLATFORM

CONTROL PLATFORM	CONTROL	LOCAL DISPLAY	REMOTE DISPLAY	BARGRAPH	AUX101/ AUX102 REMOTE I/O	HMI 113 NFPA 110 ANNUNCIATOR
POWER COMMAND 1.1/1.2	1	1	1	2	1	4
POWER COMMAND 2.2/2.3	1	1	1	2	2	4
POWER COMMAND 3.3	1	1	1	2	2	4

FUSING REQUIREMENTS FOR J22 AND TB7:

- FUSE PER NFPA 70E
- FUSING REQUIRED UNLESS ALL 3 OF THE FOLLOWING ARE TRUE:
  - A) LL VOLTAGE <= 240 VAC ON TB7/J22
  - B) NOT PARALLELED OR USING A SIGNAL TRANSFORMER
  - C) SIZE <= 125 KVA
- USE FUSE FERRAZ SHAWMUT ATMR 1/2 OR EQUIV.
- USE FUSE HOLDER FERRAZ SHAWMUT 39323R (ONLY 200K AIC) OR EQUIV.
- PLACE IN ALTERNATOR HOUSING FOR J22
- PLACE NEAR BUS SOURCE FOR TB7
- FUSE TRANSFORMER PRIMARY AS NEEDED FOR TB7 IF APPLICABLE

3RD HARMONICS IMPACT ON PCC VOLTAGE METERING

- PCCs VOLTAGE METERING (GENSET AND BUS) ARE IMPACTED BY 3RD HARMONIC VOLTAGE DISTORTION
- 5/6TH PITCH ALTERNATORS HAVE PROMINENT 3RD HARMONICS. 2/3 PITCH ALTERNATORS DO NOT HAVE 3RD HARMONICS
- SOLUTION: ISOLATE THE NEUTRAL CONNECTION ON J22 AND TB7 WHEN USING THE DELTA CONFIGURATION OR WHEN USING A 5/6 PITCH ALTERNATOR
- REFER TO ALTERNATOR MANUFACTURING DAT SHEET TO IDENTIFY ALTERNATOR PITCH

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# **SECTION 5**

## **ATS SPECIFICATIONS AND DRAWINGS**

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# POWERCOMMAND®

# OTEC TRANSFER SWITCH

POWERCOMMAND® 40 CONTROL | OPEN TRANSITION | 40 A–1200 A

AUTOMATIC TRANSFER SWITCH

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## DESCRIPTION

The OTEC series transfer switch provides the basic features typically required for primary source and generator set monitoring, generator set starting and IS-1271 load transfer functions for emergency standby power applications. They are suitable for use in emergency, legally required, and optional standby circuits in commercial and light industrial applications. The OTEC transfer switch features the new PowerCommand® 40 control with a comprehensive feature list to suit a wide variety of ATS applications.

## FEATURES

**PowerCommand® 40-01 control** – A fully featured microprocessor-based control with LCD digital display and tactile-feel soft-switches for easy operation and screen navigation. Control highlights include Modbus communication, front panel PC software configuration. Advanced features include, three phase sensing on both sources, manual restore to S1, synch check, and event logging capability. Please see the S-6560 PowerCommand® 40-01 control specification sheet for the full description, benefits and features.

**Programmed transition** – Open transition timing can be adjusted to completely disconnect the load from both sources for a programmed time period, as recommended by NEMA MG-1 for transfer of inductive loads.

**Advanced transfer switch mechanism** – Unique bi-directional linear actuator provides virtually frictionless constant force, straight-line transfer switch action during automatic operation.

**Positive interlocking** – Mechanical and electrical interlocking prevent source-to-source connection through the power or control wiring.

**Main contacts** – Heavy-duty silver alloy contacts used with multi-leaf arc chutes are rated for motor loads or total system load transfer. They require no routine contact maintenance. Continuous load current not to exceed 100% of switch rating and tungsten loads not to exceed 30% of switch rating.

**Ease of service and access** – Single-plug harness connection and compatible terminal markings simplify servicing. Access space is ample. Door-mounted controls are field-programmable; no special tools are required.

**Complete product line** – Cummins is a single source supplier with a wide range of equipment, accessories and services to suit virtually any backup power application.

**Warranty and service** – Products are backed by a comprehensive warranty and a worldwide network of distributors with factory-trained service technicians.



## TRANSFER SWITCH MECHANISM

- Transfer switch mechanism is electrically operated and mechanically held in the Source 1 and Source 2 positions. The transfer switch incorporates electrical and mechanical interlocks to prevent inadvertent interconnection of the sources.
- Independent break-before-make action is used for both 3-pole and 4-pole simultaneously switched neutral. This design allows use of sync check operation when required, or control of the operating speed of the transfer switch for proper transfer of motor and rectifier-based loads (programmed transition feature).
- True 4-pole switching allows for proper ground (earth) fault sensing and consistent, reliable operation for the life of the transfer switch. The neutral poles of the transfer switch have the same ratings as the phase poles and are operated by a common crossbar mechanism, eliminating the possibility of incorrect neutral operation at any point in the operating cycle, or due to failure of a neutral operator.
- Electrical interlocks prevent simultaneous closing signals to normal and emergency contacts and interconnection of normal and emergency sources through the control wiring.
- High pressure silver alloy contacts resist burning and pitting. Separate arcing surfaces further protect the main contacts. Contact wear is reduced by multiple leaf arc chutes that cool and quench the arcs. Barriers separate the phases to prevent interphase flashover. A transparent protective cover allows visual inspection while inhibiting inadvertent contact with energized components.
- Switch mechanism, including contact assemblies, is UL 1008 certified to verify suitability for applications requiring high endurance switching capability for the life of the transfer switch. Withstand and closing ratings are validated using the same set of contacts, further demonstrating the robust nature of the design.



## SPECIFICATIONS

Voltage rating	Up to 600 V AC, 50 or 60 Hz.
Arc interruption	Multiple leaf arc chutes provide dependable arc interruption.
Neutral bar	A full current-rated neutral bar with lugs is standard on enclosed 3-pole transfer switches.
Auxiliary contacts	Two isolated contacts (one for each source) indicating switch position are provided for customer use. Contacts are normally open, and close to indicate connection to the source. Wired to terminal block for easy access. Rated at 10 A Continuous and 250 V AC maximum.
Operating temperature	-22 °F (-30 °C) to 140 °F (60 °C)
Storage temperature	-40 °F (-40 °C) to 140 °F (60 °C)
Humidity	Up to 95 % relative, non-condensing
Altitude	Up to 10,000 ft (3,000 m) without derating
Surge withstand ratings	Voltage surge performance and testing in compliance with the requirements of IEEE C62.41 (Category B3) and IEEE C62.45.
Total transfer time (source-to-source)	Will not exceed 6 cycles at 60 Hz with normal voltage applied to the actuator and without programmed transition enabled.
Manual operation*	Transfer switch mechanisms are equipped with means to manually transfer. All sources must be de-energized before manual operation is attempted.

\*See Operator Manual for further details.

## TRANSITION MODES

Open delayed transition – In this transition mode the time required for the transfer switch to transfer between sources is adjustable so that the load-generated voltages decay to a safe level before connecting to an energized source. Recommended by NEMA MG-1 to prevent nuisance tripping breakers and load damage. Adjustable 0.5 secs-10 minutes, and default 0.5 seconds.

Open in-phase translation – Initiates open transition transfer when in-phase monitor senses both sources are in phase (voltage, phase and frequency). Operates in a break-before-make sequence. Includes ability to enable programmed transition as a backup. The module waits indefinitely for synchronization unless the 'Return to programmed transition' function is active in which case after 2 minutes it performs a programmed delayed transfer.

## UL 1008 WITHSTAND AND CLOSING RATINGS (WCR)

The transfer switches listed below must be protected by circuit breakers or fuses. Referenced drawings include detailed listings of specific breakers or fuse types that must be used with the respective transfer switches. Consult with your distributor/dealer to obtain the necessary drawings. Withstand and Closing Ratings (WCR) are stated in symmetrical RMS amperes.

BREAKER PROTECTION								
		MOLDED CASE CIRCUIT BREAKER (MCCB) PROTECTION				SPECIAL CIRCUIT BREAKER PROTECTION		
Frame	Amperage rating (A)	With specific manufacturers MCCB (kA at 480V)	With specific manufacturers MCCB (kA at 600V)	Max MCCB ratings (A)	Drawing reference	With specific Current limiting breakers (kA at 600V)	Max. Current limiting breakers CLB rating (A)	Drawing reference
A	40, 70, 125 (3-pole only)	14	14	225	A050J441	200	225	A048J566
	40, 70, 125 (4-pole only)	30	30	400	A048E949	200	400	A051D533
B	150, 225, 260	30	30	400	A048E949	200	400	A051D533
C	300, 400, 600	65	65	1200	A056M829	200	1200	A048J564
D	800, 1000	65	50	1400	A056M821	200	1400	A048J562
E	1200	85	65	1600	A056M825	200	1600	A048P186

## FUSE PROTECTION

Frame	Amperage rating (A)	WCR with current limiting fuses (kA)	Fuse size and type	Drawing reference
A	40, 70, 125 (3 and 4-pole)	200	200 A, Class: J, RK1, RK5, T	A050J441
B	150, 225, 260	200	1200 A Class L or T, or 600A class J, RK1, RK5	A048E949
C	300, 400, 600	200	1200 A Class L or T, or 600A class J, RK1, RK5	A056M829
D	800, 1000	200	2000 A Class L or 1200 A Class T or 600 A Class J, RK1, RK5	A056M821
E	1200	200	2000 A Class L or 1200 A Class T or 600 A Class J, RK1, RK5	A056M825

\*All WCR values are at 600 V

## TIME BASED RATINGS: 0.05S (3-CYCLES AT 60 HZ)

Frame	Amperage rating (A)	WCR (kA at Vmax and below)	Max. MCCB rating (A)	Drawing reference
C	300, 400, 600	25 at 600 V	1200	A056M829
D	800, 1000	35 at 600 V	1400	A056M821
E	1200	42 at 600 V	1600	A056M825

## TRANSFER SWITCH LUG CAPACITIES

Frame	Amperage rating (A)	Cables per phase	Size
A	40, 70, 125 3-pole	1	#12 AWG-2/0
	40 4-pole	1	#12 AWG-2/0
	70, 125 4-pole	1	#6 AWG – 300MCM
B	150, 225	1	#6 AWG – 300MCM
	260	1	#6 AWG – 400MCM
C	300, 400	2	1 cable of 3/0 to 600MCM OR 2 cables 3/0 to 250MCM
	600	2	250 – 500 MCM
D	800, 1000	4	250 – 500 MCM
E	1200	4	#2 AWG to 600 MCM standard (feature N045) 1/0 to 750 MCM optional (feature N066) Compression Lug Adapter optional (feature N032)

\*All lugs 90°C rated and accept copper or aluminum wire unless indicated otherwise.  
Refer to the latest NFPA 70 Article 310 - Conductors for general wiring for the ampacity calculations.

## ENCLOSURE

The transfer switch and control are wall-mounted in a key-locking enclosure. Wire bend space complies with 2017 NEC.

### DIMENSIONS – TRANSFER SWITCH IN UL TYPE 1 ENCLOSURE

Frame	Amperage rating (A)	Height		Width		Depth		Weight	
		in	mm	in	mm	in	mm	lb	kg
A	40, 70, 125 3-pole	27	686	20.5	521	12	305	82	37
	40, 70, 125 4-pole	35.5	902	26	660	16	406	165	75
B	150, 225	35.5	902	26	660	16	406	165	75
	260	43.5	1105	28.5	724	16	406	170	77
C	300, 400, 600	54	1372	25.5	648	18	457	225	102
D	800, 1000	68	1727	30	762	19.5	495	360	163
E	1200	90	2286	39	991	27	698	730	331

### DIMENSIONS – TRANSFER SWITCH IN UL TYPE 3R, 4, 4X, OR 12 ENCLOSURE

Frame	Amperage rating (A)	Height		Width		Depth		Weight		Cabinet Type
		in	mm	in	mm	in	mm	lb	kg	
A	40, 70, 125 3-pole	34	864	26.5	673	12.5	318	125	57	3R, 12, 4
		46	1168	32	813	16	406	255	116	4X
	40, 70, 125 4-pole	42.5	1080	30.5	775	16	406	215	98	3R, 12, 4
		46	1168	32	813	16	406	255	116	4X
B	150, 225	42.5	1080	30.5	775	16	406	215	98	3R, 12, 4
		46	1168	32	813	16	406	255	116	4X
	260	46	1168	32	813	16	406	255	116	3R, 12, 4, 4X
C	300, 400, 600	59	1499	27.5	699	16.5	419	275	125	3R, 12, 4
		73.5	1867	32.5	826	19.5	495	410	186	4X
D	800, 1000	73.5	1867	32.5	826	19.5	495	410	186	3R, 12, 4, 4X
E	1200	90	2286	39	991	27	698	730	331	3R, 12, 4, 4X

## ENCLOSURE ACCESS FOR CABLE INSTALLATION AND MAINTENANCE

All frames allow for top, side, and bottom cable entry. NEC Requires Minimum 36" Front Access. Additional front clearance is needed to remove the mechanism. Refer to the outline drawing.

OTEC DRAWING PART NUMBERS						
		Outline Drawing				
Frame	Amperage rating (A)	Type 1	Type 3R & 12	Type 4	Type 4X	Open construction
A	40, 70, 125 3-pole	0310-0544	0310-0453	0310-0445	0500-4184	A065S429
	40, 70, 125 (4-pole)	0500-4896			0500-4896	
B	150, 225	0310-0414	0310-0454	0310-0446	0500-4184	
	260	0310-0540	0310-0455	0310-0447	0500-4184	
C	300, 400, 600	0310-1307	0310-1315	0310-1316	0500-4185	
D	800, 1000	0310-0417	0310-0457	0310-0449	0500-4185	
E	1200	A065S431		A065S432		A065S430

WIRING DIAGRAM PART NUMBERS						
		Wiring Diagram				
Frame	Amperage rating (A)	Utility to Genset (120 – 480 V)	Utility to Genset (600 V)	Interconnection	Utility to Genset, Open Construction (120 – 480 V)	Utility to Genset, Open Construction (600 V)
A	40, 70, 125 3-pole	A065K034	A065H782	A065H780	A065H783	A065H784
	40, 70, 125 (4-pole)					
B	150, 225					
	260					
C	300, 400, 600					
D	800, 1000					
E	1200					

## SUBMITTAL DETAIL

### Model

- 40, 70, 125 A, (3- and 4-pole)
- 150, 225, 260 A
- 300, 400, 600 A
- 800, 1000 A
- 1200 A

### Poles

- A028 Poles – 3 (solid neutral)
- A029 Poles – 4 (switched neutral)

### Application

- A035 Utility-to-genset

### Frequency

- A044 60 Hz
- A045 50 Hz

### Phase

- A041 single phase, 2-wire or 3-wire
- A042 three phase, 3-wire or 4-wire

### Voltage ratings

- R020 120V
- R038 190V
- R021 208V
- R022 220V
- R023 240V
- R024 380V
- R025 416V
- R035 440 V
- R026 480 V
- R027 600 V

### Enclosure

- B001 Type 1: Indoor use, provides some protection against dirt (similar to IEC type IP30)
- B002 Type 3R: Intended for outdoor use, provides some protection from dirt, rain and snow (similar to IEC type IP34)
- B003 Type 4: Indoor or outdoor use, provides some protection from wind-blown dust and water spray (similar to IEC type IP65)

- B004 open construction: no enclosure - includes automatic transfer switch and controls
- B010 Type 12: Indoor use, some protection from dust (similar to IEC type IP61).
- B025 Type 4X: Stainless steel, indoor or outdoor use, provides some protection from corrosion (similar to IEC Type IP65).

### Standards

- A046 UL 1008/CSA certification
- A080 IBC seismic certification

### Control voltage

- M033 12V, Genset starting voltage
- M034 24V, Genset starting voltage

### Control options

- M032 Elevator signal relay
- M081 MODBUS RS485 Communication module

### Auxiliary relays

- Relays are UL Listed, and factory installed. All relays provide (2) normally closed isolated contacts rated 10A @ 600 VAC. Relay terminals accept (1) 18 gauge to (2) 12-gauge wires per terminal.
- L101 24 VDC coil - installed, not wired (for customer use).
- L102 24 VDC coil - emergency position – relay energized when switch is in source 2 (emergency) position.
- L103 24 VDC coil - normal position - relay energized when switch is in source 1 (normal) position
- L201 12 VDC coil installed, not wired (for customer use)
- L202 12 VDC coil - emergency position – relay energized when switch is in source 2 (emergency) position
- L203 12 VDC coil - normal position - relay energized when switch is in source 1 (normal) position

#### Optional Cable Lugs

- N032 Lug adapters, compression, ½ stab (1200A only)
- N045 Cable lugs, mechanical, 600 MCM, 4 per pole (1200A only)
- N066 Cable lugs, mechanical, 750 MCM, 4 per pole (1200A only)

#### Miscellaneous

- C027 Cover - guard
- M003 Terminal block - 30 points (not wired)

#### Warranty

- G004 2-years, comprehensive
- G007 5-years, comprehensive
- G014 3-years, comprehensive
- G015 10-years, comprehensive

#### Shipping

- A051 Packing - export box (800 – 1000 A)

#### Request for quotation (RFQ)

- Z555 Nonconfigurable spec [ETO]

#### Accessories

- AC-170 Accessories specification sheet

## CODES AND STANDARDS

	<p>All switches are UL 1008 Listed with UL 50E Type Rated cabinets and UL Listed CU-AL terminals.</p>	<p><b>NEC®</b></p>	<p>Suitable for use in emergency, legally required and Standby and Critical Operations Power Systems (COPS) applications per NEC 700, 701, 702 and 708.</p>
	<p>All switches comply with NEMA ICS 10.</p>	<p><b>ISO®</b></p>	<p>All switches are designed and manufactured in facilities certified to ISO 9001.</p>
	<p>All switches are certified to CSA C22.2 No. 178.1 switching of electrical energy in emergency or other systems, up to 600 VAC and 4 kA.</p>	<p><b>IBC®</b></p>	<p>All switches are certified to IBC 2018.</p>
	<p>All switches comply with IEEE 446 Recommended Practice for Emergency and Standby Power Systems.</p>	<p><b>EMC</b></p>	<p>Display controllers meet the following Electromagnetic Compatibility (EMC) standards:</p> <ul style="list-style-type: none"> <li>▪ EN 61000-6-2 Generic Immunity Standard for the Industrial Environment.</li> <li>▪ EN 61000-6-4 Generic Emission Standard for the Industrial Environment.</li> </ul>
	<p>All switches comply with NFPA 70, 99 and 110 (Level 1).</p>		

For more information, please contact your local Cummins distributor or visit [cummins.com](http://cummins.com)

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# POWERCOMMAND® 40-01 TRANSFER SWITCH CONTROL

## OTEC TRANSFER SWITCHES

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### DESCRIPTION

The PowerCommand® 40-01 Transfer Switch Control is a sophisticated microprocessor-based control with the basic features you need for primary source and generator set monitoring, generator set starting and load transfer functions for emergency standby power applications.

The control human machine interface (HMI) includes a LCD display with tactile-feel soft-switches for easy operation and screen navigation. All data on the control can be viewed by scrolling through screens with a display scroll button. The control displays the current active fault, fault occurrences and time-ordered history of the 10 previous faults with respect to Real Time Clock Stamp and Engine Running Time.

### FEATURES

**Digital display** – The PowerCommand® 40-01 offers a clear back-lit LCD 4-line text display, showing system status, contextual icons and warnings. The display is also equipped with 9 red and green LEDs indicating operational status.

**Modbus network communication** – Modbus network communications capable. Optional Modbus RTU RS485 connection (1 serial port).



**Diagnostics and reporting** – Detailed event logging with enhanced fault codes, alert lists, power event history, and diagnostic capability during service events and provides the ability to meet any reporting requirements.

**PC & Front Panel Configurations** – The modules can be easily configured using the PC software. Selected front panel editing is also available.

**Ease of service and access** – Built-in plug-and-play control with minimized point-to-point connections and compatible terminal markings simplify servicing.



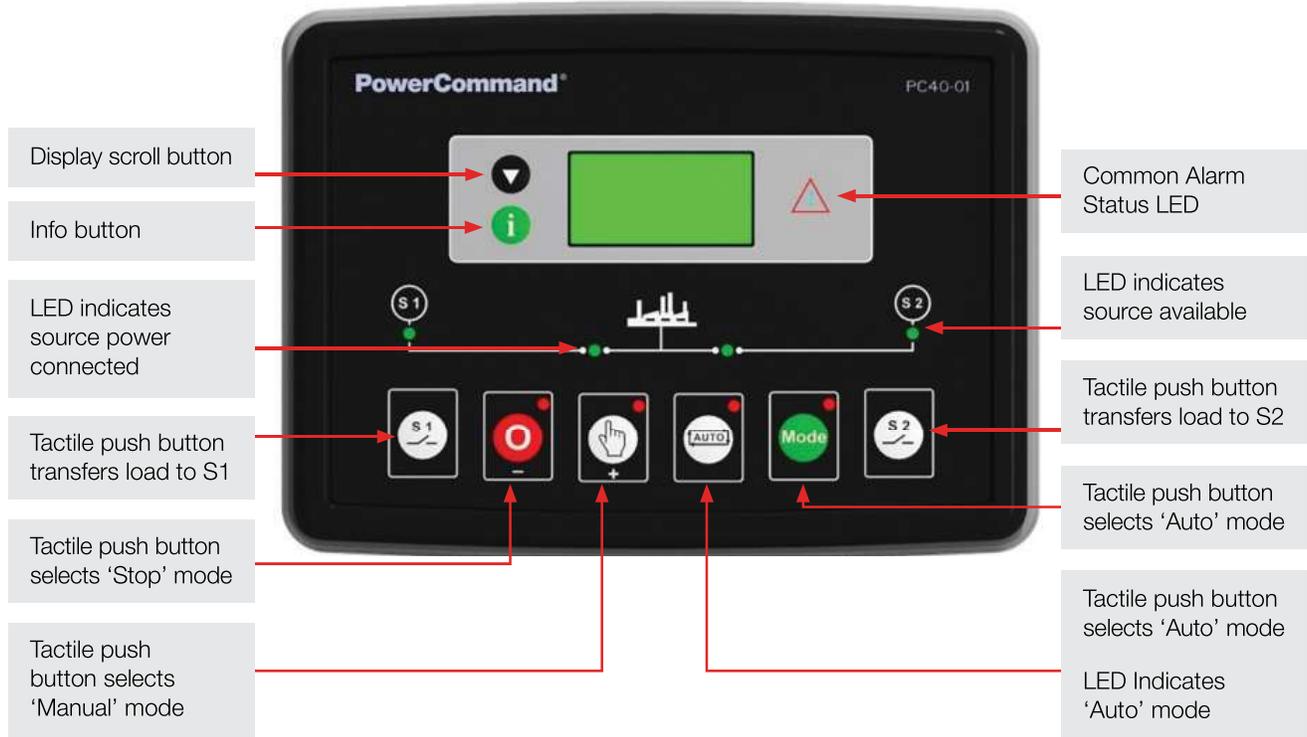
**Complete product line** – Cummins is a single source supplier with full scope of power system solutions, integration and service capability, from paralleling to system level controls, switchgear and remote connectivity.

**Warranty and service** – Products are backed by a comprehensive warranty and a worldwide network of distributors with factory-trained service technicians.



*Isometric (ISO) projection: front views*

## HUMAN MACHINE INTERFACE (HMI) CAPABILITIES



## CONTROL FUNCTIONS

### TRANSFER INHIBIT

When transfer inhibit external input is active, the control does not automatically transfer the transfer switch to a standby source even when the preferred source fails.

### RETRANSFER INHIBIT

When retransfer inhibit external input is active, the control does not automatically retransfer the transfer switch to a preferred source even when the preferred source returns.

### REAL TIME CLOCK

This feature is used by the control for fault and event time stamping and as a reference for exerciser schedules and exception schedules.

### TEST – REMOTE

Test feature allows the user to automatically test the standby source and the transfer switch. The test command can be issued from the remote source.

The test has following types available:

- Remote Start On Load
- Remote Start Off Load

### PREFERRED SOURCE SELECTION

Using this feature the user can swap the priority of the sources which are preferred and standby.

### ELEVATOR SIGNAL

This optional feature allows an elevator connected to the system to come to a complete stop before the switch transfers.

### EXERCISER SCHEDULER

The Scheduler allows the user to configure pre-set automatic starting and stopping of the Generator as well as stopping the ATS carrying out a transfer (when in Auto mode).

### BANK 1 / BANK 2

Each Bank of the Exercise Scheduler is used to give up to 8 scheduled runs per bank, 16 in total. This run schedule is configurable to repeat every 7 days (weekly) or every 28 days (monthly). Do Not Transfer, Off Load and On Load. Each scheduler bank configured differently either to weekly or monthly based exercises.

### SOURCE AVAILABILITY

This feature monitors the frequency and voltage sensors on the preferred and standby sources to determine and declare the availability status of the two sources, irrespective of which source is connected to the load. It declares the states as event codes. Preferred/Standby Available - active inactive.

### VOLTAGE SENSING

3-phase sensing on Source 1 and Source 2 (up to 600 Vac with no need for additional PTs).  
Plant battery voltage monitoring.

### ALPHANUMERIC DISPLAY

- S2 Voltage L1-N
- S2 Voltage L-L
- S2 Frequency
- S1 Voltage L1-N
- S1 Voltage L-L
- S1 Frequency
- Battery voltage
- Current alarms with icons
- Event log
- Scheduler
- About

**TIME DELAYS**

The following adjustable time delays are built into the transfer switch control. External modules to accomplish these delays are not required.

- **Start Delay** (Also known as Time Delay Engine Start, TDES adjustable from 0 to 10 hours)
- **Warming** (Also known as Time Delay Normal to Emergency, TDNE adjustable from 0 to 1 hour)
- **Elevator Delay** (Also known as Time Delay Elevator, TDEL adjustable from 0 to 5 minutes)
- **Non-sync Transfer Time** (Also known as Time Delay Programmed Transition, TDPT adjustable from 0.5 s to 10 minutes)
- **Return Delay** (Also known as Time Delay Emergency to Normal, TDEN adjustable from 0 to 5 hours)
- **Cooling** (Also known as Time Delay Engine Cool-down, TDEC adjustable from 0 to 1 hour)

**LED INDICATOR LIGHTS**

- Auto mode (RED)
- Auto with manual return to utility mode (RED)
- Test without load (RED)
- Test with load (RED)
- Source 1 available (GREEN)
- Source 2 available (GREEN)
- Source 1 connected to load (GREEN)
- Source 2 connected to load (GREEN)

**EVENT LOG**

The control displays information on up to 10 events displayed in chronological order, beginning with the most recent event, about either source. The event information shall include the following:

- Failure modes
- Warning
- Tests and exercises
- User-driven inputs (e.g., override, transfer inhibit)

**SUPPORTED APPLICATIONS****APPLICATION TYPES**

- Utility - Generator Set

**COMMUNICATIONS**

The PowerCommand® 40-01 Transfer Switch Control features an optional network communication module.

Features include:

- Optional Modbus® RTU RS485 communication module (1 isolated serial port)
- USB port for service tool interface

**PROTECTION****PHASE ROTATION SENSING**

- Source 1 and Source 2

**UNDER-VOLTAGE SENSING**

- 3-phase normal, 3-phase emergency
- Accuracy:  $\pm 2$  % of full-scale phase to phase
- Phase to neutral voltage range 50Vac to 414Vac.
- Phase to phase voltage range 86Vac to 717Vac.

**OVERVOLTAGE SENSING**

- 3-phase normal, 3-phase emergency
- Accuracy:  $\pm 2$  % of full-scale phase to phase
- Phase to neutral voltage range 52Vac to 416Vac.
- Phase to phase voltage range 90Vac to 720Vac.

**OVER/UNDER FREQUENCY SENSING**

- Normal and emergency
- Accuracy:  $\pm 0.2$  Hz
- Frequency range 3.5 – 75 Hz

**SYNC CHECK**

- For in-phase transfer

**ENVIRONMENT**

<b>Operating Temperature Range</b>	Control operates over an ambient temperature range: -30 °C to 70 °C.
<b>Storage Temperature Range</b>	The control operates after being exposed to Storage Temperatures in the range of -40 °C to 85°C.
<b>Ingress Protection</b>	The front panel is to be IP65.

**CODES AND STANDARDS**

	The PC40-01 control is a UL Recognized Component Marked for United States and Canada.		Capable of being used on systems compliant with NFFPA 70, 99 and 110 (Level 1).
	The control is IEEE C37.90.2 certified. Capable of being used on IEEE 446 compliant systems; Recommended Practice for Emergency and Standby Power Systems.		Control and display as installed in a transfer switch enclosure comply with NEMA 4X and IP65 at the transfer switch level - if the transfer switch enclosure is also NEMA 4X & IP65 compliant.
<b>RoHS</b>	The control is RoHS compliant.	<b>NEC®</b>	Capable of being used on systems suitable for use in emergency, legally required and Standby and Critical Operations Power Systems (COPS) applications per NEC 700, 701, 702 and 708.
	Fulfills the requirements of relevant European product directives.	<b>LVD</b>	The unit is designed to comply with European directive 72/23/EEC by complying with harmonized European safety standard BS EN 60950.
<b>EMC</b>	The control is tested to meet the following CE Electromagnetic Compatibility (EMC) standards for EN 61000 series (electromagnetic compatibility): EN 61000-6-2 Generic Immunity Standard EN 61000-6-4 Generic Emissions		

For more information, please contact your local Cummins distributor or visit [cummins.com](http://cummins.com)

Our energy working for you.™

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**Cummins Inc.**  
**Box 3005**  
**Columbus, IN 47202-3005**  
**U.S.A.**

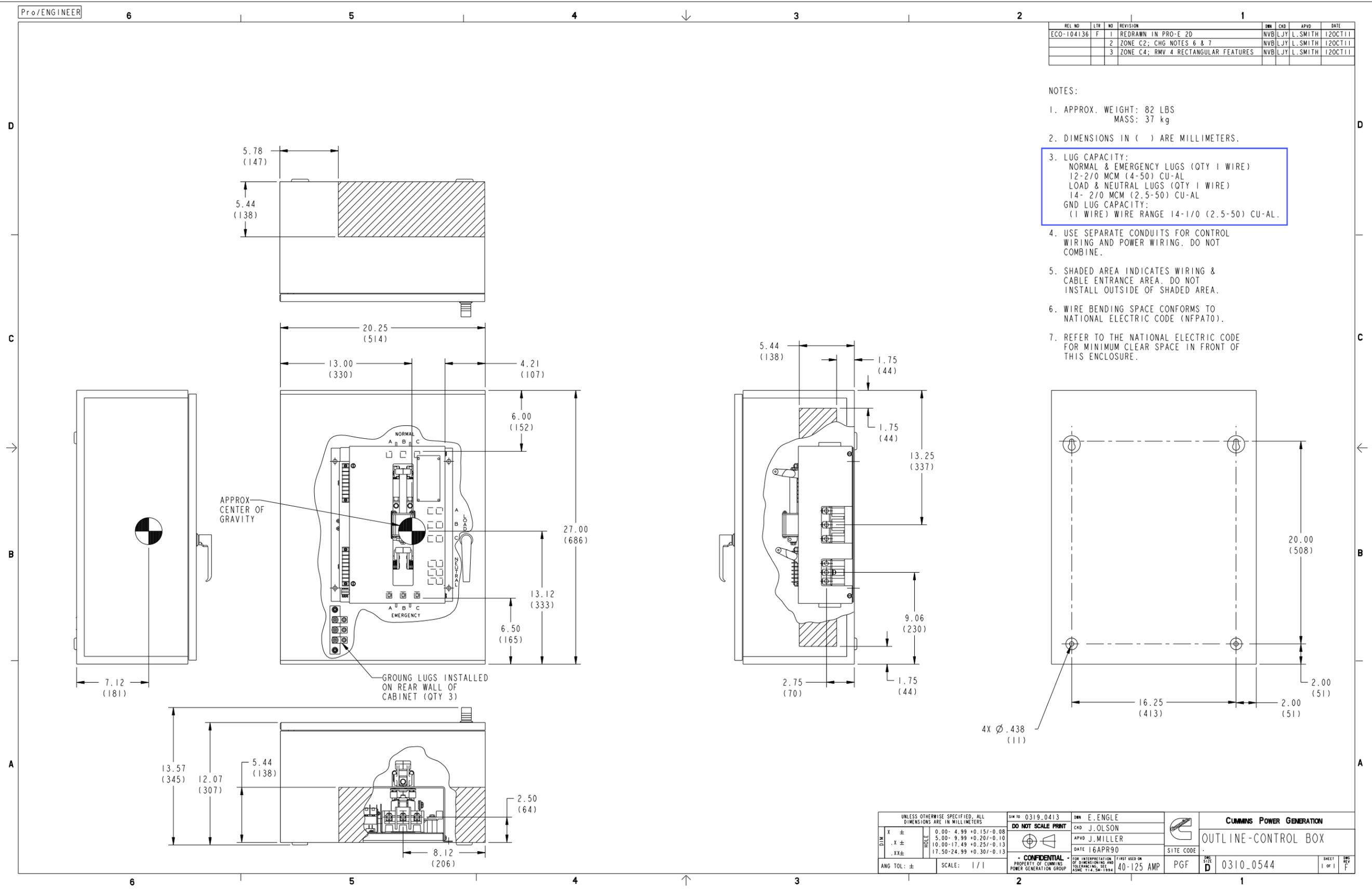
[cummins.com](http://cummins.com)

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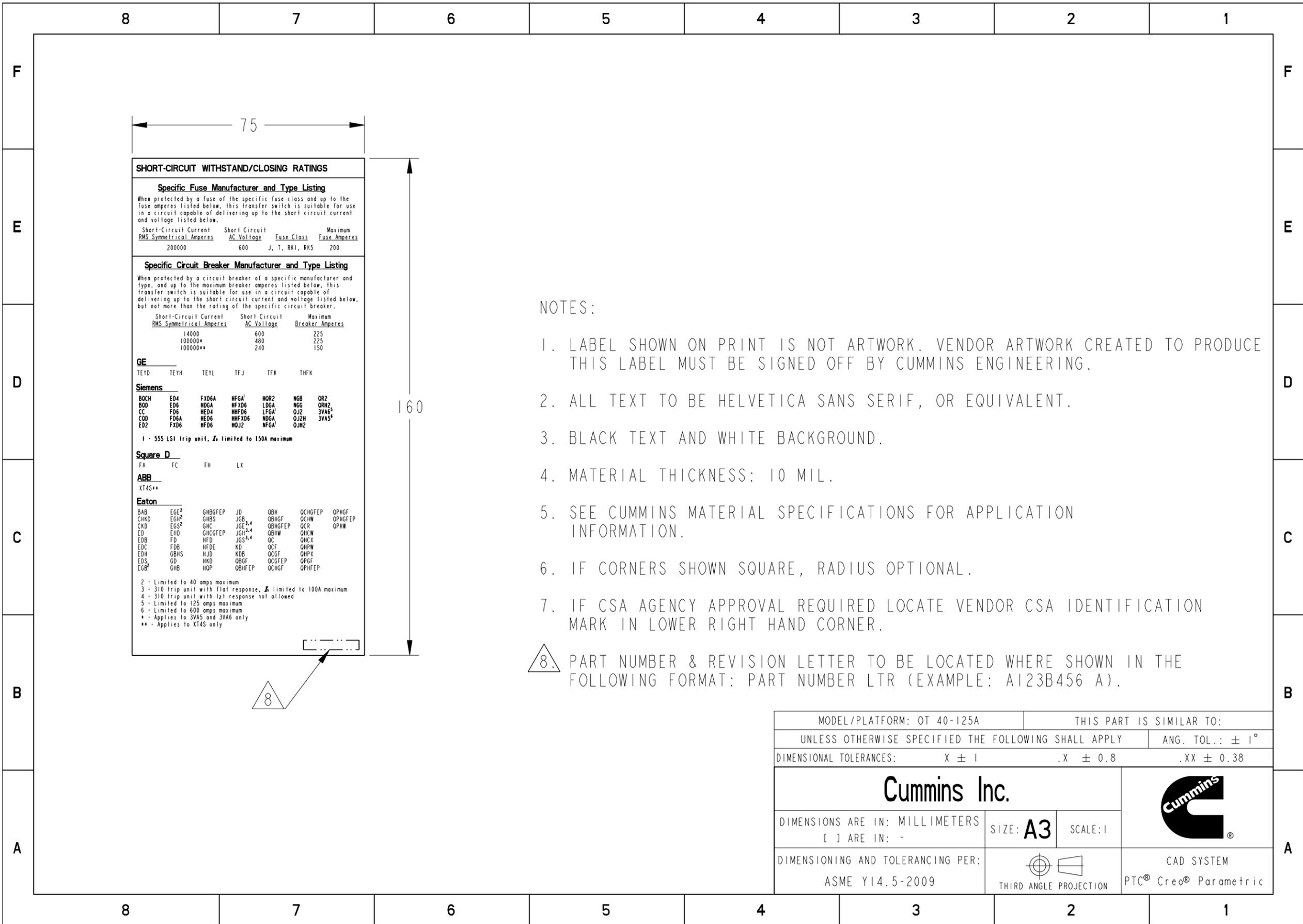
REL NO	LTR	NO	REVISION	DMN	CAD	APVD	DATE
ECO-104136	F	1	REDRAWN IN PRO-E 2D	NVBLJY	L.SMITH		12OCT11
		2	ZONE C2; CHG NOTES 6 & 7	NVBLJY	L.SMITH		12OCT11
		3	ZONE C4; RMV 4 RECTANGULAR FEATURES	NVBLJY	L.SMITH		12OCT11

NOTES:

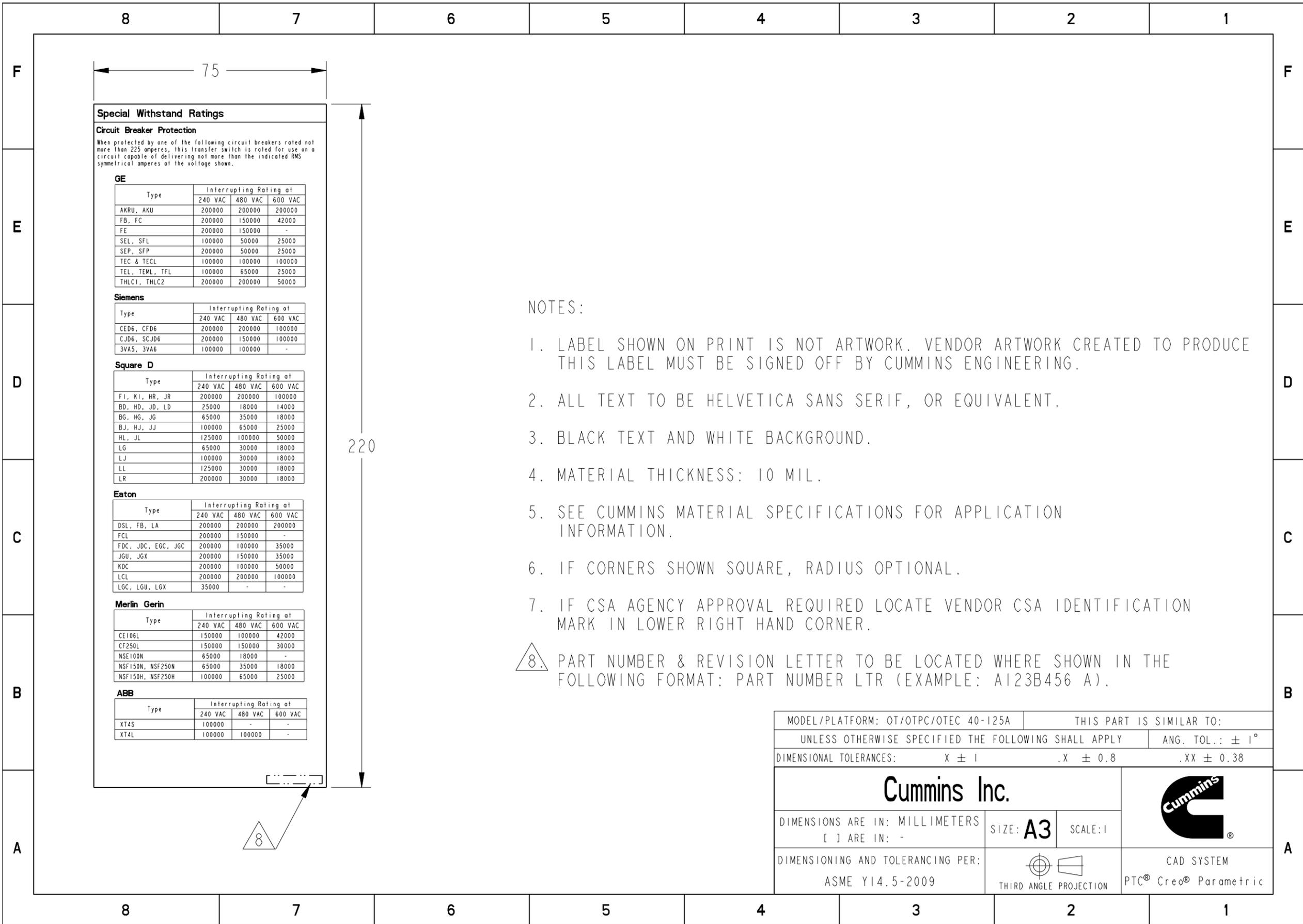
- APPROX. WEIGHT: 82 LBS  
MASS: 37 kg
- DIMENSIONS IN ( ) ARE MILLIMETERS.
- LUG CAPACITY:  
NORMAL & EMERGENCY LUGS (QTY 1 WIRE)  
12-2/0 MCM (4-50) CU-AL  
LOAD & NEUTRAL LUGS (QTY 1 WIRE)  
14- 2/0 MCM (2.5-50) CU-AL  
GND LUG CAPACITY:  
(1 WIRE) WIRE RANGE 14-1/0 (2.5-50) CU-AL.
- USE SEPARATE CONDUITS FOR CONTROL WIRING AND POWER WIRING. DO NOT COMBINE.
- SHADED AREA INDICATES WIRING & CABLE ENTRANCE AREA. DO NOT INSTALL OUTSIDE OF SHADED AREA.
- WIRE BENDING SPACE CONFORMS TO NATIONAL ELECTRIC CODE (NFPA70).
- REFER TO THE NATIONAL ELECTRIC CODE FOR MINIMUM CLEAR SPACE IN FRONT OF THIS ENCLOSURE.



UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIM NO 0319_0413	DMN E. ENGLE		CUMMINS POWER GENERATION															
DO NOT SCALE PRINT			CAD J. OLSON		OUTLINE-CONTROL BOX															
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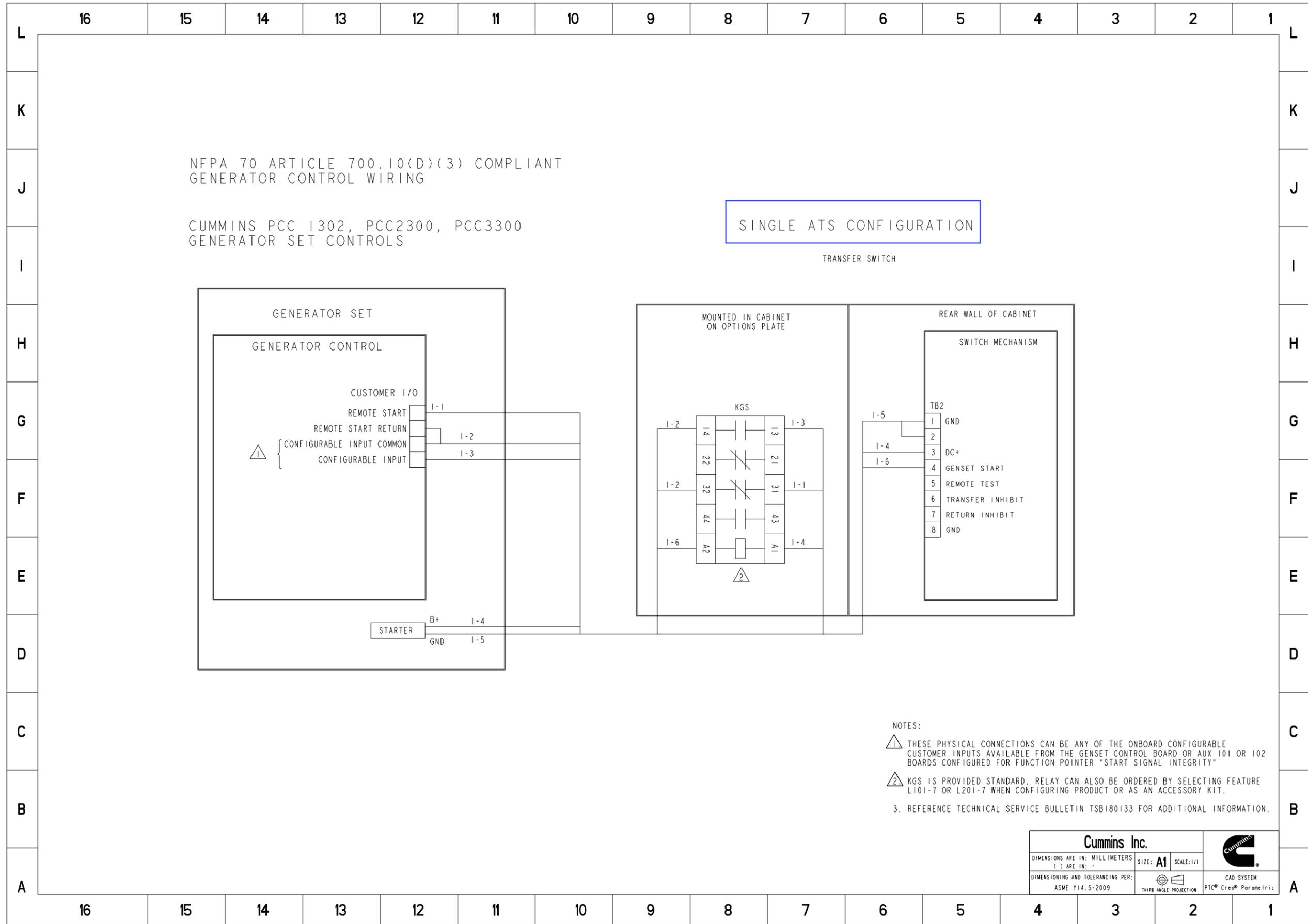


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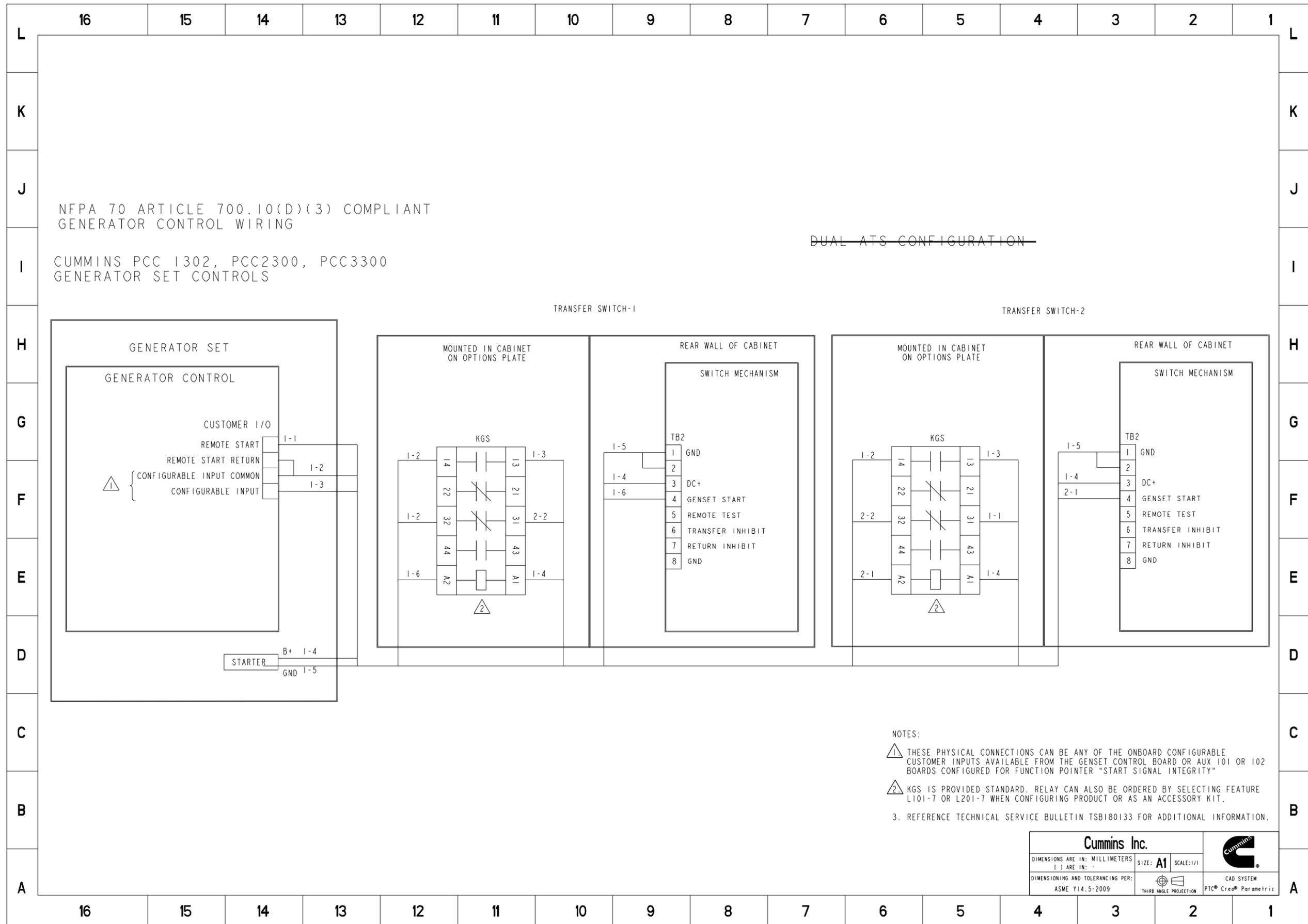


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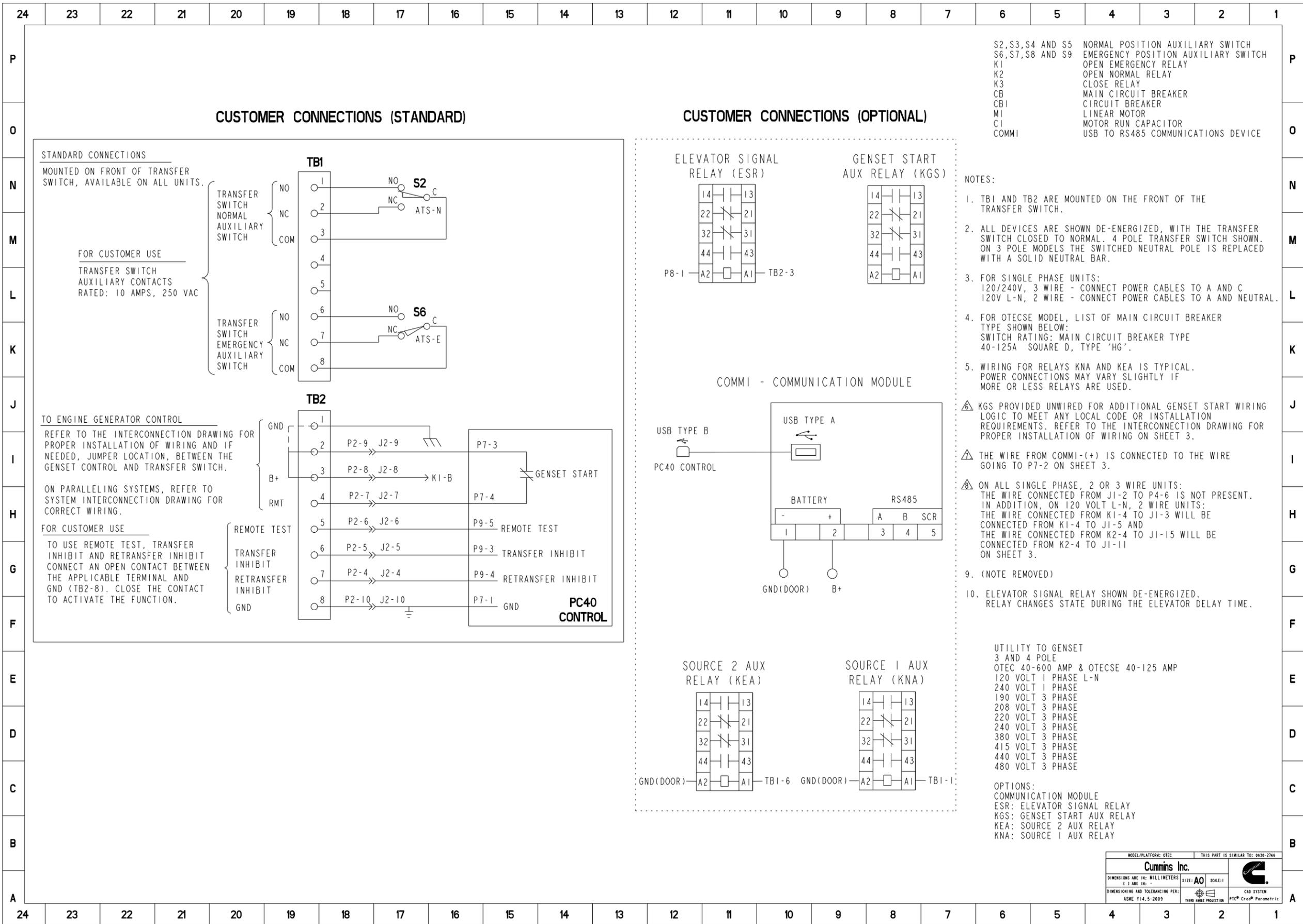




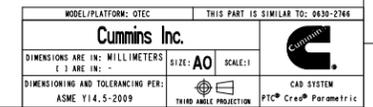
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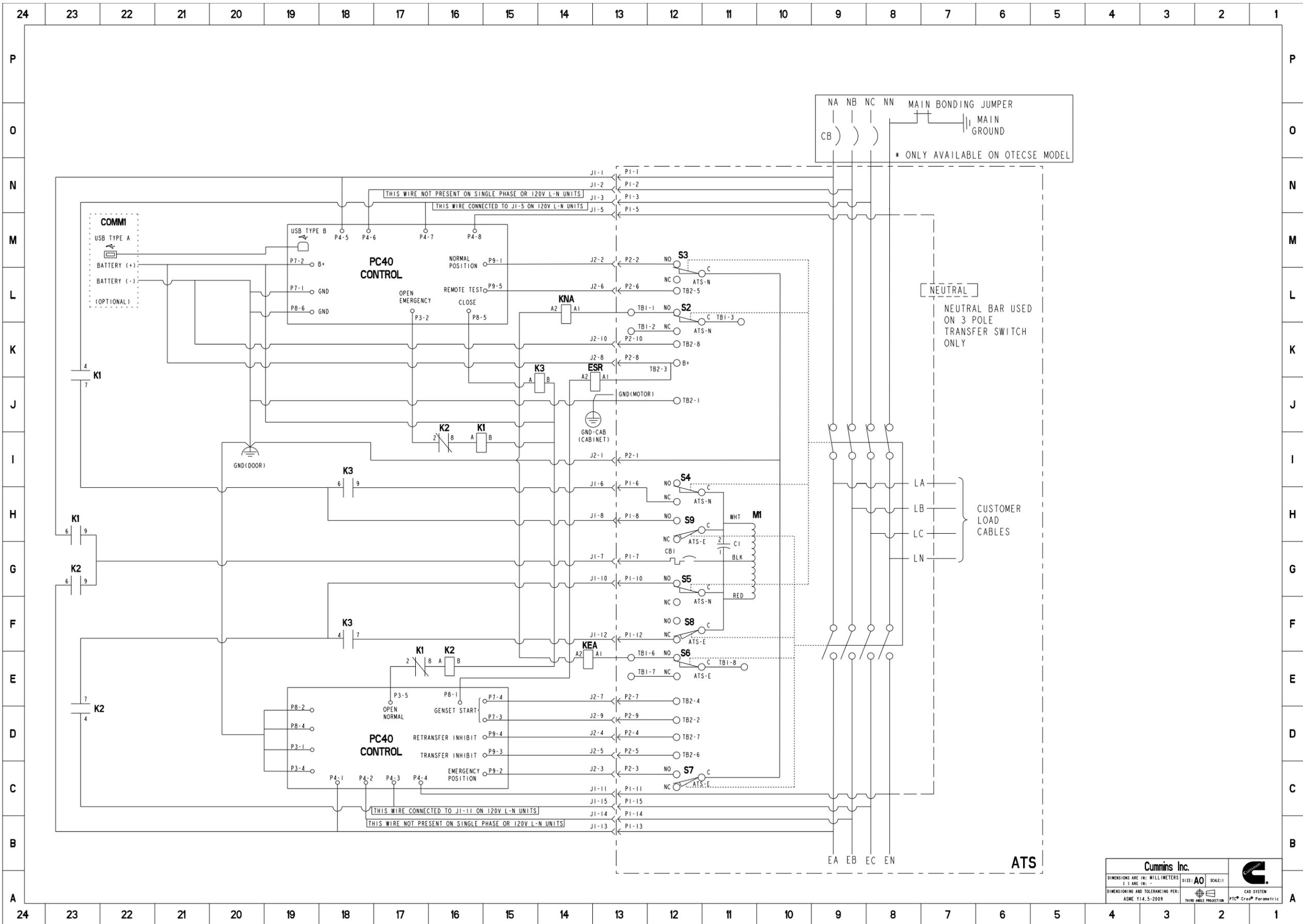


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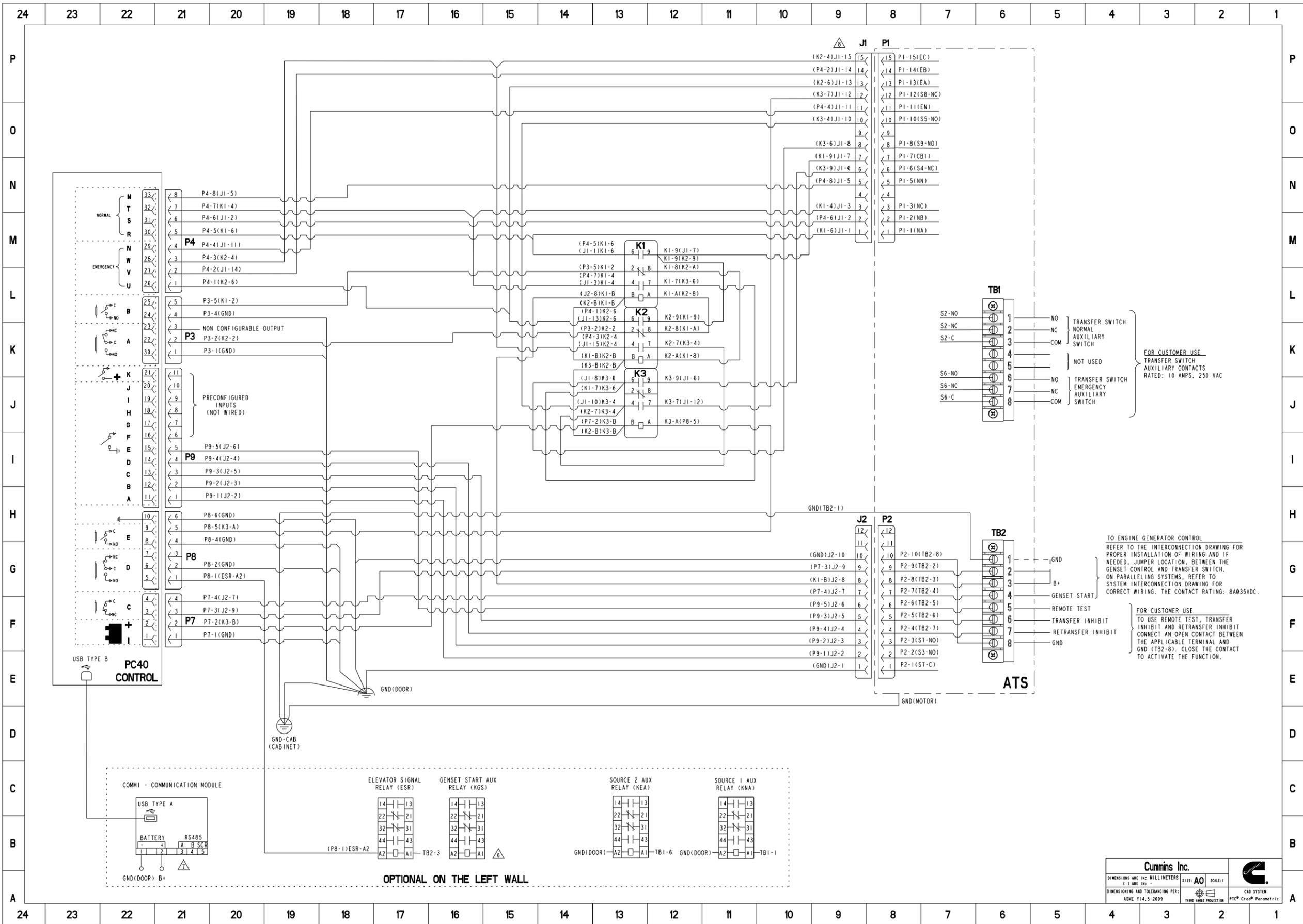


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# **SECTION 6**

## **START-UP AND WARRANTY**



## Cummins Sales and Service Customer / Contractor Pre Commissioning Inspection Form

The intent of this form is for the contractor to prepare for equipment to be commissioned by a certified Cummins Field Service Power Generation Technician. Filling out this form is required and will minimize delays due to equipment failing to meet requirements. Completing this checklist in its entirety should minimize the need for additional billing beyond the previously provided commissioning quote.

The items listed are the responsibility of the contractor and not Cummins Sales and Service.

Project Name/End User: \_\_\_\_\_

Contractor: \_\_\_\_\_

Address: \_\_\_\_\_ Contact: \_\_\_\_\_

Business Phone: \_\_\_\_\_ Cell Phone: \_\_\_\_\_

Email: \_\_\_\_\_

### ON SITE INFORMATION

On-Site Contact Information: \_\_\_\_\_

Address: \_\_\_\_\_

Time Requested Onsite: \_\_\_\_\_

Sub location of Generator (ie. Roof, basement, floor): \_\_\_\_\_

Does the facility have the following:    Loading Dock  Elevator

Access (from truck and load bank parking to generator in feet): \_\_\_\_\_

Parking: Is parking available on-site for service truck: Yes  No

Permits: Have all necessary air quality and local permits been secured: Yes  No  N/A

Fuel Tank Testing: Is fuel tank testing required: Yes  No

If yes when is the inspector scheduled for: \_\_\_\_\_

**ON SITE INFORMATION CONTINUED**

YES	NA	NO
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Is the facility occupied and is customer aware there will be power outages after generator is started?

Will there be any site safety training needed for technician prior to beginning? On site contact for training: \_\_\_\_\_

Will customer representative be on site for operator training?  
On site contact for operator training: \_\_\_\_\_

**MECHANICAL LOCATION AND PLACEMENT OF THE GENERATOR SET**

YES	NA	NO
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Generator is properly secured to pad or vibration isolators

Generator Enclosure and/or Room is free of all debris

No airflow obstructions to the engine or generator are present for cooling combustion  
(See Cummins T-030 or Installation manual of generator set)

Room is designed for adequate inlet and outlet airflow

**GASEOUS FUEL Natural Gas/LP Vapor/LP Liquid**

YES	NA	NO
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Natural gas and/or LPG fuel supply is connected.

Fuel piping is the appropriate size based on full-load CFH/BTU requirement. Pipe size after service regulator: \_\_\_\_\_

Service regulator(s), (if supplied), fuel strainer(s), flexible fuel line(s) and manual shut off are installed

Fuel pressure after service regulator is: \_\_\_\_\_ inches of H2O

*I have read and fully understand the fuel requirements for this equipment, I am verifying that the piping and fuel supply meets or exceeds those requirements. I also understand failure to meet the requirements will result in additional charges.*

\_\_\_\_\_  
**Contractor "requestor" Signature**

\_\_\_\_\_  
**Date**

### DIESEL FUELED GENERATORS

YES    NA    NO

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Flexible fuel connections, (supply and return) are connected to generator and piping.

Day tank installed, wired and plumbed (lines free of obstruction) to genset and main fuel tank if applicable. Only black iron pipe for fuel lines, never use copper or galvanized pipe.

All tanks filled with enough fuel to perform startup and testing.

A return line from engine to day tank and day tank to main tank should be in place

### EXHAUST SYSTEM

YES    NA    NO

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Exhaust wrapped or isolated to prevent accidental activation of fire protection devices and sprinklers.

Exhaust flex-pipe is installed at engine exhaust outlet (The silencer and flex-pipe are supplied with the generator set).

Silencer is installed with appropriate supports (no weight should be placed on the exhaust outlet of the genset).

Exhaust system has proper expansion joints and wall thimbles (Thimbles are required for wall or roof penetration).

### GENERATOR ELECTRICAL CONNECTIONS

YES    NA    NO

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Load conductors connected to breakers

Flexible connections used on all conduit connections to the generator set output box

Remote start interconnection **stranded** wiring is installed between the generator set and the automatic transfer switch(s) and annunciator.

AC Power conductors in dedicated conduit separate from any DC control or network wiring

Ground fault connected/functioning on generator, if supplied

AC power wired to the coolant heaters (Do NOT energize)

Check for AC oil pan heater, control heater or generator winding heater (Needing AC wiring)

Generator is grounded in compliance with local codes

If applicable, louver motors are operational and connected to generator controls

### GENERATOR ELECTRICAL CONNECTIONS CONTINUED

YES    NA    NO

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Annunciator mounted in a location where someone can observe a fault of the remote generator system

Where is annunciator located? \_\_\_\_\_

Are there additional ancillary devices/equipment that need to be integrated into the system? If yes, please define \_\_\_\_\_

Battery charger mounted (free of vibration, weather, accessible for an operator to observe easily) and connected to the appropriate AC and DC wiring to operate the charger.

### TRANSFER SWITCH ELECTRICAL CONNECTIONS

YES    NA    NO

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Conductors connected for Utility, Load and Emergency

Remote start interconnection **stranded** wiring is installed between the generator set and the automatic transfer switch(s).

Four Pole Transfer Switch: Is generator neutral grounded?

### DAY OF STARTUP

YES    NA    NO

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Training of facility personnel will be done on the same day as start up. Additional trips for operational training will be an additional charge.

Can transfer switch be tested at time of generator startup? (There will be a power interruption) **Note: After hours testing could result in additional charges.**

If the associated switchgear and/or ATS(s) are not provided by Cummins, will the manufacturer's representative be on site?

Exercise with or without load?

If known, Transfer Time delay set recommendations Generator Set to exercise Day: \_\_\_\_\_ Time: \_\_\_\_\_

\_\_\_\_\_  
Contractor "requestor" Signature

\_\_\_\_\_  
Printed Name

Date: \_\_\_\_\_

**Please complete this form and return to schedule start up, if not returned within 5 business days prior to scheduled startup it may be delayed. I understand that the start-up date may have to be rescheduled at my expense if the above items have not been completed properly.**



# Warranty Statement

## Global Commercial Warranty Statement

Generator Set

## Limited Warranty

### Commercial Generating Set

This limited warranty applies to all Cummins Power Generation® branded commercial generating sets and associated accessories (hereinafter referred to as "Product").

This warranty covers any failures of the Product, under normal use and service, which result from a defect in material or factory workmanship.

### Warranty Period:

The warranty start date<sup>†</sup> is the date of initial start up, first rental, demonstration or 18 months after factory ship date, whichever is sooner. See table for details.

**Continuous Power (COP)** is defined as being the maximum power which the generating set is capable of delivering continuously whilst supplying a constant electrical load when operated for an unlimited number of hours per year. No overload capability is available for this rating.

**Prime Power (PRP)** is defined as being the maximum power which a generating set is capable of delivering continuously whilst supplying a variable electrical load when operated for an unlimited number of hours per year. The permissible average power output over 24 hours of operation shall not exceed 70% of the PRP. For applications requiring permissible average output higher than stated, a COP rating should be used.

**Limited-Time Running Power (LTP)** is defined as the maximum power available, under the agreed operating conditions, for which the generating set is capable of delivering for up to 500 hours of operation per year.

**Emergency Standby Power (ESP)** is defined as the maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage or under test conditions for up to 500 hours of operation per year. The permissible average power output over 24 hours of operation shall not exceed 70% of the ESP.

**Environmental Protection Agency – Stationary Emergency (EPA-SE)** is defined as being the maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generator set is capable of delivering in the event of a utility power outage or under test conditions and used in strict accordance with the EPA NSPS for stationary engines, 40 CFR part 60, subparts IIII and JJJJ, where a reliable utility must be present. The permissible average power output over 24 hours of operation shall not exceed 70% of the EPA-SE.

**Data Center Continuous (DCC)** is defined as the maximum power which the generator is capable of delivering continuously to a constant or varying electrical load for unlimited hours in a data center application.

**Base Warranty Coverage Duration  
(Whichever occurs first)**

Rating	Months	Max. Hours
COP	12	Unlimited
PRP	12	Unlimited
LTP	12	500 hrs
ESP	24	1000 hrs
EPA-SE	24	Unlimited
DCC	24	Unlimited

<sup>†</sup> Warranty start date for designated rental and oil and gas model Products is determined to be date of receipt of Product by the end customer.

### Cummins Power Generation® Responsibilities:

In the event of a failure of the Product during the warranty period due to defects in material or workmanship, Cummins Power Generation® will only be responsible for the following costs:

- All parts and labor required to repair the Product.
- Reasonable travel expenses to and from the Product site location.
- Maintenance items that are contaminated or damaged by a warrantable failure.

### Owner Responsibilities:

The owner will be responsible for the following:

- Notifying Cummins Power Generation® distributor or dealer within 30 days of the discovery of failure.
- Installing, operating, commissioning and maintaining the Product in accordance with Cummins Power Generation®'s published policies and guidelines.
- Providing evidence for date of commissioning.
- Providing sufficient access to and reasonable ability to remove the Product from the installation in the event of a warrantable failure.
- Incremental costs and expenses associated with Product removal and reinstallation resulting from non-standard installations.
- Costs associated with rental of generating sets used to replace the Product being repaired.
- Costs associated with labor overtime and premium shipping requested by the owner.
- All downtime expenses, fines, all applicable taxes, and other losses resulting from a warrantable failure.

**Limitations:**

This limited warranty does not cover Product failures resulting from:

- Inappropriate use relative to designated power rating.
- Inappropriate use relative to application guidelines.
- Inappropriate use of an EPA-SE application generator set relative to EPA's standards.
- Normal wear and tear.
- Improper and/or unauthorized installation.
- Negligence, accidents or misuse.
- Lack of maintenance or unauthorized repair.
- Noncompliance with any Cummins Power Generation® published guideline or policy.
- Use of improper or contaminated fuels, coolants or lubricants.
- Improper storage before and after commissioning.
- Owner's delay in making Product available after notification of potential Product problem.
- Replacement parts and accessories not authorized by Cummins Power Generation®.
- Use of Battle Short Mode.
- Owner or operator abuse or neglect such as: operation without adequate coolant or lubricants; overfueling; overspeeding; lack of maintenance to lubricating, cooling or air intake systems; late servicing and maintenance; improper storage, starting, warm-up, run-in or shutdown practices, or for progressive damage resulting from a defective shutdown or warning device.

- Damage to parts, fixtures, housings, attachments and accessory items that are not part of the generating set.

This limited warranty does not cover costs resulting from:

- Difficulty in gaining access to the Product.
- Damage to customer property.

A "Data center" is defined as a dedicated facility that house computers and associated equipment for data storage and data handling.

Reliable utility is defined as utility power without routine or regularly scheduled black-outs.

Please contact your local Cummins Power Generation® Distributor for clarification concerning these limitations.

**CUMMINS POWER GENERATION® RIGHT TO FAILED COMPONENTS:**

Failed components claimed under warranty remain the property of Cummins Power Generation®. Cummins Power Generation® has the right to reclaim any failed component that has been replaced under warranty.

**Extended Warranty:**

Cummins Power Generation® offers several levels of Extended Warranty Coverage. Please contact your local Cummins Power Generation® Distributor for details.

[www.power.cummins.com](http://www.power.cummins.com)

**THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS POWER GENERATION® IN REGARD TO THE PRODUCT. CUMMINS POWER GENERATION® MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

**IN NO EVENT IS CUMMINS POWER GENERATION® LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.**

This limited warranty shall be enforced to the maximum extent permitted by applicable law. This limited warranty gives the owner specific rights that may vary from state to state or from jurisdiction to jurisdiction.

Product Model Number: \_\_\_\_\_  
 Product Serial Number: \_\_\_\_\_  
 Date in Service: \_\_\_\_\_



# **Warranty Statement**

## **Transfer Switch Extended Warranty**

## Limited 2 Year Comprehensive Extended Warranty – G004

### Transfer Switch and Paralleling Systems

When purchased, this limited extended warranty applies to all Cummins Power Generation® branded Transfer Switches, Paralleling Systems and associated accessories (hereinafter referred to as "Product").

This warranty covers any failures of the Product, under normal use and service, which result from a defect in material or factory workmanship.

### Warranty Period:

The warranty start date is the date of initial start up, first rental, demonstration or 18 months after factory ship date, whichever is sooner. The coverage duration is 2 years from warranty start date.

### Cummins Power Generation®

#### Responsibilities:

In the event of a failure of the Product during the extended warranty period due to defects in material or workmanship, Cummins Power Generation® will only be responsible for the following costs:

- All parts and labor required to repair the Product.
- Reasonable travel expenses to and from the Product site location.
- Maintenance items that are contaminated or damaged by a warrantable failure.

### Owner Responsibilities:

The owner will be responsible for the following:

- Notifying Cummins Power Generation® distributor or dealer within 30 days of the discovery of failure.
- Installing, operating, commissioning and maintaining the Product in accordance with Cummins Power Generation®'s published policies and guidelines.
- Providing evidence for date of commissioning.
- Providing sufficient access to and reasonable ability to remove the Product from the installation in the event of a warrantable failure.

In addition, the owner will be responsible for:

- Incremental costs and expenses associated with Product removal and reinstallation resulting from non-standard installations.
- Costs associated with rental of generating sets used to replace the Product being repaired.
- Costs associated with labor overtime and premium shipping requested by the owner.
- All downtime expenses, fines, all applicable taxes, and other losses resulting from a warrantable failure.

### Limitations:

This limited extended warranty does not cover Product failures resulting from:

- Inappropriate use relative to designated power rating.
- Inappropriate use relative to application guidelines.
- Failures due to normal wear, corrosion, varnished fuel system parts, lack of reasonable and necessary maintenance, unauthorized modifications and/or repair, and use of add-on or modified parts.
- Improper and/or unauthorized installation.
- Owner's or operator's negligence, accidents or misuse.
- Noncompliance with any Cummins Power Generation® published guideline or policy.
- Improper storage before and after commissioning.
- Owner's delay in making Product available after notification of potential Product problem.

Limitations Continued:

- Replacement parts and accessories not authorized by Cummins Power Generation®.
- Use of Battle Short Mode
- Owner or operator abuse or neglect such as: operation without adequate coolant or

lubricants; overfueling; overspeeding; lack of maintenance to lubricating, cooling or air intake systems; late servicing and maintenance; improper storage, starting, warm-up, run-in or shutdown practices, or for progressive damage resulting from a defective shutdown or warning device.

- Damage to parts, fixtures, housings, attachments and accessory items that are not part of the generating set.

This limited extended warranty does not cover costs resulting from:

- Difficulty in gaining access to the Product.
- Damage to customer property.
- Repair of cosmetic damage to enclosures.

[www.cumminspower.com](http://www.cumminspower.com)

**CUMMINS POWER GENERATION® RIGHT TO FAILED COMPONENTS:**

Failed components claimed under warranty remain the property of Cummins Power Generation®. Cummins Power Generation® has the right to reclaim any failed component that has been replaced under warranty.

**THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS POWER GENERATION ® IN REGARD TO THE PRODUCT. CUMMINS POWER GENERATION® MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

**IN NO EVENT IS CUMMINS POWER GENERATION® LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.**

This limited extended warranty shall be enforced to the maximum extent permitted by applicable law. This limited extended warranty gives the owner specific rights that may vary from state to state or from jurisdiction to jurisdiction.

Product Model Number: \_\_\_\_\_

Product Serial Number: \_\_\_\_\_

Date in Service: \_\_\_\_\_



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## **SUBMITTAL FOR APPROVAL**

### **MERIDIAN TWP. COUNTY PARK LIFT STATION**

### **FLYGT PUMPS, VALVES AND ACCESSORIES**

**CUSTOMER: CHARTER TOWNSHIP OF MERIDIAN**

**SEPTEMBER 27, 2023**

**JOB # 122019**



KENNEDY INDUSTRIES PERSONNEL HAVE DONE ITS DUE DILIGENCE TO ENSURE THAT ALL PROJECT REQUIREMENTS ARE MET BY OUR SUPPLY. THE FOLLOWING DRAWINGS, SPECIFICATIONS & CUT SHEETS ARE THE OFFERINGS THAT WE SUBMIT FOR APPROVAL TO SUPPLY. KENNEDY INDUSTRIES IS A SUPPLIER AND STRIVES TO PROVIDE OUR CUSTOMERS WITH THE HIGHEST QUALITY PRODUCTS AND LEVEL OF SERVICE. IF A CHANGE OR DEVIATION FROM THE FOLLOWING IS DESIRED PLEASE ADVISE US AND WE WILL CHANGE OUR SCOPE OF SUPPLY AS REQUIRED. IF MATERIALS OF CONSTRUCTION OR SCOPE OF SUPPLY CHANGES, IT MAY IMPACT THE CONTRACT PRICE.

<b>PROJECT:</b>	COUNTY PARK LS	<b>JOB #:</b>	122019
<b>KI CONTACT:</b>	RICK ALVAREZ / CHRISTINE TORRES	<b>CUSTOMER:</b>	MERIDIAN TWP
<b>OWNER:</b>	CHARTER TOWNSHIP OF MERIDIAN	<b>ENGINEER:</b>	N/A
<b>DATE:</b>	9/27/2023	<b>CONDITION:</b>	426 GPM @ 63.4' TDH
<b>PUMP TYPE:</b>	SUBMERSIBLE	<b>PIPE DIA:</b>	6"
<b>PH/VOLT:</b>	3/460	<b>WW DEPTH:</b>	21'
<b>WW DIA:</b>	N/A		
<b>NOTES:</b>			

QTY.	DESCRIPTION	COMMENTS
2	FLYGT NP6020.091 HT, 242 IMP, 10 HP, 3/460V, 3"	TOTAL WT = 340 LBS
2	FM RATING	CLASS 1, DIVISION 1
2	FLS	DETECTS MECHANICAL SEAL LEAKS
2	POWER AND SENSOR CABLE	0.75" O.D., 50' LENGTH
2	DISCHARGE CONNECTION	3", #4446805
2	P-INSTALL KIT	7481815
2	UPPER GUIDE BRACKET	2", 316SS
4	KI RAIL CONNECTORS	2"
5	GUIDE RAILS	2", 304SS
2	LIFT CHAIN	1/4", 21' LENGTH CAPACITY = 1400 LBS
2	QUICK LINKS	1/4", 304SS CAPACITY = 880 LBS
2	6" APCO CHECK VALVE WITH LEVER & WEIGHT	CVS,6,250A,F1,DIF,DI-S11-S2-NBR*LW
3	6" KENNEDY GATE VALVE WITH HANDWHEEL	FIG 8561A
2	DP GATEWAY	8164700
2	7" TOUCH SCREEN HMI	8224800
2	POWER SUPPLY	14-603008

# Concertor DP N80-7800

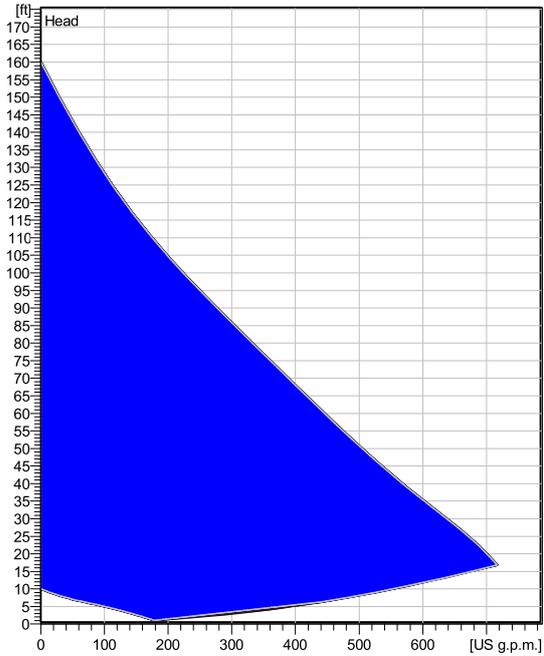
A process-controlled wastewater pumping system suitable for customers who utilize specially designed process control algorithms and want to benefit from lower capital costs, smaller control cabinets and higher pump system efficiencies. Concertor DP is also suitable as a reliable and energy efficient on/off controlled wastewater pumping system for customers who want to benefit from easily adjustable pump performance, soft start/soft stop, constant power and motor protection. This system is scalable to as many pumps as required by your application, with one gateway per pump.



## Technical specification



Curves according to: Water, pure [100%], 39.2 °F, 62.42 lb/ft<sup>3</sup>, 1.6891E-5 ft<sup>2</sup>/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for performance guarantees.

## Configuration

<b>Motor number</b> N6020.091 18-08-1AZ-W 10hp	<b>Installation type</b> P - Semi permanent, Wet
<b>Impeller diameter</b> 170 mm	<b>Discharge diameter</b> 3 inch

## Pump information

<b>Impeller diameter</b> 170 mm
<b>Discharge diameter</b> 3 inch
<b>Inlet diameter</b> 110 mm
<b>Maximum operating speed</b> 800-3214.3 rpm
<b>Number of blades</b> 2
<b>Max. fluid temperature</b> 40 °C

## Materials

<b>Impeller</b> Hard-Iron™
-------------------------------

<b>Project</b>	Xylect-20925376	<b>Created by</b>	Rick Alvarez
<b>Block</b>		<b>Created on</b>	7/28/2023
		<b>Last update</b>	7/28/2023

# Concertor DP N80-7800

## Technical specification



### Motor - General

<b>Motor number</b> N6020.091 18-08-1AZ-W 10hp	<b>Phases</b> 3~	<b>Rated speed</b> 800-3214 rpm	<b>Rated power</b> 10 hp
<b>ATEX approved</b> FM	<b>Insulation class</b> H	<b>Rated current</b> 10.5 A	<b>Type of Duty</b> S1
<b>Frequency</b> 60 Hz	<b>Rated voltage</b> 460 V	<b>Motor efficiency class</b> IE4 according to IEC/TS 60034-30-2 Ed. 1	

### Motor - Technical

<b>Power factor - 1/1 Load</b> 0.95	<b>Motor efficiency - 1/1 Load</b> 90.0 %	<b>Nominal speed - 1/1 Load</b> 2300 rpm
<b>Power factor - 3/4 Load</b> 0.95	<b>Motor efficiency - 3/4 Load</b> 91.0 %	<b>Nominal speed - 3/4 Load</b> 2070 rpm
<b>Power factor - 1/2 Load</b> 0.95	<b>Motor efficiency - 1/2 Load</b> 91.0 %	<b>Nominal speed - 1/2 Load</b> 1840 rpm
<b>Starting current</b> 10.5 A		

<b>Project</b>	Xylect-20925376	<b>Created by</b>	Rick Alvarez	<b>Last update</b>	7/28/2023
<b>Block</b>		<b>Created on</b>	7/28/2023		

# Concertor DP N80-7800

## Monitoring and Control equipment



### Gateway

Yes	
Power Supply	24 V DC
Ports	1 x USB 1 x RS485 1 X Ethernet RJ 45 1 x Display interface, CAN
Communication	Modbus RTU Modbus TCP
Standard I/O	4 x Digital outputs 4 x Digital inputs 1 x Analog input 1 x Analog output
Pump Interface	1 x Pump Communication Port
User Interface	14 x LED 1 x Rotator Switch
Data Logging	1000 data points
Environment Class	Protection class: IP 20 Operation temperature: -20°C to +65°C
Software Version	DP software – Variable performance control via external signal, status and alarms
Approvals	CE, UL, CSA

### Interface (HMI)

None

<b>Project</b>	Xylect-20925376	<b>Created by</b>	Rick Alvarez	<b>Created on</b>	7/28/2023	<b>Last update</b>	7/28/2023
<b>Block</b>							

# Concertor DP N80-7800

## Performance curve

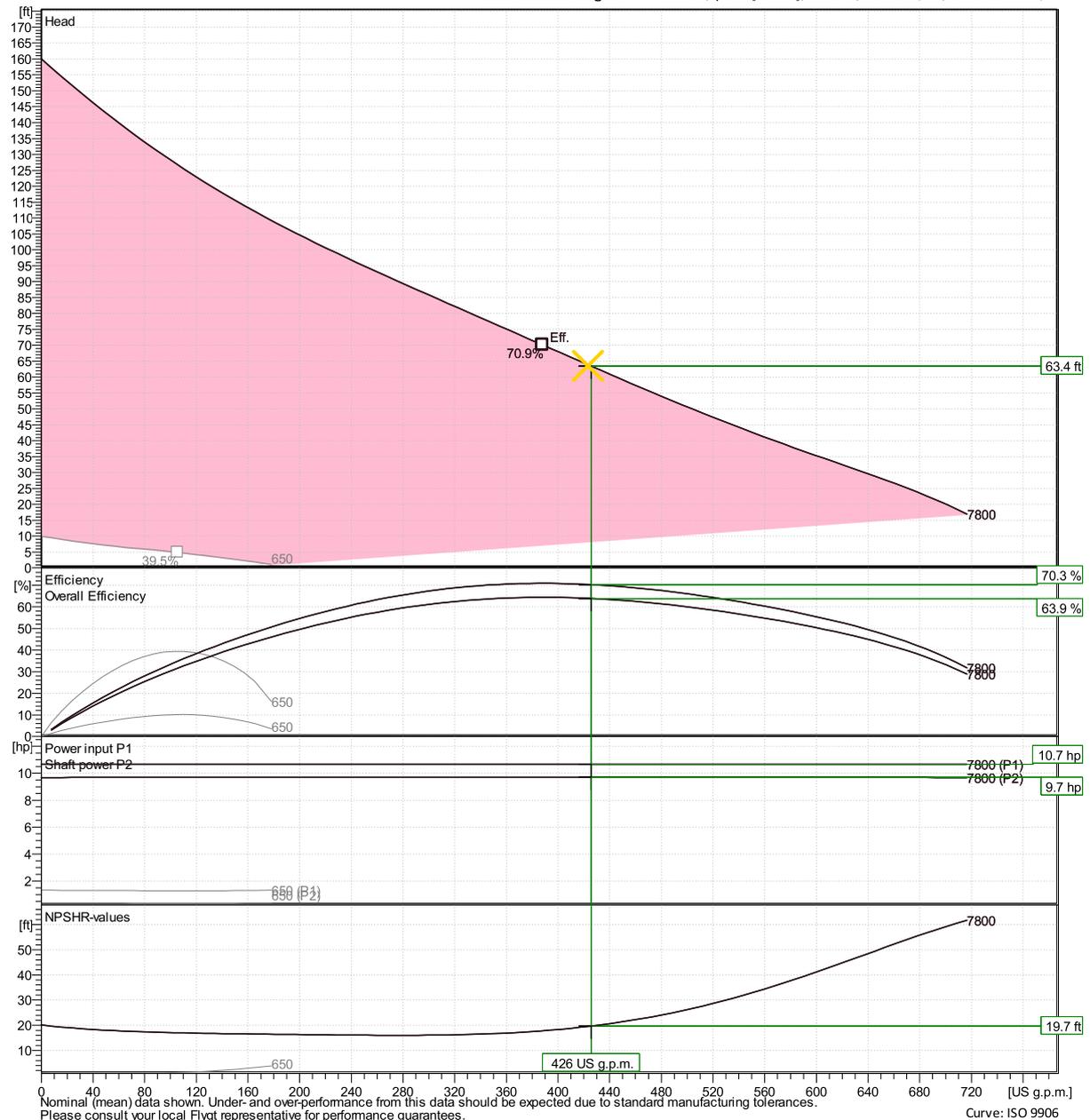


### Duty point

**Flow**  
426 US g.p.m.

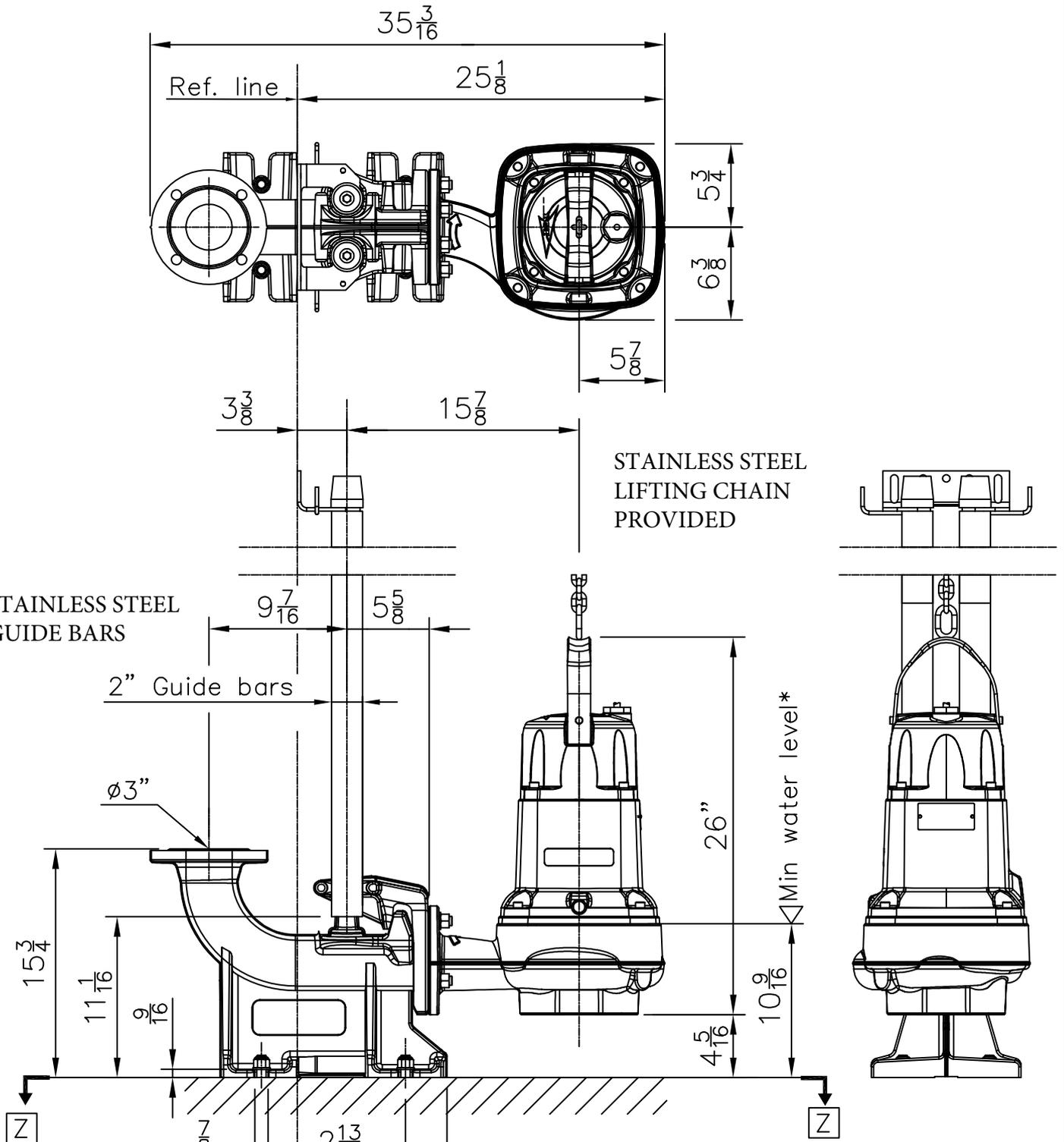
**Head**  
63.4 ft

Curves according to: Water, pure [100%], 39.2 °F, 62.42 lb/ft<sup>3</sup>, 1.6891E-5 ft<sup>2</sup>/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for performance guarantees. Curve: ISO 9906

<b>Project</b>	Xylect-20925376	<b>Created by</b>	Rick Alvarez	<b>Last update</b>	7/28/2023
<b>Block</b>		<b>Created on</b>	7/28/2023		



\* Only applicable for intermittent duty. Consult the IOM for more info.

Weight	Pump	Stand
lbs	245	75

	NP	6020	HT	Discharge outlet ø3"	Scale 1:10	Date 220209
	APX F -7			Pump outlet ø3"		
				Pump inlet	Drawing number	Revision
				Suction inlet	8033900	4

## 6020 Standard Pump Cable

Pump Model	HP	Volts	Ø	Cable Size/ Nominal O.D.	Part Number	No. of Cables	Max. Cable Length (Ft)
6020	5.5	200 - 240	3	S3x6+3x6/3+S(4x0.5) 0.83"(21mm)	94 19 91	1	200
	7.5	380 - 480	3	S3x2.5+3x2.5/3+S(4x0.5) 0.75"(19mm)	94 19 90	1	280
10		380 - 480	3	S3x2.5+3x2.5/3+S(4x0.5) 0.75"(19mm)	94 19 90	1	215

See last page for break down of conductors used in one cable.

## **Flygt Concertor NP- 6020**

Furnish submersible non-clog wastewater pumps. Each pump shall be equipped with a submersible electric motor connected for operation on 60 hertz with submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and have P-MSHA Approval. The pump shall be equipped with a fully adjustable submersible electric motor. The pump shall be fully adjustable in the field as needed due to potential field variances.

Quantity of Pumps: 2  
Horse Power: 10  
Voltage: 460  
Cable Length: 50 FT.

### **PUMP DESIGN CONFIGURATION (Wet pit installation)**

The pump shall be supplied with a mating cast iron discharge connection and be capable of delivering the design point listed below. The pumps shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor. Each pump shall be fitted with stainless steel lifting chain. The working load of the lifting system shall be 50% greater than the pump unit weight.

Design Point: 426 GPM at 63.4' TDH  
Discharge Size: 3"  
Length of Stainless Steel Lift Chain: 21'

The motor horsepower shall be adequate and adjustable from 0-10 hp so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out. The motor shall be able to operate non-submerged without damage while pumping under load.

Starting method: Speed ramp up at reduced current. All devices to soft start the pump via reduced voltage shall be incorporated within the pump/motor housing. These same devices shall also provide for a "soft stop" of the pumping element.

### **Pump / Motor design – Explosion Proof Class 1, Division 1**

Single-stage close-coupled submersible centrifugal pump with of semi open multi vane impeller designed to transport wastewater with fibrous materials and heavy sludge. It shall be submersible up to 65 feet (20m) according IEC 60034 and protection class IP 68.

The impeller blades shall be self-cleaning upon each rotation as they pass across a sharp relief groove in the Insert ring cast integrally into pump volute's replaceable bottom wear plate and shall keep the impeller blades clear of debris. The impeller shall move axially upwards on its shaft to allow larger debris to pass through and immediately return to normal operating position.

The pump shall be operated by a synchronous motor and an integrated control system and be capable to run at constant power at any point of the performance field without being overloaded. Motor shall utilize a permanent magnet rotor to maintain synchronous speed and maintain level IE-4 premium efficiency standards. The motor shall withstand at least 60 starts per hour.

An integrated pump control system installed in the pump/motor housing shall ramp up the speed at start-up of the pump to reduce the start-up current and secure that the direction of the impeller rotation is always correct. There shall be no need for any human intervention to ensure that the impeller is rotating in the correct direction within the volute. The control system that is integrated within the pump/motor housing shall be encapsulated to protect it against moisture ingress, and vibration. Motor, pump and control system shall be designed and produced by the same manufacturer.

The integral control system mounted within the pump/motor housing shall be capable of adjusting the motor/impeller speed so that the pump can safely operate without overloading anywhere within the pumps' operating envelope.

The pump shall incorporate a "pump-cleaning" function to remove debris from the impeller. The cleaning function shall be initiated when the integral control system senses an increase in current draw due to debris in the pump. The cleaning function shall consist of forced stopping, reversal and forward runs timed to allow for debris to fall from the impeller. After cleaning cycle is complete, the pump shall resume to automatic operation. If the pump impeller/volute does not clear itself after the programmed number of attempts, the control will initiate and alarm to notify that the pump inlet / volute is blocked by large debris.

The cooling system shall provide sufficient cooling to run the pump at continuous pump duty in a liquid temperature of up to 104°F (40°C). Operational restrictions at temperatures below 104°F (40°C) or the demand of auxiliary cooling systems like fans or blowers are not acceptable.

Stator shall be insulated with class H trickle impregnated insulation rated at 356°F (180°C)

### **Cable**

The motor shall be equipped with 50 feet of shielded submersible cable. The shield within the cable shall allow for a control panel mounted interface component to communicate both ways with the integrally mounted control unit within the pump/motor housing. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

### **Motor protection**

The integrated control system shall continuously monitor the leakage sensor in the stator housing and the temperature of the motor. If the motor temperature is too high, the pump shall be capable of operating at a reduced speed until the high temperature conditions are normalized.

The operator shall be able to modify the setting of the control system to decide if the active leakage signal shall stop or not stop the pump. External trips or overload devices for motor protection shall not be required.

### **Bearings**

The shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a single row ball bearing to handle radial loads. The lower bearing shall be a double row angular contact ball bearing to handle the thrust and radial forces. **Single row lower bearings are not acceptable.** The minimum L10 bearing life shall be 50,000 hours at any usable portion of the pump performance field.

### **Motor sealing**

The cable entry shall be threaded and sealed by a field replaceable grommet. A nylon clamp shall secure a strain relief function. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

The shaft shall be sealed by two seals in a tandem arrangement, incorporated into a single unit assembly. The seals shall require neither maintenance nor adjustment and shall be capable of operating bi-directionally without damage or loss of seal function. The seal unit shall be designed as Plug-in unit which can be replaced without any special tools. The upper seal rotating surface shall include vanes etched into the seal surface to push any potential seal leakage back towards the pump volute.

Shaft seal face material of construction:

- Pump side: - Corrosion and abrasion resistant Tungsten carbide WCCR /WCCR
- Motor side: - Corrosion and abrasion resistant Tungsten carbide WCCR / WCCR

## **PUMP CONSTRUCTION**

Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be of stainless steel. All exposed nuts or bolts shall be AISI type 316 stainless steel construction.

Machined surfaces shall incorporate **metal-to-metal contact** between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or optional Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

### **Coating**

All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be blasted and surface oils and debris removed for proper coating adhesion before coating. All wet surfaces are to be coated with two-pack oxyrane ester Duasolid 50. The total layer thickness should be at least 120 microns. Zink dust primer shall not be used.

### **Impeller**

Due to the likely presence of sand and or grit the impeller shall be of Hard-Iron™ ASTM A-532 Alloy III A 25% chrome cast iron, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The leading edges of the impeller shall be hardened to Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be locked to the shaft, held by an impeller bolt.

### **Volute / Suction Cover**

The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. Due to the likely presence of sand or grit the insert ring shall be cast of Hard-Iron™ ASTM A-532 Alloy III A 25% chrome cast iron and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

### **Pump Shaft**

Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be stainless steel – ASTM A479 S43100-T.

The use of shaft sleeves of different material than the shaft shall not be acceptable.

### **Lifting and Installation equipment**

Each pump shall be supplied with a mating cast iron 3 inch discharge connection. The pump shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. There shall be no need for personnel to enter the wet-well.

No portion of the pump shall bear directly on the sump floor. Each pump shall be fitted with (see plans for depth) feet of stainless steel lifting chain. The working load of the lifting system shall be 50% greater than the pump unit weight.

## **CLOG-FREE GUARANTEE**

The supplier of the pump and control system shall guarantee clog-free operation for a period of 24 months from the date of start-up. A certificate of guarantee shall be provided to the Owner on the day of start up with the local contact information and effective date. Should the impeller clog with typical solids and/or modern trash debris normally found in domestic wastewater during this period, an authorized representative shall either travel to the jobsite remove the pump, clear the obstruction and reinstall the pump at no cost or reimburse the Owner for reasonable cost to provide this service. A written report shall be provided to the Owner detailing the service call with pictures for verification purposes

**WARRANTY**

Pump shall be provided with a 5 year prorated warranty.

## WARRANTY

Xylem Water Solutions USA, Inc



### ADDENDUM A - Warranty Coverage by Product

PRODUCT	PRODUCT SERIES AND CONFIGURATION	WARRANTY COVERAGE (Months)									
		1-12	13-18	19-24	25-36	37-39	40-48	49-60	61-84	85-120	
Axial Flow / Mixed Flow / Centrifugal Pumps & Mixers	3000 Series (CP, NP, DP, CT, NT, CZ, NZ, LL) 4000 Series (SR, PP) 7000 Series (PL)	100%		50%			25%				
Concertor Pumping System	6000 Series (N, DP, iPS, XPC)	100%		50%			25%				
	6000 Series w/ iPS or XPC Panels (w/ 1 year purchase of Flygt Cloud and built in i2r)	100%			50%			25%			
ETO Electrical Control Panels	Engineered to Order, Xylem Manufactured Control Panels (permanently installed) - 3 Years	100%	LIMITED 100%								
Grinder Pumps	3000 Series (MP, MF, MH)	100% (From Ship Date)			100% (from manufacture date)						
Abrasion/Corrosion Resistant & Chopper Pumps	3000 Series (FP, FS, FT, HP, HS) 5000 Series (HP, HS) 8000.280Series (DP, DZ, DT, DS, DF)	100%									
Centrifugal Pumps	1300 Series	100%									
Dewatering Pumps	2000 Series (BS, KS) 3000 Series (CS, NS, DS) 8000.280 Series (DS, DF)	100% (From Ship Date)									
TOPS	Fiberglass Pump Station	100% (From Ship Date)									
Accessories	Permanent / Portable	100% (From Ship Date)									
Hydroejectors/Aerators	HE, JA	100%									
Portable Pump Controls	Control Boxes (Nolta, MSHA etc.)	100% (From Ship Date)									
TOPS Control Panels	TOPS controlpanels (permanently installed)	100% (From Ship Date)									
Small Pumps	3045, 3057, SX	100% (From Ship Date)									
Parts	All new Flygt parts (mechanical & electrical)	100% (From Ship Date)		NOTE: Parts that fail when used in a repair are warranted for one (1) year from the date of the repair for the failed part only – no labor; This Includes Flygt pump controllers, Flygt supervision equipment, Flygt submersible level transducers, etc.							
Monitoring & Control	Multismart Pump Station Manager and Operating System	100 (From Ship Date)									
	Flygt Probes (excluding the DuoProbe)	100 (From Ship Date)									
	All other Xylem M&C Products	100% (From Ship Date)									

## **Pump Storage**

For long periods of storage, the equipment must be protected against moisture and heat. The impeller should be rotated by hand (for example once every month) to prevent the Seal Rings from sticking together.

### **Storing for 6 Months:**

In general, rotating machinery left idle for extended periods of time tend to establish a “set” position due to inaction of the moving parts. Some of these areas may be damaged (especially seals) from the sudden fast breakaway of start-up after a prolonged idle time.

To insure that all rotating parts are free for final installation and start-up, it is good practice to rotate the Impeller/Propeller by hand at a minimum once a month. If the pump is stored for more than a six (6) month period, this rotation schedule is mandatory.

### **Storing Up to 12 months:**

In addition to the above it is recommended the use of a silicon spray or rust inhibiting oil be sprayed through the pump outlet and up through the pump inlet so as to coat the Impeller/Propeller and the inside of the Discharge with a protective coating.

Pumps should not be stored in a place where the ambient temperature may be in excess of 50°C for any length of time or drop below freezing 0°C. Any unit that may be exposed to ambient temperatures of 0°C or below must be emptied of any water what so ever. It is particular important that the Seal Oil Chamber only contain clean oil (no free water or oil-water emulsion would be allowed).

After long periods of storage the pump should be fully inspected before it is put into service. Pay special attention to the Shaft Seal and the Cable Entry making sure the compression screws are tight.

Pumps stored in their original shipping cartons/crates must be periodically removed from these cartons/crates in order to meet the storage mandate.

A log showing dates in which the proper maintenance was performed is essential and will be required for review in the event a failure occurs after start-up following a prolonged period of storage.

Further considerations that should appear in “the log” when storing product for prolonged periods twelve (12) months or more:

- 1) Drives should be stored without coolant
- 2) Pump Drives should be stored in the horizontal position
- 3) Impellers should be removed from the Shaft along with the Volute.
- 4) Shaft should be rotated monthly to protect Seals.
- 5) Power Cables should be positioned in such a way that strain is removed from the cables

## **Pump Storage**

### **PERIODS OF EXTENDED STORAGE FOR FLYGT PUMPS GREATER THAN TWELVE (12) MONTHS:**

Before installation the operator must, at a minimum provide documentation that the following procedures have been accomplished:

- 1) Inspect the unit for corrosion around the pump and under the Junction Chamber Cap for indications of condensation.
- 2) Reinstall the Impeller in accordance with Flygt procedures
- 3) If used, fill with new coolant having a mix of 30% mono-propylene glycol and 70% water.
- 4) Manually rotate the Impeller after introducing new coolant
- 5) Perform all static electrical checks of the Drive and Motor
- 6) Ensure that all bolts and fasteners on the pump are tight and secure
- 7) Install pump and run for fifteen (15) minutes.
- 8) Remove pump after fifteen (15) minute run and check oil in Oil Housing. If discolored or contains water, change Shaft Seals as described in Flygt service manual.
- 9) Inspect Stator for moisture as indicated in manual.
- 10) Before returning the pump for operation, check that the direction of rotation is correct.

The ability to keep Flygt product clean, out of the elements and free of rust and/or corrosion should maintain the integrity of the Flygt pump components for extended periods of time and reduce the deterioration probability to a point where it would no longer be a consideration.

In conjunction with the steps outlined above there are three O-Rings that should be replaced (if equipped on the unit) after prolonged periods of storage:

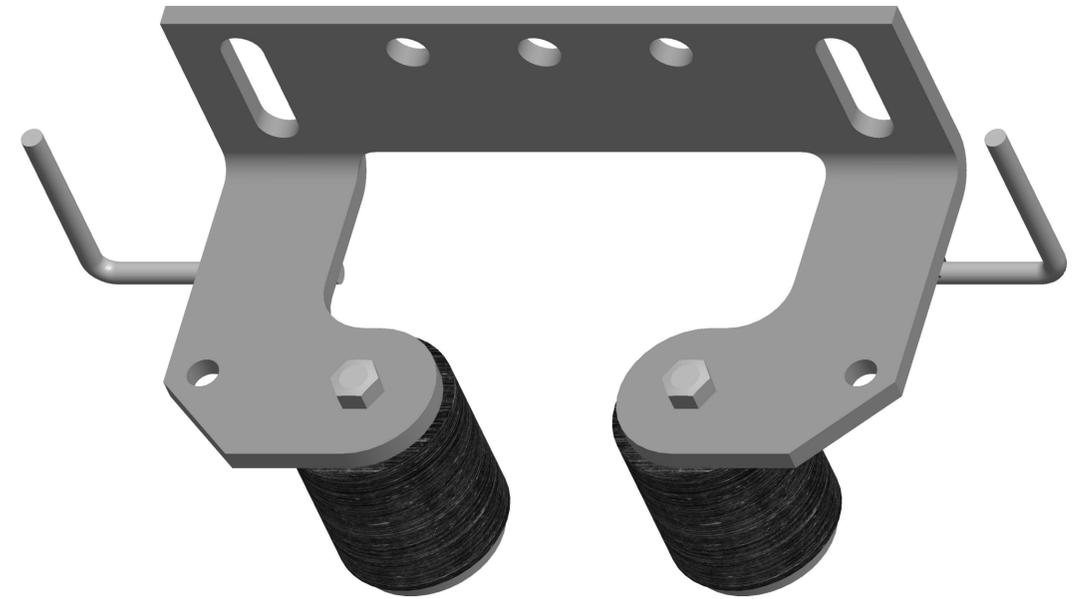
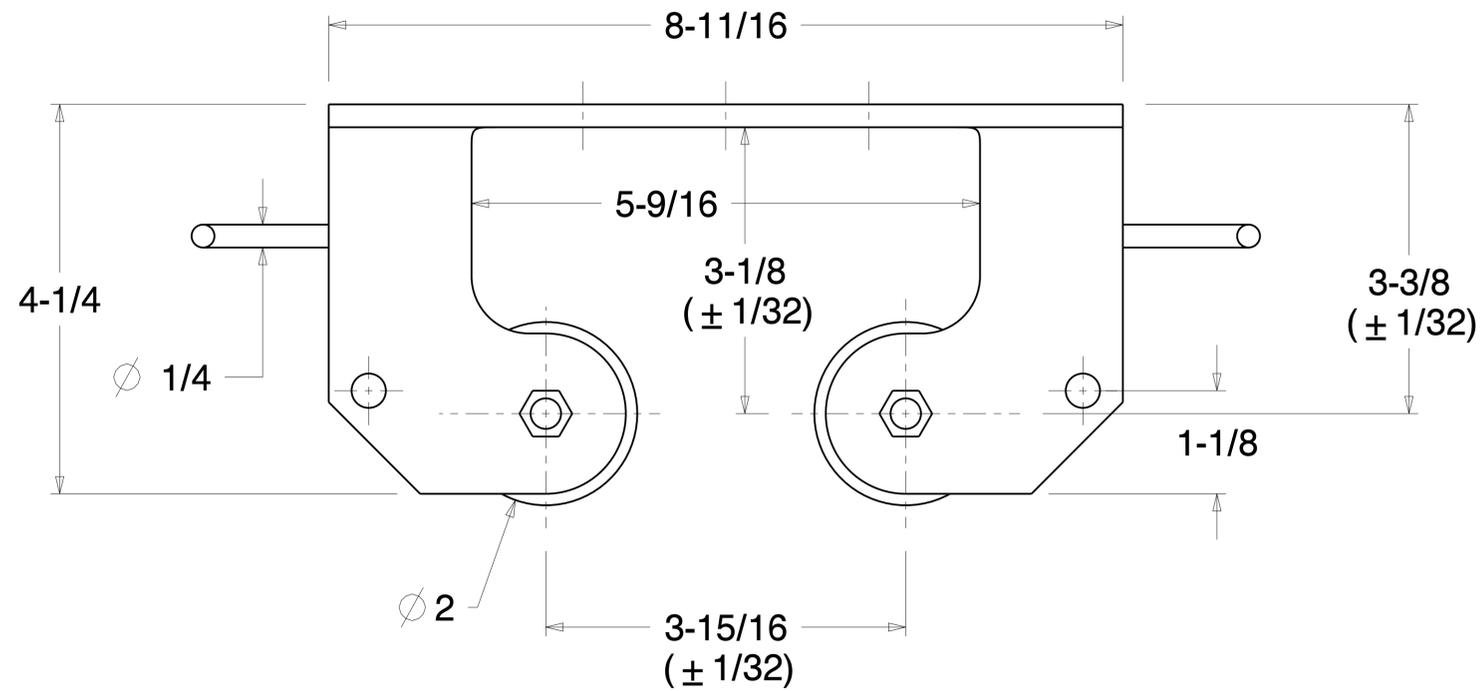
- The two (2) inspection O-Rings and the O-Rings located in the Junction Cover.

By introducing proper maintenance, cleanliness and some common sense in the "equation"... the integrity of a Flygt pump will be long lasting.

Regarding warranty... the standard is... Start-up must occur within one (1) year from ship date.

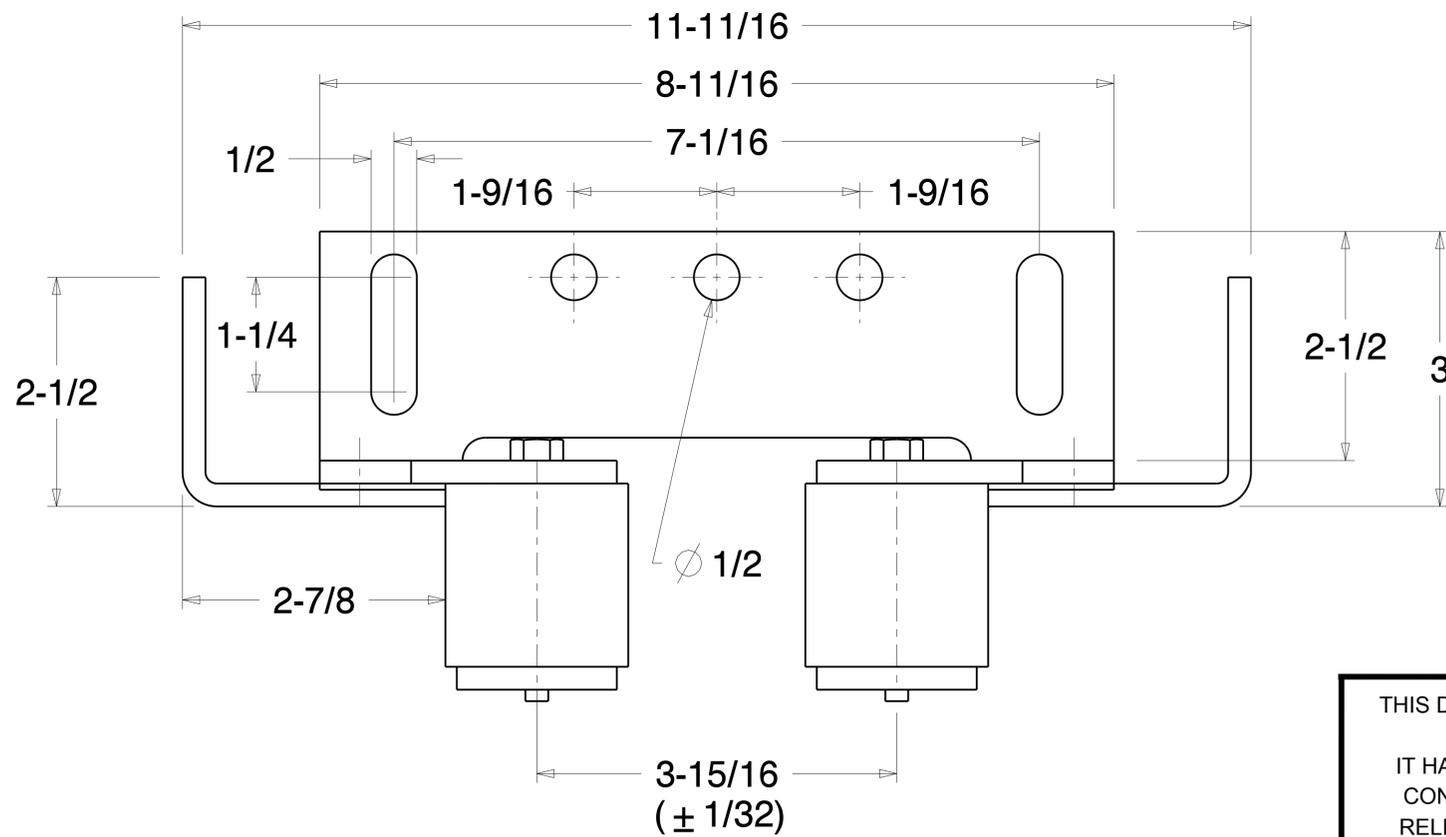
Quality/Warranty

REV LVL	REVISION DESCRIPTION	DATE



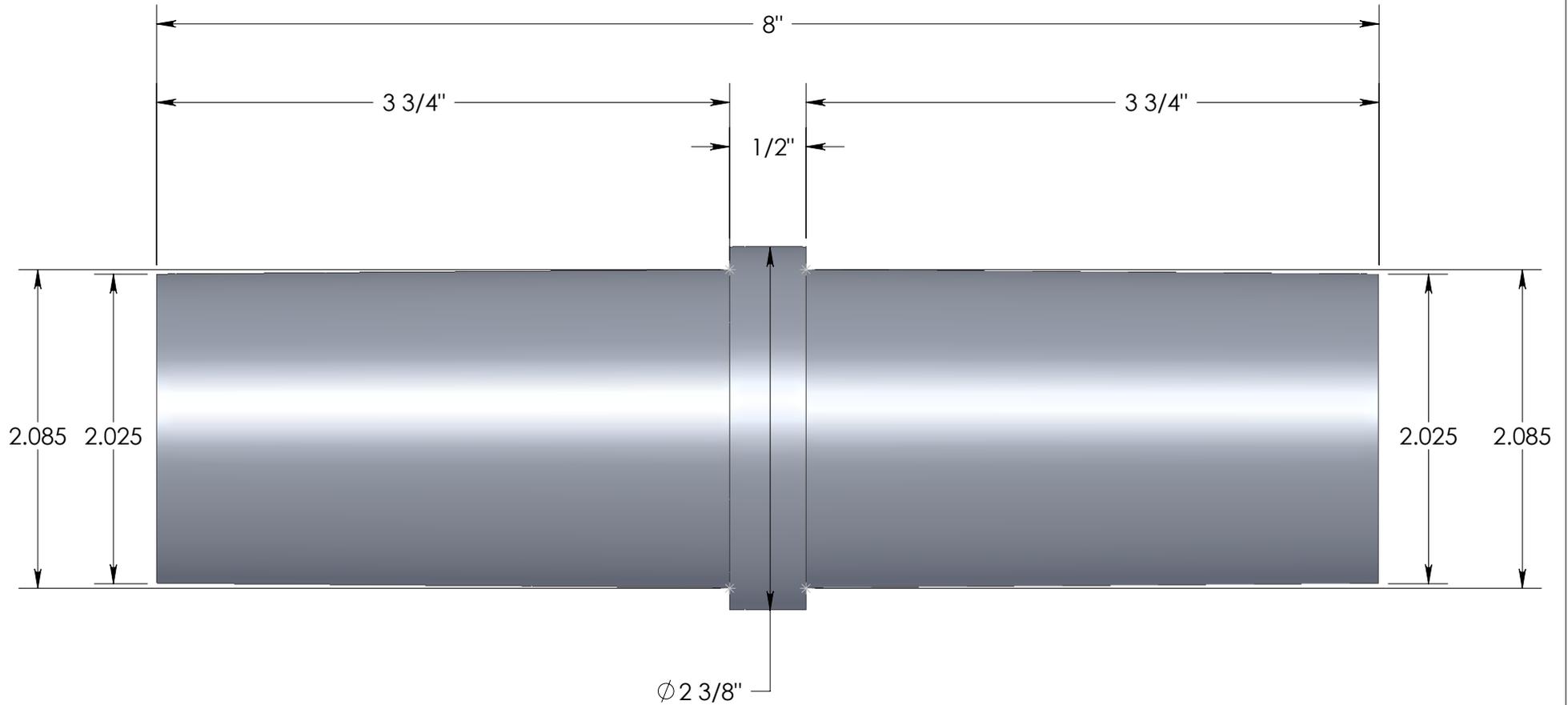
**NOTES:**

- 1.) STAINLESS STEEL UNITS SHALL BE GRADE 304 OR GRADE 316 STAINLESS STEEL, PER NOTE 5.
- 2.) FOR GALVANIZED UNITS, ALL OTHER MATERIAL SHALL BE HOT ROLLED STEEL CONFORMING TO A.S.T.M. A-36.
- 3.) GALVANIZED UNITS SHALL BE HOT DIP GALVANIZED PER A.S.T.M. 123.
- 4.) PLEASE SPECIFY REQUIRED MATERIAL:  
 GALVANIZED (F-UGRB-GALV-2")  
 304 STAINLESS STEEL (F-UGRB-304SS-2")  
 316 STAINLESS STEEL (F-UGRB-316SS-2")



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DRAWING TITLE		<b>ASSEMBLY DETAIL FOR 2" UPPER GUIDERAIL BRACKET Product # 140006136804W</b>	
DRAWN BY:	SBEGOVIC		P.O. Box 1821 6177 South Bay Rd. Cicero, N.Y. 13039
DRAWN DATE:	11-Mar-10		
CAD FILE NAME:			
DO NOT SCALE DWG IF IN DOUBT, ASK UNLESS OTHERWISE SPECIFIED			
SCALE:	SEE DWG DIM ARE IN: INCHES		
TOLERANCE:	± 1/16	Phone # 315-699-2601 Fax # 315-699-2982	

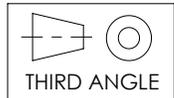


**OPERATION:** *Default*

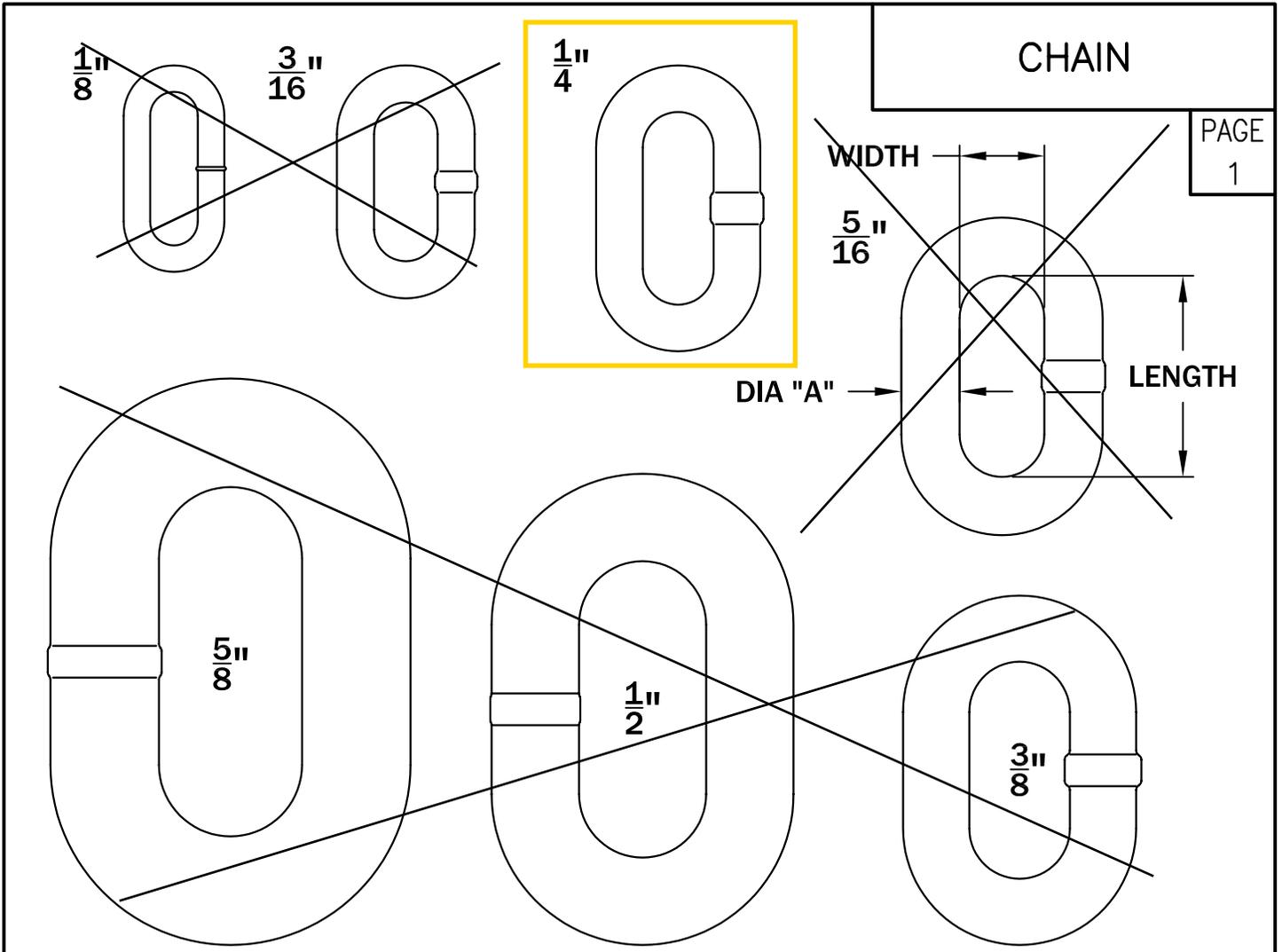
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REMARKS / REVISIONS	8/9/2012
-	
-	
-	
-	



CUSTOMER		JOB NO.	
-		-	
MFG / MODEL		PART	
-		2" TAPER PIN RAIL CONNECTOR	
MATERIAL		PART NO.	QTY
6061 SOLID ALUMINUM		-	-
8/9/2012	SCALE: 1:1		DRAWN: J.Swinney



SIZE	LENGTH	WIDTH	DIA "A"	SAFE WORK LOAD
1/8"	0.90"	0.29"	0.16"	375 lbs
3/16"	0.97"	0.40"	0.22"	800 lbs
1/4"	1.19"	0.50"	0.28"	1,400 lbs
5/16"	1.24"	0.50"	0.33"	1,800 lbs
3/8"	1.33"	0.57"	0.39"	2,800 lbs
1/2"	1.72"	0.75"	0.52"	4,500 lbs
5/8"	1.90"	0.82"	0.66"	6,800 lbs

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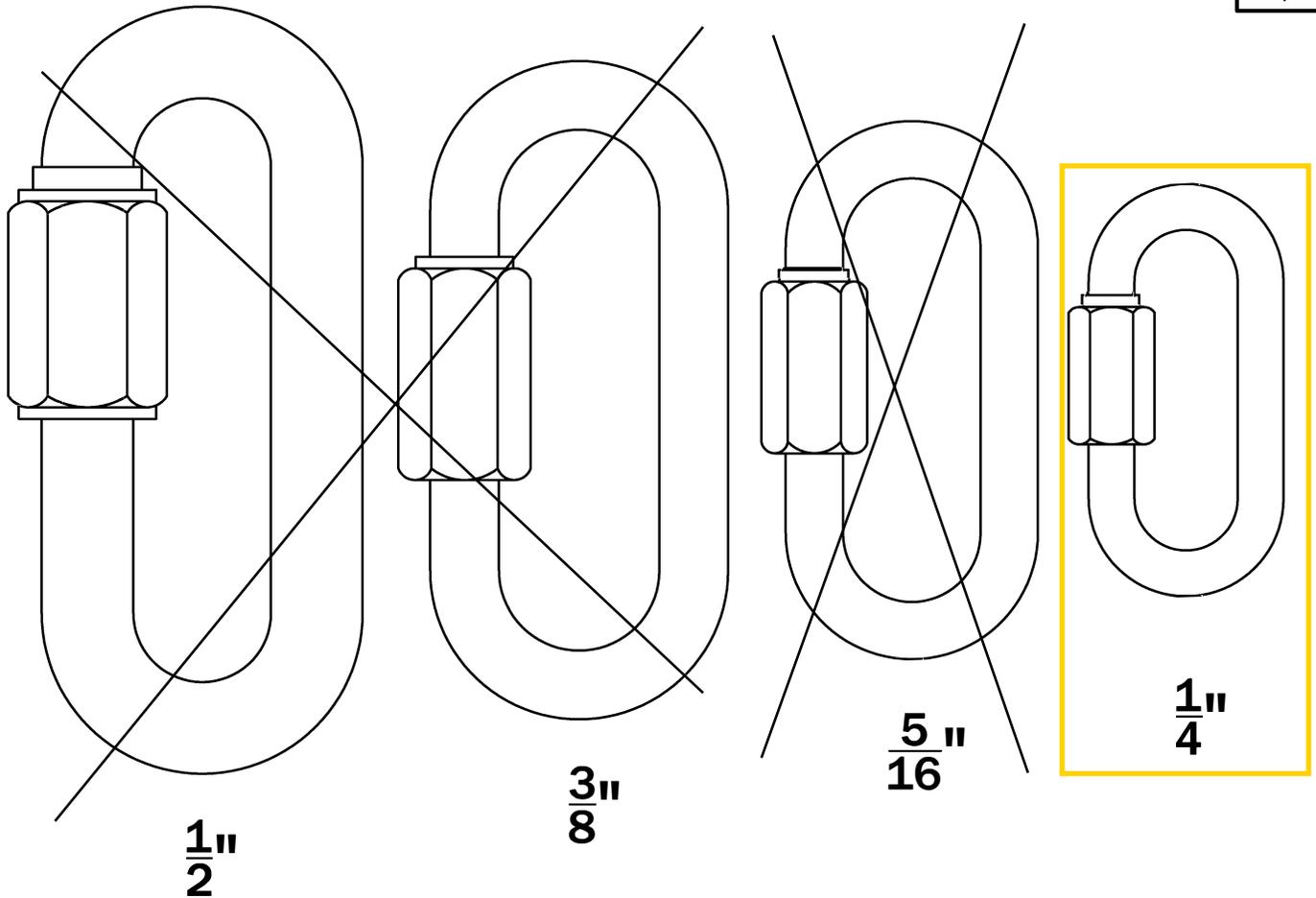


CHANGES	TOLERANCES	DRAWN BY	DATE
F	DECIMALS .XXX = ±.005 .XX = ±.010 FRACTIONAL X/X = ±.1/64 ANGLES X° = ±1/2°	D. MIDDLETON	03/22/04
E		MATERIAL SPECIFICATION:	
D			
C			
B			
A			

<b>SPECIFICATION SHEET DIMENSIONAL DATA</b>	
SCALE:	PART NO.
FULL	STAINLESS STEEL

# QUICK LINK

PAGE  
1



SIZE	LENGTH	WIDTH	MATERIAL	SAFE WORK LOAD
1/4"	2.25"	1.06"	316 SST	880 lbs
5/16"	2.94"	1.38"	316 SST	1,700 lbs
3/8"	3.53"	1.63"	316 SST	2,200 lbs
1/2"	4.18"	1.75"	316 SST	3,300 lbs

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CHANGES	TOLERANCES	DRAWN BY	DATE	SPECIFICATION SHEET DIMENSIONAL DATA	
F	DECIMALS .XXX = ±.005 .XX = ±.010 FRACTIONAL X/X = ±.1/64 ANGLES X° = ±1/2°	D. MIDDLETON	03/22/04		
E		MATERIAL SPECIFICATION:		FULL	STAINLESS STEEL
D					
C					
B					
A					

# VALVES



# Submittal Data Sheet

Date: 09/26/2023

USA

QUOTE NUMBER 333410  
REV

PROJ. CHARTER TWP OF MERIDIAN

Fact. ITEM	Cust. ITEM	QTY	DESCRIPTION
1	MERIDIAN TWP	2	CVS,6,250A,F1,DIF,DI-S11-S2-NBR*LW

<b>Style</b>	CVS	Swing Check Valves
<b>Size</b>	6	6 Inch (150mm)
<b>Body Style</b>	250A	Series 250 Swing Check Valve
<b>End Connection</b>	F1	Flanged; ASME 125/150
<b>Body Material</b>	DIF	Ductile Iron: Fusion Bonded Epoxy, 12 Mils Interior and Exterior
<b>Disc</b>	DI	Ductile Iron
<b>Shaft</b>	S11	303 Stainless Steel
<b>Body Seat Material</b>	S2	316 Stainless Steel
<b>Disc Seat Material</b>	NBR	Acrylonitrile-Butadiene (NBR)
<b>Actuator Type</b>	LW	Lever & Weight

### RELATED DOCUMENTS

A070021	DWG INST CVS F1 LW 2-36" 250/250A
A070027	DWG VALVE ASSY CVS 2-36" 250/250A
A070064	DWG ASSY 250/250A LW CLOSURE CONTROL

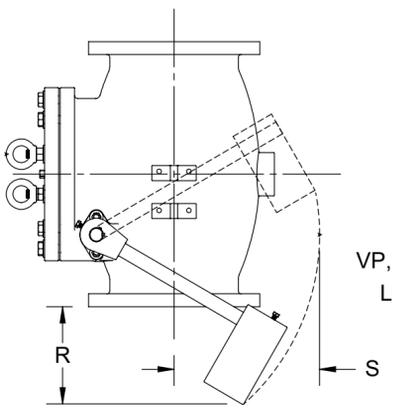
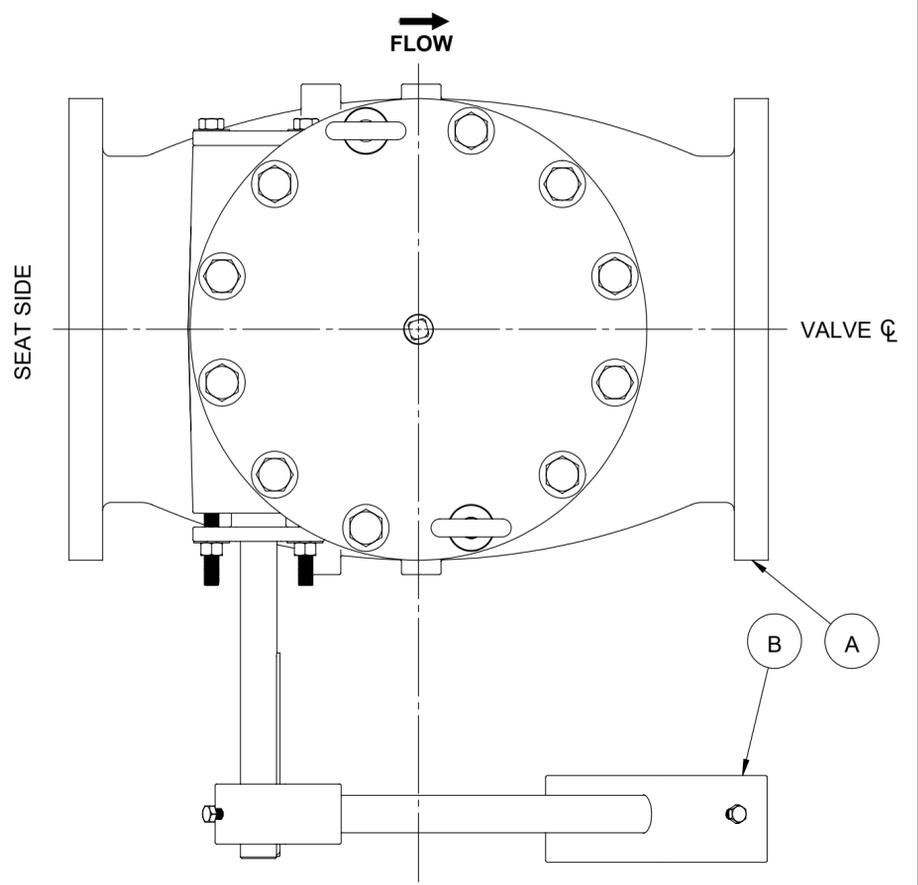
### FEATURES

Tag: KI JOB#122019

VALVE SIZE	DIMENSIONS (INCHES / MM)																
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
2	8.00 203.2	10.00 254.0	3.50 88.9	10.92 277.4	4.12 104.6	6.00 152.4	4.75 120.7	0.63 16.0	-	-	4	5/8-11	0.62 15.7	7.00 177.8	10.00 254.0	6.00 152.4	9.38 238.1
2.5	8.50 215.9	9.72 246.8	3.50 88.9	10.92 277.4	4.12 104.6	7.00 177.8	5.50 139.7	0.88 22.4	-	-	4	5/8-11	0.88 22.4	6.50 165.1	9.88 250.8	6.13 155.6	9.38 238.1
3	9.50 241.3	10.00 254.0	4.50 114.3	11.00 279.4	4.00 101.6	7.50 190.5	6.00 152.4	0.75 19.1	-	-	4	5/8-11	0.75 19.1	5.88 149.2	10.13 257.2	5.50 139.7	9.25 235.0
4	11.50 292.1	10.75 273.1	5.00 127.0	11.75 298.5	5.00 127.0	9.00 228.6	7.50 190.5	0.94 23.8	0.75 19.7	6	2	5/8-11	0.94 23.8	4.88 123.8	10.75 273.1	4.88 123.8	8.75 222.3
6	14.00 355.6	11.75 298.5	5.75 146.1	13.50 342.9	6.50 165.1	11.00 279.4	9.50 241.3	1.00 25.4	0.88 22.2	6	2	3/4-10	1.00 25.4	2.13 54.0	11.63 295.3	4.63 117.5	7.88 200.0
8	19.50 495.3	13.75 349.3	7.25 184.2	17.00 431.8	7.50 190.5	13.50 342.9	11.75 298.5	1.13 28.6	0.88 22.2	8	-	-	-	2.00 50.8	15.50 393.7	5.88 149.2	10.38 263.5
10	24.50 622.3	15.00 381.0	9.38 238.1	16.25 412.8	9.00 228.6	16.00 406.4	14.25 362.0	1.19 30.2	1.00 25.4	12	-	-	-	3.00 76.2	18.38 466.7	9.00 228.6	13.63 346.1
12	27.50 698.5	19.00 482.6	11.00 279.4	18.25 463.6	11.00 279.4	19.00 482.6	17.00 431.8	1.25 31.8	1.00 25.4	12	-	-	-	3.25 82.6	21.13 536.6	9.00 228.6	14.25 362.0
14	31.00 787.4	22.50 571.5	13.50 342.9	26.00 660.4	14.00 355.6	21.00 533.4	18.75 476.3	1.38 34.9	1.13 28.6	12	-	-	-	6.63 168.3	25.88 657.2	11.75 298.5	18.75 476.3
16	36.00 914.4	24.50 622.3	14.25 362.0	29.50 749.3	15.00 381.0	23.50 596.9	21.25 539.8	1.44 36.5	1.13 28.6	16	-	-	-	2.00 50.8	32.00 812.8	7.25 184.2	15.88 403.2
18	40.00 1016.0	26.50 673.1	17.38 441.3	31.00 787.4	18.63 473.1	25.00 635.0	22.75 577.9	1.56 39.7	1.25 31.8	16	-	-	-	7.00 177.8	36.00 914.4	9.25 235.0	21.25 539.8
20	40.00 1016.0	28.75 730.3	17.63 447.7	32.38 822.3	18.63 473.1	27.50 698.5	25.00 635.0	1.69 42.9	1.25 31.8	20	-	-	-	6.00 152.4	41.00 1041.4		
24	48.00 1219.2	32.50 825.5	20.13 511.2	34.00 863.6	21.00 533.4	32.00 812.8	29.50 749.3	1.88 47.6	1.38 34.9	20	-	-	-	0	38.00 965.2	8.75 222.3	19.25 489.0
30	56.00 1422.4	37.20 945.0	21.85 555.0	39.00 990.6	24.00 609.6	38.75 984.3	36.00 914.4	2.13 54.0	1.38 34.9	28	-	-	-	14.13 358.8	53.13 1349.4	15.50 393.7	24.00 609.6
36	63.00 1600.2	42.91 1090.0	26.38 670.0	42.00 1066.8	27.00 685.8	46.00 1168.4	42.75 1085.9	2.38 60.3	1.63 41.3	32	-	-	-	14.63 371.5	57.50 1460.5	15.00 381.0	21.00 533.4
42	70.00 1778.0	56.30 1430.0	32.28 820.0	39.29 998	33.27 845	53.00 1346.2	49.50 1257.3	2.63 66.7	1.63 41.3	36	-	-	-	19.69 500.0	53.54 1360.0	22.83 580.0	14.17 360.0

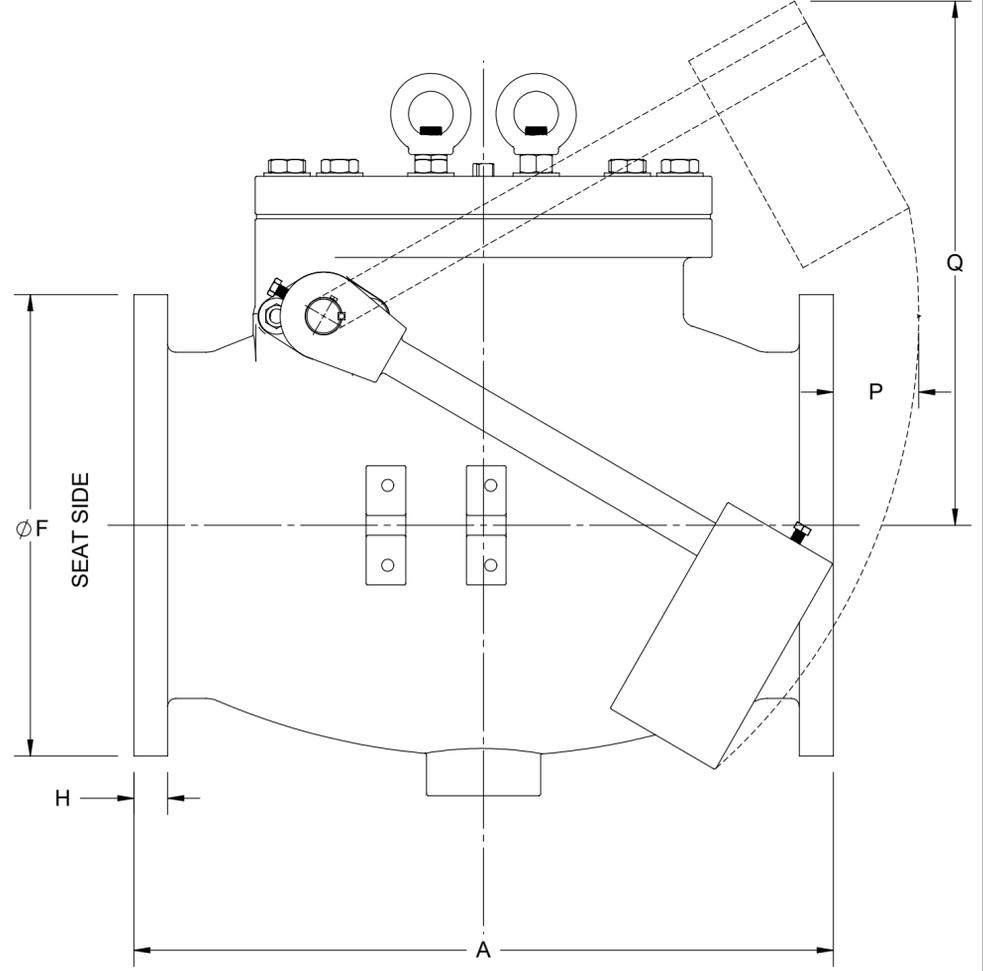
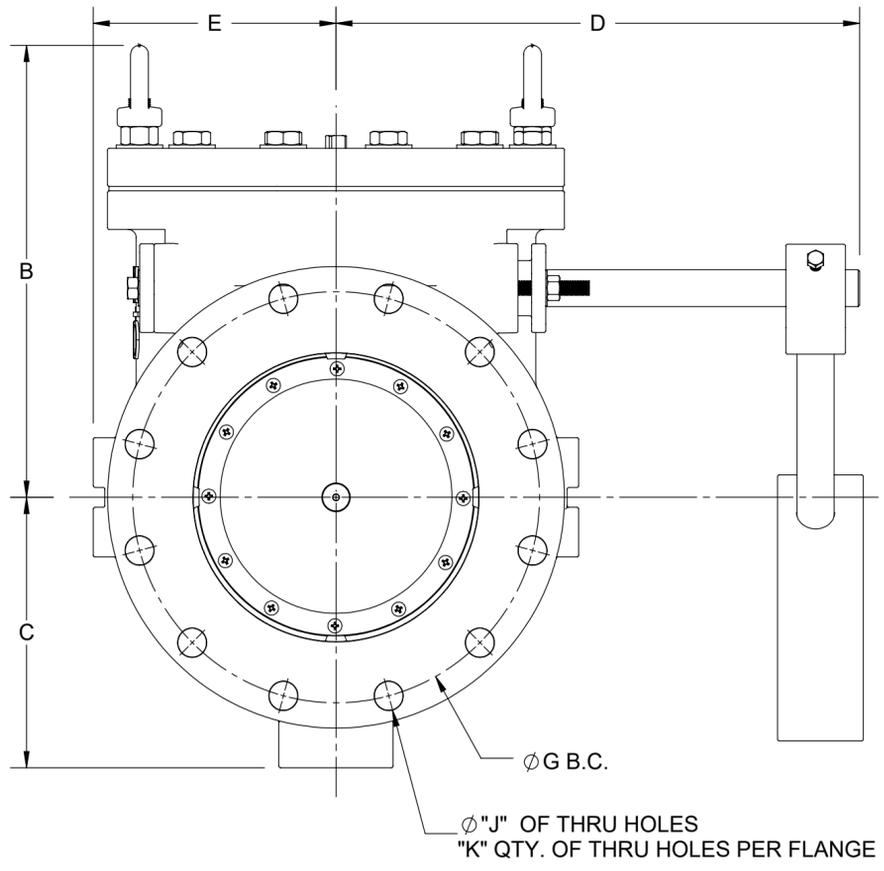
ITEM NO.	DESCRIPTION
A	VALVE
B	LEVER & WEIGHT CLOSURE CONTROL

NOTE:  
 1. VALVE SIZES 2" THRU 14" ARE 250A BODY STYLE.  
 2. LEVER ARM IS ANGLED 30° BELOW THE HORIZONTAL WHEN VALVE IS CLOSED. LEVER ARM HAS A MAXIMUM OF 60° OF TRAVEL.  
 3. FACE TO FACE DIMENSIONS ARE IN COMPLIANCE WITH AWWA C508.

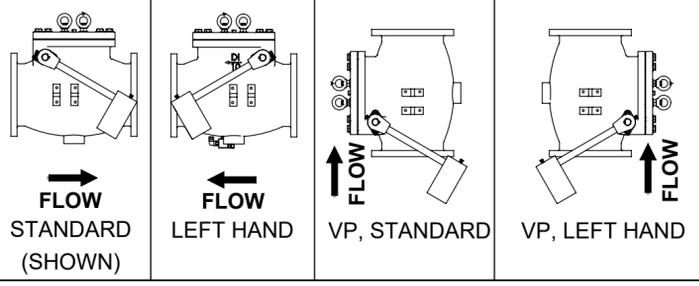


**NOTICE**  
 THIS DRAWING DOES NOT SHOW ACCESSORIES. IF ACCESSORIES ARE REQUIRED, REFER TO THE APPROPRIATE ACCESSORY INSTALLATION DRAWING FOR DIMENSIONS AND OTHER RELATED INFORMATION.

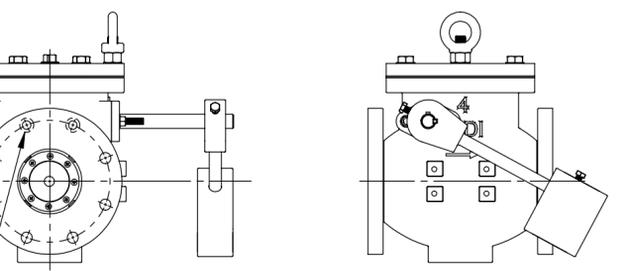
VP, VERTICAL FLOW UP  
 LEVER ARM SWING



PLEASE CONFIRM HAND MOUNTING POSITION. IF NOTHING IS NOTED, STANDARD WILL BE PROVIDED.



"L" QTY. OF TAP HOLES PER FLANGE  
 "M" TAP HOLE SIZE  
 "N" DEPTH OF TAP HOLE

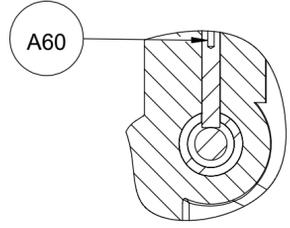
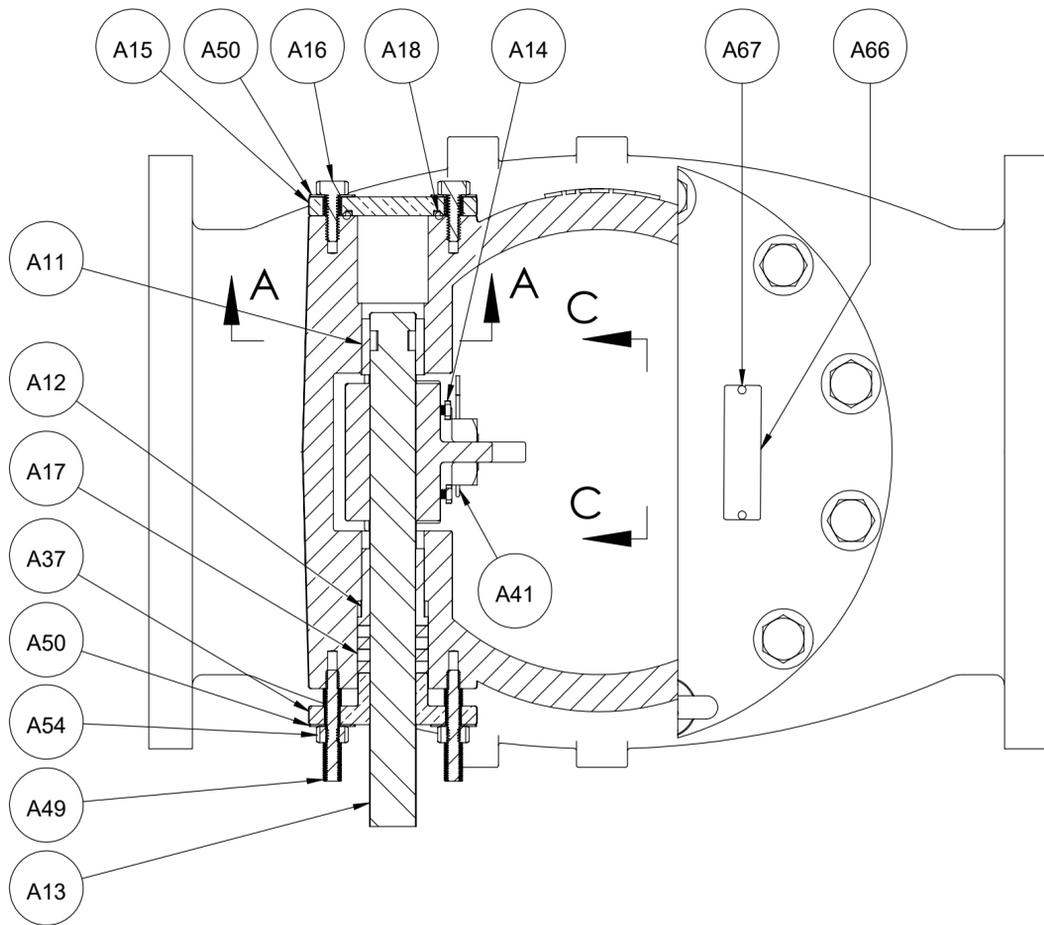


SIZES 2" THRU 6" VALVE BODY CONFIGURATION

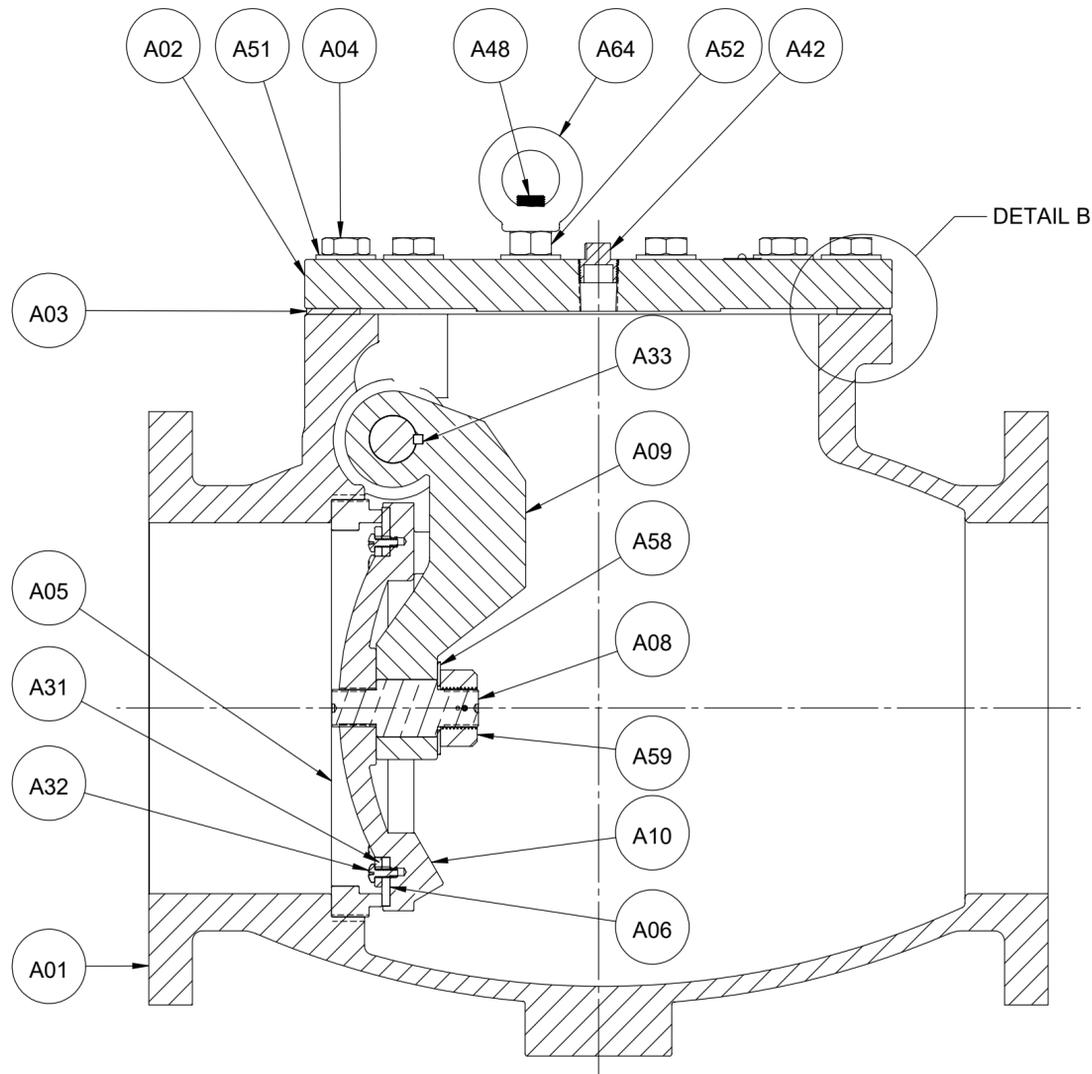
U	L	W	D	C	B	A
					50312	7/11/17



APCO CVS SWING CHECK VALVE, SIZES 2" THRU 36" 250 SERIES, LEVER & WEIGHT CLOSURE CONTROL			
DOCT. CODE	DRAWN	APPROVED	
C1	JPD	TMO	
CHECKED	DATE		
DWZ	10/23/2013		
			<b>A70021</b>

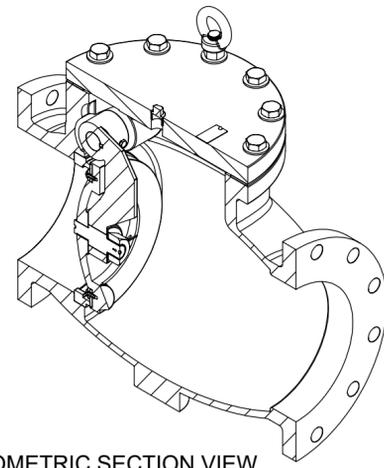


SECTION A-A

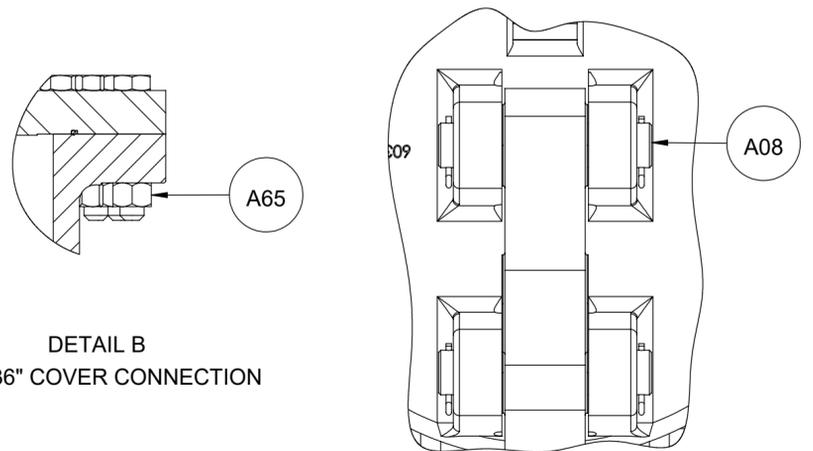


DETAIL B

DETAIL B  
30" & 36" COVER CONNECTION



ISOMETRIC SECTION VIEW



VIEW C-C  
30" & 36" DOUBLE CLEVIS CONNECTION

ITEM NO.	DESCRIPTION	QTY
A01	BODY	1
A02	COVER	1
A03	COVER SEAL <sup>4</sup>	1
A04	COVER BOLT	-
A05	BODY SEAT RING <sup>1</sup>	1
A06	DISC SEAT <sup>4</sup>	1
A08	DISC STEM / PIN	1
A09	DISC ARM	1
A10	DISC	1
A11	PIVOT SHAFT STRAIGHT BUSHING <sup>2</sup>	1
A12	PIVOT SHAFT FLANGED BUSHING <sup>2</sup>	1
A13	PIVOT SHAFT	1
A14	DISC ARM RETAINING SCREW	-
A15	PIVOT SHAFT COVER	1
A16	PIVOT SHAFT COVER BOLT	-
A17	PACKING <sup>4</sup>	1
A18	PIVOT SHAFT COVER SEAL <sup>4</sup>	1
A31	SEAT RETAINING RING <sup>4</sup>	1
A32	SEAT RETAINING SCREW <sup>4</sup>	-
A33	DISC ARM KEY (4" & UP)	1
A37	PACKING GLAND	1
A41	DISC PIN RETAINER	1
A42	COVER PIPE PLUG	1
A48	COVER STUD <sup>3</sup>	2
A49	PACKING GLAND STUD	2
A50	WASHER	4
A51	COVER BOLT WASHER	-
A52	COVER NUT	2
A54	PACKING GLAND NUT	-
A58	DISC ARM WASHER <sup>3</sup>	1
A59	DISC STEM NUT <sup>3</sup>	1
A60	SHAFT RETAINING PIN	1
A64	COVER EYE NUT <sup>3</sup>	2
A65	COVER NUT (30 & 36")	-
A66	DATA PLATE	1
A67	DRIVE SCREWS	2

NOTES:

1. BODY SEAT RING ON VALVE SIZES 2" TO 24" IS THREADED.
2. ITEMS A11 & A12 ARE NOT USED ON VALVE SIZES 2", 2.5", OR 3".
3. ITEMS A48, A58, A59, A64 ARE NOT INCLUDED ON VALVE SIZES 30" & 36".
4. REPLACEABLE WEAR PARTS: A03, A06, A17, A18, A31, A32.

APX F -23	7/12/80	10/4/22	9/24/15
C	L	W	D
C	B	A	50312

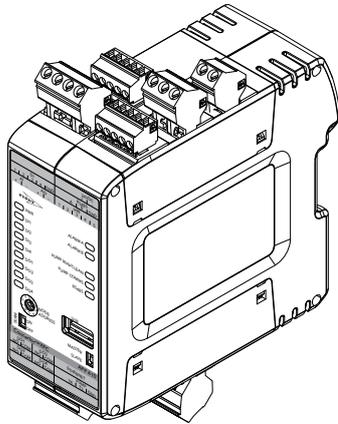
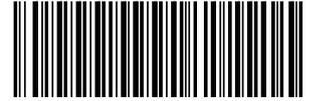


APCO CVS - SWING CHECK VALVE, 250 SERIES, 2" THRU 36" BASIC VALVE ASSEMBLY			
DOCT. CODE	DRAWN	APPROVED	
C1	JPD	DWZ	
CHECKED	DATE		
DWZ	10/28/2013		
			<b>A70027</b>





# **DP GATEWAY**



# FPG 414

## Concertor™

## 1 Product Description

### 1.1 Product design

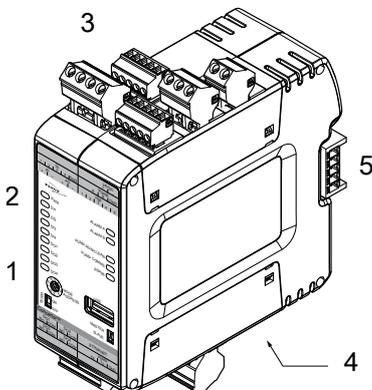
FPG 414 is a gateway that is part of the Concertor™ system. The gateway is connected to Flygt pumps 6020.180/090 or 6020.181/091. The gateway starts and stops the pump based on the input signal from the APP 411 controller, or from the external control system. All the alarms are sent back to the external control system. Data is logged by and stored in the gateway or in the APP 411 controller.

Product name	Part number	Description
FPG 414	8164700	Gateway for Concertor™ DP or Concertor™ XPG. Dynamic pump performance change, through 4–20 mA or Modbus, or pump control through APP 411.

### 1.2 Approvals

- CE
- UL
- CSA
- RCM

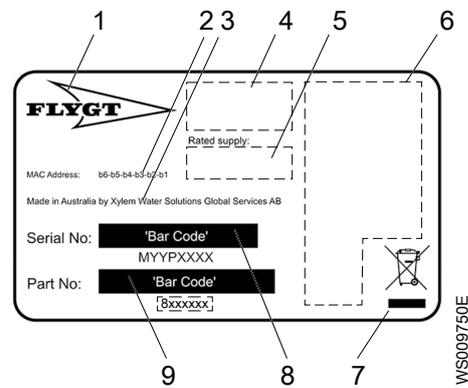
### 1.3 Parts



1. Front connections
2. Status LEDs
3. Top connections
4. Bottom connections
5. Backplane connector

WS009747C

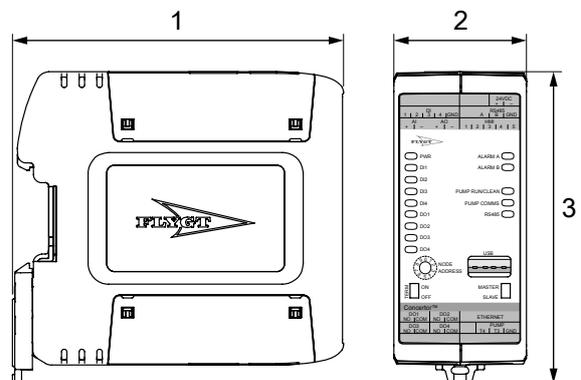
### 1.4 The data plate



1. Brand
2. MAC address
3. Country of origin. Manufacturer.
4. Product
5. Rated supply
6. Approvals
7. Waste disposal symbol
8. Serial number
9. Part number

## 2 Technical Reference

### 2.1 Dimensions



1. 112 mm (4.4 in)
2. 45 mm (1.8 in)
3. 106 mm (4.2 in)

WS009746B

## 2.2 Environmental requirements

Parameter	Value
Operating temperature	-20°C – +65°C (-4°F – 149°F)
Storage temperature	-20°C – +70°C (-4°F – 158°F)
Operating humidity	Relative humidity, maximum 90%
Sunlight exposure	UV-resistant
Maximum altitude	<ul style="list-style-type: none"> <li>With UL approval: Maximum 2000 m (6562 ft)</li> <li>Without UL approval: 4000 m (13 123 ft)</li> </ul>
Pollution degree	2
Installation location	Indoors

## 2.3 IP rating

IPXY  
 1 2 3  
 WS011523A

1. Degree of protection of enclosure
2. Degree of protection against foreign objects
3. Degree of protection against water

### IP20

**Table 1: Degree of protection against foreign objects**

Description	Definition
Protected against solid objects greater than 12 mm	Finger or similar objects not exceeding 80 mm in length Solid objects exceeding 12 mm in diameter

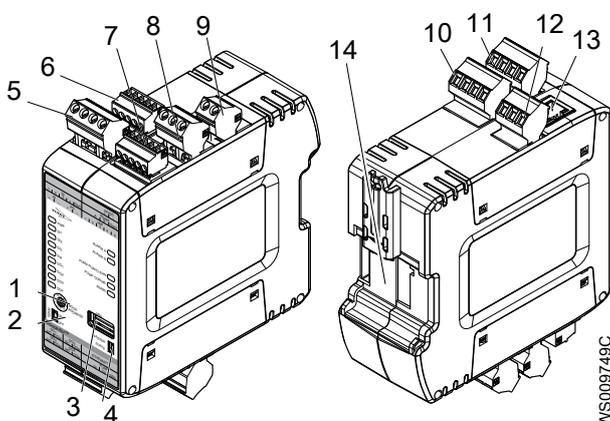
**Table 2: Degree of protection against water**

Description	Definition
Non-protected	–

## 2.4 Electrical data

Parameter	Value
Supply voltage	+ 24 VDC
Supply voltage tolerance	21.5–28.5 VDC
Current consumption	< 700 mA. Typical: 150 mA

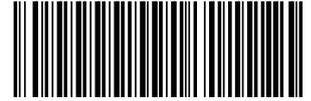
## 2.5 Terminals



Section	Terminal	Description
1	NODE ADDRESS	Node address 0–9, rotary switch. 0 is not used.
2	TERM	Backplane termination switch

Section	Terminal	Description							
3	USB	Standard type A USB socket							
4	MASTER, SLAVE	MASTER/SLAVE switch							
5	AI	+ –	Isolated analog input, 4–20 mA Maximum 24 VDC Scaling: 0–100% Offset: 0–16 mA with 0.1 mA resolution						
		AO		+ –	Analog output, 4–20 mA Maximum 24 VDC				
6	DI	1 2 3 4	Digital inputs Maximum 24 VDC						
		GND		Common ground (earth)					
		7		HMI • Flygt FOP 315	1 2 3 4 5	Ground CAN low Shield CAN high + 24 VDC output			
					8		RS-485	A B GND	Modbus RTU
								9	
10	DO3 DO4		NO COM NO COM						
			11		DO1 DO2		NO COM NO COM		
		12		PUMP		T4 T3 GND	Pump communication Not used		
			13		Ethernet	• Modbus TCP • Web server			
14	Backplane		The Flygt controller communicates with the Flygt gateways through the backplane.						

# **HMI TOUCH SCREEN**



# FOP 402

## 1 Product Description

### 1.1 FOP 402

#### 1.1.1 Product design

FOP 402 is a touchscreen HMI that is connected to one or more web servers.

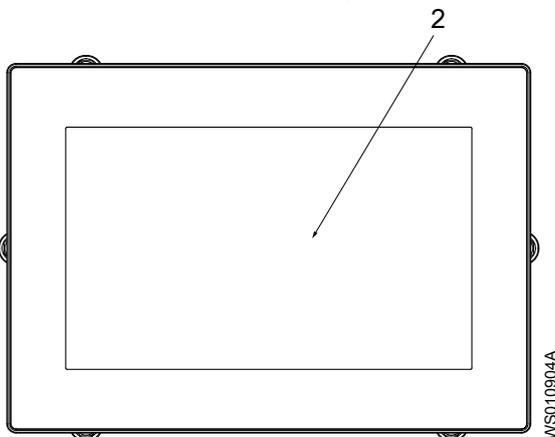
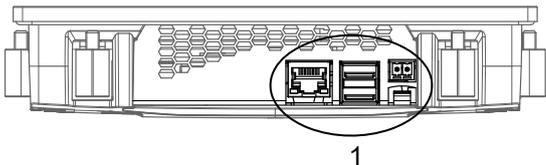
The HMI is installed on a wall or in the cabinet door.

Product name	Part number	Description
FOP 402	822 48 00	Hand-Off-Auto for one or more units.

#### 1.1.2 Approvals

- CE
- UL

#### 1.1.3 Parts

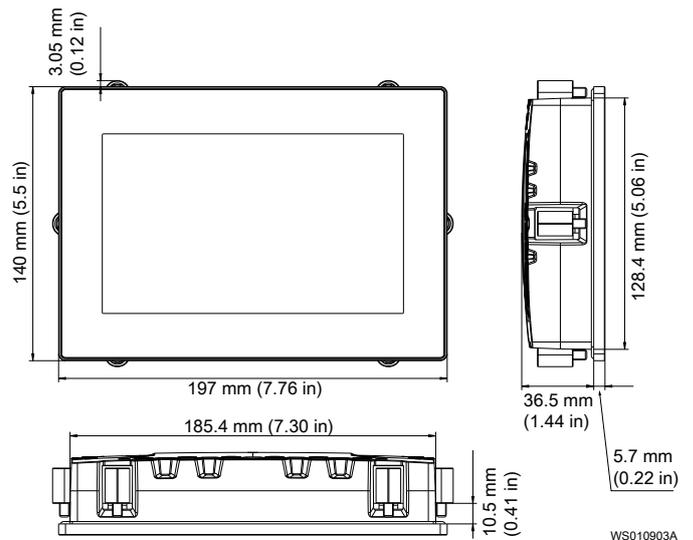


1. Terminals, see [Terminals](#) on page 2
2. Screen

## 2 Technical Reference

### 2.1 FOP 402

#### 2.1.1 Dimensions



WS010903A

#### 2.1.2 Environmental requirements

Parameter	Value
Operating temperature	-20°C – +60°C (-4°F – +140°F)
Storage temperature	-30°C – +80°C (-22°F – +176°F)
Operating humidity	Relative humidity: 20–90 %

#### 2.1.3 IP-rating

- IP20, back side
- IP65, front side

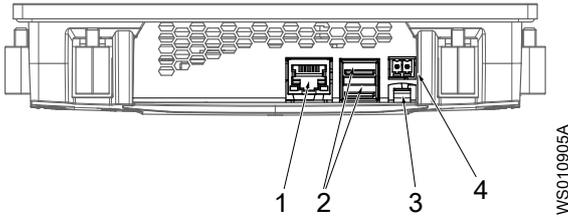
#### 2.1.4 Electrical data

Parameter	Value
Supply voltage	24 VDC
Maximum current at nominal voltage	0.35 A at 24 VDC
Maximum power consumption	8.5 W
Voltage range	24 VDC (-15% / +20%)

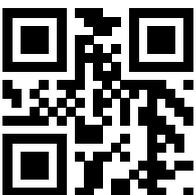
## 2.1.5 Display data

Part	Description
Processor	ARM Cortex A9, dual core, 800 MHz
Display	7" TFT LED, resolution 800 x 480 pixels
Brightness	500 cd/m <sup>2</sup>
Contrast ratio	600:1
Colors	16.7 M
Touch-panel type	Multi-touch, PCT
Memory	512 MB Flash, 1 GB RAM

## 2.1.6 Terminals



Number	Terminal	Description
1	Ethernet	-
2	USB	The HMI is equipped with a USB 2.0 host controller with two USB interfaces.
3	Power supply	24 VDC
4	Grounding clip	-



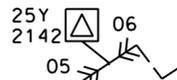
Xylem Water Solutions Global Services AB  
 361 80 Emmaboda  
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 Tel: +46-471-24 70 00  
 Fax: +46-471-24 74 01  
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[www.xylemwatersolutions.com/contacts/](http://www.xylemwatersolutions.com/contacts/)  
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**xylem**  
 Let's Solve Water

NOTES:  
 -SWITCHING & TAGGING REQUIRED  
 -OUTAGE REQUIRED  
 6271 E LAKE - INGHAM COUNTY 517-676-2233  
 6273 E LAKE - MERIDIAN TWP 517-349-4640  
 517-853-4440  
 -FOOTAGES ARE APPROXIMATE

ONE LINE

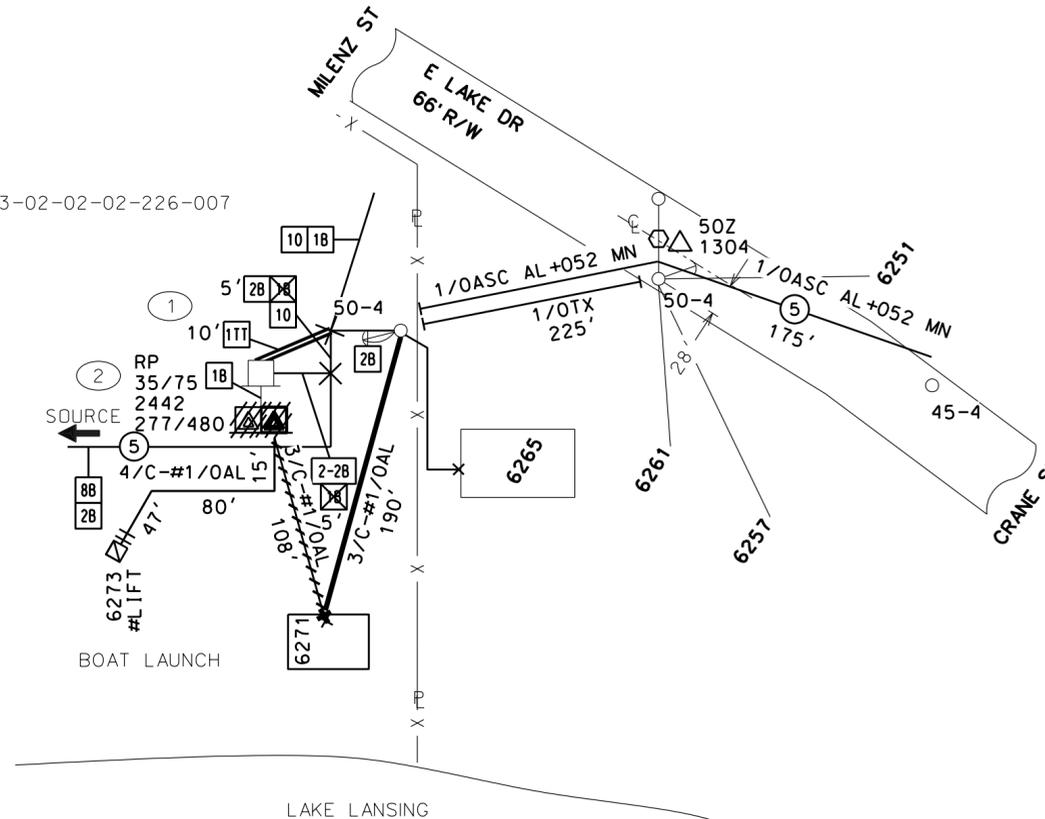


MISS DIG System, Inc.  
 1-800-482-7171



- ① INSTALL  
(3) LBE  
FIGURE 65-251
- ② REMOVE  
ENCLOSURE  
10KVA  
25KVA
- INSTALL  
75KVA DF RF  
FIGURE 66-302-1  
DETAIL A  
215' OFF CL

33-02-02-02-226-007

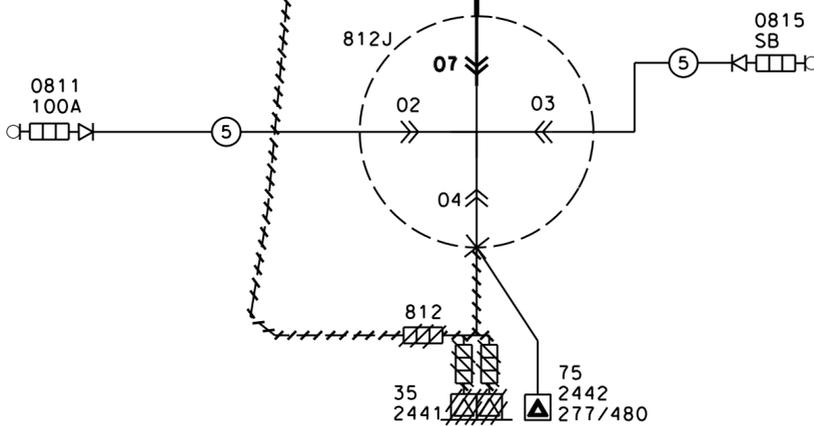


PROPOSED VOLTAGE DROP  
6273 \*LIFT

ADDED LOAD	0
XFMR LOAD	25.5
FLICKER LOAD	60
VOLT DROP	1.09
FLICKER	2.26

PROPOSED VOLTAGE DROP  
6271

ADDED LOAD	0
XFMR LOAD	18
FLICKER LOAD	0
VOLT DROP	1.3
FLICKER	NA



**UNDERGROUND LEGEND**

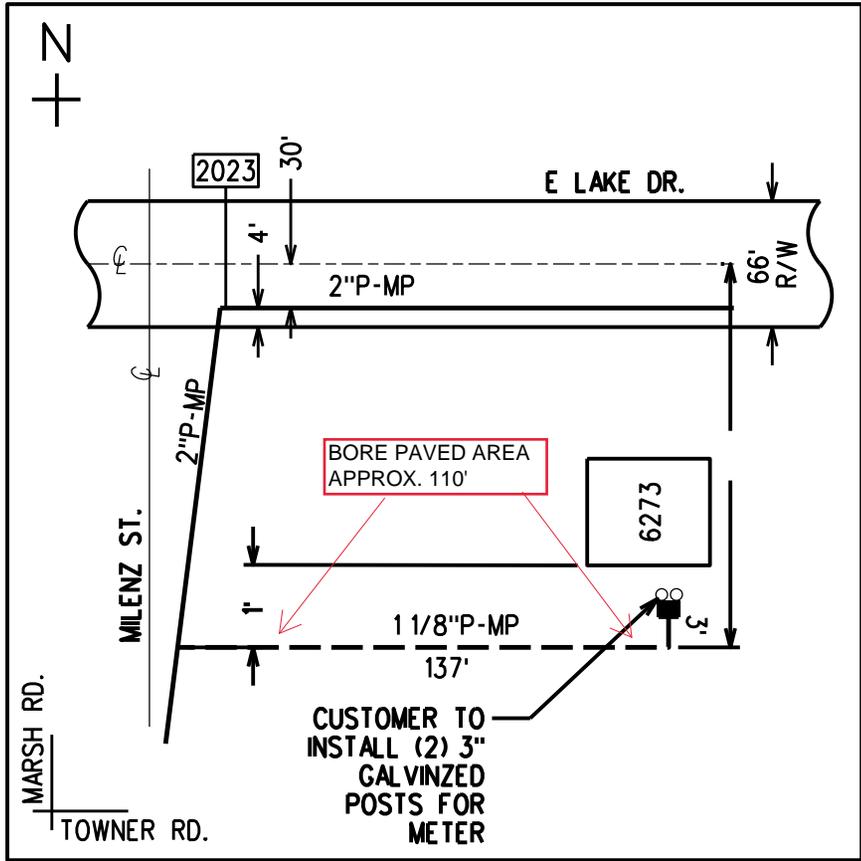
1. Single phase primary	A. No 2 AL cable 175 mbs, 15KV, or secondary.
2. Open eye primary	B. No 1/0 AL cable 175 mbs, 15KV, or secondary.
3. Three phase primary	C. No 3/0 AL cable 175 mbs, 15KV, or secondary.
4. Single phase secondary	D. 350 kcmil AL cable 175 mbs, 15KV, or secondary.
5. Combination light and power secondary	E. 500 kcmil copper cable 175 mbs, 15KV, or secondary.
6. Three phase power secondary	F. 750 kcmil AL cable 175 mbs, 15KV, or secondary.
7. Single phase service	FF. 1000 kcmil AL cable 175 mbs, free-retardant INS, jacketed.
8. Combination lighting and power service	G. No 1/0 stranded AL cable, 280 mbs, 28KV.
9. Three phase power service	H. No 3/0 stranded AL cable, 280 mbs, 28KV.
10. Strengthening conductor (2/C-1D CU)	I. 750 kcmil AL cable, 280 mbs, 28KV.
11. Strengthening conductor (2/C-1B AL)	J. Cable joint.
12. Covered neutral conductor for ducts	K. 350 kcmil AL cable, 280 mbs, 25KV.
13. Strengthening conductor (2/C-1/0 AL)	L. Marker to locate cable.
CONDUIT	M. Refer to Note on Drawing, N1 for Note 1, etc.
2" Plastic	N. No 1/0 AL, solid cable, 280 mbs, 28KV.
3" Plastic	O. No 1/0 AL, stranded cable 280 mbs, 28KV, jacketed.
4" Plastic	OT. No 1/0 AL, stranded cable, 260 mbs free-retardant INS, 25KV, jacketed.
2" Steel	V. 350 kcmil AL, stranded, 260 mbs, 25KV, jacketed.
3" Steel	VI. 350 kcmil AL, stranded, 260 mbs free-retardant INS, 25KV, jacketed.
4" Steel	W. 750 kcmil AL, stranded, 280 mbs, 28KV, jacketed.
6" Steel	WT. 750 kcmil AL, cable, 260 mbs free-retardant INS, 25KV, jacketed.
PROP. ELEC. CONDUCTORS ONLY	EX. 15. No 1/0 solid AL cable for three-phase primary
PROP. ELEC. AND GAS LINES ONLY	EX. 16. No 1/0 AL cable for 3-phase primary and 350 AL cable for 1-phase secondary
PROP. ELEC., GAS AND TELECOMMUNICATIONS	CONDUCTOR CHANGE
EXIST. ELEC. CONDUCTORS ONLY	
EXIST. GAS LINE ONLY	
FUTURE ELECTRIC TRENCH	

SUBSTATION	WD NO.	
PEACOCK	1290	
CIRCUIT	CKT NO.	
COLEMAN ROAD	02	
TLM NUMBER	# OF RODS	OHMS
0401022441		
CE STAKING REQ'D	Yes <input type="checkbox"/> No <input type="checkbox"/>	
FORESTRY REQ'D	Yes <input type="checkbox"/> No <input type="checkbox"/>	

6273 E LAKE DR HSLT, ECNC RLU				
CM NO. 100007391868				
ORDER TYPE	MAT. TYPE	NOTIFICATION NUMBER	DESIGN NUMBER	ORDER NUMBER
ECNC	RLU	1068396338	11559625	
ECNC	RSU	1068029484	11559831	

METER ORDER NUMBER	METER NUMBER	READ	METER LOCATION
JOB PURPOSE: CUSTOMER REQUESTED UPGRADE TO 277/480 FOR NEW LIFT PUMPS			
UPSTREAM SECTIONALIZING DEVICE:		CONSUMERS ENERGY CONTACTS	
0811-100A		DEPARTMENT	NAME
E END OF QUAIL ST		BOB BEAGAN	
		DESIGNER	ROB GOODWIN
			NUMBER
			517-282-2106
			517-749-3000

ADDRESS		
6273 E LAKE DR HSLT, GCNC NBS		
PROJECT TITLE		
6273 E LAKE DR		
DESIGN NUMBER	AS-BUILT NUMBER	
11573571		
CONSTRUCTION MEASURE NUMBER		
100007391949		
NOTIFICATION NUMBER		
1068394471		
ORDER TYPE	ORDER NUMBER	
GCNC		
MAINTENANCE ACTIVITY TYPE		
NBS		
METER ORDER NUMBER	METER NUMBER	
READ	METER LOCATION	
<input type="checkbox"/> SET	<input type="checkbox"/> REMOVE	<input type="checkbox"/> EXCHANGE
COUNTY		
INGHAM		
CITY/TOWNSHIP		
HASLETT / MERIDIAN		
TRS	DATE	
040102	11/6/2023	



A CMS Energy Company *SERVICE*

PC CONTACT NAME:  
ROBERT BEAGAN  
PC CONTACT PHONE:  
(517) 282-2106

CUSTOMER CONTACT NAME:  
JACK HUGHES  
CUSTOMER CONTACT PHONE:  
(517) 853-4470